Variability Assessment of Soil Water Balance Components in an Almond Field using Distributed Process-Based Modeling and Electromagnetic Induction Data

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Abstract

Accurate estimates of the soil water balance components are critical for optimizing irrigation water use in agricultural fields. Estimates are normally obtained using simple water balance models and for representative areas, not taking into consideration the within variability of soil properties. In this study, we used the MOHID-Land distributed process-based model to compute the variability of the soil water balance components in a 23ha almond field located in southern Portugal, at a resolution of 5m. The main objective was the possible assessment of management zones for improving water productivity in that water-scarce region. An electromagnetic induction survey was carried out first to obtain electromagnetic conductivity images which provided the spatial distribution of the real soil electrical conductivity (ff) with depth. The spatial distribution of ff was then correlated to soil particle size distribution using an in-situ calibration. Afterward, pedotransfer functions were applied to define the soil hydraulic parameters necessary to run the distributed model and map the within soil variability at the field scale. Irrigation data was monitored on-site, at two locations, while weather data was extracted from a local meteorological station. The distributed modeling approach included the definition of potential evapotranspiration fluxes computed from the product of the reference evapotranspiration obtained according to the FAO56 Penman-Monteith equation and a crop coefficient for each stage of almond's growing season, the variable-saturated flow using the Richards equation, and root zone water stress following a macroscopic approach. Modeling results were used to present the maps of the variability of the seasonal actual crop transpiration and soil evaporation, the mean soil moisture, seasonal runoff, and seasonal percolation. Then, management zones for improving irrigation water use in the studied almond field were proposed.

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