

*“When the well is dry, we know the worth
of water.”*

Benjamin Franklin

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BALWOIS

Welcome to BALWOIS 2010 !

On behalf of Organising Committees, it is our privilege and honour to invite you to participate in the Fourth International Scientific Conference on Water Observation and Information System for Decision Support which is held in Ohrid, Republic of Macedonia, from 25 to 29 May 2010 (Hotel Bellevue).

The primary focus of the Conference, built on the success of the previous conferences – Ohrid, 2004, 2006 and 2008 - is to further enhance the knowledge in the following fields:

- Topic 1 : Climate and Hydrology
- Topic 2 : Environment and Human Activities
- Topic 3 : Water Related Risks
- Topic 4 : Integrated Water Resources Management
- Topic 5 : Ecohydrology and Hydrobiology
- Topic 6 : Computing and Technologies

A specific session is organised by Drought Management Centre for Southeastern Europe (DMCSEE) focusing on drought monitoring and related risks mitigation. However, other fields of research are investigated during the conference in order to favour exchanges with researchers focused on water related issues and those working in other environment fields.

Thus, BALWOIS is a platform for creating partnerships in solving water scarcity problems, floods, droughts, environmental degradation and risk affecting not only at the Balkan scale, but wider. Oral presentations, exhibitions and poster sessions are all designed to facilitate contacts and interactions between participants.

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Please join us at the conference and enjoy the beauty of the town of Ohrid and of its fabulous lake!

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IMPROVING OUR KNOWLEDGE TO RESPECT THE WATER AS A NATURAL POWER AND DEVELOPING SKILLS IN ITS GENUINE MANAGEMENT, IS THE GOAL WE SHOULD ALL PUT OUR ENDEAVORS IN STAKE.

THE BALWOIS CONFERENCE, PROVIDES US WITH OPPORTUNITY NOT ONLY TO SHARE EXPERIENCES, BUT ALSO TO BUILD KNOWLEDGE ASSETS AND TO ANTICIPATE WHAT IS AHEAD OF US.

Sonja LEPITKOVA
Dep. MINISTER,
MOEPP of Rep. of Macedonia

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TOPIC 1

CLIMATE AND HYDROLOGY



004 Climates Classification of Pakistan

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The work deals with the climates of Pakistan. It is based on the study and analysis of the data regarding temperature, rainfall, number of rainy days, humidity, wind speed and direction, pressure, evapotranspiration, sunshine, and also with the classification of climates. The factors bringing variation in the climates of Pakistan are latitudinal location, proximity to sea level, rough topography, continently, marine influence in the extreme south, vegetation cover, and soil contents. On the basis of temperature, Pakistan has been classified into five regions i.e. hot, warm, mild, cool, and cold. The southern parts of Pakistan have high temperature (28°C at Hyderabad) that decreases toward north up to 10°C at Astore. Four rainfall regions have been identified i.e. arid, semi-arid, sub-humid, and humid. The rainfall concentration decreases from 171.4cm (68.6inches) at Murree in the north to 3.4cm (1.5inches) at Nokkundi in the south. The eastern part of Pakistan receives heavy rains during summer, from southwesterly currents, called monsoon, whereas the western parts have high rains in winter, from southwesterly winds, called western disturbances. The extreme north of the country has heavy rains from local thunderstorms caused by convectional uplifting of air parcel due to local heating. Pakistan experiences four rainy seasons i.e. winter rainfall, pre-monsoon rainfall, monsoon rainfall, and post monsoon rainfall. The winter and monsoon are the moistest seasons, while the other two constitutes as the driest seasons of the country. The highest annual number of rainy days is 91.3 at Murree in the north, while it decreases to 4 at Nokkundi in the south. The relative humidity of Pakistan is above 70% at Makran coast and less than 40% in southwestern Balochistan, and in the extreme north, while the rest of Pakistan has 40% to 70percent. The lower latitudes of the country along with coastal belt have a recorded wind speed of above 6knots, while it decreases to 2knots in the northern mountainous region. The lower Indus plain and southwestern Balochistan records low pressure in summer, while a ridge of high pressure develops over Himalayas in winter. The Makran coast and parts of Balochistan and Sindh have sunshine duration above 8hr/day, which reduces to 7hr/day toward northern mountainous region. Most of the plain has evapotranspiration above 3mm (0.12inches), while it decreases to 2mm (0.08inches) in highland. Due to its sub-tropical location, Pakistan has

two main seasons i.e. summer and winter. The summer season of the country lasts for seven months in plain and for four months in highland, while the winter season varies for five months in plain and seven months in highland. These two main seasons of Pakistan are further sub-divided into four sub-seasons i.e. cold, hot, monsoon, and warm. The cold season varies from mid-November to mid-April, hot season from mid-April to June, and monsoon season from July to mid-September and warm season from mid-September to mid-November. On the basis of distribution and variation of weather elements, Pakistan can be divided into five macro-regions, which are further sub-divided into 18 meso and 46 micro climatic types.

025 Climate Change, Climate Variability and/or Human Impact!?

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IPCC establishes the increase of approximately 0.8-0.1 °C in the average global temperature near Earth's surface since 1900, and strongly connects it with anthropogenic influences of "greenhouse gasses". American Geophysical Union considers that the complexity of the climate system makes it difficult to predict some aspects of human induced climate change. Climate change has become widely synonymous with that of global warming. This is paradoxically, construed in a very negative way as inevitably catastrophic in whole planet. For the detailed and unbiased analysis of this great planetary problem one of the obstacle is that the science of climate change is inextricably mixed up with politics and media. In this paper some long lasting hydrological and climatological time series are used in order to explain differences between the concepts of climate changes and climate variability. Second goal of the paper is explanation of interconnections between natural (geophysical) and human impacts on variability observed in these long lasting time series. Definite conclusions are that impacts of climate change are very uncertain, and that human interventions can influence hydrological and climatological changes on restricted (local or regional) regions.

Keywords: climate changes, climate variability, anthropogenic influence

036 Volga-Caspian Water Ecosystems Stability Under the Possible Climate Change and Natural Fluctuation

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According to the data of WMO during the nearest several decades in the region of the Caspian sea watershed area various scenarios predict the rising of annual air temperature by 2 to 4°C. As the result of the anticipated climate warming the volume of the annual water flow of the Volga will increase by 15-20%, but during the year this volume will not be equal within months. During the spring flooding caused by snow melting, the volume of flow will be 40% higher than today and during the summer rain floods the volume of flow will decrease by 20% to the modern state. These processes will influence the water ecosystems, but in each region they will have their own features. In the region of the Upper Volga increase of the flow due to snow melting and temperature increase together with increasing precipitation and changes in the snow melting processes may cause serious inundations. Inundations will widen the zones of under-flooding that may cause the ground water table increase and accordingly to additional widening of swamp massive. The water from the shallow floodplain territories flow into the deep channel part of the reservoir and provoke the oxygen deficit which results in massive fish kill. Researches in some regions showed that together with the water temperature increase the increase of the ammonium level and nitrogen of ammonia take place on one hand and decrease of the level of dissolved oxygen, especially during the dry and warm period of the year, on the other hand. In the region of the Lower Volga the anticipated temperature increase and the surface flow during summer decrease will cause the increased demand for water in the irrigated areas, which suffer from the drought now. Climate change effect will lead to additional increase of water consumption. Changes in the level of inner waters may influence the regime of navigation and endanger the fisheries, the terms of sprawling of existing species will change and more heat-loving species may intrude.

Keywords: climate change, Volga-Caspian water ecosystem

**038 Various Calculation Indexes for Evaporability
for Republic of Moldova's Territory**

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On the basis of measurements from 14 meteorological stations and using different interpolation methods we calculated evaporability. At the same time have been drawn maps showing the spatial variation of evaporability on the territory of the Republic of Moldova.

Keywords: evaporability, spatial interpolation

043 Turkey Surface Water Potential and Its Change in Time

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Water which is in brisk demand for drinking, watering, energy and the other requirements gains in importance in Turkey day by day. Questions about the existence of water which is risen in value and its changes in the period of time are placed on the agenda importantly. This study which intends to answer these questions, surveys the position of surface water trend and its changes in the period of time. In this study, data of daily mean, annual mean and maximum, minimum trend belonging to 130 of river observation stations in the 25 basins in Turkey are used. When the changes in the trends according to distribution over the regions are examined with the available water potential, trends of rivers in Marmara, Ege, Ic Anadolu, (including Sakarya basin) and Akdeniz regions, have a change. This change observed in the trend is in the position of decreasing generally except some stations. As a conclusion, in the last 39-73 years, it is obvious that there is a decreasing trend in surface water in the west, middle and South regions. In contrast, surface water in the other regions increases in the period of time.

Keywords: Water Potential, River Basin, Trend, drought, Dry and Wet Period

048 Detecting Trends in Drini River Basin

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The present study aims to analyze the river flow of Drini River, situated in northern Albania, using the data from this watershed. The objective of the study is to investigate whether there is any support for increases in river floods in observational data. Flood trend studies tend to focus in the annual maximum flood series, which means that in years with many high flows only one flood event per year will be selected, and in years with no large flows at all, a relatively low flow will be selected. In the present study it is used a Peak-Over-Threshold approach (POT), selecting all floods above a certain threshold that occur in an entire flow record, provided that the floods extracted can be regarded as independent. This means that in one particular year several floods may be recorded, whereas in another year no floods may be recorded. Thus the use of POT series also allows an estimate of the trend in the frequency of floods, rather just their magnitude, by calculating the number of POTs that occur each year and investigating the trend in this series. The data to be use are these of maximum monthly river flow in Drini river basin and are selected to be free of human influence (as much as it is possible). The method used to estimate whether there is a significant positive or negative trend in flood magnitude and frequency is the linear regression. By this method a regression line fits to the series and the slope describes whether the trend is strong or not. The null hypothesis is that the slope of the line is zero. However, the linear regression method requires the assumption of normal distribution and is very sensitive to outliers in the data, by ranking the observation and applying the non-parametric Mann-Kendall test, a more robust measure of trend is obtained.

Keywords: flood, water regime, peak over threshold

**049 The Impacts of Global Climate Change in Africa:
the Lake Chad, Adaptation and Vulnerability**

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The "Lake Chad" is one of the world's largest and most historical Lake located in the Sahel region of Africa (lat. 12:30 N to 14:30 N and long. 13:00E to 15:30 E) which is one of the most vulnerable regions to climate change bordering North-Eastern Nigeria, North-Western Cameroon, South-Eastern Niger and South Western Chad republics. The lake was 25,000 km square in the 1940s as indicated by the historians and some geo- archaeological and historical evidences, the recent of which was the accidental discovery of an ancient Canoe dating back to over three thousand years (3000) located in about Six hundred kilometres (600) away from the present day bank of the Lake in the Nigerian Territory, in the year 1992 by a peasant farmer from the Kanuri inhabited desert areas of Damaturu-Nigeria, while digging a well in quest of water for his domestic activities as reported by Abubakar, B. (IJNA 37.2,2008), but due to the continues incessant impacts of climate change in Africa which resulted in the incessant drying of rivers especially those feeder rivers supplying over 90% of the Lake water like the River Shari in the republic of Cameroon and the river Yobe in Nigeria has resulted those community living along the courses or banks of the feeder rivers to be blocking the rivers from supplying the water in to the Lake while trying to adapt to this climate change situation by building Dams along these feeder rivers in quest of water for their irrigational activities as well as other activities like the generation of Hydro electric city and other relevant activities. This situation has resulted in the reduction of the water of the Lake to just 1800km square and presently the Lake is at (lat. 12:50 N to 13:00 N and long. 14:50 to 15:00 E). Hence this situation has already started causing problems to the indigenous communities living around and depending on the Lake for their survival, because there is increasing drop in fishing activities in the lake as well as reduction in water supply for pastoral and irrigation farming activities in addition to other secondary impacts like the increasing rate of rural-urban migration, job loses and desert encroachments due to the growing numbers of people running into the fire wood selling businesses which depends on the deforestation of the shrubs and the little scattered trees serving as a shelter belt between the Sahara desert located in the north of the Sahel region and the fertile Lands. It was in view of the above, I came up with the under listed suggestions/recommendations:

1. Since the geology of the Lake Chad basin is indicating that the basin is holding one of the world's largest reserves of underground water, The United Nations in collaboration with the governments of the member countries of the "Lake Chad Commission" should jointly source for fund and invest in redeveloping the

Chad basin area, through modern irrigation agriculture water project like the one commission in Libya in the early 1990's.

2. The River Congo in the Democratic Republic of Congo presently flowing in to the Atlantic Ocean and which was geographically thought to be among the ancient or earlier major feeder rivers of the Lake in the past, should be diverted to be flowing in to the Lake again.

3. The governments of the member countries of the Lake Chad Commission in collaboration with the African Union (AU) and the Economic Community of the West African State (ECOWAS) should encourage and attract foreign investment into the Lake Chad area to help revive the Lake.

4. The Lake Chad research institutes should be properly funded.

5. Non-agricultural investments should be encouraged in order to avoid the growing pressure on fishing on the already drying lake.

6. Lake Chad University should be established by all or any of the stakeholders in order to provide jobs, promote research and education for the children of the inhabitants.

7. Since oil prospectors are already discovering new oil fields within the Lake Chad Region as in the case of the Lake Chad basin areas of the republics of Chad and Niger, the Lake Chad commission should ensure the employment of the inhabitants of this area is given an upper priority in this new emergent petroleum industries in order to reduce pressure and over dependence on this Lake.

8. The United Nations Environmental Program and relevant stakeholders on water issues should assist in their capacities and technical know-how in preventing the pollution of the lake from the newly emergent petroleum industries within the Lake Chad basin.

9. The indigenous communities should be mainstream into the decision Making processes in reviving the lake as well as fighting climate change.

10. Expert on climate change should be organizing series of educative Conferences, seminars, workshops and training on climate change and adaptation.

I believe that if the above-mentioned suggestions /recommendations are adopted and implemented it will help protect the Lake Chad from completely drying up in one hand and save the lives of millions of people and animals depending on the Lake for their survival which is facing the impacts of climate change.

Keywords: Water, Climate, Vulnerability, Africa, Kanuri

050 Meteorological Extreme Events and their Evaluation Based on Climate Change Scenario

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Extreme meteorological events are present in the downstream of Drini River. Regarding to the climate change scenario for Albania which leads to an increase of these extreme meteorological elements, review existing information is evaluated. Trend of occurrence of meteorological hazardous for the time horizons 2025, 2050, and 2100 are evaluated based on climate change scenario for Albania. Taking into account the increase of temperature, suggested from scenario, a decrease of number of frozen day $<-5^{\circ}\text{C}$ will occur. (Less than one day/year). An increase of about 10 day/year with the temperature $>35^{\circ}\text{C}$ by 2100 time horizons is expecting. Another extreme event is droughts. They have dramatically increased in the number and intensity in some parts of Balkan Region. Also an increase of the consecutive number of no rainy days is expected. Thus, the SPI index for Albania is calculated in the frame of the project Drought Management Centre for Southeast Europe (DMCSEE) financed by European Union through South East Europe Transnational Cooperation Programme. The impact of the meteorological hazardous in some of the key economic sectors is estimated too.

Keywords: extreme meteorological elements (heavy rain, extreme temperature, drought, strong wind.), climate change scenario, impact in some of the key economic sectors

051 Trend Analysis of Maximum Snow Depth and Water Equivalence

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Trend analysis of time series of annual maximum snow depth, time series of snow water equivalence of annual maximum snow depth and time series of annual maximum snow water equivalence were carried out at 17 snow measurement stations located in Yukari Kizilirmak, Seyhan, Firat ve Dicle-Zap catchments. Elevation of stations are changing between 1300-2400m. Observation periods

of stations are changing from 1966 to 2008 year. Mann-Kendall trend method are used for trend analysis. As a results of his study, it has been determined that there was no change at all stations for long term (1966-2008) period except at two station (18-K01 and 18-K03).

Downward trend for station no:18-K01 and upward trend for station no:18-K03 is determined.

Keywords: Maximum Snow Depth, Water Equivalence of Maximum Snow Depth, Trend Analysis, Mann-Kendall Trend Method

054 Global Climate Change Impacts on Albania: Meteorological Analysis of Ohrid Basin

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Albania is a small country, there are important climatic differences, (Mankolli H., 2007), which are result of the very broken country's relief. Four climatic zones: Lowland-Mediterranean Zone, Hilly-Mediterranean Zone, Pre-mountain-Mediterranean Zone and Mountain-Mediterranean Zone. Typical Mediterranean climate characterizes the lowlands and the plains. The mountainous area has in principle typical continental climate with a slight Mediterranean influence. But there is a significant difference between the North and the South. In the South the summers are drier and the differences between summer and winter temperatures are not as big as in the North. The data climatic for same year's period where minimal and maximal temperature and precipitation on micro zone in territorial areas Ohrid_Pogradec, Albania, take on study, we have value from coefficients of Q with small limits boundary. The index Q from applied method Emberger is 102.9. Eco zone in the mountainous and lake ecosystem of Ohrid_Pogradec classification on bioclimatic model, with humidity, with value (Q) over 90. The data climatic for same year's period where minimal and maximal temperature and precipitation on micro zone in territorial areas Ohrid_Pogradec, Albania, take on study, we have value from coefficients I_c , I_t , I_o : the index I_c from applied method Rivas Martine's is 11.13, the index I_t from applied method Rivas Martine's is 371.3 and the index I_o from applied method Rivas Martines is 4.6.

Keywords: climatic index, meteorological data, climate change, Ohrid basin

**072 Effects of Climate Variability on Wheat Crop Productivity
over the Central Rift Valley of Ethiopia**

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Effects of Climate Variability on Wheat Crop Productivity over the Central Rift Valley of Ethiopia Tadesse Tujuba¹, Girma Mamo² ¹Arba Minch University, Ethiopia ²Ethiopian Agriculture Research Institute The assessment of climate variability, its effect and predictability would have enormous advantage for countries like Ethiopia whose economy is highly dependent on agriculture. It was with strong background that this research was conducted to contribute to climate risk management in Ethiopian agriculture development dynamics with particular reference to wheat production in the Central Rift Valley of Ethiopia. Climate data, yield data and different oceanic indices were obtained from National Meteorological Agency of Ethiopia, Central Statistics Agency of Ethiopia and the website of NOAA/Climate Prediction Center respectively. Spatial and temporal rainfall variability was assessed in terms of some agriculturally important patterns like the time of onset/end date, length of growing period and dry spells. Accordingly, the time of rainfall onset date and length of growing periods are highly variable, making the decisions related to when and which cultivar to plant more critical. The correlation analyses between seasonal rainfall of Kulumsa area and global ocean indices show both Atlantic and Indian Oceans. SSTs dictate seasonal rainfall of the area in addition to ENSO. Forecasting of June-September (JJAS) season using SSTs and SOI as predictors is also possible with reasonable skill at the area. The stepwise multiple linear regression method was used to develop the forecasting model. On the other hand, the March-April-May (MAM) season rainfall of the area is highly variable, and hence SSTs alone could not have a deep explanatory power. The assessment on whether ENSO phases have effect on seasonal rainfall amount and crop yield using composite analysis shows El Ninjo increases the MAM season rainfall and decreases the JJAS season rainfall and crop productivity. It is also characterized by late rainfall onset, early end date and shorter growing period. La Ninja decreases MAM season rainfall and crop productivity, and increases the JJAS season wetness. In addition, the analyses done using REF-ET software show crop water requirement is highly variable from year to year and within the growing season. May-June is the best planting time as far as crop water requirement is concerned. The stepwise multiple linear regressions used shows that wheat crop productivity could be predicted before harvest with certain skill at Kulumsa. Therefore, user tailored seasonal climate information is very critical for wheat production at the area. Above all, sub

seasonal climate variability, probability of extreme events and other underlying causes of climate variability related to atmospheric conditions like jets and waves should be assessed in future works.

Keywords: Seasonal, Rainfall, Wheat, ENSO

101 Climate Change Influence on River Run-Off and Hydro Power Developments in Southeastern Europe

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The Norwegian energy company Statkraft has launched activities in South East Europe with the aim of defining feasible projects for developing the water power resources in the region. Until now the first project is approved by the government of Albania. Designing and operation of hydro power plants (HPP) has many challenging aspects. During the design phase optimization of the installed capacity must be in accordance with the inflow. During the operational phase the production has to be optimized from the forecasted input of water resources to the system and from the predicted electricity demand in the market. The main commodity to a hydro power plant is always the inflow. Recent climate change studies have shown that the rainfall in South Eastern Europe (SEE) is likely to decrease in the future while the temperature will increase. In this paper we want to present the preliminary results of the work we have done to study the effects of climatic changes on the runoff in some selected rivers in SEE, and to discuss the consequences this effect will have on energy production in the region. In order to calculate the effects on runoff we have applied a hydrological model (HBV) using precipitation, temperature and climate scenarios as input, and the output from the model simulations is time series of runoff and evapotranspiration. We will also discuss briefly how a possible reduced inflow may influence on the hydro power production and the price of electricity in the region. The project is collaboration between Statkraft, hydro-meteorological institutions in SEE and research institutes in Norway.

Keywords: Hydrology, climate change, hydro power

**104 The Role of Hydroelectric Power Projects in Climate Change:
a Case Study of Ravi Basin in Chamba District
of Himachal Pradesh India**

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Dams have had serious impacts on the lives, livelihoods, cultures and spiritual existence of indigenous, tribal and illiterate people, moreover on the physical environmental conditions and on the biodiversity of the area concerned. The dam related developmental activities in Ravi catchment area have been threatening the biodiversity in the whole catchment. There are more than 50 rivulets in the Ravi catchment and on which more than 70 power projects have been planned by the government by putting biodiversity at the stake. All these have unintentionally produce weather and climate modifications on a larger scale and threaten the existing biodiversity. Such developmental activities have been started day back in 1980s in Ravi basin with the installation of Baira Suil Power Project and today it has covered all most all Ravi basin starting from interstate broader of Jammu & Kashmir, Punjab and Himachal Pradesh and engulfed the green cover of the area. Because of this extinction the catchments area is experiencing drastic climatic changes, because of 100 km reservoirs of Shahpur Kandi (125MW), Thein Dam (600MW), Chamera-I (540MW) and Chamera-II (300 MW) and tunnelization of Ravi in 19.38 kms with a dia of 7 to 9 meters and dry Ravi in almost all its natural route (27 kilometers in Chamera I & II). In this dry region there is a tremendous increase in the temperature and there is no timely and usual rain in the basin after the installation of power projects. The present paper is based on original micro field research conducted by the researcher, has been carried out in the in the lower Himalayan Region by using exploratory and descriptive method. To analyse the impacts on climatic conditions, the viewpoints of respondents have been supported with the data provided by metrological department and Tyndall Centre for Climate Change Research, Norwich, UK.

Keywords: Dams, Human intervention, Climate change, Hydroelectric power projects

**119 Bureden of Drinking Water as Function of the Climate Change
in the Republic of Macedonia**

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Climate change has a complex connection with health. This includes direct influences like illnesses and conditions that may end with deadly outcome and are connected with the changes in temperature; health impacts of extreme weather events (floods, droughts and storms); and the effects of air pollution. Other ways of impacts like those on disease distribution related to drinking water, food or vector-translated and zoonoses, or health conditions resulting from lack of food and water, follow indirect ways. The most widely impacts of climate change on drinking water resources in the Republic of Macedonia concern availability of water supply as reduced in-stream flows, decreasing snow pack, earlier and more intense snowmelt and runoff, and reduced aquifer recharge which can be manifest with increased risk of drinking water pollution by arsenic in south part of the country. Drinking water and food- translated diseases could be affected by climate changes. Floods, droughts and storms bring in their wake increased health risks, such as diarrhoea among children. Possible increasing risk for surface water sources for drinking water can be result as more widespread and persistent algal blooms, changes in watershed vegetation, and increasing water temperature with associated increases in eutrophication, disinfectant demand and re-growth potential-Berovo, Bitola, Strumica, etc. Lots of influences of climate change including health effects, could be diminished or avoided with different adaptabilities. Important mechanisms for disease prevention originating from water and food are traceability, microbiological risk assessment, risk communication and risk management. The high priority adaptation measures are proposed in the following domains: Irrigation and water supply of population, floods and droughts, erosion and sedimentation, drinking water resources management; water quality and monitoring.

Keywords: Climate Change, Health, Risk, Drinking Water, Adaptation

120 A Framework for Including the Impacts of a Changing Climate on Future Water Security

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Umgeni Water, the second largest bulk water utility in South Africa, is responsible for supplying bulk potable water to some 6 million people at high levels of assurance. The demand for water is increasing rapidly as the utility increases its customer base, and at the same time addresses the water requirements of the millennium development goals. To maintain this level of service, timeous decision making regarding future water resources and infrastructure requirements is of paramount importance. To facilitate this, a framework that incorporates a changing climate has been developed to provide plausible scenarios of water resources and water supply in the future. The framework is presented, and as a proof of concept, a model configuration and results from the Mgeni catchment in South Africa are discussed. Results include potential impacts on a) water resources, b) water yield and assurance of supply, c) future water requirements, and on c) proposed future capital expenditure programmes. The framework includes contemporary hydrologic, climate and water yield models, and can be adapted and installed to other locations with relative ease.

Keywords: Climate Change, Water Resources Management and Planning, sustainable economic development, ACRU Agro-hydrological model, adaptation, Water Resources Yield, Risk, Assurance of Supply, Mgeni catchment in KwaZulu-Natal.

121 A General Outlook to the Climate Change of Northern Cyprus

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Northern Cyprus (NC) for being an island has suffering from variety of climate conditions all around the country. NC is divided to six meteorological regions. Observation records showing great variety for each region. The first record was done in 1975 and each station has at least five gauge stations. In winter seasons,

the rainfall records reveal maximum at Southern Coast as of 457mm/year and minimum at Central Mesaoria as of 295mm/year. The average annual rainfall is measured as 373mm /year in the country. The temperature, which is having great effect in the water budget of the country, in summer times have an average of 30 °C and 15 °C for winter times, averagely. The pan A observations for evaporation reveals 12mm/month which falls to 80% of the rainfall over the regions. In this research, the climate change in NC; rainfall, temperature, moisture content and evaporation values, will be searched using statistical methods, regional and district basis whenever possible.

Keywords: Northern Cyprus, climate change, rainfall, statistical methods

127 Spatial Distribution of Climate Factors in Average and Extreme Years

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Mapped spatial distribution of seasonal precipitation amounts and average air temperature are obtained for the research areas in years with normal and extreme values of glaciers runoff as well as total river runoff. To achieve this we used anomalies of precipitation amount for October-April and anomalies of average air temperature for June-September during 1961 - 1990, at 93 meteorological stations located along the intervals: latitude 30.20° - 44.08°N, longitude 67.20° - 82.98°E, and altitude of 122 - 4 169 meters above sea level. According to this information for each point-element (i.e. meteorological station with proper data) were calculated statistical probabilities by means of sample volume equaled to 30 years and received averages and standard deviations for each year. In characteristic years were revealed significant differences for spatial distribution of runoff climate factors. It was found out that the spatial distribution of the total amount of glaciers melting is the most variable in years with average water yield, as compared to the extreme years. This peculiarity is very beneficial for hydropower and agriculture because provide additional and natural ability to stabilize water balance of reservoirs. A piecewise multi-linear equations were obtained also to calculate the statistical probability of glaciers total melting in low and high flow years as a function of geographical coordinates and the average altitude of firn boundary. Statistics of climate factors of glaciers runoff, including integral and differential distribution and spatial correlation functions, provide a

much more informative impact of climate change on the hydrological regime of glaciation, compared to the empirical estimates of averages values alone.

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Keywords: climate factors of runoff, spatial distribution, extreme years

131 General Pattern of the Hydrologic Balance in the Sava River Basin

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Most important components of hydrologic balance within river basin are precipitation - P_b , runoff - Q (often represented by net precipitation - P_n), and evapo-transpiration - E_t . Precipitation and runoff are commonly measured with satisfying accuracy. However, evapo-transpiration is difficult and expensive to measure, and frequently is estimated by various mathematical models or simply as difference $P_b - E_t$. Mechanisms that govern the considered processes and their relationships upon each other are very complex for they depend on the climate, topography, geology, vegetation etc. Many of these factors, except for within-the-year fluctuations, are stable or slightly variable over long time periods. This feature offers an opportunity to assess a general pattern of the balance components within the catchment. This paper describes a mathematical model that relates components of hydrologic balance to the total precipitation - P_b , observed at a considerable number of gauging stations. Available data collected over the Sava River catchment support a reasonable assumption that a relation between average annual values of P_b and P_n can be linearised. From that, a linear relationship between E_t and P_b , as well as a hyperbolic dependence between runoff coefficient - f and P_b , can be obtained. The model cannot replace analyses of hydrological data regularly collected over considered catchment. Yet, it can give a general insight into spatial distribution of the considered processes. Also, it can be used as a tool for a rough assessment of water resources on ungauged catchments or for a quick overall check-up of calculations based on the observed data.

Keywords: Precipitation, runoff, evapo-transpiration, runoff coefficient

138 Rainfall, Fertilization, Soc Changes in a Long Term Field Experiment

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Seasonal changes of SOC's mechanisms of arable soils are essential in understanding and mitigating global climate change. The objectives of this study were to determine of rainfall and fertilisation impacts on SOC's changes in a long-term field experiment on a Haplic Luvisol using popular rotation crops in a fragile agro-ecological environment at Nyrlugos city (Nyrség region; N: 47° 41' 60" and E: 22° 2' 80") in Hungary from 1962 to 2002 for 40 years. During 40 experimental yr seasonal correlations (R^2) amongst SOC (mg kg^{-1}) and precipitation (mm) in winter half year's (WHY's), and in summer half year's (SHY's) ranged from WHY's $R^2 = 0.4401$ to 0.8934 , and from SHY's $R^2 = 0.3343$ to 0.9078 in a significance at $P < 0.001$. NPKCaMg fertilization impact on SOC (mg kg^{-1}) and precipitation (mm) correlations were significantly ($P < 0.001$) at a mean of $R^2 = 0.4691$ in the WHY, $R^2 = 0.6171$ in the SHY, and $R^2 = 0.6582$ over the 40 yr. However, organic carbon stores (mg kg^{-1}) in soils decreased linearly by increasing precipitation between 322 mm yr^{-1} and 727 mm yr^{-1} .

Keywords: Precipitation, fertilization, SOC

**146 Climate Change Impacts on Water Resources
in the Upper Basin of Okpara in Benin (West Africa)**

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This survey aims at evaluating climate change impacts on water resources availability in high basin of Okpara. It focuses on the water resources vulnerability as regards to climate modifications observed in the basin. The modifications are characterized with climate indicators' variability. To identify current signs of climate change data of normal (1941 - 1970) and (1971 - 2000) are analysed and compared. The heap of rain days, the rainfall average have been used to determine gaps between the two considered normal. Data obtained at different scales have been reported in relative values. As for temperatures, warming up indicators are based on the calculation of gaps ($^{\circ}\text{C}$) between the considered normals (1941 -

1970 and 1971 - 2000). Besides, by taking into account the climate indicators' evolution on the set of reference 1961-1990, their future evolution has been estimated. The comparative analysis of rain data, rainfall between normals 1971-2000 and 1941-1970, shows an overall decrease between 16 and 28% in the high basin of Okpara. In this same period of time, temperatures have increased of 1°C overall in the basin. This situation has led into a deterioration of water resources in the basin, which has resulted into a decrease of the Okpara River's flow. Indeed, the analysis of hydraulic regime on the set 1965 - 2000, shows an overall tendency to the decrease in order of 20 to 25% during months such as July, August, September and October, which consequently of water resources in the basin. By 2050, on the basis of projections and scenarios, temperatures will increase between 1,5 and 2°C in the basin in relation to the decrease of the rainfall would be strode between 11 and 30%. As for flows, on the same horizon, 2050, this decrease will pass at 30% in 2010, then 40% in 2050. If this situation does not reverse, one would attend a reduction of the water availability in the basin. In this context, the reduction of superficial water resources will disturb the ecological and socio-economic systems of this basin already vulnerable because of current climate contexts.

Keywords: Climate change, water, vulnerability, upper basin of Okpara, Benin

159 Mean Monthly Snow Cover Depth Trends in East Anatolia Region of Turkey

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This study investigates possible Mean Monthly Snow Cover Depth (MMSCD) trends at 13 meteorological stations (5 cities and 8 town) in East Anatolia Region of Turkey, spanning a period of November to April for approximately 27 years. Homogeneity in time series are tested by using a method developed by Swed-Eisenhart. The non-parametric Mann-Kendall trend test is used to demonstrate any existence of possible MMSCD trends. The results show that there are 64 series don't indicate trend of MMSCD. However, 6 stations have positive trend, 2 stations have negative trend. It is tried to examine the linear relationship but coefficients of correlation are too low, so there is no linear relationship in time series that have trends. These changes could be associated with regional climate changes and global warming phenomena.

Keywords: Mean Monthly Snow Cover Depth, Trend Analysis, Mann-Kendall Test, East Anatolia Region

**166 Trend Analysis of Hydrometeorological Parameters
in Turkey Climate Regions**

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Due to its possible effects, climate change has been a significant topic of research in recent years. Trend analysis is a basic tool to understand variations in time. The purpose of this study is to investigate the trends in hydrometeorological parameters for five different climate regions of Turkey. Long term annual mean temperature, precipitation, pan evaporation data and actual evapotranspiration estimations derived by Turc Formula has been used to determine trends. The data has been analyzed by run test (swed-eisenhart) for homogeneity of time series and implemented mann-kendall non-parametric trend test. The results will show the temporal and spatial distribution of trends for hydrometeorologic parameters and will give an idea about water potential change in time.

Keywords: trend analysis, mann-kendall test

**170 Climate Change Scenarios of Precipitation Extremes Based
on Regional Climate Model Simulations**

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Future scenarios of high quantiles of precipitation amounts are examined in an ensemble of regional climate model (RCM) simulations for the 21st century, carried out within the European projects PRUDENCE and ENSEMBLES. Differences between winter and summer seasons, and the dependence of results on the driving GCM and emission scenario are examined. We apply the region-of-influence method as a pooling scheme in the estimation procedure, which takes into account data from a "region" (set of gridboxes) when fitting the extreme value distribution in any single gridbox. "Homogeneity" of the regions, i.e. the condition that one may assume that the distributions of extremes are identical apart from a

gridbox-specific scaling factor, is tested by a built-in regional homogeneity test. Climate change scenarios for the early-21st century (2020 - 2049) and late-21st century (2070 - 2099) time slices over central Europe show that precipitation extremes are likely to increase in severity in winter and, with less agreement among models, also in summer. The inter-model and intra-model variability and related uncertainties in the pattern and magnitude of the change are large but the scenarios tend to agree with the precipitation trends recently observed in the area, which may support their credibility. In most scenario runs, the projected change in extreme precipitation in summer is of the opposite sign than a change in mean seasonal totals; a combination of enhanced heavy precipitation amounts and reduced water infiltration capabilities of a dry soil may severely increase peak river discharges and flood-related risks. The application of the pooling scheme in the frequency analysis efficiently reduces (random) variations in the estimates of parameters of the extreme value distributions in individual gridboxes that result from large spatial variability of heavy precipitation, and represents a useful and straightforward tool for “weighting” data from neighbouring gridboxes within the estimation procedure.

Keywords: precipitation extremes, climate change, regional climate models

172 Climate Change & Water Resources: Risk & Risk Management - Guyana

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Sea level rise resulting from climate change can be severe on coastal rivers and aquifers on continental coastal areas and small islands. Guyana is on the north eastern coast of South America, most of the population of which resides on a narrow coastal strip bordering the Atlantic Ocean, and below high tide level of the ocean. Water supply for domestic, agriculture and industrial uses are obtained from a combination of ground and surface water sources. In this paper an attempt is made to analyse situations that can arise as a result of sea level rise. A specific sea level rise of one meter by the end of the century and the impacts of this rise is investigated. The results indicate that the consequences for the surface water resources can be severe, but not as severe for the ground water resources.

Keywords: sea level rise, surface water, ground water

183 Impacts of Climate Change on the Hydrology of an Alpine Catchment, Assessed from an Ensemble of Regional Climate Models

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The Alps are the source of many major rivers in Europe. Possible changes in runoff of Alpine watersheds are of great importance also for the surrounding lowlands. The objective of the present investigation is to assess the impacts of climate change on the hydrology of the Lech Valley (1,000 km²), situated in the northern parts of the Alps. An ensemble of 9 climate projections provided by the EU-funded project ENSEMBLES has been used to simulate future climate. In order to overcome the gap between RCMs and the hydrological model, the delta change approach was chosen. An observed 30-year time series (1971 - 2000) of precipitation and temperature was perturbed according to mean monthly changes between the RCM runs. The hydrological simulations were employed with the semi-distributed model HQsim in an off-line mode. Both the calibration and validation of HQsim indicate that the model simulates runoff well in a complex topography like the Alps. The results show considerable increases in monthly temperatures and significant accompanying changes in the seasonal rainfall patterns, including an increase in the rainfall from November to May and a decrease in the rainfall from June to August. The resulting effects to the runoff indicate large seasonal varying changes. A decrease in monthly runoff during summer and increases in winter minimize the inter-annual disparities between low runoff in winter and high runoff in spring and summer. An analysis of monthly peak flows shows substantial changes in the magnitude of winter and summer floods. Due to these changes, water management will face new challenges in future. In comparison to existing studies, the use of an ensemble of different GCM-RCM combinations in this research allows to assess uncertainties in the climate projections. The overall agreement on climate runs provides high confidence in the simulations.

Keywords: Climate change, Hydrology, Uncertainty, Stream flow

**186 Impact of Global Warming on the Regime of Precipitations
in South Bulgaria**

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Recent years have seen a very large concern among the scientific community on the problem of global warming and climate changes. Increased the extremes of climate as a record droughts and floods, which losses worldwide are estimated at hundreds of millions dollars and thousands of lives. Many forecasts of scientists suggest that the Planet will be warming and one of the most affected areas will be Southern Europe, including Bulgaria. It was conducted investigation in one of the most intensive agricultural region in Bulgaria - Tracia lowland, in order to establish the changes of precipitation regime during the last 70 years. It was used the main meteorological information for the last 70 years. Meteorological data were processed with conventional methods in climatology and agroclimatology (Gulinova, 1974; Kelchevskaja, 1975). There were established changes in rainfall regime during the vegetation period in the direction of drought; changes in agroclimatological resources and conditions for growing major in country and Tracian region agricultural crops. Require a change in technology for growing crops with a global trends.

Keywords: global warming, climate change, precipitation regime, agroclimatic resources, agriculture, yield, optimal conditions

**192 Long-Periodical Variations of Earth Rotation, Determined
from Reconstructed Millennial-Scale Glacial Sea Level**

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The variations of the Earth rotation in time are caused by the gravitational influence of Moon, Sun and planets, displacements of matter on the Earth surface, inside the Earth liquid core and core-mantle boundary. An important part of Earth rotation excitation is the influence of the Mean Sea Level (MSL) changes, due to polar ice sheets variations, followed by changes of the axial momentum of inertia. Significant polar ice variations occur during the last glacial-deglacial

cycles. Recently the glacial sea level variations have been reconstructed for the last 380Kyr by Siddall et al. (2003). These data are used to determine the long-periodical variations of Universal Time UT1 and Length of Day (LOD). The long-periodical components of MSL and Earth rotation are determined by means of spectral analysis, Fourier approximation based on the Least-Squares estimation of trigonometrically coefficients and autoregressive time series analysis (ARIST) of the unknown frequencies. The estimated periodicities of MSL and UT1 variations are compared with the variations of Earth precession and Earth orbit parameters. The results will expand our knowledge about the global Earth processes and mutual influences between long-term climatic variations, hydrological cycles, Earth Orientation Parameters (EOP) and Earth orbit at millennial time scale.

Keywords: mean sea level, glacial cycles, Universal Time UT1, Length of Day LOD

***193 A Model of Global Water Redistribution During Solar Cycles,
Derived by Astronomical Data***

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The global hydrologic cycles are widely affected by climatic variations, which are mostly driven by solar-terrestrial influences. The existing hydrological time series describe in details the global water redistribution over the continents and oceans, but we have not enough information about the decadal ice changes over the polar caps. A model of global water redistribution is created by means of the Earth rotation data for the period 1623 - 2005, reconstructed Total Solar Irradiance (TSI) data since 1610, sunspot data since 1749 and Mean Sea Level (MSL) data from various maregraph stations since 1774. The used method includes determination of the Universal time UT1 response to 11-year sunspot cycles and separation between the solar signals in Earth rotation and the Earth core signals; determination of the necessary change of the Earth angular momentum, corresponding to the observed mean amplitude of 11-year UT1 cycles, due to the solar activity; estimation of the mean amplitude of 11-year MSL cycles, determined from maregraph data and determination of the necessary water redistribution between the oceans and polar ice, corresponding to the observed 11-year UT1 cycles. This approach yields an estimation of the redistribution of the evaporated ocean water over the continents and polar ice, due to the 11-year sunspot cycles and corresponding TSI variations, as well as global water redistribution, due to

the 22-year magnetic solar cycles and 45-year equatorial solar asymmetry cycles. The calculated time series of polar ice thickness oscillations and continental water storage variations with periods 11, 22 and 45 years will improve our knowledge about the hydrological cycles and will help long-term hydrological prediction.

Keywords: Universal Time Ut1, solar activity, sunspots, total solar irradiance, mean sea level, decadal icethickness variations, global water redistribution

204 “Yield - Water” Relationship of Soybean

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The aim of this study is an establishment of reliability of two formulas for calculate the relation “Yield - water” of soybean (Biser var.), grown in region of Plovdiv (Bulgaria). The experimental work has been carry out for 5 years (2003 - 2007). Data for relative yield and relative irrigation depth, by different irrigation regime (0, 30, 50, 70 and 100% of irrigation rate) have been used. These data have been calculated through special computer program “YIELD”. The curves which we have got, interpret exactly the experimental data ($R = 0.90$ and over). Yield coefficient without irrigation is average 0.54. The experimental data are able to use for management of irrigation of soybean.

Keywords: soybean, irrigation, yield, water deficit

198 Correlation Between Precipitation and Sava River Discharge in Zagreb

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We are witnessing an increasing importance of contemporary climate changes. This paper deals with correlation between amount of precipitation and Sava River discharge in Zagreb. Ljubljana is the representative meteorological station for Sava River discharge investigation in Zagreb . Due to prominent variability of the process

the emphasis is on establishing linear trends. In order to reduce the negative characteristics of shifting arithmetic means, only three-year shifting arithmetic means are shown. The increase of annual precipitation amount in Ljubljana leads to increased Sava discharge in Zagreb. Correlation between precipitation and discharge is linear, therefore we have linear correlation. Calculated correlation coefficient is 0.81. Sava river discharge in Zagreb has been recorded since 1926, but due to the break between 1996 and 1998, the existing data from the following few years after the break were not used. There has been a downward trend of Sava discharge in Zagreb since 1926. However, there is a distinct difference between the older period (1926-1959) and the recent one (1960-1995). In the older period there is a big variability of Sava discharge. Three-year shifting arithmetic means also prove it. The recent period is characterized by a decrease of difference in mean annual Sava discharge. Distinct trend in discharge decrease is also very important. Linear trend shows that "linear" annual discharge between 1960 and 1995 decreased by 118.85 m³s⁻¹. That is undoubtedly alarming information.

Keywords: precipitation, discharge, Sava River, Zagreb, climate

202 Influence of Climatic Changes on Characteristics of Snow-Melt Flood of the Rivers of Prypyat's Basin Within the Limits of Ukraine

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Global changes of atmospheric circulation, which took place during the last decades on considerable territory of Europe, influenced on the terms of forming of the hydrometeorological phenomena, in particular maximal flow on the rivers of Prypyat's basin within the limits of Ukraine. For the normal functioning of objects of the economic setting within the limits of this territory is exceptionally important knowledge about the changes of basic characteristics of snow-melt flood (as a main phase of intra yearly division of flow) of, which occurred under the influence of climate changes.

According to results of our previous researches, beginning of period of modern changes of the hydrological regime of the rivers of Ukraine and Prypyat, in particular, can be attributed to 1989.

Consequently, research of characteristics of snow-melt flood of the rivers of basin was made by us for two representative periods: 1) from the beginning of observation (the post-war period) for 1988 inclusive; 2) from 1989 to 2007.

Were analyzed changes of such characteristics of snow-melt flood, as the date of its beginning and end, the volume of runoff, maximum specific discharges, runoff of spring snow-melt flood as a percentage of annual runoff and duration of snow-melt flood on rivers of right-bank part of Prypyat's basin.

According to results of researches of characteristics of snow-melt flood were built comparative histograms for two selected periods. Were built digital maps of changes of the characteristics of snow-melt flood for specific periods.

Was detected change of basic hydrological characteristics of snow-melt flood on the rivers of Ukrainian part of Prypyat's basin for the last 20 years.

Noted a significant decreasing of maximum specific discharges, volumes of runoff for a snow-melt flood during the last twenty years, for some hydrological observing stations even in two times. Nowadays there is smaller percentage of the annual runoff (29%) on the period of snow-melt flood, than it was to 1989 year (39%). Dates of start and end of snow-melt flood in the modern period have shifted to earlier terms. For the duration of snow-melt flood, (the average on a basin) this value has increased since 1989.

This kind of changes of basic characteristics of snow-melt flood of the rivers of Prypyat's basin can be attributed to intensive growth temperatures of air in winter - spring period, diminishing the depth of soil freezing and value of water equivalent of snow during the last decades of XX century and at the beginning of XXI century.

Keywords: snow-melt flood, annual runoff, the volume of runoff, maximum specific discharges, duration.

210 Analysis of Air Temperature Variations in Bulgaria

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A long-term air temperature fluctuation in Bulgaria is examined. The seasonal and annual mean, maximum and minimum air temperatures are used to study these fluctuations. In analysis the emphasis are on the existence of trends and periodicity in the time series. Diurnal temperature range (DTR) is calculated, too. DTR generally decreases under global climate warming due to more significant night minimum temperature increase. Number of days with maximum temperature above given threshold and their variations are studied. The warmest decade in Bulgaria is determined. The distribution of temperature in this period is compared with this one in 1961-1990 reference period recommended by WMO

as representing present climate. The extreme indices are analyzed, too. The obtained result could be used as an analogue for future. To estimate the change and its significant character some statistical methods are used.

257 Recent Results of Hydrological Monitoring in the Catchment of Karst Springs on the Planina Polje (Sw Slovenia)

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Several karst springs are located at the southern border of the Planina karst polje in south-western Slovenia. The most important are the Unica ($Q_{min}=0.04\text{m}^3/\text{s}$, $Q_{avg}=13.5\text{m}^3/\text{s}$, $Q_{max}=70\text{m}^3/\text{s}$) and Malencica ($Q_{min}=1.1\text{m}^3/\text{s}$, $Q_{avg}=6.7\text{m}^3/\text{s}$, $Q_{max}=11.2\text{m}^3/\text{s}$) springs. Unica flows from the 6.6km long Planina Cave, and Malencica is its right tributary. Their catchments are interlacing, for both interchange between surface and underground flows is characteristic. The catchment can be divided into three separate but hydrologically connected parts. The central part is the karst massif of Javorniki and Sneznik. It borders at the western side on the valley of the Pivka river and its tributaries, and on the eastern and northern side on a string of karst poljes (the biggest among them is the Cerknica polje), which are distributed gradually in the SE-NW direction. In the first of these three contribution areas the underground flow is dominant, and in the other two surface streams are present also. They are mainly recharged by karst waters, and after a certain distance of surface flow they sink again underground. In order to study the relations between these contribution areas, which are changing according to hydrological conditions, a monitoring net was installed within the catchment in 2007. Three rain-gauges were set in the three contribution areas. The sondes for measuring of water level (occasional parallel measurements of discharge enabled the assessment of discharge curves), temperature and electrical conductivity were installed at 2 karst springs and 5 water streams within their catchment. Based on the interpretation and comparison of obtained data for 2 hydrological years, the influences of different types of recharge, exchanges between surface and underground waters, relations between the inflows from various parts of the catchment and their contributions to the discharges of springs were assessed.

Keywords: karst hydrology, discharge, electrical conductivity, temperature, Planina polje, Slovenia

307 Bioclimatic Variability

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The present research relates to the study of the global variability of the bioclimatology in Benin. The impact of the global warming on the human bodies during these two decades last ones worries more and more the international community. But all the available data is global data. Consequently, the indications of comfort and discomfort due to the reheating in the scale regional and local are not exactly determined. Now it is important to have precise data for effective decision-making. The analysis of the series of the temperatures and the humidity on the synoptic stations by means of the statistical methods and the tests of analyze bioclimatic thus allowed to have a rough idea of the indications of comfort in Benin. The results revealed that the temperatures are everywhere for the increase and that this increase of temperature influences the bioclimatic atmospheres indicating a general discomfort on the whole country.

Keywords: Benin, warming, tendency, bioclimatic atmosphere

309 Seasonal Changes of Precipitation and River Discharges in Croatian Part of Drava River Basin

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This paper analyses long term trends of seasonal precipitation and discharges and their statistical relationship in Croatian part of Drava river basin. Researched area has continental type of the annual course of precipitation - precipitation maximum is in Summer and minimum in Winter. Discharge regime of Drava in Croatia is mainly combined nival-glacial, with maximum in warm half-year (June). Influence of precipitation at Varazdin, Koprivnica and Donji Miholjac meteorological stations on discharge values for Drava-Donji Miholjac hydrological station is analysed using 50-year data series (1958 - 2007). Decadal values of precipitation and discharge amounts are calculated for each season in order to detect possible similarities. Linear trends show decrease of average amount precipitation in

Spring and Winter, and increase in Autumn. Influence of these seasonal changes on Drava-Donji Miholjac discharge regime is studied. Furthermore, long term trends and correlation coefficients are calculated in order to identify whether the changes in precipitation amount cause adequate changes in discharge regime. Although analyses of yearly values of precipitation and discharge show moderate connections, there are significant differences in correlation for each season. Highest values of correlation are calculated for Spring, and lowest for Winter.

Keywords: precipitation, river discharge, climate change, Drava

310 Simulations of Low, Moderate and Heavy Daily Precipitation Amounts for the Territory of Bulgaria

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Stochastic daily precipitation models have been widely used in climate and hydrology studies. A standard technique of analyzing such series is to decompose the original time series into two relatively simple time series called occurrence and intensity processes and then handle these two time series data by standard generalized linear models (GLMs) software. It has been reported that these models can reproduce well the observed precipitation probabilities, wet and dry spell length distributions as well as many other statistics of interest concerning various precipitation occurrence events. However, in the majority of these studies it was reported that high precipitation intensity distributions had not been fitted reasonably well by single right skewed distributions such as Gamma or lognormal. A progress in statistical modeling of precipitation intensity data was made recently - "Furrer, E. and Katz, R. (2008). Improving the simulation of extreme precipitation events by stochastic weather generators, WRR, vol. 44, W12439, doi:10.1029/2008WR007316." These authors replaced the Gamma by a hybrid distribution comprised by a Gamma and Generalized Pareto (GP) distribution while still being admissible in a GLMs framework to allow the straightforward introduction of covariates and systematic assessment of uncertainties. This paper deals with an improved daily precipitation amount model for the territory of Bulgaria based on GLMs that accommodate equally well the small, medium and extreme precipitation intensities. Following closely the methodology of the above authors we propose to model the intensity component of the precipitation models,

conditional on the synoptic atmospheric fields via: (1) a Weibull and a mixture of two Weibull distributions; (2) hybrid distribution of Weibull and GP distributions; (2) a hybrid Gamma and distribution discussed. The model is applied to a network of 32 stations and the results show that the observed intensities are reasonably simulated.

