Wappfruit: a project for the optimisation of water use in agriculture

EGU23-1485, updated on 31 Mar 2023
https://doi.org/10.5194/egusphere-egu23-1485
EGU General Assembly 2023

Wappfruit: a project for the optimisation of water use in agriculture

Davide Gisolo[1], Mesmer N'sassila[1], Alessio Gentile[1], Francesca Pettiti[2], Mattia Barezzi[3], Umberto Garlando[3], Luca Nari[2], Stefano Ferraris[1], Danilo Demarchi[3], and **Davide Canone**[1]

[1]Polytechnic and University of Torino, DIST - 10125 Torino, Italy (davide.gisolo@unito.it)
[2]AGRION, The Foundation for Research, Innovation and Technological Development of Piedmont Agriculture - 12030 Manta, Italy
[3]Polytechnic of Torino, DET - 10129 Torino, Italy

The WAPPFRUIT project is related to the optimisation of irrigation techniques in the Piemonte Region, Northwest Italy. The main goal is to control irrigation to understand if it is possible to reduce the volume of water used for irrigation and also save energy. The project involves several stakeholders, among which Politecnico and the University of Torino, Piemonte Region, Agrion Foundation for research in agriculture, and three farms (two apple orchards and one Actinidia orchard). The optimisation relies on soil matric potential measurements at several soil depths. The irrigation will be triggered using a particular algorithm which is based on a system of matric potential thresholds at the depths of 20 and 40 cm. These thresholds are based on soil texture, and vegetation species (including root depth).

Each orchard is divided into two parts: an “experimental area” where the irrigation algorithm will be tested, and an area that will be irrigated as usual by farmers. Each orchard is equipped with four to six measurement nodes, with soil water content and soil matric potential profile having measures at 20, 40, and 60 cm of depth.

The retention curves, as well as the spatial and temporal variability of soil water content and soil matric potential, can be inferred from measures, which reveal high volumes of water used for irrigation (frequently the soil was near saturation conditions). In addition, all the soils show, in the retention curves, a hysteresis due to wetting/drying cycles.

The farmers continued to irrigate as usual in the two parts of the fields up to October 2022. Hence, to investigate the matric potential behavior and identify good estimates of thresholds, modeling approaches are important for the simulation of soil without irrigation, to understand when water stress conditions could occur. To this purpose, two models are used to simulate the water fluxes in the atmosphere and the soil (and, particularly, the matric potential). The two models adopted are the hydrological model Hydrus 1D and the land-surface model CLM5. Forcing the models with the precipitation summed to irrigation of the fields, Hydrus, in its 1D formulation did not yield reliable results, although more studies are needed to fully understand the causes for the misrepresentation. The CLM model yields instead more reliable outcomes. The CLM model is then used to simulate the behavior of the soil matric potential under the hypothesis of no irrigation.

The results illustrate that the matric potential threshold for triggering irrigation could be around -50 kPa at 20 cm, whereas the threshold at 40 cm for the deactivation of irrigation could be around -40 kPa for the sites with apple orchards. The site with Actinidia could have the aforementioned thresholds equal to -40 kPa at 20 cm and -30 kPa at 40 cm.