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Analyzing natural variability and future changes of precipitation extremes in the CRCM5 Single-Model Large-Ensemble

Raul R. Wood, Fabian von Trentini, and Ralf Ludwig
LMU Munich, Department of Geography, Munich, Germany (raul.wood@lmu.de)

A reliable estimate of extreme events is of great interest for water management and public safety. Many studies show an increase in the magnitude and frequency of meteorological extreme events as a result of climate change. However, the contribution of internal variability to the magnitude and frequency of hydrological extreme events is not yet fully understood. Therefore, the internal variability must be determined in order to accurately interpret the signal of climate change in the dynamics of extreme precipitation.
In the scope of the ClimEx Project (www.climex-project.org), a new single-model large-ensemble was created by dynamically downscaling the 50 members of the Canadian Earth System Model version 2 (CanESM2) initial-condition large-ensemble with the Canadian Regional Climate Model version 5 (CRCM5), resulting in unique high-resolution, transient datasets for a European and an Eastern North-American domain under RCP8.5. By utilizing the ClimEx 50-Member Large-Ensemble (ClimEx-LE) a thorough analysis of internal variability in extreme events is possible.

The contribution of natural variability to the magnitude and frequency of extreme precipitation for various durations (1 hour through 5 days) over Europe is shown for current and future climatic conditions. This study provides answers to the following research questions: What regions show a strong forced signal and emerge from the noise of internal variability? When does the climate change signal emerge? Can land-atmosphere feedbacks explain changes in heavy precipitation? How many members are needed to quantify the internal variability of extreme precipitation?