EGU2020-10599
https://doi.org/10.5194/egusphere-egu2020-10599
EGU General Assembly 2020

Optimizing water use in agriculture to preserve soil and water resources. The WATER4EVER project

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The WATER4EVER Project (http://water4ever.eu/) was built on the premise that agriculture is by far the largest consumer of water, with about 70% of the diverted water being used in irrigation. Agriculture is also considered as a key source of diffuse pollution with inefficient practices resulting in high water and nutrient (particularly N and P) surpluses that are transferred to water bodies through diffuse processes (runoff and leaching), promoting eutrophication, with associated biodiversity loss. WATER4EVER aims thus to develop new monitoring strategies at the plot and catchment scales to provide detailed information of water and nutrient flow, and gain new insights on the connectivity between both scales. New monitoring strategies were developed and tested in agricultural fields in Portugal, Spain, Italy and Turkey and included: (i) crop physiological indicators assessment using static sensors for defining improved deficit irrigation strategies for woody crops; (ii) crop stress and productivity maps from measurements taken with a smart sensor mounted on a tractor and equipped with LIDAR 2D, normalized difference vegetation index (NDVI) and thermal cameras, and a GNSS receiver; (iii) leaf area index maps at 30 m resolution derived from ATCOR and Landsat 8 imagery data using the NDVI and the Soil Adjusted Vegetation Index (SAVI); (iv) soil moisture maps at 100 m resolution by combining the 10 m resolution synthetic-aperture radar (SAR) images from Sentinel 1 with the 10 m resolution NDVI computed from Sentinel 2 images, averaged into 100 m cells, and then by considering the backscatter difference with the driest day, or alternatively the backscatter difference between two consecutive dates; (v) soil moisture maps at 1 km resolution created with the DISaggregation based on a Physical And Theoretical scale CHange (DISPATCH) algorithm for the downscaling of the 40 km SMOS (Soil Moisture and Ocean Salinity) soil moisture data using land surface temperature (LST) and NDVI data; (vi) conventional monitoring techniques combined with modeling tools for assessing the impact of different soil managements (conventional tillage, tillage with grass trips, grass cover) on soil infiltration, soil

water content, runoff and soil erosion of hillslope vineyards; (vii) an improved deterministic model for irrigation and fertigation management at the plot scale; and (viii) a decision support system for irrigation water management at the plot scale which integrated a deterministic model for irrigation scheduling and the NDVI computed from Sentinel 2 imagery data for crop growth monitoring. Preliminary results derived from the use of the innovative monitoring and mapping strategies, besides model applications are presented. The remote sensing products described above were also applied for catchment modeling validation of streamflow, which results fall outside the scope of this communication. WATER4EVER activities were thus wide and diverse, aimed at optimizing crop management practices which will help to promote the sustainability of different Mediterranean production systems.

WATER4EVER is funded by the European Commission under the framework of the ERA-NET COFUND WATERWORKS 2015 Programme