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Decadal predictions for hydrological extremes assessment in Europe

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The Horizon2020 research project “BINGO” has investigated the impact of climate change on multiple water related problems at 15 research sites in six European countries. More than 20 hydrological models have been applied, driven with climatic decadal predictions from 2015 to 2024. The model applications focus on different water compartments and scales, such as flooding by combined sewer overflows in Badalona (Spain) and Bergen (Norway), changes in groundwater recharge for drinking water abstraction in the Veluwe, (the Netherlands), altered reservoir management in the Wupper river basin (Germany) and in Bergen (Norway), flooding in Cyprus, and increasing salinization in Portugal. Furthermore, consistent land- and water use scenarios have been developed in order to analyze and assess their impact on the water cycle.

The model results show that the impacts of climate and socio-economic change vary between geographical regions and water compartments affected (i.e. groundwater or surface water). For example, at the Norwegian reservoir an increase of inflow is predicted, while the German reservoir is predicted to remain stable or even decrease. The groundwater levels at the Dutch and Portuguese site are both showing effects of not returning to the same antecedent conditions (reference period) or even featuring decreases. The combined sewer overflows at the Spanish and Norwegian sites both feature increasing trends. The comparison of the impacts of land-use and water use changes as well as extremal episodes also provide an indifferent picture. For example, land-use changes are predicted to further increase flood peaks in Cyprus, while no changes in the hydrographs of the German sites have been observed.

The results are used by stakeholders, such as water providers and managers, local authorities, and others in order to be prepared for and to cope with near time climate change effects. Stakeholders have been included in Communities of Practice right from the project start and have influenced the modelling goals and protocols. Some of the models are implemented by stakeholders and are used operationally. Further, the model results have been used to conduct case sensitive risk analysis. The combined bottom-up (stakeholder, water managers, local problems) and top-down (modelling framework, decadal predictions, socio-economic scenarios) approach has shown to be a very promising way ahead to tackle multiple water problems at multiple sites and countries at the same time.