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CLIMATE CHANGE IMPACTS ON THE MANAGEMENT OF WATER RESOURCES

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Impacts of climate change on water resource management

- Regional strategies and European view -

2nd annual IWRM NET meeting and SCP workshop
25 October 2011 at MEEDDTL, Paris

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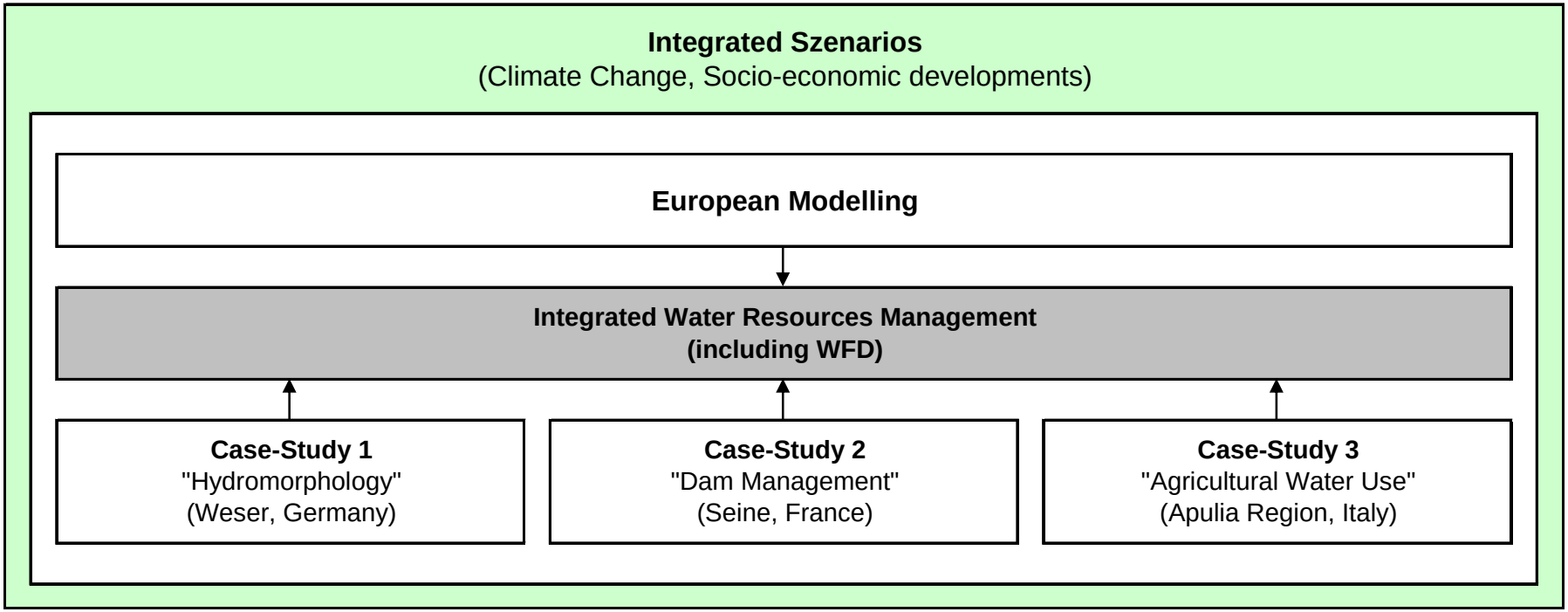
Structure of CLIMAWARE



Outlook

- **European modelling and Scenario Selection**
- **Projected change in Temperature and Precipitation**
- **Baseline water availability and water use in Europe and in the focus regions**
- **Projected change in Water Withdrawals (WWD) / Consumptive Use (CU) by different sectors**
- **Projected change in water availability**
- **Projected Water stress**
- **Conclusions and Project Outlook**

