Simple and approximate upper-limit estimation of future precipitation return-values

Rasmus E. Benestad[1], Kajsa M. Parding[1], Abdelkader Mezghani[1], Anita V. Dyrrdal[1]

[1]The Norwegian Meteorological Institute, Oslo, 0313, Norway

Correspondence to: Rasmus E. Benestad (rasmus.benestad@met.no)

Abstract. We present estimates for an upper limit for twenty-year return-values for 24-hr precipitation at different locations in Europe and a crude method to quantify bounds of likely intervals. Our results suggest an increase by as much as 40-50% projected for 2100, assuming a high emission scenario, RCP8.5. The new strategy is based on combining physics with the limited available information, and utilises the covariance between the mean seasonal variations in precipitation and the North Atlantic saturation vapour pressure to estimate the maximum effect that a temperature change can have on precipitation, rather than the actual expected values. Return-value projections were derived through a simple and approximate scheme that combines the one-year 24-hr precipitation return-value and downscaled annual wet-day mean precipitation for a 1-in-20 year event. The twenty-year return-value was estimated by the 95th percentile of multi-model ensemble spread of downscaled climate model results. We found geographical variations in the shape of the seasonal cycle of the wet-day mean precipitation which suggest that different rain-producing mechanisms dominate in different regions. These differences indicate that the simple method used here to estimate upper limits was more appropriate for convective precipitation than for orographic rainfall.