CCI-HYDR

Climate change impact on hydrological extremes along rivers and urban drainage systems

DURATION OF THE PROJECT
Phase 1: 15/12/2005 – 14/12/2007
Phase 2: 15/12/2007 – 31/01/2010

BUDGET
521.343 €

KEYWORDS
Flood risk, Low flow, Climate change, Hydrology

PROJECT DESCRIPTION

Objectives

The climate change impact on the risk of hydrological extremes along rivers and urban drainage systems will be studied for the local hydro-climatologic conditions in Belgium. For rivers, both floods and low flows will be considered, while for urban drainage systems only flood extremes are of relevance. The proposed research will take five main steps:

1) Study of climate change scenarios. This step includes a detailed review of climate change scenarios relevant for the hydrology in Belgium, the downscaling of recent climate model simulations, and the selection of potential climate change scenarios for further analysis
2) Statistical analysis of trends and cycles in long-term series of historical rainfall, evapo(transpi)ration and river flow, and verification of the consistency of the climate change scenarios selected in (i) with the present and past climate
3) Impact modelling towards flood risk and low flow risk along rivers, using hydrological and coupled hydrological – hydrodynamic river models for selected river subbasins, and consistency check with the statistical trend analysis on the river flow series for the present and past climate, taking into account the trend contribution from land use changes and trends in water management (floodplain restoration and river valley rewetting)
4) Impact modelling towards flood risk along urban drainage systems, considering the impact on sewer flood frequencies and magnitudes, combined sewer overflow frequencies and receiving river impact for selected sewer systems
5) Analysis of the effects of the changes in flood and drought risks on environment and economy. In collaboration with the project ADAPT, also the wider implications to the society, water managers and policy makers will be investigated

Methodology

The project will apply in (i) new analyses for spatial and temporal downscaling of the Global Circulation Model results to the scale required for hydrological investigations. These combine statistical methods (mainly used in hydrology such as scaling laws and areal reduction factors) with regional climate model results. The latter results are largely used in climatology, but do not allow the intrinsic climatic variability to be described at the scale of hydrological processes, neither the influence on the extremes. Also in (ii), the separate fields of statistical hydro-climatology and hydrology and physical climate modeling will be brought together to verify the climate model derived scenarios with the present and past climate. This will be done by statistical hypothesis testing on the basis of historical series of rainfall, evapo(transpi)ration and river flow discharges. In tasks (iii) and (iv) the climate change scenarios therefore also will be processed towards changes in terms of Intensity-Duration-Frequency (IDF) relationships for rainfall and evapo(transpi)ration and Discharge-Duration-Frequency (QDF) relationships for the impact to river and sewer flow. The uncertainty on both the climate scenarios and the impact predictions will be taken into account through ensemble modelling and probabilistic simulations.

The Meuse and Scheldt river basins will act as river case studies, modelled at the large basin scale as well as the more detailed smaller scale of subbasins. The urban drainage impact modelling will be carried out for 2 urban drainage systems in the country. All these cases will be selected based on the availability of existing hydrological and hydrodynamic tools, which are applied in the current water management practice.
The project will be enriched by investigations in (v) on the implications that the projected flood and drought risks would have on the economy (flood damage), and the environment (river water quality).

INTERACTIONS BETWEEN THE DIFFERENT PARTNERS

See Partners - Activities
In addition to the interaction between the project partners, close cooperation is set up with the ADAPT project. The ADAPT project focuses on the wider implications to the society (e.g. perception by the public), to water managers and

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to policy makers (e.g. decision support for adaptation measures). Common Follow-up Committee meetings will be organized for both projects, and common case-studies selected.

Link with international programmes

The Belgian partner of the European ESPACE project on "European spatial planning: Adapting to climate events" is a member of the Follow-up Committee; and the project coordinator became an Extended Partner of ESPACE.

Prof. J-P van Ypersele, member of the Follow-up Committee, is a member of the Intergovernmental Panel for Climate Change (IPCC).

Dr. Karen Fabbri from the DG Research - Natural & Technological Hazards - of the European Commission will be invited to each Follow-up Committee meeting.

Furthermore international links are set with the Netherlands; Dr. M. de Wit from RIZA is a member of the Follow-up Committee. Contacts with other countries are in the process of being strengthened.

EXPECTED RESULTS AND/OR PRODUCTS

End tasks (a):
- Sub-report on the study of climate change scenarios
- Scenario data and downscaling processing results made available in the format agreed by the project team

End tasks (b):
- Sub-report on the statistical analysis for the historical rainfall and evapo(transpi)ration series
- Sub-report on the results of the hypothesis testing on rainfall scenarios, including the final selection of climate changes scenarios
- Changes to rainfall and evapo(transpi)ration IDF relationships and to QDF flow relationships made available digitally to the project team

End tasks (c.1) and (c.2):
- Sub-report on the rainfall and evapo(transpi)ration modification
- Modified series made available to the project team in the format agreed

End tasks (c.3), (c.4) and (c.5):
- Sub-report on the simulation results of the non-meteorological trends (including the changes to the QDF relationships)
- Sub-report on the flood and drought river impact results

End tasks (d):
- Sub-report on the urban impact results (including the changes to the QDF relationships)

End tasks (v):
- Sub-report on the flood and drought implications
- Final report including a summary of the project results and conclusions, and a collection of all sub-reports (after redaction to reach consistency)

PARTNERS - ACTIVITIES

KULeuven (O.Boukhris, P.Willems)
Flood and low flow risk assessment; spatial and temporal rainfall modelling and analysis; river and urban drainage modelling (water quantity and physico-chemical water quality).

IRM/KMI (P.Baguis, E.Roulin, G.Demarée)
Analysis of the results of climate models; climatological time-series analysis and probability of occurrence of extreme events; hydrological modeling.

CONTACT INFORMATION

Contact Information

Website of the project:
http://www.kuleuven.be/hydr/CCI-HYDR

Coordinator

Patrick Willems
Katholieke Universiteit Leuven (KULeuven)
Department of Civil Engineering – Hydraulics Laboratory
Kasteelpark Arenberg 40
B-3001 Heverlee (Leuven)
Tel: +32 (0)16 32 16 58
Fax: +32 (0)16 32 19 89
Patrick.Willems@bwk.kuleuven.be
http://www.kuleuven.be/hydr

Promoter

Emmanuel Roulin
Royal Meteorological Institute of Belgium (IRM/KMI)
Meteorological Research and Development Department / Risk Analysis and Sustainable Development Section
Avenue Circulaire 3
B-1180 Brussels
Tel: +32 (0)2 373 05 54
Fax: +32 (0)2 373 05 48
Emmanuel.Roulin@oma.be
http://www.meteo.be

Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting http://www.belspo.be/fedra or http://www.belspo.be/ssd