Understanding water worries

Drs Ralf Ludwig, Sihem Benabdallah, Antonino Soddu and Isabelle La Jeunesse explain how a current research project could help explain the long-term effects of climate change on the hydrology of the Mediterranean basin by gathering data and information which will quantify future impacts on the region




First, could you outline the long- and short-term goals of the CLIMB project?

RL: Our project is targeted towards the quantification and, ultimately, a reduction of uncertainties in the understanding of climate change impacts in the Mediterranean. One major building block is to quickly contribute to overcome current limitations in the availability of relevant data and information. Therefore, we have dedicated a strong work force, not only in the collection of conventional data, but also to focus explicitly on geophysical field campaigns and remote sensing analyses to improve the data base for the parameterisation of complex integrated hydrological model systems. In the long term, we will apply such systems to explain how climate change will impact on the water sector and to assess and communicate the associated risks for water security in the region.

What was the impetus for establishing a conjoint Work Package with the WASSERMed and CLICO projects?

RL: In order to better assess the consequences and uncertainties regarding climate impacts upon human environment systems, the European Commission has launched a coordinated topic between Theme 6 (Environment) and Theme 8 (Socioeconomic Sciences and the Humanities) of the Seventh Framework Programme (FP7) in its 2009 call. The three selected projects form the research cluster CLIWASEC (CLImate, WAter & SECurity) for multidisciplinary scientific synergy and improved policy outreach, which was manifested in a conjoint work package among the projects.

ILJ: The cluster comprises a critical mass of scientists and expertise to build relationships with relevant policy representatives and stakeholders at EU level and Mediterranean countries covered by the projects.

Could you discuss the seven study sites chosen for this project and what you hope to learn from them? What factors were taken into consideration when choosing each site?

SB: The seven study sites were chosen on the southern European coast, along the North African, and the Middle East coast, building a representative basin network across the southern part of the Mediterranean countries. Study sites are located in France, Sardinia, Northern Italy, Turkey, the Palestinian administered area in Gaza, Egypt and Tunisia. The CLIMB partners have selected their study sites, showing their commitment to open a discussion on common issues in the Mediterranean concerning freshwater and groundwater management, and to contribute to the international focus on climate change. Some of the case studies are well instrumented and monitored while others present low density measurement networks. These case studies will bring us to an understanding of complex issues related to water management, hydrological processes through modelling and climate change impacts.

The effects of climate change are fairly unpredictable and also depend upon human intervention. How will CLIMB work to mitigate uncertainty and ensure accuracy of their findings?

RL: You are right in arguing that the prevailing uncertainties in climate projections and manifold subsequent impact models are imposing strong limitations on water-related decision making. Our approach is based on a close-up analysis of regional watersheds, where we can summarise, control and actively mitigate such sources of uncertainty with our comprehensive set of monitoring and modelling tools. We maintain a constant exchange with local networks composed of experts and decision makers, who we trust to assess the possibilities of human intervention and related adaptive capacity.

AS: Furthermore, we are confident that the selected case studies are sufficiently representative to ensure that CLIMB's findings will contribute to a more accurate understanding of climate change and water-related mechanisms even on larger scales within the Mediterranean.

How will this project benefit from collaboration both within the consortium and with other related projects?

RL: The clustering of projects and the cooperation between thematically or regionally related projects can help push forward current understanding of the interactions of climate change impacts on ecological, economic and social components of human environment systems. A multidisciplinary approach is essential for advancing towards optimised regional solutions for water resources management under climate change. Obviously, no single project can cover all the manifold causes and impacts of climate change for a given region, thus, collaboration by means of an exchange of data, research concepts and general knowledge and information is crucial to avoid redundancy, build upon existing experience and achieve value-added results for the dependent and involved societies.