Keywords: Precipitation downscaling, Weibull distribution, Generalized Pareto distribution, Mixture of distributions, Hybrid distribution

316 A Case Study: Evaporation Estimation at Oymapinar Dam

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Water is crucial for all socio-economic and environmental aspects and needs to be managed and used in a sustainable use to ensure its long-term availability. Water scarcity, its irregular distribution, limited availability and quantitative and qualitative problems, which are likely to be worsen by climate change and desertification processes, are the main challenges that water managers, policy makers and stakeholders currently face. Water scarcity is a common problem in Turkey especially and there are 40 dams throughout the Mediterranean Cost. Oymapinar Dam construction was finished in 1984 by General Directorate of State Hydraulic Works. It is located in Manavgat, Antalya City in the West Mediterranean Cost. Annual total evaporation from the dam lake is approximately 737.894m³. There are Class a Pan Evaporation measurements at the dam site. In this study, evaporation from Oymapinar Dam lake will calculate by temperature correlation and multiple linear regressions. Dam lake levels, average temperature °C, average wind speed, total precipitation, relative humidity and total radiation data will be used in multiple linear regressions. Homogeneity and ANOVA tests will be applied to data set.

Keywords: evaporation, water scarcity

**324 A Space - Time Analysis of Temperature and Rainfall
in Peninsular Malaysia**

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This paper discusses the potential evidence of global warming - climate change by examining the trend - surface behavioral patterns of temperature and rainfall of three major river basins at different stages of development in Malaysia. The basins examined were the Klang River Basin described as a very developed basin in Malaysia, the Perak River Basin which is at an intermediate level of development and the Kelantan River Basin, which is at a minimal level of development. The paper discusses the results of temporal and spatial analyses using time-series and trend surface techniques on the temperature and rainfall data derived within the basin and of surrounding areas. The major objective of the study was to investigate trend changes of temperature and rainfall (percent change) and whether there exist changes in the spatial patterns of distribution of the parameters. The spatial patterns were also mapped by using administrative mapping units based on the mukims and districts and also using isolines to show the spatial patterns of percent change in temperature and rainfall. Temperature and rainfall records were derived from Department of Meteorology Malaysia stations located within the three basins identified. Temperature and rainfall records were analysed for the period 1951 to 2007. Temperature and rainfall records were also derived from stations operated by the Department of Drainage and Irrigation Malaysia to further enforce the temperature and rainfall records of the Department of Meteorology. The latter temperature and rainfall records were for the period 1935 to 2007. The time series and trend surface analysis performed was based on monthly data for the period mentioned. Hydro-meteorological regions and its temporal and spatial trends and patterns were distinguished from the study. Identification of these hydro-meteorological regions thus describes the potential risk regions to climate change induced stresses within the three basins studied.

Keywords: river basins, temperature, rainfall, percent change, trend analysis, surface analysis

352 The Rainy Autumns in the Last Decade in Oltenia-Index of Climatic Changes

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In this paper we analysed the changes in the regime of autumn precipitations of Oltenia-as a part of the aspects considered by the IPCC indexes of climatic changes which take place on the whole planet. Crossed by the 45°N parallel and the 24°E meridian, Oltenia is exposed to different air masses driven by the general circulation of the atmosphere. This region is in equal measure the subject to the action of continental polar and arctic air masses from the North and North-East in the cold season,as well as it is subject to the action of hot and dry tropical air masses or cold and moist maritime polar air masses in the warm season. The interactions between these air masses lead to the overlapping of submediterranean and continental influences. In this paper we focused our analysis on the pluviometric regime of the autumns in the interval 1998 - 2008; and in this purpose we used the database and the satellite information of CMR Oltenia, as well as the data and map archives provided by the international centers in Bracknell, Berlin, Paris, Moscow. The method used in our analysis is Hellmann's Criterion. The analyse of the time types in the considered period revealed that the percentage in matters of space and time of the exceedingly pluviometric time type was of 63.6%, normal pluviometric was 9.1% and scantily pluviometric was 27.3%. An important change relatively to the previous century is the fact that September has been excessively rainy, as well as the first part of October. In addition, the values of the secondary pluviometric maximum greatly exceeded those of the main pluviometrical maximum making the trend of the aridisation of the climate in springs and summers obvious. Ion Marinica-PhD, Senior Researcher, Weather Forecaster First Degree Andreea-Floriana Marinica-Student, Earth and Space Sciences Departament Jacobs University Bremen, Germany

Keywords: rainy autumns, submediterranean climate,fast floods,Mediterranean cyclons,humidity excess

**368 Hydrological Regime of Lake Prespa - Lake Ohrid
- Crn Drim River System**

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Hydrological regime of Lake Prespa - Lake Ohrid - Crn Drim River System is presented in the paper. Crn Drim River catchment area is 5.885km² and the average absolute altitude 1.132m. Its hydrographic network gathers the waters of a typical mountainous territory. The objective of study, which results are presented in the paper is analyze and characterize of the hydrological regime of Lake Prespa-Lake Ohri-Crn Drim River hydrographic system, that is very complex and includes a wide range of important elements such as natural and artificial lakes, underground waters and springs, numerous branches and rivers. In the study are also include important aspects on catchment area environment, such as hydro morphology, climatology, limnology, hydrogeology, hydro economy, etc. Ecological conditions of this system represent a principal part of the paper. Many particular scientific monographs, studies, presentations in conferences and international project have been performed on Crn Drim River hydrographical complex for period 1927 - 2005. This study, which result are presented in the paper, is an attempt to present a general evaluation of the hydrological regime of this complex.

370 Impact of the Climate Change In Albanian Adriatic Littoral

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The general cascade impact of the climate change on Albanian Adriatic Littoral: decreasing country water resources, influence on the hydrographic regime of Adriatic Sea and on ecosystems are presented in the paper. The study is based on the results of inversion of 6 thermologs data for the ground surface temperature history in Albania, and climate change according to the multi annual meteorological data from different regions of Albania. The wells and the meteorological stations are located in Sedimentary Basin of Albania, at the field region in the west of Central Albania and in the ophiolitic belt in the mountainous

region of the northeast Albania. Based on inversion data at coastal plane western region of Albania, GST history presents a gradual cooling before a middle of the 19th century, followed by 0.6 K warming. Climate warming of 0.6 K in the 20th century is observed also in mountainous northwestern Albania. This warming mainly after the second half of the 20th century is presented also by meteorological data: temperature, rainfall, and wind regimes. There are estimated continental water flow, created by atmospheric rainfalls. Impact on processes of the forming and circulation of the Adriatic Sea water mass has been analyzed by particularly attention, for wet and dry years are analyzed. Estimation of run-off discharges is carried out for two categories of river basins: first, for river systems, where run-off discharge is computed as a function of the altitude of water level river section. Second, for the water system of Scutary Lake-Drini River-Buna River, which is very complicated and is the single in Mediterranean Hydrography. The warming impact on country climate, and ecosystems of Albania, thermal stress in the wetlands, lagoons and lakes have presented in the paper. Impact it is observed first of all on the biodiversity.

Keywords: Climate change, impact

381 Trends of Climate Extreme Indices in the 21 St Century in the Danube Middle and Lower Basin

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Daily values of precipitation, minimum and maximum temperatures at 10 stations situated in the Danube middle and lower basin were analyzed from the point of view of changes occurred in the climate extremes indices (CEI) in 21st century compared to the 20th century, considering values simulated with the 4 models: CNRM (Meteo-France- Toulouse), ECHAM5-MPI (The Institute of Meteorology Max-Planck, Hamburg), EGMAM (The Free University of Berlin) and IPSL (Pierre Simon Laplace Institute - Paris). Before the data processing, a bias correction procedure related to the observations from 1961 - 1990 was applied.

For the precipitation the results obtained by analysis of changes in CEI were compared with the analysis by Extreme Value Theory (EVT). Probability

distribution functions and the return levels for different return periods were obtained by means of GEV and GP distributions.

From the 27 CEI analyses for the extreme temperatures in the 21st century comparative with the 20th century, the most significant results show a significant increasing of the tropical nights number and of summer days, a decreasing of intervals with cold days and days with frost. This result is valid for both Danube middle and lower basin.

The extreme precipitation results are not as evident as in the temperatures and there is a little difference between stations situated in the middle and lower basin of Danube. However, it can be noticed a light trend of increasing of the maximum number of drought consecutive days. From the CEI analysis it can be noticed a light trend of decreasing of the wet days number and of the annual total amount of precipitation in the extremely wet days, but there are years with annual amount of precipitation in the 21st century exceeding that of the 20th century, this being in accordance with the EVT analysis results.

Keywords: climate change, extremes of temperature and precipitation

405 Climatic Factors and the Ground Water Table In Eastern Sofia Field

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Shallow sub-soil waters are a source of productive soil moisture in agriculture. When available, they meet part of crop evapotranspiration needs. Their presence in the soil water balance means that certain irrigational water amounts would be saved. Contemporary climate change has a proven negative impact on the hydrothermal conditions for crop growing in our country. The restriction of the atmospheric water income causes a decrease in the water resources in soil, namely in the available water content and its feeding up by the sub-soil waters. The goal of the paper is to investigate the dynamics of water table level in the eastern part of Sofia Field during the 40-year period 1960 - 2000. The long-term levels of the water table at 4 representative manholes from the measuring net of NIMH on important for agricultural crops vegetation dates and their trends has been processed. A long-term succession of monthly water table level has been traced. A parallel with the monthly precipitation and open water evaporation has been drawn in order to find out the natural preconditions of the phenomenon. The

dependence of the water levels on the precipitation sums of different periods has been studied. The results show a decreasing tendency of the water levels in the manholes. This is indicative for the water table dropping deeper in the soil profile, hence - for less available soil water for the crops.

Keywords: water table, climate change, agriculture, regression, Bulgaria

295 Southern Oscillation Effect on Balkan Precipitation

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El Nino Southern Oscillation (ENSO) is one of the most significant atmospheric events, which affects the hydrologic parameters on the world. Therefore, the objective of this study was to determine whether the Balkans was also affected from ENSO or not. In this context, the precipitation stations of Marmara Region of Turkey (exists at the Balkans) were taken into consideration by generating synthetic monthly precipitation data. This data generation was performed instead of the El Nino year's monthly precipitation by using Feed Forward Back Propagation Artificial Neural Network Model. Therefore, there would be obtained two precipitation data sets for each station (synthetic and original) whose statistical parameters were compared with each other to determine whether the generated data and the original data differ from each other or not. As a result, significant El Nino effect was determined and plotted on the maps for the precipitation data of Turkey's Balkan Region and the surroundings which should be considered for long term drinking water, irrigation, energy and environmental planning purposes. These results can be extended for all the Balkan countries in the subsequent studies to obtain the regions affected from ENSO more precisely.

Keywords: Southern Oscillation, El Nino, Balkan, Precipitation

**415 Climate Variability of Drought Indices in Romania
in the 20th and 21st Centuries**

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The climate variability of drought conditions in Romania was studied by using 2 indices; a drought index based on temperature and precipitation data (DI) and the self calibrating Palmer Drought Severity Index (sc-PDSI) available on line at <http://www.cru.uea.ac.uk>. The drought index DI was calculated using mean seasonal values of temperature and precipitation for 25 stations in Romania for the period 1951 - 2003. The comparison between summer (JJA) DI at three stations (Bucuresti, Sibiu and Tg. Mures) and sc-PDSI for the same season in 3 grid points very close to the mentioned stations indicate a good concordance. The seasonal values of DI for the period 1951 - 2003 were decomposed in empirical orthogonal functions (EOF) and rotated EOF. The time evolution of the first principal component for each season and the spatial distribution of the first rotated component were analyzed. For spring and summer the time evolution of the first component indicates a tendency to dryness for the period 1999 - 2003. The investigation of the spatial distribution of the first rotated EOF component pointed out the fact that in spring, autumn and winter the homogeneous zones for the DI are in the south-east of Romania. In summer, the homogeneous zones for the DI are in the south-west of Romania. The change in the DI between the 20th and the 21st century is analyzed from simulations with the GCM EGMAM. The analyzed station is Drobeta Tr. Severin (situated on the Danube river side at the entry in Romania). The drought index is calculated for the periods 1950 - 1999, 2000 - 2049 and 2050 - 2099 and differences between the periods are shown. We can observe a tendency to dryness for the periods 2018 - 2028, 2042 - 2050 and also a tendency to excess of moisture for the periods 2005 - 2018, 2030 - 2041 and 2090 - 2098.

Keywords: Drought index, Empirical Orthogonal Functions

287 Effect of Climate Changes on Grounwater in the Konya Closed Basin

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As a result of global warming and climate change, in the future groundwater problems is going to be one of the most important issues in the world. We are concentrate on the water problems and It's solution suggestions in this study. It has important water potential Konya Closed Basin. But groundwater level is decreasing, groundwater reserves runs out at basin conditions to come drought for climate change, low rain amount and unconscious use. Basin's water resources are very limited and groundwater constitute basin's major part. Groundwater of Basin is meteoric origin and from Southwest to Northeast. Groundwater level is directly related rains and climate change. Basin climate type is E, B1, db3 (drought, mesothermal, not have extra water near the Ocean effect climate type). Meteorologically, drought is defined as precipitation falling below normal over a certain period of time. Rainfall in recent years is below average rainfall for many years. According to rainfall distribution graph between 1984-1996 years is rainy period, between 1988-2009 is dry period.

Keywords: Drought, rain, Groundwater, Konya Closed Basin

284 An Analysis of Temporal Changeability of the Rivers Flow in the Pripyat Basin on the Territory of Ukraine

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Changeability of atmospheric (weather) processes and as a result changes of climate are significantly influence on the conditions of formation and spatial-temporal changeability of the rivers flow, origin of dangerous hydrological processes or phenomena. In turn, the aggregates of long-term water flow fluctuations sufficiently represent climatic processes that take place in one or other basins. Taking into the account regional changeability of a flow allows us to get a complete picture of changes in conditions of its formation, to specify and confirm conclusions of regional, interyearly, intrayearly changeability of precipitations, long-term fluctuations of meteorological sizes and phenomena researches. To study the changeability of water flow and determine changes

in the intrayearly distribution of the rivers flow of the right bank of Pripjat the sequences of average annual flow values for hydrological years and data of average monthly water discharges for the duration of 60 years for 6 hydrological water posts are used. According to the data change of average annual flow for calculation period and its variations are analysed. The annual water flow of the rivers of Pripjat's right bank almost did not change (trend not found), but there is an obvious tendency to decreasing of its fluctuations dispersion. For deeper study of water flow changeability it is important to take into account variations not only of annual water flow but also long-term flow fluctuations for warm period of a year, flow for cold period of a year, changeability of maximal water discharges. Most of rivers have no tendencies to increase or decrease of an annual mean flow, but at the average there is a tendency to increasing of a flow for warm period (from May to October) and decreasing for cold period (from November to April). With respect to changeability of maximal water discharges for all explored rivers the maximal water discharges during a spring flood considerably diminished in comparison with previous periods. For maxima rain floods for long-term period there is no considerable tendencies to increasing or diminishing, although for the last 20-25 years decreasing of their variation is obvious. To find out how intrayearly flow distribution on explored rivers changed for the last 60 years the norms of average monthly water flow were calculated for 3 thirty years terms with overlapping of these periods. Almost on all rivers the redistribution of water flow took place: during spring (May-April) snow-melt flood water flow is diminished in comparing with previous periods and there is some increase of a flow in other months.

Keywords: Temporal and spatial flow changeability, annual mean flow, flow for warm and cold period of a year, maximal flow, intrayearly flow distribution

***281 Estimation of Authenticity and Tendencies in Changes
of Water Flow on The Rivers of Western Bug Basin
(Within the Limits of Ukraine)***

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The river water flow is formed under the combined influence of many factors and processes and is the generalized index of their complex action. Change of climatic terms which are stipulated changeability of atmospheric processes, is considerably influence on the terms of forming and spatial-temporal changeability of the rivers flow, origin of dangerous hydrological processes or phenomena. For

the estimation of authenticity and tendencies in the changes of water flow on the rivers of Western Bug basin (within the limits of Ukraine) the sequences of middle annual flow values are used for hydrological years and data of average monthlies water discharges by duration 60 years for 4 hydrological water posts. Within the limits of catchments area there is a synchronicity of flow fluctuations, which is conditioned by natural factors. In general influencing of adjustment on the rivers flow is insignificant. To argue authenticity and tendencies of structural fluctuations the theory of casual processes with analysing of the row of random variables equally distributed in time was applied here. Verification of independence and homogeneity of statistical hypotheses was done. Violation of the independence condition in the long-term fluctuations of annual flow in our case is manifested in years grouping of promoted and reduced water content or quasiperiodicity of long-term changes of water flow. The autocorrelation coefficients of the explored rows between the flow of contiguous years are indicate on this, that is by the water flow for years separated by time intervals in one, two and three years, and also estimations after the nonparametric criteria of series and amount of extremes. In the long-term fluctuations of hydrological descriptions the special attention is payed to the problem of confirmation of the presence or absence of appropriate changes of mathematical hope, or trend. The use of parametric methods simplifies not only an estimation trend but also verification of its existence i.e. the real change in time (trend detection). All these situations can be described by linear and polynomial approximation of the trend. The change of the average annual flow and its variation for calculation period is analysed. The long-term flow fluctuations in the Western Bug basin have difficult enough character. At its left-bank part water flow has uniform fluctuations near a statistical norm with increasing variation of these fluctuations. On the Western Bug River and its influxes in a riverhead, there is a clear tendency of increment of an annual flow which can be described as cyclic trend. The variation coefficients of average annual flow for these basins in a long-term period increased in the last decades. In relation to the intrayearly distribution of flow for the last 60 years almost all explored rivers have the redistribution of water flow: during spring flood (May-April) water flow diminished in comparing to the previous periods, there is mainly some increase of flow in other months. An exception is Western Bug, where water flow increased during throughout the year.

Keywords: river flow, intrayearly flow distribution, authenticity in the changes of flow, tendency of structural flow fluctuations, the autocorrelation coefficient, parametric and nonparametric criteria of casual processes

274 Tourism in the Context of Climate Change in Albania

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Albania, even a small country, because of the physic and geographic conditions, from the climatic point of view has territories or places with a large variety of meteorological indexes, which are characterised for example: with an annual sum of air temperature from 1400°C, similar to the north part of Europe (the south part of Scandinavian countries); as well as has spaces characterised by an annual sum of air temperature up to 6100°C. Climate is a national resource and in the touristic context, it remain still an unstudied field and unevaluated in the requested levels from the touristic demands of our days for our country; furthermore in the sense of what is expected from the point of view of climate change and the respective impact in this sector. In this presentation aimed to present some considerations about those specific aspects offered by the climate of Albania with interest for the tourist, which by different group and interest is in need to have in her hand and to get a preliminary better knowledge, not only for a better organisation for himself, but also how to select the right place in space and time. Also, a special attention will be dedicated to history of meteorological observation in Albania and to the extreme weather events, which time by time are problematic for the country economy; as well as how they can influence the tourist and his decision-making are another site of this presentation.

Keywords: Climate, Tourism, Albania

**401 Characteristics of Precipitation and Surface Yield
in Deciduous Forests at the Petrohan Scientific Experimental
Forestry Station Over the Period 1998 - 2008**

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Climatic factors have a significant impact on the surface water yield. The impact of precipitation is the most tangible. In order to perform monitoring of this impact a hydrological station was established in the Petrohan Scientific Experimental Forestry Station (SEFS) on the river Gavaneshitsa. An on-going

monitoring process started in 1998. The results of precipitations and surface yield measurement over the period 1998 -2008 are presented in the article. The results are tentative due to the short-term period of monitoring.

Keywords: climatic factors, hydrological station, rainfall, runoff

375 Effects of Climate Change on the Regional Hydrological Cycle of the Micro Prespa Lake Basin

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The Prespa Lake System consists of Micro and Macro Prespa, which are shared by Albania, Greece and Republic of Macedonia. This paper focuses on the analysis of the hydrological cycle of the Micro Prespa Lake by applying a monthly rainfall runoff model in the basin using past hydrometeorological datasets. The second step is to quantify and incorporate in the model the climate change is it is estimated by the latest assessment of the intergovernmental Panel on Climate Change (IPCC). The change in the monthly regional hydrologic cycle of the basin is presented and its possible effects on the fragile ecosystem of the area are analyzed.

Keywords: Micro Prespa Lake, Climate Change

486 Discharge Variation In Drainage Basin of Nisava River and its Possible Relation to Climate Change

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Recently, climate change excites reasonable attention. However, in the drainage basin of Nisava River, these changes may be quite different from the usual performance projections based on Intergovernmental Panel on Climate Change

(IPCC). Annually to all three profiles (Piroť, Bela Palanka and Nis) have shown decrease in discharge in the observed period (1961-2000). This may be consistent with the allegations and the IPCC, the dominant influence of anthropogenic greenhouse effect on reducing discharge of rivers in Serbia. The only weather station in the drainage basin of Nisava River continuous series of data which is not disturbed by growth of the urban heat island is Dimitrovgrad. The trend of temperature in the period since 1961 up to 2000 year, is negative (-0.0012 °C per year). Although this change is statistically insignificant, the sign of change is not in accordance with a thesis of the dominance of anthropogenic greenhouse gases. This means that any changes in discharge, at least in the upper part of the drainage basin of Nisava River in the period of research, cannot explain this effect. Even more, the trend of rainfall in the entire period, changes sign from negative to positive and growing at a rate of 0.1175mm per year. We may conclude that in recent decades there is not anything dramatic happening with climate locally within the investigated area. However, it is necessary to investigate the influence of anthropogenic factor which may contribute significantly.

Keywords: Nisava River, discharge, temperature, human activity

489 Experience from Simulation of Climate Change Impacts on Water Regime in Monthly and Daily Time Step

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Bilan water balance model, which was originally developed for simulation of water cycle components in monthly step by staff of T.G. Masaryk Water Research Institute in Prague, has already been applied in great number of research projects and practical applications not only in the Czech Republic but also in a number of other mainly European Countries. Its application in other countries was facilitated by international cooperation of its developers, mainly within the activities Low Flow group of North-European section of FRIEND (Flow Regimes from International Experimental and Network Data) project and associated fact that the model is described in detail in Tallaksen and Lannen (2004) and its executable version is available with example data sets on the CD that is attached to the textbook. Requirements stemming from the international cooperation and those specified by Ministry of the Environment of the Czech Republic for its further development were reflected in a number of its modifications and particularly in the fact that the Bilan was interlinked with climate change scenarios, MODFLOW (modular three-dimensional finite-difference groundwater flow model developed by the United

States Geological Survey) and also with a River basin management model. Its applicability therefore includes studies of possible impacts of climate change on water cycle components (water regime), surface water resources and also groundwater resources. Results of some of these studies are described e.g. in Novicky et al., 2007, 2008 and 2009. The paper describes experience from recent developments of the Bilan model, which were focused mainly on its modification for daily step, and from its subsequent application for simulation of climate change impacts on water regime in monthly and daily time step. References Novicky, O., Ka p rek, L., Uhlck, J. (2007) Possible impacts of climate change on groundwater resources and groundwater flow in well developed water bearing aquifers. In: Proceedings from The third international conference on climate and water. Helsinki, Finland, 3-6 September 2007, ISBN 978-952-11-2790-8. Novicky O., Ka p rek L., Vyskoc P. (2008) Integrated simulation by hydrological, hydraulic and water management modelling techniques in support of water resources management in the Czech Republic, In Taniguchi, M. et al. (Eds) From headwaters to the ocean, Kyoto (Japan), Leiden (NL): CRC Press/Balkema, 2008, p. 243-248, ISBN 978-0-415-47279-1. Novicky O., Ka p rek L., Vaculik M., Fridrichov. R., Tremil P. (2009) Flow trends in observed data and climate change scenarios, In: 33rd IAHR Symposium, Vancouver, Canada. Tallaksen, L., Lannen, H. (editors) 2004 Hydrological drought - processes and estimation methods for streamflow and groundwater. Developments in water science, 48, Elsevier B.V., Amsterdam.

Keywords: Water regime, climate change, Bilan model

497 Impacts of Climate Constraints on Surface Water Resources Availability in Oueme River Basin (Republic of Benin)

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The climate variability in West Africa and in Benin, has an impact on the available water resources on a level with great river systems in Benin during these three last decades. This survey aims at evaluating the impacts of climate constraints on the availability of the surface water resources in basin of Oueme. To proceed with this evaluation, climate data made up of rain heights, temperatures and of the Real Evaporation of the statistical set 1951 - 2000, and the hydrologic data have been treated and analysed. In this context, the rainfall irregularities, the climate and the hydrologic balance in the basin have been determined. The results? assessment shows a decrease of rain heights; the increase of temperatures and

the Evaporation on analyse of statistical set. On the 1951-2000 set, rain heights have decreased between 12 and 20 percent, whereas temperatures are marked with an augmentation varying between 2 and 4 percent at the basin stations level. This situation leads to a deficiency of the climate balance for many years. Due to that fact, one can experience a deficit of the outflow, and a poor hydrologic balance in the Oueme river basin. The decrease of the surface water resources availability leads to some social and economic problems in the basin.

Keywords: Climate constraints, surface water resources, deficit, Oueme river basin, Benin

498 Trend Analyses of Precipitation-Temperature and Drought Extents of Cankiri Province Turkey

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Cankiri Province is located in the northern part of central Anatolia region which is border to Blacksea region in Turkey. The meteorology of Cankiri has been analyzed in this study. Required data for the analyses acquired from the meteorological stations located in Cankiri Province which are operated by Turkish State Meteorological Service. Analyses of temperature and precipitation data are indicator to understand global warming effects. So the meteorological variables such as minimum-mean-maximum temperature, mean humidity, mean pressure, mean wind velocity and total precipitation are selected to explain province meteorology. Periods of drought connected with global climate change are adversely affecting the usability and sustainability of limited water resources. The spatial and temporal extents of drought in Cankiri Province have been manipulated by using Standardized Precipitation Index (SPI) method. Drought analyses have been carried out for various time scales such as 1-3-6-12-24-48 months. The trend analyses of the mean and extreme temperatures and precipitation data acquired from the meteorological stations have been made by using Student t, Mann-Kendall and Spearman's Rho test statistics.

Keywords: Meteorology, Drought, Precipitation, Trend Analysis, Climate Change

**499 Atmospheric Water Cycle over Equatorial Central Africa
through Ncep/Ncar Reanalysis**

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Moisture fluxes and Precipitation recycling from National Center of Environmental Prediction-National Center of Atmospheric Research (NCEP/NCAR) datasets are analyzed over Equatorial Central Africa (ECA) (12.50E-300E; 50S-50N) on the period 1968- 2000. Moisture convergence was compute from water balance equation, neglecting atmospheric water due to seasonal timescale, and precipitation recycling to evaluate precipitation recycling based on an efficiency method Burde et al. (2006), providing a numerical realization of the general bulk recycling model formulated in Burde and Zangvil (2001a) and Burde and Zangvil (2001b).

The main results show that:

- 1)based on seasonal variation, the north component of the African Easterly Jet plays an important role for moisture budget in the region by decreasing upper level zonal moisture divergence when it's located in the north part of ECA (January-March and October-December);
- 2)in the same period it increase upper level meridional moisture flux convergence;
- 3)an important part of moisture fluxes vertically integrated in layer 1000-850hPa advected into ECA, from August to November, originate from Atlantic ocean;
- 4)on inter-annual variability, for both differences between wet and dry years and year to year variability, lower level moisture convergence from Atlantic ocean modulate the entire atmospheric column moisture variability;
- 5)in all seasons the contribution of regional evaporation to precipitation increases from east to west in most of the region due to predominance of east-west transport of water vapour flux;
- 6)in both north and south of ECA, recycling ratio is quiet similar in wet and dry years with maximum (minimum) around summer (winter) of each hemisphere;
- 7)the large and similar seasonal variability of precipitation and contribution to precipitation from evapotranspiration superficially suggest that vegetation and soil moisture status are important for precipitation.

Keywords: water cycle, equatorial central Africa, precipitation recycling

762 Comparative Analyses of Landfill Leachate Generation

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Designs of the leachate collection system within the landfill and also of the leachate treatment plant depend on the estimated leachate quantity. Landfill leachate shows significant temporal variability in terms of quantity and leachate composition. The paper presents comparative analyses of the implementation of different methodologies for landfill leachate generation for the particular landfill in the municipality of Centar Zupa.

Water balance is a general term for characterizing, over time, the change in water content within the refuse. It is necessary to differentiate the water contributions and losses from landfill over time to be able to predict the leachate generation rates. Sophisticated methodologies for estimation of leachate generation rates within the landfill include the Water Balance Method (WBM) and the Hydrologic Evaluation of Landfill Performance (HELP) Model. The difference between these two models is that HELP model uses a much more detailed sequence of calculations. HELP model carries out the calculation sequence on a daily basis. The model also has the ability to analyse water fluxes through the complete vertical profile of a landfill.

In order to compare the estimated quantity of generated leachate, the amount of leachate that will be generated within the landfill in Centar Zupa municipality has been estimated using WBM and HELP model. Using climate and meteorological data for the nearest meteorological station in Debar, the annual generation of leachate has been estimated for the planned period of exploitation of the landfill. The calculations of the leachate by HELP model were constrained by a lack of daily meteorological data. Daily data for the main meteorological parameters were obtained by correlation with the nearest meteorological station in Ohrid. The paper presents comparative analyses of the results obtained by WBM and HELP method.

Keywords: landfill leachate, generation, Water Balance Method, Hydrologic Evaluation of Landfill Performance Model

**524 Definition of the Size of the Krupac Spring Drainage Area
(Carpatho-Balkanide Arch, Southeast Serbia) for a Karst Aquifer
Water Balance Assessment**

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The quality of karst groundwater is generally high and does not require substantial investment in treatment to drinking water standards. However, from a hydrologic perspective, karst groundwater resources are the least researched of all water resources and hydro-meteorological services do not devote sufficient attention to them. This paper addresses the definition of a procedure/model for the determination of the size of a karst-spring drainage area, when discharge data are available for short/long periods of time. The data that can be used to define the size of a drainage area are meteorological data (precipitation, air temperature, air humidity, water vapour pressure, ...). However, other data are also required, such as information about discharges from the catchment area into which the analyzed spring drains, or information about the amounts of water drained from an "analog" karst spring over a multi-annual period. The method developed and presented in this paper is illustrated through a case study of the Krupac Spring, Svrljig Mountains, Southeast Serbia.

Keywords: karst hydrology, water balance, karst spring drainage area

**567 The Simulation on Environmental Geological
of Desertification Phenomena in Libya**

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Since 400million years ago, the Libya had witnessed geological activities resulted in formation of the physical landscapes of the Libya and formation of the oil and groundwater basins. After the preliminary development of the system of the Tectonic processes during the development stage of karmi & Permian Tish sea water revolved to cover huge areas of the Libyan territory until got to Tibisti

mountains, then revolved back until in the Pleistocene epoch a climate change caused rain shortage formation of a Rock layers, hills and huge sand dunes thus creating more desert situation then causing sand dunes extending to huge areas thought the Libyan areas (1,700.000)km². It is believed that the forth geological epoch had formed most of the Libya Landscape. Libya is situated within the sub dry climate is characterized with rarity of rain fall, which in then caused a wide spread of desertification where huge fertilized hands became dry areas, lacks plantation and animals, therefore resulting in a very poor environmental. The phenomena of desertification is due to far always climate condition as a result of drop in rain fall, in addition to the situation as a result of the area within a sub-desert climate, causing a rise in evaporation rate transpiration a drop in soil moisture high rise in CA+HCO₃ and bi-HCO₃ thus causing the spread of swamps and therefore rarity of plant cover in particular in the western rang. Also the intensive irrigation process caused increase in soil salt to become a salt soil not fit for agriculture or for constructions cutting trees in addition to improper pastry. The climate conditions have played a vital role in water shortage which is one of the main problems causing an increase in desertification process. In this study we propose for desertification eradication to use silica formation 90% of rocks metals of the earth sphere .such process come as a result of fusion. This metal is common in all earth rocks and is characterized with the ability to absorb water molecules in order to be able to form of water and provide the same to plant roots, then again compensate whatever quantity of water which may be lost by absorption of air moisture containing water. The square meter needs 25-50kg of silica further we may attempt to fix the sand dunes and stop their marsh by planting pine trees ,oak construction of a water hole to reserve rain water in and outside of the cities and villages in order to benefit from it in crops irrigation .also eructation of five purification plants along the Libyan coast to process rain water and sanitary drainage . This water must be used in soil fixing besides preservation of the Great Man made river which must be used for drinking purposes only. In addition to be above one may use remote sensing to be control soil marching and finding an economic plan of plantation in and outside of cities and villages via frees distribution of trees on citizens establishment of prairies within cities contraction of wind buffers around them so to prevent march.

581 Climate Change and Agroclimatic Resources on the End of Twentieth Century in Bulgaria and Macedonia

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Climate change in Bulgaria and Macedonia in the end of twentieth century are investigated. The changes and the variability of the air temperatures and the rains are largely reviewed. The course of the climate is developed in warming up and a drying, together with fortification of his unsteadiness and continentally. Temperatures change investigation during last 30 years includes finding the temperature normals for each of representative meteorological (agrometeorological) stations, definition of size and sign of deviation related to climatic normals for 1961 - 1990 and definition trend of change. There are present climatic averages of temperatures in Bulgaria and in Macedonia, deviation in relation to previous thirty years period (1961 - 1990) and trend of these deviations. Assessment and characterization of conditions for moisture probability is a main subject for analysis of agroclimatic resources in the both countries. Soil moisture conditions define in large degree dependence between yields from crops that can grow under given thermal conditions and measures which must be taken for high and steady outputs. This defines economical opportunity to develop agriculture on the given territory. Was analyzed and present spatial distribution of rains sum during the last 30 years and tendencies in relation to 1961 - 1990 period.

Keywords: temperatures, rainfalls, climate change, agroclimatic resources

597 Impact of Modern Climate Change on the Values of Winter Precipitation and River Flow in Georgia

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The river flow is one of the important parameter that have a sufficient impact on economy - mainly agriculture and energy sector. The secular courses of the recurrence of the anomalies of warm months according to decades are investigated as the river run-off depending on precipitation and snow melt is regulated by air

temperature. During XX century the recurrence of warm months in winter are determined for West and East Georgia. The secular courses of the recurrence of the anomalies of warm winter months according to decades are synchronous between West and East Georgia. The correlation value is high. Statistical analysis of the recurrence of warm winter months in XX century for natural (1921 - 1960) and natural - anthropogenic (1961 - 2000) periods of climate change, define that in second period in comparison with first one the recurrence of warm winter months decrease. The recurrence of warm winter months was the biggest in 1950 - 1969, in 1971 - 1980 the recurrence of warm winter months was decreased and after 80-ies was increased and this value becomes more than corresponding ones of cold months. Investigation of changes of atmospheric precipitation and river run-off are made for the warm and cold winters defined that the run-off of the rivers, which basins are located till 1000-1200m from sea level are more correspondingly for West and East Georgia for warm winters in comparison with cold ones and the precipitation is more for cold winters in comparison with warm ones. Analysis of changes of average values of river run-off for winter season for time periods 1925 - 1960 and 1961 - 1996 defined that in second time period in comparison with the previous one corresponding values of run-off had increased and totally for Georgia the growth of run-off is 5.3m³/s.

Keywords: Climate hydrology precipitation river run-off

635 Impact of Climate Variability and Changes on the Kupa River Runoff

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The latest studies on climate variability and changes in South and East Europe, including Croatia, the continued air temperature increase trend is expected to be accompanied by further decrease in precipitation and, consequently, number of days with snow and snow cover, decrease in runoff, land humidity and availability of water resources. The results of studies on climate variability and changes (WMO, UNEP, 2008) indicate 23-36% decrease in annual runoff in South and East Europe for time thresholds set at 2020, 2050 and 2070. The Kupa River annual runoff analysis for the locations near Hrvatsko and Kamanje (period: 1957 - 2008) shows a decreasing trend. An outcome of such, less than optimistic, forecast is a need for demanding water resources management. The observations and forecasts of climate variability and changes should be continued, focusing in

particular on the near future. Also, it is necessary to continue with observation of meteorological and hydrological values for the region and take into consideration the anthropological impact on climate variability and changes.

Keywords: climate variability and changes, runoff, Kupa River

636 Effect of Global Climate Change on Water Balance of Beysehir Lake (Konya -Turkey)

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Beysehir Lake was the largest drinking water reservoir in Turkey. It has some special statues and it is important for water animals, and lake has many environmental problems. The water level of Beysehir Lake is fluctuating and there are significant relationship between temperature, precipitation, evaporation and water feeding to and withdrawn from the lake. Knowledge of lake levels has recently attracted increased attention because of accelerated lakeshore developmental activities. Lake levels are affected by hydro-meteorological conditions (evaporation, runoff, precipitation, temperature etc.) and anthropogenic activities. Its surface covers an area of approximately 65,000 hectares at the elevation of 1,123m and average depth is 5 meters (8 m max.). According to long-term statistics, the lake water level is fluctuating between 1121.03m and 1125.6m altitude but severe decline in water level was observed in recent years due to overexploitation. Global warming resulting from increases in greenhouse gases and, in turn, local climate changes may potentially affect hydrospheric and biospheric environments locally. As a particular consequence of this, during wet periods, there may be water-level rises that may cause economic loses to agriculture and human activities along the lake shores, whereas during dry periods there may be water-level ebb tides that may cause descending water resources. Therefore the stable changes in the hydrologic regimes of an unregulated basin generally reflect changes in climatic conditions. It is thus important to analyze trends of lake levels. In addition to providing an understanding of the impacts of climatic change on society and ecosystems, such analyses may result in independent corroborative evidence to confirm the results of trend detection for climate variables.

Keywords: Bysheir Lake, Global warming, Climate Change, Water, Konya, Evaporation

**637 The Impacts of Climate Changes and Vegetation Dynamics
on Streamflow in the Yellow River Basin, China**

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The climate changes, combining with the vegetation and soil, impact on the hydrological processes and control the streamflow in the basin scale. This study was conducted to investigate the impact of climate changes and vegetation dynamics on streamflow in the Yellow River Basin (YRB), China. The temporal trends of streamflow were explored by the Mann-Kendall method and linear fitted model, and the relationship between the streamflow, precipitation and potential evapotranspiration (ETp) were investigated. Furthermore, the contribution of the climate changes to streamflow was revealed by Budyko's method and the simple water balance model. The results addressed that: (i) the decrease abrupt changes were detected in 1990, which used to divided the streamflow into two periods (baseline period and changeable period); (ii) 67 among 80 stations showed decreasing trends with average reduction -10.37% of annual precipitation changes, while most of the stations displayed increasing trends with an 3.71% increase in annual ETp; (iii) the precipitation and ETp elasticity of streamflow revealed that streamflow increases with the increasing trends of precipitation, whereas is reduced by the increasing trends of ETp; and (iv) the climate changes accounted for 44.02% decline in streamflow from baseline period and changeable period, while the vegetation changes contributed a larger magnitude to the decreases of streamflow, which explained 56.98% reduction in the streamflow.

Keywords: Climate change, Hydrological processes, Climate elasticity of streamflow, Precipitation, Potential evapotranspiration, Yellow River Basin

**682 Time-Spatial Characteristics of Precipitation Regime
in the Republic of Macedonia, for the Period 1951-2000**

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Summary Precipitation data from main meteorological stations in the Republic of Macedonia are analyzed in this paper. The analysis of time-spatial characteristics of monthly, seasonal and annual values of precipitation is made. Isohyetal maps are made, pluviometric regime is determined, average, maximum and minimum precipitation sums are separated, as well as their probability of appearance according to the summary Gauss's arrangement for the period 1951-2000. The analysis refers to 13 meteorological stations: Gevgelija, Strumica, Demir Kapija, Shtip, Skopje, Bitola, Prilep, Kriva Palanka, Ohrid, Berovo, Mavrovi Anovi, Lazaropole and Popova Shapka. In the same time the analysis of monthly values and comparison of lasting 30 years (normal) series, 1951-1980, 1961-1990 and 1971-2000 are made for 9 main meteorological stations: Demir Kapija, Shtip, Skopje, Bitola, Prilep, Kriva Palanka, Ohrid, Berovo and Lazaropole.

Keywords : Rainfall, Climate

**683 Changes in Temperature and Precipitation in the Last Decade
in Bosnia and Herzegovina**

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Bosnia and Herzegovina has a complex climate and the point can be divided into three different climatic zone with more or less expressed the transitional zones. That is the reason we decided to investigate the changes of long term means of temperature and precipitation in the meteorological stations within each area and obtain the spatial distribution of these changes for the entire territory of BiH. We produced mean temperature and the average amount of rainfall for the last decade in the period of 1999 - 2008 for twenty-meteorological stations on the territory of the RS and FBiH and compare them with corresponding values from the reference period, i.e. normals (1961-1990). It was noted that the level and intensity of these changes are not the same for some regions in

BiH. The lowest temperature increase is observed in a Mediterranean climate zone, larger at the edge of the Pannonian plain, (i.e. in the region influenced by moderately continental climate from the North) and the largest in the region of Banja Luka. The records showed a certain reduction of mean Precipitation in the Mediterranean climate zone, increasing in other parts, with the highest growth linked to the central mountain belt, i.e. Belt mountain climate. It should be noted that this region of Herzegovina is still among the regions with the highest rainfall. The research has improved with the corresponding statistics of extreme temperature and maximum of daily precipitation.

Keywords: climatic zone, spatial, temperature, rainfall

687 Spatial Variability of 2003 Hydrological Drought in the Dyje and Upper Vltava River Basins

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Since 2008 Czech Hydrometeorological Institute (CHMI) and T. G. Masaryk Water Research Institute (WRI) have cooperated in study of hydrological drought in the Czech Republic (CR). In 2008 the background research was done and suitable daily streamflow time series from several gauging stations were chosen for detailed analysis. Since the first half of 2009 the temporal analysis has been in progress. At Hydrology Division of CHMI the deficit volumes (in mil. m³), drought durations (in days) and also probabilities of non-exceedance were computed. The drought was defined by the Q95 and Q70 values here, whereas shorter (1961-2005) and longer (from beginning of gauging to 2007) periods were considered always. Thereby important dry periods were found. Of course this large quantum of data required cartographical representation that could be more general than tables themselves. Firstly, in the second half of 2009, the area of CR has been divided into smaller parts. The Dyje River basin, the Upper Vltava River basin and especially the 2003 drought have been chosen experimentally. We have decided that the raster creation (gridding) should be in use mainly (similarly to the meteorological drought). In case of drought duration mapping the interpolator called ordinary kriging (OK) has been used. The spherical semivariogram without nugget effect has been set. The numbers of lags and lag-sizes have been changed optionally. Note that anisotropy has not been used, so that only the search radius has been set. It has varied between 50km and 100km according to studied area and location of gauging stations. The 2003 drought did not occur at some places;

hence these stations have been leaved out of interpolation. Choosing suitable method for the deficit volumes mapping has been worse because every river or stream has different discharge. This problem has been tackled using ratios developed by dividing mean discharges of dry period by long-term discharges of 1961-2005 period. These ratios have been showed as diagrams in the maps of duration. Their size explains the drought severity alternatively instead of the deficit volumes straight. Even though the maps look fine, there are many phenomena that are not included in them (e.g. terrain configuration, land cover, groundwater, dams or precipitation and other climatological factors). We are planning to create such maps for the whole of CR but it is still difficult.

Keywords: hydrological drought, geostatistics, Dyje, Vltava, Czech Republic

696 Status of Drought Monitoring in Montenegro

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HMZCG does not have long term drought monitoring. Information about it exist in non consecutive forms analyzed mainly when drought occurs and reported in public journals or scientific papers. In 2003 an initiative to calculate SPI index was unsuccessful. It is evident lack of meteorological experts and a great demand of disposable experts to be trained. The establishment of the DMCSEE network and its mission is crucial regarding to the drought problems and obstacles in SEE. The Hydrometeorological Institute of Montenegro-HMZCG is one of the partners in DMCSEE projects and in this paper an intention is to present first obtained results related to the droughts for the territory of Montenegro.

Keywords: HMZCG, DROUGHT MONITORING, DMCSEE, drought indices

**720 Global Warming, Drought and Soil Humidity
in Republic of Macedonia**

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These days global warming has more and more attendance in all part of living. Also global warming has effect in big part of our economy, especially agriculture. We analyzed influence of global warming and appearance of drought, because it is main threat in agriculture. We analyze soil temperature, air temperature, precipitation and their depend of global warming from agriculture areas: Skopje, Pelagonija and Ovce Pole. We used meteorological and agrometeorological data from main meteorological stations: Bitola, Prilep, Stip and Skopje-Zajcev Rid, and data for soil moisture from agrometeorological stations: Dolneni, Novaci, Lozovo, Tarinci and Butel. Our analyze show that global warming have very big influence in appearances of drought and drought periods. According global warming scenarios drought and drought periods are more often in R. Macedonia, and this will inspire reduce in production of organic food.

Keywords: global warming, drought, soil humidity

**717 Projection of Temperature And Precipitation Changes
in the XXI Century on the Territory of Republic of Macedonia**

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Republic of Macedonia has ratified the United Nation Framework Convention on Climate Change (UNFCCC) on December 4th, 1997. As a Party to the Convention, there is an obligation for preparation of regular National communications on climate change. The first National communication on climate change was prepared in 2003 and from March 2005 until March 2008 the Second National communication on climate change has been elaborated. Both National communications comprise elaboration of different scenarios for the changes of the main climatic elements as air temperature and precipitation in the XXI century. Significant progress has been achieved with the Second national communication, were has been investigated not only general assessment of the climate change on the level of the entire

country according to the latest Global Circulation Models (GCMs) and Special Report on Emission Scenarios (SRES), but also first estimations were done for the regional changes of the basic climate parameters. Also, initial vulnerability assessment to climate change for water resources sector has been elaborated, showing that reduction of outflows from the country is primarily caused by climate change.

Keywords: national communication, climate change, climate scenarios

704 Analysis of Climate Conditions In the Region of Pomorie Lake

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In the frame of the elaboration of management plan of the protected zone of Pomorie lake the local climate condition in the area has to be estimated. The separate components of the environment as climate conditions surface and ground water regime, air and water quality and quantity and others form the living space of the reserve. The close connection between the biotic and abiotic factors necessitates working out a plan for governing of the lake to pay serious attention to abiotic conditions in the examined region. In the presented paper the local climate regime in the region of Lake Pomorie is described. The long-term variability of the air temperature and precipitation is canalized. In the elaboration the expected temperatures for years 215, 2010, 2050 and 2080 are given

Keywords: Protected zone, climat, ecology

**714 Climate Change Induced Hydrological Impact
for the Tisza Basin and a Tributary of the Lower Danube Basin**

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Hydrological impact related results of the Project CLAVIER - CLimate ChAnge and Variability: Impact on Central and Eastern Europe concerning mostly Hungary, Romania, and Bulgaria are discussed. Hydrological part of the project is aimed at the production of future hydrological scenarios based on the output of regional climate models. Analysis of the simulation results received by hydrological models serves as direct or indirect input for water management DSSs: VITUKI-NHFS and Consul-VIDRA conceptual hydrological models were used to produce long term hydrological series. Mostly Tisza River Basin (the largest - by drainage basin size - tributary of the Danube) and its subcatchments have been studied with special emphasis on Upper Tisza and Mures/Maros rivers. Separately the Arges basin drained by the lower Danube was also covered. The catchments comprising river systems are situated in various climatological and geo-morphological settings across the region. The hydrological models used in CLAVIER project require 0.1 degree grid resolution meteorological input data. Since the REMO 5.7 dataset was only available in 0.25 degree resolution, a downscaling procedure based on elevation distribution functions was performed by VITUKI in order to get a dataset in the needed resolution. REMO5.7-ERA40 (1961 - 2000) and REMO5.7-A1B (1951 - 2050) produced by the Max Planck Institute for Meteorology, Hamburg was further processed. The original error corrected dataset was provided by WegCenter, Graz and INHGA, Bucharest. Transient simulations were carried out covering the period 1951 - 2050. Validation was related to the period 1984 - 2000. Sub-basin temperature and precipitation projections were analysed together with the investigation of the impact on flow conditions. Characteristics of periods 1961 - 1990 and 2021 - 2050 were compared. Results indicate in most cases slight decrease of annual mean flow throughout the region, with significant spatial variability and even some increase for the high elevation zones in the Upper Tisza subcatchments.

Keywords: climate change, hydrological impact, Danube, Clavier

**725 Assessing Climate Change and Adaptation from Poor Peoples
- Perspective - a Case Study of Bangladesh**

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Bangladesh is likely to be one of the most vulnerable countries in the world in the event of climate change. A number of studies on the impact of climate changes in Bangladesh exist. However, quite a few details have been found discussed in this real impact on identified coastal areas victims. In this paper, the households' opinions based on what they noticed or can reveal due to climate change issues were examined. To explore clear picture at root level of potentially affected areas of natural hazards and vulnerable for any degree of climate change, a survey was designed to gauge households' reactions to a possible impact, consequences and plans to engage poor people who are mostly affected along the coastal belt. During March 2008 to June 2008, the two coastal districts of Bhola and Patuakhali in Bangladesh were visited and surveyed several times to take a snapshot of how poor families are experiencing the changing climate, and how they might deal with this in the future. Based on the survey results, it has been revealed from the widespread insight from ordinary villagers that the climate was already changing, particularly in its unpredictability compared to 10 or 20 years ago, and the extremes it can reach. They report cyclones, unpredictable weather, the threat of salt water intrusion from sea level rise, and unpredictable and concentrated rainfall causing more flooding than usual or flooding at unusual times of the year. It has been further noted that poor peoples at root level are real sufferers undoing any harm to the environment related to climate change issues. Additionally, study found that any adaptive measures in these coastal areas for that potentially affected people should be focused according to there perspective so as to ensure successful implementation and long term operation.

Keywords: Climate change, Hydrology, Poors, Adaptation

746 Effects of Climate Change on the Water Level of an Oxbow of the Danube

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In the Carpathian Basin wetlands are very vulnerable to climate change. One of the most vulnerable regions is the Duna-Drava National Park, where the small and shallow oxbows along the river Danube are endangered. The purpose of this paper is to determine how climate change, as projected by the CLAVIER project of the EU affects a typical oxbow located in Gemenc in the Duna-Drava National Park in Southern Hungary. To simulate the water levels of the investigated oxbow, a hydraulical "FOK" model is applied. This model requires meteorological data and water level time series of the river Danube. The original meteorological data for the period 1951 - 2050 according to the IPCC's A1B scenario are provided by the Max Planck Institute for Meteorology, Hamburg and the post-processed, error-corrected version is provided by WegCenter, Graz in the frame of the CLAVIER project. The long term water level time series are simulated by the VITUKI-NHFS conceptual hydrological model.

Keywords: climate change, hydrological impact, Danube, Gemenc

753 An Example of Weather Impact on a Hilly Landscape

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Quantities of precipitation within a certain area and during a certain period of time vary from time to time. If observed in a more general sense, precipitation certainly has an effect on the state of the surroundings, i.e. the landscape. The paper is an example of the influence of weather conditions on a hilly landscape in a technical sense. The key example of said landscape is a hilly portion of north-western Croatia, where sliding of natural slopes occurred within a certain period of time and due to certain weather conditions.

Keywords: precipitation, hilly landscape, seepage, erosion, sliding

**378 Hydroclimatic Trends in Romania Over the Second Half
of the 20th Century**

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Streamflow records from 55 undisturbed watersheds in Romania have been tested for trends with the Mann-Kendall nonparametric test in three study periods (1951-2000, 1961-2000, 1971-2000), in order to analyze the annual and seasonal changes in the daily streamflow distribution. In order to discriminate trends from stochastic fluctuations and from the influence of serial correlation in the time series, the series presenting positive lag-1 serial correlation after detrending were prewhitened by applying a first order autoregressive filter to the data prior to trend analysis. The statistical significance of trends is tested for each station on an annual, seasonal and monthly basis and for different streamflow quantiles. Identified trends in streamflow are then related to the observed changes in precipitation and air temperature, and correlated with the basin attributes (area, mean altitude, mean slope, basin shape index, river network density, mean soil depth, mean SCS curve number, and forest coverage). Finally, a bootstrap procedure is applied for testing the field significance of trends.