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WP1 European Modelling

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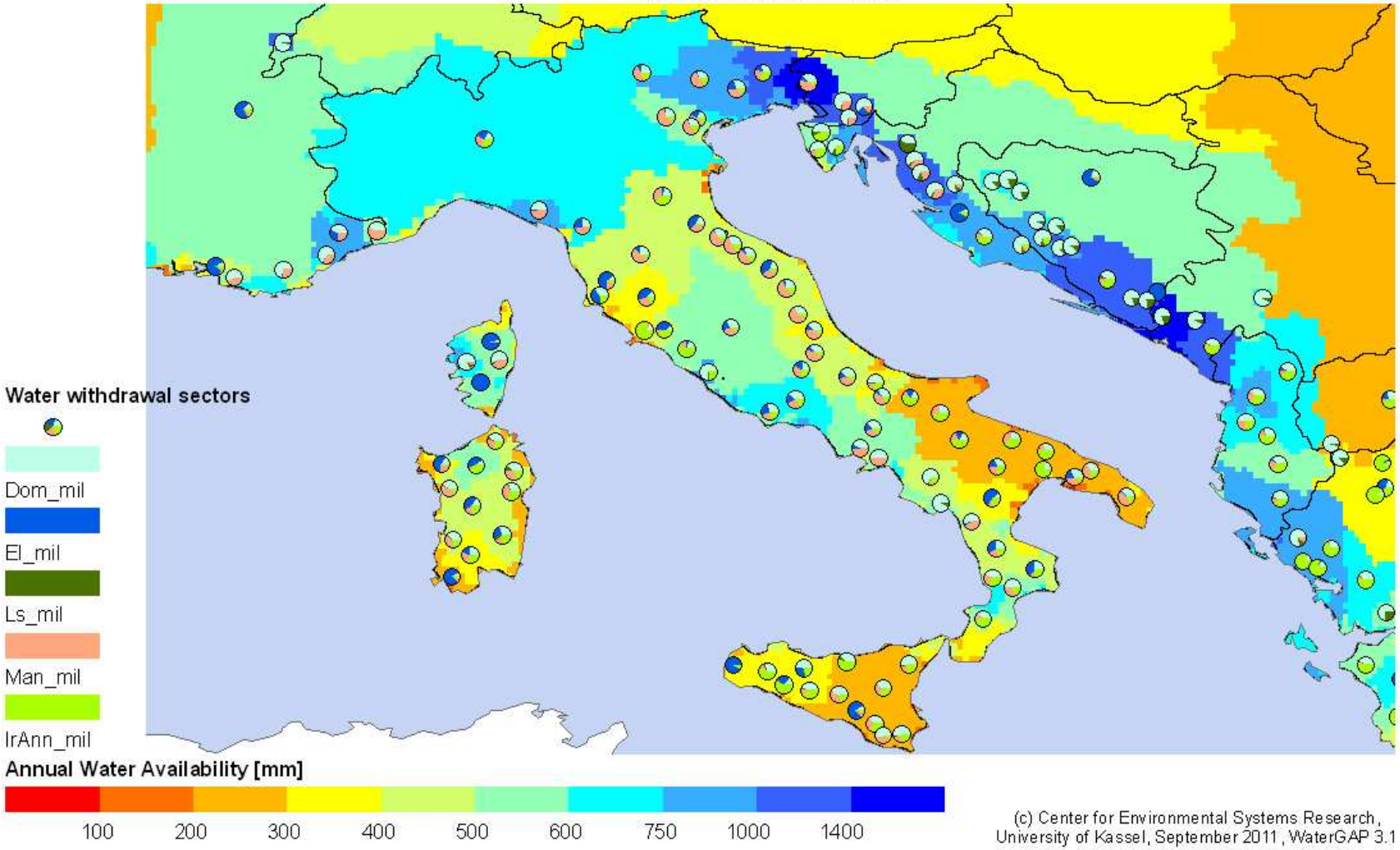
Water Availability and the share of water withdrawal by sectors