TUNISIA - CHIBA FIELD CAMPAIGN - ARTIFICIAL RECHARGE WITH TREATED WASTEWATER, KORBA

Multidisciplinary modelling

Focusing on the Mediterranean basin, the **CLIMB** project seeks to reduce uncertainty and quantify risk of climate change on hydrology by implementing an integrated monitoring and modelling system

WHILE SIGNIFICANT UNCERTAINTIES still surround predictions of regional climate changes, several generations of climate projections have consistently indicated that the Mediterranean basin is one of the most prominent and vulnerable regions of Europe. The most serious impacts are likely to be felt in North African and eastern Mediterranean countries with warmer and drier conditions. Governmental policies in some countries have been concerned with water production but they require efficient management to ensure economic efficiency, the preservation of the resources and social equity by the availability of drinking water. Further reduction in water availability induces further water demand, particularly for drinking water and irrigation with implications on crop yields and food production. These changes are expected to have strong impacts on the management of water resources and key strategic sectors of regional economies.

The regions of the Mediterranean landscape are already experiencing and expecting a broad range of natural and manmade threats to water security, which will give rise to an increasing potential for tensions and conflict among the political and economic players in this vulnerable region. To address this concern, the Climate Induced Changes on the Hydrology of Mediterranean Basins project (CLIMB) looks at creating an integrated risk assessment tool for adaptive water resources management and best agricultural practice under climate change conditions. Moreover, in response to an EU call for projects combining both environmental scientific research with socioeconomic sciences and humanities, CLIMB is embedded in a research cluster of independent projects with WASSERMed (ENV) and CLICO (SSH) to create scientific synergy and improve policy outreach.

THREE PRONGED APPROACH

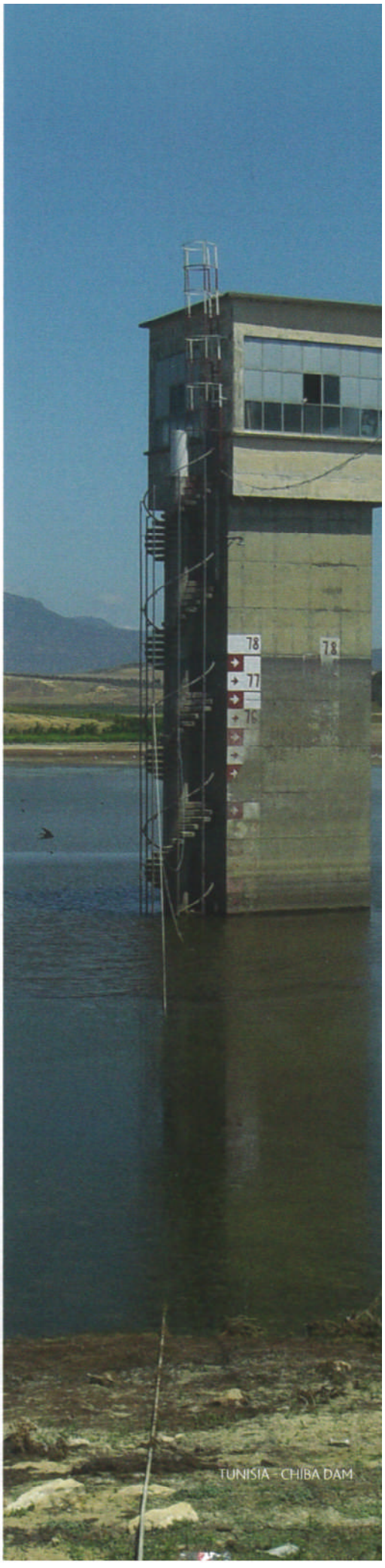
The strategy of CLIMB is to employ and integrate advanced field monitoring techniques, remote sensing analyses and retrievals, climate models auditing and integrated hydrologic modelling and socioeconomic factor assessment, in a new conceptual framework to significantly reduce existing uncertainties in climate change impact analysis. The research brings together three different strands of knowledge to monitor and describe environmental change:

