Data disaggregation and evapotranspiration modeling: a synergism between multi-spectral/multi-resolution remote sensing data

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Evapotranspiration (ET) is a surface process that is particularly well constrained by remote sensing data in the shortwave, thermal infrared and microwave domains. The near-surface soil moisture (NSSM) retrieved over the 0-5 cm layer at L-band is a key parameter of soil evaporation (E). The green vegetation index (GVI) estimated from red and near-infrared reflectances controls the partitioning between E and plant transpiration (T). The surface albedo (SA) derived from shortwave reflectances modulates the available energy and provides information on plants' phenological stage. The land surface temperature (LST) derived from thermal infrared radiances is a signature of the surface thermodynamic equilibrium, which is largely regulated by ET. This talk will present recent developments of three remote sensing methodologies based on the synergy between NSSM, GVI, SA and LST observations, and their physical link with ET process:
- DISPATCH is a unique algorithm that combines NSSM, GVI and LST data within an E-based disaggregation scheme of NSSM. It aims at estimating the NSSM variability within a 40 km resolution SMOS (Soil Moisture and Ocean Salinity) pixel at resolutions ranging from 100 m to several km using the shortwave/thermal data collected by Landsat/ASTER (Advanced Spaceborne Thermal Emission and Reflection radiometer) and MODIS (MODerate resolution Imaging Spectroradiometer), respectively.
- SEB-1S is a mono-source surface energy balance model to estimate crop ET using ASTER/Landsat-derived LST, GVI and SA data. It provides a consistent physical interpretation of two commonly used methodologies based on the LST-SA and LST-GVI spaces.
- SEB-4S is a four-source version of SEB-1S that provides an estimate of ET and E/T partitioning by separating the surface of agricultural fields in four components: bare soil, unstressed green vegetation, water-stressed green vegetation and senescent vegetation.
In each case, a link between ET modeling and NSSM/LST data disaggregation will be highlighted. Finally, the prospect of coupling SEB-4S ET formalism with disaggregation schemes of NSSM and LST data at high-spatial resolution will be presented.