Geophysical Research Abstracts
Vol. 21, EGU2019-5449, 2019
EGU General Assembly 2019

Projected increase of future extreme short-term rainfall: the temperature-driven step from daily to sub-hourly

Gerd Bürger (1), Axel Bronstert (1), and Angela Pfister (2)

(1) University of Potsdam, Regional Climate Impacts, Potsdam, Germany, (2) EMSCHERGENOSSENSCHAFT / LIPPEVERBAND, Essen, Germany

Estimates of present and future sub-hourly extreme rainfall are derived for a group of stations in central Germany, based on very long (>70y) records of 10-minute local measurements and global climate model (GCM) projections. The notorious spatial and temporal scale gaps are bridged using a two-step procedure:

step 1 (spatial): GCM daily → stations daily
step 2 (temporal): stations daily → stations sub-hourly

While step 1 employs a standard downscaling scheme (Expanded Downscaling), step 2 introduces a novel method of a temperature-sensitive disaggregation, MC^+. It is derived from the multiplicative random cascade model, MC, of Olsson (1998), and implements a sensitivity on temperature that, unlike MC, respects Clausius-Clapeyron (CC) scaling. An immediate consequence is that extreme sub-daily rainfall becomes more likely on warmer days. For future rainfall, we show that even with no change projected for daily rainfall extremes, a significant increase at the sub-hourly scale is obtained from using MC^+, but not MC, that must be attributed to the direct effect of warmer temperatures via CC scaling.