Estimating reference evapotranspiration by ERA5 products under different irrigation districts

D. Vanella1\*, G. Longo-Minnolo1, A. Castagna2, R. Quarta3, M. Ippolito4, A. Comegna5, O. R. Belfiore6

1 Dip. di Agricoltura, Alimentazione e Ambiente, University of Catania, 95123 Catania (Italy), [daniela.vanella@unict.it](mailto:daniela.vanella@unict.it)

2 Dept. of Agricultural and Environmental Sciences, University of Milan, 20133 Milan(Italy)

3 Dip. di Scienze e Tecnologie Agro-Alimentari, University of Bologna, 40127 Bologna (Italy)

4 Dept. of Agricultural, Food and Forest Sciences, University of Palermo, 90128 Palermo (Italy)

5 Dept. for Agro-Foresty Systems Management, University of Basilicata, Potenza (Italy)

6 Dept. of Agricultural Sciences, University of Naples Federico II, 80055 Portici (Italy)

**Keywords.** Reanalysis dataset; Weather ground-based observation; Water management; Irrigation

**Abstract.** Nowadays, climate reanalysis products can provide fundamental inputs for agro-meteorological and hydrological applications. In this sense, the global reanalysis datasets ERA5 single levels and ERA5-Land (ERA5-L), released by the European Centre for Medium-Range Weather Forecasts (ECMWF), offer consistent time-series of multiple climate variables at about 30 and 9 km horizontal resolution, respectively. The aim of this study was to assess the potential use of these datasets as alternative weather data source for estimating reference evapotranspiration (ET0). In particular, the daily ET0 estimates provided by the new generation ECMWF reanalysis datasets were compared with 66 observational sites distributed over 7 irrigation districts throughout the Italian territory during the period 2008-20. In particular, under the Köppen-Geiger classification, a number of 7 study sites, located in Apulia, were characterized by arid, steppe, cold climate (BSk); 19 sites, placed in Campania and Sicily (Eastern and Western part), were featured by dry and hot-summer temperate climate (Csa); 7 sites, placed in Sardinia, were classified as dry and warm summer temperate climate (Csb); and 32 sites, located in Emilia-Romagna and Lombardy, were referred to no dry season, hot summer (Cfa) temperate climate conditions.

At 86% of the total number of the irrigation districts under study, ET0 performances resulted more consistent using ERA5 than ERA5-L products, when compared to the observational sites. In particular, ET0 resulted in greater and lower performance under Csa, with average RMSE of 0.65 and 0.59 mm d-1 for ERA5 and ERA5-L, respectively, and Bks, with average RMSE of 0.90 and 0.88 mm d-1 for ERA5 and ERA5-L, respectively, climate conditions. Intermediate performances were obtained under Cfa and Csb climate zones (with average RMSE of 0.69 and 0.67 mm d-1 for ERA5 and ERA5-L, respectively).

The high accuracy obtained in estimating ET0 by reanalysis products suggests the potential use of this information for calculating the daily crop evapotranspiration rates aiming at supporting the irrigation scheduling especially under Csa conditions.