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Assessing soil moisture constraint on soil evaporation and plant transpiration fractioning

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Over semi-arid agricultural regions, detecting the crop water need at the onset of water stress is of paramount importance for optimizing the use of irrigation water. Evapotranspiration (ET) is a crucial component of the water cycle, it strongly impacts the water resource management, drought monitoring, and climate. Remote sensing observations provide very relevant information to feed ET models. In particular, the microwave-derived surface (0-5 cm) soil moisture (SM), which is the main controlling factor of soil evaporation, the visible/near-infratred-derived vegetation cover fraction (fc), which provides an essential structural constraint on the fractioning between vegetation transpiration and soil evaporation, and - thermal-derived land surface temperature (LST), which is a signature of both available energy and evapotranspiration (ET) rate. The aim of this work is to integrate those independent and complementary information on total ET within an energy balance model. As a state-of-the-art and commonly used model, we chose the TSEB modelling as a basis for developments. An innovative calibration procedure is proposed to retrieve the main parameters of soil evaporation (soil resistance, r_{ss}) and plant transpiration (Priestly Taylor coefficient, α_{PT}) based on a threshold on fc. The procedure is applied over an irrigated wheat field in the Tensift basin, central Morocco. Overall, the coupling of the soil resistance formulation with the TSEB formalism improves the estimation of soil evaporation, and consequently, improves the partitioning of ET. Analysis of the retrieved time series indicates that the daily α_{PT} mainly follows the phenology of winter wheat crop with a maximum value coincident with the full development of green biomass and a minimum value reached at harvest. The temporal variations of α_{PT} before senescence are attributed to the dynamics of both the root zone soil moisture and the amount of green biomass.