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A Thermal-based Two-Source Energy Balance Model for Estimating Evapotranspiration over Complex Canopies

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Land surface temperature (LST) provides valuable information for quantifying root-zone water availability, evapotranspiration (ET) and crop condition as well as providing useful information for constraining prognostic land surface models. This presentation describes a robust but relatively simple LST-based land surface model called the Two-Source Energy Balance (TSEB) model. The TSEB algorithms solve for the soil/substrate and canopy temperatures that achieves a balance in the radiation and turbulent heat flux exchange for the soil/substrate and vegetation elements coupled to the lower atmosphere. As a result, the TSEB modeling framework is applicable to a wide range of environmental and canopy cover conditions, which has been a limitation in many other LST-based energy balance approaches. This is particularly relevant in applying surface energy balance models using LST over heterogeneous landscapes with complex vegetation distribution and architecture/structure. An overview of applications of the TSEB modeling framework to a variety of landscapes will be presented. In addition, a modeling system will be described called the Atmosphere-Land Exchange Inverse (ALEXI) that couples the TSEB scheme with an atmospheric boundary layer model in time-differencing mode to routinely map continental-scale daily ET at 5 to 10-km resolution using geostationary satellites. A related algorithm (DisALEXI) spatially disaggregates ALEXI output down to [U+FB01]ner spatial resolutions using polar orbiting satellites such as Landsat, which provides pixel resolutions at the scale of human management activities affecting land use\land cover.