IV – Water resources and management

Parallel session A – Monday 10th March 14:00-15:30

ID Nº: [67]

Title: **ADAPTING TO FUTURE DROUGHTS: A RISK-BASED APPROACH FOR INCREASING DROUGHT PREPAREDNESS**

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Drought frequency and severity is expected to change in the future, adding to the need for developing drought adaptation strategies. The FP7 DROUGHT-R&SPI project aims at supporting drought preparedness by proposing adaptation practices, following an integrated analysis of drought-related risks in six selected Case Studies (The Netherlands, Portugal, Switzerland, Po river Basin in Italy, Jucar River Basin in Spain and Syros Island in Greece). A stakeholder-driven adaptation process is adopted, as vulnerability to drought and options are discussed with and evaluated by local stakeholder fora.

Starting from future drought risk identification (in terms of duration, severity and frequency) on the basis of climate projections, the analysis concludes to recommendations for future drought risk reduction. A probabilistic analysis of future drought impacts (risk assessment), for different sectors and adaptation practices, supports the evaluation of options on the basis of three criteria: risk of economic losses, vulnerability, and cost-benefit ratio. Results are discussed with stakeholders, in order to: (i) incorporate in the evaluation process their perception of effectiveness and feasibility of implementation of each option, and (ii) promote their adoption by the local authorities. Besides case-specific recommendations, the synthesis of results from the individual Case Studies is used for making general suggestions for developing drought adaptation strategies.

Presenter

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Conference on European Climate Change Adaptation
Research and Practice

ID Nº: [202]

Title: **A REGIONAL OVERVIEW OF CLIMATE CHANGE IMPACTS ON HYDROLOGY IN SE EUROPE, TURKEY AND THE CAUCASUS REGION**

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Climate change is expected to substantially affect hydrology and runoff regimes in the region ranging from SE Europe, over Turkey to the Caucasus countries. As most of the economies in that region are either emerging or are expected to emerge in the near future, there is a growing need for electricity production, e.g. from hydropower plants. The study analyses potential climate change impacts on runoff regimes (e.g. mean monthly discharge) for exemplary catchments in the region. The objective was to use a straightforward multi-emission scenario modelling scheme for several catchments in the region to give a large-scale regional overview of the range of possible hydrological impacts.

In a first step, past temperature and precipitation trends over the past 30 years were analysed using the E-OBS gridded data set. The results show a clear trend towards increasing mean annual, but also seasonal temperatures. In contrast, precipitation trends show more ambiguous patterns, with increasing precipitation in some areas and decreasing precipitation in other areas. Observed runoff trends are often hampered by a lack of long term gauging data or the influence of water infrastructure such as large dams which may alter the runoff regime considerably.

In a second step, possible temperature and precipitation trends were compiled for the entire study region. The data were taken out of an ensemble of 16 CMIP3 GCMs and three SRES emission scenarios (A2, A1B, B1) from the ClimateWizard project (www.climatewizard.org). The time slice between 2040 – 2069 was chosen. The three SRES scenarios represent low (B1), mean (A1B), and high (A2) emission scenarios. All three projections result in temperature increases for the entire study region, with the A2 emission scenario showing highest temperature increases and the B1 scenario resulting in lowest temperature increases in the region. Again, precipitation projections show regional differences, with some areas becoming dryer and other wetter.

The combined temperature/precipitation projections resulting from the three SRES scenarios were applied in the hydrological model HBV for several catchments throughout the study region. The catchments vary in size and catchment characteristics (e.g. area, topography). Mean monthly runoff for each catchment was calibrated and validated for reference conditions, i.e. with observed hydro-climatological data. Simulated runoff under reference conditions was then compared with the runoff simulations resulting from the three different SRES scenarios. Despite the variety of the catchments, a general shift in runoff generation towards earlier peak discharge (e.g. shifting from summer towards spring) or a shift towards higher winter and lower summer runoff could be observed. The simulated changes vary depending on the temperature/precipitation projection, ranging from pronounced to moderate changes in runoff generation.

