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Uncertainties in assessing climate change impacts on the hydrology of Mediterranean basins

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There is substantial evidence in historical and recent observations that the Mediterranean and neighboring regions are especially vulnerable to the impacts of climate change. Numerous climate projections, stemming from ensembles of global and regional climate models, agree on severe changes in the climate forcing which are likely to exacerbate subsequent ecological, economic and social impacts. Many of these causal connections are closely linked to the general expectation that water availability will decline in the already water-stressed basins of Africa, the Mediterranean region and the Near East, even though considerable regional variances must be expected.
Consequently, climate change impacts on water resources are raising concerns regarding their possible management and security implications. Decreasing access to water resources and other related factors could be a cause or a 'multiplier' of tensions within and between countries. Whether security threats arise from climate impacts or options for cooperation evolve does not depend only on the severity of the impacts themselves, but on social, economic, and institutional vulnerabilities or resilience as well as factors that influence local, national and international relations. However, an assessment of vulnerability and risks hinges on natural, socio-economic, and political conditions and responses, all of which are uncertain. Multidisciplinary research is needed to tackle the multi-facet complexity of climate change impacts on water resources in the Mediterranean and neighboring countries. This is particularly true in a region of overall data scarcity and poor data management and exchange structures.

The current potential to develop appropriate regional adaptation measures towards climate change impacts suffers heavily from large uncertainties. These spread along a long chain of components, starting from the definition of emission scenarios to global and regional climate modeling to impact models and a subsequent variety of management options and adaptation strategies.

Therefore, the 4-year FP7-project CLIMB (Climate induced changes on the hydrology of Mediterranean basins, GA: 244151) includes a major focus on the assessment and quantification of uncertainties. First, CLIMB employs a rigorous climate change model analysis, auditing the Global and Regional Climate Model data available through the ENSEMBLES and PRUDENCE initiatives. The audits lead to select the best regional performers as compared to observed values during the climatic reference period (1971- 2000). Specific bias correction and downscaling procedures are applied to provide the driving inputs and meet the demands of the subsequent impact models, transferring a future climate signal (2041-2070) into hydrological quantities at the catchment or landscape scale. However, very limited quantitative knowledge is as yet available about the role of hydrological model complexity for climate change impact assessment, where predictive power becomes more and more important and raises the demand for process-based and spatially explicit model types. Thus, CLIMB uses hydrological model ensembles to analyze the performance of existing models and works to identify the appropriate level of model complexity, and thus to determine the data specifications required to provide robust results in a climate change context.
The presentation focuses on the CLIMB multi-level strategy to uncertainty assessment and highlights latest findings in some of the seven CLIMB case studies. In particular, the presentation will demonstrate the current constraints of hydro-meteorological data availability and processing and searches for solutions that can eventually be provided by integrating hydro-meteorology and ICT research communities.