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Field validation of root water uptake functions using experimental measurements and SWAP model

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In agro-hydrological research particular attention is devoted to correctly simulate plant behavior to water stress conditions, as a consequence of increasing water scarcity. From this viewpoint one of the fundamental processes is that of root water uptake, the way it is modeled and parameters definition.

With this perspective, the main objective of the present work was to compare different functions for describing water stress based on the "macroscopic" approach (reduction coefficient for root water uptake as function of soil water pressure head) and to calibrate root water uptake parameters, as implemented in the different models employed.

The study was based on irrigated field conditions with an alfalfa crop in Southern Italy.

We present the results of simulation of water movement in the soil-plant-atmosphere system using a modified version of SWAP code. In particular, the most relevant modifications concerned with the possibility of employ different reduction functions for root water uptake, as found in literature. The results of the different approaches were compared using statistical parameters calculated by comparison of measured and simulated transpiration, and soil water storage.

The model validation was performed by using measurements of actual evapotranspiration (Bowen ratio), soil water content and water pressure head at different depth, along with meteorological and crop parameters.

The results of validation have confirmed the model precision in predicting the magnitude of actual evapotranspiration fluxes and water content over the soil profile explored by plant roots.