Validation of evapotranspiration maps from 100-m to the 1-km scale over a semi-arid irrigated agricultural area

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VALIDATION OF EVAPOTRANSPIRATION MAPS FROM 100-M TO THE 1-KM SCALE OVER A SEMI-ARID IRRIGATED AGRICULTURAL AREA

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Evapotranspiration (ET) estimates are particularly needed for monitoring available water over arid lands. Remote sensing data offer the ideal spatial and temporal coverage needed by irrigation water management institutions to deal with evolving regional water table issues. Low spatial resolution products present strong advantages as they cover larger zones and are acquired more frequently than high spatial resolution images. Further, they usually offer a long record history, such as the Moderate Resolution Imaging Spectroradiometer (MODIS). However, validation of ET products at low spatial resolution still remains a difficult task.

The objective of this study is to evaluate instantaneous fluxes obtained through local meteorological observations and remote sensing data (in visible, near infrared and thermal infrared domains) from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER; resampled to 100-m spatial resolution) and MODIS (resampled to 1-km spatial resolution). It was considered the Surface Energy

Balance System (SEBS; Su, 2002) and the Two-Source Energy Balance (TSEB; Norman et al., 1995) models. The study zone is a 4 km×4 km semi-arid irrigated agricultural area located in the North-West of Mexico (Yaqui, Sonora; 27°12'N, 109°57'W). Wheat is the dominant crop, followed by maize and vegetables. The ASTER dataset includes 7 dates from December 30, 2007 to May 13, 2008. Daily available MODIS products were considered for the same dates.

ET retrievals from ASTER data using both models showed good performances when compared to eddy covariance measurements from 7 locations within the 4 km×4 km square. Next, they were linearly aggregated to the 1-km scale (and considered as the reference ET) and compared to the ET maps obtained using MODIS data considering the SEBS and TSEB models. Further, in order to analyze the effect of the spatial resolution of the inputs, fluxes were also derived by first considering the inputs of the TSEB and SEBS models estimated from ASTER radiances and reflectances previously aggregated to 1-km and then considering all the parameters of both models derived from high spatial resolution ASTER radiances and reflectances before being aggregated to 1-km. MODIS ET estimates compare well with the reference ET (relative bias is about 5% for SEBS and 10% for TSEB). Discrepancies are mainly related to fraction cover mapping for TSEB and vegetation height mapping for SEBS. This is consistent with the sensitivity of each model to these parameters. Low spatial resolution fluxes obtained using both models and ASTER aggregated input data compare well with the reference fluxes, illustrating the relatively good accuracy of using aggregated inputs (relative bias is about 6% for SEBS and 2% for TSEB).

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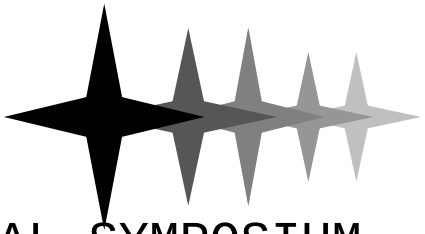

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