Quantifying Irrigation Volumes Using Sentinel-1 Soil Moisture Data in Central Italy

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**Abstract.** The efficient use of water resources in agriculture represents a strategic objective, particularly in areas like Central and Southern Italy, where crops are strictly dependent on irrigation and where deficit phenomena are more likely. This objective must be pursued through technical and infrastructural improvements of irrigation systems and management optimization. A reliable and effective management strategy requires the availability of updated and detailed data of the actual extension of irrigated areas and water consumption, as required by the EU directive on water (2000/60 EC). The most interesting perspective for obtaining this information is represented by satellite data, particularly those that provide information on soil moisture.

However, the use of satellite soil moisture data for this purpose is still an open challenge, especially in agricultural contexts where a mismatch exists between the spatial resolution of satellite retrieved information and the extent of the irrigated fields.

In this work, soil moisture datasets at different spatial resolutions (1 km and plot-scale), derived from Sentinel-1 observations, as well as rainfall and evapotranspiration products are used to input the SM-based inversion approach (Brocca et al., 2018; Dari et al., 2020) with the aim of retrieving information on irrigation volumes. The method is applied over a complex-topography agricultural area of about 3000 ha, corresponding to the Upper Tiber River valley (central Italy). For this area, information about irrigation water consumption in the period 2017-2021 is used as a benchmark. The analyses are carried out both at the district and the plot scale, thus allowing to evaluate the performances of Sentinel-1-derived soil moisture data in estimating irrigation quantities at different spatial scales and highlight potential benefits associated with the progress towards hyper-high-resolution data.

References

Dari, J., Brocca, L., Quintana-Seguí, P., Escorihuela, M.J., Stefan, V., Morbidelli, R., 2020. Exploiting high-resolution remote sensing soil moisture to estimate irrigation water amounts over a Mediterranean region. Remote Sens. 12, 2593

Brocca, L., Tarpanelli, A., Filippucci, P., Dorigo, W., Zaussinger, F., Gruber, A., Fernandez-Prieto, D., 2018. How much water is used for irrigation? A new approach exploiting coarse resolution satellite soil moisture products. Int. J. Earth Obs. Geoinf. 73, 752–766