

Assessment of daily reference evapotranspiration in Sicily by means of POWER-NASA agro-climatology archive

Amro Negm (1), Jay Jabro (2), and Giuseppe Provenzano (3)

(1) PhD, Fellowship Researcher. Department of Agriculture and Forest Science, University of Palermo, Viale delle Scienze 12, Ed. 4, 90128 Palermo, Italy. E-mail: amro_negm@hotmail.com, (2) PhD, Research Soil Scientist. Northern Plains Agricultural Research Laboratory, USDA-ARS, 1500 N. Central Avenue Sidney, MT 59270; USA. E-mail: jay.jabro@ars.usda.gov, (3) PhD, Associate Professor. Department of Agriculture and Forest Science, University of Palermo, Viale delle Scienze 12, Ed. 4, 90128 Palermo, Italy. E-mail: giuseppe.provenzano@unipa.it

The importance of evapotranspiration, ET , processes has long been recognized in many disciplines, including hydrologic and drainage studies as well as for irrigation system design and management. A wide number of equations have been proposed to estimate crop reference evapotranspiration, ET_0 , based on the variables affecting the process. When a full data set of climate variables is available, the Food and Agriculture Organization (FAO) of the United Nations recommended to use the physically based FAO-56 Penman-Monteith equation. The lack of climate variables and particularly of solar radiation has led several researchers to propose simplified ET_0 estimation equations using a limited number of climate variables. These equations, however, need site-specific validation prior to their use and cannot be generalized. Recently, the American National Aeronautics and Space Administration (NASA), created an efficient and open access agro-climatology archive in the frame of the Prediction Of Worldwide Energy Resource (POWER) project containing, on global scale, a long-series of meteorological variables and surface solar energy fluxes.

The main objective of the research was to assess the suitability of POWER-NASA open access archive to estimate daily reference evapotranspiration, ET_0 , in Sicily, for the period 2006-2014. Daily ET_0 were evaluated according to FAO-56 PM equation, by considering the POWER-NASA database characterized by a grid resolution of 1° latitude \times 1° longitude, as well as the climate data measured on the ground, by a network of 36 meteorological stations installed in Sicily and belonging to the Agro-meteorological Information Service (SIAS).

After comparing the climate data available in both databases (minimum, maximum and average air temperature and relative air humidity, wind speed, solar radiation and air pressure), a statistical comparison was also carried out on ET_0 values estimated with the FAO-56 PM equation. The analysis showed a good correlation between the climate variables of both the databases; in addition, ET_0 values estimated with POWER-NASA database resulted comparable to those obtained by using the SIAS records, with bias and root mean square error equal, on average, to 0.18 mm and 1 mm, respectively.

The results support the possibility to obtain suitable estimations of daily ET_0 based on the POWER-NASA agro-climatology archive, even to other Mediterranean countries where most of climate variables are not measured.