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Uncertainty propagation in the generation of reference crop evapotranspiration database in Spain

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A high spatial resolution (1.1km) database of weekly reference crop evapotranspiration (ETo) was generated in Spain for the period 1961-2014 using AEMET (Spanish National Weather Service) data. The methodology followed to generate this database has three main steps: i) grid generation of each climate variable needed to estimate ETo (i.e. maximum temperature, minimum temperature, dew point temperature, wind speed and sunshine duration) ii) use of FAO Penman Monteith equation to estimate ETo and iii) estimation of ETo uncertainty by propagating climate grids uncertainty.

For each variable, the grid generation follows these steps: i) quality control, ii) gap filling, iii) homogenization, iv) data selection (only series with high percentage of original data are used in the following step) and v) interpolation using a kriging method. We assume grid uncertainty to be related with gap filling and interpolation processes. As we introduce the gap filling uncertainty as an input of the kriging method, we can assume the uncertainty of the grid to be equal to the variance of the kriging method.

After that, ETo values are obtained by using FAO Penman equation, and ETo uncertainty is obtained by multiplying the covariance matrix of climate grids by the Jacobian of ETo.

To assess the uncertainty quantification of the climate grids we took advantage of the high number of automatic weather stations installed during the last decade and not used in the interpolation due to their short period. We tested the adjustment of these observed values with their nearest points of climate grid, considering that the interval [mean value – variance, mean value + variance] has to contain approximately 68% of observations