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Characterization of water and energy exchanges for rainfed olive orchards in a semi-arid land : modeling and integration of remote sensing data

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Evapotranspiration is one of the most important fluxes of the water balance in semi-arid areas. The components of evapotranspiration are soil evaporation (E) and transpiration (T) through the stomata of the plants. The estimation of crop actual transpiration is a major issue in central and south Tunisia because it affects irrigation scheduling, crop growth and yield. Olive is well adapted to the soil and climate conditions of Tunisia and covers an entire agricultural land of 1.7 million hectares representing nearly 79% of the total tree area. The southern part of the Mediterranean basin faces climate change and could affect olive tree production in rainfed conditions. The hydrological functioning of sparse olive trees is difficult to characterize because of its low LAI. For a good comprehension of the functionning of the water and energy transfers throuigh the Soil–Plant–Atmosphere continuum, we combine the eddy covariance method, soil water content measurements and sap flow method. The main objectives of this study are 1) to characterize the eco-hydrological processes of sparse olive trees from a dedicated experimental protocol and a SVAT model adapted to the sparse characteristic of such crop 2) to analyze the vulnerability of the system to climate change. First, we identify the factors of changes of transpiration at different time steps and characterized the different water stress levels by the combined use of different types of ecophysiological (sap flow) and spectral (photochemical reflectance index) measurements. Then, we estimate the percentage of evaporation, transpiration and the total evapotranspiration (ET). We compared scaled evapotranspiration values (the fraction of cover fraction contributing to the footprint of total ET fluxes) with scaled sap flow values. The sum of soil evaporation and transpiration matches well the total ET. A SVAT model is currently be applied and expanded to represent the impact of canopy structure on radiative and turbulent exchanges and the ecophysiology (stomatal processes, hydraulic resistance, root extraction ...).