- natural flow -
(WFD, climate nomal, 1971-2000)



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WP1 European Modelling

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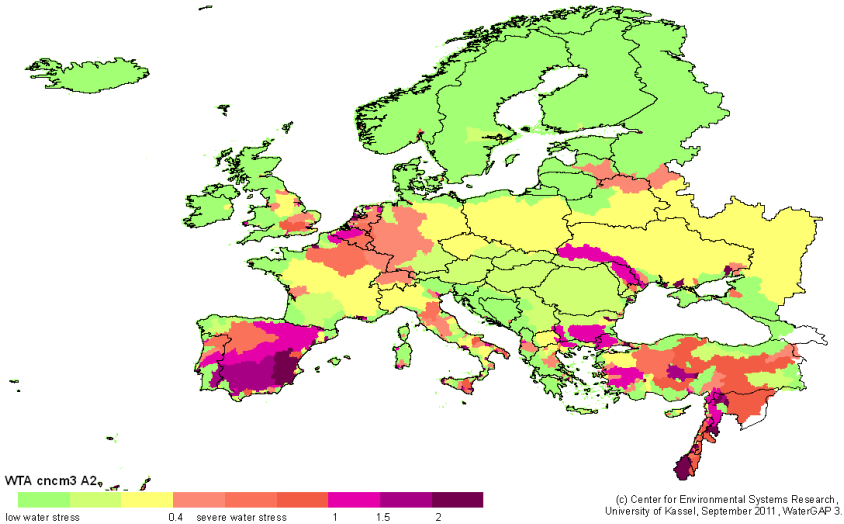
Annual Withdrawal to Availability Ratio

- considering dam management -
(CNCM3, A2 scenario, 2050s)



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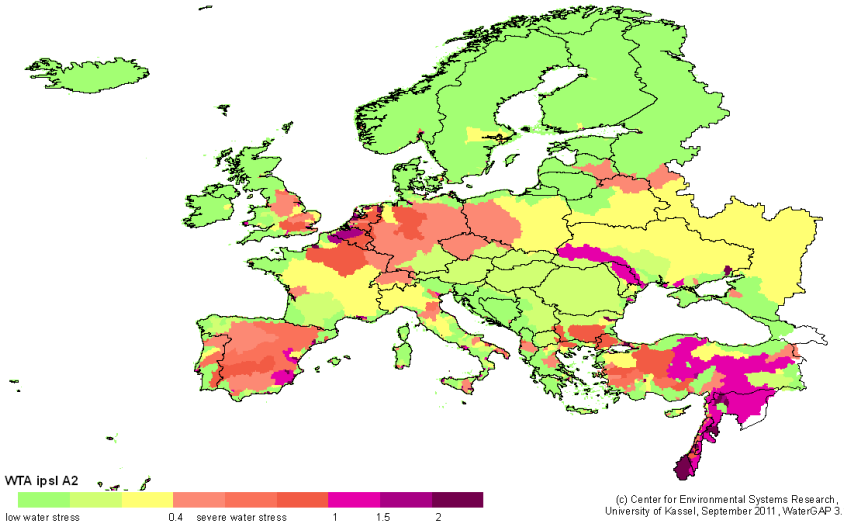
Annual Withdrawal to Availability Ratio

- considering dam management -
(IPSL, A2 scenario, 2050s)