- Theoretical studies to increase understanding of links between natural and socioeconomic impacts of climate change
- Analysis of environmental data series, based on geophysical ground experiments and networks and multi-parametric remote sensing to improve knowledge of the spatial variation of soil hydraulic and vegetation properties, crop water requirement and actual consumption to optimise the parameterisation of environmental models
- The implementation of numerical model ensembles, validated for reference climate periods in transition and used for projections of progressing climate change

TEST SITES

The analysis of climate change impacts on available water resources has been targeted on mesoscale river or aquifer systems. Selection criteria of the sites included: an expected high susceptibility to climate induced changes in water availability, runoff regimes and water quality. The chosen sites represent Mediterranean areas comprised of one to several of the following components that impose a threat on future

CLIMB STAKEHOLDER WORKSHOP – MAY 2011
ALEXANDRIA, NILE DELTA



TUNISIA - CHIBA DAM

water security: high agricultural productivity, overexploitation of water resources, heavy multi-source nutrient loads and pollution, sea water intrusion or growing water use rivalries.

Professor Ralf Ludwig, coordinator of the project, explains why the CLIMB partners have chosen to emphasise two 'super' test sites: "While we equally value the importance and characteristics of each CLIMB case study, we are restricted in capacity to apply our full methodological framework in all sites". Consequently, the Sardinian and the Tunisian site were to represent the Southern European and Northern African watersheds. Dr Antonino Soddu – leading CLIMB project scientist for AGRIS in Sardinia – explains why they were selected for their commonalities and significant differences: "First, we can build upon existing knowledge from earlier projects, good time series of environmental data measurements, well established local networks and geographical proximity," he explains. "Second, we can thoroughly analyse climate change impacts on water risks and security in regions of different watershed management traditions and governance and under varied socioeconomic and sociocultural boundary conditions."

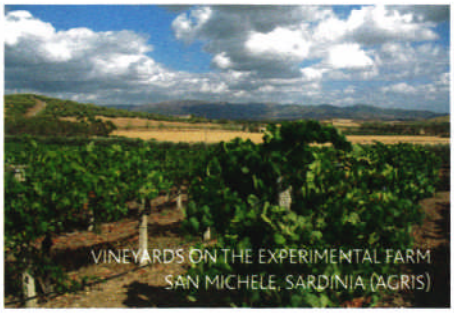
ADVANTAGEOUS DESIGN

The structure of the project has been designed to take full advantage of a multidisciplinary approach. CLIMB is comprised of eight work packages (WPs). None of these stand alone, but are interconnected by means of interfaces, dependencies and feedback loops to ensure an iterative reduction of uncertainty and a more accurate assessment of water related ecological and economic risk. For example, future water availability, projected from climate modelling and downscaling (WP4) and hydrological modelling (WP5), is converted into practical risks and threats through socioeconomic (WP6) and water uses and rivalries (WP7) analyses. Working in this way ensures a broad assessment, not only of water resource, but also of water uses and socioeconomic vulnerability factors.

DISSEMINATION

A unique aspect of WP7 is the use of this dissemination phase as a way of involving stakeholders and employing their knowledge about water uses and rivalries. Using interactive methods, the stakeholders themselves can identify impacts on their own water uses and rivalries resulting from the outputs of CLIMB hydrological modelling and risk assessment. Professsor Isabelle La Jeunesse from the Université François-Rabelais de Tours and leading scientist

SARDINIA - IRRIGATED FIELDS ON THE EXPERIMENTAL FARM SAN MICHELE (AGRIS)



VINEYARDS ON THE EXPERIMENTAL FARM SAN MICHELE, SARDINIA (AGRIS)

for this WP is keen to stress the importance of this approach: "Such a 'bottom-up' strategy is complementary to socioeconomic vulnerability assessment and will allow us to evaluate the risks generated by an increase of water rivalries and threats to security due to climate change impact scenarios at the river basin scale".