**151 One-Dimensional Unsteady Flow Model
in the Non-Prismatic Butoniga Channel**

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The Butoniga channel, as a drainage - retaining channel of the Botonega accumulation is a typical and complex trapezoidal earth channel with inundations on both sides that can be found in most water-managing solutions in Croatia. Within hydraulic interrelationship research, this channel is appropriate for the performance of several series of water measurements with different discharges in unsteady conditions. This is particularly important for the analysed section of the Butoniga drainage - retaining channel for practical reasons, that is, for the purpose of establishing the maximum capacity of the channel in terms of evacuation of high waters. On the basis of the numerical model of one-dimensional unsteady flow, created in the software package MIKE11, we can determine all kinematical and dynamic characteristics of the Butoniga channel and simulate or identify channel

spillways. The article defines ruling equations for the modelling of 1D unsteady flow in the Butoniga channel and the algorithm for determining the coefficient of roughness. Furthermore, the most frequent methods for defining the numerical schemes for calculation of unsteady flow in the open hydraulics channels have been described too. The developed model of 1D unsteady flow in the non-prismatic Butoniga channel represents the contribution to the development of hydraulic modelling in terms of the insurance of an adequate tool for the quantification and verification of the influence of the channel geometry change on the coefficient of roughness and thereby on the channel throughput.

Keywords: the Butoniga channel, unsteady flow, numerical model, channel throughput, coefficient of roughness

245 Vulnerability of Renewable Energy Production to Climate Change

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Due to concerns regarding global warming and air pollution there has been an international movement in the promotion of renewable energy sources (RES) for electricity generation. The energy production from RES greatly depends on climatic conditions, which may be impacted in the future due to global climate change. This paper analyze the vulnerabilities of renewable energy production for the case of windpower and hydropower production. A model of off-grid hybrid power system with renewable energy sources will be presented, as well as the investigation of the potential impacts of wind speed changes and water flow changes, due to the climate change, on production of wind power and hydro power. For that purpose several scenarios will be analyzed. For each scenario production of RES, renewable fraction, emissions of pollutants and total net present costs of the system will be estimated. In order to determine the configuration of the system which will meet consumption demands, the software tool of HOMER-product of National Renewable Energy Laboratory is planned to be apply. The input data for the software are: load inputs, resource inputs (wind speeds, water flows, diesel price), component costs and characteristics, emissions penalties, project lifetime and annual real interest rate, and the outgoing is the optimal solution of the system respecting the net present costs aspect.

Keywords: Renewable energy sources, vulnerability, energy production, microgrid, Net Present Costs



TOPIC 2

ENVIRONMENT AND HUMAN ACTIVITIES



**002 Water Quality Evaluation of Ala River and some Wells
and the Impact on Agriculture in Akure Ondostate Nigeria**

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This paper reports the estimation of some quality parameters of Ala River and some well in Akure. Surface qualities of the river were studied in order to evaluate its uses. Water and soil samples were collected from the river and nearby small-irrigation farms at Alagbaka, Oyemekun Oba Ile and Adesida quarters. The samples were analyzed using standard analytical techniques and were compared with recognized water quality standard. Quality parameters like pH, Dissolved oxygen, Turbidity, Total alkalinity, Temperature. Chloride, Total hardness, calcium, magnesium, Total solid, Nitrate and colour were determined in water samples from selected well and Ala river. The range of values obtained were pH (6-7), Total solid (50.0-192.0mg) Dissolved oxygen (2.6 to 4.8mg/L) Calcium hardness (36.0-48.0 mg/i). These values when compared with standard showed that the river and well are polluted. Appropriate treatment should be employed to make it fit for domestic water supply, Agriculture and recreational activities. The results obtained in the analysis were compared with the World Health Organization Standard for portable water and recommended that the water be further purified before domestic use.

Keywords: Agriculture, Recreational, water Quality, World health organization standard

**005 Impact of Eucalyptus on the Groundwater
(a Case Study of Udigram, Swat Valley Northwest Pakistan)**

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The plantation of eucalyptus on mountains is not profitable, because it evaporates above 50liters groundwater per day into atmosphere and is more dangerous to watertable as well as rock reservoirs. The water evaporated by eucalyptus is

more as compared to the incoming water. This imbalance in water cycle causes change in watertable as well as flow of water from the springs. On the other hand, its wood is of poor quality, and having low market demand and domestic use. The rainfall shows -5cm (2 inches) decrease per year in winter between 1995 and 2000, whereas, the rate of increase is 1.24inches (3cm) per year in summer season. The major share of annual rainfall was from winter precipitation before 1995, but onward, it is from summer and the area dropped from humid to sub-humid climates. This seasonal fluctuation of rainfall and dryness of rocks reservoirs due to plantation of eucalyptus on mountains has not only decrease the watertable and groundwater but it has also caused change in the flow of water from the springs, and has decreased with discharge of rivers. The dryness of wells after reduction in rainfall, generally, leads to the digging and intensive use of tubewells in the area.

**015 How to Plan a Sustainable Forestry Management
when Environmental Goals Conflict with Existing Practices
in National Prespa Park**

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Concerns over the relationship between environmental protection, prevention of loss of biodiversity and protection of habitats and of internationally important species of flora and fauna on the one hand and sustainable economic activities and recreation in a protected area on the other can all be dealt with effectively by appropriate regulatory and policy measures, particularly with the support of local actions that strive to preserve local biotopes and conditions. The aim of the present paper is to provide information on the current situation of the forestry on the Albanian side of the lakes Macro and Micro Prespa, along with the existing practices and regulations, and to offer views from an Albanian perspective that will help resolve some of the current difficulties. Forestry is one of the main economic activities in the area. Forest areas in Prespa mainly consist of oak forests (63%) and beech stands (15%). Lack of alternative heating resources set a high pressure on forests that are used for firewood production for communities living within and in some areas around the Prespa Park. In addition, fodder production and forest grazing are damaging the forests area. Some forest areas (3,721 ha) are transferred to communal use and are managed by the Forest Users Association of Ligenas. In the last three years several improvement interventions (coppicing, fencing, thinning) are realized with the support of World Bank, WFP and other donors. There is a need for a general forest management plan and improvement interventions in the area. The forestry policies and practices applied in Albania

over the last fifty years have negatively affected the region's biodiversity in general and its forest species in particular. It is very important for the future of the species found in the Prespa region, as well as for the communities that depend upon them, to strive, through best practices, analysis of policy and positive actions of trans-boundary cooperation, to improve the current situation. Some remedies are presented in the present paper.

Keywords: Forestry, environment, biodiversity, pasture, firewood

020 Improving Hydrological Responses of Degraded Soils in Semi Arid Kenya

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A number of techniques have been developed for range rehabilitation in semi-arid environments of Kenya. Grass reseeding technology has been used as a management tool for soil and water conservation and restoration of degraded ecosystems in Kibwezi district, Kenya. The aim of this study was to establish the contribution of reseeding using indigenous perennial grasses namely *Eragrostis superba* (Maasai love grass), *Enteropogon macrostachyus* (Bush rye) and *Cenchrus ciliaris* (African foxtail grass) in improving soil hydrological properties and thus control soil erosion. The experiment was carried out using simulated rainfall, Kamphorst simulator, on bare ground and at different grass stubble heights. The experimental plots were set up under sprinkler irrigation control conditions to ensure availability of sufficient moisture for seed germination and subsequent establishment. Results showed that sediment production as a function of soil erosion, runoff and infiltration capacity were significantly different ($p < 0.05$) at different grass stubble heights. *Cenchrus ciliaris* had the greatest influence on improving soil hydrological properties. *Enteropogon macrostachyus* and *Eragrostis superba* were ranked second and third respectively. This was attributed to the growth characteristics of the perennial grasses. Generally, an increase in grass height increased infiltration capacity, reduced runoff and sediment production.

Keywords: Reseeding, semi-arid, soil hydrological properties, sediment production

**030 Water Quality and Human Influence on Coastal Ecosystem
of South India**

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The problem confronting coastal resource managers in the west coast of India is analogous to the question of whether economic policy makers in India should be focusing on restoring the fundamentals of capitalism. Pragmatic monitoring and prediction capabilities must also be built to provide further confidence that human impacts are being minimized. There is a need to develop a framework to integrate biodiversity effects methods with risk assessment methodology. Such integration will improve the basis for risk-based assessment of coastal health. To protect estuary and coastal ecosystems and the health of communities effectively, management infrastructure requires the tools and resources necessary to detect damage to estuary and coastal ecosystems and their components, identify causative agents, impose remedial action, and demonstrate that measures have been effective. In contrast, bottom-up restoration strategies not only simplify planning, but they recognize that basal ecological mechanisms are what define coastal ecosystems. Populations of the majority of fish species showed drastic reduction over the past five decades in west coast of India. We conducted an intensive study of Aghanashini estuary for water quality and fish diversity in west coast of India. Coastal ecosystems are impacted by many stressors and are continually subjected to threats from multiple stresses imposed mostly by human activities predominantly as a result of increased population growth in India. The most significant categories of threats derive from water pollution from numerous sources including thermal effluents, heavy metals, oil, sewage, pesticides, pulp mills, habitat loss and degradation: overexploitation: eutrophication and misguided human perceptions. Wide array of prohibited fishing methods are rampant by using of insecticides as poisons, destruction and modification of habitats, dynamiting, using chemical and herbal poisons. Due to deteriorated water quality from anthropogenic activities fish diversity has drastically reduced. In complex coastal ecosystems, strategies for restoration can become equally complicated. Our tendency to want to predict and establish performance targets for the charismatic megafauna which populate the higher trophic levels of an ecosystem may reduce our ability to actually implement restoration plans.

Keywords: Human activity, water quality, fisheries

052 The Study of Floristic Diversity in the Lake Ohrid Ecosystem

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The ecosystem of Ohrid Lake is one of the most important areas in Albania because of the variety of diversity, floristic diversity and variations of cultivating plants. Many spaces of Ohrid ecosystem have a national and international protection. The study: "The study of floristic diversity on the Lake Ohrid ecosystem" realized in the two points of study Tushemisht and St Naum realized on 2007 year. In the Albanian and Macedonian part of the Lake were found one after the other, six areas of vegetation: a. the area of *Chara* spp., b. the area of *Potamogeton* spp., c. the area of *Phragmites australis* or the group of reeds, d. the area where prevail floaty kinds of leaves, e. marsh areas f. the area of woods (up to 1000 m). In many places the highest density is noticed in the classes *Phragmitetea* (close to the waterside) and *Charetea* (from 5-20 m of depth). In the Albanian and Macedonian part of the lake, is developed the part of reeds. The founding of a monitoring system for taking the measures, in order to notice the changes in vegetation. Preservation of the equilibrium between the natural ecosystem and the agroecosystem. Based on the height of the area, they may be divided in: oak forest termofil with wide leaves, where the oak prevails, and *Quercus frainetto*, associated regularly with *Acer inospessulanum*, *A. platanoides*, *Fraxinus ornus* in the lowest and warmest parts of oak forests. Forests with oaks that endure the cold, such as *Quercus petraea* and *Q. cerris*, associated by *Sorbus torminalis*, *Acer obtusatum*, *Fraxinus excelsior*, encountered in the middle and upper part of the oak forests. Formations of the forests with beech leaves that fall encountered in the upper part of the forest. A prevailing species is *Fagus sylvatica* associated by *Carpinus betulus*, *Acer obtusatum*, *A. pseudoplatanus*, *Daphne mezereum*, *Tilia cordata* the *Sorbus aria*, *Populus alba*, *Salix alba*, *Fikus* spp. etc. a species with a special interest is chestnut, *Castanea sativa*, with woods that grow in the park and in the hills close to Pogradec. Near the hills of Tushemisht and mountain beam, is found an endemic plant *Alyssum markgrajii* (LINNAEUS, 1758).

Keywords: vegetation, lake, mountain, ecosystem

**105 Toxicological Study of Pesticides in Paris Rainwater
by a Bioluminescence Method**

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A detailed toxicological study on several pesticides, including chlorothalonil, cyprodynil, dichlobenil, pendimethaline, trifluraline and alpha-endosulfan, present at the trace level in Paris rainwater was described. Rainwater samples were collected during sampling campaigns in February-March 2007, and analysed for their pesticide content by HPLC-UV. Toxicity measurements were performed by using the Microtox - bioluminescence method, based on the evaluation of the bioluminescence inhibition of *Vibrio fischeri* marine bacteria at two exposure times to the pesticide solutions. The specific toxicity, represented by the EC50 parameter, was determined for each of these pesticides. Also, the global toxicity, which corresponds to the toxicity of all micro-pollutants present in the sample, was evaluated for the extracts of atmospheric precipitation (rainwater) samples. The EC50 parameter values varied significantly between 0.17 and 0.83 mg/mL, and 0.15 and 0.66 mg/mL, respectively, for exposure times of 5 and 15 min, according to the type of pesticide. The extent of the Paris rainwater global toxicity and the respective contribution of the toxic potency of the various pesticides contained in the samples were discussed.

Keywords: rainwater pollution, pesticide traces, toxicity measurements, bioluminescence method

152 Changes of Physical and Water-Air Properties of Soil Type Pseudogley with Drainage

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Institute of soil science, Belgrade, in 1950's established experimental field on pseudogley type of soil, with intention for agrochemical experiments. In 1978. on a part of the experimental field, it was established horizontal drainage system with flexible, perforated pipes - 80 mm in depth 0,95m on marble filter, with drain spacing of 25m. In 2002. horizontal drainage was performed in additional two variants, with drain spacing 20m and 30m, using flexible perforated PVC pipes, - 80 mm, on marble filter, 0,90m depth. On experimental area it was opened five pedological profiles: profile 1- control; profile 2 - in area with drain spacing of 20m; profile 3 - drain spacing 25m above the drain; profile 4 - drain spacing 25m, between two drains; profile 5 - in area with drain spacing of 30m. Intention for this examination was to define starting values for future comparative analysis of the elements of water-air regime of pseudogley type of soil. In laboratory it was performed following analysis of water-physical properties of soil samples: mechanical composition, bulk density, specific gravity, porosity, air capacity, retention characteristic of soil.

Keywords: Drainage, Pseudogley, Water-air regime

158 The Impact of the Mining Activities Over the Environment

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The mining activity has a long history in Romania, since Dacian times. After the 1850 the negative phenomena of the mining activities start to have amplitude. The industrialization of these mining activities provoked majored changed: allocation of the localities, the migration of populations, construction of montages roads, or the primary processing of the ore. In industrialization area after 1989, all were going on chaotic. The mining activity has an influence in more plans: -

The decantation for the sterile from the flotation processing- in those dumps can be found not only sterile but elements of others minerals also; - The localization of the mining dumps- all those are localized in areas isolated and in the civic center of some localities; - The installations for the ore primary processing milling, flotation, separation and transport can be found in the mountain areas, but also in the center of the mining localities which are partial or total demolished; - The galleries and the mine openings- some of those are building with concrete; others are destroyed or are open. All those are dangerous even in the isolated areas or in the localities perimeters; - The loading platforms can be found now, even under the level of some surfaces waters. The materials from those constructions are transported day and night, and produce a polluting effect, which is not taking in consideration by the authorities. If the wrappers are take in consideration thanks the visual discomfort, the mining activities elements (radioactive metals, decantation dams, dislocated galleries, the underground waters strongly polluted) for the moment are treated with very low importance. The authors propose a systematic and interdisciplinary study useful for the inhabitants from the affected areas, which through the disappearance of the mono industrialization, the environment destruction, the spirituality modification are exposed at different forms of aggression.

Keywords: mining, pollution, radioactivity, mountain

168 Water Infrastructure and Food Security Linkages in Three Selected Regions of Ethiopia

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Access to water infrastructure reduces the exposure of people to a variety of diseases that obstruct the intake and utilization of food. In addition, it can reduce the time of hauling water by women thereby increasing their productivity and status. The study has considered two important water infrastructures, namely, domestic water supply schemes and irrigation that affect food security in Ethiopia. Within Ethiopia, three regions that fall within the Ethiopian portion of the Nile Basin, namely, Amhara, Oromia and Tigray, were purposively selected. Data and information pertaining to food security situations and the status of domestic water supply and irrigation for all zones in the regions have been collected. Descriptive and inferential statistical techniques have been used to analyze the data. The findings of the study have shown that food security status in the three regions of Ethiopia is generally low and varies considerably from zone to zone and region to region. The study has also established the existence of strong linkages between

water infrastructure and food security in Ethiopia. One finds a relatively lower number of food insecure population in areas where there are better accesses to water supply and irrigation agriculture. This implies the need for policy interventions that can help in upgrading and expanding water infrastructures, adopting an integrated food security and infrastructure development approach, maintaining the existing water schemes and universalizing water coverage in Ethiopia.

Keywords: food security, water infrastructure, livelihood vulnerability, water scarcity, food security strategy

**246 Assessment of Rainfall Water Potential for Rain-Fed Crop
Production in the Central Highlands of Ethiopia:
Case of “Yerer” Watershed, Oromia Region**

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This study was conducted to assess the rainfall potential of ‘Yerer’ watershed in the central highlands of Ethiopia, Oromia Regional State. Different models like FAO(1978), Reddy (1990), the NMSA (1996) and the Markov Chain were used to analyze and explain the thirty three years of weather record (1975 - 2007) and subsequently determine and estimate the onset and end of the growing season, the length of the growing period and the dry/wet spell lengths and distributions in the study area. The mean onset of the main growing season was found to occur during the second meteorological decade and ended during the end of September. Similarly, though unreliable and only few occurred during the entire study period, the mean onset of Belg season was found to occur during the beginning of the first decade of April. The length of the growing season during the main rainy season, Kiremt, ranged from 112 to 144 days with a standard deviation of 9.6 days and coefficient of variation of 7.5%. However, the mean growing length during the Belg season was found to be 22.4 days with a standard deviation of 27 days and coefficient of variation of 122%. The results of analysis obtained both from the Markov Chain model and Reddy indicated higher probabilities of dry spell occurrences during Belg but the occurrences of the same in Kiremt was very minimal. Like wise, the SPI model detected some drought events ranging from mild to severe classes in both seasons based on one and three-month time scale analysis.

Keywords: SP,I Onset, End, Belg, Kiremt, Markov Chain

**196 Impact of Environment and Some Agronomy Practices
on the Productivity of the New Wheat Variety Bolyarka
in South Dobrudzha Region**

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Wheat is one of the most widely distributed crops worldwide and is of primary importance as food for human nutrition. Increasing the productivity of the new wheat varieties according to the specific climate of the region is a permanent major task. The impact of environment and some agronomy practices (previous crop and mineral fertilization) on the productivity and the structural elements of yield of the new variety Bolyarka and of the national standard Sadovo 1 were analyzed during a 3-year period (2004 - 2006) under field conditions. The main components of productivity were investigated: grain yield, 1000 grain weight, number of productive tillers, number of grains per spike and weight of grains per spike, as well as some characters indirectly related to yield: plant height, test weight and spike length. The varieties were grown after four previous crops: bean, sunflower, grain maize and silage maize. Three levels of nutrition regime were involved. The applied mineral fertilization was differentiated according to the type of previous crop as follows: N6P6K0 and N10P10K0 after bean, and N10P10K0 and N14P14K0 after the other predecessors. The trial included also a check: N0P0K0. Mineral fertilization had strongest effect on the formation of the character number of productive tillers and on grain yield. Variety Bolyarka was remarkably responsive to fertilization and increased its productivity with the higher fertilization norms. The year conditions had significant effect on plant height, test weight, spike length and on the structural elements of yield: number and weight of grain per spike. Bolyarka is a new bread wheat variety which demonstrated a higher productive potential than the standard Sadovo 1 expressed in higher grain yield, larger and plumper grain, higher spike length, greater number of grains per spike with higher weight.

Keywords: Wheat - Yield - Environment - Fertilization - Previous crop

**203 Influence of Meteorological Factors During Vegetation Period
on the Yield and Evapotranspiration of Irrigated
and non Irrigated Grain Corn**

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The aim of experiment was to establish the influence of meteorological factors during the vegetation period of grain corn, on the yield and evapotranspiration. The experiment was carry out during 2004 - 2007 period, on Mollic fluvisols (FAO - UNESCO) in region of Plovdiv (Bulgaria). The data from irrigation (by 75% of FC) and non irrigated corn have been used. Dependencies between yield and meteorological factors have been established, as well as soil layer water depletion. The value of evapotranspiration and it's formatting nave been calculated (274 - 379 mm without irrigation and 378 - 515mm by optimum irrigation).

Keywords: corn, irrigation, evapotranspiration, yield

**328 Water Deficit Influence During Different Growth Stages
on the Soybean Yield**

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Two year field experiment with soybean was conducted on the meadow-cinnamon soil in Sought Bulgaria with 14 variants irrigation regimes in 3 replications. Two types irrigation regimes were realized: with 0, 0.35, 0.7, 1.0 and 1.35 relative irrigation depth during the all vegetation period and the others-with regulated water deficit-i.e.0, 0.35,0.7 relative irrigation depth during one growth stage and 1,0 during the other two stages. Gypsum blocks were used for soil moisture dynamic evaluation and Infra red thermometer- for plant water status evaluation. Precipitation, air and soil temperatures, relative humidity were determined during soybean vegetation season. Physiological plant water stress indicators (proline content, electrolyte flowing, plastide pigments content) were determined. Relationships "relative yield-relative irrigation depth", "relative yield-relative evapotranspiration", "yield- number of days with $dT>0$ ", "yield reduction-number

of days with $dT > 0^\circ$ with high correlation were obtained ($R^2 > 0,8$). Physiological stress indicators were in accordance with temperature difference (dT) between canopy temperature (T_c) and the ambient air temperature (T_a).

Keywords: canopy temperature, yield, irrigation depth

332 The Main Environmental Driving Forces of the Invasive Plant Species in the Romanian Protected Areas

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The invasive species are largely recognized as major cross-cutting issues in terms of threatening native biodiversity, ecosystem structure and functions, especially within protected areas, causing severe negative socio-economic consequences requiring effective management. The invasive flora of Romania currently includes more than 400 species (13.87% of the Romanian flora) and according to the third National Report of Biological Diversity Convention, six of them are tree species (*Acer negundo*, *Ailanthus altissima*, *Amorpha fruticosa*, *Cytisus scoparius*, *Fraxinus americana*, and *Fraxinus pennsylvanica*). Within the protected areas, some of the most representative invasive plant species (IPS) are: *Amorpha fruticosa* in Balta Mica a Brailei National Park, *Ailanthus altissima* and *Accacia ssp.* in Muntii Macinului National Park, *Acer negundo*, *Parthenocissus quinquefolia* and *Ailanthus altissima* in Lunca Muresului Natural Park etc. The paper is aiming to identify and analyze the main environmental driving forces responsible for the introduction and spread of the IPS in Romanian protected areas (natural driving forces: relief, lithology and soil, climate, hydrology, vegetation etc. and human-induced driving forces: agricultural practices, grazing, forest exploitation, mining activities), that could develop introduction pathways whose dimension and dynamics are directly related to the restrictive measures imposed by each UICN category. The authors have as main purpose to create a GIS-based inventory in order to realize the distribution maps of the main IPS existing in the protected areas of Romania. Based on this assessment and on other relevant case-studies, the authors are aiming to identify the impact of IPS upon the natural habitat of some rare species, especially when talking about protected areas and their conservative importance. The importance of assessing IPS in protected areas is increasingly important in terms of establishing the best management measures for invasive species mitigation and promotion of efficient cooperation at national and regional level to prevent or minimize their adverse impacts.

Keywords: Invasive plant species (IPS), environmental driving forces.

364 Changes of Some Soil Characteristics in Result of Degradation Processes in Maleshevska Mountain, Bulgaria

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Forest soils in the Bulgarian part of Maleshevska mountain are being seriously degraded and destructed due to erosion processes. The mountain relief, climate conditions, density of the hydrographical network, deforestation and intensive pasturing as well as changes of the land-use type are of primary importance for intensive soil erosion processes in the Struma river watershed, which is strongly influenced by the Mediterranean-type of climate. The objective of this study was to assess how some of the most important soil chemical and physical properties are affected by degradation processes, if the lands are subjected to different types of use. The studied lands are located in the middle part of the Struma watershed basin. Two watersheds - Sedelska and Vojche have been selected as representative torrential tributaries. The main soil groups are represented by Luvisol, Cambisol and on the upper part of these watersheds also partly by Regosols. The soil skeleton, particle size distribution and their relations with other soil properties of the superficial soil horizon were analysed. Soil organic carbon (OC) and total nitrogen (TN) were also determined. The Arc Info 9.2 software was used in order to present the geographical distribution of the data obtained. According to our investigations, the soil degradation has resulted in a clear differentiation of the soil skeleton depending on the type of exposure and on the position of the sampling sites on the slopes. On the slopes with a sunny exposure, the skeleton increased to 67%, whereas on the less sunny slopes, which are those exposed to the north, it reached only 44%. The results of particle size distribution show a tendency of a prevailing content of the sand fractions in the soil on the slopes with southern exposure and an opposite one for the northern slopes. There was no significant difference in the determined OC contents in the branch cutting oak coppices forests and pasture lands. The soil in the sampling sites used as a fallow land demonstrates the lowest content of OC - 0.82 g kg⁻¹.

Keywords: erosion, forest soil, fallow land, soil skeleton, particle size distribution

**299 Regulated Deficit Drip Irrigation Impact
on the Yield and the Growth of the “Lyulin” Primocane-Fruiting
Raspberry Cultivar**

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The problem of water scarcity deepens all over the world, the agriculture accounting for more than 70 % of the total consumption. The use of irrigation water can be decreased with the introduction of more efficient methods (microirrigation) and technologies (Regulated Deficit Irrigation, RDI). Both approaches were subjected to an eight-year investigation together with the ‘Lyulin’ primocane-fruiting cultivar. The raspberry crop was chosen because of its good positions on the international market and the short time for the investments to pay-back. The water application rates during the main phenophases - intensive growth, blossom, and fruit ripening - equaled 100%, 75% and 50% of the crop evapotranspiration. The yield varied considerably according to both the meteorological conditions during the vegetation and the health status of the plantation. Compared to the control, only the maximum reduction of irrigation resulted in significant yield decrease. Generally, the regulated deficit irrigation did not significantly affect the growth of the raspberry plants. Based on the results, there is a good reason to suppose that the observed differences between variants are mostly climatic. Other factors as the plantation age and the viral infections propagation should not be excluded, yet. With the “Lyulin” cultivar, the application rates can be reduced to 75%, and even to 50% in the phase of intensive growth, without negative effect on the yield and the fruit quality. Under severe water deficit, raspberry crop may be irrigated with a half of the estimated application rates, but only on the basis of an economical analysis.

Keywords: drip irrigation, RDI, *Rubus idaeus*, yield, growth

262 Research of Changes of Ionization and Meteorologic Factors of Atmospheric Air in Rezekne City, Latvia

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The analyze of many scientific literature sources shows the important role of air ions on living nature, especially pointing out the well-mined impact of light negative air ions on human organism. The level of ionization is original indicator of energetic saturation as well as pollution of atmospheric air. In spring, summer and autumn of 2009 were performed measurements of positive and negative air ion concentrations in the air-ground interface of Rezekne city in Latvia. Measurements were taken by portative air-ion counter "Sapfir-3M" (Russia) in 8 different points of Rezekne city thrice per day. The concentrations of positive and negative air ions with mobility factor $k = 0,4 \text{ cm}^2/\text{V s}$ were obtained. Such meteorological conditions like temperature, relative humidity, wind velocity and direction, etc. were also entered. The interconnections among ionization and chemical and mechanical pollution of air according to meteorological conditions were analyzed. The greatest concentrations of air-ions were established in mornings, in afternoons they decreased while growth of anthropogen air pollution in city. The unipolarity factor was typically < 1 in mornings but mostly > 1 in afternoons especially in the most polluted city areas where minor concentrations of air ions were detected in general. The measurements of air-ions are not widespread in Latvia and it is novelty of air pollution evaluation in Rezekne city.

Keywords: air ions, air quality, urban ecology

263 Land Use and Land Degradation in the Romanian Tableland Regions

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The Romanian tableland area occur both outside and inside the Carpathian Arc (among its divisions), usually between 300m and 600m altitude covering around 30% (69.000km²) of Romania's surface-area. Regional differences have engendered several types of units in terms of the nature of rocks, altitude and

degree of fragmentation. Looking at the evolution of its relief, structure, tectonics and lithology and position towards the Carpathian Mountain Chain, several sub-units have been distinguished: Moldavian Plateau, Getic Plateau, Transylvanian Tableland, Dobrogea Plateau and Mehedinti Plateau, the largest being Moldavian Plateau (25.000km²) and the smallest Mehedinti Plateau (1.100km²). Each relief unit has its own particular features in terms of land use, dynamics and intensity of degradation processes. Being a heavily populated region the environment is subjected to severe human pressure - deforestation, farming and a dense network of communication routes. The aim of this paper has been to analyse the main land use changes and their impact on the degradation of grounds, as well as the characteristic features that differentiate each of these hilly divisions. The post-1990 restructuring processes had a big, sometimes negative, impact on land use (forest clearing, terrain fragmentation, inadequate farming practices, etc.). However, other factors, too (usually landslides, gully erosion and sheet erosion), contributed to enlarging the degraded areas. As damaging proved to be the extreme climatic and hydrological phenomena such as floods, with disastrous effects on vast stretches of agricultural land, settlements, routes of communication and terrains of various destinations. The data sources this paper is based on are the 1990 - 2007 statistical figures, Corine land Cover data-base for 1990, 2000 and 2006, geomorphological maps and maps of present-day processes (GIS-based landslides susceptibility map), flood hazard maps and field surveys of significant areas.

Keywords: Romanian tableland regions, land use, terrain degradation

268 Air Quality in Urban and Suburbs Area of Prishtina and the Impact of Meteorological Conditions in the Distribution of Pollution

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In this study we have taken Prishtina, because it is one of the cities with the biggest number of residents in Kosovo and has a range in the vicinity of 5km² area near Power Plants kosovo A and B, that this region considers as potential air pollutants with PM₁₀, PM_{2.5}, SO₂, NO_x, CO. This power plant during technological processes for production of electricity releases a high amount of pollutants in air that risks the health of the population in areas around this stations where as the area under the influence of the pollution from power plants are around 138 actual settlements. We are focused on air pollution with Suspended Partikel meters

PM10, PM2.5, and heavy metals in these particles for suburban and urban areas of Prishtina, where we simultaneously measure the meteorological parameters and phenomena in monitoring in order to see how conditions affect meteorological distribution of pollution and how this pollution will reach within the city of Prishtina. PM10 and PM2.5 are measured by continuous automatic monitoring of instrument Sharp 5030 (methods combined nephelometer + beta attenuation) Grimm as well as the volume of low sampler (LVS) Derenda, where particles are collected on the filter then analyzed in AAS (Spektometri of atomic absorption) where heavy metals are determined. Keywords: Quality of air in urban and suburban area, the impact of meteorological conditions in the distribution of pollutants in the air

Keywords: Quality of air in urban and suburban area, the impact of meteorological conditions in the distribution of pollutants in the air

386 Studies Geological-Engineering on the Process of Erosion of River Llap

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This science paper we are certain factors that are tattle damage the river bed, how can you avoid these factors These factors negatively affect the river water in quality. Soil erosion can occur as a consequence of flows generated by the rainfall in urban areas and leaks transferred from agricultural land and landfills. What impact could this erosion in quality water surface. What are the preventive measures of the earth to erosion priority basin? What may have reinforcement of the river bed? What basic material types used for strengthening the river bed, which are priorities of vegetative zones, etc. As preventive measures to earth erosion basin are: - To avoid debris and obstacles in water leak; - Not jump leaves, grass cutting waste or organic materials near or in water leak. - Create conditions for drainage of water from agricultural land - The construct dumps with fully standards - Forestation etc.

Keywords: Water quality, erosion, Llap basin, river bed, water surface

**406 Evaluation of Agricultural Sustainability
in Respect of Ecology and Global Warming**

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The livings are effected different environmental parameters in natural ecosystems. Actually, all interactions between different livings are in a whole harmony. Individual sustainability of a person develops together with the sustainability of the ecosystem. Natural systems are open to external systems, always in alteration and are always dynamics, but also balanced inside with feedbacks. However, it was a long time to reach equilibrium again when its' balance was broken-down. Natural ecosystems are required to sustain of agricultural activities and than to produce healthy products. In this study it was evaluated some parameters for sustaining of organic agriculture such as global warming, balance and harmony, reasonable usage, biological variation, and appropriateness with geography and climate.

Keywords: Sustainability, agriculture, ecology, ecosystem, global warming

**408 Is Determinated the Flora and Vegetation of Mirusha (Kosovo)
and Kolshi (Albania) from the Serpentine Substrate
and Climate Condition?**

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It is knower that climatic condition and substrate composition of ecosystems determine and its flora and vegetation. The serpentine substrate are closely linked with high presence of Mg, Ni, and Cr and low values of Ca and nutrients. Both habitats presented in this study are composed from serpentine substrate. The substrate and microclimatic conditions of Mirusha and Kolshi area have influenced and in species diversity and cover vegetation of their natural ecosystems. Similarities are observed in the presence of relict species like *Aristolochia merxmulleri*, *Euphorbia glabriflora*, *Forsythia europaea*, *Genista hasseriana*

and *Halascya sendtnerii* and the main plant communities ass. Orno-Quercetum pubescentis and ass. Polygalo-Forsythietum europaea. The differences are observed in the occurrence of several rare and endemic species. Composition of species group, plant communities and changes in endemic plants for both ecosystems are description in this paper.

Keywords: Serpentine substrate, climate condition, plant communities, relict and endemic species

410 Applicability of Various Erosion Risk Assessment Methods for Engineering Purposes

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Various methods for erosion risk assessment are used by various countries in Europe. Generally, three types of approaches exist to identify areas at risk (Eckelmann et al., 2006): qualitative approach, quantitative approach, and model approach. All these methods vary in their characteristics and applicability. All already developed methods and approaches are improved in the recent period through use of geospatial databases developed using GIS technology. Within the RAM-SOIL project (2006) were evaluate 5 characteristics of the methods: scale, transparency, complexity, cost efficiency and ambiguousness. The choice for a particular model largely depends on the purpose for which it is intended and the available data, time and money (Grimm, Jones, Montanarella, 2002). The most spread erosion type in the East and Southeast Europe as well as in whole continent is water erosion. Objective of this study is to evaluate applicability of these methods for various engineering purposes for water erosion control measures.. For these purpose were analyzed the following methods and approaches: CORINE approach (EEA-1985); the RIVM (1992); "the Hot Spots" approach (EEA - 2000, based on previous maps by Favis-Mortlock and Boardman, 1999; de Ploey, 1989, and other data); USLE method (Universal Soil Loss Equation - Wischmeier & Smith, 1978). The INRA, PESERA approach (Gobin et al. -1999), the European Soil Erosion Model – EUROSEM - (Morgan et al., 1998), Limburg Soil Erosion Model – LISEM - (De Roo et al., 1996a and 1996b; Takken et al., 1999), and Erosion Potential Model (EPM) established by Gavrilovic (1970). The elements for evaluation were scale and outputs (maps and values) and qualitative research method was used. Evaluation was separated per activity: agro-engineering, bio-engineering and watershed management. The

first output of these methods is map that is useful for preparation erosion control strategies. According to the numeric output and scale, applicability for engineering purposes vary from sector to sector.

Keywords: erosion risk assessment

279 Irrigation and Study of Biological Factors in Olive Culture

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The study on irrigation and biological factors is realized in the autochthonous olive cultivar (*Olea europea sativa*) cv Kalinjot. The researches are carried out in three vegetative cycles (2006 - 2008) in the coastal area of Vlora. The irrigation of five olive trees is applied to maintain constant land humidity at 70%, while in other five trees is not applied any irrigation. The vegetative growth of 200 branches, the inflorescence and the flower abscission until the fruit maturation in dynamics in each tree are estimated. Indicators of fruit caliber (fresh weight, dry matter, oil percentage and acidity) are estimated in 100 fruits of each tree. The analysis of variance is realized according to JMP Program. The results obtained have confirmed the biological effect of irrigation on vegetative and reproductive characteristics of olive cv. Kalinjot. The progressive growth of branches is increased 234%, while the fructification 210%, fruits caliber 74% and the percentage of oil 13%. Irrigation do not influence so much in the increased oil percentage of the fruit, but the increased yield (267%) has affected the higher general oil content of the tree.

Keywords: olive, cv. Kalinjot, irrigation, fructification, oil percentage

**271 Development of Methodologies and Tools
for Agricultural Production Risk Management**

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The objective of this work was to develop some methodologies and tools to integrate a crop monitoring and information system for risk evaluation and management in agricultural production. This information system is mainly based on soils and climate data, satellite images, and simulation models run, and all information is integrated into a Geographic Information System (GIS). The region under study included three Departments (Rio Negro, Soriano and Colonia) from the most important agricultural production zone of Uruguay. To carry out this work, an agro-climatic characterization was done, including thirty years of climate observed data. Soil information, including physical and chemical properties of twenty nine different soils, and a landscape characterization was also necessary. Combining climate and soil data, Agro-ecological Homogeneous Zones (ZAH) were defined. Furthermore, to identify the effects of different crop production technologies, the DSSAT (Decision Support System for Agro-technology Transfer, Tsuki et al., 1994) model was used running with three different corn cultivars (large, medium and short cycle), two different nitrogen fertilizer rates (0 and 80 Kg N/ha), two different planting methods (tillage and no tillage) and three planting dates (early, normal, and late). The thirty six crop technology combinations were simulated in twenty nine different soils, and with a climatic database from 1965 to 2006. The crop yields values, resulting from the DSSAT simulation model run, were mapped and integrated into a GIS, and Agro-ecological Specific Zones (ZAE) were defined. This work was part of the project "Desarrollo de un Sistema de Informacion y Monitoreo para la Evaluacion de Riesgos en la Produccion Agricola (SIMERPA) en Paraguay y Uruguay", funded by the "Fondo Regional de Tecnologia Agropecuaria" (FONTAGRO).

Keywords: Risk management, Information system, Remote sensing, Modelling

482 Environmental Problems Caused by Mining Activities in Kosovo

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Kosovo has inherited a large number of environmental problems, accumulated for decades as a result of uncontrolled exploitation of natural resources and mining, industrial production coupled with a high degree of pollution, and the absence of major policies, laws and institutions relevant to address and solve these problems. This has led to a significant degradation and irreparable environmental cases and with it a direct impact on health. Historical moment in which Kosovo is going through, and its orientation to the future of European integration processes, aimed at gradual improvement of its environment and conditions charged with pollution from the past, and hence also improve the health of the population. In this review paper is the likeness of environmental problems caused activity and mining and industrial activity in the territory of Kosovo, such as: - Mining, flotation and Kosovo's main foundry - KEK as the biggest polluter of environment nowadays - Some environmental problems in Trepca - Rehabilitation and closure of industrial waste landfills - Treatment of waters polluted acidic mining - Another problem for the environment are also quarries - Air monitoring system, water and soil around mining and metallurgies spaces in Leposavic, Zvecan, Mitrovica, Tunel i par, Kizhnic and Artan.

739 Hydrogeologic Characteristics of the Region Drenoc-Rahovec (Kosovo)

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In the municipality of Rahovec hydro-graphic network is relatively good. Natural wealth and this presents one of the conditions for the existence of plant and human world . Hydro-graphic network of the municipality comprise several hundreds of current and sustainable sources. Hydro-graphic research shows that most sources of periodic and permanent karstic.

Keywords: water, underground water, Rahvec, Drenoc, water resources

**490 Comparison of Erosion Intensity Monitored on Plots
with Different Shape**

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Various approach, methods and instrumentation for erosion monitoring exist. Erosion intensity can be monitored classical on experimental plots, sedimentation into the reservoir through direct measurement, could be used pins, remote sensing etc. Contemporary approach predicts organizing of sample plots stored as grid cells or on transect. Erosion plot studies were started at the University of Missouri in 1915. Later, network of 10 soil erosion experimental plots was established in 1928. The form of these plots was rectangle. The dimension varies and the Wischmeyer establish standard dimensions 22,1x4m. Gavrilovic (Serbia) in 1970 established square formed erosion plots having an area of 100 m² (10x10m). If length of slope is longer then 300m the output results are not satisfactory. Beside it, these plots are previously aimed fro agriculture land where sheet and rill erosion processes are dominant. Mountain terrain is rough, dissected and these plot form is not enough for getting relevant results. The aim of this study is to compare results of runoff and erosion intensity got from plot with standard form and plot with irregular form appropriate to the terrain. For this purpose were established two experimental plots: one with square form and dimension 10x10m, and the second plot with irregular form stored around small gully. These plots are established on the locality "Parkac" on the Malesevski Planini in East Macedonia on 1000m a.s.l. This is the mountain region where two years ago were burned about 1000 ha forests. Gullies cover significant part of the terrain. Pluviometer station is near by the plots. Observer check the plots after each rain, notice the level of runoff (level in the barrels) and collect samples for further laboratory analysis of the sediment. The results of this research should contribute to better modeling of the erosion processes in mountain region.

Keywords: erosion monitoring, plots

491 Erosion Potential Method (Epm) Modifications - Risk or Need

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Introduction During the past decades, there were numerous modifications of the existing and improved erosion and sediment models. Itch serious and accepted method for erosion and sediment investigation is product of long term field investigation and numerous laboratory tests. All tasks need well experienced staff and state financial support. No one developed method is perfect. All of them have limitations and bugs. That is reason for modification. Today it is very easy trough GIS processing to compute all imputed values and product everything which is look like needed output. At this moment all over the world exists tens of modifications of Erosion Potential Method (EPM). There are several different types of erosion mapping, for which their authors claim to have applied EPM. Method All available EPM modification is classified into several types; - Modifications which try to change the established limits and purpose. - modifications characterised by a partial or complete modification of the research procedures, input coefficients but with original model - Modifications which change the complete structure of the model and the accompanying coefficients. - modification of the already modified model, Preliminary data shows differences of all analysed modification and original method. The resulting errors led to fruitless investment in several river reservoirs where sedimentation occurred after only several years. In such cases the erosion was underestimated, but there are also examples to the contrary. Novel aspect No one hasn't problem with good modified method. Serious problem is with wrong way modified method. Erosion mapping and following calculation is input data for other experts in the field of planning on a regional and the state level. At this moment new upgrading of EPM is in developing phase. Intention is to speed up research procedure and learning process.

Keywords: Soil erosion, erosion mapping, models of erosion calculations

**504 Erosion of the Sava Riverbed in Croatia
and its Foreseeable Consequences**

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Disrupted processes as riverbed erosion and bottom deepening are part of natural fluvial processes in upper stream. The increasing gradient of this changes is interconnected with level of human influences in river basin and riverbed as well. In time the consequences of the riverbed erosion will become serious as well as dangerous, i.e. it may have an impact on the lowering of the underground water levels in the river basin or threaten the stability of hydro technical structures. This process is not usually visible to the naked eye, it is lengthy and slow, but can be easily detected by analysis of specific types of measurements. The article will show the section of the Sava River from the Croatian-Slovenian border down to the rkm 670+000, where the Drenje hydropower plant is planned. Regular measurements of water levels, discharge, amount of load transport and cross section profiles along this section of the Sava River prove that significant changes in the riverbed have occurred in the last 20 years. Because of the deepening of the riverbed, at some locations by more than 3.5 m, the stability of bridges in Zagreb and the surrounding area are especially at risk. As result of unpredictable bottom erosion, the railway bridge Sava Jakuzevac damage on 30 Mart 2009 showed that erosion may lead to the wearing away of bridge foundations which in turn is very likely to lead to serious damage to other bridges.

Keywords: Bottom erosion, load transport, level of underground water, stability of hydro technical structures

**528 Forest Cover and Main Indexes of Runoff and Sediment Load
of Shkumbini River**

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Shkumbini River is one of the most important river that cross Albania. It is extended on the middle of Albania and gathers water from a basin of 2445km² and a length of 181km. The upper part lays out in the Central Mountainous Region

and has form of a valley river. On the lower part flows westward to the Coastal Region and discharges into Adriatic Sea, north of Karavasta Lagoon. Records on runoff and suspended sediment load include the period 1948-1985(37 years). By statistical analysis of the series of water discharges Q and suspended sediment loads Q_s for four hydrological stations was possible to attain the relationships between suspended sediment load and water discharge expressed by polynomial equations, with correlation coefficient from 0.63 to 0.87. Also, is determined the relationship between specific suspended sediment load q_s and mean high of watershed H that indicates the specific sediment load increase by decreasing of mean height of watershed, consequently of increase of area covered by eroded rocks from 23% up to 47% in the downstream zone. This relationship serves as a good basis to extrapolate data for calculation of sediment load at parts of watershed without data and for mapping of suspended load. By this graph it is possible to observe also that the annual specific suspended load has an increasing trend with the distance, confirming as the downstream stations give a major contribute to the year suspended volume of sediment.

Keywords: catchment basin, specific yield, sediment load, soil erosion

503 Development and Productivity of the Serbian Oat Cultivars under Agrometeorological Conditions in Bulgaria

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Within the period 2006 - 2008 in the experimental field of the Plant growing Department at the Agricultural University - Plovdiv, Republic of Bulgaria a comparative test was carried out with three cultivars of Macedonian oats (Slaruj, Lorken, Rajac) compared to the Bulgarian standard for spring cultivars - "Obraztsov Chiflik 4" Block method was repeated three times. The cultivars were sown in March; sowing rate - 600 germinating seeds per m². Phenological observations were carried out. The level of tillering as well as other basic elements of productivity formed under the specific agrometeorological conditions of 2006, 2007 and 2008 were found out. The elements of panicle and its productiveness were analyzed. The yield of the tested Macedonian breeds as per 1 da under the weather conditions in Central Southern Bulgaria was also evaluated. The Macedonian cultivars were considered highly adaptive. The Lorken cultivar proved best yield results.

Keywords: oat, cultivar, yield

554 Essential Oil of *Tanacetum Parthenium* (L.) from East Part of Kosovo

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The essential oil from leaves of *Tanacetum parthenium* (L.), obtained by hydro-distillation was analyzed by GC-MS. Out of 25 peaks, 22 components, which constitute 88%, were identified in oil. The main compounds of *Tanacetum parthenium* (L.) from east region of Kosovo, were camphor (63%) and camphene (9.6%). This study demonstrates the occurrence of camphor/camphene chemotype of *Tanacetum parthenium* (L.) from east part of Kosovo. The present work presents the chemical composition of the hydro-distilled oil of *Tanacetum parthenium* (L.) from East part of Kosovo, and the results are compared to those reported in the literature. After comparison of our data with those reported in literature we can conclude that environmental factors play a role in determining the composition of essential oil of *Tanacetum parthenium* (L.).

Keywords: *Tanacetum parthenium* (L.), Essential oil, East part of Kosovo, camphor/camphene chemotype.

571 Environmental Changes for Historical Period, from last 2000 Years, Recorded in Sediments of Lake Burdur, Turkey. Preliminary Results

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This work was realised on recent sediments of the Lake Burdur, near Isparta (SW part of Anatolia). Lake Burdur (30x7km) is a closed, saline lake at 845m a.s.l., its surface covers 250km² and its catchment area is of 6150 km². During the last 30 years water level of the lake lowered significantly (~15 meters). This processus, the origin of which was not yet studied, can be due to climatic variations, to human activity or to seismic activity, all acting on the local scale as during Holocene this area was strongly populated. On the larger scale, it contributes to the studies of the palaeoclimatic variations of the Earth, particularly in the « Mediterranean-Caspian seas corridor ». In the lately dried up part of the lake,

we have taken 3 sediment cores, each 5m long. Preliminary results of analyses done on these cores show significant changes in the Ca and Mg carbonates content, in granulometry, in clay mineralogy as well as in organic matter content and its isotopic composition (Total Organic Matter, $\delta^{13}\text{C}$, N). Radiocarbon dating obtained on plant fragments (^{14}C AMS ages) have a good internal consistency all along the analysed sequence, the base of which has been fixed at about 2000 yrs B.P.. The obtained results suggest changes in the lake water level from that time, related to the available humidity and show the indications of processes in the catchment area (for instance intensity of detrital supply and the nature of the vegetation cover) and the conditions in the basin. (salinity, oxygenation of water, biological productivity etc). We have detected a specific, strongly disturbed sedimentary unit, the age of which is well correlated to the earthquakes known for this area from archeological investigations. These earthquakes occurred during 6 and 7 th centuries AC.

577 Influence of Human Activities and Demographic Trends on the Environment of Grdelicka Gorge (South Serbia)

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As worldwide the major factor in provoking degradation of natural resources in Serbia is the anthropogenic. Special attention in the paper is given to the soil degradation emphasising example of Grdelicka Gorge, being one of the areas most endangered by erosion in Europe in the mid fifties of the last century. The development of erosion processes can be divided into the period until 1950s and from the mid 1950s to the present day. The first period was characterized by the highest agrarian pressure and accelerated erosion. The basic demographic-economic problematics of hilly-mountainous area of Grdelicka Gorge is being reduced to the disproportion between the number of the agricultural population and the soil areas at disposal, i.e. the manner of agricultural production. This disproportion has resulted also in others, such as: the population - number of livestock, the areas - number of livestock, etc. It is however the man to soil, i.e. land use disproportion, that remains as the most important one. The second period was characterized by population migration, large extent of erosion control works, changes in the structure of agriculture production and, as the consequence, the decline of erosion intensity. The high agrarian pressure in investigated area was primarily reduced by migrations. As younger household members migrated, arable fields were left uncultivated, invaded by weeds, and converted into pastures which contributed to diminishing erosion. This cannot be

called development. The revival of degraded regions should be based on people remaining in the area and being able to have decent livelihoods. Participation of all stakeholders in sustainable land management and decision making can make it possible. Paper presents demographic trends and influence of anthropogenic factor on the state of erosion processes in the area of Grdelicka Gorge.

Keywords: agrarian pressure, erosion, migrations, sustainability

579 Future State of the Climate Change, Mitigation and Development of Sustainable Agriculture in Bulgaria

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Hydro-meteorological conditions in the country are worsened. The most entire estimate is made from the IPCC 2007. Most of authors proven that the last decades are really warmest for last century, even for the entire period of the most instrumental observations. The main goal of the paper is framing in conditions of the expected climate changes in our country for period 2020-2050-2070 and the most likely impacts on the agriculture with inspection padding to the consequences in them and making physical conditions for development of proof farming in production regions. By the means of the systematized database of agrometeorological data for the period of this survey (1971-2000) we provide assignment of the expected climatic changes according to the different scenarios for the periods until 2020-2050-2070. Recover the growth, development and the productivity of the agricultural crops is realized by means of the simulation models as WOFOST, DSSAT and CROPWAT. We determine regions where agriculture is impossible without irrigation and appropriate crops for low-favored regions. This is in connection of expected changes and it is the base for necessary reconstruction of agriculture in dependence with the real resources in all regions of the country further to the expected climatic changes in 2020-2050-2070.

Keywords: climate change, agroclimatic resources, future conditions

580 Peculiarities of Phenological Development of by Cherry, Peach and Apple Trees in Dependence of Thermal Conditions

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Development of orchard trees depends from agrometeorological conditions and dynamics of weather elements, which are subject of daily observations. Thermal regime and its influence on the agricultural crops and plantations in national and regional scale of investigation are the scientific problem, which is permanently in the field of vision of agro-climatologists. Many scientific developments in Bulgaria are devoted to climate variability and change of air temperature during the active growing season. As an indicator for characterization thermal conditions in agro climatology is used the period with average daily air temperatures above 10 °C. The steady transition of air temperatures at intervals of 10 °C correspond to beginning of active vegetation for all plants. That is why duration of this period is named real vegetative period (RVP). The existence of relationship between the thermal regime of the environment and the vital activity of crops is on the basis of the duration of inter-stage periods change in dependence of temperature conditions. The aim of present investigation is to find empirical relationships between the duration of inter-stage periods and the temperature sum during the RVP throughout the year ($t > 10^{\circ}\text{C}$) in the period 1992 - 1997 for the basic orchard trees (apple, cherry and peach, grown in our country. Investigation of these climate indicators is interesting because of their practical importance for observing seasonal dynamics of natural resources connected with agricultural activity.