Presenter

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ID Nº: [268]

Title: **ASSESSING THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON COASTAL GROUNDWATER RESOURCES AT THREE MEDITERRANEAN SITES**

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The current work presents the combined assessment of three potential climate change impacts on groundwater resources in the coastal Mediterranean, namely: i) a decrease in recharge: ii) an increase in crop water demand and iii) sea level rise. The combined study of these impacts is essential, as they can be interrelated: a decrease in recharge and increase in crop water demand will both result in higher groundwater pumping rates, and together they will have a more pronounced effect on the decline in groundwater levels, which may enhance the impact of sea level rise. The individual and combined impacts of these factors on groundwater levels and flows into coastal wetlands were studied at three locations, in Morocco, Spain and Portugal, and the study was carried out within the CIRCLE-MED project CLIMWAT.

Climate scenarios were developed using the ENSEMBLES projections that consider the A1b scenario. Temperature and precipitation data of three climate models were bias-corrected with two different methods for a historical reference period, after which scenarios were created for 2020-2050 and 2069-2099 and used to calculate aquifer recharge for these periods based on two soil water budget methods. The multiple combinations of climate models, bias correction and recharge calculation methods allowed incorporating and assessing the level of uncertainty inherent to climate change impact assessment studies. Groundwater flow models were developed for the three sites and subsequently used to integrate the future scenarios for recharge and crop water demand, based on the soil water budget methods, and sea level rise.

The results show that short-term predictions are marked by large ranges of changes in recharge, only showing a consistent decrease at the Spanish site, particularly due to a reduction in autumn rainfall. The latter is also expected to occur at the Portuguese site, resulting in a longer dry period. More frequent droughts are predicted at the Portuguese and Moroccan sites. Towards the end of the century, results indicate a significant decrease in recharge in all areas, though most pronounced at the Portuguese site in absolute terms and the Moroccan site in relative terms. The models further predict a steady increase in crop water demand, causing 15-20% additional evapotranspiration until 2100. Scenario modeling of groundwater flow shows its response to the predicted decreases in recharge and increases in pumping rates, with strongly reduced outflow into the coastal wetlands. The effect of sea level rise is not significant when compared to the decrease in recharge and increase in crop water demand. Despite the inherent uncertainty, also related to the CO_2 emission scenario, the GCM model and the downscaling techniques, the results show that even though groundwater may have a higher resilience than surface water resources, adaptation measures are needed to minimize the risk of future groundwater overexploitation in Mediterranean coastal aquifers.

Presenter

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ID Nº: [250]

Title: **MANAGING WATER SCARCITY IN THE MAGDALENA RIVER BASIN IN COLOMBIA. AN ECONOMIC ASSESSMENT.**

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In Colombia, water conflicts emerged with the economic development in the 70ies and 80ies and the term “water scarcity” became a common word in this tropical country. Despite a mean annual runoff of 1840 mm, which classifies Colombia as a water rich country, shortfalls in fresh water availability have become a frequent event in the last 2 decades. One reason for the manifestation of water scarcity is the long-held perception of water abundance, which has delayed technical and political developments to use water more efficiently.

The Magdalena watershed is the most important and complex area in Colombia, because of its huge anthropogenic present, economic development and increasing environmental problems. This river basin has a total area of 273,459 km^2, equivalent to 24% of the territory of the country. It is home to 79% of the country’s population (32.5 million of inhabitants) and approximately 85% of Gross Domestic Product of Colombia is generated in this area. Since the economic development of the 1970s and 1980s, large changes in land cover and related environmental conditions have occurred in the Magdalena basin. These changes include deforestation, agricultural land expansion, soil degradation, lower groundwater and increased water pollution.

To assess the consequences of geophysical alteration and economic development, we perform an integrated analysis of water demand, water supply, land use changes and possible water management strategies. The main objective of this study is to determine how global and local changes affect the balance between water supply and demand in the Magdalena river basin in Colombia, the consequences of different pricing schemes, and the social benefits of investments into various water management infrastructures.

To achieve this goal, a constrained welfare maximization model has been developed. The GAMS (General Algebraic Modeling System) based mathematical program uses information from spatially detailed Geographic Information System including topography, land cover and water systems. Spatially resolved economic data are included to depict the price-sensitive consumption decisions of major water users. Water management adaptation options include wet ponds and dams. The model maximizes economic net benefits subject to physical and technological constraints. The results of this study are relevant to water management stakeholders, and to governmental agencies for the development of better water policies.

Presenter

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