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Trends and mechanisms behind extreme hourly precipitation

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Climate change likely affects the probability of occurrence and intensity of extreme precipitation, due to, e.g., changes in moisture holding capacity, vertical stability and wind patterns.

Whereas many studies have focused on trends in daily extremes, the present work aims on assessing and understanding trends in intensity and frequency of hourly extreme precipitation for 5 stations in the Netherlands (De Bilt, de Kooy, Vlissingen, Maastricht and Eelde) and multiple stations in Norway, Germany and Spain for the period 1958 till 2015. Trends are differentiated on season, location of the station, and duration of wet events.

Quantile regression is applied to fit linear trends on independent 2-day maxima in hourly precipitation, of which maxima occurring ≤ 5 % of the time are defined as extremes. Significance of the trends is tested with a Monte Carlo permutation test. In a Taylor diagram different factors (temperature, dewpoint temperature, convective available potential energy, and wind direction) are combined to quantify the mechanisms behind the observed trends.

Multiple significant trends ($p > 95\%$) are detected for 2-day-maxima. However, even for a small country as the Netherlands there are large spatial differences. This study contributes to the detection and understanding of trends in extremes in a changing climate.