Keywords: orchard trees, temperatures, phenological development, duration of periods between stages

582 Burgas Port Ambient Water Quality Status

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Burgas port is located in the Burgas Bay that is the largest bay of the Bulgarian Black Sea Coast. It is 41km at its widest part and 25m at its deepest, reaching 31km at its greatest innermost extent, approximately. The salinity of water in the

bay is 17 and the sand is of magnetite origin. The Burgas Lakes are located in the wetlands to the west. There are several small islands in the southern part of Burgas Bay. The surroundings, land-based and seaport activities in this area have affected more or less all components of marine and coastal environment, ecosystem and biodiversity. Since Bulgaria has adopted the Water Framework Directive (WFD), it has exerted great efforts to follow the EC Directives and to meet the relative requirements for legislation and institutions in the port region. As a result, considerable progress has been made in the field of environmental protection. With regard to the implementation of the WFD, the fundamental laws/acts and regulations have already been discussed and passed. The River Basin Management Plan and Port Waste Management Plan are developed. All that remains outstanding is their practical implementation. The current ambient water quality status of the Burgas bay and the Burgas port, respectively according to all available historical and current information is evaluated for the first time. The sampling station and the parameters that are determined are given. The generalized data are tabulated and illustrated graphically where the variation of water quality parameters for the period of 2001 - 2008 could be seen. Finally some conclusions are given. They will be a basis when the environmental management plan according to UNI EN ISO 14 000 series of standards for the port of Burgas will be developed.

Keywords: Water pollution, Burgas Bay, ambient water quality

594 Soil Erosion From the River Sides

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The protection of the soil from erosion is for our country a big problem with high extension and with complex character. The forms of erosion are different and in dependence of factors which are caused. But, the phenomena is present in all the rivers and streams of our country where the losses of the soil are estimated some tens of hectares every year. This phenomena in all the cases is accompanied not only with the loss of the soil but with the failures of the infrastructure in the bottom of the rivers and the embankments around. The problem of soil protection from the erosion in general and especially the protection for eroding the bottom of the rivers especially are the most important that are required today for the protection of the soil. The damages in the rivers bottom are with very heavy consequences in the national economy. These damages are not seen immediately but very often

cause serious complications with heavy consequences in the land and in the social life of the communities that are situated in the vicinities of the rivers. The factors that influence are: The slant of the rivers; the immediate turns; the non stable sides of the rivers; the concentration of the rains in different periods of the year; the high coefficient of water flow in surface; the absence of the plants cover. In this study, through monitoring we give an information of the concrete situation of the river's bottom in the soils around them, the factors of this situation, the problems that seek a solution and the measures to be taken. The study has been fulfilled in four river ponds: 1. Drin, Buna, Mat, Shkumbin. 2. Erzen, Tirana River, Turkuza river, Zeza river and Droja river. 3. Seman, Osum, and Devoll rivers. 4. Vjosa, Shushica and Drino river. From the study results that: endangered soils from the slips and demolitions are 109.000ha. Destructed and slipping soils are 4000 ha. The erosion of the soil in the river's bottom and sides are present in all the segments of our country. The monitoring shows that for soil losses within a years are some tens of hectares.

601 Erosion Process in Rogozna (Southwest Serbia)

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The problems of erosion and soil loss can be traced back to the beginning of agriculture. In recent times, the problem of soil erosion has occurred more frequently, due to the increase in population and agricultural pressure. This paper deals with the definition of the condition of the erosion process in Rogozna and calculation of the mean annual erosion sediment yield and discharge. The investigated area covers an area of 58.81km². The methodology applied in this paper is based on the cartographic, teledetection and empirical methods. By the data obtained by the detailed terrain recognition, analysis of the satellite photos, data on the geological and pedological base, climate factors, as well as data on the vegetation arrangement, the coefficient of erosion (Z) for the area was determined analitically, by the separated hydrological units (watersheds and inter-watersheds) by the methodology of Professor S.Gavrilovic. Since the mean coefficient of erosion for the area in Rogozna is $Z=0.282$, this area can be classified into the Category IV of the destructiveness. According to the type of the erosion surface and combined erosions are dominant, whereas deep erosion is present sporadically. The total sediment yield in the area is $W_{year}=17172,32$ m³year⁻¹, and mean specific sediment yield is $W_{spec}=291.99$ m³ year⁻¹km⁻². The quantities of the sediment discharge which refer to the area Medenovac-Karavansalija is $V=6796,19$ m³god⁻¹, and the specific quantity of sediment,

i.e. quantity of the sediment per 1km² of area is $V_{spec}=115.56 \text{ m}^3\text{km}^{-2}\text{year}^{-1}$. According to the calculated coefficient of erosion Z , sediment yield and discharge, the most frequent category of erosion in the investigated area is weak erosion, which is in the accord with the way in which the soil is used (the territory is mainly covered by forest and grass areas).

Keywords: erosion processes, coefficient of erosion, sediment yield

645 The Influence of Human Activities and Air Pollution on the Rainfall Regime in B&H

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We studied the rainfall regime during the working week at three sites in Bosnia and Herzegovina: Sarajevo, Tuzla and Ivan Sedlo. Sarajevo and Tuzla are industrial center with a typical emissions into the atmosphere, which is the greatest during the working week, and some decreases over the weekend. Ivan Saddle altitude weather station is outside the urban area. We observed a correlation between the days of the week and the amount of precipitation, with emphasis on the maximum amount of rainfall and the occurrence of showers. It is shown that the correlation is not great but still exists. Minimum rainfall registered during the weekend. The largest increase was recorded at the beginning of the working week and the maxima observed on Tuesday and Wednesday. This is not the case with the number of days with precipitation, which further underscores the importance of the previous conclusion as to naturally expected that these two parameters to a greater statistical correlation. To confirm these results link with the amount of air pollution in these three cells, we compared the results with measurements of air pollution, and obtained a similar correlation.

Keywords: rainfall, human activities, air pollution, week

652 Impact of Climate Uncertainties and Irrigation Scheduling Strategy on Irrigation Season Length

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The objective is to assess the impacts of several irrigation scheduling alternatives for maize on irrigation number and season length in a vertisol and a chromic cambisol soils in the Thrace, Bulgaria by application of the formerly validated ISAREG model to the period 1970 - 2005. Simulation modelling and data from furrow irrigation experiments are used to define the irrigation scheduling strategies aimed at improved water use and water saving in vertisol (TAW=173 mm m⁻¹): (1) refilling the soil reservoir adopting management-allowed depletion fraction (MAD) of 0.60 and application depths 110mm; (2) refilling the soil reservoir adopting MAD=0.47 and application depth 90mm; (3) refilling the soil reservoir adopting MAD=0.33 and application depth 60mm; (4) partially refilling the soil reservoir with 60 mm but adopting MAD=0.47. The irrigation scheduling alternatives generated for surge furrow and sprinkler irrigation in chromic cambisol soil (TAW=136mm m⁻¹) are (2) and (3) refilling the soil reservoir adopting MAD of 0.60 and 0.40 and application depths 90 and 60mm and (4) partially refilling soil reservoir with application depths of 60 mm but adopting MAD=0.60. Statistical analyses of results indicate that when maximum yield is aimed at the number of irrigation events ranges from 2 to 4 for alternative 2 and reaches 3 - 6 or 2 - 6 (alternatives 3 and 4) in vertisol. An additional irrigation is required in average/high irrigation demand years in chromic cambisol. The larger are the TAW and MAD the shorter is the irrigation season. When water is depleted from the deeper soil layers (alternatives 2 and 4) average irrigation season is 27 - 32 days in the vertisol and 44 - 45 days in the chromic cambisol. Alternative 3 leads to 43- and 54-day irrigation season on the average in both soils and 62- and 82-day at the most. The season starts earliest in the very dry year, on 8/06 for alternative 3, and ten days latter for alternatives 2 and 4 and between 3 and 17/07 in the years of average/ low irrigation demand. The last possible irrigation timing is between 31/08 and 12/09 in the chromic cambisol and between 7 and 14/08 in the vertisol.

Keywords: The Thrace plain, Bulgaria, irrigation scheduling, irrigation method constrains, ISAREG model, climate uncertainties, irrigation season length

659 Research on the Atmosphere in Northeastern Bulgaria

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The atmospheric total ozone content variations over the North-eastern region of Bulgaria have been observed during the May-August period of 1989. The measurements are conducted above the hydro-meteorological station in the Kaliakra peninsula using a ground-based ozonometer M-124. The experimental data for the total ozone content distribution have undergone processing and the mean month values have been calculated. A distribution anomaly has been observed during the second half of July, when the trend is negative.

658 Salt Marshes Plant Diversity of Coastal Zone in Albania

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The salt marshes of Albania comprise a narrow belt along the Adriatic and Ionian Seas, with a total length of 476 km from the north to south. They have long been the subject of a range of human activities causing habitat loss. Enclosure for agricultural use, ports and other infrastructure has reduced many salt marshes to a narrow fringe along estuary shores. Salt marshes are important for a range of interests. In particular they support a range of specialist plant communities and associated animals (especially breeding and wintering birds) and often have a high nature conservation interest. They rarely exist in isolation and form an integral part of many estuaries, other tidal inlets and bays. The objectives of this study are flora and vegetation of salt marshes. In this study, on the basis of field surveys, is given a phytosociological classification of the Albanian salt marshes vegetation by the European standard methods of phytosociology (Zurich-Montpellier). The salt marsh communities of Albania are poor in endemism and generally similar to relevant vegetation types elsewhere in the Mediterranean. In all 61 plant taxa were determined from this area. Families with highest number of taxa were Chenopodiaceae, Poaceae, Asteraceae, Cyperaceae, Fabaceae and Plumbaginaceae with dominating genera like: *Arthrocnemum*, *Limonium*, *Puccinellia*, *Chenopodium*, *Plantago*, *Tamarix* and *Juncus*. The representative species recorded were *Arthrocnemum fruticosum*, *Halimione portulacoides*,

Halocnemum strobilaceum, *Juncus acutus*, *J. maritimus*, *Limonium vulgare*, *Polypogon monspeliensis*, *Salicornia europaea*, *Suaeda maritima*, and *Tamarix dalmatica*. Phytosociological analysis evidenced 16 associations, which belong to 4 classes, 5 orders and 6 alliances.

Keywords: habitat loss, salt marshes, flora and vegetation, phytosociological analysis

691 The Economic Effects of Irrigation and Dunging in the Sugar-Beet Production

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The research of production and economic effects of irrigation to the sugar-beet and sugar growth per hectare was carried out on the carbonate humus of favorable water-physical and chemical characteristics on the location of Rimski Sancevi during the period from 2004 to 2006. The experiment was set according to the method of the Split-plot system being done in four repetitions with the usage of raindrop irrigation. During the experiment there were kept humidity soil treatments from 60 to 65% and the field water capacity (FWC) of 75-80% with a controlling variant being included. During a three-year period, irrigation had an influence on the increased sugar-beet growth of 8,2 t/ha and on the sugar growth, because of the increased growth of the root, of 0,9 t/ha. The irrigation effects varied according to sorts from 5,7 t/ha by Sara to 12,1 t/ha by Drena. Dunging levels approximately influenced the growth increase of 8,6 t/ha and varied from 6,8 to 11,0 t/ha ($r = 0,960$). It was judged that the amount of annual precipitation and temperatures and their disposition significantly influenced the movement and varying of the growth in the observed rainy years. The realized profit per hectare during irrigation is 1607 \$/ha and it is approximately greater of 17,6% in comparison with the production in the controlling variant. Economy shows that to a unit of invested capital there is realized 1,49 unit of profit during irrigation or more than 4,2% comparing the production without irrigation. Profitability measured from the point of relationship between profit and incomes is 32,8% during irrigation and it is greater of 6,8% than the production in the controlling variant. The productivity indicator tells us that for one produced tone of sugar-beet during irrigation is approximately spent 1,28 hours of total working time or it is produced 0,783 t/ working hour of sugar-beet.

Keywords: sugar-beet, economic effects, irrigation, dunging, growth, profit, economy, profitability and productivity

**731 Deposition of Transuranium Nuclides in Finland
from the 1986 Chernobyl Accident - Meteorological Aspects**

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The Chernobyl nuclear accident happened in the former Soviet Union on 26 April 1986. The air parcel trajectories originating from Chernobyl at the time of the accident show that the radioactive plume moved first northwestwards. Over Lithuania the plume separated to two main paths. At altitudes of 750-1000m the plume continued towards Sweden and Norway. At altitudes of 1500-2500m the plume turned towards north. The plume arrived in southwestern Finland 27 April at 12 UTC for a release height of 2000m. Then the plume went across the country north-eastwards and back to Soviet Union. A frontal zone north of this route hindered the plume to reach northern Finland which could have caused catastrophic socio-economical effects on the reindeer husbandry in northern Finland. One third of the country was still covered by snow and even in southern Finland the agricultural activities hadn't started yet. Also the cattle was kept still indoors. This reduced the effects of the accident on agricultural products during the early phase of the accident. In contrast to the 1960's nuclear weapons test fallout, the Chernobyl fallout was very unevenly distributed in Finland. The first release from the reactor explosion contained debris of the reactor fuel including refractory nuclides like transuranium nuclides and ⁹⁵Zr. These were mainly deposited on a relatively narrow band from southwestern Finland towards northeast. During the air mass passage there was no precipitation occurring in south-western Finland and the nuclides were dry-deposited. A part of these radionuclides were associated with hot particles with a high deposition velocity. It has been estimated that the total activity of ²³⁷Np, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, ²⁴¹Pu, ²⁴²Pu, ²⁴¹Am, ²⁴²Cm and ²⁴⁴Cm in Finland from the Chernobyl accident was 1.1E7, 5.4E10, 3.8E10, 6.2E10, 9.5E12, 8.5E8, 3.7E10, 1.5E12, and 8.2E9 Bq, respectively, decay-corrected to 1 May 1986.

Keywords: Chernobyl, deposition, transuranium nuclides

735 Impact of Atmospheric Precipitations on the Surface Water Chemistry in Mountain Area

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The presented results are obtained through a complex investigation on the water and precipitation quality in the highest part of the mountain. A temporary local monitoring network for surface water quality was established in the examined period (2004 - 2009). The investigation focused on the upstream sections of the main rivers in the central part of the Vitosha mountain (Bulgaria). The monitoring points (rivers' and precipitation's) are situated above 2000m. The findings present the background levels of the studied hydrochemical parameters. The predominant anions in river water are hydrocarbonates and sulphates while the predominant cations are calcium and sodium. The measured pH values suggest the pure precipitation's influence on river water in terms of acidity. It is perceivable that the majority of the nitrate concentrations in river water originate in the precipitations. The investigated parameters are in low concentrations and characterize the background conditions in the Vitosha mountain surface and precipitation water. The river water nitrate concentrations are commensurate to the nitrate concentrations in precipitations samples obtained at the Cherni vrh synoptic station. It is perceivable that the majority of the nitrate concentrations in river water originate from the precipitations. The predominant anions in river water are hydrocarbonates and sulfates while the predominant cations are calcium and sodium. The pH of precipitations decreases with increasing of the water temperature due to thermodynamic reasons. The pH of river water enhances with increasing of the temperature up to the reach of normal reaction (pH values).

Keywords: surface water quality, precipitation chemistry, background surface water

734 Winter Air Mass Transport and Precipitation Chemical Composition in South-West Bulgaria

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The purpose of the investigation is to determine the dependency between the precipitations' chemical composition and the origin and trajectory of the precipitating air masses. The local and advective components of precipitation pollution are illustrated through four types of precipitation situations predominating the winter seasons. The contribution of local pollution to the precipitation's composition is assessed through air quality analysis before and after the precipitation. Acid precipitations are an object of scientific and public interest. Basic precipitations, which are polluted precipitations, as well, are not well studied. From long-lived observation in Bulgaria, it is evident that the precipitations in the big cities are predominantly alkaline. The precipitations chemical composition network is geared primarily towards measuring the main anthropogenic factors contributing to acid precipitation. This orientation of the chemical analysis does not help to explain the origin of alkaline precipitations. From this point of view, conducting analysis for the discovery of all chemical elements in samples from a wide spectrum of precipitation situations is paramount. The present work investigates the chemical composition of precipitations in Bulgaria under three types of general atmospheric circulation - WZ, SWA, and NZ according to the classification of Hess and Brezowsky and Mediterranean cyclones in winter. A relationship between the precipitations' chemical composition and the path of the cloud systems was studied. The presence of the main anthropogenic ions in the air leading to precipitation acidity was investigated. The influence of transboundary factors is determined analysing the simultaneous precipitations from the same cloud systems in urban areas and the background regions. The pollution sources in South-West Bulgaria have not been investigated vis-a-vis precipitation chemical composition till now. Nor have there been comparisons between precipitations' chemical composition in urban areas and background stations. The contribution of trans-boundary transport on the precipitation composition has not been differentiated.

Keywords: precipitation chemistry, precipitation chemistry and air quality, atmospheric circulation

738 Construction of Ceiling Layer Coal Basin Sector East Kosovo

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Systematic survey of the coal basin Kosovo as one of the basins with very large reserves of coal have started 50 years since the last century. The first general data such as geological-structural construction, and palaeontological data have biostratigraphics years since before 1956. This database on the construction of the basin of Kosovo is the result of multi-year research started from 1950, with first drilling performance of intelligence that continue until today. Results of research conducted in many monograph summarized positively assessed by specialists and by many studies, projects and reports stored in the archive of documents research conducted by various institutions. Since a large part of career Kosovo "surface" run under the river aluvionet Sitnica, required knowledge emerged as the best natural hydrogeologic conditions of deposits in zhavorrorore entire career. For this purpose is determined first network discovery wells in 1965 with a limited number. This research network was later expanded in view of the dynamics of career development. Their number is up in 1985 reached up to 65 wells scattered uniform discovery in an area of 4.5km². Discovery wells have included space between the concrete bridge over the river north Sitnica, Lismir village in the south eastern border in the west and career surface rail-Kosovska Mitrovica in Kosovo Polje east. Now when the coal reserves from existing mines are White and Mirash end, a need of expanding the mine to the east of Mirash mine, in terms of the Sitnica River, which is also called "the eastern sector. The purpose of this topic is to present the construction and distribution of layers litologjie in this sector, first of all strata of Coal overlay.

Keywords: Coal, coal basin of Kosovo, coal surface career, Mirash mine

770 Participatory Irrigation Management in Albania

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Albania is located on the eastern shore of the Adriatic sea, south of former Yugoslavia, north of Greece, and west of Macedonia. It is divided into three agro-ecological zones based on climate, soils and vegetation: the fertile coastal

plains, the intermediate hilly region, and the non-arable mountain zones. Annual rainfall varies from 800 to 2,000mm in coastal areas to 1,600 to 2,000mm in the hilly regions and up to 3,000mm in the mountains. Rainfall is concentrated mainly in the winter, and less than 20 percent of annual rainfall occurs in the six-month period between April and September. Crop water deficits between June and August range between 400 and 500mm that cannot be supplied from soil moisture, making irrigation necessary for adequate crop growth, especially in the coastal areas.

Agriculture was and is Albania's most important sector, presently accounting for over 50 percent of GDP and employment. Due to the importance of this sector and the need for irrigation, the previous regime made massive investments in irrigation and drainage between 1950 and 1975. By the end of 1980s, about 420,000ha of land, representing over 50 percent of Albania's arable land and delivering some 80 percent of its agricultural production, was provided with irrigation facilities. Drainage was also recognized as a necessity along with the irrigation. A substantial part of irrigation development is in the coastal plains, where soils are heavy and the land is flat since much of it was reclaimed from swamps. As winter rain frequently causes waterlogging, extensive networks of drainage have also been developed.

Water Sources. Albania is a water-rich country, with an annual average of 3,080 m³ per capita, the highest in Central and Eastern Europe. Total run-off equals on average 25.7 billion m³ per year, of which 2 percent or 588 million m³ can be stored in irrigation reservoirs. This water, together with 450 million m³ diverted from rivers and lakes, constitutes the present volume of 1.0 billion m³ available for irrigation from surface water.

Irrigation and Drainage Infrastructure: System Size and Fragmentation. Irrigation systems are highly fragmented since 55 percent of the irrigation command area is supplied by small systems covering less than 5,000 ha. Some 653 dams and reservoirs supply water to about 184,000 ha, and 639 pumping stations with some 1,250 electrical pumps and installed power of about 200,000 kW provide lift irrigation from rivers and lakes for about 78,000 ha. Run-of-river schemes account for water on some 160,000 ha, with groundwater supplying the remaining 1,000 ha of land under irrigation command.

522 Some Important Correlations Between Forest Ecosystems and Water Resources in Albania

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A small, but very beautiful country, Albania, is located on the Balkan Peninsula, on the south eastern part of Europe. There is a population about 4.1 million habitants, capital Tirana.

Albania enclosed from terrestrial, sea, rivers and lakes border. Total long of Albania border is about 1094km; from them 657km terrestrial, 316km sea border, 43km rivers border and 73km lake border.

Albania has a lot of water resources including here: seas, rivers, lakes, lagoons as well as underground waters. Most important of them are: i) seas: Adriatic and Joan; ii) lakes: Ohrid, Prespa, Shkodra and Butrinti; iii) rivers: Drini, Buna, Mati, Shkumbini, Semani; Vjosa, Ishmi and Erzeni, and also a lot of artificial reservoirs. In Albania there are some glacial lakes as Lura and Balgjaj, as well as some lagoons as: Karavasta, Patok and Kune–Vain.

But, in Albania there are many geothermal water resources, and many specialist have studied how to use them, for example for heating buildings, for production of agricultural plants, or for decorative and forest sampling.

Albania has about 1,485mm precipitation in year, rain and snow forms. Most of precipitation descend from the rivers and flow into the Adriatic Sea. In a year into, the sea, flow 42 milliard m³ water, from which 12.8 milliard m³ corresponding underground water. About 23% of underground water are distributed in all the country and is using from people for different activities.

There are also a lot of kind of natural habitats and ecosystems as: Mediterranean shrubs, broadleaves forests, conifer forests, mixed forests, alpine a sub-alpine pasture ecosystems, meadows, rocks area, marine ecosystems, coastal, lagoons and other wetland area, lakes, rivers, but of course and agricultural area. And all of them have good correlations between the vegetation and water resources. This correlation is more evident near the rivers, lakes, lagoons etc

Around 36 % of total surface of Albania are covered by the forests that means 1,043,158 ha with a total standing volume from 81,334,000 m³. In Albania are 361,568.7 ha (12.58 % against of total Albania surface) Protected Area, according to IUCN criteria.

Flora of Albania results with about 3,250 kinds of vascular plants, about 30% of

European's flora, represented from 165 family and 910 genders. In Albania grow up around 30 endemic and 160 sub-endemic species.

Finally, as results of all written above, we conclude that Albania has very good conditions and a good geographical position. Also Albania is very rich with water resources, with various vegetation that grows up very well and there is in continuity a very strong correlation with water resources.

Keywords: Albania, resources, water, river, lake, sea, Mediterranean, flora, forest, biodiversity, species endemic, vegetation, monitoring, climate, threaten, conservation, protected area, rainfall ,precipitation, biodiversity.



TOPIC 3

WATER RELATED RISKS



016 Flood Risk for North Bulgaria

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This paper presents the parameters of high river's water at north part of Bulgaria - area for agricultural production and urban area. It focuses frequency and volume of high waves during the year and by watershed, duration of high water (by hours) and chronology of flood. The investigation takes spatial distribution for flood risk.

Keywords: flood, river, risk

023 Considerations upon the Droughts of Oltenia and their Effects

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Droughts are extremely complex climatic phenomena determined by a great range of factors as: atmospheric precipitations, the air and ground temperature, the water reserve in the ground which is accessible to plants, the humidity of the wind (or, to be more precise, the low humidity degree of air also known as the dryness of the air), the evapotranspiration and the wind speed. Global and regional climatic changes, the anthropic impact on the environment, the irrational use of ground resources led to an extension of the area affected by droughts, to intensifications in the processes of dryness and desertification, and also to the increase in frequency and duration of droughts in certain regions of the world and even of our country. In this paper we analysed the droughts that affected Oltenia after 1987. The frequency and intensity of this phenomena increased proportionally with the intensification of the climatic risk phenomena associated with the global warming of the atmosphere. In matters of frequency and intensity, the droughts and the early heat waves in the warm season determined a fast-growing aridity especially in the South of Oltenia. These have drastically reduced the agricultural

productions playing an essential role in the raising prices of food and daily use products, this raise is strongly related to the climatic risk phenomena. This paper highlights important aspects of these phenomena in Oltenia, and we extended our analysis to the droughts of the cold season. The analysis is based on the processing of long data series from meteorological and pluviometric stations in Oltenia and has a crucial importance for the regional climatic evolutions, being of great use to climatologists, meteorologist, agronomists students, those who try to achieve a master or doctor degree and also to those interested in the evolution of the climatic phenomena in Oltenia.

Keywords: drought, dryness, heat waves, aridity, desertification, draining, climatic changes, precipitations, average temperatures.

024 Meteorological Situations that Generated Exceptional Discharges along the Danube River

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For Europe, the undisputed importance of the Danube can be rendered by some general data: Its hydrographic basin surface exceeds 817,000km², i.e. about 10% of that of the continent, its length is 2857km and its mean multiannual discharge is about 6500m³/s, thus ranking second to Volga River. Romania is the country with the largest surface situated within Danube catchments river basin (97.4%), representing 29% of catchments river basin. The water resources of the Danube in Bazias section amount to 173 billion cubic meters (m³), 3,30 billion m³ of which are technically usable resources. Our analysis aimed at determining those complex meteorological situations at the European continent level that generated exceptional discharges along the Danube river, resulting in severe flooding, causing in turn heavy damages, fatalities, population evacuations and considerable rehabilitation costs. A complex analysis was performed, of statistical-synoptic type and those complex meteorological situations were identified that determined the occurrence of such disasters. Discharges and levels of the Danube river were used along the whole measuring period, data from the archive of the National Meteorological Administration, and data, map and image archives from Wetterzentrale (Kartenarchiv, NCEP, NCAR, AVN etc.). The complex meteorological situations at the level of the European continent that generated exceptional discharges along the Danube river correlate with intense cyclonic activity, of both the Icelandic and the Mediterranean cyclones,

with the negative phase of the North-Atlantic Oscillation and with decreasing or minimum solar activity (according to data from NOAA's Space Environment Center). The most disastrous floods occurred in the spring of 2006. The paper is important for meteorologists, in their weather forecasting activity, for hydrologists, in their hydrological forecasting and for the organizations involved in the flood management.

Keywords: discharges, flood, forecast, North-Atlantic Oscillation

060 The Flood Situation of Assam - a Case Study

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The problem caused by water may broadly be categorized into two major groups' viz. shortage of water and surplus of water. Shortage of water causes drought and surplus water causes flood. The water is the vital ingredients for the survival of human being but sometimes it may cause woe to the human not due to insufficient water but due to abundant water which in turn causes the natural disaster called as flood. Assam is situated at the easternmost part of India. Geographically it is at the foothills of the Himalaya. Every year Assam experiences a huge amount of losses due to devastating flood caused by the river Brahmaputra. The losses are more in few places like (Majuli, biggest river Island), Dhemaji, North Lakhimpur, Dhakuakhana and few places of Barak valley in Assam. The problem of flood is very old in Assam and the solution is very much difficult due to complex and devastating nature of the River Brahmaputra. Both short term and long term measures are sometimes failed to mitigate the losses caused by flood. This paper presents the case study on the losses in terms of livestock, human lives and that in terms of property that have taken place in some district of Assam.

Keywords: Disaster, Water, Loss of property, Human lives

**073 The Analysis of the Risk Hydro-Climatic Phenomena
in the Ialomita-Buzau Hydrographical Space.
Structural and Unstructural Measures for Prevention and Intervention**

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The Buzau - Ialomita hydrographical extent area covers an area of 15614km², and is located on the outside of the curvature of the Carpathians. The altitudes vary from 6 to 2505m. In accordance with the altitude the annual precipitation varies from 400mm/year in the plain area to 1400mm/year in the mountains. On the other hand, due to a very high variability of weather conditions, droughts as well as excessive rainy periods may occur during the year. This area's climate is temperate - continental, but because of the variety of landforms there can be distinguished three main climate types: mountain, hill and plain. The average annual temperature is 11.8°C, with a registered highest temperature of +44.5°C (Braila County, 1951) and a lowest temperature of - 38.5°C (Omu Summit Weather Station, 1929). The paper focuses on specific hydro-climatic events which are threatening, such as droughts and floods in the studied area. The period of time we have analyzed is represented by the past two decades, in which we have encountered an increase both in frequency and intensity of these phenomena; droughts and extreme rainy events becoming stronger and longer. The flood frequency has increased mainly because of climatic variations but also because of the fact that many villages have emerged in areas that are naturally and normally flooded by rivers. The paper also aims at dealing with specific measures of managing the risk situations in order to prevent and mitigate the effects that these hydro-climatic events have upon livelihood. In the end we have proposed both structural and unstructural measures that could prevent and deal with various situations which may result as a consequence of floods. We have also presented a few measures that aim at protecting the natural and anthropic environment against the effects of these hydro-climatic realities.

Keywords: hydro-climatic phenomena, hydrographical space, structural and unstructural measures, torrentiality, adequate management

**099 On the Risk Assessment of Severe Convective Storms
and Some Weather Hazards Over Bulgaria (1991-2008) -
Meteorological Approach**

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Severe convective storms (SCS) produce such dangerous weather phenomena during the warm half of the year like heavy and very intense rainfall, thunderstorms, hailfall, which are often associated with gusts of strong up to violent wind (sometimes with such dangerous events like squall and tornado). From meteorological point of view these events are defined as small-scale severe weather phenomena (SCSWP). These SCSWP are sparse in space and time and have unfavourable influence on the economics and societies especially in the small countries causing significant property and infrastructure damages as well as losses of life. According to the WMO experts about 90% of natural disasters are due to weather, climate and water. The present investigation is based on proper selection of SCS and associated with them severe and hazardous meteorological events like heavy (30-59.9mm/24h) and torrential (totals =60mm/24h in one station are considered) precipitation, wind (speed =20m/s), hail and thunderstorms in six different parts of Bulgarian territory. Their monthly and seasonal distribution is obtained, as well as the risk assessment of their occurrence for short periods during each season and each region. The frequency of the days with torrential rainfall (Q=60mm/24h), extended thunders and hailfall, and wind have been analysed separately. Statistically significant increase (about 30-50%) of days with torrential 24-hours precipitation is revealed during the period of investigation (1991 - 2008) in central and east parts of the country, while in South-West Bulgaria these dangerous events decreases with about 20-35%. The increase in frequency of stormy days in the autumn months September and October is observed almost in all parts of the country.

Keywords: extreme precipitation, thunderstorms, hail, flood events

107 Flood Risk in Slovakia

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Adoption of the “Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risk” proves that flood protection is one of the most important tasks for all the governments in EU. This directive requires creating effective tools, which will provide information about the flood risk and help decision-making in flood management. In accordance with that directive it is necessary to create flood hazard maps and flood risk maps showing the potential adverse consequences associated with different flood scenarios, including information on potential sources of environmental pollution as a consequence of floods. In Europe, there have already run some projects, which deal with the directive 2007/60/EC, but in Slovakia, we are just on a very beginning. Flood protection in Slovak Republic is usually being solved like a case-studies, research projects or scientific and technical projects. In present, there are few pilot projects implementing the directive and creating flood hazard and flood risk maps for several places. Present tool for flood risk management is so-called “risk analysis” based on principles of the probability theory, mathematical modelling and classification of the endangered area according to the type of economic activity. The aim of this paper is to describe the present situation in analyzing flood risk in Slovakia, legislation dealing with flood protection and the possible procedure of creating flood risk maps in Slovakia.

Keywords: flood, risk, flood risk map, flood risk management

134 Water Scarcity and Droughts Management In Spain

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The Special Action Plans include: i) Geographic zoning of the river basin, essentially along the lines of Water Usage Systems, a traditional device that has been maintained in present water management legislation. ii) A system of hydrological indicators for characterizing drought severity, defined in four phases which are,

in increasing order of severity: normality, pre-warning, alert and emergency. iii) The basic indicators are: reservoir levels, piezometric readings which take account of aquifer reserves, runoff data in certain parts of the system and rain gauge readings, as well as indicators of water quality or environmental effects. iv) The above indicators have been grouped into different categories: by their purpose (warning, effect and efficiency indicators), type of PES measurements involved (forecasting, operating and organisational and management indicators) and by the availability of information (initial and potential indicators). v) Following a similar procedure in all basins, all the drought indicators were converted into dimensionless values ranging from 0 to 1 (status index). One task - based on the analysis of historic droughts and hydrological simulation techniques - that proved to be highly complex was the definition of the "threshold values" of the indicators used to characterize drought and measure its severity.

Keywords: Droughts, Management, Plans

149 Storm Sewer System Analysis in Urban Areas and Flood Risk Assessment

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The urbanization changes the hydrological regime of urban streams as sites are cleared and natural vegetation is replaced by impervious cover such as rooftops, roadways, parking lots, sidewalks, and etc. One of the consequences is that more of a stream's annual flow is delivered as storm water runoff rather than baseflow. Depending of the watershed impervious cover, the annual volume of storm water runoff can increase by up to 16 times that for natural areas (Schueler, 1995). Together with the human activities related to land use practices, improper maintenance and management, as well as climate change impacts, the flood issue is recognized as complex problem in flood control and protection measures in urban sites and associated ecosystems.

This paper will present a case study on frequent flooding, hydrological analysis, and hydraulic modeling of existing storm sewer system of Prishtina airport in Kosovo. Availability, suitability, and quality of hydrological, meteorological, geomorphic, topographic, maintenance and management data are discussed.

Some results from frequency analysis of storm events in the region, as well as the results obtained by hydraulic modelling using HEC-RAS are presented. Flood risk maps have been created, flood risk analysis was performed and measures against flooding of the runway and surrounding terrain were proposed.

Keywords: storm drainage system, runoff, culverts, flood mapping, hydraulic modelling, flood risk assessment

181 Impact of Human Activities on Flood Events in Brahmaputra Basin in India

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The Brahmaputra basin extends to four northeastern states of India viz. Arunachal Pradesh, Assam, Meghalaya and Nagaland. The Brahmaputra river drains 1.94 x 105km² area with an average annual flow of 537.2km³ of water at an annual average of 17040m³ sec⁻¹. The basin is endowed with rich resources of water, soil and vegetation but their indiscriminate use has rendered them in a fragile state. About 455.1 Mt of soil is lost every year through erosion and this huge quantity of soil, along with runoff, takes away large amounts of absorbed and dissolved crop nutrients to different sinks. Due to heavy soil erosion, about 72370km² area or 36.1% of the total geographical area has degraded, with irreversible damage at some places. The major activities through which the human interferences induce floods in the basin are; prevalence of shifting cultivation involving 14660km² area, land tenure system, free range grazing, urbanization, deforestation, construction of roads and mismanagement of rainwater. The human activities help in generating heavy sediment load in runoff, resulting in silting of river bed, causing floods in the plains. A multidisciplinary long-term study was undertaken with seven land use systems, including shifting cultivation. The methodology for estimating the possible deposition of eroded soil and associated nutrients from the Brahmaputra basin is primarily based on determining the loss of soil and the deposition at different places by quantifying the sediment and nutrients load in the runoff. Soil loss from erosion was estimated through monitoring gauges installed at the exit point of each watershed. Total soil and nutrient load was estimated as a product of soil loss from the gauged areas of watersheds studied, extrapolated to the total areas of the basin, taking into consideration slope, rainfall, vegetation and clay content of the soil.

Keywords: Human activities, flood events, Brahmaputra basin in India

**171 Flood Risk Assessment - a Basin Approach for Estimation
of the Maximum Water Discharges**

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Basis of the proposed approach is the theoretical definition of the concept "Flood risk". It is demonstrated in the paper that the probability component in the flood risk is equal to the probability of water discharge to be largest or equal to given value. When the goal of the investigations is flood risk estimation in the whole river basin (or whole river length), it is obviously necessary to complete the calculations in a great number of river points with the same probability of the discharges. It is known that the equal probability values of the discharge change with the length of the rivers. However, these changes are known only in the points of hydrometrical stations. Another problem rises from the boundary condition of the hydraulic differential equation calculating for determination of the water levels in short river parts. Usually the calculation are made under condition of a constant water discharge value in every consecutive part. In the large river strictest these approximately constant values are different. An applied method for decision of these problems is given in the paper. It is supported by statistical methods of water discharge probability calculations by means of available data and estimation of theirs values, and probabilities in cases without direct observations.

Keywords: Flood risk, probability, river strictest, irregular flow, water level, flooding areas.

**174 Flood Forecasting and Flood Control in Turkey-Bulgaria
Cross Boundary Cooperaion Region**

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Implementation and operation of the Maritza River Flood Forecasting and Early Warning System (FFEWS) by a team of experts led by DHI Water&Environment&Health will result in significant improvements of State Hydraulics Works of Turkey's (DSI) ability to prepare for, fight and warn of floods.

The important features of the FFEWS include the following:

- Improve precision and reliability in the decision making process by incorporating data acquisition system, forecasting technology/transfer and stakeholder requirements while addressing regional and national flood preparedness goals,
- Improve ability of DSI to meet current and future requirements for flood management and flood protection;
- Improved interoperability of FFEWS in the shared Maritza basin, and
- Provide benefits to overall flood management in the basin, and provide a model of collaborative flood management in transboundary rivers.

Keywords: Flood Control, Flood Forecasting, Maritza

225 Flash Floods in Czech Republic in Summer 2009

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At the turn of June and July 2009 a bigger part of Central Europe was under influence of cyclonic situation accompanied by intensive thunderstorms. Heavy convective precipitation occurred in many places of Czech Republic. As a consequence of that, some places was affected by disaster flash floods. 15 people died and total damage was calculated on 8,4 milliard Czech crowns (about 325 million Euros).

Keywords: Flash flood

228 Very Local Heavy Rain on the Bulgarian Black Sea Coast in Late Summer/Early Autumn: Examples and Analysis

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It has been found that the Bulgarian Black Sea coast sees increased number intense precipitation events in late summer/early autumn probably connected with global climate change. In this work we will focus on some cases with heavy rain

on the Black sea coast which happen during the late summer or early autumn. All of them are very local event related to coastal and orographical effects. We make the analysing of the weather conditions favouring the development of such systems. We use data from synoptical and climatological national weather set, satellite and radar imagery, model analysis and forecasts, some applications, information from the media. This study will help to improve the short range weather forecast of the Bulgarian National service for the Black Sea coast in late summer/early autumn.

Keywords: heavy rain, forecasting, coastal effect, climate

237 Mathematical Consideration of Flood Risk

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Various engineering and infrastructure systems, as well as urban areas and agricultural lands are prone to flooding by the adjacent rivers, which can endanger their existence and performances. To protect valuable goods and human lives, protective structures of high cost are constructed (spillways, river channels, embankments etc.). The capacity of these structures represents a compromise between required safety and cost of construction. Common engineering practice is to select the structure's capacity, which can provide a protection from extreme floods that can be exceeded with relatively small probability p . Probability, p , is either defined by law or by engineering judgment on acceptable risk depending on the value of protected goods. Theoretically speaking, the return period of flood event, $T=1/p$ is, an average time between two consecutive floods corresponding to the given probability, p . However, there always exist a risk that the design flow will be exceeded X times ($X = 1$) in a period of n years (n is the period of construction or life-time of the system). Usually, n is considerable smaller than the return period, T . For that reason it seems reasonable to assess the risk to which the systems/goods are exposed. This paper describes a mathematical model for evaluation of risk. Considerations presented herewith rely upon the commonly used probabilities of the design flood, p , which are routinely calculated in many design reports. In addition to the mathematical formulation of the risk, the paper gives graphical presentation of the risk for return periods most frequently used in engineering practice.

Keywords: peak flow, flood, probability, return period, risk

239 Flood Warnings for Railways in Austria

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In August 2002 a passenger train was stopped by a flood wave at the river Salzach between Werfen and Golling (Salzburg). In August 2005, railway tracks were destroyed by a flood in Western Austria and caused a freight train to derail, in the east of the country floods along the river March (Lower Austria) set railway tracks under water. As a consequence of these events, the Austrian railway company decided to establish a warning system in which existing forecasting models were included. A pilot project of such a warning system showed that an effective flood warning could have been issued in sufficient time for the 2002 event in Salzburg. As existing warning systems supply forecasts for gauges along the river, this information has to be transferred to critical locations along the track. Therefore, the identification of dangerous sections along the railway tracks had to be carried out in a first step. This was achieved by combining data from different sources in a GIS application. The forecasted runoff was combined with additional steady and unsteady hydraulic river stage simulations taking into account the contribution of the catchment area between the gauge and the critical location to calculate critical water levels along the reach for the event of August 2002. This method was then used to identify endangered parts in the entire Austrian railway network.

Keywords: flood warning system, hydraulic simulation, GIS

240 Real Time Hydrologic Flood Forecasts for the Danube Tributaries in Austria

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In 2002, a 100 year flood at the Austrian Danube and some of its tributaries has caused significant damage. As a consequence and to fulfil future flood management strategies flood forecasting systems were developed for several Danube tributaries in Upper Austria and Lower Austria. The forecasting model

shown includes all Austrian Danube tributaries and has been in operational use since 2006. The paper gives a general overview of the hydrologic flood forecasting model for the Danube tributaries. Runoff is estimated for all tributaries to the Austrian Danube with a total size of more than 90.000km². The model is based on a conceptual water balance model. The catchments are divided into sub basins with sizes ranging from 25km² to 42.000km² according to on-line available gauging stations. Hourly data from 90 discharge gauges from 2003 to 2009 were used to calibrate the runoff in the catchments. Precipitation and temperature data were provided by the Austrian Meteorological Service as areal mean values for the same period. MODIS-Data are used to verify the output of the snow routine. Simulation results from different calibration periods are shown. Hydrologic forecasts are based on meteorological forecasts, also provided on an hourly basis by the Austrian Meteorological Service. Both deterministic and ensemble forecasts cover a time span of 48 hours. A real time updating procedure based on ensemble Kalman filtering is implemented to have the best state variables of the model at the beginning of an event. The results of the hydrologic forecasting model provide the basis for a hydraulic 1D-model of the Danube river.

Keywords: real-time, hydrologic flood forecasting

199 Extraordinary Rainfalls Autumn 2008 in Rome

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In autumn 2008 in Rome, as in large areas of Italian territory, have been recorded unusual precipitations that in some cases have been extraordinary. In the considered period the events occurred have been recorded strong intensity and short duration. These characters of persistent precipitations caused human being losses, and flood in the main and secondary reticulum of the river basin of Tevere. In this paper pluviometric data of about forty stations located, in homogenous way, in the roman area have been studied. These data have been compared with the historical reference series of the Observatory Roma Collegio Romano. The quarter year under investigation is the fourth most rainy one of complete series (from 1782), while the December month results the third most rainy one, in the same period. Have been studied, moreover, the precipitations hourly scansions and the sequences of more one day precipitations. This analysis has showed repeating events of down-pour, that interested as limited areas of territory, the

western part of town (17 events of 13 October and November), as large areas of the town (28 event of October), where the critical threshold has been exceeded in twelve stations. The pluviometric data of 11 December recorded is the maximum every day precipitation of the entire historical series. The aim of this study is to supply useful information and tools, so that, for future similar events, can be possible to plan actions and operations of maintenance for nets of water-drainage in city area in order to reduce damages and risk of flood.

201 SPI as an Indicator of Drought in South Bulgaria

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During the years an increase of the number of extreme natural events has been observed all over the world. Drought in Southeastern Europe is among the extreme events, which might have significant negative impacts on the most socio-economic sectors. Drought in Bulgaria is in details assessed in Bulgaria, but being a problem of vital importance, is continuously considered with enhanced attention. 50 years time series of precipitation, collected from 20 weather stations located in the plain regions of South Bulgaria are used for SPI calculation with the purpose to detect drought periods and intensity. Some trends in drought frequency are analysed. This study is implemented under the activities dedicated to the Drought Management Centre for Southeastern Europe.

Keywords: Bulgaria, drought, SPI

213 Floods in Serbia in 1999 - 2009. Period - Hydrological Analysis and Flood Protection Measures

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In some regions of Serbia increased flooding have been recorded in the past decade. In this paper several statistical methods will be applied in order to determine maximum water level and discharges on rivers in Serbia, in which river

basins were recorded the biggest floods - Vojvodina region and some areas in central Serbia (Sumadijski, Zlatiborski, Moravicki i Raski district). It will be tried to determine the main floods causes (precipitation, disorderly river regime etc) in the specified period. Based on available hydrological data, using Pearson function of III type method, hydrological analysis of maximum water level and discharge in selected rivers and statistical probability of their occurrence will be done. Also, using comparative analysis with the measured values of high waters, scale of these floods will be established. In a special chapter will be discussed existing flood protection measures in these regions and suggestions for their improvement.

Keywords: floods, maximum water level and discharges, hydrologic analysis, flood protection measures

251 Creation of Flood Hazard Maps

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Flood events are a part of nature. They have existed and will continue to exist. Society has become more vulnerable to natural hazards. Although floods are natural phenomena, human activities and human interventions such as urbanization, agricultural practices and deforestation, have considerably changed the situation in river basins. The probability of flooding is expected to increase: the climate is changing rapidly. The recent floods, in Europe caused casualties and caused a damage amounting to several thousand million Euros in many countries. The European "Directive on the assessment and management of flood risks" aims to reduce the adverse consequences on human health, the environment, cultural heritage and economic activity associated with floods in the Community. Flooding results in damage of property, crops and negative impacts on human welfare. That is why it is important to know the zones along the rivers reaches which are vulnerable to inundation. For this reason it is of great importance to have hydraulic modelling of discharges and water levels along these rivers terraces. The output data for the high water levels from the hydraulic modelling can be integrated in GIS environment. Different methods for spatial analyses are way for floodplain mapping. For adequate evaluation of the inundation risk it is necessary to simulate hydrological scenarios for max water discharges with different return periods and create corresponding flood maps. Highly accurate DEM is required when developing flood maps. Satellite image processing and analyses

of the extent of the flood are very important for verification and validation of the hydraulic models outputs. GIS allows analysis of flooded areas with information on infrastructure, land use, population density or any other information stored in the users GIS. Flood maps are indispensable tools to provide information about hazards, vulnerabilities and risks, and to implement the necessary preventive and preparedness measures.

Keywords: flood hazard

260 Flood Forecasting and Early Warning System for the Maritsa and Tundzha Rivers

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Climatic and geographical characteristics of Maritsa and Tundzha River Basins lead to specific run-off conditions, which can result in extreme floods downstream, as occurred in August 2005 and March 2006. To improve the management of flood hazards, a Flood Forecasting and Early Warning System was set up. This paper describes a forecasting system recently developed in cooperation with the National Institute for Hydrology and Meteorology (NIHM) and the East Aegean River Basin Directorate (EARBD) for the rivers Maritsa and Tundzha. The system exits of two model concepts: i) a numerical, calibrated model consisting of a hydrological part (MIKE11-NAM) and hydraulic part (MIKE11-HD) and ii) a flood-forecasting model and system. For some basins both meteorological and discharge measurements are available. These basins are calibrated individually. The hydraulic models are calibrated based on the 2005 and 2006 floods. The hydrological and hydraulic models are combined and calibrated again. The flood-forecasting system (using MIKE-Flood Watch) uses the combined calibrated hydrological and hydraulic models and produces forecasted water levels and alerts at predefined control points. The system uses the following input: - forecasted meteorological data (based on Aladin radar grid), - measured meteorological data - calculated and measured river discharges - calculated and measured water levels. Depending on the available input the forecast lead-time is short but accurate, or long but less accurate. If one of the input data sources is not available the system automatically uses second or third order data, which makes it extremely robust. A data assimilation routine is used to update calculated water levels and discharges at the inflow points with the observed data and to correct during the forecast period.

A Data Exchange Tool (DET) disseminates relevant information between the databases of NIHM and the EARBD, the flood forecasting system and a website that shows forecast bulletins.

Keywords: forecast, floods, MIKE11 model, hydrological modelling, data assimilation

306 Case Study on Culvert Analysis for Road Flood Protection

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Frequent roads and highways flooding can be referred mainly to design gaps and insufficient maintenance. In addition, damage to culverts usually results in a full or partial washout or misalignment of the culvert. These damages may be due to insufficient design capacity or end treatments, inadequate slope protection, inadequate erosion protection, or inadequate protection from stone and woody debris. Careful determination of the cause for the damage is necessary, as different causes require different mitigation or repair measures.

This paper deals with case study on culverts at regional road P-605 near Strumica in Macedonia. The seasonal storm events recently caused flooding of the road section at constructed box culvert to pass the water flowing from upstream torrent watershed. So, first step in identifying the causes was to check the design and to do site visit. Hydrological and hydraulic analysis of the section along the gully upstream and downstream of the road and the culvert was missing. This paper will present some results out of these analyses.

Keywords: culvert, steep slope, erosion, backwater, protection maintenance

**314 Winter Flood in the Daugava River
and its Floodplain Lakes (Latvia) - a Possible Scenario
in Climate Change Context**

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In 2007 January, in the Daugava River (Latvia) and its floodplain lakes uncharacteristic high water level (winter flood) was observed and a high temperature. In accordance with researches increasing of such winter precipitation and temperature in Latvia promote and further will be constrained with climate changes. A research purpose was to look after and to forecast, what kind will be changes of plankton organisms in such cases collecting plankton samples and taking physicochemical measures of water in the Daugava River and in its largest floodplain lakes. It was established, that the Daugava River and the floodplain lakes mainly dominated by various kinds of blue-green alga (in the main, *Oscillatoria*) and characterised by considerably large biomass, especially Kosha Lake. Zooplankton abundance and biomass between lakes and river was various. Mainly such taxa as *Keratella cochlearis*, *Synchaeta* sp., *Polyarthra* sp., *Bosmina longirostris*, *Cyclopoida* and nauplii prevailed, and *Kellicottia longispina* in a lake Kosha respectively. Zooplankton might respond differently to hydrological and temperature variability depending on the lake nutrient enrichment, lake morphometry and other conditions. Along with the existing trends of climate change, such hydrologic and weather conditions are expected to be observed more frequently in the floodplain of the Middle Daugava. Therefore, more frequent blooming of the blue-green algae during the winter low water period as well as a significant reduction of water quality in the Daugava River at Daugavpils is expected.

Keywords: winter flood, floodplain, plankton

**315 The Importance of Flood Zoning Using GIS a Case Study
from Macka, Trabzon, Northeastern Turkey**

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From the viewpoint of damages on humans, flood disaster is one of the most important meteorological hazards. During 2009, 86 floods have occurred and 66 people have died in Turkey. Ministry of Environment and Forestry declared that flood risk maps of Turkey should be prepared at once and year 2010 has been declared as a “struggle year against the flood hazards” to publicize the danger. In this study, a flood analysis performed by using Geographic Information Systems (GIS) and a hydraulic model HEC-RAS, for Macka town center, located in Eastern Black Sea Region of Turkey is presented. Degirmendere River floods the Macka town, and Degirmendere Basin is surrounded by high mountains (maximum attitudes 3080m) and the size of drainage area is 1052km² and the length of the main branch is 60km. Eastern Black Sea Region has the highest long term mean annual precipitation in Turkey about 2200mm. The soil mantle is mostly saturated due to heavy rainfall and the geomorphologic slopes are very steep. Therefore not only floods but also many landslides occur frequently. For example in 1988 at Catak Village of Macka, 64 people died because of landslide. The last big flood of 1990 caused 47 human losses in and around Trabzon city. At Macka town most of the buildings are located at the banks and flood zones of river due to the limited plain area for urban settlements. Therefore there is very high risk of frequent flooding at the location. For example if water level in the river rises 2m, a large part of the city is flooded. In this study the annual peak flows for different return periods such as 10, 50, 100, 500 and 1000 years are estimated from available flow data and 3-D model of the possible flood zones are defined by using GIS different flood scenarios. 3-D models are prepared by using GIS from 1/1000 scale maps and necessary structural measures to control flood events are presented.

Keywords: Flood Mapping, Macka, Trabzon, Turkey, Flood Protection Measures

323 Urban Flood by Extraordinary Severe Rainfall in Small River Basin

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The big flood was occurred by the extraordinary severe rainfall in the urban area of the middle part of Japan in 2009. One of the cause of severe rainfalls is estimated by the effect of the climate change. The rainfall amounts over 140mm per hour caused the big flood and affected severe flood damages in the urban area of the down stream of the small river. The runoff analysis is carried out by the runoff model, named Tank model and the characteristics of the flood is cleared. Furthermore, how to modify the flood alarm information and flood fighting system are discussed to reduce the flood damages.

