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Scaling and trends of hourly precipitation extremes in a warming climate

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Hourly precipitation extremes in very long time series from the Hong Kong Observatory and the Netherlands are investigated. Using the 2 m dew point temperature from 4 h before the rainfall event as a measure of near surface absolute humidity, hourly precipitation extremes closely follow a 14 % per degree dependency – a scaling twice as large as following from the Clausius-Clapeyron relation. However, for dew point temperatures above 23 °C no significant dependency on humidity was found. Strikingly, in spite of the large difference in climate, results are almost identical in Hong Kong and the Netherlands for the dew point temperature range where both observational sets have sufficient data. Trends in hourly precipitation extremes show substantial increases over the last century for both De Bilt (the Netherlands) and Hong Kong. For De Bilt, not only the long term trend, but also variations in hourly precipitation extremes on a inter-decadal timescale of 30 yr and longer, can be linked very well to the above scaling; there is a very close resemblance between variations in dew point temperature and precipitation intensity with an inferred dependency of hourly precipitation extremes of 10 to 14 % per degree.