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A reference crop evapotranspiration database for Spain

Miquel Tomas-Burguera (1), Santiago Begueria (1), Sergio Vicente-Serrano (2), and Marco Maneta (3)

(1) Estación Experimental de Aula DEI, Consejo Superior de Investigaciones Científicas (EEAD-CSIC), Zaragoza, Spain, (2) Insituto Pirenaico de Ecología, Consejo Superior de Investigaciones Científicas (IPE-CSIC), Zaragoza, Spain, (3) Geosciences Department, University of Montana, Missoula MT, USA

We present a monthly reference crop evapotranspiration (ETo) gridded database for continental Spain based on the Penman-Monteith equation proposed by FAO-56. The database spans the period from 1979 to 2011 at 9 km resolution. The grid was generated combining information from a network of weather stations operated by AEMET with outputs from a high-resolution regional weather model (WRF at 0.088° forced by ERA-Interim). The information from these two sources was blended using a novel technique that couples a Bayesian optimal interpolator with an extended Kalman filter for the simultaneous estimation of 1) gridded monthly ETo means and variances, 2) optimal station interpolation weights necessary to fill gaps in the observational record, and 3) estimation variances of the station-based estimations of mean monthly ETo.
To calculate observed ETo and obtain simulated (a priori) ETo, we used information on minimum and maximum temperature, relative humidity, sunshine duration and wind speed obtained from the observational network and from the WRF model, respectively. Our methodology permits to overcome problems associated with the scarcity and inhomogeneity of the observational data necessary to calculate ETo. For this, we leverage information about the spatial structure of climatic variables contained in physics-based weather models to inform the optimal interpolation process. This information is also used to drive the coupled extended Kalman Filter that estimates the in-between station interpolation weights used to interpolate missing data and generate optimal observed monthly ETo means and variances.