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

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Hydrometeorological extreme events are of great interest and concern for water management and public safety. Many studies show an increase in the magnitude and frequency of hydrological extreme events as a result of climate change. However, the contribution of natural variability to the magnitude and frequency of hydrological extreme events is not sufficiently understood and questions on the robustness of extreme event estimates yet remain. Therefore, novel data and methods are required to reliably distinguish the range and effects of natural variability, understood as an irreducible uncertainty, from a clear climate change signal. In the scope of the ClimEx Project (www.climex-project.org), a new single-model large-ensemble was created by dynamically downscaling the Canadian Earth System Model version 2 (CanESM2) large-ensemble with the Canadian Regional Climate Model version 5 (CRCM5) for a European and a Eastern North-American domain. By utilizing the ClimEx 50-Member Large-Ensemble (ClimEx-LE) a thorough analysis of natural variability in extreme events is possible under current and future climate conditions.

The presentation highlights the contribution of natural variability to the magnitude and frequency of extreme precipitation for various durations (1 hour through 5 days) over Europe and Eastern North-America. Results from the ClimEx-LE analysis show where and when a strong forced signal emerges from the noise of internal variability, and where the changes are significant. Changes in precipitation characteristics in terms of timing of the events are illustrated. Further, early findings to address the following research questions are delivered: Can we attribute impacts of climate change already for the current climate? Can we define patterns in antecedent climate conditions that trigger the severity of extreme events? How are the extremes connected to other climate variables? Are the changes in extreme precipitation following the Clausius-Clapeyron scaling?