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An improved E-OBS pan-European gridded data set for global radiation

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Question. Currently, we already provide an E-OBS pan-European gridded data set for global radiation. However, improvements might be made in the reliability of the estimate in areas with a low network density, in the effective spatial resolution as well as in the reliability of the ensemble dispersion. In this work, we use lessons learnt from earlier work (Frei et al, IJC, 2015) and the E-OBS wind grid, and apply them to the radiation grid, in order to see if we can achieve these improvements.

Approach. Our approach is to use aggregated regression kriging. First, we use linear regression to fit a monthly background field of the observed global radiation as a function of several covariates. In order to allow for the inclusion of multiple covariates, yet avoid over-fitting, we use forward selection linear regression to construct the monthly background field. Apart from covariates like longitude, latitude, distance to coast and altitude, we include monthly-varying PCA modes of reanalysis-based radiation patterns. Then, we use kriging to regress the daily anomalies with respect to the monthly background field.

In order to provide the gridded data set as an ensemble of 20 members, we run a 20-fold bootstrapping loop over the entire gridding procedure. Because this still leads to an underestimation of the grid uncertainty – or ensemble dispersion – we apply ensemble dispersion improvement auto-tune (EDIT) as an ensemble post-processing step.

Results. We provide a gridded data set of daily global radiation at a resolution of 0.1x0.1 and 0.25x0.25 degrees longitude and latitude. The standard data set consists of ensemble mean and ensemble inter-quantile range, however, the full ensemble can be made available upon request. A comparison against the available EUMETSAT satellite data will be made. The data set will be provided for the period 1950-present, with monthly updates, and will be available for download from the E-OBS website.