Keywords: Urban flood, Extraordinary severe rainfall

333 The Raab Flood Forecasting Structure - Improving International Flood Management

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The Raab Flood Forecasting System generation is a project with European dimensions. The Raab watershed extends over two countries: Austria and Hungary whereas the last one is located downstream compared to Austria. Due to these geographical characteristics the probability for a flood genesis is much more significant in Austria than in the Hungary but the related flooding risks are distributed over the entire watershed. The project Flood Forecasting Raab gives a concrete example of international cooperation in the field of Flood management The structure in development will be build out of one International Flood Forecasting Centre and four regional centres. It illustrates how a trans-boundary flood forecasting system can operate. The main element is the International Flood Forecasting Centre installed in Graz (Austria) where all the

necessary online data and meteorological forecasts will be automatically collected and formatted for the simulations. Furthermore, each hour will start a simulation with a forecasted time of two days whereas the main results will be published on the Internet. The complete model setup and the results will be transferred to the four regional centres. Therefore, on these regional centres it will be possible to analyse detailed results and to develop local scenarios using for example modified meteorological forecasts or other initial conditions. This technical solution allows a perfect synchronisation for online data, pre and posts processing files, information and results from the simulations between all five Flood Forecasting Centres. It contributes therefore to a noticeable improvement for information organisation between Austria and Hungary and should be considered as a new method for Flood and Risk management. The new communication strategy coupled with the automatic and continuous modelling as well as the result publication on the Internet delivers a concrete example for Flood prevention and resources management that can be transferred to other trans-boundary watersheds.

Keywords: Flood forecasting, International Basin, Raab River

261 Wastewater of Textile Industry and its Treatment Processes

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In this study, the wastewater originating from textile industry and its treatment methods together with alternative treatment processes were examined and a general evaluation was performed by compiling previous studies in the literature. Because of increasing population and industrial developments, a huge amount of wastewater is discharged to the environment above the level that the nature can eliminate. One of the most important industrial activities in Turkey with its magnitude of economy and provided employment is the textile industry and wastewater including contaminants (COD, azo dyes, BOD, TSS) in different concentrations is discharged as a result of the activities in this industry. The excess negative properties of textile wastewater for the environment and the health of human beings show how important is to find a solution for this problem. In various stages of textile industry, a significant amount of water is consumed and this situation puts forth the necessity for regular control of textile wastewater into consideration. In order for textile wastewater not to impair the environment and the health of human beings, this water should be discharged to the environment after various treatment methods. The reason for using various

treatment methods for textile wastewater is that there are various contaminant parameters (especially azo dyes) present in the wastewater. It's necessary to find the most suitable treatment method for textile wastewater that will minimize the production and investment costs of wastewater treatment plants. One of the most dangerous wastewaters that is discharged from textile industry is dyed wastewater. Since the colour load of dyed wastewater is high and its biological degradation is difficult, it's also difficult to treat it. Nowadays, the treatment of dyed wastewater is performed mostly by physical and chemical methods and nanotechnological textile membrane structures have started to be used for a more effective treatment.

Keywords: Textile Industry, Textile Wastewater, Treatment, Dyestuff

356 The Frequency of the Rainy and Drought Spells in the Western Romanian Plain, North of Mures River

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In the present work, periods of two or more consecutive rainy days were chosen for the analysis of the rainy spells. The dryness and drought spells have been considered according to Hellman's definitions. Daily amounts of precipitation have been used from 5 weather stations, during the years 1961-2000. They all have a common observation period. Because of the very different duration of the rainy, drought and dryness spells, the number of rainy, drought and dryness days has been studied, as this method offers a better analysis of the phenomena. Within a year may occur, on the average, about 30-35 rainy spells with an average duration of 4 days. On the analysed territory, 119-141 rainy days may occur annually, on the average. Namely, on this territory it rains about 4-4.5 months a year. Most of the rainy days were recorded in the intervals November-January and April-June. The linear tendency of the annual number of rainy days is decreasing. Within a year may occur, on the average 4 drought spells with a mean duration of 16 days and 14 dryness spells with a mean duration of 7 days. The drought phenomenon can produce in any month of the year, with the highest frequency in the spell July-October. The monthly analysis of the drought days number shows the presence of an autumn drought and a spring or winter drought, the autumn one being much more intense. On the analyzed territory the dryness and drought phenomena represent about 5 months a year. The frequency of the annual average number of

rainy, drought and dryness days out of the total number of days of the year shows that the highest weight belongs to the rainy days, followed by the dryness days and then the drought days.

Keywords: rainy spell, drought spell, dryness spell, rainy day, frequency, tendency

342 Seasonal and Regional Dependence of Radon Concentration in Tbilisi (Georgia)

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For the first time there are presented results of long regular measurements of content of radioactive gas radon Rn-222 in potable (tap) water for various city areas of Tbilisi depending on time (For the period of 2009). It is shown, that due to level of radon content in potable water the investigated city areas can be divided conditionally into 2 groups: with rather big radon content more than 1 Bq/L (Vake, Saburtalo, Isani, Ortachala), and areas with rather small radon content - less than 1 Bq/L (Digomi, Vazisubani). It is underlined, that this circumstance can be connected with presence of two qualitatively distinguished sources of supply of Tbilisi by potable water - underground (artesian wells near settlements Natakhtari, Bulachauri, Mukhrani) and surface (Tbilisi reservoir filled with waters of the rivers Aragvi and Iori) for which conditions of aeration and degassing by radon have essentially various character. Also there are marked some other features in character of distribution of radon.

Keywords: Concentration of radon, Water quality, Drinking water

360 Interrelation of Droughts and Floods through Outlier Identification on Rivers in Serbia

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As floods and droughts are normal, recurrent features in climate, this paper will present an introduction to an in-depth analysis of draught and flood interrelation on rivers in Serbia. There are 144 gauge stations flow data available for analysis. These stations form an observation network of Hydro-Meteorological Service of the Republic of Serbia. Gauge stations from the Province of Vojvodina will not be taken into consideration due to unnatural flow regime caused by Danube-Tisa-Danube channel. Data sets to be analyzed are annual minima, maxima, average flow, and 30-day minima. Outlier identification will be performed by Grubés and Beck test, also known as Pilot and Harvey test. The identified outliers will be removed from the series as a kind of data verification, and their return frequency estimated from shortened series. A criteria for accepting an outlier as valid event will be judged by estimated return frequency compared to data record length. It is expected that extremely wet/dry years will be shown as synchronized outliers at a gauge station in each of the tested series either as high or low outlier. Taking existence of an outlier as the only drought/flood criteria, new series of extreme events will be formed. Data for years when low outlier appears in the series of annual minima will be excluded from the series of annual maxima and vice versa. This approach will lead to formation of series with data from the same population. Statistics of the series of extreme events will be compared for observed series, series without outliers, series from the same population and series of 30 days minima. The significance of difference in statistics of these series will be analyzed and presented. Regions prone to hydrologic droughts, floods, or both are expected to be identified for the territory of Serbia.

Keywords: floods, hydrologic draught, outliers

**485 Methodology of Research Related to Social Consequences
of Natural Disasters - Possibilities to Modify some Techniques
for the Collection of Data**

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Methodology of Research related to Social Consequences of Natural Disasters - Possibilities to Modify some Techniques for the Collection of Data It is a generally known fact that knowledge in the field of methodology represents a prerequisite for a successful engagement in scientific work. In the region of Serbia, in the field of sociological research, the collection of data about various social phenomena is usually characterized by an uncritical application of the same techniques to collect data for different social content. Problems in sociological works could be classified into two groups: a) theoretical analyses without a concrete empirical argumentation; b) rare, insufficiently theoretically and methodologically founded empirical researches. Among the sociologists, one can notice the tendency towards the researches with the application of only one technique for data collection, one technique in opinion poll research, and, naturally, one instrument - the questionnaire with the close type questions. Adjustment of the instrument to a faster and easier data processing limits the cognitive range of these researches. At the same time, many socially significant problems, like for example natural disasters, do not represent a topic of a broader sociological interest. In addition to causing great material damage, floods which occurred during April 2005 in the Banat area also pointed to a significant unpreparedness related to collecting data on the basis of which one organized the collection and distribution of humanitarian aid, removal of the flood consequences and undertaking activities to prevent new floods. The occurring disaster pointed to the general unpreparedness, both at the local and a broader level, related to the "monitoring" of the initial conditions and observation of the development of the flooding. Therefore, it is necessary to investigate the effects of the application of the existing research techniques and point to the possibilities for their modification, with the goal to collect the most relevant empirical data which would serve as the basis for planning future activities. Keywords: methodology, flood, natural disasters, research techniques

Keywords: methodology, flood, natural disasters, research techniques

282 The Water Volumes (from Precipitations) during Catastrophic Floods in July 2008 on the Rivers of Ukrainian Carpathians

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The rain floods which passed on the rivers of Ukrainian Carpathians in July 2008 certainly became a prominent "hydrological event" and brought changes in the actual and calculated parameters of maximal river flow. The amount and intensity of natural weather phenomena are determined by the thermodynamic and energy individuality of barometric formations, which depends on a weather (synoptic) process and macro scale circulation. An effect of these factors is significantly corrected by the features of geographical location of territory, its relief and creates the regional peculiarities of their distribution. At the beginning of the XX century in the north hemisphere a position change of centres of atmospheric action, increase of meridional and weakening of zonal circulation, and accordingly change of trajectory, intensity and recurrence of cyclones are observed. Cyclones which entered Ukraine in this period were moving to south trajectories. They had considerably less kinetic energy and velocity, greater soil moisture content. Baric formations are more intense than in previous years. This led to increase in amount and intensity of elemental precipitations in Ukraine. Such conditions were observed in Central Europe from 22 to 27 July 2008 and caused very strong and unique in its duration rains in the western regions of Ukraine, which caused destructive catastrophic floods in the river basins of Dniester, Prut and Siret. Materials from 18 meteorological observation stations and 75 hydro-meteorological posts are used for the analysis of precipitations fields and their time behaviour. Total water volume, which fell out during rains July 22-27 on the territory of the river basins of Carpathians region attained 6,80km³. Thus directly on mountain catchment's area fell out about 5,15-5,20km³. Conclusion about intensity of precipitations can be done taking into account the water volumes which fell out to unit areas. Such characteristics allow us to estimate stability of orographic districts of maximums and minimums of precipitations, condition of floods forming and consequences of their passing in comparison with water abounding years. For 4 days (22-27.07) amount of precipitations over 100mm in the Dniester basin to Zalischiky fell out on the area of 13km². The area about 9km² (mainly mountainous part) the total amount of precipitations attained 200-350mm. Maximal discharges and water levels were formed on the Carpathians Rivers as a result of the most intensive rains on July 24-25. In the basic areas of floods forming the amount of precipitations at this time reached for 24 hours: in the Dniester basin 120-140 or even 150-167mm (the Opir, Bistritysa Solotvinska and Bistritysa Nadvirnyanska basins), on highland of Bukovynian Carpathians

(in the Prut basin) 100-135mm. Only in the Tisza basin they did not exceed 60-80mm. In the same days the amount of precipitations during 12 hours was quite often 50-70 and 70-90mm.

Keywords: The circulation of atmosphere, cyclone, precipitations, flood, volume of water

377 Water Risks Management at the Coastal Area of Lezha Region

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The coastal area of Lezha Region is located 155.2km² North of Shengjini mount, up to the Ishmi river in South and from the national road Tirana - Lezha (East) up to the Adriatic Sea (West). It belongs to 3 communes: Shingjin, Shinkoll and Fusha Kuqe. It has 16 settlements and 33,614 inhabitants.

This geographical location: between Tirana (the capital) and Shkodra (principal centre of North Albania) together with the presence of fertile land and of the sea, the Mediterranean climate and both surface and ground water resources, as well as the rich flora and fauna have encouraged the presence of a dense population and the development of a complex economy, mainly of the primary and tertiary sectors.

Due to the lower streams of three relatively big rivers going through the area (Drini i Lezhas up North, Mati in the centre and Ishmi at South) water related risks have always been a threat. Floods from rivers and heavy rains have been common until 1965, when works were carried out for the riverbed management, for marshes reclamation and pumping of superfluous water. After 1990, due to damages to protection infrastructure and drainage systems, the flood risk is present again causing (almost every year) property and environmental damages.

Failure to properly manage these risks is mainly caused by lack of funding at the local level. Obviously, the area is in urgent need to solve the problem. Protection infrastructure needs to be rehabilitated along the riverbeds, drainage canals need to be cleaned and deepened, pumping stations need to become operational, etc.

This paper provides new information and awareness on the probability and size

of the problem, on forms and possibilities for successful management of water risks.

Methods used comprise site observation and surveys, documents consultation, measurements, mapping, photographing, analysis and synthesis.

Keywords: Water, risks, floods, infrastructure.

419 Assessment of the Drought Pattern Change In Camlidere Basin Using SPI Index

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Drought and floods which are the major issues of today's world have several inverse impacts on economy, society and ecology. The severity of the drought is related with main usage of water and can be expressed in different indexes. These indexes could give different information for the drought analysis and one of them is the standardized precipitation index (SPI). In this study, the analysis of severe and longer duration of drought events has been carried out by applying the SPI. The severity and change pattern of drought has been analyzed by SPI for the Camlidere dam basin where the basin supplies most of the domestic water to the capital city of Turkey where the total supplied water is about 800.000 m³/day. The meteorological data for the period of 1926-2006 is used and the period is divided into two periods as 1926-1966 and 1967-2008. The analysis of these periods have been carried out by the investigation of short term and long term periods with different cumulative months as 1,3,6,9,12,24. Additionally the change in pattern of drought is analyzed by examining the change pattern for different return period of drought events. The results showed that there is %120 increase in the second period of 24 month SPI and % 40 increase for 12 month SPI, where as 10% increase in short term SPI is examined. The extreme difference between two periods showed that there is a change in the pattern of droughts in Camlidere dam basin.

Keywords: Turkey, Drought, SPI

**422 Procedure Used in Danube Floodrisk Project
for Flood Waves Decomposition**

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One of the important issues in order to obtain flood hazard maps is to guarantee that the flood corresponding to a certain return period (or a certain exceedance probability) is used in the hydraulic simulation between two successive gauging stations along the whole reach of the river. The problem is very simple if there are no important tributaries or there is no significant distributed inflow between these gauging stations. On the contrary, this problem is much more complicated if important tributaries (whose discharges are measured before the confluence) or an important number of small un-gauged rivers are present along the reach. For small-medium basins (less than 5.000km²) at the level of a country this problem is solved using rainfall-runoff models. Unfortunately this approach cannot be used in the case of Danube River. The main issue is to be sure that along every sub-reach (situated between the confluences of two successive tributaries with the Danube River) of the examined reach the flood (which is not registered in these intermediate points) has the same return period. This problem is also known as the decomposition of the flood waves; of course, the solution is not unique. A procedure consisting in 5 steps was proposed in the Danube Floodrisk project (Interreg IVB South East Europe) for the delineation of the flooded area corresponding to the floods characterized by P% probability of exceedance. The obtained floods are then used in hydraulic computations to obtain flood hazard maps.

Keywords: floods, hazard map, return period

**428 Dridu Dam Failure Scenarios
and Accidental Flood Wave Propagation**

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Between 1990 and 2001 several phenomena were observed at the Dridu dam structure like longitudinal cracks, local sliding located in the downstream slope of the contour dyke, entrapment of sandy material at some of the drains from

the visiting gallery and infiltrations between the power plant and the spillway. Most of these phenomena were considered unusual and some constraints in dam operation were imposed. Even the described phenomena did not occur anymore, several dam break scenarios were developed, computing the corresponding flood waves. Thus, based on dam characteristics and behaviour 3 failure scenarios were imagined. The flood hydrographs generated by the breach evolution were computed; the maximum discharge of the flood in the worst case scenario is 2360m³/s. In order to delineate the flooded area downstream the dam a specific mathematical model was developed for Ialomsita river from Dridu dam to Tandarei (190km). The modelling process using HecGeoRAS and HecRAS software was challenging because of the input data obtained from different sources (e.g. Digital terrain model extracted from topographical maps and measured cross sections). The steady state hydraulic model for the river bed was calibrated using the water levels from the rating curves at three gauge stations. In the unsteady state hydraulic model the roughness coefficients for the floodplain were proposed according to the aerial images. The flow hydrograph for the worst failure scenario of Dridu dam and the rating curve downstream at Tandarei gauge station were introduced as boundary conditions. After running the model the variation of the water level in each cross section was obtained and the flooded area was extracted in ArcGIS using HecGeoRAS. Based on these results, the authorities may design in advance the measures to be taken to protect the inhabitants from the downstream settlements.

Keywords: dam break, accidental flood, hydraulic simulation, flooded areas

430 Microbial Water Pollution of Vjosa River and the Vegetable Contamination by Irrigation

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The Vjosa River is the second longest river in Albania. In Greece, it runs for 80km, from Mountains Pindi, in Albania it runs for 192km, joining some other small rivers and empties into Adriatic Sea. The large area of Vjosa River is very fertile farmland and agriculture activity is present. The mismanagement of nitrogen fertilizer and effluent spreading practices in farming causing significant agriculture water pollution. Non-modified human wastes are discharged into the river causing a high pollution. Another issue is industrial and urban waste dumped on the banks of the river. Is monitored the Vjosa river microbial water

pollution at the Permeti Region, and the impact the water has on vegetables by the irrigations. The tests of the faecal indicators is used. For the vegetables is used testing for pathogens as well. The water of this river is sometimes much polluted. The vegetables: tomatoes, lettuce, courgettes, eggplants, capsicum watered by the river are very polluted by the faecal coliforms. The Salmonella test of these vegetables is negative.

Keywords: Vjosa, Heterotrophs, coliforms, Salmonella, CFU

437 Danube Floodrisk Project

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Flood endangers economic development all along the Danube; a total of approximately 27.300km² shared between the following countries RO: 32,5%, HU: 20,2%, Serbia: 14,4%, SV: 8%, HR: 5,8%, BG: 3,8%, AT 3,4% and DE: 5,7% are characterized by a high flood risk. The overall objective of the FLOODRISK project, submitted under Interreg IVB South East Europe programme is to develop and produce high quality, stakeholder oriented flood risk maps for the transnational Danube river floodplains to provide adequate risk information for spatial planning and economic requests. The project's single objectives are: - Development of a joint mapping method for flood risk and harmonization of data sources. - Production and provision of risk maps and risk information. - Integration of relevant stakeholders and users on different levels into the definition and realization processes. - Involvement of different economic aspects of land use in the river basin like spatial planning, recreation and agriculture as well as energy supply or health service. - Linkage of flood risk mapping and provision of maps as basis for planning, e.g. within the EU Floods Directive. - Development and distribution of exemplary procedures within the Danube countries and beyond. - Reflection of the EU Directives, e.g. WFD, Floods Directive, providing feedback based on the experiences of the project cooperation by using the platform of the ICPDR Flood Protection Expert Group. The implemented harmonized approach will reduce regional disparities and will provide a feedback to national and regional policies. This project will represent the basis to develop a transnational flood risk management strategy in the Danube basin, which is a key issue for economic development. The paper will present the whole project and the current stage of the project development.

Keywords: flood risk, transboundary cooperation, harmonized approach

273 The Flash Flood and its Consequences upon the Evolution of the Solid Discharge in Riverbeds of Small and Very Small Basins

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The paper provides a deep analysis of the evolution of solid discharges during flash floods produced by heavy rainfall located over areas of 2-30km². In order to study this we have selected some river basins that were seriously affected by such floods, such as: Clit and Saca, located in the middle part of Suceava River Basin, Sugura, Agas, Seaca, Beleghet, Goioasa, Grohotis located in the upper part of Trotus River Basin, both being situated in mountainous or pre-mountainous areas of the Eastern Carpathians. The analysis aims at the following objectives: - the genesis of flash floods with implications in the creation of solid and liquid excedents - the determination of the liquid run-off during floods and designing probabilities for the resulted discharges - the evaluation of the solid suspended and rolled discharge during such floods - the estimation of large sediment volumes deposited in river beds, especially at the confluences of major rivers (Suceava and Trotus rivers respectively) - the evaluation of the damages produced by flash floods As a result of this analysis we can easily observe that these flash floods have a great destructive power with liquid discharges that have the following return periods: 20 years for Sugura River, 200 years for Agas River, 500 years for Beleghet River (located in the upper part of the Trotus River Basin), extremely high solid discharges (0.117kg/s - 137kg/s for Sugura River, 0.156 - 190 kg/s for Agas River, etc.) and volumes of large sediments deposited in the river beds that can vary between 10000t and 30000t. To these hydrological parameters we can add human lives loses, the destruction of rail roads, of houses, bridges, highways and national roads, the submersion of large agricultural lands, silted or polluted wells.

Keywords: flash flood, sediment volumes, granulometric fractions

**376 Water Related Risks of the Territory of Uzbekistan
in Climate Change Condition**

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Uzbekistan highly vulnerable to the potential negative impacts of climate change. For Uzbekistan, the highly recurrent and most potential threats are linked to drought, mudflows, flash floods and outbreak lakes.

Climate change is expected to make the country even more vulnerable. Uzbekistan is already facing a number of serious ecological problems aggravated by negative impacts of global warming:

- Strong water resource deficiency;
- The Aral Sea crisis;
- Arable land degradation (intensive salinization, all types of soil erosion) due to irrigated water shortage and irrational natural resources management;
- Reduction of pasture area and its degradation;
- Biodiversity reducing at the ecosystem level.

The growth of the precipitation fluctuation amplitude for the last decade, intensive warming, increasing water demand and reorientation of the water reservoirs work to the power basis mode in the upper streams of the Syrdarya and Amudarya rivers have significantly increased the risk of drought especially for the Amudarya's delta. The issue of the large scaled drought happened during 2000-2001 could be drawn as example.

Owing to the climate change it is expected that the number of floods and mudflows will increase while the duration of natural disasters periods will tend to be extended according to assessment made.

Recent studies have shown that glacier retreat is another significant phenomenon which can cause outburst of glacial lakes as well as serious downstream floods. That is aggravated by its steep topography owing to a wide altitude range within a very short span. These unusual phenomena potentially have adverse impacts on biodiversity and ecosystem health affecting the achievement of MDGs in general and MDG7 in particular.

Climate change leads to increase of drought risk, accelerated snow and glacial melting process, increase in the size of glacial lakes and formation of new lakes, rainfall variation, impacts on forests and biodiversity which have direct bearing on human health and food security of Uzbekistan.

At the same time, there is the one more barrier is that management has no reliable methodological basis necessary for decision making in climate change conditions. To present day the following assessments has not carried out yet in the country:

- assessment the nature response to anthropogenic impact,
- the biased assessment for economic efficiency in aspect of the environmental and natural resource management conditions affecting activities,
- the biased assessment for water and land ecosystem productive capacity, in particular, of irrigated farming.

According to Second National Communication of the Republic of Uzbekistan prepared in 2008, average rates of warming from the beginning of 1950th on territory of Uzbekistan have made 0.29°C for a decade that more than in too times exceeds rates of global warming. Warming is accompanied by increase of the dry and warm periods that changes conditions of water resources formation and increase their deficit. In Uzbekistan the increase in number of mudflows on 19-24% by 2050 and increase of mudflow period duration are expected. Besides augmentation of precipitation variability and increase of high-altitude border of mountain lakes will take place. Probability of occurrence of new lakes in a zone of glacier deviation and danger of their break will increase as well. Warming in Uzbekistan is accompanied by strengthening of extremeness of weather, in particular increase in number of strong precipitation and numbers of droughty days. Such conditions are especially dangerous in a combination with deficiency of water for irrigation what could result in decrease or destruction of crop yield at large territories.

It clearly shows the gravity of the problem.

269 Investigation of Temporal and Spatial Variations in Climatologic Precipitation Deficit Index in Gediz Basin

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It is envisaged that depending on global climate change, drought will be felt more seriously particularly in the Mediterranean Basin while serious declines in rainfall might take place in the Mediterranean, Aegean and Central Anatolian regions in Turkey. The greatest user of fresh water is agriculture. Thus, the efficient use of water in agricultural sector, which will be affected most by drought, is

gaining more and more importance. Furthermore, drought analysis is of great importance for planning and operating soil and water resources. Climatologic precipitation deficit index, which investigates the difference between rainfall and evapotranspiration, is one of the indices used for monitoring agricultural drought. With the determination of climatologic rainfall deficit, it is possible to determine the requirement for irrigation water in a region and to carry out agricultural planning, irrigation planning as well as product pattern and economic planning. In this study, the temporal and spatial variations in the climatologic precipitation deficit index in the basin will be examined by making use of the climatic data of some meteorology stations in Gediz Basin with an essential potential in Turkey.

Keywords: Drought, evapotranspiration, precipitation, Gediz.

389 Assessment and Comparison of Storm Interpolation for Average Storm Estimation at Shirinab Basin

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Spatial distribution of point rainfall is a main step in Rainfall-Runoff modelling. For this process that is among uncertainties of storm estimation for Dam sites and prediction of Flood, numbers of techniques were evaluated. In this paper Deterministic and Geostatistical method have been analyzed and compared. Deterministic techniques used the existing configuration of the sample points to create a surface (Inverse Distance Weighted) or fit a mathematical function to the measured points (radial basis functions). Geostatistical techniques, as their name implies, create surfaces incorporating the statistical properties of the measured data. All methods that were used in this research are IDW, RBFs, Spline, Krigings and Co_Krigings that were applied in order to evaluate the use of these approaches in GIS environment to examine rain interpolation. For geostatistical methods different semi-variogram models were used and the relevant biases as well as the increases in variance have been assessed. Different methods are using to reduce bias of the predictions, decrease the uncertainty and provide a realistic estimate for each predicted location. Finally, cross validation technique was used for comparison of these methods in which each measured point is removed and compared to the predicted value for that location.

Keywords: Storm, Spatial distribution, Interpolation, Deterministic, Geostatistic, GIS

**442 Flood Forecasting and Early Warning System
for Maritsa and Tundzha Rivers - Data Exchange Tool and Web-Site**

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This article covers some of the results of the project “Technical Assistance for Flood Forecasting and Early Warning System for Maritsa and Tundzha Rivers”. This project was part of the more global European PHARE project “Capacity Improvement for Flood Forecasting in the Bulgarian-Turkey Cross Border Cooperation Region”. Its realization has been entrusted by the Ministry of Regional Development and Public Works to the consortium “BCEOM societ e d’Ingenierie” (now EGIS) & “HKV Consultants” from France and Holland with the participation of Bulgarian experts and the support of the National Institute of Meteorology and Hydrology (NIMH) and the East Aegean River Basin Directorate of the Ministry of Environment and Water.

One of the project results is a real-time flood forecasting system with proper data exchange which provides on-time information to authorities from Bulgaria and Turkey in charge of alerting the population and of managing the operations during the flood events. In order to integrate existing, prescribed and requested databases and systems a Data Exchange Tool (DET) was developed. A dynamic web-site was created to disseminate results.

This article describes how the different systems and databases work, how the web-site provides access to users of different levels of responsibility, and how information eventually reaches the stakeholders and the general public.

Keywords: database, web-site, flood forecasting, warning

461 Flood Risk Management in River Basins Arges, Romania

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Floods in many countries in recent years and the consequences that followed have led, amid an increase in social responsibility to a new approach to flood risk management, approach the human community awareness and involvement are essential in avoid loss of lives and reduce damage. Flood risk management

is applying policies, procedures and practices with the objectives of risk identification, analysis and evaluation, treatment, monitoring and reassessment to reduce their risk so that human communities, all citizens can live, work and to needs and aspirations in a sustainable physical and social environment. Arges Basin is one of the major river basins in Romania because of the hydroelectric potential of the existing water resources used in industry, irrigation and water supply of population, including the capital Bucharest. Arges catchment area is 12,550km² which overlaps with the mountain, Carpathian and plain, is controlled by numerous lakes (8 accumulation 27 accumulation in the water volume of over 50 million m³), the derivatives pools, the adjustments, the dams, the water intakes and more. In this context is intended to highlight efforts of the authorities involved in water management activities in our country, analyzing the measures implemented in the catchment area of Arges.

Keywords: Floods, management, river basins

471 The Flash Flood and Strong Winds in Eastern Macedonia on 4-th December 2008

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On 4th of December 2008 the weather in Republic of Macedonia, especially in their eastern parts was influenced by convective storms followed by strong winds, thunderstorms, excessive rainfall, electrical discharges, hail and even small tornadoes. In a short period of about 1 hour, 53 liters rainfall per square meter caused rapid flooding. The water flowed all over inundated many places and all dry ravines were filled up with water. The result was several victims who perished in the flood, material damage registered in almost all of eastern Macedonia, especially in Radovish and the surrounding area. On this date, the circulation over Europe dominated a significant trough, which stretched from Scandinavia to N. Africa. Its position was changing slowly toward east. At the east side of Europe, the weather was influenced by a large ridge. At the surface, large anticyclones covered NE Europe and SW Europe. Between the anticyclones, the region of the upper level trough was being occupied by shallow lows. Two significant changes took place - the first one, the arrival of a deep low, which affected the British Isles and the one, the rapid deepening of a low over the Ionian Sea. The South Balkan was under a very strong southerly flow and moved over the region approaching from south. The air mass originated from North Africa had been characterized with very moist, warm and unstable conditions. The storms quickly spread northwards,

reaching the Adriatic Sea and Balkan states. It was a very strong storm with a lot of damage that could be expected in the warm part of the year, but it happened on 4th of December.

Keywords: flash flood, inundated, victims, strong winds, thunderstorms, hail

492 Natural Hazard Assessment in the Pcinja Catchment

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A natural hazard has been defined by UNESCO as the probability of occurrence within a specified period of time and within a given area of a potentially damaging phenomenon. It has been estimated that the natural hazards cost the global economy over \$50000 million per year. The aim of this work is to analyse and determine the areas of potential natural hazards in Pcinja basin. Pcinja is large left tributary of Vardar River (135km long, 2877,3km² catchment's area), which drainages surface waters from northeastern Macedonia, and in smaller part (538km² or 19%) from southeastern Serbia. Because of suitable physical-geographic factors (geology, terrain morphology, climate, hydrology, vegetation cover, soil composition, and high human impact), some parts of the catchment have significant risk of natural hazards. Given the well-known fact that they occur suddenly, independently of each other or in the mutual relationship (synergy), it is necessary to make assessment analysis of most significant natural hazards in the selected basin. Therefore, in this work analysis of vulnerability of the area to various geohazards, atmospheric and hydrologic hazards in Pcinja basin is performed, and then generalized map of the natural hazards is prepared. Assessment of geohazards is prepared by analysis of existing seismic maps, while landslide potential and excess erosion risk is estimate through appropriate methodology. Assessment of atmospheric hazards involves spatial distribution of extreme temperatures, intense rainfall (heavy rain), the average number of days with the hail and identification of areas vulnerable to drought. The hydrological hazards (hydro-hazards) involve determination of hydrological extremes, while the risk of bio-hazards involve identification of areas endangered by fires. Based on these analyses the ability to create generalized map of natural hazards in the basin Pcinja will be achieved, with areas vulnerable to certain natural treats, as well as the total area endangered from hazards.

Keywords: Natural hazards, Hazard assessment, Pcinja basin, Vulnerable areas

**493 The Influence of Intensive Rainfall on Erosion Processes
on Recently Reclaimed Land**

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Intensive rainfall can be the reason for a number of disasters, most of them doing damages which are difficult to deal with and require expert action (opinion). The negative influence of the intensive rainfall on a recently physically stabilized and biologically improved area will be looked into in this study. The aim is to present the negative influence and the erosion processes that follow after an intensive rainfall, as well as the consequent damages possibly to occur. The location is the eastern part of the Republic of Macedonia in the vicinity of the town of Radovich, namely the tailing dam "Topolnica" at the Bucim mine. After the process of physical stabilization, the biological part of the reclamation process comprised: application of soil layer (in depth corresponding to the micro-locality), choice of plant species to be used (mainly indigenous species), preparation of longitudinal contour rows, technique and technologies for seeding and timing, planting, nurturing and supervision control. The reclamation process was performed very well and the land started to take after its surroundings, until the 4th of December 2008 when an intensive rainfall occurred. The effects of it were devastation of the tailing dam by causing very big gullies, runoff and deposition of eroded material in the lower parts of the tailing dam. However, after a quick restoration took place, which alleviated the negative impact, the tailing dam was remediated as it was before the rainfall. A general remark is that natural occurrences like intensive rainfall happen and the expert community has to try and excel in providing the best possible solutions to a problem, as well as fixing it.

502 The Simulation of the Accidental Flood

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Correspondent to the appropriate flood model computation produced by a dike failure was developed in Java language, a computer program called "I.A.D." This allows, starting from a flood forecast and an acceptable risk degree to establish (including the entire range of variables in linear systems of defence against floods in the country) floodable volumes (cumulative time). The results obtained

by running program overlap within the limits of allowable above those of some studies on real cases that occurred by the failure of dikes on water courses from whole the country. This, after the main parameters were determined from a general survey based on data of a survey based on all river basins in the country, including the Danube. Regarding this there were verified the hydrograph and the flood volume and where data was found, the volume and the floodable area.

Keywords: flood, failure, risk degree, hydrograph

512 Analysis of the Istanbul Flood 2009

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In September 2009, a severe flood hit Istanbul and caused the death of more than 30 people resulting from heavy rainfall of more than 300mm. In this paper, we are going to analyse the rainfall measured by rain gauges and radar and modelled by the numerical weather model MM5. The differences of the three approaches will be highlighted and the consequences shown in computed hydrographs of the main river that was affected. The hydrological modelling is based on MIKE 11 with the SCS-Curve number module by using the land-use in the modelled basin. For this application it is important to have a good quality control of the rain gauge data and the radar data before adjusting the radar data to rain gauge values. Only after this step, a well calibrated model is able to produce useful results. Uncertainties from radar as well as from the rain gauge measurement have direct effects on the result of the possible discharge. Introduction of the uncertainties in meteorology and hydrology could help the risk management authorities to give reliable decisions.

Keywords: MM5, MIKE 11 , SCS-Curve

526 High Waters in Vrana Lake (Dalmatia) - Protection and Risks

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The lakes situated in the coastal karst areas are very sensitive hydrological systems whose aquifers are dynamically balanced with the sea. One of those systems is Vrana lake in Dalmatia which, by its surface of more than 30km², is the largest lake in Croatia. The lake is a cryptodepression, already in the 18th century connected to the sea by an artificial canal in order to create agricultural fields from the peripheral parts of the lake. Due to its outstanding natural characteristics the lake and the surrounding area has been declared a Nature park. However, the lake system salination appearances, the largest of which was in 2008, represent a threat to the natural eco-system. Therefore a need for finding the proper lake system salination protection measures has risen, primarily within the context of a possible elevation of the canal level by which the lake is connected to the sea. Such elevations also raised issues of large water protection for the influential part of Vrana field around the lake, which resulted in conducting and analyzing the high waters occurrences described in this paper. Since only a part of the surface inflows into the lake are hydrologically controlled, the high waters analysis was conducted by balance model monitoring - based on the analysis of lake water change dynamics. The analysis has established the statistical principles of high waters occurrence within the lake system, the intra-annual interdependence of high waters occurrence in relation to the previous minimal water level conditions as well as the corresponding trends. The large sensibility of lake system oscillations has also been established. These oscillations are the result of wind influence on estimated inflow values.

Keywords: lake, karst, high waters, Vrana lake, Dalmatia

**529 Towards a Flood Forecasting Operational System
Taking Into Account Hydro-Power Plants Operation**

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The operational flood forecasting service of French Northern Alps (called Service de Prevision des Crues - Alpes du Nord) needs to develop and implement an integrated flood forecasting system for the alpine Isere River basin in Grenoble. This basin has a rain and snowmelt dominated regime. Consequently, most parts of the basin are harnessed for hydropower.

Within this framework, the semi-distributed Routing System II model (Dubois et al., 2007) has been implemented on a sub-basin of 909km² where flows are intensively influenced by this power system. The first issue that will be addressed concerns the sensitivity of model simulations to the accuracy of the input precipitation and to the division by elevation bands that are used to segment each sub-basin. This modelling was performed necessarily without taking into account the hydraulic operations by using for its target the daily reconstituted natural discharges.

Then, the inclusion of the hydroelectric plants in the model was completed. A sensitivity analysis of hourly simulated discharges to different hydroelectric operating scenarios, necessary to adequately simulating the peak flow at the outlet of the basin, will be presented.

Keywords: modelling, flood forecasting, snow, hydropower , precipitation

**552 Drought Cycles over South-East Europe
for the Period 1870-2005 and their Connection with Solar Activity**

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The drought cycles over the South-East Europe are determined by means of the Palmer Drought Severity Index (PDSI) for the period 1870-2005 from the area between East longitude 11.25-28.75 degrees and North latitude 33.75-48.75

degrees. The long-periodical components of PDSI are determined by means Fourier approximation based on the Least-Squares estimation of trigonometrically coefficients and Whittaker-Vondrik filtration. The decade PDSI variations are compared with 11-, 22- and 45-year cycles of the solar activity, extracted from the sunspot and Wolf's numbers variations. Linear regression models and correlation coefficients between the decade drought cycles over the South-East Europe and solar activity are determined. Time series of non solar-driven PDSI variations and their trends are determined. The envisage result of this work is better understanding the decade drought cycles, driven mostly by the solar activity and improving the knowledge about the drought trends, due to the global warming.

Keywords: PDSI, decade cycles, solar activity

553 Fluorescence Detection of Two Mixed Dyes in Water Samples

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The fluorescence ability of some dyes enables their using as artificial tracer in the water system studies. The problem is dealt with in relation to applying the dye to trace and determine water movements within the karstic system and underground waters. Related with the aims of the study one can inject two or more dyes in the different points of the water system. We have applied the artificial tracer experiment in water system studies for the first time in our country in the karstic system study of Mali me Gropa on 2002, where we injected four artificial tracers in four different places of the system, in the same time. One can detect the maxima of the fluorescence of each tracer in water samples separating them from each other. The separation of the fluorescent dyes from each other needs the chemical supplementary treatments. In this paper only spectral separation of fluorescent dyes in binary mixtures and treatments based on pH-variations are described. The concentration and synchronous scan methods were used for the measurement of the Uranine, Eosine and Rhodamine WT fluorescence by the means of a Perkin Elmer LS 55 Luminescence Spectrometer. These results help us to decide which dyes can be used together in the same water system study. According to these results we can decide how to detect the maxima of their fluorescence in water samples, too.

Keywords: Spectral Determination, Uranine, Fluorescence Intensity (IF), synchronous scan, artificial tracer

572 Influence of Meteorological Drought on Selected Components of Water Balance in Horna Nitra Area, Slovakia

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The research was focused on analysis of meteorological drought influence on groundwater runoff and storage formation. Two different models - conceptual model of water balance BILAN and physically-based rainfall - runoff model FRIER with distributed parameters were used. Both models work in daily time step. At first, meteorological drought parameters and occurrence were analyzed using classification based on yearly precipitation amounts and SPI index. Consequently, years with the highest drought intensity were selected. Hydrological balance elements in those years were analysed in more details using both models. Several methods of model input parameters modification were used; a common methodology for input data modification was developed. Special attention was paid to precipitation because of their significant effect in the modelling process. Areal precipitation was estimated by several methods, like kriging, Thiessen polygons, altitude gradient and arithmetic mean. Similar detailed analysis was done for estimation of potential and real evapotranspiration, using different methods and formulas. The results of best model simulations were compared with the groundwater level development in monitoring wells of the adjacent area in dry years. Propagation of meteorological drought through the hydrological cycle and its effect on groundwater runoff and storage formation in the Horna Nitra basin (Slovakia) was described. The main issue of the work was to contribute to the improvement of knowledge on hydrological cycle processes.

Keywords: meteorological drought, groundwater runoff, hydrological modelling

**593 Droughts Monitoring in Northern Nigeria
Using Remote Sensing Technology**

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Drought episode has become a common phenomenon in the sub-Saharan Africa which the North western region of Nigeria is part of. The reason was being the susceptibility of the entire Sahel region of Africa to climatic anomalies. Considerable public attention is being drawn to the Sahel zone of Africa since three to four decades now due to several drought experienced throughout the region. Drought, an incessant calamity, however, is difficult to prevent but the effects on humanity and other impacts on the environment can be mitigated through prediction, early warning and other management strategies. The AVHRR (Advanced Very high resolution radiometer) data have been explored for monitoring vegetation and NDVI (Normalized difference vegetation index) data being generated for the whole Africa, so also the installation of ARTEMIS (Africa real time environmental monitoring using imaging satellites) at the FAO remote sensing centre in 1988. Thus employing remote sensing techniques in studying drought by using normalized difference vegetation index, temperature conditions index, vegetation health index, estimated monthly rainfall and cloud conditions, from NOAA (AVHRR) and FAO (ARTEMIS) respectively make Agency) was used, as well as vegetation health index and vegetation index data from NOAA and FAO, for 1985 - 2002 AND 1982 - 1999 respectively. The Findings based on the ground truth data reveals many years of drought incidence. Also vegetation health index data of July 1985 - 2002 and vegetation index data of 1982-1999 detects several years of drought condition in the study area of 6 states. Though, the study established that Northwestern region of Nigeria is a disaster prone area with particular reference to drought, the paper still makes some possible suggestions towards reducing the effects of the disaster on humanity.

Keywords: NOAA (AVHRR), FAO (ARTEMIS)

**602 Risks to Water Ecosystems in Mountain Regions
and its Possible Management**

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Water objects (WO) play significant role in any country. Pollution caused by manmade activity exacerbate situation with WO. Collapse of former USSR resulted in insufficient or lacking WO monitoring in Eastern Europe, Caucasus and Central Asia. The monitoring was especially problematic in mountain regions and across borders of former USSR republics.

Preservation, safety and correct use of WO is most actual and urgent because [1]:

1. Many WO are located in mountainous seismically active and densely populated regions. These regions have high risks of natural and manmade catastrophes such as earthquakes, landslips, mudflows and others. As a result of such catastrophes, some WO can disappear resulting in reduction of water reservoirs and in WO pollution;

2. Lack of water sources, hot climate and drought increase water consumption;

3. WO management and WO safety is difficult to maintain because of heavily complex architecture of high water dams and huge artificial reservoirs, and significant drifts in rivers. In addition, pressure from water mass in artificial reservoirs can stress an earth crust increasing the probability of earthquakes;

4. Nuclear power plants, their heat sinks and rocket fuel tanks are often located near WO. Such nuclear objects can be the subject of terrorist attacks, that may lead to ecological catastrophes. Weakly guarded borders of Chechnya, Afghanistan and other zones of frozen conflicts can further stimulate insurgency in close proximity to WO. Possible terrorist attacks can result in global pollution of river's basins in Caspian, Black, Kara Seas, and consequently in the World Ocean.

Because our generation has faced with a growing threat of global pollution, countries have to coordinate efforts to save the environment. Some of our experimental and theoretical studies, concerned with risk assessment, catastrophe prediction and prevention of natural and industrial WO are presented in [2,3] and our international projects entitled 1. "Assessment of damages from the dams' destruction of hydro systems of Caucasus Kura River"; 2. ISTC Project: "Assessing and decreasing risks of damages, caused by Tien-Shan mountain lakes outbursts".

1. A.N. Valyaev et. al . “Assessments of Risks and Possible Ecological and Economic Damages from Large-Scale Natural and Man-Induced Catastrophes in Ecology-Hazard Regions of Central Asia and the Caucasus.” in NATO Science for Peace and Security Series (NSPSS) -C: Environmental Security, Proc. of NATO ARW “Prevention, Detection and Response to Nuclear and Radiological Threat”, May 2-7, 2007 Yerevan, Armenia, Editors: S. Apikyan. Publ. House: Springer, Netherlands, 2008, pp. 281-299. This article in NSPSS NATO ARW: “Nuclear Risk in Central Asia”, June 20-22, 2006, Kazakhstan, Almaty, Editors: B. Salbu, Publ. House: Springer, Netherlands, 2008, pp. 133-149.
- 2.A.N. Valyaev, S.A. Erochin, T.V. Tusova, “ Assessments and decreasing of risks and damages from outbursts of Tien-Shan high mountains lakes” in Book:“Uranium, Mining and Hydrogeology” Published House: Springer Berlin Heidelberg, 2008, pp. 819-826.
- 3.A.N. Valyaev, S.A. Erochin, T.V. Tusova “Processes under outbursts of mountain lakes and model for risk assessment” in Book: “Proceedings CHAOS2008 Editor: H. Skiadas, Published House: World Scientific, 2009, pp. 350-363.

604 Proposal of Evaluation Criteria for Environmental Flows in Drought Situations

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Following a proposal by the of Spanish Environment Ministry (Spanish Environmental Ministry, 2007) in environmental flow studies it is recommended to use Habitat Simulation methods (Bovee, K. 1986). One of the difficulties that these methods present is the form to choose the commitment minimum point, within the curve that relates flow versus created habitat, WUA-Q curved, that generates the compatible minimum habitat that integrated the proposed environmental objective for the river; consequently this election will determine a minimum flow that it is the one that will be proposed as conservation assessment in that section. The Instruction of Planning text (Hydrological Regulation Schedule) (RPH) (R.D. 907/2007) which has been developed in our country, have the proposal to unify criteria for that minimum point election, in particular for this methodology supposes to choose a flow, that produces a fixed percentage of the maximum WUA obtained in the study of that section. For extreme drought situations the proposed percentage has been reduced and it is considered sufficient with the flow that produces 25% of the maximum WUA. Given the generalist character of this instruction, that does not consider the different answers that can take

place in the diverse channels, sections and morphologies on which the work take place, we consider necessary to evaluate the hydrologic and ecological meaning of those flows generated with the management criterion for drought situation. The proposal analysis is to state the presence in the river segment a sufficient water level to allow the continuity of the flow and the fish movements. The simulation programs are used, where the calculation are made with the flow that provides 25% of the maximum WUA, the criterion to approve or to reject that flow is to observe if a continuous lamina of at least 20 cm of depth are present, that we create are sufficient for fish passage (Garcia de Jalen et al , 1997). This work has been carried out in some rivers sections of Ebro and Segura watershed in the East of Spain.

Keywords: Drought , environmental flow, habitat simulation

**619 Development of Flood Cyberobservatory
for Supporting Science Management and Public Warning**

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The paper reviews first the emerging frameworks for watershed science and management. Reference is made to the recent advances in cyber-tools and methods (sensors, sensing networks, high-performance computing, communication technologies, GIS along with data and simulation models) enabling progress in these areas. A description of the flood observatory components is then provided to reveal their usage in supporting the decision-making process in water resources management. Flood risk management addresses water quantity & quality aspects, entail hillslope and in-stream processes, social and economic impact, being relevant locally and nationally. Initial steps in developing a flood Observatory are summarized with 2 case studies, in United States and in Romania. Finally the paper argues that, given that scientists and managers need robust information systems that have many overlapping components and functions, the time is ripe to coordinate and synergistically combine their efforts for mutual long-term benefits.

Keywords: cyberinfrastructure, information systems, flood observatories, water science

629 Biophysical Criteria Designating Agriculture Drought Affected Areas in the Context of Climate Changes

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Water related biophysical indicators used today for the designation of less favoured areas for agriculture at European scale (e.g. growing days defined as the number of days with temperatures over 5 and ratio between actual soil available water and potential evapotranspiration over 0.5, various aridity indexes: Bagnouls-Gaussen, UNESCO) are evaluated at European scale using a crop water balance simulation model (ROIMPEL) linked with soil database 1:1,000,000 and climate data for 1961 - 1990 baseline and 2020 - 2040 projections (ECHAM4, HADCM3). Each biophysical indicator shows various trends in space and time that impose a harmonisation for defining clear agriculture policies for drought management.

Keywords: drought, less favoured areas for agriculture

642 Use of Irrigation Scheduling Regime as Drought Indicator

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The impact of droughts on agricultural crops depends mainly on net precipitation distribution during the vegetation period and soil physical properties. Most of drought indices do not reflect the complicated interaction between current climate conditions, soil properties and crop water demands. This study compares the identification of summer drought by some wide-spread drought indices (seasonal net precipitation, duration and distribution of rainless periods, SPI, PDSI and simplified water balance) and by irrigation scheduling regime of maize. The case study is conducted using long-term records of climate data for Sofia region and simulation of irrigation scheduling of maize grown on two soils with contrastive properties: low water permeable Vertisol and medium water permeable Chromic Luvisol. Two scenarios with different irrigation alternatives were performed using CROPWAT program (Smith, 1992): (1) refilling the soil reservoir and adopting a management-allowed depletion fraction (MAD) in respect to crop development stage; (2) use of constant irrigation depth for partially refilling the soil reservoir.

For the very dry year all irrigation alternatives behave similarly on both soil types. For less and medium drought conditions the irrigation scheduling is more sensitive to soil properties which is reflected by the changes in number, initial data of irrigation depth and the amount of irrigation requirements. The statistical analyses of the study period indicate that there are some deviations in the estimates given by climate indices and by the net irrigation requirements. Taking into account the practical use of the results it is recommended to include the probability of exceedance of net irrigation requirements as additional indicator for summer drought and as a basis for assessment the informativity of the other indices.

Keywords: drought assessment, irrigation scheduling, maize

661 Drought Sensitivity Investigations and its Tendency

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The effects of drought depend not only on the severity of drought, but on the sensitivity of the systems suffered from the given drought event. The paper presents the sensitivity investigations carried out in Hungary. The effecting factors taken account are the precipitation, different hydrophysical characteristics of soil, ground water level, land use and the orography. The sensitivity evaluation made by categories, which describes the estimated sensitivity of the given system to the drought. Finally, the results for different time periods are compared and discussed the potential impact of climate change to the drought sensitivity.

Keywords: drought, sensitivity, climate change

667 Decision Making for Operational Management of Water Related Risks

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When faced with predicted water related extreme events like floods, operational managers have to take decisions with high impacts, e.g. whether to provide early warnings, take anticipatory control measures, or even to evacuate people. Because of the high impact of these decisions, increasingly operational water managers are provided with probabilistic, instead of deterministic forecasts. When combining their knowledge of the different impacts with the predicted probability of events occurring, the operational managers have to take their expert-judgement, risk-based decision. Or, if proper guidelines exist, risk-based decision rules are pre-defined on the basis of a pre-determined risk-based management strategy. The basis, however, for both the expert-judgement and risk-based management strategy is often not fully determined. The expert-judgement is often limited due to the limited period covered by the operator's working experience with probabilistic forecasts. The risk-based strategy is limited, because it often starts from acceptable risk levels or from the minimum-risk approach, which both usually start from the wrong assumption that the probabilistic predictions are reliable. In answer to these limitations the Hydrological Ensemble Prediction Experiment (HEPEX: Schaake et al., 2007) is directing part of its work on verification analyses to evaluate risk-based decision rules. Van Andel, 2009, showed that threshold-based decision rules can be an effective and cost-efficient strategy for anticipatory water management on the basis of ensemble predictions. The threshold-based decision rules have then to be trained using a long period of archived forecasts or a re-forecasting (hindcasting) data set, thus correcting for biases in the probabilistic forecasts. This paper presents results of a research to the relationship between reliability of the probabilistic forecast and the best decision strategy, for a flood-control case study in The Netherlands. The better the forecast reliability the more favourable a minimum-risk approach becomes, at some stage outranking the threshold-based decision rules.

