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# Vadose zone monitoring strategies to control water flux dynamics and changes in soil hydraulic properties.

Javier Valdes-Abellan (1), Joaquin Jiménez-Martínez (2), and Lucila Candela (3)

(1) Dept of Civil Engineering, University of Alicante, Alicante, Spain (javier.valdes@ua.es), (2) Geosciences Rennes, UMR 6118 CNRS, Université de Rennes I, Rennes, France (joaquin.jimenez-martinez@univ-rennes1.fr), (3) Dept of Geotechnical Engineering and Geoscience, UPC, Barcelona, Spain (lucila.candela@upc.edu)

For monitoring the vadose zone, different strategies can be chosen, depending on the objectives and scale of observation. The effects of non-conventional water use on the vadose zone might produce impacts in porous media which could lead to changes in soil hydraulic properties, among others. Controlling these possible effects requires an accurate monitoring strategy that controls the volumetric water content, $\theta$, and soil pressure, h, along the studied profile. According to the available literature, different monitoring systems have been carried out independently, however less attention has received comparative studies between different techniques.

An experimental plot of 9x5 m2 was set with automatic and non-automatic sensors to control $\theta$ and h up to 1.5m depth. The non-automatic system consisted of ten Jet Fill tensiometers at 30, 45, 60, 90 and 120 cm (Soil Moisture®) and a polycarbonate access tube of 44 mm (i.d) for soil moisture measurements with a TRIME FM TDR portable probe (IMKO®). Vertical installation was carefully performed; measurements with this system were manual, twice a week for $\theta$ and three times per week for h. The automatic system composed of five 5TE sensors (Decagon Devices®) installed at 20, 40, 60, 90 and 120 cm for $\theta$ measurements and one MPS1 sensor (Decagon Devices®) at 60 cm depth for h. Installation took place laterally in a 40-50 cm length hole bored in a side of a trench that was excavated. All automatic sensors hourly recorded and stored in a data-logger. Boundary conditions were controlled with a volume-meter and with a meteorological station. ET was modelled with Penman-Monteith equation.

Soil characterization include bulk density, gravimetric water content, grain size distribution, saturated hydraulic conductivity and soil water retention curves determined following laboratory standards. Soil mineralogy was determined by X-Ray difractometry. Unsaturated soil hydraulic parameters were model-fitted through SWRC-fit code and ROSETTA based on soil textural fractions.

Simulation of water flow using automatic and non-automatic date was carried out by HYDRUS-1D independently. A good agreement from collected automatic and non-automatic data and modelled results can be recognized. General trend was captured, except for the outlier values as expected. Slightly differences were found between hydraulic properties obtained from laboratory determinations, and from inverse modelling from the two approaches. Differences up to 14% of flux through the lower boundary were detected between the two strategies

According to results, automatic sensors have more resolution and then they're more appropriated to detect subtle changes of soil hydraulic properties. Nevertheless, if the aim of the research is to control the general trend of water dynamics, no significant differences were observed between the two systems.