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GIS—based application of Benfratello's method to estimate the irrigation deficit and its variability in the Capitanata plain under climate change

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Benfratello's Contribution to the study of the water balance of an agricultural soil (*Contributo allo studio del bilancio idrologico del terreno agrario*) was firstly published in 1961. The paper provides a practical conceptual and lumped method, based on climatic forcings and on the field capacity, to determine the irrigation deficit in agricultural districts. It generalizes the previous Thornthwaite (1948) and Thornthwaite and Mather (1955) water balances thanks to the application of a dimensionless approach introduced by De Varennes e Mendonça (1958), and of a power—law desiccation function. Since then, it has been used in many semi—arid areas in Southern Italy.

Due to its simplicity and to the small number of required parameters, Benfratello's method could be regarded to as an effective tool to assess the effects of climatic, landuse and anthropogenic changes on the soil water balance and on the irrigation deficit, both at the climatic scale and in real time.

In previous EGU—GA contributions (Barontini et al., 2021, 2022) we presented a GIS—based implementation of Benfratello's method to assess the irrigation deficit in the Capitanata plain (4550 km^2), and a theoretical development of the method to estimate in closed form the interannual variability of the calculated irrigation deficit, once known the variability of temperature and precipitation.

In this contribution we present the results obtained by applying the GIS—based Benfratello framework to assess the irrigation deficit and its variability in the Capitanata plain under different climate change scenarios.

The scenarios were generated with the following procedure: (i) evaluation of different GCMs (CNRM-CM5, CMCC-CM and IPSL-CM5A-MR) in comparison with the historical data, (ii) correction of systematic biases, (iii) application of the same biases to the corresponding IPCC RCP4.5 and RCP8.5 scenarios, (iv) statistical downscaling of the obtained models to estimate future time series for the meteorological stations of interest in the considered case study and (v) spatial interpolation with ordinary Kriging.