Keywords: decision making, probabilistic forecasting, ensemble prediction, risk, flood control

**676 Flood Risk Mapping for Effective Flood Risk Management
in Reni, Ukraine**

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In this paper we describe the procedures and data acquisition of flood risk mapping to come to an effective flood risk management in Reni. This work is a part of a Flemish funded project named "Building capacities for effective flood risk management in the Ukrainian part of the Danube Delta". The aims of this project are 1) share expertise about flood risk mapping, emergency management and damage calculation 2) create better flood prevention and protection plans for the Ukrainian part of the Danube Delta 3) contribute to the set up of an integrated flood risk management plan in line with the WFD and EU Flood Risk Directive and 4) assist with capacity building and community involvement to flood risk management. The area of Reni was chosen as a case study for several reasons. It is a community where during a flood not only 80000 population and housing are at risk but also a harbour and a water intake for water supply can suffer severe damage. Many factors need to be taken into account because the risk of flooding comes from two sources, and the combination of both can lead to heavy damage during flooding. It is caused at one hand by high water level in the Danube, with associated risk of dike breaches and on the other hand, as an extra threat, the risk for flash floods caused by rainfall runoff during rain storms in the hills. The flood risk assessment for this region is done in 4 steps. It consists of determining 1) the probability of flooding; 2) determining the flood extent and the flood depth; 3) determining the economic damage due to flooding and 4) determining the societal impact due to flooding. For all these steps a lot of data are necessary. Regional authorities and the Meteorological Institute are involved to collect the data. Local stakeholders are involved to be able to assess the damage and societal impacts. To be able to get reliable results, lot of data are missing and within this project recommendations for data collection and the use of existing earth observation are formulated to come to an effective risk assessment. It is the aim to create a flood risk map of the region and to present a set of recommendations to be able to set up in the near future an online flood forecasting system.

Keywords: flood risk, flood risk mapping, flood forecasting, data collection

686 Water Related Risks in Ukraine

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The intense sanitary and epidemic situation existing in Ukraine for the last years, tends to deterioration and it is connected with environmental pollution, including sources of water supply unpurified everyday sewage and industrial waters, waste products, an unsatisfactory sanitary and municipal condition of settlements, object of nutrition, trade. Methods of research: statistical, sanitary and hygienic. Monitoring of quality of water of superficial reservoirs testifies that their ecological state practically does not improve, and in comparison with the last years even its deterioration has been marked. The basic pollutants of superficial reservoirs are the overloaded sewerage cleaning constructions and networks which are in unsatisfactory technical state and demand conducting of major repairs and reconstruction. In consequence of insufficient financing, construction and reconstruction of the majority of objects of water supply and sewerage cleaning constructions practically is not carried out. More than 90 % of the polluted drains give water canals of cities of area and the industrial enterprises of mining and metallurgical complexes. There is sharp problem of trip-outs in reservoirs highly-mineralized open-cast mine and open-cast mine waters of Krivbass and the Western Donbass. Specific gravity of non-standard tests of the potable water selected from the sources of centralized water supply, according to sanitary and chemical; bacteriological parameters for last years is more than 13.2 % and about 3,4 %. Discrepancy of quality of potable water to normative requirements is one of the reasons of spread in the state of many communicable (virus hepatitis A, typhoid fever, rotavirus infection and so forth) and non-communicable (illnesses of system of digestion, cardiovascular, endocrine systems and so on) diseases. In 2008 there were rotavirus enteritis (there were 30 men suffered from rotavirus enteritis and among them 24 children) and virus hepatitis A (92 men suffered from virus hepatitis A, among them 37 children). The increase nitrate pollution of subsoil waters has been marked. Pollution of water by super normative concentration of nitrates adduces to morbidity water and nitrate methemoglobinemia (it concerns children), reduction of the general resistance of organism that contributes to increase level of morbidity of communicable and oncological diseases. For improvement of water supply in Ukraine it is necessary to execute steadily the state and regional programs of protection of water resources, developments of water economy and improvement of quality potable water; to provide development and timely new implementation, improvement of existing technologies, materials and the equipment concerning purifying of water.

Keywords: environmental pollution, communicable, non-communicable diseases

688 Drought Monitoring in SE Europe

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Idea of drought monitoring is not new in this part of Europe. Already before the second world war indicators were developed that are still used to analyze possible anomalies in precipitation and evapotranspiration. Later there were targeted developments in drought and aridity indicators in the Carpathian basin which are intended for analysis of actual drought impacts on crops. Recently, standard drought indicators which are used all around the world were also applied and used in the SE Europe. Almost all SEE countries have applied Standardized Precipitation Index (SPI), many are also using Palmer Drought Severity Index (PDSI). Since drought is not local phenomenon - it usually affects larger areas across international borders - there was clearly a need to establish cooperation and possibly standardization and common platform. That is one of main tasks of the project aiming at establishment of the Drought Management Centre for Southeastern Europe (DMCSEE). Beside standardization and common web platform, project aims at establishment of closer connection between drought indicators (based mainly on weather parameters) and drought impacts. Both aspects will together result in a drought early warning system for SE Europe.

Keywords: Drought monitoring

690 Application of Nwp Models in Drought Monitoring

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Numerical weather prediction (NWP) models are routinely used for weather forecast. Due to increase of available computer resources in last decade, local limited area model (LAM) configurations became operational forecasting tools in most national meteorological services. Also longer, seasonal and climatological runs of LAM were performed and their potential to improve regional details in spatial distribution of precipitation was identified. Therefore application of models for drought monitoring seems to be reasonable idea; first task is to compute model climatology for drought related variables using historical reanalyzes and to

develop a tool for drought monitoring in the SEE based on simplified interpretation of results. In order to obtain model climatology, ECMWF's ERA Interim analyses for the period 1989-2008 were used as initial and boundary conditions. High resolution regional analyses were computed by Non-hydrostatic Meso-scale Model (NMM), developed by NOAA and NCEP. NMM is suitable for use in a broad range of applications across scales ranging from meters to continental scale. Some results of reanalysis as well as operational runs and their possible application for drought monitoring will be presented.

Keywords: drought monitoring, numerical weather models

693 Water Shortage Risk Modelling in Supply Systems in the Coastal Region of Montenegro

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Coastal region of Montenegro is typical tourist area in which, during tourist season, water consumption is two to three times higher while available water resources are on minimum annual level. Due to uneven annual production and consumption of water there is an objective risk of water shortages in water supply. Although the construction of regional water supply system is underway and it will link coastal region of Montenegro with Skadar Lake and provide additional quantities of water, risk of water shortages is a latent problem which is related not only to quantity of available water resources but also to management of technical systems. In this work, annual water balance with focus on summer period and analysis of possible risk of water shortage. The main goal of this work lies in risk management through performance indicators of water supply system.

Keywords: water risk, modelling, coastal region of Montenegro

**699 Extreme Hydrological Phenomena in 2003 and 2006
on the Danube River (Calarasi-Harsova Sector)**

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The main characteristic of the Danube hydrological regime in 2003 was the lowest levels and discharges recorded in the last 100 years due to a prolonged draught. The main cause of the draught was a long lasting hot air-mass coming from Africa and resting over the entire European territory. The extreme low levels and discharges occurred during July-September 2003 determined the interruption on the Cernavoda Nuclear Plant activity and affected the entire economy of the country by ruining the whole national energetic system. In the paper it is presented the hydrological situation in 2003 on the Calarasi-Harsova sector, on the Danube river. In 2006 another extreme event occurred on the Romanian territory of the Danube river: the highest discharge of 15800 m³/s recorded at the entrance into the country (at Bazias hydrometric station), with a probability of one in more than a hundred years returning period. This flooding situation caused dike-breaks and a lot of damages along the Romanian sector of the Danube river. The hydrological regime in 2006, an estimation of the damages caused by the flood as well as the action proposed to be taken and the action already taken until now to reduce damages are presented for the same sector (Calarasi- Harsova), on the Danube river.

Keywords: extreme phenomena, drought, flood

700 Hydrological Dangerous Phenomena in the Basca River Basin

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Floods represent the most important dangerous phenomenon in the Basca river basin and the main cause of severe damages. Due to the increasing demands of the European Union it is necessary that the analysis of the river basins to be based on real data. These data can highlight the water resources, the touristic potential, the economic dimension of the entire area, the social and human potential and the main goal is to improve people's life and to contribute to the economic growth

in the region. The expected results are both dynamic and sustainable equilibrium of the environment as well as a harmonized integration into the ecosystem. In the first part of the paper it is presented a general description of the Basca river basin (the geographical position of the main river and tributaries, the human impact over the hydrological waterflow regime). In the second part there are analyzed three historical floods recorded in 1975 and 2005 in the Basca river basin (the main tributary of the Buzau river), their negative effects and the main actions to be taken in order to diminish the damages and the hydrological dangerous effects in the area.

Keywords: flood, high discharges, damages

701 Drought Monitoring in Republic of Macedonia

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According to the Republic of Macedonia last National Report to United Nations Convention to Combat Desertification (UNCCD) there is a lack of coherent and comprehensive data base and continual drought monitoring on our territory. Scattered data exist in various separate scientific projects in both scientific and governmental institutions. The need to establish certain Balkan drought center was promoted by European Regional Work Team on Drought (ERWDRO) in context with UNCCD since 1998. Drought Management Center for Southeast Europe (DMCSEE) was established in 2006, after few workshops organized with joint cooperation of CCD Secretariat and WMO. DMCSEE office is located in Environmental Agency in Republic of Slovenia. DMCSEE network includes all countries in the Southeast Region (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Greece, Hungary, Montenegro, Moldova, Romania, Serbia, Slovenia and Turkey). The mission of the center is to provide applied information research and analysis support for the development of more effective monitoring, programs, and information products for the drought monitoring and early warning system. Hydrometeorological Service in Republic of Macedonia is involved in the project DMCSEE. In this paper it will be presented the first results from drought monitoring in our country in cooperation with the Center.

Keywords: monitoring network, drought, SPI maps

702 Surface and Groundwater Drought Evaluation With Respect to Aquatic Habitat Quality Applied in Torysa River Catchment, Slovakia

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Surface and groundwater drought develops as a consequence of meteorological drought occurrence. Natural conditions of drought occurrence are often combined with human activities which may strengthen its consequences. Occurrence of meteorological drought in the upper part of the Torysa River catchment was analyzed using SPI index and year humidity classification for the period 1971-2005. Surface and groundwater drought occurrence was assessed under both - natural conditions and conditions influenced by water abstraction. Parameters of surface and groundwater drought were estimated for streamflow discharges, baseflow and groundwater levels. Changes in water quality during the drought periods were assessed, too. Habitat suitability curves derived in accordance to IFIM method were constructed for brown trout. Because of their longevity, their mobility and their sensitivity to habitat modification, fish are good bioindicators and they are often used for the assessment of the ecological integrity of rivers. Threshold levels for surface water, causing unfavourable trout life conditions were estimated, their temporal occurrence and development was assessed. In the end, drought parameters frequency and seasonality were compared with habitat suitability assessment results.

Keywords: drought, threshold level, habitat suitability curves, IFIM method

703 Regional Extension of Assessment Tools for Snow Accumulation and Ablation to Characterize Flood and Drought Conditions

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Recent efforts within the EnviroGRIDS and DMCSEE projects are discussed. The mission of the snow assessment component is to enhance the existing scientific knowledge and organisational experience at the regional level. As far as possible

common issues with flood and drought evaluation will be used: to define common indicators of extreme events; to optimize the use of land based meteorological data and satellite based products. During the last decades the knowledge on flood hydrology has improved significantly and major advances have also been made in the forecasting of floods. Medium and long term assessment and warning for snow resources is available. Probability distribution functions can be extrapolated and derived by the generated historical data sets.

Keywords: snow accumulation, snow ablation, snow melt

718 Investigation of Hydrological Drought on Transboundary Tisza Tributaries

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Long periods of low water with possible water shortages may lead to considerable losses. Despite this fact hydrological statistical analysis of such periods is often poorly represented. Water management of low water periods requires careful handling and needs deep professional knowledge. These necessities are emphasised on transboundary rivers, where decision making towards the proper measures can be reached only with the agreement of the interested countries. The Barcau/Berettyo and Mures/Maros rivers are analysed. Most of the runoff producing parts of the catchments is in Romania and the lowland sections near the mouths fall to the territory of Hungary. Flow records at most of the investigated stations are more than 50-year long. As it concerns anthropogenic impact observations cover different periods. Discharge series until 1980 are slightly influenced, while the impact of reservoirs on the temporal distribution of runoff is felt after that period. The impact of climate change and other factors can be investigated by the comparison of low flow series for 1951-1980 and 1978-2007 consequently. Discharge values of different probabilities can be compared and their temporal changes investigated. As a result of runoff regulation after 1980, an increase of minimum flow has been observed, the duration of low flow periods has shortened, the number of low flow events has increased and streamflow deficit associated with those has decreased. Changing distribution functions fitted to observed values also prove this tendency. Histograms for the beginning and the end of the observation period show clearly different features, those are shifted towards higher values. The most severe low flow events have total streamflow

deficit, which are much higher than the available regulation capacity today. Owing to the strong anthropogenic impact on the hydrological regime it is practically impossible to analyse ongoing climate change induced changes of hydrological conditions even if those are present.

Keywords: minimum discharge, low flow periods, hydrological statistical analysis, transboundary rivers, water uses, discharge values probabilities

715 Safer Project - Preparation of Risk and Floods Hazard Maps

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Fires, floods, earthquakes and eruptions of volcanoes, killing thousands of people worldwide every year. With climate change, such disasters may become more common. The project "SAFER" of the 7th Framework Programme of the EC perform and approve pre-operational version of the services for disaster response initiative GMES, which strengthens European capacity to respond to such disasters. Remote Sensing Application Center - ReSAC with partners from other European countries perform tasks "Plain Flood Risk Management", and "Assets mapping". Test areas in Bulgaria in the project Iskar River in the Sofia valley and Rusenski Lom in the municipalities of Rousse and Tsar Kaloyan. The poster will present the first results achieved in the project to evaluate the high water levels with different probabilities, land cover mapping and assessment of flood risks and mapping of past flood events with satellite images. The elaborated products can be used in the reporting of Bulgaria for the Directive 2007/60/EC - the so called Flood Risk Directive of the European Parliament and of the Council.

Keywords: Flood Risk

**705 Comparing the Palmer Drought Index and the Standardized
Precipitation Index for Pannonian Part of Croatia**

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Conventional Palmer Drought Index (PDI) and recent Standardized Precipitation Index (SPI) are compared for Pannonian part of Croatia. Historical time series of PDI and SPI are compared using spectral analysis technique. For that purpose monthly precipitation, air temperature and air humidity data for Northern Croatia and period 1951-2005 are used. The results indicate that SPI is simpler for interpretation and spatially more coherent than PDI. Further development of both indices is required. Possible applications of them in irrigation scheduling system is considered.

Keywords: drought indices' comparison, Croatia

**708 A Catalogue of Historical Droughts in Europe:
a Tool for Assessing Drought Characteristics
and Impacts at Regional to Continental Scales**

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There have been several high-profile international attempts to catalogue major flood events and index their severity and societal impacts. There is no widely-used equivalent catalogue for droughts, which represents a major research gap - a catalogue of contemporary and historical droughts would, for example, set a 'benchmark' of past drought characteristics, with which to compare future changes in drought occurrence. Any attempt to catalogue droughts faces the inherent challenges of classifying a phenomenon which exhibits complex spatial and temporal variability; for this reason, an objective methodology is preferable, to allow comparisons to be made between drought events in different regions

and over different timescales. In this study, an objective classification is made of the severity and duration of hydrological and meteorological drought episodes in Europe between 1901 and 2004, using gridded precipitation data and a network of over 500 river flow monitoring sites. Droughts are classified for a number of homogenous regions, using an index based on the regional coherence of streamflow and precipitation deficits. These sources are synthesised to create an objective drought catalogue for the European regions, which provides a visual display of drought characteristics (e.g. drought duration, seasonality and spatial coherence). The drought catalogue is also populated with information on the impacts of major droughts, using expert local knowledge and other sources of anecdotal information, to provide an assessment of socio-economic and environmental impacts of the major droughts. This paper also presents examples of the many possible applications of the catalogue (e.g. facilitating improved drought monitoring and forecasting). The drought catalogue is focused mainly on central and western Europe, for which observed data was readily available when the catalogue was first developed. There is currently less coverage of eastern and southern regions; it is hoped that the BALWOIS network will provide a good opportunity for engagement in these regions, which will enhance the geographical coverage of the drought catalogue.

Keywords: drought, streamflow, precipitation, forecasting, monitoring, regional deficiency index, standardized precipitation index.

711 Change of the Dry Day Persistence on Homogenized Precipitation Data

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The ECA indices and some other special own developed precipitation indices are realized at the Hungarian Meteorological Service. Long time daily precipitation sums series were homogenized and the climate indices series based on daily data has been analyzed for the period 1901-2008. The extreme dry indices (max number of consecutive dry days, total number of consecutive dry days, mean dry spell length, etc.) calculation results and the fitted linear trend statistics were tested on the original as well as on the homogenized daily data. The homogenization and complementing of daily data series were performed by method MASH (Multiple Analysis of Series for Homogenization; Szentimrey). We present the

results of extreme climate indices calculations on gridded (interpolated) daily data. Gridding of homogenized daily data series was carried out by method MISH (Meteorological Interpolation based on Surface Homogenized Data Basis; Szentimrey, Bihari).

Keywords: dry day persistence, homogenization, gridding

730 Contemporary Approach for Management of Water Related Natural Hazards in Mountainous Regions

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Every year natural hazards caused not only economic damages but they endanger the human life and health too. Population and economy in the hilly-mountain and mountain regions is permanently faced with risk of any natural hazard. The most exposed hazards in our country are those that are perceptible as wild fires, flash floods, landfalls, landslides etc. Otherwise there are other type of hazards that are not perceptible as drought or erosion but their impact is significant. Natural hazards are different in their character. Some hazards, can be forecast (floods) with high accuracies but some events as landslides, landfalls or rock falls can not be forecast in time and space. The speed of onset of a hazard is an important variable since it conditions warning time. At one extreme event such landslide or flash flood gives virtually no warning. Other hazards such as drought and desertification act slowly over a period of months or years. The wild fires can be controlled with early detection and quick reaction of the responsible institution especially companies that manage the forest because they are constantly on the field. For some types of hazards the actual dimensions of the occurrence may be altered if appropriate measures are taken. For others, no known technology can effectively alter the occurrence itself. There are various actors in the system of natural hazard management depend on he nature of the risk and the territorial distribution. The case study was carried out on the region of Skopje in the Republic of Macedonia. The main objective of this study was to propose more sustainable approach for improvement of the system for natural hazard management. For these purpose were analyzed the dimensions of the hazards depend on their characteristics. Single and multi hazard map of the region were developed using. Gaps in the natural hazard management system were analyzed. Later, depend

of the nature of the hazard and baseline analysis is proposed new approach.
Acknowledgement: This study was conducted through the EU-funded INTERREG IIIb CADSES RIMADIMA project, (code 5D102).

Keywords: water related risks, natural hazard management

756 Development of Drought Early Warning System of Zayandrud Dam, Iran

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The continuous growth of population and water requirements have faced water resources management with serious challenges. From another point of view, recent frequent droughts have also exacerbated the problem that is more complicated in dry regions where more recumbencies on dams exists. This situation makes the use of drought early warning system (DEWS) with the hydrological indicator very crucial to combat drought and prevent from unmanageable water scarcity.

This research is an aim to develop a drought early warning system (EWS), which consists of three essential components, including: 1) drought monitoring, 2) forecasting future inflows and water consumption and 3) indicating drought alert index (DAI). To explore the methodology, we selected Zayandeh Rud basin and its reservoir as the case study. To develop the EWS, we first predicted 6 months ahead inflows, water consumptions using of artificial neural networks (ANNS) technique and the respective uncertainty. Furthermore, we categorized drought status and water consumption in five levels, using the historical data (1983-2005) of reservoir water storage and the Self Organizing Feature Map (SOFM). Finally, the DIA was calculated, which combines the aforementioned drought and consumption levels and warns status of the river system to implement necessary measures to reduce water consumption.

Keywords: Drought early warning system, Uncertainty, Prediction, Drought, Zayand Rud dam

757 Meteorological Drought Analysis Using Artificial Neural Networks

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Droughts may be classified as meteorological, hydrological or agricultural. When meteorological drought appears in a region, agricultural and hydrological droughts follow. In this study, the standardized precipitation index (SPI) was applied for meteorological drought analysis at five stations located around the Lakes District, Turkey. Analyses were performed on 3-, 6-, 9- and 12-month-long data sets. The SPI drought classifications were modelled by Artificial Neural Networks, which has the advantage that, in contrast to most of the time series modelling techniques, it does not require the model structure to be known a priori. Comparison of the observed values and the modelling results shows a better agreement with SPI-12 and ANN models.

Keywords: drought; standardized precipitation index (SPI); artificial neural networks

752 Flooded Karst Field (Polje): Case of Donje Blato on the Island of Korcula

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The polje of Donje blato is situated on the eastern edge of the island of Korcula, between the town of Korcula and the village of Lumbarda. Donje blato is typical karst polje, from geomorphologic point of view, surrounded by hills. It stretches in the Dinaric direction (NW-SE) with length of about 1.5km and width of about 0.4km. It is separated from the Adriatic sea by hill of Pelegrin (42m a.s.l.). The lowland part of the field covers about 0.4km², with minimum elevations from

about 0.5m a.s.l. in the centre up to 3m a.s.l. on the edges. The topographic catchment of Donje blato has area of 7,2km².

In rainy period Donje blato is flooded due to weak drainage through underground. There is a "pool" (pond) in the central part of the field, which is about 450m from the sea. "Pool" has diameter of 15m and bottom elevation approximately zero (0m a.s.l.). It is connected with sea through underground and functions as estavel. Also, there are a few minor sinks and estavels on the border of lowland of the polje that play a non-negligible role in hydrological processes on concerned area.

Donje blato is flooded every year. Range of flood depends on hydrological regime. Annual precipitation varies between 460 and 1300mm. For average hydrological year, about 0,1km² is flooded through winter. In rainy year up to 0,3km² is flooded through winter and early spring. Therefore, boundary higher parts of the field are used for agriculture while central part is mainly careless.

At the end of 19th century, a drainage canal was constructed through polje to the sea. The canal was destroyed probable in the 1920's or 1930's. Today, a new drainage canal is under construction, approximately on the same route as the old, with a view to protect field against flood.

Keywords: karst polje, flood, Korcula, Croatia

776 Through Modernization of the Hydrological Monitoring towards Improved Water Forecast

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During the last eight years in the Republic of Macedonia several floods and local floodings have hapened. Old monitoring system is not capable of timely responcees on water related risks. With the modernization of the Hydrological Monitoring these problems will be reduced to minimum. Implementing new automatic hydrological stations on the rivers and new automatic rain gauge stations on the upstream catchment regions is the first step of the monitoring modernization.

Keywords: Hydrological Monitoring, Water Forecast, Flood, Hydrological Station



TOPIC 4

INTEGRATED WATER RESOURCES MANAGEMENT

**040 Current Status of Tourism and its Opportunities for Ecotourism
Development in the Prespa Lakes Region**

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The aim of the present study is to provide information on the current situation of the tourism on the Albanian side of the lakes Macro and Micro Prespa, along with the existing practices and regulations, and to offer views from an Albanian perspective that will help resolve some of the current difficulties. The Lakes Prespa region is situated in the Balkan Peninsula and is shared among the three neighbouring countries Albania, Macedonia and Greece. The Prespa region hosts unique habitats that are important from both European and global conservation perspective, and populations of numerous rare, relict, endemic, endangered or threatened species. It is also remarkable for its cultural values, including Byzantine monuments and examples of traditional architecture. However, unsustainable agricultural, fisheries, water and forest management practices as well as unsustainable use of non-timber forest products is causing stresses on the ecosystem health of the Prespa Basin. Prespa region is considered one of the most important areas regarding the potential for tourism. However, this potential is unexploited due to the generally unfavourable economic situation and the lack of basic tourist infrastructure. Tourism in the lakes area is small-scale rural and family tourism, based on a few small hotels, private accommodation and restaurants. Domestic guests dominate the Prespa tourism market, with less than five percent of foreign tourists. In general, the quality of the lake water appears to be within the acceptable limits. The future of the tourist development in the area is sustainable ecotourism which should keep a balance among the environmental, economic, and socio-cultural aspects of tourism development in order to guarantee long-term benefits to the recipient communities.

Keywords: Lakes Prespa, ecotourism, pollution, water quality, wastewater

**022 Introducing Environmental Ethics in Economic Analysis:
Lessons from HA**

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We propose a multidisciplinary approach where philosophy in general and ethics in particular tackle head on the leading contradictions in economics. The purpose of our study is centred on the fragility of nature and its potential destruction arising from irrational acts of uncontrolled consumption. In fine, we attempt to evaluate whether or not, economically speaking, economics as a discipline has shown itself to be harmful to humankind. Hence, we will develop a line of reasoning which is “moderately anthropocentric”. The consequence of combining different disciplines will enable us to rethink the approach that stems from sustainable development. To this end, we will not only adopt a critical point of view, but one which is also theoretical. The aim of this paper is to show that protecting nature can only gain our full commitment if we engage in an ethical study of economics, one which is firmly rooted in the wider notion of sustainable development. We will use these implications to clearly indicate that the “nature ethics/sustainable development” relationship automatically brings out a requirement to safeguard nature. We will also demonstrate that this requirement is associated with a more restrictive Kantian style categorical requirement. From our perspective, this “ethical recentering” sets into motion a lexicographic process where nature is dependent on human responsibility. It emerges that summum bonum, decisions about nature are subject to a Precautionary Responsibility Principle. It is no longer a case of reshaping the thinking on environmental economics, where the issue is one of optimising how natural resources are managed, but one of protecting these resources for what they are, and not for what they can provide from the classical standpoint of utilitarianism and welfare. We believe that our approach is original because it uses philosophical analysis as a starting point when examining economic practices and establishing the relevant limits. For this reason, we need to consider the work of Hans Jonas because although vitalist, his Heideggerian approach offers us the possibility of viewing the ethics involved in terms of a right to stay. Humans are on Earth as transitory beings and have a duty to leave it intact for those who come after. This vision of how things should be inevitably forces us to direct our discussion towards the fundamental meaning behind the above term, that is, the one that the Greeks subsumed within Eidos: humility. This humility could prevent humankind from behaving like a “master and ravager of nature”. Jonas contribution is very useful for the economist because the latter can reflect on the notion of time, a fundamental notion in economics. Indeed, Jonas focuses on the narrow correlation between time and ethics. This clear association has led philosophers to redefine power relationships in the light of a pure intra and

inter-generational altruism. Such a temporal stance places economic analysis in jeopardy because it is being asked to plan for the long term, and yet its short-sighted rationalism creates an epistemological misunderstanding, implying that economics has destruction to thank for its survival. Modern economics, far from adopting an optimism-filled Schumpeterian vision, has developed a cataclysmic image of nature. Indeed, the continuing damage to nature can be understood by way of a consequentialist paradigm of consumption as an economic activity. It then seems obvious that, unlike the “zero growth” suggestion from the thinkers behind deep ecology, we should in preference expect everyone to assume a role when it comes to responsible growth. In this respect, the Precautionary Responsibility Principle is capable of providing answers. Consequently, we will establish a set of positive ethics derived from our transcending the traditional Kantian approach. Self restriction, as a categorical imperative, can then distinguish itself as an ethic of dissemination, encouraging a group of behaviours which is worthy of humankind and respectful towards nature.

Keywords: Macroeconomics and International Finance Research Centre (CEMAFI)

021 Moldovan Network

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In 2003 year when was decelerated in Vorniceni village, Moldova, exceptional situation because at the “Ion Inculet” lyceum was identified 75 cases of Hepatitis A. Doctors told that the cause was low quality of drinkable water. In the future are expected other cases of disease because the lyceum is not assure in centralistic way with water. More than that - there is a danger of new epidemic, because until nowadays the lyceum has no centralized water and it results no elementary studying conditions. The first step to create The Moldovan Network of Rural Volunteering Centers for Water was done in 2003 (monitoring macro invertebrates; Youth Water Parliament etc). The MNRVCW will make an important contribution to the achievement of the Millennium Development Goals, to all of which water plays a crucial role. The local communities are involved in network activities for example pumps arrangement (persons number is unlimited); they have proper financial sources in the projects that are for water supply. People from communities informs network about garbage which is near water sources. About regional institutions for example Preventive Medical Centre, Straseni

doctors make analyses to water from pumps, wells which is checked, they prepare articles about sanitary culture from villages. At local level network can coordinate all efforts of NGOs, Local Public Administration, business to resolve problem of centralized water supply system. The local communities (Galesti, Lozova, Vorniceni etc) are involved in network activities for example pumps arrangement (persons number is unlimited); they have proper financial sources in the projects that are for water supply. People from communities informs network about garbage which is near water sources. Information about water quality will be preventing cases of catching disease; it will raise population sanitary culture. More than this poor people will have chance to participate to center's activities and a part of them will have a job. Only after supplying in centralist way and creating a water network, in village the situation will change. The water supply will give chance to youth to built houses; will appear small and middle factories, new jobs, a better informational network. Rests Centers will be opened which will contribute to ameliorate health situation.

Keywords: Local Action - Global Impact

032 Long-Term Alterations to the Varna-Beloslav Lake Complex due to Human Activities (Bulgarian Black Sea Coast)

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There are several larger lakes at the 412km long Bulgarian Black Sea coastline, as each distinguishes with a specific hydrological regime and parameters. The deepest and the largest is the Varna Lake, located west from the Bay of Varna at the North Bulgarian coast. The lake is a firth formation at the river valley under a rising sea level during the Holocene, when it was divided from the sea by a large sandy spit. In 1900s with construction of Varna Port a navigational channel between Varna Lake and the sea was built, while in 1920s it was artificially connected to the inland Beloslav Lake by other navigational channel. Since the beginning of the past century the two lakes have been subject of many direct human impacts, such as: digging of three navigational channels, situating a number of ports with different functions, constantly performed dredging activities etc. The aim of this paper was to trace the long-term changes to the lakes of Varna and Beloslav mostly associated with human activities over a 100-year period. Two types of data were used: historical topographic map from 1910 in scale 1:200 000 and nautical maps in scale 1:10 000 from 1994. The data were

processed and analysed with support of GIS and modelling in order to quantify the changes of areas and volumes of the lakes, as well as of the navigational channel between them. The findings from the study clearly reveal significant alterations of the two lakes that have been caused by increased anthropogenic impacts over the whole past century. As a result, the lakes were irreversibly altered in areas, water volumes, hydrological parameters and ecology.

Keywords: water balance, lakes, human impacts, 3D GIS model, Bulgaria

041 Management of Water Resources for Sustainable Agriculture in an Irrigated Semi-Arid Region of India

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Large-scale introduction of canal irrigation in arid and semi-arid areas has increased crop production; on the other hand it also intensified the process of secondary salinisation, which is causing universal concern because of its implication on food security and environment. The problem, however, is amenable to solution through implementation of suitable irrigation and groundwater management policies. The present study focuses on hydrological analysis and the estimation of seasonal net groundwater recharge for the study area, which is located in a semi-arid region of Haryana, India. The analysis showed that the rainfall in the area is quite variable particularly in the monsoon season and that the mean monthly reference evapotranspiration estimated for the study area showed a high inter-annual variation with values between 2.45 and 8.47mm/d in the month of December and May, respectively. Groundwater recharge analysis revealed that rainfall is the main recharge component in monsoon season (65% of total recharge). Net recharge in the monsoon season is 129.2 million m³, whereas it is negative (-38.4 million m³) during winter season because groundwater abstraction by tubewell pumping is higher than the recharge. Thus, the study area has been receiving a groundwater surplus of 90.8 million m³ during two crop seasons under the present cropping system. The increase in net recharge resulted in an annual groundwater table rise of 0.10m in the study area over the study period of 13 years. Since water table in the area has been rising continuously, suitable water management strategies has to be suggested to bring the water table down to a safe limit and to prevent further water table rise to ensure sustainable agricultural

production. Increase in groundwater abstraction by installing more tubewells and encouraging farmers to use saline groundwater in conjunction with fresh canal water could be one of the management options.

Keywords: Water resources management, waterlogging, semi-arid, water balance

056 Implementation of Urban Waste Water Treatment Directive in Albania

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The Urban Wastewater Treatment Directive concerns the collection, treatment and discharge of urban wastewater, but also of wastewater from certain industrial sectors. Albania needs to make due efforts for the proper approximation of this Directive.

This paper presents the results of the first study on this issue, completed in early 2009 by CARDS INPAEL project team: current gaps, challenges and recommendations, measures to be taken and costs to be afforded in order to achieve full approximation of this Directive in Albania in the way of country's accession to the EU.

A preliminary investment plan is drafted for the 15-20 years to come. Estimates have been made for 196 agglomerations along the 6 river basins of the country, representing a total wastewater load of 2,981,700 p.e. As water bodies sensitive to eutrophication have not yet been identified in Albania, it is assumed that all surface water bodies will be designated as "sensitive areas".

Different treatment methods have been considered according to the agglomeration size: for small agglomerations - pond systems and constructed wetlands, which may result in a significant reduction of construction and operational costs; for agglomerations of 2,000 - 10,000 p.e. - conventional treatment; for those larger than 10,000 p.e. - advanced treatment with higher removal efficiency for Nitrogen and Phosphorus.

The preliminary investment costs on the above assumptions are estimated to be about '2.4 billion, of which '0.9 billion will go for the Urban Wastewater Treatment Plants and '1.5 billion for the collection treatments. Operating costs build up ultimately to '52 million per year in the 19th year of implementation, when full compliance is expected. The overwhelming majority of costs will be the responsibility of the municipalities. Not necessarily these costs will be met through their own resources. Users of the sanitation services will contribute

through Support can be obtained also in the form of grants and soft loans from the EU, IFIs and other bilateral and multilateral aid providers.

Methods used comprise documents and legal framework overview, legal gap analysis, discussion with main stakeholders, identification of necessary implementation measures and their cost assessment.

Keywords: Wastewater, load, treatment, agglomerations.

065 Managerial Analysis of a Mixed Basin and its Future Scenario

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In recent decades, Brazil advanced juridically with the creation of specific legislation for water resource management in the country. But, in spite of this Law being from 1997, the States of the Confederation are still confronting difficulties in implanting its plans and projects, principally in regard to territorial planning with due environmental zoning and environmental protection activities. The area under study is a hydrographic basin of 41km² in Maringa county, state of Parana, more specifically, the Morangueira River (Ribeirao Morangueira) basin. Approximately 45% of the area is urbanized and the rest is used for agricultural purposes (soybeans, wheat and corn). This study elaborated an environmental diagnosis based on field studies, water quality analyses and hydrological analyses of the current situation and of the future scenario, seeking to determine the potentialities and fragilities presented by the area. Throughout recent years, the basin has been undergoing constant degradation arising from the urbanization process that is advancing in an unplanned way and, in addition, the agricultural areas that make up part of the basin use agricultural chemicals in an intensive way. Future projections show great hydrological imbalance in the area with the possibility of flooding and erosion processes and which, therefore, make management efforts necessary which are capable of implanting sustainable systems, principally in the urban drainage network.

Keywords: water resources management, basin, antropic actions

**066 Management Plan of a Hydrographic Basin with Emphasis
on the Control of Fecal Coliforms**

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The urbanization process in an accelerated and often disorder way has generated strong impacts on the environment, principally in reference to its water resources. This degradation is not simply limited to reduction of the quantity of water available and its uses, but also brings about loss in its quality, and in many cases this becomes irreversible. The present project undertook studies in the Maringa River (Ribeirao Maringa) basin, in the city of Maringa, state of Parana, Brazil. This basin is characterized by having use and soil occupation in a mixed way, for its springs are located in the urban environment and the rest of its drainage area is located in rural areas. Based on these characteristics, hydrological studies and water quality monitoring was undertaken along the main river through collection of samples at 9 well-distributed points. The studies were undertaken from February to September 2009, seeking to correlate the data in reference to fecal coliforms, taking variables such as rain and discharge into consideration. Although none of the points have presented values considered acceptable, Point 9 was that which presented the greatest rates. In the attempt to improve this problem and other problems related to degradation of the basin, a management plan was elaborated for preservation of the area and to improve control of potential sources of pollution.

Keywords: water resources management, basin, coliforms

**758 Land and Water Management for Precision Farming
in Newly Reclaimed Soils**

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This study aims at determining the profitability of precision farming (PF) in the newly reclaimed soils. The studied area is represented by an experimental pivot cultivated with maize in the Sixth of October Company for agricultural projects,

Ismailia province, Egypt, which is bounded by 30°24'02" and 30°32'16" latitudes and 31°57'36" and 32°03'06" longitudes. Two field practices were carried out during the successive summer growing seasons (2005 and 2006) to study the response of maize plants single hybrid 10(S.H.10) to traditional farming (TF year 2005) and precision farming (PF 2006) practices. TF that practiced by the farm workers themselves (year 2005) were observed and noted carefully without any interference throughout intensive field survey, deriving normalized differences vegetation index (NDVI) from satellite images to express plant health and its yielding in the different spots of the experimental pivot where a positive correlation between NDVI and yield was clearly observed. PF practices (2006) included field scouting, grid soil sampling, variable rate technology and soil and water management. PF management practices are represented by three approaches 1-fertilizer management, 2-Texture and natural drainage system management and 3- efficient water consumption use. Under PF, keeping resources, environmental and economic profitability were achieved, where a-variable rate application decreased fertilizers use and increase their efficiency affecting positively the environmental safety, b- natural drainage system was improved using natural vertical drainage system and c-consumption use for maize using SEBAL model with the aid of Remote Sensing and GIS techniques was improved ,where consumed 311978.4m³ under PF compared with 405696m³ water due to TF saving an amount of water equal to 93717.6m³ in the experimental pivot (153.79 acre)... However costs of applying PF were much higher than TF, the economic profitability (Returns-costs) achieved remarkable increase (129.6%).

Keywords: precision farming, SEBAL, remote sensing and GIS

080 Environmental Governance as an Alternative Solution to Global Environmental Problems

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Stockholm Conference was the first official comprehensive assembly that environmental problems came up the states' agenda. Although 30 years passed since Stockholm Conference, lots of academic research have done, international agreements, sanctions and thesis on sustainable development and green Technologies, the environmental problems like environmental degradation, poverty, famine and global warming increasing and going on and environmental problems are the main agenda item all over the World. On the other hand the gulf between

the rich and the poor or the developed countries and less developed countries is growing rapidly and environmental problems keep going the first agenda item. Governance approach is a multi body level governing process produced as a solution to crisis of structural adjustment policies all over the world. Governance approach is a participatory governing process also includes governments, states, intergovernmental organizations, civil commotions, voluntary organizations, non-governmental organizations, multinational companies, academics and media. Governance has taken as an alternative model while solving the environmental problems and policy making. In this context, the components of governance concept and its actors dealt with the study. And also the study aims to evaluate environmental governance's role in solving the environmental problems, the relations between environmental governance and sustainable development and the roles and effects of nation states, international organizations and multinational companies on these relations.

Keywords: Globalization, global environmental problems, governance, participation, Sustainable development

***086 Collaborative and Integrated Watershed Management (Ciwm):
Evaluation of Critical Success Factors in Beysehir Lake Basin***

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Collaborative and integrated watershed management (CIWM) is one of the major alternatives that emerged as part of the trend towards more holistic and participatory approaches to natural resource management. CIWM has evolved throughout the years, influenced by the different ecological, social, economic, institutional and political context in which this management approach has been implemented. Although scholarship on the factors facilitating or constraining collaboration in multi-stakeholder watershed partnerships is growing there is a need for research addressing the important issue how to sustain these collaborative initiatives. The present paper aims to investigate the critical success factors in CIWM. Which factors make the collaboration process successful? How can stakeholders participate into the management process? In order to answer these questions the paper addresses the Beysehir Lake Basin which is the largest freshwater lake in Turkey and evaluates: i) the sociocultural, ecological and geographic constraints

to CIWM; ii) the participants' approaches and beliefs; iii) the current participation level; iv) the success factors at the institutional cooperation and community participation level. The paper offers a systematic approach and analytical means to evaluate the critical success factors in CIWM with a combination of SWOT matrix and Analytic Hierarchy Process (AHP).

Keywords: Collaborative and Integrated Watershed Management (CIWM), SWOT, Analytic Hierarchy Process (AHP), Beysehir Lake

***090 Coordinated Water Resources Management
of Prespa Lakes at Transboundary Level,
According to the European Water Framework Directive***

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The Prespa Lakes suffer from serious deterioration of their habitats, the Macro Prespa Lake has shrunk, the Micro Prespa has been silted and the use of the water is extensive. Close co-operation between the countries sharing the Lakes is a prerequisite for sustainable management of water resources in the region and to ensure the international community's support for their sustainable management. Human activity in the catchment area of the Prespa Lakes covers fishery, tourism, industry, agriculture, forestry, and urbanisation, all of which means disruptive or polluting consequences for the Prespa Lakes. From past to present the handling of water resources in the area of the Prespa Lakes was and still is mostly driven by actual day-to-day needs and technical possibilities of each of the riparian parties and countries. A water management that follows the general of European Water Framework Directive criteria has not yet been established. To date only general objectives and goals for the management of the Prespa water resources have been defined and agreed upon by the three countries. Consequently it might be concluded that the water resources are being exploited rather than managed. Management of transboundary waters is a complex issue, which has to overcome many challenges in order to achieve its environmental objectives. The purpose of transboundary co-operation, however, is not only to preserve international water objects and the unique natural conditions of their environment, but also to secure the interests of all parties as well as the interests of local residents in the border region. To find a common approach to the governance of transboundary waters is further complicated by differing

legislation, water management practices, institutional structures, languages and cultures of the bordering countries. Nevertheless, co-operation in managing the quality and quantity of transboundary water bodies also presents an opportunity from which all of the parties involved can benefit. The new European water policy, the Water Framework Directive (WFD) that came into force in 2000 and is based on a river basin approach, addresses the issue of transboundary cooperation not only across the EU member state borders, but also beyond. The Prespa Lakes form a transboundary water body shared by Albania, Greece and Macedonia. By virtue of Greece being an EU country and Macedonia and Albania not being association countries as of yet, the Prespa Lakes form the border between the EU and non-EU, i.e. Albania and Macedonia. Being the largest international water body on the Balkans, the Prespa Lakes are very important for the region. So far no agreements have been formulated between the three countries regarding the specific requirements of water management of the Prespa Lakes, nor has a Joint Transboundary Water Commission responsible for the preparation of such an agreement been established. However, a Tripartite Agreement on the Protection and the Sustainable Development of the Prespa Park Area is being prepared, which partly addresses water management issues. In view of the legal and geographic situation, it is suggested that the future water management of the transboundary Prespa basin be set up in the spirit of, and according to the requirements of the Water Framework Directive of the European Union. In addition, water management should follow the "Dublin Principles" and other conventions relevant for the area. It is suggested that the national Governments of Albania, Greece and Macedonia establish a "Transboundary Prespa Water Commission" (TPWC). This body should represent the interests of the three countries as well as those of the local communities and of the relevant NGOs of the Prespa Catchment. At the beginning, the TPWC should be responsible for the formulation of a basic agreement on water management of the Prespa Lakes. After acceptance of the agreement, TPWC could become the tripartite body that would be responsible for coordination, control and supervision of the implementation and execution of the water management plan. To fully comply with these requirements, the TPWC should be set up as a body with strong water resources competence to cooperate with and to direct the national territorial authorities with respect to water-related issues. The elaboration of a water management plan requires the definition of respective objectives and practical principles that can also be understood as work steps or guidelines. To assist and accelerate the necessary debate, 19 practical principles for a Transboundary Prespa Water Management Plan are proposed.

Keywords: water resources management, European water directive, transboundary co-operation, Dublin Principles

**097 Public Participation: a Step Towards
the Sustainable River Restoration and Dam Management Process:
an Evidence from Balochistan Pakistan**

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Water demand is increasing in the countries such as Pakistan due to over-population and changes in socio-cultural norms, agricultural practices, lack of awareness about the latest irrigation techniques and a growing trend among the farmers towards the cultivation of high delta cash crops. At the same time, available water resources are insufficient to meet water requirements. In view of the seriousness prevailing in the country regarding the water scarcity, the government of Pakistan is taking the initiative of river restoration and rehabilitating and constructing dams throughout the country. The misfortune is that the public participation is not ensured in these mega projects irrespective of the fact that there could be serious public concerns in this regard. Consequently, local populations start creating hinderness in the on-going project activities, which ultimately have adverse affect on the sustainability of the project. To facilitate the dialogue process and to remove the misconceptions, National Engineering Services Pakistan launched a social mobilization study of the Mirani dam project, situated at Dasht River, located in Makran division of Balochistan Pakistan. The study was carried out between the periods of September 2004 to December 2007. The primarily analysis of the study shows that local population, have serious concerns regarding the project due to emerging of issues like inundation of upper riparian, resettlement and disturbance of water right of lower riparian etc, which were correlated mostly with the basis of poor public participation. The people often went on strike and stopped the construction work of the project, which caused delay for the completion of work within the specified time frame. Later, by ensuring public participation, i.e., they were provided proper forum to discuss their issues and concerns with the relevant organization, their concerns were removed gradually and they started cooperating with the project activities. Therefore, the need is to launch the awareness campaign on regular basis, so as to avoid the communication gaps, which ultimately have dual impact, user satisfaction and sustainability of the dam project.

Keywords: Awareness Campaign, Social Mobilization, Public participation, Community concerns, Communication Gap

102 Integrated Water Resources Management to Solve the Climate Change Impacts on Drainage Congestion - a Case Study in Sagarkhali Project (Bangladesh)

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Abstract A better drainage facilities in an irrigation project is very essential for managing the multiple functions of land and water resources in order to achieve an optimal mix of economic and social gains, sustainable natural resources management and a healthy environment due to climate change. Participatory Rural Approaches and mathematical modelling techniques are both necessary to model the interactions between stakeholders and water resources. A detailed modelling and feasibility study on Sagarkhali-Borobeela Drainage Project demonstrates on solving the severe problem of drainage congestion at Sagarkhali basin in the G-K project area which is located in the South-West region of Bangladesh. The construction of the Ganges irrigation canal reduced the drainage of Chapaibeel but obstructed the natural drainage of about 37,500 ha of Sagarkhali basin the low-lying area upstream of the Ganges canal causing drainage congestion problem. This study, addresses the issues leading to the resolution of the conflict through use of mathematical models based on people's participation and to increase agricultural and fish productions, thereby improving the living conditions of the people of the project area in an integrated way. Integrated mathematical model has been calibrated and validated for the study area and different technical options for improvement have been developed. The options identified and subsequently clarified through questionnaire survey of the "socio-economic and environmental studies" were tested eventually through model runs. Ten technical options for drainage improvement have been tested to find out the feasible options. Only few technically promising options have been tested for the feasibility criterion e.g. sociology, agriculture, fisheries, environment and economic analysis. People's participatory based workshop was conducted to seek consensus from them so that the conflict may be resolved in an amicable manner. Findings from the selected options along with flood maps generated which were discussed at the people's participatory workshop. People from both upper and lower riparian reaches participated in the workshop to reach upon a consensus view on the final option, which is mutually acceptable to them. Model study along with peoples participatory workshop suggested the option in mitigating drainage problem in Sagarkhali area through the construction of a syphon under main Ganges irrigation canal to drain Sagarkhali basin through Chapaibeel, Kumar river. From the findings, a syphyon along with a part of recommended option have been constructed for Sagarkhali basin area and found satisfactory performance.

Keywords: Participatory Rural Approaches, Mathematical Modelling, Stakeholders

**112 Mobilization and Management Strategies of Water Resources
in District of Lissazounme (Benin)**

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In the district of Lissazounme, the problems of water supply are still recurring and it is important to arrest the modes of mobilization and management of water resources by the populations. The inquiries of ground with the populations and the other actors allowed to collect the data and the information on the modes of mobilization, preservation, usage, and management of water resources in the environment of study. Individual interviews, investigations of groups, and participating observation were the techniques are used. The data processing and the information was remitted in the use of the statistical and cartographic tools. The results show that the District of Lissazounme is characterized by the absence of rivers and plans of water and a geologic context which does not facilitate the access to the groundwater. These two constraints make naturally difficult the water supply of the populations of Lissazounme. In front of this situation, the populations developed strategies (holes of water, traditional wells, tanks, etc.) who allow them to collect rainwaters. These waters of already doubtful origin are preserved in traditional bowls (jars, basins, tins, etc.), what exposes the populations to water affections. It is thus advisable that the local and central authorities conjugate their efforts to help the populations to reach the drinking water within the framework of the Management Integrated Water resources (GIRE).

Keywords: Lissazounme (Benin), resource in water, mobilization, management, difficulties

**113 Transboundary Environmental Cooperation -
the Case of the Prespa Lakes**

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The issue of transboundary water resources management becomes highly important not only because of water scarcity, but also as a result of its sharing across national boundaries. Approximately 40% of the global population lives in transboundary water basins, shared by more than one country, emphasizing the

need for concerted management of transboundary water bodies and harmonization of policies. Under this view, water should be managed in an internationalized way, integrating methodologies and techniques. The Water Framework Directive 2000/60 introduces integrated water management, providing a common framework between countries for the co-operation, planning and management of water resources. Furthermore, the concept of peace parks seems to gain further recognition. Those neutral buffer zones between neighbouring states with tensed relations are the most well-known examples of the newly introduced concept of environmental peacemaking. The field of environmental security focuses almost entirely on the conflict dimensions of resource scarcity or abundance and environmental stress, while environment and its confidence-building and peace-making opportunities only recently became the point of attention in research. The Prespa Lake System consists of Micro and Macro Prespa, which are shared by Albania, Greece and Republic of Macedonia, countries with tense international relations over a wide range of issues. The area is characterized by its natural beauty, its great biodiversity and its populations of rare water birds, including the largest breeding colony of the Dalmatian pelican in the world, but it is also remarkable for its cultural sites. The Macro and Micro Prespa lakes and their catchment basin are regulated and protected under a series of different National, Community and International legal instruments. The creation of the "Transboundary Prespa Park" by the prime ministers of three neighbouring countries in the year 2000 had a further aim beyond solely the environmental protection of the area, but also focused on the transboundary cooperation and the possible harmonization of the international relations between the three countries. This paper examines the potential of environmental cooperation as a platform for dialogue as well as an instrument of stability between the three countries. The analysis will be based on experience gained from past joint cross-border research projects between the three countries in the Prespa Lakes region. Moreover the role of local and national environmental cooperation in the area towards international stability will be thoroughly examined as well as the possibilities and limitations of the scientific approach in settling disputes.

Keywords: Transboundary Environmental cooperation, Ecosystems Management

220 Water Need of Agricultural Sector in Tuscany (Central Italy)

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The climatic analysis of the last years and the forecast about the future scenarios evidence as territory of the Tuscany is subjected at more often frequent water emergency situation. The periods more critical are those when the water needs of different sector, productive and not, exceed respect to the material resources. The requirement of a accurate monitoring system of water resources, in term of offer and demand, is very important to carry out a rational management. The Interdepartmental Centre of Bioclimatology (CIBIC) has elaborated a method to estimate water needs of agricultural sector. This method considers and improves the previous methodology present in literature. Within the research, a software to quantify the regional water need, has been developed. This system acquires data from industrial civil and agriculture sectors and provides information about the total water drawing in Tuscany. The application of improved methodology has permitted to quantify the water need in agriculture updated to 2008 in all municipal districts of Tuscany. The total demand, estimated in 2008, is smaller than in 2000; Pistoia, Grosseto, Arezzo e Siena result the provinces with more water request. The crops more diffuse in these territory are nursery gardening , maize and vegetables. The acquisition of meteorological data will permit a further improvement of methodology. The evapotranspiration and the precipitation during the phenological phases of the crops could be consider to conduct a better evaluation of water needs. The analysis of the trend in the last year permit the diffusion of information useful to adopt a rational and sustainable management of water resources in Tuscany territory or to identify the critical period with more effectiveness. The developed software can quantify the water needs of different sector in every municipal district and provides data in different level of aggregation.

Keywords: water resources, water requirement, methodology

**123 Cesspools: How it Contribute to the Water Budget
as an Alternative Resource in Northern Cyprus**

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The over extractions in the agricultural sector in the country caused the coastal aquifers to be salinated and some others in the interior region to be depleted since 1960s. To overcome the situation the former governments have taken some measurements like; rationing the water supply to the users, water transport from Turkey by medusa, modernization of the irrigation system in the agricultural sector and waste water reuse in garden irrigation. In this study the rainwater harvesting from the roofs will be investigated and the positive effect to the water budget will be analyzed in which the water is expected to be in drinking quality. The rain water collection is a random process in quantity since it depends on the intensity which is showing great variation even in regional basis. The capacity of the reservoir with minimum losses takes a great role in designing of such systems. The search of the minimum and maximum patterns that can be extracted from the system based on long and short periods takes a great role in designing cesspools and will be investigated and discussed in this pilot project.

