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Satellite data assimilation for the estimation of surface energy fluxes

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Latest research and model simulations showed how forecast of extreme event and runoff significantly improve using distributed information of heat surface fluxes and soil moisture. Remote sensing measurements offer a promising new source of information about land-atmosphere processes. However this information is usually only indirectly related to variables of hydrologic interest. Data assimilation provides a useful framework which allows to combine measurements and models to produce an optimal and dynamically consistent estimate. A variational scheme designed to solve the surface energy balance on multisensor imagery sequences of surface radiometric temperature is presented. The potential advantage over existing diagnostic models is the ability to make energy flux prediction between observation times and reduce requirements for ancillary parameters as surface roughness. Two recent advances of the basic scheme are here presented, aimed to: 1) improve the estimation over densely vegetated areas, and 2) improve the estimation over wet soil and in energy-limited conditions. With regard to the first point, the model has been modified in order to estimate separately the contribution of soil and canopy to pixel-scale land surface temperature and evaporation with a “two-source” formulation. This solution, although effective, needs the introduction of several new parameters related to vegetation. The second point is approached in a parsimonious way, coupling a simplified equation of surface water balance to the dynamic evolution of land surface temperature. The model is implemented over the Southern Great Plains area in US, where validation data of energy fluxes and soil moisture measurements are available from the SGP97 campaign.