Projections for Water Systems – Scientific Services for Adaptation

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Abstract

Climate change affects sustainable water ressources management (WRM) and related aspects of ecology and human development in Europe. Major research projects have been launched to describe and understand the observed and possible future variability of the water cycle and related systems. While it is obvious, that different parts of Europe have specific challenges for WRM in the face of climate change, they share many scientific challenges:

1. Climate (impact) monitoring: Long time series of hydrometeorological and hydrological variables are crucial to describe and understand the various hydrological processes affected by climate change. Intensified cross-border exchange and homogenisation of data and its cooperative use offer new opportunities.
2. Integrated analyses: Hydrological processes cover different spatial and temporal scales and interact in a complex way. To fully assess the possible impacts of climate change interdisciplinary exchange and integrated model chains (including ecological and economical aspects) are needed.
3. Uncertainty assessment: Models can be used as prognostic tools for future climate impact assessment. However, results can only be interpreted when the level and the sources of uncertainty are known and communicated. As there is currently no single "best" model chain, multi-model ensembles are regarded as state-of-the-art.
4. Science-policy interface: Given the uncertainty of climate (impact) projections resulting from current climate research, stakeholders are increasingly confronted with spans of results about climate impact rather than single values. Consequently, accounting for state-of-the-art knowledge requires a re-engineering of the science-policy interface. Uncertainty spans need to be communicated in a transparent way.

Adressing the above challenges, we discuss results of selected climate impact research activities for major rivers in Central Europe. These activities were carried out by research groups projects on a national (KLIWAS, financed by the German Federal Ministry of Transport, Building and Urban Development, BMVBS) and international level (e.g. Rheinblick2050, coordinated by the International Commission for the Hydrology of the Rhine basin, CHR).

Current research describes the climate sensitivity of aquatic systems by applying complex mutli-model chains to face the challenges 2 and 3 mentioned above. For the Rhine River, a significant part of the current uncertainty span was lined out using a 20 member multi-model ensemble of climate projections. Taking a low flow indicator (NM7Q) as an example, the resulting changes in the hydrological summer turn out to be indifferent (+/- 10 %) up to the mid of the 21st century (2021 - 2050) and show decreasing tendencies (-10 % to -30 %) for the far future (2071 - 2100). For the winter half year an increase (0 % to 15 %) is projected both for the near and the far future.

While clearly more effort should be taken to further narrow the uncertainty bands in the projections of future water availability, the description of the future challenges of WRM requires even more: Here also non-climatic elements, like scenarios of water demand, land cover and food production in face of a growing population and ecological and economical change, need to be integrated, too.

Literature

BMVBS (editor) (2009): KLIWAS Impact of Climate Change on Waterways and Navigation in Germany. First Status Conference – Federal Ministry of Transport, Building and urban Development, Berlin – 18

and 19 March 2009. Conference Proceedings. 170 p.
http://www.kliwas.de/KLIWAS/EN/Home/status_conference.pdf?__blob=publicationFile

BMVBS (editor) (2011): KLIWAS Impact of Climate Change on Waterways and Navigation in Germany. Second Status Conference – Federal Ministry of Transport, Building and urban Development, Berlin – 25 and 26 October 2011. Conference Proceedings. 218 p.
http://www.kliwas.de/KLIWAS/EN/Service/Downloads/publications/2nd_status_conference.pdf?__blob=publicationFile

Data, services, models: http://www.kliwas.de/KLIWAS/EN/05_Datenmanagement/csw_node.html

Görgen, K., Beermsa, J., Brahmer, G., Buiteveld, H., Carambia, M., de Keizer, O., Krahe, P., Nilson, E., Lammersen, R., Perron, C. & D. Volken (2010): Assessment of climate change impacts on discharge in the Rhine River Basin: Results of the RheinBlick2050 Project. CHR Report No. I-23. http://www.chr-khr.org/files/CHR_I-23.pdf.

International Commission for the Protection of the Rhine (ICPR) (2011): Study of Scenarios for the Discharge Regime of the Rhine. State: April 2011. ICPR Report No. 188. 28 p.
http://www.iksr.org/fileadmin/user_upload/Dokumente_en/Reports/188_e.pdf

Moser, H., Cullmann, J. Kofalk, S., Mai, S., Nilson, E., Rösner, S., Becker, P., Gratzki, A., Schreiber, K.-J. (2012): An integrated climate service for the transboundary river basin and coastal management of Germany. In: World Meteorological Organsation (2012) Climate ExChange, p. 88-91. Tudor Rose, ISBN 978-0-9568561-3-5. http://www.wmo.int/pages/gfcs/tudor-rose/index.html#/88/