IV – Water resources and management

Parallel session C – Tuesday 11th March 11:00-12:30

ID Nº: [259]

Title: **INTEGRATED PAN-EUROPEAN VIEW FOR COASTAL LAGOONS MANAGEMENT: A NESTED DPSIR APPROACH**

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Essentially since the last decade, European legislation for the protection of the seas have been following an ecosystem approach, meaning that the management of human activities should ensure the ecological health of the marine ecosystems and a sustainable use of their ecosystem goods and services (e.g. Habitat Directive, the EU's ICZM, and the EU MSD). Still, an efficient and effective management of the coastal zones needs to ensure that the different intervening agents on the system are heard, and addresses the interacting uses of the marine system. This is one of the fundamental goals of LAGOONS, a EU-FP7 funded project, where knowledge produced by different scientific disciplines is combined and integrated with local knowledge and the views of stakeholders, in a pro-active and participative way, in order to propose effective management recommendations for coastal lagoon ecosystems. Here, we present an integrated management recommendations framework for coastal lagoons, taking into account different actors in the system (science-base, expert judgment, end-users, stakeholders and general public) and using four coastal lagoons as representative case studies of the diversity existent in Europe, with regard to hydrology, geomorphology, governance, among other factors. For the proposal of the management recommendations, we followed a DPSIR approach, but integrating human wellbeing, welfare and ecosystem sustainability aspects (society, economy and ecology). The DPSIR allows structuring and easily communicating policies about the environment, especially when associated to ecosystem services and applied in a participatory and multi-methodology way, as the one presented here. Initially all drivers for each case study were identified and DPSIR sub-cycles performed for the most relevant ones. This information was then used to build a nested-DPSIR for each lagoon, where the DPSIR sub-cycles are combined, may have multiple interactions among each other, and, as such, need an integrated management recommendations framework (responses). This framework emphasizes the common links, but also the specificities of the responses to the drivers and the ecosystem services provided. The information collected on the four hotspot lagoons was then used to give a support for a Pan-European integration through a bottom-up approach and this way provide management priority areas and recommendations within a Pan-European context using a science-policy-stakeholder interface.

Presenter

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Conference on European Climate Change Adaptation
Research and Practice

ID Nº: [66]

Title: **ASSESSING CLIMATE CHANGE IMPACTS AND POTENTIAL ADAPTATION MEASURES THROUGH WATER BALANCE MODELING – THE CASE OF SYROS ISLAND, GREECE**

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Climate induced changes in the water balance, particularly in water scarce areas, may significantly influence the economic and environmental security of a region, stressing the need for the analysis of future water availability, demand coverage and effective options for minimising impacts on water systems. The main objective of this study, undertaken under the frame of the FP7 WASSERMed project, is to assess the impacts of climate change on the water balance and on strategic sectors (agriculture and tourism) of Syros Island, Greece, and to propose adaptation measures for achieving water security.

Climate projections from the WASSERMed project for the period 1961-2050 were used for analysing future conditions in terms of water availability (groundwater recharge), crop water requirements and tourism potential. Future socio-economic scenarios were developed for the time horizon until 2050, taking into account the current state and development perspectives. Two Workshops were organised in order to discuss scenarios and adaptation measures with local stakeholders. Five adaptation measures were selected, based on the type of anticipated climate change impacts and the existing technical infrastructure: Rainwater harvesting in the urban sector and the agricultural sector, Direct wastewater reuse for irrigation and artificial aquifer recharge, and Increase of desalination capacity.

Finally, a water balance model was developed and future water-related threats were assessed and adaptation measures were simulated and evaluated. Water balance modeling concerned baseline conditions (2010), and simulation of future scenarios (up to 2050) for climate, socio-economic conditions and adaptation measures.

The integrated assessment of climate change impacts on the island's water balance indicates the need for supporting measures towards supply enhancement. Wastewater reuse and desalination capacity expansion were shown to be the most promising options for adapting to climate change. However, through the group discussions in the Workshops it also became clear that adaptation would require integrated development planning, coordination among the different authorities involved in water management, and adequate representation of water users in participatory processes

Presenter

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ID Nº: [44]

Title: **ADAPTATION OF MULTI-PURPOSE RESERVOIRS MANAGEMENT ON THE SEINE RIVER BASIN IN A CLIMATE CHANGE PERSPECTIVE. RESULTS OF THE CLIMAWARE PROJECT**

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Climate projections established by the IPCC indicate that significant changes in precipitation and temperature are to be expected in Europe in the next decades. The ClimAware project (2010-2013, funded by IWRM-Net) was set up to develop adaptation strategies to limit the impacts of climate change in several water related domains, each being investigated through a case study: hydrogeomorphology in Germany, irrigation in Italy and reservoir management in France. An integrated European-wide modelling approach was also developed for cross-scale analysis.