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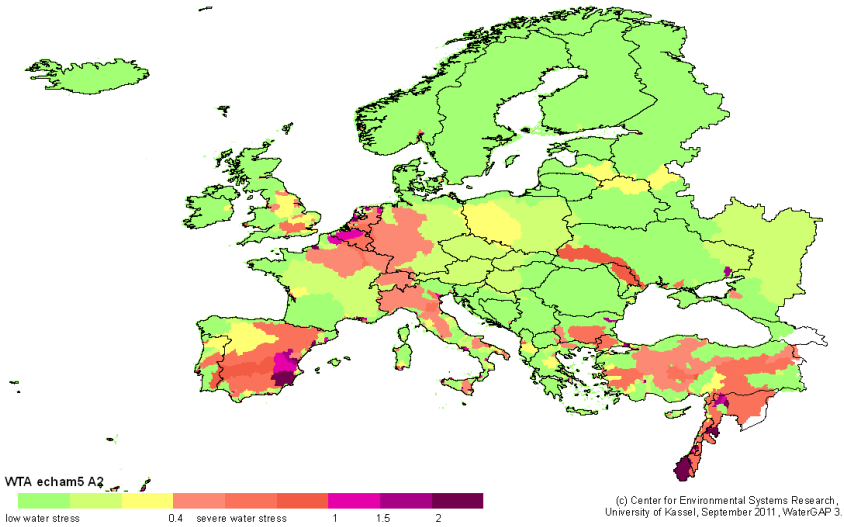
Annual Withdrawal to Availability Ratio

- considering dam management -
(ECHAM5, A2 scenario, 2050s)



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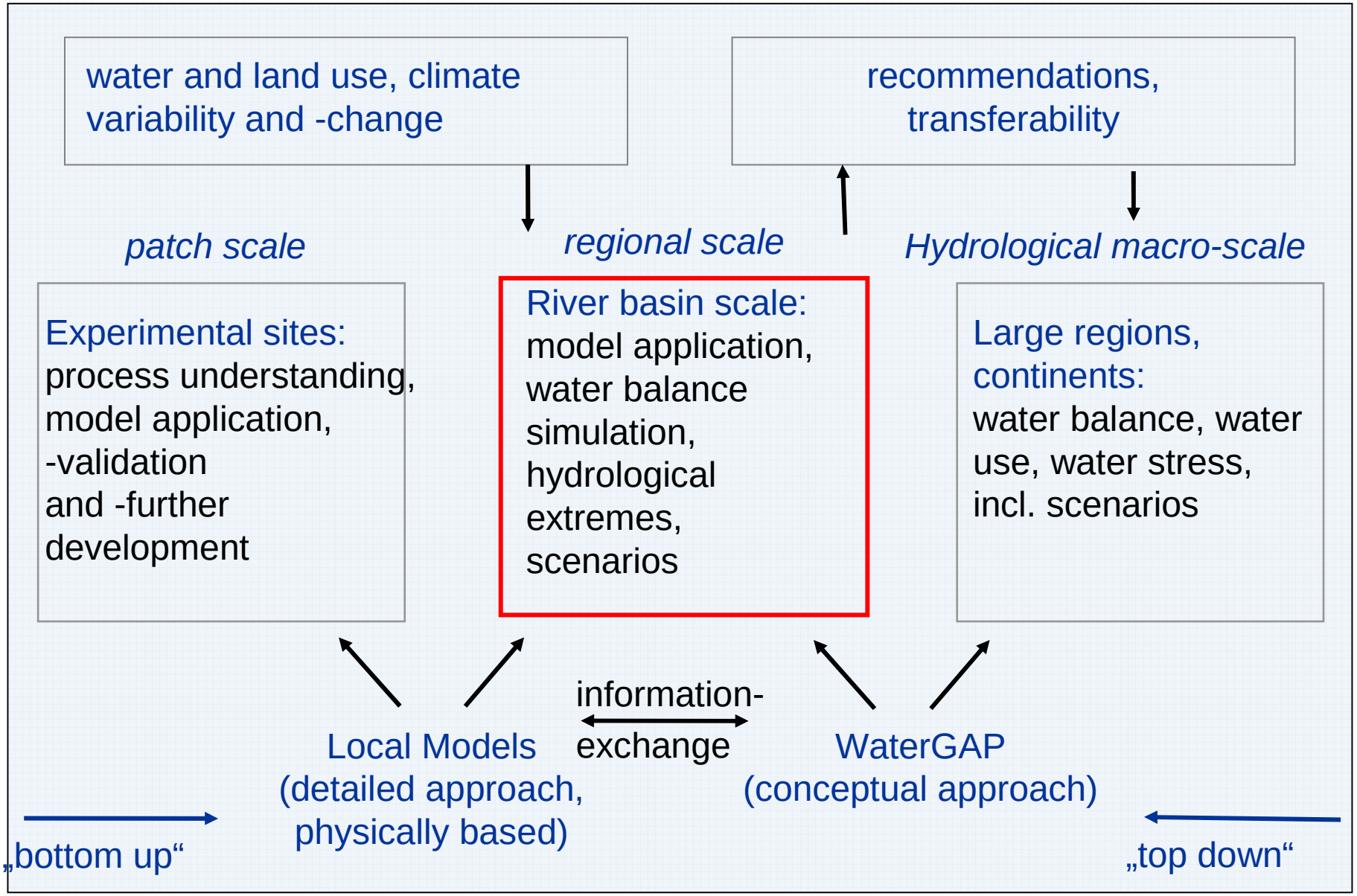
WP1 European Modelling Outlook



