Outputs

HYACINTS will develop new methodologies and tools that enable easier and more accurate use of regional scale climate and hydrological models to address local scale water resources problems. The tools will be tested on cases relevant for the water supply sector in Denmark and for an international case relevant for export of Danish water resources management expertise.

The specific deliverables are:

- Five PhDs
- Three Postdocs
- Scientific reports
- Journal and conference papers
- An OpenMI version of the HIRHAM code
- An OpenMI version of the MIKE SHE code
- A dynamic coupling of HIRHAM-MIKE SHE with a built-in statistical downscaling
- A coupled climate-hydrological model for the entire Denmark.
- An algorithm for assessing and downscaling precipitation data from a combination of satellite data and topography.
- Improved facilities for grid refinement exploiting finite element and OpenMI technologies and guidance on scaling in complex geological environments.
- New methodologies and assessments of uncertainty in relation to hydrological effects of climate change.

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HYACINTS

Hydrological Modelling for Assessing Climate Change Impacts at different Scales

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HYACINTS

Hydrological Modelling for Assessing Climate Change Impact at Different Scales

Objectives

- To make a full dynamic coupling of a climate model code (HIRHAM) and a distributed physically based hydrological model code (MIKE SHE).
- To further develop precipitation downscaling and bias correction methods when converting climate model results to hydrological model inputs.
- To develop grid refinement methods for hydrological models and methodologies for optimal conceptualisation, simulation and downscaling of complex geological environments.
- To develop new methods for estimation of precipitation from remote sensing data, particularly aimed at mountainous regions with poor data coverage.
- To establish a coupled climate-hydrological model for the entire Denmark based on the regional climate model HIRHAM and the MIKE SHE based national hydrological model (DK-model) and to assess the hydrological change at local scale in selected cases.
- To assess the uncertainties related to prediction of climate change effects on water resources at local scale, including all sources of uncertainty (climate scenarios, model structure, geological interpretations, model parameters and adaptation strategies).

Background and rationale

Traditionally, the analysis of hydrological climate change impacts has been decoupled from climate research as such. Based on the output of global or regional climate models, hydrological models have been run as stand alone models. This means that the feedbacks to the atmosphere are neglected which has an unknown impact on the predictions of the climate change, particularly at the local scale. Furthermore there is an inherent contradiction in this approach since climate models include their own (very simplified) hydrological model component. For Denmark, the important processes of the groundwater flow and the interaction between the groundwater and river systems are not represented in current climate models.

Climate models operate at spatial scales that are much larger than the scales required to analyse the effects on the hydrological system. Data on climate change scenarios are available at spatial resolutions (typically 25 km grid) that are very coarse for direct application in hydrological modelling addressing local scale problems. Remote sensing data of relevance for hydrological studies such as global rainfall have the same problem as data from climate models, namely that they are available at large spatial and temporal scales and require downscaling for most practical applications.

Regional hydrological models are increasingly being used as a basis for water resources management, both at national and European scale. However, in order to make full use of such regional models to address local scale problems, and in this way ensure coherence in the local and national water resources management, a number of downscaling problems need to be solved. These include model technical issues related to grid refinement and issues concerning how to ensure consistency in geological conceptualisation when changing between different scales in complex geological settings.

Geological interpretations are recognised as maybe the primary source of uncertainty in hydrological modelling. No previous studies have evaluated the total uncertainty on hydrological change predictions including both uncertainties on greenhouse gas emission, climate model uncertainty and hydrological model uncertainty.

Budget and timing

HYACINTS started 1 January 2008 and will run for 5 years until the end of 2012.

The total budget is 3,2 M € of which the project will receive 2 M € from the Danish Strategic Research Council. In addition, the partners contribute 1,2 M € to the project.