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Instantaneous evaporation from contextual and single pixel energy balance models driven by Remote Sensing data in an irrigated semi-arid land: comparison with flux measurements and a distributed SVAT model.

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Considering the impact of current and future climatic and anthropogenic changes on the availability of water resources, particularly in arid and semi-arid zones, the optimization of water use in irrigated agriculture is an important issue. Various types of water budget models already exist but their use often requires a lot of input data difficult to estimate, at least spatially. Remote sensing data, especially the surface temperature, gives access to distributed information about the surface energy balance and water status. The MISTIGRI satellite mission is developed in this context: to obtain high resolution thermal data (<100m) with high temporal revisit (daily). Thus the interest of developing models which integrates such data is quite significant. In this paper, four models which solve the surface energy balance equation will be compared: two single pixel models: the Surface Energy Balance System (SEBS) and the Two-Sources Energy Balance (TSEB) and two contextual models which combine remote sensing information acquired at different locations of a TIR image: the Simplified Surface Energy Balance Index (S-SEBI) and the more complex Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC) model. This inter-comparison is carried out for a large dataset acquired on a 4x4 km cultivated area in the Yaqui valley (Sonora, Mexico) in 2008, including eddy covariance system and scintillometer data as well as High Resolution satellite images in the visible and thermal bands. At the same time, a Soil Vegetation Atmosphere Transfer (SVAT) model (ICARE) has been calibrated at seven points where flux measurements as well as soil water content are available and then run spatially for the whole scene. The output of this model allows us to evaluate the quality of in-situ data and was taken as a reference for the comparison of the four models.
Locally, the models give variable results with RMSE between 50 and 200W/m^2 on the latent heat flux (LE) depending on the crop type, and the comparison against distributed flux (scintillometry) shows comparable performances. The ultimate goal of this study is to choose which parameter, between high/low resolution surface temperature and spatialized LE, is the best suited to be assimilated in a SVAT model in order to retrieve irrigation scenarios (volumes, places and dates), which are very difficult to identify at this scale.