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ClimEx – Climate change and hydrological extreme events – risks and perspectives for water management in Bavaria and Québec

Ralf Ludwig (1), Frank Baese (6), Marco Braun (2), Gilbert Brietzke (3), Francois Brissette (4), Anne Frigon (2), Michel Giguère (2), Holger Komischke (6), Dieter Kranzlmueller (3), Martin Leduc (2), Jean-Luc Martel (4), Simon Ricard (5), Josef Schmid (1), Fabian von Trentini (1), Richard Turcotte (5), Jens Weismueller (3), Florian Willkofer (1), and Raul Wood (1)

(1) Department of Geography, Ludwig-Maximilians-University (LMU) Munich, Germany (r.ludwig@lmu.de), (2) Consortium Ouranos, Montreal (PQ), Canada, (3) Leibniz Rechenzentrum (LRZ), Munich, Germany, (4) École de Technologie Superieure (ETS), Université du Québec, Montreal (PQ), Canada, (5) Direction de l'expertise hydrique (MDDELCC), Québec (PQ), Canada, (6) Bavarian State Office for the Environment (LfU), Augsburg, Germany

The recent accumulation of extreme hydrological events in Bavaria and Québec has stimulated scientific and also societal interest. In addition to the challenges of an improved prediction of such situations and the implications for the associated risk management, there is, as yet, no confirmed knowledge whether and how climate change contributes to the magnitude and frequency of hydrological extreme events and how regional water management could adapt to the corresponding risks.

The ClimEx project (2015-2019) investigates the effects of climate change on the meteorological and hydrological extreme events and their implications for water management in Bavaria and Québec. High Performance Computing is employed to enable the complex simulations in a hydro-climatological model processing chain, resulting in a unique high-resolution and transient (1950-2100) dataset of climatological and meteorological forcing and hydrological response:

(1) The climate module has developed a large ensemble of high resolution data (12km) of the CRCM5 RCM for Central Europe and North-Eastern North America, downscaled from 50 members of the CanESM2 GCM. The dataset is complemented by all available data from the Euro-CORDEX project to account for the assessment of both natural climate variability and climate change. The large ensemble with several thousand model years provides the potential to catch rare extreme events and thus improves the process understanding of extreme events with return periods of 1000+ years.

(2) The hydrology module comprises process-based and spatially explicit model setups (e.g. WaSiM) for all major catchments in Bavaria and Southern Québec in high temporal (3h) and spatial (500m) resolution. The simulations form the basis for in depth analysis of hydrological extreme events based on the inputs from the large climate model dataset. The specific data situation enables to establish a new method for 'virtual perfect prediction', which assesses climate change impacts on flood risk and water resources management by identifying patterns in the data which reveal preferential triggers of hydrological extreme events.

The presentation will highlight first results from the analysis of the large scale ClimEx model ensemble, showing the current and future ratio of natural variability and climate change impacts on meteorological extreme events. Selected data from the ensemble is used to drive a hydrological model experiment to illustrate the capacity to better determine the recurrence periods of hydrological extreme events under conditions of climate change.

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