Keywords: cesspools, Northern Cyprus, harvesting, IWRM

**129 Greek and Turkey Contribution to the Restoration Technologies
of Balkan Wetlands**

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Two wetland sites, one in Greece and one in Turkey, will be investigated by a group of scientists from both countries, in order to find out their environmental status, to investigate the problems they are confronting, and maybe to propose some ways that would lead to their remediation. The wetland that is chosen for Greece is the Cotychi lagoon, in Peloponnesus, Greece. It consist a very important wetland for Greece, because it supports a great diversity of fauna and flora. Its

importance has been recognised internationally and the lagoon is protected by Ramsar Convention. However, the local people have not recognised its vital and crucial role for the surrounding area and local economy. The overexploitation of its natural resources (fish, wood, sand), which in combination with irrational agriculture, livestock, wild fires and the arbitrary disposal of debris and solid waste make the protected area to appear degraded on a regular basis. The wetland on Buyuk Menderes Delta region, which belongs to the national park of Mykale peninsula, is encountered on the West Coast of Central Anatolia of Turkey opposite of the island of Samos. The Delta region of the national Park is a marshy area with a few lagoons, salty swamps and mud planes with an overflowing character. Its biodiversity is rich and enhosts 18 endemic flora species which are critically endangered. The Delta is under protection through international Bern and Rio agreements and Barcelona Convention. As a whole this international park does not consist for Turkey only an environmental value but also a cultural one due to Greek antiquities of the area under protection. The whole park is under stress for the same hazards and environmental problems which threat and the wetland of Cotychi. During the implementation of the project, the research team will concentrate on the negative impacts to the environment of the two protected areas and a tailor - made effort will be applied making use of selected environmental indicators (European Environmental Agency - Core set of indicators - Guide, Technical Report No 1 / 2005) in order complex environmental phenomena to be emerged and depicted in a simple and easily understood way to the common citizen.

Keywords: Wetlands, Restoration, Hydrology

141 The Lithological and Hydrologjical Characteristic of Peja's Lumbardh Puddle

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The water resources of a location has determinant importance for the development strategy of all activities of population as from these factors are depending the possibilities of a location development. In this study were treated the issues of territorial definition of Peja's Puddle Lumbardh as well as the net of running water and water sources of the Puddle and the average bringing water of these flows and resources. It was treated as well the issues which concerns the orografic, pedological elements and climactic of Puddle as well as the population of

residences of this zone which is included in this study. Having under consideration the water capacity of Peja's Lumbardh Puddle and the needs of the population for the use of these water and knowing that the farm grounds are those who mostly use this water in the region because of they spend 2/3 (two of third) of puddle water quantity while the rest quantity of puddle water is being used for the drinking water and for the other needs. In this study, we tried to introduce the present ways of using water potential for this zone, the present management and the consequences of degradation of water sources for this zone.

Keywords: Water, Lumbardhi, Puddle, Orographic, Pedology , Climatic, Residences.

148 The Function of the Butoniga Drainage and Retaining Channel in the Integral Management of the Botonega Accumulation

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The retaining Butoniga channel represents one of the most significant water-managing facilities of the Istrian peninsula. Its purpose is related solely to the protection against high waters and erosion, as well as to the irrigation of downstream agricultural lands in the central and lower part of the Mirna River. In the last few years considerable changes in the geomorphology of the Butoniga channel, primarily in its lower part, have been noticed. This article addresses basic geometric and kinematical characteristics of the Butoniga drainage channel and describes the throughput capacity of the channel in winter and summer time as well as significant appearance of its deformability during the last ten years. The measures for the improvement and rehabilitation of the Butonega earth channel and the criteria for the channel throughput capacity increase and decrease of its erosive activity are given in the Conclusion.

Keywords: the Butoniga channel, erosion, deformability, throughput, coefficient of roughness

**150 River Restoration Identifying Problems
and Developing Strategy**

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The restoration practice wild world is relatively new approach in environmental engineering. As the restoration projects are interdisciplinary the initial steps on identifying problems and getting organized are essential for the project success. The restoration initiative may come from several sources. In problem recognition and restoration effort initiation may be involved communities and any number of interested groups and individuals. Projects that come from a logical process of plan development tend to be more successful.

Regardless of the origins of the restoration initiative or the introduction of the proposed "solution", it is essential that the leadership for the restoration planning process be at local level; i.e., the people who are pushing for action, who own the land, who are affected, who might benefit, who can make decision or who can lead.

This paper deals with basic steps in getting organized, development of restoration goals and objectives, measurable attributes in definition of stream corridor conditions, planning procedures, and ecosystem recovery alternatives. The paper will outline some of the major considerations that need to be taken into account in developing restoration plan. Although restoration projects that include installation of designed measures are common, the "no action" or passive and low-cost alternatives might be more ecologically desirable.

**153 Analysis of Decreasing Tendency of Domestic Water Use
Per Capita in Tokyo**

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The amount of water supply per capita in Japan increased with economic growth reached a plateau in the 1990s and then has decreased over the last 4-5 years. The amount of domestic water use per capita in Tokyo also shows a gradual decrease over the last 6-7 years. One reason for this trend is that newer appliances

with advanced water saving technology, such as dishwashers and water-saving washing machines have been developed and supplied to the market under the condition in which the usage rates of basic water-related appliances, such as flushing toilets and private baths, have approached a degree of saturation. In this study, the amount of domestic water use was quantified by estimating the usage rates of various water-related appliances. Tokyo Metropolis was selected as a case study because it was relatively easy to obtain detailed data from Tokyo Waterworks Bureau. In the analysis, the calculations for domestic water use reproduced actual usage figures from 1998 to 2008. New model was proposed for the projection of domestic water use in Tokyo, incorporating simulated usage of a range of water-related appliances including advanced water-saving appliances. The amount of domestic water use per capita was calculated according to the proposed model from 1998 to 2008 and compared with Tokyo's actual data for that time period setting the parameter at the base year of 1997. The preliminary data of the amount of domestic water use per capita in Tokyo and the domestic usage rates of conventional and water-saving appliances obtained from the field survey conducted by the Tokyo Waterworks Bureau were used in this calculation. Novel aspect of this study is that the decreasing trend of domestic water use per capita in recent years was expressed by modeling the introduction of advanced water-saving appliances.

Keywords: domestic water use, Tokyo, water related appliances, water saving

163 Coastal Degradation Induced by Anthropogenic Impacts Along the North Bulgarian Black Sea Shore

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The present study explores modification of 10 km long coastal section between Albena resort and Balchik town, North Bulgarian Black Sea coast. The coastline alterations have been caused by armouring of this section as a road connection with solid coast-protection structure of a dike type. Dikes are onshore structures with the principal functions of protecting low-lying coastal territories against flooding and they are one of the most used defence methods along the Bulgarian coast. The research focuses the attention on the assessment of human-induced degradation at the study area: coastline shifting, sand losses and interruption of sediment supply from the cliff. Data from topographic maps (1:5000) and field

surveys data were used to investigate the coastal modifications, as the analysis and accurate assessment were performed into GIS environment. Dikes provide effective wave breaking and sufficiently protect the coast against flooding. On the contrary, such structures stop the exchange between land and sea, and vice versa, disrupt sediment input from the cliff, restrict public access to the water-area and decrease coastline attractiveness. In that case, as a consequence of dike construction, the 10km long natural coast at this section was armoured and the whole coastal ecosystem was forever destroyed.

Keywords: Bulgarian Black Sea coast, erosion, sediment sources, coastal defence

164 Establishing of Monitoring Network on Kosovo Rivers (Drini I Bardhe, Morava E Binqes, Lepenc and Sitnica)

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The main goal of this work was to establish a monitoring network on main rivers of Kosovo. We aim to apply WFD (Water Framework Directive) in Kosovo as soon as possible, and our research could be the first step towards it. Waters of the rivers Drini i Bardha, Morava e Binqes, Lepenc and Sitnica, which are of supra-regional interest, are investigated systematically for the first time. Statistical methods are applied to find locations where integrated water resources management can be suggested. Sediments of these rivers were also investigated at the same monitoring points and results have recently been published by us. In this paper we present results of mass concentrations of ecotoxic metals: Cu(II), Pb(II), Cd(II), Zn(II) and Mn(II) in waters of four main rivers of Kosovo. The natural aqua equilibration is done by Anodic stripping Voltammetry (ASV), AAS and UV-VIS spectrometry. Also some physico-chemical parameters are determined: water temperature, electric conductivity, pH, alkalinity, etc. Results of concentrations of ecotoxic metals in water are compared with concentrations found in sediments. Also, we compared the data with some available results from the past, during the period 1978-1983. The last available results were from the year 1989. Our results are showing that concentrations of Cu and Zn in water are low and pose no risk for living organisms. But, contamination with Pb and Mn is high at one station on Drini i Bardha River and at all stations along Sitnica River. Cd in high concentrations is measured only at two stations, one on Morava e Binqes River and one on Sitnica River. Comparison with available results from the past show that water pollution

decreased since 1989, what is explained with closing of heavy industry since then. Continuation of water and sediment monitoring is highly recommended, as well as establishing of permanent network of monitoring stations.

Keywords: Monitoring network , Water Framework Directive , Rivers of Kosovo, Ecotoxic metals , Pollution

165 Developing Hydro-Sources for Environment and Sustainability in Turkey: the Southeastern Anatolia Project (Gap) as a Case Study

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The Republic of Turkey has a special place in the Eurasian and Mediterranean from the respects of both its social-economic structure and its geo-politic and geo-strategic importance. It is also the best model for the Islamic World by combining the traditional and modern life styles. In the recent years, there have been many opportunities flourishing through the development of Turkey. One of these is unvalued rich agricultural and hydro-sources in the Southeastern Anatolia Region. Turkey, which has been trying to make use of these resources for years, reached a certain stage today. The Southeastern Anatolia Project (GAP), one of the most important projects in the world to develop the remarkable natural resources of the world, is accepted as a change for getting benefit from rich water and agricultural resources of the Southeastern Anatolia Region for the Eurasian. The GAP Project has been considered as a regional development projects through years, but the dimensions of sustainability, protection of environment and participatory have been attached to the master of the project in recent years. The GAP Project which take the responsibilities of some important tasks and functions in the future's Eurasian World is giving hopes and coming fertility to its region. In addition, the project will provide some contributions in the respect of water sources and agricultural development in the Eurasian. The aim of this study is to introduce this region having rich natural hydro and agricultural resources and the GAP Project. For this reason, firstly, the natural potential of the region will be introduced. Second, the GAP Project aiming to make the country use of these natural resources, especially water resources will be presented in detailed way. In the third stage, the projects being processed for protecting the natural sources and environment, making use of water will be analyzed. In the last stage,

strategies and policies to develop and to protect the natural resources of the region in short, mid, and long terms will be proposed for the Turkey's and the Eurasian's benefits.

Keywords: Natural and Hydro Resources, Environmental Economics and Sustainability, Southeastern Anatolia Region and Southeastern Anatolia Project (GAP).

167 Hydrometeorological Monitoring Network in Turkey

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Hydrometeorological monitoring networks have a key role to determine hydrologic cycle parameters. Structure of network and operating institutions varies with countries. The objective of this study is representing of Turkey hydrometeorological network. Therefore, Turkey hydrometeorological network is presented in the context of institutional structure, monitoring network, measurement techniques and case studies. There are three governmental institution which are responsible for hydrometeorologic monitoring in TURKEY. These are State Hydraulic Works (DSI), Electrical Power Resources Survey(EIE) and State Meteorological Services(DMI). DMI, EIE and DSI are responsible for meteorologic, hydrologic and hydrometeorologic measurements subsequently. DSI has approximately 2000 stations for discharge , precipitation and evaporation monitoring. EIE has 350 for discharge and DMI has 458 stations for meteorological parameters observation. In DSI conventional and advanced measurement techniques are in use at the same time. The modern methods are currently implemented in DSI, for example; discharge measurements by ADCP, river level monitoring by ultrasonic level sensors, telemetric communication by GPRS, VSAT, GSM etc. In the meantime DSI is studying on water database project . There is a EU funded Project about Meritza River Basin Flood Early Warning System between Turkey and Bulgaria. In this study, we have presented new methods for measurements, existing hydrometeorologic network in Turkey, information about Meritza Project , Water Database Project.

Keywords: hydrometeorological network, measurements, database

178 An Educational - Promotional Program for Waste Management and Environmental Protection for the City X

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In this paper is pointed out the purpose of education for the waste management and environmental protection as well as what is considered as the quality of education and promotion of proper treatment of waste and environmental protection. In this sense, in the educational and promotional program for waste management and environmental protection, which should be brought and carried out in each city, is representing a strategy according to objectives (advertising, marketing, short and long term ones), defined target groups (so, every group is sent messages in accordance with its characteristics and the messages are understood as well), key measures and actions for achieving the set goals and the program for scheduling the activities. Within the strategy and the rest of the key measures, especially is scoped the role and importance of the Center for Development and Protection of the Environment (it should be founded). At the same time, the strategic approaches in the work of the Center are numbered, its basic tasks, methods and forms of work and program features and activities for increasing the level of knowledge and skills in that field. Finally, the desired effects in protecting the environment can be expected only by the implementation of continuous education of the social groups and the systematic promotion, based on the designed programs. Otherwise, in solving of the environmental problems it continues to be "discussed" by those who do not understand the problem and they don't know how to communicate, but they do know how to blindly defend their "interests".

Keywords: education for the environment, methods and forms of work, waste management, the systematic promotion, quality of communication, concerted action by interested factors, positive approach, democratic dialogue, partnership, agreement

179 Hydrogeological Framework for Potential Groundwater Resources in the Whole Red River Delta, Vietnam

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The Red River Delta is one of two biggest deltas in Vietnam. People living in the delta depend entirely on groundwater for their domestic water. However, the aquifer system in the whole Red River Delta remains poorly understood due to the lack of available data. Recently, we were nominated to construct a hydrogeological database. Using these valuable data contained in this database, this paper analyzed the best number of 778 boreholes including well logs for the first time in order to identify the entire hydrogeological framework for potential groundwater resources. Great efforts have been made to establish and analyze hydrogeological maps, cross sections. As for the results, we found that groundwater mainly exists in Quaternary unconsolidated sediments as porous water forming the topmost Holocene unconfined aquifer (HUA) and the shallow Pleistocene confined aquifer (PCA) sandwiching the Holocene-Pleistocene aquitard (HPA), while cleft and karst water exist in consolidated Neogene formations and Mesozoic rocks constituting a Neogene water bearing layer (NWL) and Mesozoic fractured zones (MFZ), respectively. PCA is widely distributed to about 80% in the southern part of the Delta. It serves as the highest groundwater potential and the most important aquifer for water supply. HUA is also widely distributed about 75% in the south and has a high groundwater potential. NWL and MFZ, placed below PCA but exposed in the border of the Delta, are minor sources for local domestic water supply only. These findings are indispensable for further groundwater analyses needed to ensure the sustainable use of groundwater resources for the high-security water requirements in the Delta, but have never been completed sufficiently before due to the unavailability of large-scale basic data sets.

Keywords: hydrogeological database, well log, aquifer system, groundwater resources, the Red River Delta, Vietnam

**229 New Approach to River Engineering:
Case of the Juzna Morava River in Serbia**

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The Juzna Morava River is a large river in the Velika Morava Basin, and extremely important to Serbia in water management terms. Additionally, the valley of the Juzna Morava has a much broader national geostrategic, social, and economic significance. In view of the multitude of issues and the importance of the river, any river engineering concept needs to address all key aspects. Based on the goals of river engineering, both the priorities and the socioeconomic conditions under which a project is implemented must be ranked. The main goals of protection against the adverse effects of water in the Juzna Morava valley were defined more than 50 years ago. They include: protection of riparian lands against flooding; protection of roads, railroads and bridges; stabilization of the river course; and control of fluvial erosion. These goals have largely been achieved through extensive river engineering projects. However, detailed field reconnaissance of the river and its valley, as well as in situ investigations and studies, show that existing protection system has not been fully completed. In the course of planning of supplemental river engineering activities, a contemporary concept was applied which is, contrary to traditional river engineering approaches, based on the harmonization of socioeconomic, water management and environmental objectives. The definition of these objectives addressed all universal or specific environmental postulates, the most important being: the maintenance of a wide river corridor; the conservation of the highly complex floodplain biotope, including a mosaic of diverse habitats, which is very important from a biodiversity perspective; the preservation of the variability of hydraulic and morphological conditions of the flow; and the development of riverbanks based on synchronized hydraulic engineering requirements (prevention of fluvial erosion) and environmental requirements (conservation of natural habitats).

Keywords: river engineering, environment

230 An Outline of System Techniques for Analysis of Water - Resources Systems

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The existence and development of the civilizations was always closely related with utilization of the water resources. Parallel with the rise and fall of the empires in the history, in the search and demand for water as substantial mean for life, there was the development of hydraulic engineering as an important discipline, which was enabling water usage for different purposes. Integral part of the hydraulic engineering is the management of water resources systems. In this paper we will give an outline for the system techniques (simulation and optimization) that are being used for analysis of water resources systems. An overview of the early beginnings of the creation of water resources systems for integral use of the water will be given. Afterwards, the process of application of the various system techniques will be analyzed, from early period of application, the period of establishment towards the present advanced system techniques that are used nowadays. Also, some examples will be shown for application of system techniques on water resources systems in Republic of Macedonia.

Keywords: Water resources, goals, system techniques, analysis

236 An Advanced Irrigation Advisory Program

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Irrigation management advisory services must achieve significant advances in analytical capabilities in the next decade or two. Increasingly critical water shortages are forcing adoption of deficit irrigation strategies that require precise control of soil water conditions in order to manage (rather than avoid) crop water stress. Additionally, increasing waste water reuse will compel greater reliance on bioremediation in the rhizosphere for distributed, low cost tertiary treatment of irrigation return flows even before they leave the root zone; this too will depend upon precise management of soil water movement, dwell times and root system

contact. These and other trends in irrigation practice imply a need for more sophisticated irrigation advisory services than are available today. The proposed paper deals with a comprehensive, web-based decision support program developed specifically to support irrigation management when water supplies or delivery system capacities are limited. The program has been developed with US Dept. of Agriculture funding in anticipation of a time in the near future when the crisis of sustainable water supplies will have become acute, and in fact, such 'next generation' advisory services are already needed in many areas of the world. The program is an order of magnitude more sophisticated than other irrigation scheduling programs developed in recent years. It is user-directed, allowing individual managers to utilize their own experience, awareness of constraints and individual preferences in development of feasible, quasi-optimal irrigation management strategies. It explicitly models application efficiencies associated with different irrigation strategies. It supports estimation of crop yields, economic analysis and conjunctive management of multiple fields that share a common water supply in order to facilitate optimal allocations of limited water. Details of the program will be presented, and experience and insights gained by program developers and client farmers in pilot applications of the program will be discussed.

Keywords: Deficit irrigation, management, scheduling

244 Contribution of Hydro Potential in Macedonian Power System

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As a part of the overall EU energy policy for energy mix achieving stable electricity supply and sustainable development, Macedonia moves towards promotion of "green electricity" production and implementation of Renewable Energy Sources (RES) in the electricity market. The hydro power is the most exploited renewable energy for electricity generation in Macedonia. In this paper Macedonian hydro potential will be presented. At first categorization of existing ones and planned Hydro Power Plants (HPPs) will be done. Classification will be made according to the power installed capacity, in other words on small and large HPPs. In the paper, updating data for water inflows of existing and planned HPPs will be presented. Also, taking into account the hydrology conditions (dry, average and

wet), the evaluation of expected annual electric energy production of the HPPs will be made. In the analysis, the contribution of hydro potential in the Macedonian Power System, comprised of TPPs and HPPs, will be included.

Keywords: hydrology, Hydro Power Plant, electricity, generation

214 Protected and Proposed for Protection Hydric Monuments in Kosovo 2002-2008

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Despite being a small country, Kosovo possesses a diverse hydrography with permanent and temporary water-flow bodies. Geographical position, geological, pedological, hydrological composition, landscape and climate impacted the creation of many hydric monuments with rare natural and scientific values. Some of these are: Mirusha Waterfalls, The Spring of Drini i Bardhe, Gradishqe Canyon, Rugova Canyon, Thermo-mineral Spring in Banja (Banja e Pejes), etc. Protected areas are an efficient legal instrument for conservation of natural heritage values. The national network of protected areas is consisted by 97 nature protected areas with the total surface of 46,362 ha or 4.36% of Kosovo territory. Among them 1 National Park, 11 nature reserves, 82 natural monuments, 2 Regional Nature Parks and 1 Forest Park. 16 of these areas are natural monuments with hydric values. During 2002-2008 period, about 58 new natural monuments areas are added to the register of protected areas with surface of 5.5 ha. 8 of these areas are hydric monuments. Also, 37 new hydric natural monuments are proposed for protection, most of them being water spring sources, thermo-mineral water sources, lakes, waterfalls, and river canyons. In addition to their nature values, these protected areas have tourist, health, scientific and educational values.

Keywords: protected area, hydric monument, natural value, Kosovo, hydric value

**248 Upper Sarmatian Aquifer in The Badeni-Dara Area,
Buzau County, Romania**

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This work presents the geomorphological, geological, structural and hydrogeological features of the Badeni-Dara area, which is comprised in the south-eastern part of Romania. The Upper Sarmatian fissural aquifer from this area supplies with drinkable water several localities, agrozootechnical units (e.g. farms, stables, vineyards etc.) and commercial enterprises. Geomorphologically, the Badeni-Dara area is situated on the Istrita Hills which pertains to the Buzau Subcarpathians. Geologically, the following chronostratigraphical entities have been separated: Burdigalian, Badenian, Sarmatian, Meotian, Pontian, Upper Dacian, Romanian, Romanian-Lower Pleistocene and Quaternary. Structurally, the Badeni-Dara area is located on the epiorogen folded inner flank of the Carpathian Foredeep. Hydrogeologically, in the study area there is an Upper Sarmatian fissural aquifer, represented mainly by limestones, subordinately by sandstones, sands, clays. The Upper Sarmatian deposits conformably overlay the Lower Sarmatian deposits or unconformably overlay Badenian or Lower Miocene deposits. Habitually, the limestones are white, grey-whitish or white-yellowish and their thickness is generally decimetres and, sometimes, the thicker beds are separated by diastema. The springs occur almost exclusively in the base of limestones and are reduced in number. Near the calcareous slope, the water from springs disappears in Quaternary deposits, the loss favored by coarse material, reaching to Romanian deposits, which are also permeable. The fountains are very rare, deep, with low yield and temporary. On the alignment Badeni-Pietroasa Mica-Dara, several springs with yield rate between 0,1 and 3 l/sec have been met. Generally, the waters of these springs are drinkable. Some springs have been captured to supply the following localities: Badeni, Pietroasa Mica, Pietroasele, Dara, Sarata Monteoru, Gura Saratii, Merei, Stalpu, Ciobanoaia and Zoresti. Broadly, the recharge of Upper Sarmatian fissural aquifer is done from rainfalls and the surface waters infiltration. The groundwater from limestones are accumulated in fissures, on the fault planes and the stratification planes.

Keywords: Romania, Badeni-Dara area, Upper Sarmatian deposits, lithostratigraphy, tectonics, fissural aquifer.

304 Co-Conception of Flood Management Solutions: Riverscapes to Facilitate Dialog Between Dry Dam Designers and Biologists

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If involved late in flood mitigation projects, biologists can suggest only minor changes - a fortiori after the computations are completed. We advocate that conception should be multidisciplinary from the early stages, to ensure a better compromise with biodiversity preservation. Therefore, specialists need to efficiently exchange information and share common conceptual views; riverscapes and their associated biodiversity appeared excellent tools to facilitate discussions. Riverscapes formulate the results of a careful local analysis: biologists propose a hierarchies riverscape typology, including trained reaches, where the potential biodiversity and a rough view of processes are described. Comparing the shift of types caused by different technical solutions will then guide the choices. A riverscape typology was built for Polish mountain rivers. Referring to this typology does facilitate discussions to adapt bed armouring to what is necessary for dry dams and river training, and to discuss further adaptations in cross-sections. Conclusions drawn in one context are not necessarily valid elsewhere; the approach requires to build the typology locally and to organize a multidisciplinary think-tank to come up with relevant operational solutions in a reasonable time lapse. We also trust that riverscapes could be used as a basis for more detailed multidisciplinary research.

Keywords: integrated flood management, riverscapes, dry dams, river training

250 Mitigation Measures and Extraction of Floating Debris from Hydroelectric Power Plant Reservoir Zvornik

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Many non-sanitary waste disposal plants are located in floodplain areas. During flooding events municipal waste is forced into the river system and transported away from the plant. The accumulation of debris causes pollution of water bodies

and disturbs activities related to the use and regulation of water resources. It is recognized that there is an increasing amount of floating debris in the dam associated with the Zvornik Reservoir. As the last step at the Drina River system of hydropower plants, this dam already has problems with accumulation of river debris. Therefore, since the only function of this dam is for overflow control, it is facing difficulties due to the increase in debris. The presented area of research examines the upstream watershed area (2418km²) of the Drina River between two hydroelectric power plant (HPP) dam sites, HPP Bajina Basta and HPP Zvornik. All the municipalities from both sides of the river, Serbia and Republic Srpska, have been evaluated for their contribution to waste occurring in the dams. A catalog of the regular municipal landfills has been done to establish the types of waste associated with each site. The irregular landfill sites within the watershed of Drina River have also been included in this analysis. Waste management and practices have been critically assessed giving insight into the origin of waste accumulating in the dams. This paper presents analysis that was done to determine the origin of floating debris, possible mitigation measures, and appropriate procedures for preventing the future accumulation of waste and its extraction from the reservoir.

Keywords: floating debris, municipal waste, environmental pollutions

**355 Towards Integrated Management of the Prespa Lake Watershed
- Models for Stakeholder Involvement
in the Decision-Making Process**

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The unique values of Prespa Lake ecosystem are being progressively eroded because of either changes in or intensification of human activities including inappropriate water and land-use management. Therefore, efforts are being undertaken to establish an integrated land and water management basis for maintaining and restoring the ecosystem health in the region. It has been recognized that the development of a management plan for the lake's watershed in accordance to the Integrated River Basin Management principles provides an excellent opportunity for doing so. In parallel to the process for formulating the Prespa Lake watershed management plan, attempts are being made for developing a watershed management capacity by establishing and operationalizing the Prespa Watershed Management Council (WMC). The WMC will be designed

to be an innovative cross-sectoral mechanism providing a platform for an integrated, multifaceted approach to watershed management planning in the region. Considering the importance of the WMC in the efforts for introducing and maintaining long-term mechanisms for integrated management of the Prespa Lake watershed, it is essential that clear roles and responsibilities of WMC and its members are defined. The purpose of this paper is to provide an analysis of the existing legal and regulatory framework for integrated watershed management in the country, to carry out an institutional and organization assessment given the local conditions of Prespa, and based on that to provide guidance on the composition, role and mandate of the Prespa Lake Watershed Management Council. The paper will attempt to adequately reflect the specifics of the broader national and transboundary context of the Prespa Lake watershed.

Keywords: Prespa Lake Ecosystem, Watershed Management Council

256 Partnership for Environmental Policy Implementation in Bulgaria

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Partnership for policy implementation is of essential importance for the success of any policy option, but especially of the one to raise public awareness in environmental problems and ways for their solution. Due to the complexity and great diversity of the environmental issues, partnership can be the key for environmental policy implementation because actions in the field of environment require relevant perception and understanding that can be achieved through collaboration between different parties involved, namely scientific community, policy and decision makers, business companies, non-governmental organizations (NGOs), citizens. Partnership between researchers and NGOs appeared to be particularly necessary in the process of environmental policy implementation and integration into the economic and social spheres. In the paper, amongst the many environmental issues of today, climate change is chosen because the policy to address climate change is an interdisciplinary and complex field that requires a wide range of policy options to be implemented in parallel. Based on results from a study on the role of Bulgarian environmental NGOs in the promotion of energy efficiency measures as one option of the policy to address climate change, the partnership between researchers and NGOs in Bulgaria is discussed. The good examples of such partnership in the country are not yet so many, whereas the

membership of Bulgaria in the European Union sets more and more requirements. Further efforts to establish new and to develop the existing partnerships are needed. The communication of relevant scientific results to the general public and policy-decision makers is proposed as area for most effective partnership between researchers and NGOs for timely implementation of environmental policy in the country.

Keywords: partnership, communication, environmental policy

311 Environmental Challenges in Balkan Countries with a Case Study of Albania: An Economic Perspective

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Climate change is becoming an imminent risk at the global level and countries are increasingly recognizing the need to adopt new and radical measures to reverse its effects. Environmental protection measures are already a crucial component of every new urban development policy under preparation in large and affluent countries, including the United States and the European Union. This paper discusses issues related to environmental protection in the Balkan region, with a focus on the impact of environmental policies on consumption and welfare. The first part of this paper provides a theoretical background of key factors that affect environment policies and reviews the ways in which Balkan countries are responding to environmental challenges. Comparisons with policies adopted in more economically advanced countries are provided. The second part of the paper deals with Albanian environmental problems and challenges to sustainable development, including urban waste management and pollution controls. In addition to a review of the Albanian regulatory framework and policies in the environmental arena, the authors use time series modelling in order to evaluate and compare data of waste and pollution in the last decade. The paper concludes with future recommendations.

Keywords: environmental economics, environmental policies, climate change, Balkan region, Albania

358 Water Charging Policy in Strezevo Irrigation System

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The irrigated agriculture is the biggest water consumer in the Republic of Macedonia. The ability and willingness to pay of the Macedonian farmers, due to numerous political, economical, social and other factors, are low. As a result of these, we had a poor irrigation water charges collection, because of which nearly all of the water economy enterprises are in a bad economical state. In this paper the development of the irrigation water charging policy in the Republic of Macedonia and especially in the Strezevo Irrigation System will be given. The legal regulations which affect this issue will be analyzed, along with the real shown influences on the irrigation water charging policy. Also, recommendations for improving the methodology for determination of the water price for different water uses. The undertaken actions in Public Enterprise Strezevo for improving the water charge collection and the results that have been achieved will be presented.

Keywords: irrigation water charging, willingness to pay

365 Hydrogeographic Characteristics of the Kriva Reka

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The river of Kriva Reka flow the waters of respective basin and present the main water resource of east part of Kosovo. The basin of this river includes many other branches which are short and has a small amount of water. The river channel has formed narrow alluvial valley, while in the surrounding of Kamenica the flood plain is broaden and the population, economic activities, agriculture, etc. are concentrated in it. The catchment until in the Kamenica is wooded, while the lowland part with more qualitative terrain is used for agriculture. The upland and mountain relief, slope of terrain and rainfall influence in the erosion, which influence in water level and discharge. The area of the Kriva Reka's basins is 612.5km², which include around 25% of the basins of Morava e Binces, part of

which is 5% of Kosovo's territory. Kriva Reka has other permanent stream flows as River of Hogosht, Desivojces, etc. which are important flows and important water potential of this area for development of agriculture and other economic and recreative activities.

Keywords: Kriva Reka, Water Level, Discharge, River Basin

363 Hydro Geographical Elements of Lume Bardhi in Peja

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For use of water assets, and protection from damaging their activity, is required knowledge of the water resources, this can be accomplished by knowing the hydrological regimes in concrete spaces. In Kosovo, every day more and more, the economy of water is worsening. In study, are given general hydrological characteristics of Lume Bardhi's in Peja, for example: flows, and hydrological regime which is not suitable. Basin area of Lume Bardhi in Peja, is 500.3km², it takes part with about 11.5% in the general area of the Drini i Bardh basin (White Drini) and 13.7% in its course. The average level of Lume Bardhi in Peja, is 50.2cm, bringing the monthly average 5.9m³ Lume Bardhi of Peja, has formed the most beautiful and attractive gorge in Kosovo; Gryka e Rugoves. Beautiful mountains, healthy climate and other elements provide very favourable conditions for tourism, which for the past few years more and more is being visited and used by tourists.

Keywords: Lum Bardhi in Peja, Hydrological Regime, Monthly Average, Gryka e Rugoves

264 New Aspects About Territorial Planning

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The aim of the work is to show that the actual regulations in EC for the territorial planning, connected with the presence of industrial activities with potential accident high risk (submitted to the Seveso Directive), could be reviewed by considering with a different approach domino effects. It has been considered a typical case with the presence of a MARS firm in an industrial area. Domino effects can generate further accidental scenarios in terms of environment damages. Two configurations have been identified: 1) territorial planning by considering only the effects generated by the MARS firm according to the existing regulations and 2) territorial planning by considering domino effects.

Keywords: domino effect, industrial accident

373 Coastal Aquifer and Desalination Plants: Some Interpretations to New Situations

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The Mediterranean south-eastern Spanish coastline is a semiarid region, with rainfalls that usually do not exceed 300mm/year, where surface water is scanty and frequently nonexistent. The different human activities developed in this area, as urban and touristic development and especially the intense agricultural activity, exercise a strong pressure on the groundwater resources. This situation has notable repercussions on the quantity and quality of the water. In the last few years, several desalination plants have been built along the coast of the province of Almeria to face the growth of the water demand. These plants are supplied of seawater by means of boreholes. In general, the groundwater behaviour patterns may be modified in relation to their natural situation by cause of these extractions. In order to manage adequately, and to avoid serious affections to the aquifers involved in the desalination processes, a suitable knowledge of the hydrogeology and hydrogeochemistry of these resources is needed. The study area is a coastal aquifer of Cabo de Gata near Rambla Morales. A desalination plant has been built

here, in a complex geological environment which hydrogeological aspects have not been widely studied yet. We present the results of E.C. and Temperature logs over time along with the first hydrogeochemical assessment. Fifteen samples were taken at several depths in order to determine the origin of the investigated waters, its physicochemical properties, as well as the relationship of the aquifer with the seawater. The results indicate that this is a multilayer aquifer with partially confined levels. The E.C. and the Temperature patterns are related to time and pumping. The hydrogeochemical analysis indicates the presence of water with different origins. This seems to complicate the relation of these groundwaters with seawater.

Keywords: Coastal aquifer, desalination plants, groundwater-seawater relationship

265 Assessment of Water Harvest and Storage Potentials Using GIS and Remote Sensing

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Fresh water is a basic, limited, and vulnerable resource for mankind and many ecosystems. Population expansion, improved living standards, and rapid growth in economic activities are likely to increase competition for and conflicts over accessible fresh water resources. In addition, there is a concern about spatial and temporal changes in precipitation and changes in the probability of intense floods and droughts. As water scarcity increases, demand for efficient water management adaptation strategies increases as well. This paper develops a geographically explicit method to estimate the potential for rainwater harvesting and storage, and applies this method to two diverse watersheds in Brazil and Egypt. Input data at watershed level are retrieved from global data repositories and include data on elevation, rainfall, soil texture, soil depth, drainage, land use and land cover, which were then down-scaled to 1km spatial resolution. The ArcInfo-GIS was used as a tool to store, analyze, and integrate spatial and attribute information, and a platform to develop the model. Runoff potential for different combinations of land use and hydraulic soil groups were derived by SCS-CN method using mean annual precipitation. Using the overlay and decision tree concepts in GIS, potential water harvesting sites were identified for constructing on-farm water storage, regional

dams and water distribution networks, and moisture conservation. Subsequently, sites for rainwater harvesting and storage were prioritized based on the runoff generation potential (m³ per unit area), and suitability for constructing structures. Spatially distributed validation of the methodology is performed using satellite remote sensing data, and existing data on reservoir capacities and runoff. The method focuses on its application in global context, since it is an important step towards improving agricultural land productivity, and safeguarding food security concerns as a collective effort.

Keywords: Rainwater harvesting and storage potential, and structures, Geographic information systems, spatial analysis

380 Validation of Rainbow Trout as Realtime Biosensors for Satellite-Linked Automated Biomonitoring at Remote Stream Platforms

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Two remote satellite-linked automated biomonitoring stations located along the lower reach of Laurel Branch, a second order stream in the Tellico River Drainage of the Southern Cherokee National Forest, Tennessee, U.S.A., were maintained as part of a U.S. Fish and Wildlife Acid Precipitation Mitigation Program. Each remote station was equipped with a satellite-linked Data Collection Platform (DCP), a stream stage height recorder, a flow calibrated flume, a U.S. Geological Survey Water Quality monitor, an in-stream stilling well and associated fish biomonitoring chambers, and amplifier devices to measure fish gill ventilatory activities. Stations monitored and collected real-time data including rainbow trout (*Oncorhynchus mykiss*) gill ventilation responses, stream pH, conductivity, temperature, and stage height under base flows and simulated episodic acidification events. Hourly data stored by each DCP were transmitted via earth satellite (NOAA, GOES) providing near real-time data acquisition. Results of in situ monitoring from remote stream platforms demonstrated that rainbow trout gill ventilation activities could be detected in near, real-time with the remote biomonitoring systems to reveal episodic acid deposition events.

Keywords: Rainbow Trout, Gill Ventilation, Automated Biomonitoring, Satellite Linkage, Remote Water Quality Monitoring, Calibrated Watershed, *Oncorhynchus mykiss*

385 Environmental Impacts of Engineering Deep Structures

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Geotechnical information obtained from site investigations and groundwater levels are powerful tools in planning of deep structures, with respect to anticipating hazards and design problems. The difficulties due to the uncertainties of the geological characters can determine huge consequences such as the environmental and safety negative effects. Related to environmental impacts of engineering deep structures there are some questions: when is necessary to deep the groundwater level what it happens with groundwater's drainage patterns, doesn't exist the risk of pollution of groundwater and the soil during the construction, how affect water the structures in their working life? The paper emphasizes some studies related to deep structures situated in Bucharest city and the solutions proposed to minimize the adverse environmental impacts.

Keywords: deep structure, groundwater, environmental impact

388 Groundwater's Role in the Management of Water Resources from South Dobrogea, Romania

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Nowadays, the management of water resources with respect to the environmental aspects is a very important goal of the economy. Due to its natural and anthropic features, South Dobrogea (Romania) represents, a very interesting area especially from a hydrogeological and environmental protection point of view. South Dobrogea is a region of about 4800Km² surface, situated in the south-east of Romania, cross boarding the west coast of the Black Sea. In the region there are two superposed calcareous aquifers - the upper aquifer (Sarmatian) and lower aquifer (Barremian - Jurassic) - and they form the so-called "karstic system" of strategic importance. The objectives of paper are the modifications in time of the resources state, as ampleness and reasons of the variation.

Keywords: Danube, water management, karst aquifer, piezometric levels, water resources variations, water resources magnitude, accumulation, drought, irrigation

**393 WFD Implementation in Serbia: Preliminary Study for Assessment
the Pressures and Impacts in Kolubara River Basin District**

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The Water Framework Directive (WFD) represents a fundamental change to water management by introducing a single system of coordinated objectives to be met through integrated River Basin Management Plans (RBMPs) within specified timeframes. The Danube River Basin (DRB) covers territories of EU-Member States and several non-member states including Serbia. Thus Serbia's involvement in WFD implementation activities on the DRB level was necessary although it had no related legal obligations. Analysis of pressures and impacts, according to the provisions of Article 5 of the WFD, is one of the key phases in preparing of the RBMPs. This paper describes a methodological framework for preliminary pressures and impacts assessment in order to facilitate the implementation of the WFD on small and medium rivers which are not, or are only partly, included in the national monitoring network. In order to fill this gap, proposed methodology combine available data, environmental management tools and regulations (such as IPPC, EIA, and ERA), GIS and expert opinions for assessment of significance of driving forces and pressures. This approach enable to start with risk assessment in early phases of "DPSIR" cycle using the following steps: (1) determination of the water bodies to be analyzed, (2) identification and characterization of the driving forces producing pressures over the region, (3) screening for significant driving forces, (4) identification and characterization of all existing pressures, (5) determination significant pressures; (6) assessing the impacts resulting from the pressures on water bodies, and (7) assessing the risk of failing the WFD objectives. Methodology was used in the Kolubara river basin district (central Serbia) as a case study.

Keywords: WFD, Kolubara river basin district, assessment, pressures, impacts

409 Approach to River Regulation Under the New Conditions

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The current technical solutions are mainly based on the engineering approach to design, and the performance of hydro-technical works on watercourses. In doing so, account was taken largely on the success of functioning, without taking into account the long-term consequences that may primarily affect the ecological, social, cultural, and political or any other plan.

Consequently, the paper will make a brief analysis of the conditions of watercourses in BiH, and the present reflects the EU directive on the protection of the water and on IWRM. Special attention will be paid to the Directive on the management of flood risk, with special emphasis on environmentally acceptable arrangement of watercourses.

Keywords: river regulation, environmentally acceptable, EU Directive

291 Assessing the Ecological Quality of Evrotas River Basin (Southern Greece) According to the Water Framework Directive 2000/60ec

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The implementation of the Water Framework Directive (WFD) 2000/60/EC has launched an "aquatic" revolution in the European's Union policy concerning the assessment and management of water resources. According to the WFD's ambitious goal, all surface waters must be in at least good ecological status until 2015. During the period 2006-2008, the ecological status of the Evrotas River Basin (Peloponnese, S. Greece) was assessed, based on hydromorphological, physicochemical and biological quality elements (fish and macroinvertebrate fauna). Our results indicated that the physicochemical quality elements and macroinvertebrates can provide relatively reliable results of the pollution impacts on Evrotas River. Sites located in upland areas were found to be in high and/or good status while pollution impacted sites scored moderate to bad ecological

status. In contrast, the fish fauna index that was developed and applied for the Evrotas River was found to be more sensitive to hydromorphological alterations. Based on fish fauna, almost half of the sites were assessed as being in bad condition. Hydrological alteration regime due to uncontrolled water abstraction appears to be the major impact of Evrotas River and in 2007 almost 80% was desiccated. Overall, our assessment techniques, when combined, can provide an integrated assessment of the status of the Evrotas basin. The results from this study may contribute to the development of the River basin Management Plan for Evrotas River and subsequently guide conservation and restoration efforts.

Keywords: Ecological quality, WFD, Greece

421 Rain Water Harvesting: A New Technology for Recharging the Aquifer

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Water is an essential condition of life. Different sources of water on Earth served mankind in different civilizations. Now ground water from the subsurface aquifer is a great source of fresh water which is fulfilling our domestic, industrial and agricultural need to a great extent. Water in the aquifer is accumulated by the natural process of recharging when the rain water is stagnant or running over earth's surface. But the natural process of recharging is very slow and is not adequate now, as a huge quantity of water is drawn out from the aquifer for our daily use. As a result the water level of aquifer is gradually going down and possibility of getting water for all purpose, particularly for Agriculture from this source is a threat to mankind. A new technology has been developed to inject sufficient quantity of water at a very fast rate from the runoff rainwater flowing through the streams and rivers with a great speed for major period of the year to the aquifer continuously. Firstly, the turbidity will be filtered and contamination will be removed from the runoff rainwater. Then the filtered and contamination-free water will be injected to the aquifer through two set of pipes pushed up to the aquifer. The technology functions with the principle of siphon by the help of atmospheric pressure forming recharge cone in the aquifer without constant supply of energy. Speed of recharge (200m³/hr with intake pipe 7.5 cm (3inch) diameter when the water level of the ground water is 20m approx.) depends on the water level of the aquifer, not on the quantity of water available on the surface of the earth. A significant quantity of water will recharge the aquifer with this

process continuously and spread through out it obeying the principle of ground water movement. Thus the greatest source of fresh and easy available water will be recharged sufficiently. As a result, the possibility of getting water from that source will increase for future use. It is important to note that this technology could help to dilute the arsenic contamination in the ground water and may help to produce electricity as a byproduct.

Keywords: Rain Water Harvesting, New Technology, Aquifer, Siphon, Runoff Rain Water

285 The Efficiency of the Water Purification Systems

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The paper presents an analysis of substances that conduct at by-product formation of reaction at the water treatment. The organic substance concentration reduction from water before of disinfectant's application may conduct at concentration decrease of accrued by-product. It is presented the condition of coagulation's getting. The coagulants for the coagulation process are selected for a maximum global efficiency. The choice reagents and the work conditions of coagulants must be accurately established. The studies concerning the water's treatment in Chirita treatment station make obvious the following conclusions:

- The water source present treatment difficulties because of elevated concentration of organic substances; concentration of total organic carbon is (10 - 18) mg C/l.
- Removal maximum efficiency of the organic loading through advanced coagulation is obtained with ferric chloride (5 - 7) mg Fe³⁺/l and reduced pH (6 - 6,5). It is necessary to use powder active coal for the coagulation - flocculation optimum process.
- The water's treatment with ozone and granular active coal establish good qualities, in the limit imposed by the standard.
- Sulphide hydrogen may be eliminated with 100% efficiency using filtration and oxidation with chloride.
- The filtration process on sand has not good efficiency; it is not drinkable water. It is necessary the coagulation - flocculation and clarifying process. It is recommended the clarifying tank with (4 - 5)m/h and sedimentation time of 1h.

- It comes out that chlorine and ammonium concentrations grow up in the maximum consumption period of network: Cl = (0,1 - 0,35) [mg/l] and Am = (42,55 - 43,31) [mg/l]. In the same time, pressure and debit grow up because to the increase of the active consumers number in the network: p = (3,01 - 4,09) [bar] and Q = (0 - 1650,74) [m³/h].

Keywords: coagulation, filtration, oxidation, pollutant, polymer

280 Water Management in Aflaj System Under Changing Climate Change

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The Aflaj systems are an indigenous engineering technique for an ancient irrigation system in Oman. These were created by the ancient Omanis civilisation hundreds of years ago to supply water for irrigation and domestic use and have become an important part of the Omanis social life and heritage. Climate change has had a profound effect on the Middle East and has led to a rise in temperature, a drop in rainfall and droughts and heat waves in recent years. The 2008 Stockholm World Water Week and the third Water WDR concluded that the main impacts of climate change on humans and the environment occur through water. The effect of climate change in the Aflaj system is reflected by a degradation of Falaj numbers and a noticeable reduction of water flow which is being seen as a warning and that it is time to commence taking steps to reduce the effect of climate change and save these systems from extinction. The research shows the effect of climate change on the Aflaj system and examines the risks associated with climate change and its impacts on the Aflaj system. Given the importance of the Aflaj system to the Omanis society, the research highlights the potential negative effects and recommends strategies to mitigate the risks. The strategy recommends better water management through improved water demand management, irrigation efficiency. The data analysis shows that rainfall in recent years takes storm type in most cases therefore, it recommended harvesting more runoff through constructing recharge dams. More efforts should be given for the use of water saving technology. With all of these measures, impact of climate change on Aflaj system can be reduced.

Keywords: Drought Management, climate change, water Management

276 Groundwater Monitoring System in Romania According to the Requirements of the Water Framework Directive and Derivation of Natural Background Level and Threshold Values for Groundwater

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Water Framework Directive (2000/60/EC) and Groundwater Directive (2006/118/EC) are integrated legislation which stipulated the objectives of "good status" for all waters in Europe. Article 8 of the Water Framework Directive in the water field (2000/60/EC) sets requirements for the monitoring groundwater status. According with Article 8 (1) of the Water Framework Directive, EU Member States should establish groundwater monitoring programs to knowledge and classification "status" of those within each river basin district. Groundwater monitoring network should be designed to provide knowledge of the quantitative and chemical status and to allow identify long term trends of pollutants due to human activities. Also, groundwater monitoring may be supplemented by additional programs regarding protected areas (eg, protected drinking water catchment areas). To determine the chemical status of groundwater with respect to the quality of groundwater, concentrations in WFD-monitoring points should be compared to European standards and Threshold Values (TV). European standards are set for nitrate (50 mg/l) and pesticides (0,1 µg/l individual and 0,5µg/l total). For other pollutants member states have to derive TV.

Keywords: integrated monitoring system, increasing trend of pollution, general and specific criteria, natural background level and threshold value

277 Water Resources Use and Pollution, as Environmental Implication for Developing of New Thermo Power Plants in Kastriot (Kosovo)

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Central part of Republic of Kosovo, that represents the home of 80% of country's industrial facilities, is one of the most water starved regions of Balkans, with river flow rates averaging only 2-4l/s in each square kilometers. The strategic

plans, for a project of the new power plants, represents a big challenge to overall society, considering the high level of inherited and actual pollution of environment in general and water resources in particular by energy sector exactly in the area where new plant supposed to be build. In this paper are presented main aspects of expected environmental impacts in environmental mediums by the new power plant with main focus in water resources use and pollution. Water resources of the area where PP is planned to be build faces a scarcity of water flows. The main river in the area, Sitnica has a flows rate averages of 10m³/s with dramatic variability during the seasons. All untreated waste water from cooling processes of existing power plants, including waste water from ash hills of existing PP flows into the Sitnica. This facts shows that environmental requirements for the construction of new power plant have to be very strict, in order to avoid as much further water pollution of Sitnica and through it Ibar River Basin, which also can cause trans-boundary environmental problems with neighbouring countries.

Keywords: environmental impacts, scarcity, water use, Sitnica, trans-boundary, power plant

275 Transfers of Irrigation Management and Performance of the Irrigation Systems in Turkey

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Two ways are pursued in the management of irrigation systems in Turkey, like in the world. The first one is the State Irrigation Management and the second one is the irrigation management performed by local administration or water users. State management of irrigation systems had largely been observed in the management of irrigation systems in Turkey until the 1990s while a accelerated transfer program was realized with the support of the World Bank as of the midst of the 1990s. In the studies made, it is generally observed that it was failed to attain the targeted performance level in irrigation systems under state administration in Turkey. It is considered that the basic factor in this result is the ignorance of social dimension, that is to say, the human factor in irrigation management.

Keywords: irrigation management, WUAs, irrigation performance

440 Need of “Fresh” Approaches in Sustainable Land Management

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Wise and sustainable use of natural resources is essential for meeting the needs of both present and future generations. The alarming magnitude of ongoing and present natural resource and environmental degradation and its detrimental impacts worldwide suggest that fresh alternative strategies are necessary for addressing natural resources management and environmental problems. The UN Millennium Declaration, the UN Development Goals, the World Summit for Sustainable Development (WSSD) and Plan of Implementation and activities of international institutions such as World Association of Soil and Water Conservation (WASWC), European Society for Soil Conservation (ESSC) and others, recognised the maintained integrity and restoration of land resources as a critical factor in achieving economic and ecological sustainability. To meet these challenges, new and innovative approaches are required. This includes close cooperation with governments, civil society and international organisations to ensure a broadly acceptable and efficient implementation, as well as the necessary additional financial, institutional and human resource support. In the paper were presented world's and European view of this theme through the work of WASWC, ongoing WOCAT programme (World Overview of Conservation Approaches and Technologies) and new DPSIR approach. There were also presented Serbian's experiences in this respect.

Keywords: land, degradation, sustainability, “fresh” approaches

457 Water Management Strategies Analysis Using Multi-Criteria Techniques Towards Sustainable Development of Northern Gaza Strip

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Gaza Strip is located on the southeastern coast of the Mediterranean Sea. In this region, water resources are currently facing extreme over exploitation leading to the sharp decline of groundwater level. It leads seawater intrusion to the coastal

aquifer and increases the salinity of the groundwater. These environmental impacts have consequences on the agricultural productivity and affect the regional economy. In order to guarantee sustainability of regional development, groundwater artificial recharge (AR) is considered as a potential response to the current water resources problems at the area. The objective of the present study is to analyse several water management strategies for the implementation of AR project in Gaza Strip and their potential impacts on wastewater management, agriculture, environment and socio-economy. Based on the water policy (Yr. 2005 - 2025) on wastewater reclamation and reuse, four AR management scenarios were developed in close cooperation with the local stakeholder community. The scenarios were compared with a base line scenario referring to the so-called "Do Nothing Approach". Twenty-one criteria were selected for the evaluation of the possible impacts of the scenarios in the area. The decision criteria were quantified by socio-economic studies, field surveys, mathematical modelling and GIS analysis. Analytical Hierarchy Method (AHP) and Ideal Point Method were used for Multi-Criteria Decision Analysis (MCDA). Wide spectrum of criteria selection, criteria grouping and weighting were performed to postulate the robustness of the MCDA on ranking of defined AR management scenarios. The analysis shows that the AR management scenarios have best performance over the "Do Nothing Approach?". Both of the MCDA methods show that the implementation of AR with secondary treated effluent in maximum rates and together with sustainable development of the agricultural sector is the best and robust alternative. It can be concluded that AR implementation in the Northern Gaza-Strip contributes significantly to the sustainable development in that region.