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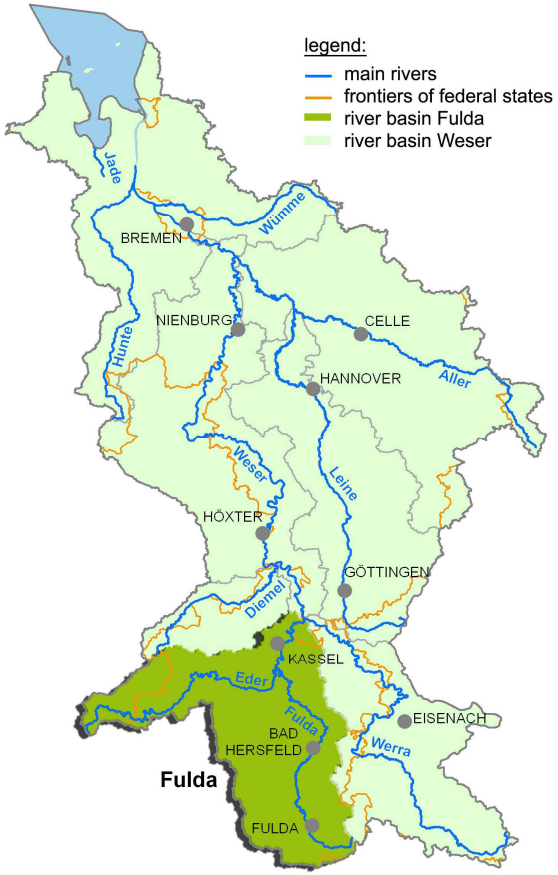
WP2
Case Study „Hydromophology“

Objectives:

- Investigation of impacts of climate change on a regional river system (Weser)
- Investigation of the compliance of the river basin management plans based on the WFD considering: - hydromorphology (renaturation)
  - hydrological regime (dam managemen
- Hydraulic parameter analysis using a hydrodynamic numerical model (2D) (e. g. water levels, flow velocity, flood area and shear stresses)
- Continuous development of planning tools and methodical approaches



