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A WEF NEXUS tool for integrating soil moisture and meteorological IoT data.

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According to the European Parliamentary Research Service, agriculture is a major user of ground and surface water in the Mediterranean region. Agriculture accounts for more than 40% of water use in the EU and most freshwater abstraction is for agricultural use. Water applied as irrigation enables crop production in arid regions and replenishes soil moisture in humid regions when rainfall during the growing season is insufficient. It helps to increase crop productivity, but it also poses a threat to the conservation of water resources. The issue of water scarcity therefore requires careful consideration of the trade-off between increased agricultural productivity and the degradation of water resources. Ensuring food security in the face of climate change requires improved water management capacity.

Nowadays, the interest in estimating the average soil moisture content (SM) and its variability is a cross-cutting issue in many areas of scientific research in the natural sciences. The water contained and transiting in the vadose zone is involved in and plays a central role in many natural processes related to plant physiology and agriculture, soil microbial activity, groundwater pollution and, more generally, eco-hydrological and bio-geochemical processes.

SM depends either on soil characteristics, i.e. hydraulic conductivity, porosity, soil texture, etc., or on meteorological forcing, i.e. precipitation, temperature, evapotranspiration, etc. Knowing the soil characteristics, a numerical model for unsaturated flow (Hydrus-1D) can be calibrated using time-lapse measurements of meteorological forcing and SMs obtained by IoT enabled sensors. After the calibration, the numerical model can generate a very large number of SMs for many meteorological forcings. With these data, a WEF Nexus tool, based on a machine learning approach, integrates the SM and meteorological IoT data to estimate crop water demand.

This research aims to develop and test a building block for possible future water demand estimation tools. As a future perspective, further development and integration may lead to new tools with user-friendly interfaces.