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Scaling and Intensification of Extreme Precipitation in High-Resolution Climate Change Simulations

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Climate change projections of extreme precipitation are of great interest due to hydrological impacts such as droughts, floods, erosion, landslides and debris flows. Despite the trend towards dryer conditions over Europe, many climate simulations project increases of heavy precipitation events, while some theoretical studies have raised the possibility of dramatic increases in hourly events (by up to 14% per degree warming). However, conventional climate models are not suited to assess short-term heavy events due to the need to parameterize deep convection. High-resolution climate models with kilometer-scale grid spacing at which parameterization of convection can be switched off, significantly improve the simulation of heavy precipitation and can alter the climate change signal (e.g., Ban et al., 2015).
Here we present decade-long high-resolution climate change simulations at horizontal resolution of 2.2 km over Europe on a computational domain with 1536x1536x60 grid points. These simulations have become feasible with a new version of the COSMO model that runs entirely on Graphics Processing Units. We compare a present-day climate simulation, driven by ERA-Interim reanalysis (Leutwyler at al., 2016), with a Pseudo-Global Warming (PGW) simulation The PGW simulation is driven by the slowly evolving mean seasonal cycle of the climate changes (derived from the CMIP5 model), superimposed on the ERA-Interim reanalysis. With this approach, the resulting changes are due to large scale warming of the atmosphere and due to slow-varying circulation changes.
We will present the differences in climate change signal between conventional and high-resolution climate models, and discuss the thermodynamic effects on intensification of extreme precipitation.

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