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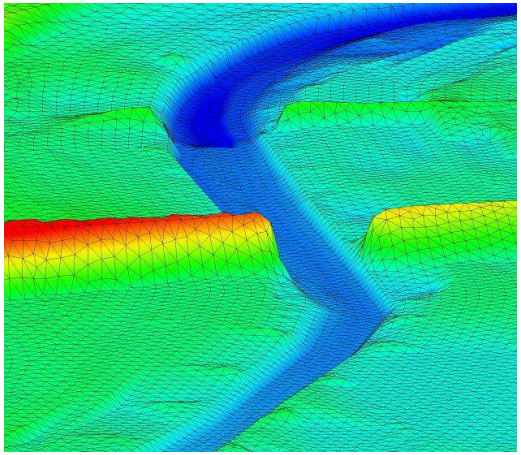
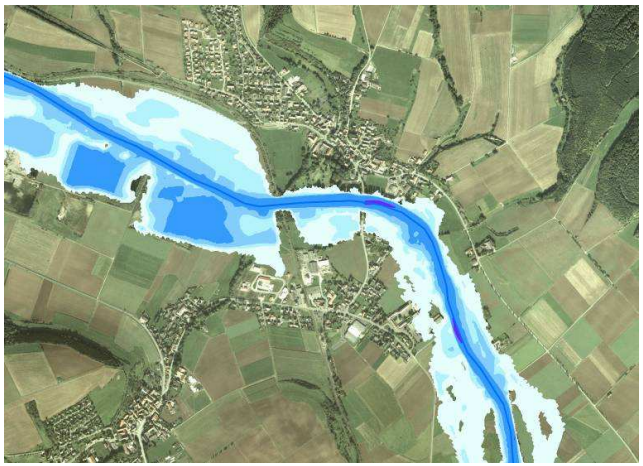
WP2
Case Study „Hydromophology“

Activities during the last year:

- selection of the case study area
  - reach of the Eder downstream the Eder Lake
- analysis of the actual state
  - hydrological regime (flood, low water)
  - hydromorphological situation
- creation of a digital terrain model
  - river channel and floodplain
  - based on existing cross sections
- creation of a 2D hydrodynamic-numerical model
- simulation of scenarios
  - current state
    (flood situation, low water situation)





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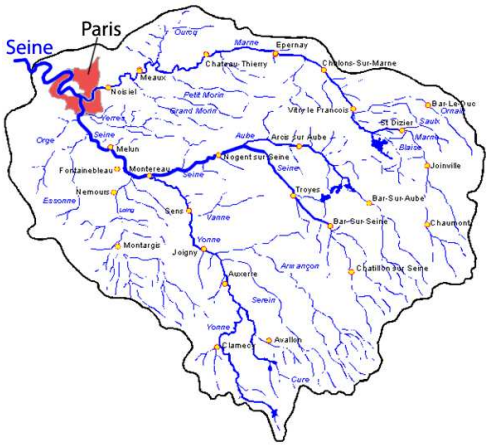
WP2
Case study „Dam Management“

Studied basin:

- The Seine River basin at Paris (43 800 km²) with four large reservoirs (850 hm3) managed to sustain low flows and alleviate floods

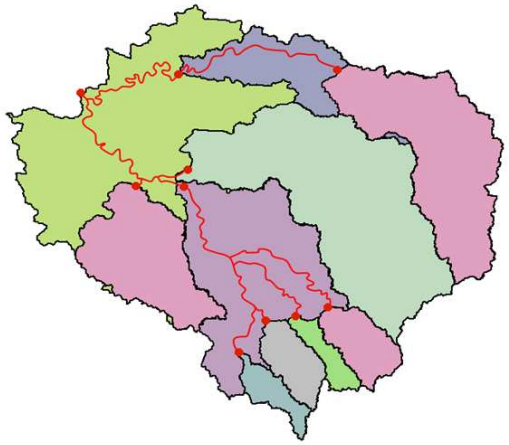


Objectives:

- Evaluate the impact of climate change on water ressources and on the management of reservoirs by 2050
- Define adaptation strategies in terms of dam management rules

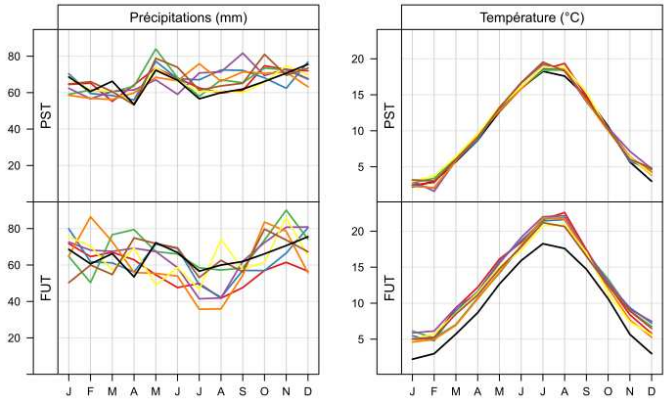
Data and methods:

