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Evaluation and uncertainty assessment of probabilistic and deterministic UERRA regional re-analyses of precipitation by using single-estimate and ensemble observational datasets

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The aim of the present study is to evaluate daily precipitation data from the new regional re-analyses of UERRA in two topographically complex sub-regions of Europe, namely the European Alps and Fennoscandia.
UERRA is a EU-FP7 research project, where several regional deterministic (HARMONIE re-analysis produced at SMHI) and probabilistic re-analyses (re-analysis of the UK Met Office and UniBonn/DWD with COSMO model), as well as downscaling procedures based on these re-analyses (MESCAN - MétéoFrance), are calculated over several decades (30-50 years). They benefit of recent research efforts with the ambition to improve high-resolution multi-variate climate datasets for environmental applications.
Our evaluation aims to provide a quantification of uncertainties in daily precipitation fields, both by means of standard verification scores and by investigating uncertainty as a function of the spatial scales of interest. The evaluation is particularly relevant for hydrology and the provided information should help the users to assess the impact of uncertainty in their applications. Scale dependence of the uncertainty/accuracy is examined in our analyses by considering nested hydrological catchments of variable size and by decomposing precipitation fields into orthogonal wavelets of variable scale.
The reference datasets are spatial analyses from high-resolution rain-gauge networks. The Alpine rain-gauge dataset, covers territories of seven countries and encompasses more than 5300 daily rain-gauge observations on average. In Fennoscandia, we focus on Norway, Sweden and Finland where a dataset of approximately 2000 daily rain-gauge observations is available. The reference datasets are themselves affected by uncertainties in a degree that may be significant at the resolutions considered and, hence, could affect a scale-dependent evaluation. For an unbiased evaluation of re-analyses we adopt a new probabilistic rain-gauge dataset in the Alpine Region, which explicitly quantifies uncertainties by ensembles. Having an ensemble area-mean precipitation dataset as a reference opens interesting possibilities and requires adapted methodologies for evaluation.