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The application of a Hybrid Evapotranspiration approach in rainfed wheat

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The spatio-temporal estimates of evapotranspiration (ET) have been traditionally addressed applying the water balance (WB) model of the root zone using the FAO-56 approach. The WB model is a prognostic approach of obtaining estimates of the ET and soil moisture on a daily basis. The reflectance based basal-crop coefficient Ksbrf in the WB model is determined from remote sensing data instead of the tabulated averaged basal crop coefficients (Kcb). This improvement over tabulated Kc describes the actual temporal and spatial variability and the growing conditions pattern within the field. Maps of spatially distributed actual ET are obtained applying a two source energy balance (TSEB) Model of Norman et al. (1995), which provides instantaneous estimates of surface energy fluxes including the latent heat flux that can be extrapolated to daily estimates of ET. The soil moisture (SM) plays a key-role in understanding the spatial and temporal variability for improved estimates of both SM and ET. A multiple layer model simulating the dynamics in the soil profile has been used in order to better describe the SM status obtained using the FAO-56 model that considers a single value in the root zone. The SM content is very important in semiarid areas where the crops can develop their roots under water stress environments. Estimates of ET from the TSEB and WB models are independent and can be combined using data assimilation techniques. This hybrid ET approach as described by Geli (2012) and Neale et al. (2012) provides improved estimates of both ET and SM of the root zone and was also applied to irrigated and non-irrigated cotton grown under highly convective conditions.

In this work the hybrid ET approach is applied to a rainfed wheat area of 18 ha in extension in La Mancha, Spain (39° 17′N, 1° 59’W, 700 m amsl) during the growing season of 2006. The area has a Mediterranean climate, considered semi-arid with scarce rain with a total of 122 mm measured throughout the growing season and high air temperatures (16ºC on average). The canopy grew part of the time under water stress and it was monitored at field when the fraction of vegetation cover (fc) was on 35 % (February 28th) until the harvesting on June 14th. Estimates of Surface energy flux and soil moisture content were compared with ground-based measurements.

References

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