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Future Changes in Extreme Rainfall over Northern Europe

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Empirical studies show that the frequency distribution, n_P, with respect to daily precipitation amount, P, can for a large number of location be approximated by an exponential law, $n_P \propto e^{mP}$, with negative values for the exponential coefficient, m. Furthermore, the exponential coefficient is not a constant but varies from location to location and exhibits a systematic relationship with the local mean temperature and precipitation as well as other geographical parameters. These properties allow an estimation of extreme values in form of high percentiles, once the mean conditions are known. Furthermore, given changes in the mean local climate, it is possible to infer changes in the extremes. A new multi-model ensemble of the most recent climate simulations, carried out for the next Intergovernmental Panel on Climate Change (IPCC) report, due to be published in 2007 (AR4), has been subject to empirical-statistical downscaling and provide best-estimates for the continuing trends in mean temperatures and precipitation in northern Europe. These scenarios are used in conjunction with the established relationship between the exponential coefficient m of the distribution function on the one hand, and local mean temperature and precipitation on the other, to infer changes in the 90-percentiles of the rainfall for year 2050. This approach is different to previous work based on regional climate models or more traditional means of downscaling. This new independent analysis points towards an increase in the number of extreme precipitation events and more rainy days over northern Europe.