



## Summertime sub-daily precipitation extremes in a EURO-CORDEX 12-km ensemble: evaluation and future projections

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Sub-daily precipitation extremes have received relatively little attention in evaluations of regional climate models. This is to a large extent due to lack of data, regarding both observations and models. The EURO-CORDEX 0.11 degree ensemble is the largest ensemble currently available to a broader community through the ESGF nodes. Although several studies have found issues with sub-daily precipitation in models with parametrised convection, it is interesting to investigate this in more depth since the ensemble is tempting to use in a climate services context, or other adaptation related applications. In this study, depth duration frequency (DDF) analysis is performed for precipitation extremes with durations of one to 12 hours in the EURO-CORDEX 0.11 ensemble, which are then evaluated with national data sets for selected countries around Europe. The analyzed RCMs (RCA, HIRHAM, REMO and RACMO) mainly underestimate 10-year depths at short durations, but do better at longer (12 h) duration when compared with country wide median values for Sweden, the Netherlands, Germany, France and Austria. The reproduction of the observed spatial patterns of extremes over Germany is reasonable at 12 h duration, but shows little to no resemblance at shorter durations. For France, the more large-scale forced spatial pattern is better reproduced also at shorter durations, although with strongly underestimated depths. Future projections under RCPs 4.5 and 8.5 are investigated for several time-slices by relating changes in depths to mean temperature changes. A strong linear relationship is found for each single GCM-RCM combination across sub-regions, time slices and RCP scenarios between relative changes in extreme depths and mean temperature change (%/K). However, the scaling is different between the different GCM-RCM combinations, with about equal influence of the GCM and RCM. The scaling ranges between 1–10%/K at 12 h durations, and are generally higher for shorter durations.