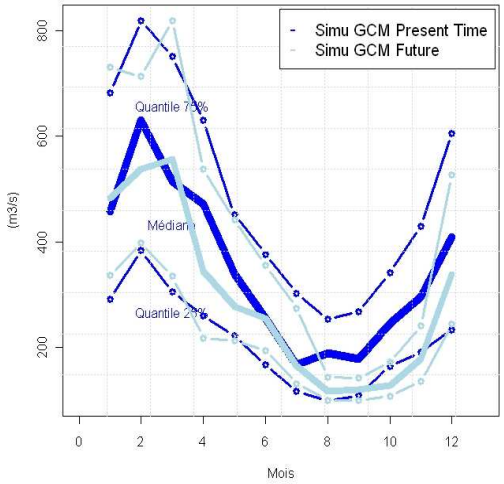
- 50 years of observations on 25 sub-catchments
- 7 climate change projections from 7 GCMs (A1B scenario)
- Semi-distributed hydrological model
- Management optimiztion tools



Evolutions between 1961-1990 – 2045-2065 at Paris

- Climate
  - small decrease in precipitation: -5%
  - rise in temperature: +2.4°C
  - rise in potential evapotranspiration: +25%
- Natural flows
  - decrease in mean flow: -15-20%
  - more prolonged low-flow periods in late summer-autumn





Future work

- Introduce dams in the model
- Test the sustainability of current management rules

Main Objectives

- **An integrated hydrological-economic model is proposed to define the water balance components (groundwater recharge, surface runoff, river flow, etc) at regional scale, referring in particular to water demand for irrigation scope.**
- **The integration with the economic model allows simulation of farmers' decision process in response to changes both in the constraints and in the boundary conditions.**
- **The tool will provide a comprehensive information framework including: water balance components, crops irrigation water requirements, farmers choices in terms of cropping patterns and techniques; economic results; environmental impacts.**

