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Using a dew point temperature scaling framework to interpret changes in hourly extremes from convection-permitting model simulations

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While summer rain storms are very intermittent, chaotic and influenced by multiple atmospheric drivers, some statistics of observed short duration precipitation actually display surprisingly simple, regular behaviour. As an example, 10-min rainfall extremes derived from Dutch climate data show a dependency of 13% per degree over an almost 20-degree dew point temperature range. Similar behaviour has also been found in hourly precipitation observations. Each degree of warming reflects 6-7% more moisture in the air, following from the well-known Clausius-Clapeyron (CC) relation which is the cornerstone to understand and quantify the influence of climate change on precipitation extremes. According to the above finding, however, precipitation intensities may be increasing with temperature at a rate twice the commonly expected CC rate. In this presentation we will use output from a number of 10-year simulations for present-day and future climate with the convection permitting model HCLIM-AROME to investigate how hourly extremes respond to warming in both a pseudo global warming (PGW) and a GCM driven setup. In particular, we use the scaling diagram -- different percentiles of the rainfall distribution, usually the 90, and 99th conditioned on the occurrence of rain, as a function of dew point temperature -- as a analysis environment. Focus will be on how the scaling diagram is affected by climate change, and what information can be derived from these changes in scaling. While changes in the scaling diagram between present-day and future climate are in general consistent with a CC prediction, evidence of super CC behaviour, between 10 and 14 % per degree dew point, is also present. The same applies to changes in the most extreme events from the simulations, which show super CC behaviour in both PGW and GCM driven setups when scaled with the appropriate dew point temperature change.