BINGO – Bringing INnovation to onGOing water management

There are plenty of long-term concepts on how to face climate change. But how can decision-makers and end users face the intermediate challenges climate change brings and what is the right path for inter-annual to decadal time scales? The Horizon 2020 EU-project BINGO – Bringing INnovation to onGOing water management – A better future under climate change (duration 2015–2019) will provide more adequate near-term predictions (until 2025) of the distribution (including extremes) of relevant climate variables, at the temporal scale required for modelling both average situations and extremes at the regional and local level. In parallel, suitable response strategies that help to better manage the remaining uncertainties will be developed at each of the six European research sites (Cyprus, Germany, Norway, Portugal, Spain, The Netherlands) (**Figure 1**). The project involves 20 European Partners from six countries, including research and innovation centres, water authorities, water users and companies.

Combined RCM and statistical approaches to obtain seasonal to decadal forecast

In detail, building on existing climate predictions from global decadal prediction systems, regionalisation steps (downscaling) are performed using nested regional dynamical climate models (RCM) and statistical approaches (e.g., a conditional weather generator and generalised regression approaches) to obtain seasonal to decadal forecast on the appropriate spatio-temporal scales. These are linked to local weather characteristics at the research sites across Europe. For each of the different research sites the usability of global climate model simulations is increased by downscaling to the appropriate regional/local scale with particular consideration of extreme events. Combining RCM with statistical approaches allows selecting only those episodes for very high-resolution downscaling which are relevant to hydrological extremes; this reduces the numerical burden while staying with the resolution required for hydrological modelling.

Based on the provided climate predictions, the impact of extreme weather events, as well as of average climate variability conditions, on water quality and quantity and the subsequent effect on key sectors in society is assessed. Within the German research site, the Wupper basin, IWW determines in collaboration with Wupperverband the impact of climate change on raw water provision (drinking water production, hydropower), ecological flow, agriculture and recreational use. Risk assessment focusses especially on the increasing climate variability as there is a manifestation of extreme climate events in the Wupper river basin which ranges from dry periods in spring time to heavy convective rainfalls in summer time and river floods caused by the combination of snow melting and rainfall during the winter season.

Under the BINGO framework, Wupperverband is focusing on two pilot areas: the Dhünn catchment area (ca. 200 km²) and the Mirke catchment area (ca. 8 km²).

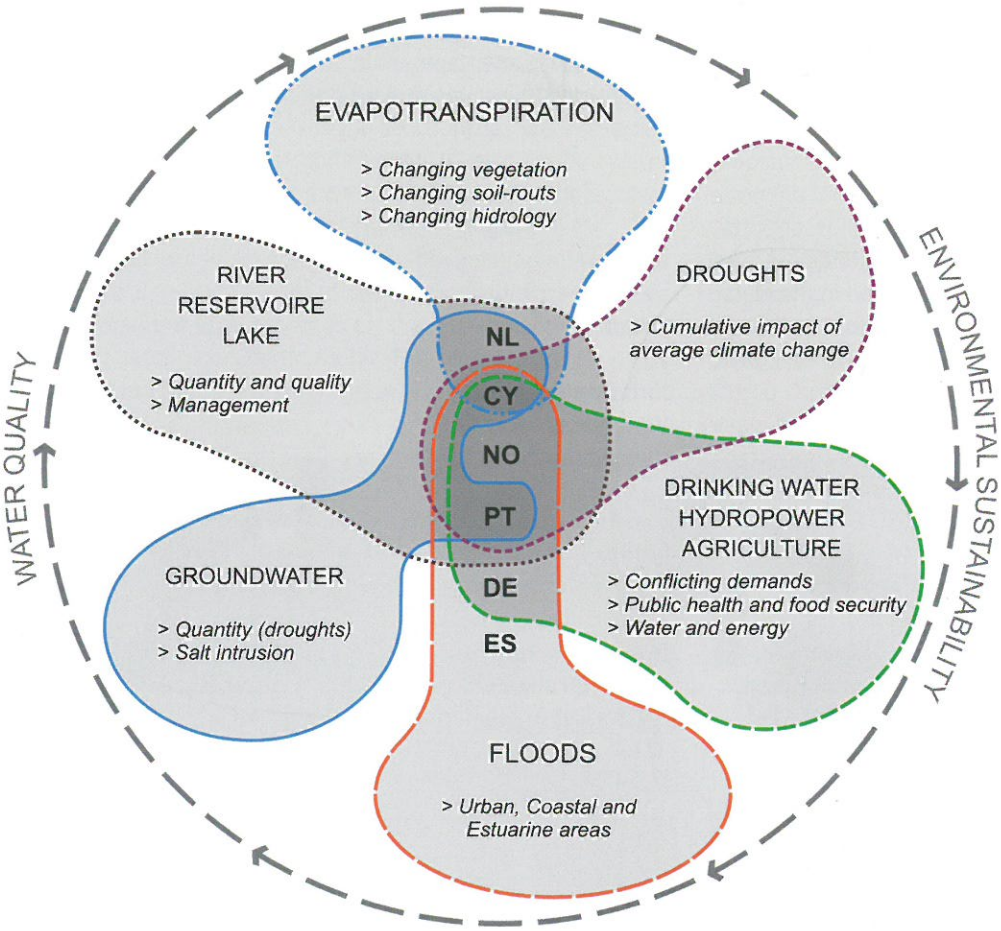

Figure 1: Range of water systems, strategic uses, and key problems addressed at BINGO research sites