The Seine River case study focuses on the adaptation of reservoir management for two main objectives: low-flow augmentation and flood alleviation, with important socio-economic stakes especially in the great Paris area. Four large reservoirs control the upstream parts of the four main rivers (Aube, Seine, Yonne and Marne) and are managed by the *Seine Grands Lacs* public basin authority.

A daily hydrological modelling chain was designed to explicitly account for reservoir management rules. It was calibrated in current conditions (1958 to 2009) and then fed by the outputs of seven climate models in present (1961 to 1991) and future (2046 to 2065) conditions, forced by the SRES A1B scenario, downscaled using a weather-type method and statistically bias-corrected. The impact of climate change was assessed using performance indicators for different scenarios of reservoirs management.

The adaptation of two levels of management design was investigated in the project:

- tactical management based on the annual objective filling curve of the reservoirs and designed from an analysis of historical hydrological regimes and extreme events;
- real time management, accounting for real time constraints linked to ongoing conditions, which is currently reactive and decentralized and only depends on local available data (level in the reservoir and flows in the upstream and downstream reaches).

The proposed adaptation scenario for tactical management is based on a statistical method, giving the filling curves associated to risk probability of failure in achieving one objective in the future. We developed new filling curves for the available climate simulations by minimizing the risk, following a priority order among objectives.

For real time management, a Tree-Based Model Predictive Control (TB-MPC) was used. It is a proactive and a centralized method, using information available in real-time, including ensemble weather forecasts. TB-MPC uses an internal model and an objective function to find the optimal release from the reservoirs. The internal model predicts the future effect of present releases, and the objective function penalizes high and low flows at different locations downstream, including at Paris.

Adaptation strategies for the two management levels were tested in present and future climate conditions and management performances were compared to current management practice.

Presenter

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ID Nº: [168]

Title: **THE CHANGE TO PROBABILISTIC PROJECTIONS: FARM RESERVOIR DESIGN IN THE UK**

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(Theme: Water resources or Uncertainty and decision making)

The change to probabilistic projections: farm reservoir design in the UK

ABSTRACT

Climate projections are increasingly being presented in terms of uncertainties and probability distributions rather than median or "most-likely" values. The current national UK climate change projections, UKCP09, provide 10,000 probabilistic projections and 11 spatially coherent projections (11SCP) for three future emission scenarios. In contrast, previous iterations such as UKCIP02 provided only a single "most-likely" (deterministic) projection for each scenario. This move to probabilistic methods of communicating climate change information, whilst highlighting some of the uncertainty (though still not all), complicates the process of adaptation planning. However, it is not clear beforehand whether or how it would change adaptation decisions, and hence its added value.

UK farmers are being encouraged to build on-farm irrigation reservoirs as an adaptation to water resource constraints. Climate change in the UK is expected to simultaneously increase water demand and reduce summer water availability.

This paper examines the application of probabilistic climate change projections to irrigation reservoir design at three sites in the UK, using data from a concurrent cost-benefit project on reservoir construction. It compares the optimum reservoir sizes calculated using the median or "most likely" projection against capacities using the 11SCP projections and the 10,000 probabilistic projections, under various decision making criteria. The implications of sub-sampling the probabilistic projections using both simple random and Latin-hypercube sampling were also explored.

The results showed the difference between the emission scenarios was very small. Such differences between scenarios for single "most-likely" (deterministic) projections have sometimes been used as a proxy for the range of uncertainty, but would have given a very unrealistic picture. Comparing the 11 spatially coherent scenarios suggested a wider range, but would still give too narrow a picture. In contrast, there was a substantial range in irrigation water needs and hence in optimum reservoir capacity within the 10,000 probabilistic projections, such that some extreme scenarios suggested doubling the median capacity whilst other suggested not building the reservoir at all. However, the central 50% all fell within about + or – 15% of the median. Furthermore the economic analysis showed the net present value was not highly sensitive to choice of capacity near the optimum for any given scenario.

Whether and how that additional information would affect the choice of reservoir capacity depends on the risk appetite of the decision maker, and will be discussed.

Keywords: Probabilistic scenarios, uncertainty, UKCP09, adaptation planning, farm reservoirs, UK

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