In addition to the inclusion of stakeholders, the project will provide explanatory tools and media and constructive recommendations to capture the interest of policy makers and, consequently, contribute to the science-policy interface. For potential end-users on the regional and local levels, there will be a comprehensive, easy-to-use Web-GIS-interface enabling direct interaction with experts and access to specifically prepared project results. Further, annual CLIMB policy briefs, the project website, newsletters, reports to the EC and related publications and press releases, are intended to provide orientation for those dealing with the CLIMB subject on a practical or theoretical level.

CHALLENGES AHEAD

Since the kick-off meeting in Cairo in January 2010 the project has produced some unique results. In the case studies, the team has collected an inventory that Ludwig describes as "probably the most comprehensive database that exists to date". They have also succeeded in the setup of hydrological model ensembles in catchments around the Mediterranean coastal regions, although these findings are still preliminary.

Furthermore, through interviews and discussions with stakeholders in the region, La Jeunesse has observed a key issue for the project to pinpoint: "There is still a lack of awareness about the potential risks associated to climate change related water scarcity – food for thought and something for CLIMB to focus on," she notes. CLIMB faces certain challenges as the work packages are implemented over the next few years: "The diversity of the current processes and the available tools that are spread among different institutions makes the collection of data or building an inventory of information about the physical and socioeconomic characteristics of the basins a more convoluted process," says Professor Sihem Benabdallah from the Centre de Recherches et des Technologies des Eaux (CERTE) in Tunisia. Keeping the collaboration vital and fruitful among the geographically dispersed partner institutions will remain a demanding task: "It will be most important to keep stakeholders interested and involved during and beyond the lifetime of the project," Professor Ludwig highlights.

INTELLIGENCE

CLIMB

CLIMATE INDUCED CHANGES ON THE HYDROLOGY OF MEDITERRANEAN BASINS

OBJECTIVES

To employ and integrate advanced field monitoring techniques, integrated hydrologic modelling and socioeconomic factor assessment in a new conceptual framework to reduce uncertainties in climate change impact analysis.

PARTNERS

Ludwig-Maximilians-Universitaet Muenchen, Germany • **Agenzia per la Ricerca in Agricoltura**, Italy • **Christian-Albrechts-Universitaet zu Kiel**, Germany • **Centre national du Machinisme Agricole**, France • **Centre de Recherche et des Technologies des Eaux**, Tunisia • **Consorzio Interuniversitario Nazionale per la Fisica delle Atmosfere e delle Idrosfere**, Italy • **Centro di Ricerca, Sviluppo e Studi Superiori in Sardegna**, Italy • **Deutsches Zentrum fuer Luft- und Raumfahrt e.V.**, Germany • **Forschungszentrum Juelich GmbH**, Germany • **Gebze Yuksek Teknoloji Enstitusu**, Turkey • **Institut National de la Recherche Scientifique Eau, Terre et Environment**, Canada • **Joanneum Research Forschungsgesellschaft mbH**, Austria • **Islamic University of Gaza**, Israel • **Università degli Studi di Padova**, Italy • **UNITN**, Italy • **Zagazig University**, Egypt • **VISTA Geowissenschaftliche Fernerkundung GmbH**, Germany • **Bayerische Forschungsallianz Gemeinnutzige GmbH**, Germany • **Université François-Rabelais de Tours**, France

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CONTACT

Dr Ralf Ludwig

Department für Geographie
Ludwig-Maximilians-Universität München
80333 München, Germany

T +49-89-21806677
E r.ludwig@lmu.de

www.climb-fp7.eu

RALF LUDWIG is a Professor in Applied Geography and Environmental Modelling at the University of Munich (LMU), Germany.

SIHEM BENABDALLAH is an Associate Professor and researcher at the Centre de Recherche et des Technologies des Eaux, (CERTE) Tunisia.

ISABELLE LA JEUNESSE is Professor of Geography at the University of Tours (Citeres CNRS unit) and is associated with the University of Angers (LEESA unit).

ANTONINO SODDU is a researcher at the Agenzia per la Ricerca in Agricoltura di Sardinia (AGRIS).