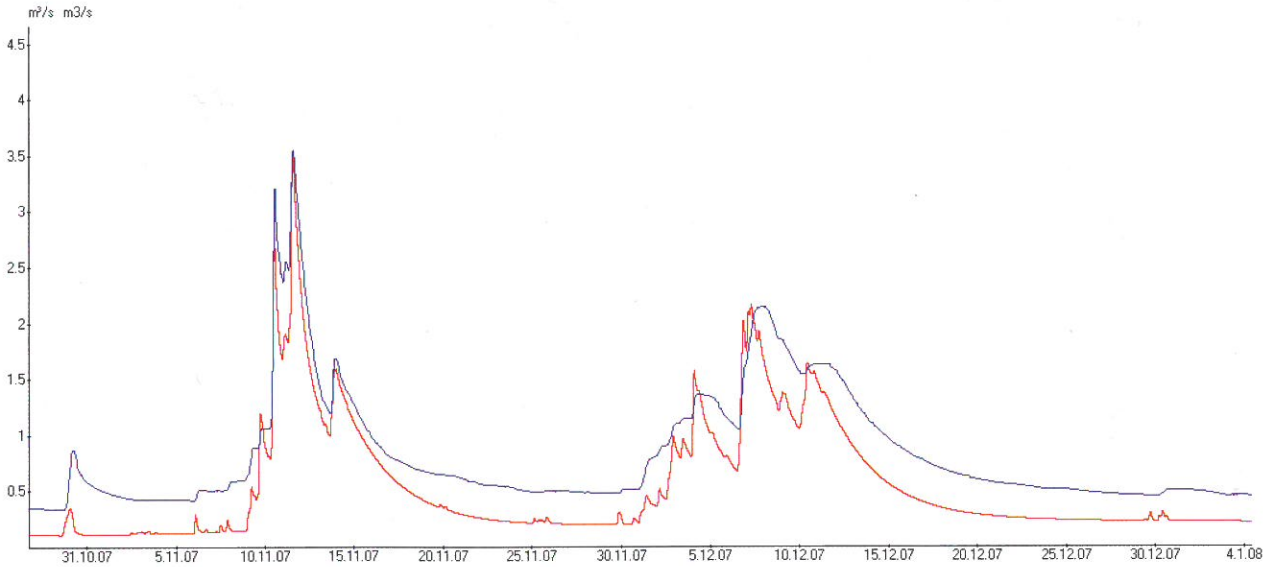

Figure 2: Observed (blue) and NASIM-simulated (red) river discharge at the Scherfbach sub-basin within the Wupper catchment

The Dhünn River is the main tributary of the Wupper River. Nine sub-basins of the Dhünn River Basin are modelled individually with NASIM due to the availability of previously built up models and the need of performing separated calculations. The models are interdependent: outflow from upstream models is used as input for downstream models. The models are able to reproduce the whole water balance for both flood and water scarcity scenarios. An example for modelled river runoff for one of the sub-basins (Scherfbach) is given in **Figure 2**.

Currently, all models at the six European research sites have been calibrated, validated and evaluated for climate data of the last 20 to 30 years. As a next step, multiple scenario runs will be conducted to assess the impact of climate change and climate variability on local water resources. In addition, these climate scenarios will be combined with land-use and water use scenarios in order to be able to cope with socio-economic changes.

Field work to get a better understanding of local processes

All six research sites are conducting field work to better understand local processes, which determine the translation of climate extremes into hydrological extremes. For example, soil moisture sensors and a lysimeter have been installed at the Wupper catchment, as soil moisture is a key driver for runoff generation, e.g. during floods.

Within each of the six BINGO-research sites, decision makers develop strategies to cope with the impacts of extreme weather events in their local and specific situation taking into account technologies and other solutions to mitigate climate impacts on the water cycle. Risk treatment solutions are to be co-produced with various stakeholders, such as end users, representatives from environmental offices and ministries within stakeholder-workshops and expert meetings. Finally, adaptation measures will be assessed to find the best-suitable adaption strategy, whereas cost and benefit and socio-economic impacts of the different measures are to be taken into consideration.

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Further information:
http://projectbingo.eu/

Authors

Dr. Tim aus der Beek
IWW Water Centre
Mülheim an der Ruhr, Germany

Juliane Koti
IWW Water Centre
Mülheim an der Ruhr, Germany

Marc Scheibel
Wupperverband
Wuppertal, Germany

Paula Lorza
Wupperverband
Wuppertal, Germany

Andreas Hein
IWW Water Centre
Mülheim an der Ruhr, Germany

Dr. David Schwesig
IWW Water Centre
Mülheim an der Ruhr, Germany