Optical remote sensing for supporting irrigation management under different climate conditions

Giuseppe Longo-Minnolo1\*, Florian Deissenberger2, Simona Consoli3, Daniela Vanella3, Juan Miguel Ramírez-Cuesta4, Francesco Vuolo2

1\* International Doctorate in Agricultural, Food and Environmental Science - Di3A - University of Catania, Via S. Sofia, 100, Catania 95123, Italy (corresponding author: [giuseppe.longominnolo@phd.unict.it](mailto:giuseppe.longominnolo@phd.unict.it); +39 320 6960695)

2 Institute of Geomatics, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter-Jordan-Straße 82,1190 Vienna, Austria

3 Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania, Via S. Sofia, 100, Catania 95123, Italy

4 Ecology Department, (CSIC-UV-GVA), Desertification Research Center (CIDE), Carretera CV-315 km 10.7, 46113 Moncada, Spain

**Keywords.** Sentinel-2, OPTRAM, Soil Water Content, Irrigation events, Irrigated areas.

**Abstract.** Nowadays, irrigation is one of the main sources of consumption of fresh water in the agriculture sector. In this context, remote sensing (RS) techniques can offer their potential for the spatial and temporal assessment of water resources.

The main purpose of this study was to provide a novel stand-alone RS approach based on the use of the Optical Trapezoid Model (OPTRAM) methodology for supporting sustainable irrigation management in different climate conditions, such as humid and semi-arid climates. Specifically, high-spatial-resolution multispectral imagery acquired by Sentinel-2 satellite sensor was coupled with the OPTRAM approach: i) for detecting the irrigation events occurred at the Marchfeld region (Austria) within the irrigation season 2020 and; ii) for mapping the irrigated areas at the irrigation district “Quota 102.50” in Sicily (Italy), within the irrigation seasons 2019-20.

An overall linear parameterization of OPTRAM was tested and applied at Marchfeld region for providing 20 m spatial estimates of soil water content (SWC). The SWC patterns were compared with in-situ observations, showing a good agreement with accuracies of about 70%. Crop-specific linear parametrizations of OPTRAM, based on seasonal Normalized Difference Vegetation Index clusters, were applied at “Quota 102.50”. The outputted irrigated areas were compared with the information provided by the Sicilian Irrigation Consortia at the sub-district level, showing slight overestimations of 2.12% and 0.18%, within the irrigation seasons 2019 and 2020, respectively.

In conclusion, the proposed RS approach provides promising results for supporting the irrigation management in different climate conditions permitting to identify the irrigation events and patterns under humid climate conditions, and mapping the actual irrigated areas in semi-arid climate conditions.