Keywords: Water scarcity, wastewater reuse, groundwater artificial recharge, multicriteria analysis, Gaza strip

463 Initial Scoping and Consensus Building Stage in Participatory Watershed Modelling

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In this paper we present a participatory process for supporting decision-makers in the integrated watershed management that considers the scientific approach while taking at the same in full account both stakeholders perspectives as well as local communities' needs and knowledge. Our proposal is the participatory

modelling incorporating the interested and involved parties - researchers, local stakeholders, policy and decision makers - into an analytic process. Here we discuss the initial stage of the modelling framework aimed at problem scoping and consensus building among all actors involved in the integrated watershed management. In particular, we introduce the case-study of the sub-basin of the Pusiano Lake watershed situated on the Southern edge of the Alps (Northern Italy, Lombardy Region). In the last part of the paper we present the lessons learned and the way forward matured within our experience, which we believe could help to achieve successful participatory modelling efforts elsewhere.

Keywords: Integrated watershed management, Participatory modelling, Decision-making, Census building

464 Characterization of Surface Waters on the Pilot River Basin of Nisava in Accordance of Water Framework Directive

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River Nisava is the largest left tributary of the river South Morava. The paper gives conducted analysis of the pilot river basin of Nisava which is important from two aspects: area river basin of Nisava is greater than 4,000km², and as cross-border river. Characterization and delineation of surface water bodies is made. Affiliation of the pilot basin to ecoregions is determined. Characterization of surface water bodies is made, on the rivers and lakes. Significantly changed water bodies are preliminary determined. Classification of surface water bodies by types based on the abiotic parameters: the size of the basin, belonging to the basin altitude, geological substrate and the substrate of the basin bottom is made. The last phase of characterization determining "water bodies" is implemented.

Keywords: ecoregion, type of surface water, water body

495 Utilisation of Hydro Power Potential Already Existing Water Resources and Other Structures in Serbia

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Building small hydro power plant are necessary significant resources and average price of building 1kWh usually is higher at small hydro power plant rather than bigger hydro power plant. Usually construction works significantly influence the price of building SHPP, which later influence the price of already produced electric energy. The biggest fact of rentability of SHPP is period of construction. The effect of small period of construction is small period of beginning of production electric energy, it means refundation of invested money. Therefore in Serbia, at the beginning, it is necessary that the location of SHPP should be look for where constructions are partly or completely finished. There are significant possibilities to build SHPP in already existing water resources structures and water mills, which construction and hydrotechnical objects are in good conditions and with very small reconstruction could be able to build in electromechanical equipment with low cost. SHPP who are not in function are useful to be reconstructed and rebuilt. There are about 40 plants like this, who with additional works and installation of suitable equipment soon could be transformed in SHPP which will product electric energy. Some of abandoned SHPP which objects are not significantly destroyed, could start the production again with insignificant reconstruction of structures and revitalisation of equipment, soon and with low investments. This paper shows the significant of utilisation of hydro power potential of water resources and other structures in Serbia building in SHPP everywhere where is rational possible. As an example are shown from already existing water supply systems where are capable for completely hydro power potential utilisation of already existing water resources by building in SHPP on the constructions of the system.

Keywords: SHPP, water resources structures, hydro power potential

496 Sustainable Water Management System for Crop Production in Nigeria - Plantain, Citrus, Pineapple and Tomato as Case Studies

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Four candidate crops namely citrus, plantain, pineapple, tomato were selected for this study. Twenty seven year rainfall data were obtained from NIHORT, Ibadan. Growth stage of the crops citrus, 1977 - 1985; plantain, 1993 - 1994; pineapple, 1995 - 1996; and tomato, 2007 - 2008 were determined. Land mass (km²) of twelve cities such as Port Harcourt, Kano, Sokoto, Jos, Abuja, Bida, Markurdi, Eket, Warri, Enugu, Calabar, and Ibadan were assessed through the Internet. Positions of each city were obtained from the Nigeria Institute of Meteorology (NIMET). Three months rainfall data of the twelve cities were retrieved from NIMET. Monthly maximum and minimum temperatures were collated. Reference evapotranspiration, crop coefficient and crop water needs were calculated. Predicted and potential amount of rainfall water available for harvest were evaluated. Rainfall harvesting structure was installed and tested. Results obtained showed that about 15m³ of water was harvested at Ibadan between August and December, 2008. Eket with land area of 175,477km² and monthly rainfall of 452.5mm positioned on latitude 4°57'N and Longitude 8°20'E exhibit the highest rainfall water harvesting potentials at 1.728 x 10⁶m³ in three months. Analysis of the crops water need indicated 124.27mm, 358.15mm, 385.05mm, and 7,634.35mm per growth season for tomato, pineapple, plantain and citrus respectively using the generated model from the rainfall-water harvest of NIHORT, Ibadan, $Y = 5.75 X + 198$, where $X = \text{rainfall (mm)}$, and $Y = \text{rainfall water harvested in litres}$.

Keywords: sustainable, water management, rainfall, citrus, plantain, pineapple, tomato

513 Research of Water Resources on Karst Islands on the Example of Krk Island (Croatia)

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Local water resources on karst islands are of high importance due to their specific location and general characteristics of karst. They are characterized by spatial detachment and isolation from the regional aquifer, as well as greater openness to the influence of the sea and salt intrusions, especially in terms of continuing and intensifying the present trend of sea level rise. Beside the use of well known hydrologic and hydrogeological methods in the research of water resources increase and their exploitation, such detachment and isolation dictates application of some new, innovative approaches. This paper shows an analysis of the island of Krk that is located in northern Adriatic with the area of 405.2 km² and approximately 18,000 permanent residents. Number of inhabitants increases drastically during summer months due to numerous visitors, when the island's water reserves are minimal. The paper describes methods for estimating global water balance of the island using Langbein's method in GIS environment, detection of coastal concentrated groundwater discharges using thermal-infrared images, and the use of the results of the performed analysis for the island's aquifer functioning on specific water intake locations. The most important water resources of the Krk Island are: coastal lake Njivice (cryptodepression) and accumulation Ponikve in the central part of the island. For these two permanent surface water phenomenon correlation analysis of the dynamics of the surface water and groundwater fluctuations will be performed. The paper also describes evaluation of the possibilities of using precipitation to meet part of the island's water needs in agriculture.

Keywords: islands, karst aquifers, Krk, water balance, water use, water reserves studies

**530 Gap Project and Problems Conducted on the Euphrates
and Tigris Rivers in Southeast of Turkey**

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GAP (Southeastern Anatolia Project) in southeastern Turkey realized the scale, size and objectives, as is one of the world's largest regional projects. Project area in the Euphrates and Tigris basins and Upper Mesopotamia located Adiyaman, Batman, Diyarbakir, Gaziantep, Mardin, Siirt, Sanliurfa, Sirnak and Kilis province covers. Project, 7-Euphrates basin, and 6 to Tigris basin 13 sub-projects will be carried out consists of a package. 19 double-purpose (irrigation-energy), including 22 dams, 19 hydroelectric power plants and associated covers the construction of irrigation facilities. Total planned irrigated area in Turkey can be economically irrigated 20% of total area corresponds. Thuse 28.5% of the total water potential of Turkey will be under control with 52.94 billion cubic meters more water from on the Euphrates and Tigris rivers drain facilities However, these large projects, economic benefits in addition to the natural environment, settlement, cultural and political geography brings many problems in terms. One of the most important view of the severe drought in the area of irrigated land will occur in conjunction with salinity and degradation that is. Other problems; Ecosystem change, transporting, settlement, cultural heritage and archaeological values remain under water and Turkey's neighbours to live with trans-boundary waters is a problem.

Keywords: GAP Project , Turkey, Southeast Anatolia, Euphrates River, Tigris River

**543 Energy Valorization of the Hydro Potential
for Water Supply Companies**

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Water Supply Companies are managing with water resources for water drinking supply, for irrigation, or other purposes. Taking into account the geographical conditions, technical possibilities and other infrastructure, some of the water supply

systems besides the main business, the water can be used for energy purpose as additional business. It is very attractive to construct small Hydro Power Plants (Small HPP) on water pipes and systems. The contribution of using the water for electricity generation means additional financial income for the company.

Keywords: Water Supply, Small Hydro Power Plant, electricity, generation

551 Challenges of Setting the Decision Makers Importance Weights within Group Decision Making Contexts

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Paper analyses sensitivity of the solution (the final decision) when the importance of the decision makers is varied in the group decision making context. Widely accepted multi criteria decision making method (MCDM) known as Analytic hierarchy process (AHP) has been used to illustrate different outcomes that can happen in case of inconsistent (ill) judgments of the decision makers at various stages of the decision making process. In addition, options and implications of aggregating individual decisions into a group decision are discussed, assuming that decisions are derived by other standard multi-criteria analysis tools such as SAW, SPW, CP, and TOPSIS. Concerning the problem of setting weights for decision makers, the importance limits are assessed to identify benchmark cases when possible preorder of finally ranked alternatives may occur. Limits are analyzed for illustrative example of selecting most suitable irrigation technology. Three experts (in irrigation technologies, in water resources economy and in water resources system analysis) participated in individual assessing of the criteria set by using standard AHP pair-wise comparisons. This way individual priority vectors of criteria are obtained. From that point it was possible to vary weights of decision makers within specific limits, and to apply other involved MCDM methods. Sensitivity analysis of different aggregation mechanisms traced recommendation on how to manage individual decisions into a trustful group decision.

Keywords: decision making, weights of decision makers, AHP, group context

**555 Transboundary Politics in the Meric River Basin:
Iwrm in a Critical Perspective**

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Bulgaria, Greece and Turkey are the major riparian of the Meric/Maritsa/Evros river basin. There are many historical agreements related to the water use and allocation in the boundary and transboundary waters of the basin. The agreements are found to be inadequate both in terms of their issue coverage and with their dispute settlement mechanisms to address the current problems in the basin. The increasing needs of the irrigation water and flood protection, particularly between Turkey and Bulgaria, constitute the major issues of the transboundary water management. This article examines transboundary politics in the Meric river basin within the framework of the bilateral and multilateral water relations among the riparian as well as with respect to the European Union water policies. In this respect, major approaches (i.e. integrated water resources management) and legal frameworks of the European Union, namely the European Union Water Framework Directive (2000) and Flood Directive (2007) will be critically analyzed with their possible repercussions on the Meric river basin transboundary water politics.

Keywords: Meric/ Marits/Evros river basin, transboundary politics, integrated water resources management, European Union water policies

574 Historical Development of Hydrology

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It is not easy to answer the question "When and where the science of hydrology began?". The first civilizations began and developed on the shores of the rivers since the water was so vital for human living and also those areas were suitable for settlement because of their mild climate. The first water structures were for the control of the nature to supply water for the developments, construction of irrigation and drainage channels, dams and dikes. The first water structures were seen on the Nile of the historical Egypt. The ancient Ionian philosophers tried to

explain the nature without the help of myths of Gods. The explanation of periodical flooding of Nile was a subject to think about among the ancient philosophers such as Thales, Herodotus, Democritus. Platon was the first philosopher to give explanation of hydrological cycle. Aristoteles has written a book named "Meteorologica". Almost all the great philosophers and scientists of the ancient times have somehow tried to explain some part the hydrological cycle. These are Leonardo da Vinci, Giovan Fontana, Benedetto Castelli, Pierre Perrault, Edme Marioette, Edmont Halley, Robert Hooke, Henry de Pitot, Antoine Chezy, Pierre Louis Georges Du Buat and John Dalton.

Keywords: Hydrology, History, Philosophers

584 Perspectives on EU River Basin Management

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PMG has participated on EU Technical Assistance projects in the Accession States (many now New Member States) since the mid-nineties. The primary focus has been the implementation of the Environmental Acquis, which comprises over 300 Directives relating to the EU legislation on environmental issues and with regard to development of river basin management plans. Many EU countries are meeting the requirements of the EU WFD as regards the deadlines set for such activities as (i) characterisation studies of their catchment basins and (2) development of water quality monitoring programmes of all water bodies. However the problems and constraints will be in developing programmes of measures to meet the objectives of the EUWFD, and whether such measures are technically and financially feasible. The first generation of Water Framework Directive - RBMP's will reflect a low level of ambition and lack of innovative approaches. This presentation focuses on (i) issues, (ii) constraints and (iii) problems facing EU and non EU countries in implementing river basin management plans. The presentation will also focus on the new EU accession countries non EU countries (e.g. Ukraine & Russia) where the author has worked on the development of river basin management plans based on the EUWFD, and will highlight the problem issues (such as corruption and inefficiencies) in developing RBMP's particularly in a transboundary context.

Keywords: environmental acquis, characterisation, water quality monitoring, programme of measures, transboundary

**587 Deep Aquifer Recharge Study through Water Level Monitoring
in Kathmandu Valley, Nepal**

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Kathmandu Valley is an intermontane basin situated in the Lesser Himalayas of Central Nepal, which has Kathmandu, Lalitpur and Bhaktapur cities with total area of about 650km². Groundwater in Kathmandu Valley has been extensively used since long time through stone spouts (dhunga dharas) and the dug wells. The water in these stone spouts and dug wells is coming from upper aquifer which is shallow in depth. Due to increase in urbanization the surface area for infiltration is decreased and therefore there is problem in getting water from these stone spouts and dug wells. Groundwater found in Kathmandu Valley occurs under unconfined, semi confined and confined conditions. There are three groundwater districts in Kathmandu Valley, i.e. northern groundwater district, central groundwater district and southern groundwater district. The northern groundwater district includes principal water supply well fields. For the study, 45 deep tubewells were selected in Kathmandu Valley which represents all three groundwater districts. Among these deep tubewells 37 tubewells were selected for static water level monitoring and 8 tubewells were selected for pumping water level monitoring. Groundwater monitoring was done once a month and this investigation has been initiated in the valley by the GWRDP for MWSDB. The monitoring data and available well lithologs show that northern groundwater district is potential for groundwater exploration. Due to the presence of excessive granular material near the surface, the area is favorable for the groundwater recharge. Central and southern groundwater district have mainly confined aquifer below thick impermeable clay layer. This clay layer prevents the recharge from the precipitation. The static water level monitoring data shows that the groundwater level in Kathmandu Valley is decreasing from 2000 to 2005. During these six years the static water level of the northern groundwater district is decreased more in comparison to other two groundwater districts. In northern groundwater district, the piezometric level is declined from few cm to 17m. Similarly in central and southern groundwater district, the piezometric level is declined from 1m to 13m. The maximum fluctuation difference in water level is seen around Bansbari area in northern groundwater district. This may be due to the distribution of much coarser sediments (gravels) in this area. The annual average rainfall was 1437.25mm, 2003.70mm, 1743.64mm, 1551.25mm and 1195.65mm from 2000 to 2005. Though the static water level is decreased from 2000 to 2005, the trend of decreasing is faster in the recent years (i.e. 2005) in comparison to past (i.e. 2000). This may be due to less rainfall in recent years and

decrease in infiltration area because of increase in urbanization. The fluctuation in the static water level in the deep tubewells shows that these tubewells are being recharged. The groundwater level in deep tubewells of all the three groundwater districts is increased during the rainy season or just after the rainy season. The monthly monitoring data shows that the natural recharge in the deep aquifer does take place.

588 Rivers Water Life and the Responses of Possible Hydropower's to be Constructed in the Water Courses of Vjosa, Semani and Drini in Albania

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The subject of this paper is the energy issue and the Rivers of Vjosa, Semani and Drini the main contributor with freshwater to south eastern Adriatic. The rivers of Albania are mostly natural; they have hardly been dammed or channeled, except for some existing dams in the middle part of the river courses. Therefore these rivers, especially in their upstream part, constitute very valuable natural ecosystems. In Europe, examples are scarce of rivers of this size that still enjoy a natural course. The Albanian rivers generally have a high physical quality. The biochemical quality is probably altered by emissions of domestic or industrial wastewater. On a small territory, Albania has a high diversity of ecosystems and habitats. Within its territory there are maritime ecosystems, coastal zones, lakes, rivers, evergreen and broadleaf bushes, broadleaf forests, pine forests, alpine and sub-alpine pastures and meadows, and high mountain ecosystems. The country is rich in forest and pasture resources. The coastal zones are rich in valuable wetlands. The mountain areas are less populated and have generally remained relatively pristine, with some very valuable ecosystems. Unfortunately they suffer from emigration, and abandoned agricultural areas (including for instance terrace agriculture) are a common landscape. Nowadays there is a general increase of "invasion" to the river systems in Albania and wider area due to the energy increasing demand. In this paper there is presented the potential impact of constructed and possibly to be constructed hydropower's. Beside that there is an EIA procedure developed, the tendency of water life and catchments affection is of a great concern. The fish communities and particularly migrating

ones, freshwater or marine will be directly affected. The affect of regulation on fish and fishing is a complicated interaction between a number of physical and biological factors.

Keywords: Albanian rivers, energy, biodiversity, fish community, vegetation

**596 Waste Water Treatment Urban Plant in Seaside of Vlora,
in South of Albania**

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The waste water treatment urban plant in the seaside of Vlora, as the first in Albania, is thinking to separate in two phases. The first phase is including sewerage, pretreatment and primarily treatment. The second phase consisted in secondary treatment and treatment of sludge. The aim of waste water treatment urban plant for Vlora's city is to treat the waste water according to the regulations. This treatment do not consist to transform the waste water in the water supply for the consumer but to make it so clear as to have reduced parameter that can't damage absolutely life and water activities.

Keywords: waste water, sludge, sewerage

**598 Transboundary Water Issues of Turkey and its Immediate
Surroundings, Historical Development, Legal Dimension
and Solution Offers**

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In this article, the transboundary water issues of Turkey and its immediate surroundings will be examined. The examples used are the water issues of the Danube on European scale, the Syr Darya and the Amu Darya in Asia and

the Nile for the water issues in Africa. In the Middle East, the water issues of the Orontes, the Tigris, the Euphrates and the Jordan and its springs and the Litani are examined in detail by taking into account their historical developments, political and legal dimensions.

600 Individual Residence Wastewater Wetland Construction in Turkey

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Constructed wetlands can be a good alternative to conventional on-site wastewater disposal systems, which usually consist of a septic tank and a soil absorption field. Constructed wetlands are classified as a pretreatment technology, meaning that they treat the septic tank effluent prior to discharge to an absorption field where final polishing occurs. Pretreatment eases the burden on the soil absorption area by lowering the chemical and biological strength of sewage. It serves as a safety net, filtering out most intestinal pathogens. Additionally, it may buffer the soil during short periods of saturation, extend the life of the system and allow repair or renovation of a failing system when there is no other alternative. Constructed wetlands are used in treatment of both domestic and industrial wastewater in several countries owing to its advantages such as low-cost requirement and ease of operating, when compared to the traditional wastewater treatment. This system depends on the process of treatment of wastewater using the various plants that are in specially designed basins. In Turkey, "Artificial Wetlands" or "Wetlands cultivated land known as" natural treatment method in the village started to be implemented. The first application was started in the village of Ankara-Haymana Obelisk. Wetlands in the municipal waste water treatment, in general, 80-99% of biological oxygen demand (BOD), chemical oxygen demand (COD) and removal of bacteria, suspended in 92-95% dry matter intake (AKM), total nitrogen and 30-80% 20-70% total phosphorus removal was obtained. This research has been conducted in the village of Yorukcal which is in the province of Vezirkopru in Samsun. *Phragmites australis* and *Juncus sp.* are used to determine the efficiency of treatment in this region.

Keywords: constructed wetlands, domestic wastewater treatment, plants

605 Evaluation of the Land Use Decisions to Coastal Areas Protection; a Case Study in Mudanya-Bursa, Turkey

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Coastal settlements, with their natural functions, are the richest and the most productive ecosystems of the earth. It is the fact that the port settlements are the most vibrant centers of their era throughout the history. Coastal ecosystems that provide contributions to local, regional and national economy have also an important status for the people living in the vicinity. However, rapid population growth, urbanization and economical development have led to the destruction and extinction of the natural resources. This degradation occurred in the natural ecosystem is one of the most serious issues of the people and the societies all around the world. Additionally, unsustainable and unplanned urbanization could be seen as an important factor of global environmental disaster in recent years. In this way, the importance and the value of coastal areas has begun to be understood. Today, in many countries all around the world, several measures are being took in order to protect these areas. According to the strategic importance of Turkey's coastal areas have been protected considering National Environmental Action Plan (UCEP). However, natural resources of the country have been used excessive. Also, coastal cities have been functioned for tourism, industry and sea transportation. These land use decisions aggravate the pressure to coastals. Mudanya is a district of Bursa Metropolitan Area in Turkey that has an important role for national and international sea transportation. At the same time, it was located in the Marmara Sea Coast an inland sea. Also, it has been an important commercial center with its agricultural potential throughout the history. Mudanya Coastal Settlement is selected as a case study area for this paper. Urban and rural land use decisions which cause excessive consumption of the natural resources will be evaluated in the study. 1/25.000 Plan, natural analysis and relations with the Environmental Action Plan (UCEP) will be used as an measuring tools. Also, a field survey will be applied by using a questionnaire and deep interview techniques in order to determine attitudes of local people relating to the coastal land use. Finally, the data results will be evaluated and discussed in the light of the ecological principles.

Keywords: Coastal ecosystems, ecological planning and land use decisions

625 Relation of Water and Architecture in Urban and Construction Scales; Eskisehir Municipal Urban Development Project

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Creating urban space that urban life is passed defines the quality of life itself. Living besides water sources -generally a river, a channel or a lake- may be a dream or a nightmare. In this study how a nightmare that is living in Eskisehir with Porsuk River is changed a dream by means of rehabilitation of the river . Eskisehir is situated in the western part of the central Anatolian, wherein the Porsuk River forms the main characteristics of the city. Eskisehir Municipal Urban Development Project is to minimize the risk of flooding damages by Porsuk River and reduction of leakage from the irrigation canals to underground water that endanger buildings around these canals. The services mainly cover the design review/design and construction Improvement of Porsuk River Channel -approximately 8 kilometers- and landscaping, construction seven vehicle bridges, evaluation of four existing pedestrian bridges from earthquake risks point of view and replacement/ retrofitting of these pedestrian bridges, seven new pedestrian bridges, four water levels control structure. In this study same questions based on Porsuk River is asked as from the geographic experience, what might the relationship between water and space mean? Should the relationship between water and land be understood as a "shore" problematic or as a "threshold" one? How could the nature of water be realized as a matter? What might be the water's existing ground? However, from the arguments shaped around these questions, the relation water and architecture in urban and construction scale were designated.

Keywords: water and architecture, Eskisehir, Porsuk River

626 Urban Water Footprint and its Application for Policy Implications - a Case Study of Beijing, China

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Water supply is often insufficient in North China. As a modern mega-city, Beijing ranks first in terms of per capita urban consumer expenditure of China and also has a very poor water resources endowment. In recent years, global virtual water trade is considered as a useful tool for solving the problem of insufficient water supply in the water scarce regions. Following the virtual water concept, the water footprint concept was advanced to highlight the consumers' responsibility for saving water. The two concepts together give new hope for solving water crisis by adding global and consumer perspectives for water resources management. However, most previous studies focus on the descriptive calculation of global virtual water flows or water footprint, while paid little attention to the assessment of the economic and social effects on the two indicators. Choosing Beijing as a case study, we analyze the change of virtual water flows and water footprint using an input-output based water footprint accounting framework under the alternative scenarios of different final demand patterns and water use in the year of 2020. Some policy suggestions for water use of different sectors are then advanced based on the results of four scenarios.

Keywords: water footprint, virtual water, input-output analysis, scenario analysis

627 Assessing Impact of Low Quality Water Used in Irrigated Agriculture on Food Production

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Using irrigation water of poor quality without assessment of their impact on the existing ecological balance, it could worsen the quality of agricultural and food production. Usually, the assessment of the impact of irrigation water

quality on environment in real conditions has been avoided because of the lack of appropriate tools in order to process and analyse a great quantity of information, mainly laboratory analysis data. In the same time, the analysis of the agricultural practices shows the necessity of development of such type of tools for assessment of the impact of used lower quality water on the crop, respectively on food production, for its effective usage, for preventing the possible negative impacts. The development aims to build up-to-day, innovative system preparing precise decisions of its application, to create preconditions for sustainable agriculture, preservation of the food quality and ecological equilibrium of irrigated areas by using other water sources ensuring water of not so good quality. The objective of the first stage was the creation of a methodology and a model for assessment of the impact of irrigation water on the crop, respectively on food production. It contain the developed methodology and general structure of the model for assessing the impact of low quality water on food production and soil health, for assessing suitability of irrigation water determined in accordance with the evaluation of the influence of different land-use type of soil and water quality. In the making are the preparing recommendations for available water use in the area regarding its soil and climatic characteristics, variety of the grown crops and data from laboratory analysis of water quality. Thus, less good quality water could be used for irrigation without causing any negative effect on the growing crops and environment, and to disturb the sustainable development of the area.

Keywords: Irrigation Water Quality, Sustainable Agriculture, Food Quality

630 The Romanian Groundwater Preservation with the Purpose of their Sustainable Exploitation

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The natural richness represented by groundwater is very important because of their superior quality, in comparison with other categories of freshwater which exists in nature. Besides quality, the groundwater also have other advantages like the compensation of the exploited discharges through natural renewal, the protection against evaporation loss and against surface pollution, and also the fact that in numerous occasions it is more in handy in terms of utilization. Groundwater is the world's largest freshwater reservoir, representing more than 97% of all the freshwater reservoirs available on the globe. The rest of 3% mainly comprises the surface water (lakes, rivers and swamps) and soil humidity. These

have an essential role in the hydrological cycle and are vital for maintaining the humid areas and the river flow, acting like a buffer reservoir during the dry periods. Depending on the rock type, the human activities impact can affect the groundwaters on a long period of time. Due to the fact that the groundwater circulates differently through soil and underground, depending on rock type, the human activities impact can affect them on a long period of time. This means that the pollution is determined either by agricultural or industry sources or by other human activities that can currently threaten the water quality and in certain cases this also may continue in the future. The groundwater is a "hidden resource" which is more important from the quantity point of view than surface water, and for which the pollution prevention, monitoring and rehabilitation are much more difficult than for the surface waters, because of their inaccessibility. This hidden character makes the locating and the pollution adequate characterization very difficult and also the understanding of the pollution impacts, often having as a result a lack of acknowledgment and/or record of the risks and pressures extension. From the entire phreatic groundwaters resources of the Romanian territory, there is currently an annual exploitation of 10% remaining available an amount of approximately 90% for the future. Regarding the deep groundwater on the Romanian territory, there is currently an annual exploitation of approximately 8% from the total resource, remaining available an amount of approximately 92% from the total. Groundwater preservation is a priority at national level and also at the European one. In Romania, in the Law no. 310/2004 for the modification and completion of the Waters Law no.107/199, there are stipulated the groundwater pollution definition as a result of human activities, the necessity of preventing or limiting the pollution impact and also its progressive reduction through the qualitative and quantitative management of water resources within the national strategy of the National Administration "Romanian Waters" through the Water Directorates. Also, through the Romanian Government Decision no.930/2005 there are approved: "The special norms regarding the type and the size of the sanitary and hydrogeological protection" of the catchments, constructions and installations that are intended for the centralized supply of drinking water and therapeutic mineral water for internal cure or bottle-filling. These norms also comprise the measures for the field setting up of the protection areas mentioned above. As a consequence of implementing the Water Framework Directive 2000/60/EEC, In Romania it was identified, determined and characterized a number of 142 underground water elements, and for each one of these elements it was made a characterization of the chemical state (qualitative) and quantitative state, and there was also established a measures program for the prevention and reduction of these bodies.

Keywords: groundwater bodies, groundwater preservation

633 Land Use Efficiency of the Kara Menderes Basin (NW Turkey)

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In this study, it was aimed to determine the land use efficiency of the Kara Menderes Basin (KMB) taking into account land use capability (LUC) classes and land use types. The KMB, lying between the latitudes north 39°36'42" to 40°01'33" and longitudes 26°08'06" to 26°59'48" east, covers an area of 1996km². Land use efficiency was determined by comparing the land use types in 1985 and 2007, based on data obtained from the soil report of Canakkale Province and the LANDSAT satellite images, respectively. The analysis results revealed that arable lands cover an area of 70.904 hectares in the KMB. The non-agricultural use on the arable area of the basin for 1985 and 2007 was 36,1% and 26,1%, respectively. On the other hand, it was determined that 28,9% of the non-arable areas were allocated to agricultural activities. Thus, our data showed the existence of misuse on both agricultural and non-agricultural areas, which was at higher rate in 2007 than 1985.

Keywords: Kara Menderes Basin, Canakkale, land use, land use efficiency, land use capability

634 Trilateral Ecosystem Management Cooperation Driving Mechanism in the Prespa Lakes Basin

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Green policy in the world of political conflicts stands as a hub and a way towards successful dealing with environmental and political problems/issues. Environmental issues sometimes reflect the current political situation especially when dealt with transboundary cooperation in the field of environment. This paper reveals the successful story of transboundary environmental cooperation in the

Prespa watershed region representing perfect example of existence of apolitical machinery that serves as a highly technical environmental driving engine for ecosystem management. Neglecting the hardship of no existence of legal binding agreement, environmental cooperation between the three states in Prespa Lakes Basin in the field of environmental monitoring, ecosystem oriented management of the productive sector, water management, species and habitats conservation, maturation of Prespa Coordination Committee, is on amazing level. This paper explains in detail the origin, status and future development of this cooperation for all existing environmental cooperation chapters/activities in the region without having any political bias yet explaining in detail not only past but still ongoing green policy and agreements in the Prespa Lakes region.

Keywords: Cooperation, transboundary, agreement, aquatic ecosystem, integrated, environment, watershed, trilateral, UNDP, GEF, Ministry, Republic of Macedonia, Republic of Albania, Republic of Greece, Prespa Lakes, productive sector, ecosystem oriented

638 Effect of Water Consumption in Irrigation

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The ever increasing demand for water resources and its temporal and spatial unavailability in terms of required quantity and quality necessitate its efficient use or management to provide economic, environmental and social benefits. Water resources management policies have been improved as to European Union approaches, global and regional developments, sustainability, present and future needs due to urbanization, industrialization and agricultural production in Turkey. The available water potential is 112 billion/m³ per year in Turkey. We use only 40 billion/m³ per year. Approximately 73% of this is consumed in agriculture for irrigation. Therefore, the primary component in water resource management is agricultural irrigations. Our target is to reduce this rate to 64% by 2030 through modern irrigation methods. Turkey has shifted its policy from traditional irrigation networks (open canals) to the water saving systems (pipeline, sprinkler, trickle). In addition to, because of the high population growth rate and fragmentation of lands by inheritance, parcels are continuously getting smaller and problems arise in obtaining the expected benefit from irrigation projects in Turkey. Water management problems are generally arisen every stage of water related issues ranging from water resources development to field-scale water utilization practices.

As is known, land consolidations projects with a lot of development works on project area have been also done. Thus, agricultural fields are completely become ready for irrigation. After land consolidation projects, every parcel has own road, irrigation and drainage system, so efficiency of agricultural and performance of irrigation system goes up. If increasing the rate of irrigation, an efficient irrigation and providing water saving in agriculture is being requested, irrigation projects should be completed to combine with land consolidation projects. In this study, current state of water resources, management and problems were discussed and recommendations were made toward the solution of these problems.

Keywords: Water resources management, water consumption in irrigation, land consolidation projects

**639 Effects of Basin Activities and Land Use
on Water Quality Trends in Tahtali Basin, Turkey**

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The rapid increase of population, industrial growth and disorganized urbanization has put considerable stress on the available water sources, which are already scarce, not only by the increased usage but also by deterioration of the quality of available resources. Both statistical and GIS analyses were adopted in this study to examine the changes in water quality parameters associated with the changes in land use within a major watershed in the city of Izmir, Turkey. In this study, the satellite images containing the periods prior and after filling of the main pool of the Tahtali reservoir, were analyzed and the affects of the land use changes on the water quality were investigated. For this purpose, the aerial photos of the basin taken in 1995 (October) composed of 130 sections having a scale of 1/5000 were obtained and these images were compared with images of the Ikonos satellite taken in 2005 (November) with a resolution of 1 meter. New residential buildings, greenhouses and industrial buildings were presented in separate layers to document changes in basin activities since 1995. Later on, changes in all 130 sections were merged and the thematic maps of the basin were obtained. In order to investigate the effects of changes on the water quality, the water analysis values obtained from samples taken at 6 different reaches within the basin and at the main lake for the years of 1995-2005 were obtained. Seasonal Kendall test was selected and applied to the water quality data to investigate which parameters increased/decreased and how these changes were related to the effects of urbanization and industrial development. This study also

investigated and quantified soil erosion in the basin by the universal soil loss equation (USLE) for two different land use compositions and soil maps from two years: 1995 and 2005.

Keywords: landuse, GIS, water quality, USLE, Tahtali Basin

644 Watershed Management: Activities and Consequences - Case Study of Stara Planina

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Hilly-mountainous regions are extremely vulnerable as a consequence of natural characteristics and human impact. Mismanagement in headwater areas produces negative impacts: hard degradation of topsoil and native vegetation; endangering of all animal and plant species residing in small areas; severe fragmentation of the remaining old-growth forests; floods and bed-load deposition on downstream sections of river beds. Degradation of land and water quality in mountain watersheds was followed by depopulation, economy and social problems within local societies. The environmental impacts in Serbian ski resort Stara planina (headwater of Zubska River) are very strong leading to degradation of unique mountain landscape and functionality losses.

Keywords: watershed management, erosion, surface runoff, transfer of impacts

649 Protection of Glacier Lakes - Case Studies of Biogradsko and Plavsko Lake

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Biogradsko and Plavsko are glacier lakes, located in mountainous region of Montenegro. Both lakes are extremely endangered by fulfilment with sediment and regressive erosion processes. Concept of protection has been presented in the paper.

Keywords: glacier lakes, erosion processes, sediment deposition

660 Flood Forecast and Weather Radar

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Flooding is of universal concern and interest. It is one of the most dramatic interaction between man and his environment, emphasising both the sheer force of natural events and man's inadequate efforts to control them. The ability to provide sufficient advance warning of flood occurrence is important in reducing the potentially disastrous effect of flooding. It may, for example, save lives by giving floodplain residents time to remove themselves and their possessions to safety, and it may save property by allowing time to effect various structural and other adjustments. Flood flow forecasting for a catchment due to rainfall requires a quantitative estimate of precipitation. This can be accomplished using several methods including raingauges, weather radar or a combination of raingauges and weather radar. The traditional approach to flood forecasting is to use rainfall input estimated from a number of raingauges. The recent advance of new technologies such as weather radar, satellites, GIS and high speed computer workstation provides new opportunities for hydrological forecasts improving. Basic advantages of radar (as instrument for surveillance and measurements at distance) are the providing with information in real time (with frequency up to 5min.), large observation space and high spatial resolution. Quantitative real-time rainfall measurements utilising weather radar provide opportunities for real-time flood forecasting. Rain production is connected with: vertical and horizontal clouds dimensions, life cycles, cloud water vapour amount, thermodynamical and microphysical processes. Some characteristic cloud formations and theirs radar signature important for flood forecasting are presented in this paper.

Keywords: radar, flood, forecasting

668 Seasonal Variations of Hydrographic Conditions Marine Waters Near the Bojana River

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In order to understand the various biological and physicochemical processes in the area near the Bojana River, variations in temperature, salinity, O₂, turbidity, chlorophyll were studied. Conductivity, temperature, and depth (CTD) transect

were conducted seasonally between November 2007 to June 2008 at 7 locations for the Adriatic Star project. The hydrographic characteristics in the sea waters near entrance Bojana River in the sea showed marked seasonal changes. These results will be discussed and analyzed.

Keywords: CTD Transect, river Bojana, marine waters, Adriatic sea

671 Water Use and Technical Efficiencies of Private Irrigated Perimeters in Zeuss-Koutine Watershed, South-Eastern Tunisia

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In this paper, data envelopment analysis (DEA) is used to assess the farm-level technical efficiency measures and sub-vector efficiencies for water use of a sample of irrigated farms based on surface wells in Zeuss-Koutine watershed (south-eastern of Tunisia). In the study area, private irrigation perimeters play an important role in rural development, but the water scarcity and the increasing pressure on these resources calls for a more efficient water use. With the Data Envelopment Analysis (DEA) techniques used to compute farm-level technical efficiency measures and sub-vector efficiencies for water use, it was shown that under Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) specification, substantial technical inefficiencies, of 26% and 15% respectively, exist among farmers. The sub-vector efficiencies for water proved to be even lower, indicating that if farmers became more efficient using the technology currently available, it would be possible to reallocate a fraction of the irrigation water to other water demands without threatening the goal of surface wells irrigation.

Keywords: irrigation, technical efficiencies, DEA method, surface wells, Tunisia

**681 Quantitative and Qualitative Status of the Groundwater Bodies
from the South-Eastern Part of the Romanian Plain**

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The groundwater bodies from south-southeastern part of the Romanian Plain, from geomorphological point of view, have a large development in Upper Pleistocene and Holocene deposits along the main rivers, the Danube's terraces and on the interfluvies and were given for management to Arges-Vedea and Buzau-Ialomita Water Directorates. The aim of the paper is to reveal groundwater regime changes in 2007, characterized by a lack of precipitations and exceeding temperatures comparative with 2008 year and also with the multiannual mean. Quantitative status of the groundwater bodies was accomplished by charts, the qualitative one consisting in graphical comparison of the nitrogen compounds concentration and ammonium. The piezometric level values and the specified hydrochemical parameters values were provided from the monitoring wells that constitute the National Hydrogeological Network. The conclusions are marked out taking into account the processing results with ArcGIS software. According to the resulting maps and charts, in 2007 the piezometric levels decreased in the studied area, whereas the analysed physico-chemical indicators concentration increased.

Keywords: Romanian Plain, groundwater body, quantitative and qualitative status

685 Water Management for Human Settlements

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Permaculture evolved from concern with the degradation of the environment. There are several key issues which affect how we, our children, and grandchildren can live on this earth. They are: Water pollution and availability, Soil toxicity: long term: nuclear, less long term, chemical, climate change which will affect, species and production systems in all countries, growth and development economies PERMACULTURE is A DESIGN SYSTEM FOR HUMAN SETTLEMENTS PERMACULTURE AND ORGANIC AGRICULTURE Is an Albanian NGO, working on the field of introduce and practice sustainable agriculture, as a real

possibility that by mobilization and maximally using of the local resources can reduce poverty in rural areas. Sustainable Agriculture and Organic Agriculture is registered as Local NGO,s according to the Albanian law. Vision of P&OA Capacity building of the young generation, extension workers, specialist of the local governments, students of the middle schools and agriculture universities, pedagogical staff, NGO sector etc for introduce and practice permaculture as a real possibility in the farm and community to maximally use of the local resources and mobilization of the resources and energy, for improve living condition and reduce poverty in rural areas. Volunteer's approach of the staff is the main spirit to support youth etc. Mission of the P&OA To learn people how to understand the philosophy and principles of permaculture and the importance of the practical effect by application permaculture methods and techniques in all aspects of the human beings activity, and with small investments to take the maximal outputs. Understanding that the resources in the world are un limited, and is the duty of people, science and experts to put all the energies in the service of the human beings, and looking the future of the world with optimism. P&OA support people to work in the community and other social activities of the field of agriculture, fruit culture, forestry, water resources, saving and improve the fertility of the land, using the alternative energies in the service of the human beings, such as wind energy, solar energy, biogas energy and measures for environment protection and reduce emission of CO₂ in the atmosphere, saving the genetic pollution and diversity of spices, organic way of production etc. Support understanding the role of individuals including women and youth for the P&OA inform periodically the public with the progress of permaculture and organic agriculture, through local TV and written media, publish leaflets, photos and video reflecting the activities in the farm, school, youth and women, in local and national level for application of the sustainable agriculture. Water management is the crucial part of the permaculture. Herein are some photos illustrating the possibilities to maximally using of the local resources. Reservoirs in high mountain villages are an example how to create well-being in remote villages. Village Velez is situated on a mountain zone in Tirana. A village with around 150 families have constructed more than 4- reservoirs with capacity of 100 0 300 cubic meter water for irrigation. They produce tomatoes on August September October, with very good quality and very good taste, and they have secure market thanks to the quality and god climate condition where they are produced. Model of lake may be considered the Lucerne Lake, where the town was constructed on the sides of lakes decorated, with decorative trees, roads, gardens and social places. The lake is very clean, and according to the legislation, is not allowed at least a leaf to fall down to pollute the lake. A Very good example model in the world is Ohrid Lake. Clean waters and very good protected and designed, combination with mountain, forest, town , economical and the tourism These models have to be adopted and planed for investments. Shkodra Lake needs many investments to change it like Ohrid model.

Keywords: water management

**185 Integrated Geological, Geoelectric and Geochemical Studies
for Groundwater Resource Evaluation in Coastal Areas
of Sagar Island Region, West Bengal, India**

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The importance of water for sustenance of life cannot be overemphasized and groundwater being a part of the hydrologic cycle needs attention for its proper evaluation and management not only to meet our need for the present but also for the future generations to come. Sagar Island, the largest Island in the Ganga delta, is almost flat low lying region built up of unconsolidated alluvial sediments of Quaternary age. For water supply villagers are totally depending on the sweet groundwater tapped from deep confined aquifers through deep tube wells having depth more than 240 m. The deeper sweet aquifers lie between 180 m to 335 m below ground level (bgl). Surface water or dug well water is totally saline. The overlying shallow aquifer is also saline water bearing. The present study comprises an integrated geological, geoelectric and geochemical investigations to assess the prevailing surface and ground water condition, viz. aquifer depth, chemical quality of ground water and hydrological characteristics in some parts of Sagar Island and adjoining mainland for groundwater resource studies. Vertical electric soundings (VES) were carried out with maximum electrode spacing of 1200 m and the resistivity layers parameters obtained from VES studies through light on the facies change in subsurface lithology and reveal the existence of a saline water bearing zone overlying a fresh water bearing zone. The VES curves are interpreted by 1-D inversion technique and the results show presence of five to six prominent layers consisting of alluvial top soil, saline water, brackish water, impermeable clay layer, fresh water and bottommost clay with silt and sand lenses under the prevailing hydrodynamic condition. Such a fresh confined aquifer is typically developed in the area with overlying clay-rich silty formation which prohibits the infiltration of saline and brackish water. The average thickness of the freshwater bearing zone under confined condition is about 180 m at an average depth of about 182 m from the surface. Resistivity section and fence diagram are constructed from VES interpretations for showing lithological and hydrological characteristics of the area. Some potential zones of aquifer are marked for drinking water purposes. Chemically fresh groundwater is Na-HCO₃ type with TDS ranging from 500 to 780 mg/l. Chemically the groundwater is safe for drinking and domestic purposes with low to medium Sodium Adsorption Ratio (SAR) values. It is free from As and Pb. Na content is relatively higher than the values of other elements present in the groundwater. The seawater contamination (SWC) values for these water samples are significantly low.

Keywords: Vertical electric sounding, Sodium adsorption ratio, sea water contamination, Aquifer

719 Water Resources Challenges and their Transboundary Impacts

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This paper presents the challenges of water resources of Kosovo in the context of natural, socio-economical, ecological, managerial as well their trans-boundary impacts. According to hydrological indicators the water resources of Kosovo are estimated to be around 1700m³/per capita/annual/. It is thought that the area with such hydrological recourses are found in the places with potential water stresses. Geographical position and terrain topography have affected the dispersion of river system and their flowing in three sea watersheds: towards the Adriatic Sea , Black Sea and Aegean Sea. These factors have affected Kosovo to be in the upper part of rivers that cross the borders, so that it makes Kosovo rich with high level domestic water resources i.e. 90% whereas only 10% transit waters. The main water challenges of Kosovo are relatively water limited recourses, rapid increase in demand and intensive intersectorial necessities, fervent pollution, flooding, droughts, inadequate management and so on. The most national hydrological challenges are reflected in different ways even in the trans-boundary waters. The main Kosovo rivers cross the border with Serbia in the three points, one with Macedonia and two with Albania. The average annual water flow is in the direction of Albania which is 56%, in Serbia 37.1% and in Macedonia 6.9%.

Keywords: challenges, management, water resources, rivers, borders

721 Impact of Low Danube Levels on the Water Intake in Danube-Tisza-Danube Hydrosystem

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The paper analyzes occurrence, duration and change of low and minimal water levels of the river Danube on the watergauge station Bezdán. The analyses have been conducted regarding the conditions for water release from the river Danube to the Main Canal Network of the Danube-Tisa-Danube Hydro-system (MCN HS DTD) on the main water intake at Bezdán. Short historic overview of the development of early waterintake facilities and problems in their work is

represented in the introductory part of the paper. The occurrence of the low water level of Danube that restricts the work of the waterintake facility is presented and statistically analyzed later on. Namely, the maximal water release into the canal, of about 60m³/s, occurs only at certain water levels. At lower levels the possibility of the gravitational release of water into the canal gradually diminishes until complete cessation of this option and transfer to the work of pumping station which total capacity amounts to 12m³/s (3 x 4m³/s). The work mode of the pumping station also depends of the Danube water level. Namely, here too the decrease of water level excludes the possibility of the work of certain pumps until the complete cessation of the work of pumping station and the possibility of supplying water to HS DTD in any way. Throughout the history of the water intake at the canal Danube-Tisa-Danube, as well as today, it is clear that the Danube water levels in the region of w.s. Bezdan are of a great importance and can represent significant restriction in providing water to multipurpose hydro-system. The occurrence and duration of the aforementioned characteristic water levels and its change at water gauge station Bezdan, have been analyzed during the perennial period . The obtained results show that the occurrence of low water levels is more frequent and its duration is significantly longer, with the possibility of intensifying this problem even more in the following period.

Keywords: Danube, water level, water gauge, hydrosystem Danube-Tisa-Danube

***722 Integrated Water Resources Management
on the Irrigated Lands of the South of Ukraine
in the Global Climate Changes Conditions***

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Were developed principles and methods of integrated management of water resources in irrigated areas of south of Ukraine in the global climate changes conditions. Management was carried out taking into account the improvement of irrigation systems and the evolution of soil-hydrogeological process of agrarian landscapes under the influence of irrigation and drainage. Methods: field experience carried out for the years, ecological and land-reclamation monitoring, GIS-technology. When forecasting processes was used method of neural networks.

Keywords: irrigation, derange, evolution, integrated management, soil-hydrogeological process, GIS-technology, climate

727 Optimal Management of Multipurpose Reservoir System of Kwanza River

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This paper describes an optimisation model for the management of reservoir system of Kwanza river in Angola. Key uses are energy production, irrigation and supply water at Luanda. Given the uncertainty due to the inflows, water demand and evaporation variables, we will determine the prediction models of the two first variables using the Box-Jenkins methodology and Visentini method for the last variable. Then we model the decision-maker preferences and finally, formulate the expected multiattribute utility model that needs to be maximized.

Keywords: Kwanza river, Box-Jenkins methodology, Visentini method, Decision-maker preferences, Utility function, Dynamic programming

754 Canal, Water, Environment and Regulation

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A relatively long and wide canal built in alluvial layers next to the Drava River is used to evacuate water from the engine room of the Varazdin Hydropower Plant to the river. This paper deals with water fluctuations in the canal and their effects on the river surroundings, as well as with its maintenance procedure.

Keywords: canal, water level, meandering, seepage, erosion, protection

**755 Anthropogenic Effects on the Environment
in the Delta of the River Neretva (Croatia)**

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Delta, or the characteristic shape of the Neretva River estuary, attracts a great number of visitors due to the beauty of this nature park and its natural resources. The Neretva delta covers approximately 20,000 hectares of magnificent landscape. This paper deals with the protection of the Neretva River delta, its swampy areas and springs, and also water management.

Keywords: swamps, environment protection, water springs, water management

760 Hydrological Risk Phenomena in the Basca Roziliei River Basin

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Everything that mankind could not conquer or explain has been put on hazard. Hazard consists of two major components: one is related to the repeatability of a phenomenon and its main determining causes the other one is related to its random character, having no connection with the past, component that give the hysteresis state of the studied system.

In the first part of this presentation there are analyzed the main flood risk factors such as: general presentation of the river basin, the definition of flood, the main characteristics of a flood, the geographical position of the river basin and its main rivers, the human impact in the hydrological waterflow regime.

In the second part there are analyzed the three historical floods from 1975 and 2005 recorded on the Basca river: at the Varlaam gauging station on the Basca Mare river and on the Basca Mica river, and the other one at the Basca Roziliei gauging station on the Basca river. After that, an evaluation of the negative effects are analyzed and actions to take in order to diminish the hydrological dangerous effects in this river basin are also suggested.

Keywords: hydrological risk, hash flood, inundation, Basca

**768 Implementation of Nitrate Directive 91/676/Ehs
and Water Monitoring in Slovak Republic**

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The main aim of the Nitrate directive 91/676/EEC is to protect water from pollution caused by nitrates from agricultural sources. The implementation plan for Nitrate Directive 91/676/EHS was developed in 2001. It includes timetable of securing relevant activities in the field of planning, legislative measures, monitoring, advocacy, reports translation, communication and it determined the organizations, which are responsible for its realization. The main task resulting from the Directive is monitoring securing, which subserve the control and evaluation of agricultural activities impact on groundwater quality.

Groundwater monitoring network has to be drafted to provide continual and comprehensive view about chemical and quantitative groundwater status in all vulnerable areas and to uncover a long-term impact of agrochemicals applications, mainly the increasing trends in monitored indicators of nitrate. It also has to allow the evaluation of accepted measures in aspect of action plans and to identify specific producers of water pollution. The smallest administrative unit is the cadastre municipality; therefore a rule was accepted that monitoring has to allow identifying contaminants in every cadastre classified in vulnerable zone.

Analyses of original status of groundwater monitoring within SR were made. On the basis of these analyses a plan and program of groundwater monitoring in term of nitrate was processed. Also completion of monitoring network with about 702 new observation objects and extension of monitoring in 300 existing monitoring objects was done.

**533 Potentiality of Using Plant Treatment Stations' Sludge
and Water in Agricultural Practices**

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Suffering from shortage of irrigation water and organic matter in agriculture, it is indispensable to look for other sources. Sludge and water derived from biological treatment of wastewater could be such sources.

In recent years, 68 stations for artificial biological treatment of wastewater were established and exploited in Bulgaria. Sofia wastewater treatment plant, situated in Kubratovo village, has been put into operation and this is the largest purification plant of the country. After the biological treatment the outcome is sludge and purified water. Sludge accumulates in the surrounding area of the stations, hinders their functioning and pollutes the environment. The treated water is discharged into the water intakes instead of being used for irrigation and fertilization.

There are two major issues:

- Sludge utilization
- Treated water utilization

In order to develop technology solutions for sludge and treated water utilization in agriculture it is necessary to assess the characteristics of sludge and purified water according to the requirements of European and Bulgarian legislation and to determine its impact on irrigation and its influence on soil characteristics and product qualities.

The main goal of the research is to identify opportunities how to use water and sludge originated from wastewater treatment plants as an instrument of fertilization and irrigation in field conditions.

A field experiment was set up in the region of Sofia wastewater treatment plant and methodical plan how to carry out it for a long period of time was developed.

Traditionally, some vegetables have been grown in the region: cabbage, lettuce, potatoes. The experiment is set up for these vegetable plants according to the method of long lots in three variants: non-fertilized, fertilized and fertilized with 40 t/ha sludge. At each variant of fertilization and at each vegetable were applied three regimes of irrigation: non-irrigated, irrigated with clean water and irrigation with purified water.

Results have showed good crops development as a consequence of combined use of sludge and treated water.

Keywords: Sludge, Wastewater, Irrigation

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