Improved bias-adjustment methods for subdaily precipitation extremes

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Extreme precipitation events are responsible for severe damage to various aspects of human society and ecosystems. Short-term extremes especially affect people in urban areas through flash floods. Extremely heavy precipitation is increasing in frequency and intensity due to global warming and Regional Climate Models (RCMs) of high-resolution are needed to estimate associated increased risks. However, even the RCMs that explicitly resolve deep convection are known to significantly underestimatesubdaily precipitation extremes. Impact modellers and other users of climate projections therefore often use some form of bias correction.

In this study, we propose bias adjustment methods especially designed for the estimation of future subdaily extreme precipitation return levels. These methods take into account the scaling intensity-duration-frequency (IDF) relationship between different levels of accumulation, and jointly estimate extreme rainfall over multiple rainfall durations (i.e. from hourly to multi-day extreme precipitation events). After comparison with established methods, we identify only one method that preserves the scaling IDF relationship, which is a necessary condition to have bias-adjusted return levels consistent among the different durations. A comparative analysis in a multi-model pseudo-reality setting shows that this method is superior to existing bias adjustment methods.

Finally, future projections of bias-adjusted subdaily precipitation return levels for Belgium are obtained in the form of an ensemble of 28 EURO-CORDEX simulations at 0.11° spatial resolution, under the RCM8.5 emission scenario.