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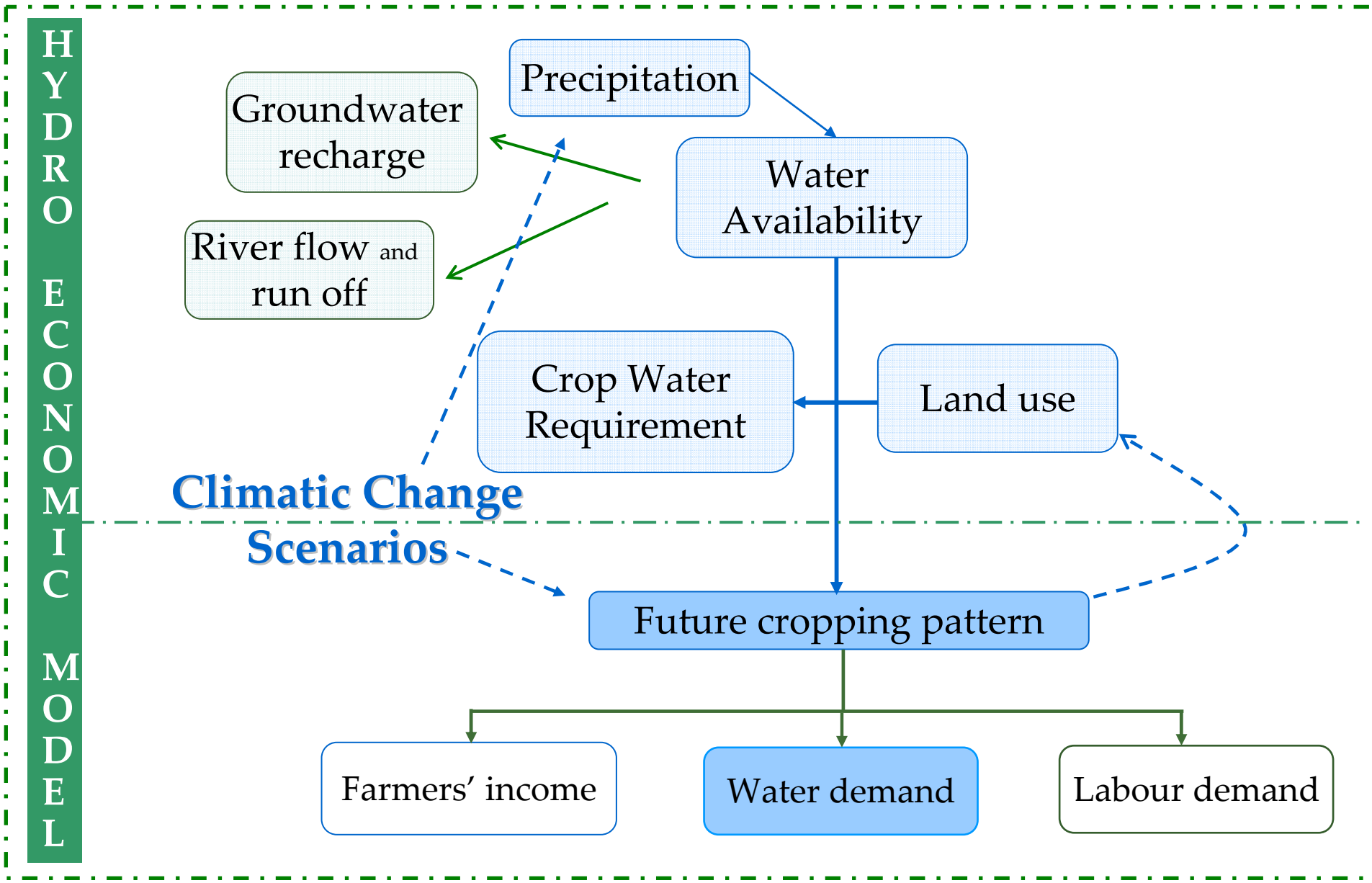

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Case Study 3 "AGRICULTURAL WATER USE" (Apulia Region, Italy)

Main steps achieved

- Collection, analysis and elaboration of economic, climatic, soil and land cover data;
- Estimation of surface water balance components;
- Development of an economic test model for the estimation of crops land allocation in future scenarios;
- Analysis of climate change scenarios and application to climatic data

Future steps

- Estimation of the Crop Irrigation Requirement for the entire region and under the identified climate change scenarios;
- Estimation of the underground water balance components: subsurface runoff, groundwater recharge;
- Simulation of the land allocation and water balance under the identified climate change scenarios;
- Analysis of the results in terms of water balance and agricultural sector performance.

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WP3
Cross-case and cross-scale comparison and integration

- Comparison of case-studies with respect to impacts of climate change and management (adaptation) strategies
- transferability of successful regional measures to larger scale
- Comparison of scales, from regional to European modelling
- description of the various methods of modelling and their grades of elaboration
- comparison of the modelling results of the case studies and the European modelling

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WP 4: Dissemination of results, knowledge transfer

- Participation of practice partners and stakeholders
- Grands Lacs de Seine -> project partner and practice partner (operator of dams)
- Conferences with regional and international audience

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Thank you for your attention!

Partners:

Germany

University of Kassel:

Department of Hydraulic Engineering and Water Resource Management

Center of Environmental Systems Research (CESR)

France

Cemagref

Les Grands lacs de Seine

Italy

Istituto Agronomico Mediterraneo di Bari (CIHEAM-IAMB)