

CLIWASEC – A RESEARCH CLUSTER ON CLIMATE CHANGE IMPACTS ON WATER AND SECURITY IN SOUTHERN EUROPE AND NEIGHBORING COUNTRIES

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ABSTRACT

The Mediterranean region is experiencing a broad range of threats to water security. According to climate projections, the region is at risk due to its pronounced susceptibility to changes in the hydrological budget and extremes, which is expected to have strong impact on the management of water resources and on key strategic sectors of regional economies. Related developments have capacity to exacerbate tensions, and intra- and inter-state conflict among social, political, ecological and economic actors. Effective adaptation and prevention policy measures call for multi-disciplinary analysis and action.

THE RESEARCH CLUSTER CLIWASEC

The European Commission actively prepares Europe and neighboring regions for climate induced ecological and socio-economic challenges that lie ahead and has placed related priority research topics in the Seventh Framework Program for Research and Technological Development (FP7). In order to better assess the consequences and uncertainties regarding climate impacts upon human- environment systems, a coordinated topic has been launched between Theme 6 ('Environment (incl. climate change)') and Theme 8 ('Socio-Economic Sciences and the Humanities') of the programmatic setup of FP7.

Three recently launched projects form the research cluster CLIWASEC (CLimate change Impacts on Water and SECurity, www.cliwasec.eu) for multi-disciplinary scientific synergy and improved policy outreach. The cluster comprises a critical mass of scientists from 44 partners (29 institutions from the EU, 5 institutions from S&T countries and 10 international institutions) to build relationships with relevant policy representatives and stakeholders at EU level and Mediterranean and neighbouring countries covered by the projects. It tackles most relevant research questions with regard to climate change impacts on water resources as a threat to security in an integrated way:

WASSERMED – Water Availability and Security in Southern Europe and the Mediterranean (funded under FP7-ENV), co-ordinated by Prof. Roberto Roson (CMCC, Italy) - www.wassermmed.eu
CLICO – Climate Change, Hydro-Conflicts and Human Security (funded under FP7-SSH), co-ordinated by Prof. Giorgos Kallis und Dr. Christos Zografos (UABICTA, Spain) - www.clico.org
CLIMB – Climate Induced Changes on the Hydrology of Mediterranean Basins (funded under FP7-ENV), co-ordinated by Prof. Dr. Ralf Ludwig (LMU, Germany) - www.climb-fp7.eu

SCIENTIFIC SYNERGIES AND POLICY OUTREACH

The three projects are joining forces to identify and foster scientific synergies and to establish a more focused and efficient policy outreach strategy. Major building blocks of this collaboration include scientific exchange and review, identify and utilize complementary monitoring and modeling methods, harmonize and share data and discuss dissemination strategies or elaborate and propose adaptation alternatives. The projects have agreed on joint annual general assemblies, a dissemination plan for

presenting the results of the three projects in the scientific literature and the setting up a cluster project web-portal, which hosts and advertises further related projects. Policy briefs of the projects findings are prepared and posted on the cluster website on an event basis. At any time, regional, national and international stakeholders and policy bodies are invited to express their research needs and recommendations.

To optimize benefits from the variety of cluster partners' competences, joint research must be devoted towards a better understanding and description of interfaces in such complex systems. Two main challenges lie ahead: i) bridging scales and ii) quantifying and reducing uncertainty. Integrating different methods from natural and social sciences can contribute to better conceptualize each project's research findings and propose solutions for water resource management under climate change, especially when a variety of different situations can be covered in complementary case studies.

THE CASE STUDIES

The analysis of climate change impacts on available water resources and security is targeted on Southern Europe and neighbouring regions. The case studies, selected according to project specific criteria, are complementary in either scope, region or scale.

WASSERMed: Syros Island (GR), Merguellil (TN), Sardinia (IT), Jordan River (JO), Nile (EG)

CLICO: Cyprus, Andalusia-Morocco biosphere, Sarno (IT), Niger, Alexandria (EG), Sudan, Seyhan (TR), Jordan River, Sinai Desert (EG), Nile (ET), Ebro (ES)

CLIMB: Noce (IT), Rio Mannu (Sardinia, IT), Thau (FR), Chiba (TN), Izmit Bay (TR), Gaza (Palest. Adm.), Nile Delta (EG)

BRIDGING SCALES

Besides the different perspectives on climate induced changes as a threat to water security, the CLIWASEC projects are considering different scales, as processes with a pronounced spatial character (e.g. precipitation, evapotranspiration) interact with linear processes (e.g. river runoff) as well as with processes without any direct connection to one specific spatial scale (e.g. economic, political or social decision making, where impacts are spatially disaggregated to various scales). Depending on selected process and scale, these processes can be described i) explicitly (microscale – field to small-sized catchments in the range of up to several 100 km²), ii) mechanistically (mesoscale – in the order of medium sized river catchments in the range of up to several 1.000 km²) or iii) effectively (macroscale – in the order of regions, possibly ranging up to over 100.000 km²). The transition from microscale to macroscale and back is always complex if the described processes are not linear and the case studies being investigated are heterogeneous, such as the ones proposed by the CLIWASEC projects. While maintaining project research focus, one great opportunity for project collaboration comprises improved descriptions of scale interfaces. The spatially explicit results of distributed scale-crossing (environmental) models, such as the ones used in CLIMB (micro- to mesoscale) and WASSERMed (meso- to macroscale), can support and feed a yet largely unused interface to socio-economic sciences, which transfer the high-resolution signal of climate induced hydrological change into relevant socio-economic information at the appropriate scale. Decisions and courses of action which are consequently derived, such as any change in management practices, can in return be spatially disaggregated using the same interface to provide an additional external force for the hydrological/environmental models operating at the small scale. In this way, research groups can follow their sectoral expertise and joint efforts can focus on the definition of interfaces and their functionality to bridge scales.

QUANTIFYING AND REDUCING UNCERTAINTY

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. The critical mass of research capacity obtained through clustering the projects will allow for quantifying uncertainties in climate change impact analysis for the Mediterranean and neighbouring regions to a yet unprecedented level, as most of the inherent contributors to uncertainty are being addressed. Again, a specified definition of interfaces, linked to an exchange of data, methods and model results, is the key prerequisite. Most projects dealing with climate change impact analysis are usually making vast use of available Global and Regional Climate Model data (GCM and RCM respectively) without ever exchanging the methods and reasons for making their climate data selections. The audits that lead to select the best regional performers as compared to observed values during the climatic reference period can be openly discussed and exchanged and thus contribute substantially to the reduction of uncertainty. Conjointly evaluated procedures for downscaling RCM data will deliver the driving inputs for subsequent (hydrological) impact models, transferring a future climate signal 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. Hydrological model ensembles serve to analyse existing models and help 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 joint research forces provided by clustering expand the possibilities for data mining and exchange. Data uncertainty can be reduced by creating a potent and multi-scale data repository that serves to parameterize integrated impact models and comprehensively describe the regions' vulnerability, associated risks and adaptive capacity. Further, the lack of awareness or understanding of the complex climate-resource-society dynamics often leads to take inappropriate or no measures at all. An inventory of international, national and regional policies dealing with responses to climate change, water resources management, responses to hazards and disasters, and security in the region, is essential for proposing a suitable policy framework to integrate security, climate change adaptation and water management issues and specific recommendations for policy streamlining at the UN, EU, national and regional levels.