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Adapting regional watershed management to climate change in Bavaria and Québec

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The international research project QBic3 (Quebec-Bavarian Collaboration on Climate Change) aims at investigating the potential impacts of climate change on the hydrology of regional scale catchments in Southern Quebec (Canada) and Bavaria (Germany). For this purpose, a hydro-meteorological modeling chain has been established, applying climatic forcing from both dynamical and statistical climate model data to an ensemble of hydrological models of varying complexity. The selection of input data, process descriptions and scenarios allows for the inter-comparison of the uncertainty ranges on selected runoff indicators; a methodology to display the relative importance of each source of uncertainty is developed and results for past runoff (1971-2000) and potential future changes (2041-2070) are obtained. Finally, the impact of hydrological changes on the operational management of dams, reservoirs and transfer systems is investigated and shown for the Bavarian case studies, namely the potential change in i) hydro-power production for the Upper Isar watershed and ii) low flow augmentation and water transfer rates at the Donau-Main transfer system in Central Franconia. Two overall findings will be presented and discussed in detail:

a) the climate change response of selected hydrological indicators, especially those related to low flows, is strongly affected by the choice of the hydrological model. It can be shown that an assessment of the changes in the hydrological cycle is best represented by a complex physically based hydrological model, computationally less demanding models (usually simple, lumped and conceptual) can give a significant level of trust for selected indicators.

b) the major differences in the projected climate forcing stemming from the ensemble of dynamic climate models (GCM/RCM) versus the statistical-stochastical WETTREG2010 approach. While the dynamic ensemble reveals a moderate modification of the hydrological processes in the investigated catchments, the WETTREG2010 driven runs show a severe detraction for all water operations, mainly related to a strong decline in projected precipitation in all seasons (except winter).