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Spatial disaggregation of POWER-NASA air temperatures and effects on grass reference evapotranspiration in Sicily, Italy

Amro Negm, Mario Minacapilli , and Giuseppe Provenzano

Department of Agriculture and Forest Sciences, University of Palermo, Viale delle Scienze 12, Ed. 4, 90128 Palermo. E-mail: amro_negm@hotmail.com

The accurate estimation of grass reference evapotranspiration (ET0) is important for many fields, including hydrology and irrigation water management. Being direct measure of ET0 difficult, expensive and time consuming, application of simplified approaches and web-based meteorological information are often preferred.
The Prediction of Worldwide Energy Resource project developed by the American National Aeronautics and Space Administration (POWER-NASA) provides meteorological observations and surface energy fluxes on 1° latitude by 1° longitude grid, with a continuous daily coverage and for the entire globe. However, the broad spatial resolution of these data represents a limiting factor, for example when they have to be used for local estimations of reference ET0.
In this work, a procedure for the spatial disaggregation of POWER-NASA daily average air temperature was proposed. In particular, a daily scaling factor was initially defined as the ratio between disaggregated average air temperature and the corresponding native value. This ratio was then modeled with a cosine function, characterized by three parameters depending on elevation, so to account for seasonal and regional variability. The proposed model was calibrated with three years of ground measurements (2006-2008) and then validated over six years (2009-2014).
The suitability of the procedure was finally assessed by applying two simplified empirical models to estimate ET0 (Turc, 1961; Hargreaves, 1975). When compared to ET0 values obtained with FAO-56 PM equation, both simplified equations associated to downscaled meteorological observations, were characterized by RMSE ranging between 0.44 and 1.08 mm (average of 0.72-0.74 mm), and average MBE of -0.06 (Turc equation) and 0.13 mm (Hargreaves equation). These results indicated the strength of the proposed procedure to estimate ET0, even for regions characterized by the lack of detailed meteorological information.