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Application of a new calibration strategy on an evapotranspiration model based on surface biophysical characteristics

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A consistent partitioning between soil evaporation and plant transpiration is crucial for modeling crop evapotranspiration (ET) along the agricultural season. To help constrain the evaporation/transpiration partition of the TSEB (Two-Source energy Balance) modeling using readily available remote sensing data, fractional vegetation cover (fc), radiometric land surface (LST) temperature and near-surface soil moisture (SM) are integrated simultaneously within a new calibration procedure to retrieve the main parameters of soil evaporation (soil resistance) and plat transpiration (αPT). To address both issues a two-source energy balance model named TSEB-SM is first derived from the TSEB formalism by explicitly representing soil evaporation using the parameters (arss and brss) of soil resistance. In practice, the soil resistance parameters are retrieved at the seasonal time scale from SM and LST data with f_c$\leq$0.5. While αPT is retrieved at the daily time scale from SM and LST data for f_c>0.5. The approach is tested over three irrigated wheat plots in the Tensift basin, central Morocco. The convergence of the iterative calibration procedure on (arss. brss) and αPT is successfully tested when all three parameters are estimated at the seasonal time scale, as well as when considering a daily variability of αPT. Retrieved values of αPT, arss and brss are in the range of 0.0-1.4, 5.7-9.5, and 1.4-6.9, respectively. The temporal variations of αPT follows the phenology of winter wheat crop even during the growing stage which can be attributed to the dynamics of both root zone soil moisture and Leaf Area Index. In terms of flux estimates, the root mean square difference (RMSD) between TSEB-SM and eddy-covariance ET estimates is 67 W/m2 (24% relative error), compared to 108 W/m2 (38% relative error) for the original TSEB version using default parameters.