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Storm-type specific scaling of sub-daily precipitation with temperature over the North Atlantic and Europe

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Sub-daily precipitation extremes are expected to increase in intensity in a warming climate, at a rate higher than that expected from the Clausius Clapeyron scaling. Depending on the region, these precipitation extremes can be caused by different weather system types, such as extratropical or tropical cyclones, fronts, and thunderstorms. In this study we use a storm typology, based on the objective identification of cyclone, fronts and thunderstorms, to add insight to the scaling relationship between temperature and extreme precipitation.

We use 6-hourly information on the type of weather system present at each grid box over the North Atlantic and European region from ERA5 (1981-2000) during boreal winter (DJF). The mean hourly 2-m dew-point temperature over the 6 hours closest to the weather system type, and the maximum of the hourly precipitation over the same period are then used to estimate the scaling of the precipitation extremes with temperature for each storm type. Preliminary results using quantile regression we find significantly larger scaling for weather systems including thunderstorms (greater than CC scaling) than for those that do not. We also find that for the most common weather systems over Northern Europe (front only and cyclone and front together), the scaling of extreme precipitation with temperature is below CC scaling. The future impacts of the extreme precipitation events will depend on the future changes in the frequency of different weather system types as well as the temperature scaling.