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Exploring the potential of an integrated radiative transfer and surface energy balance model

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Users of remote sensing products in agriculture, weather prediction and climate research are interested in surface energy and water fluxes, soil moisture content, growth of vegetation and harvest. These variables are a few modeling steps away from the primary product observed with a satellite, notably radiation at the top of atmosphere. Although the spectral signature of the surface observed by a satellite contains implicit information about the variables of interest, the relationship is not trivial.

We developed a model, which calculates radiative transfer at the soil surface and in the vegetation on the one hand, and photosynthesis, and soil, latent and sensible heat fluxes on the other hand. The radiative transfer model calculates the spectrum in the optical and thermal domain (0.3 to 50 um), and radiative scattering of chlorophyll fluorescence. Consistent integration of a micrometeorological and a radiative transfer model allows sharing parameters (LAI, net radiation, leaf temperatures) between the two sub-models. Other parameters, such as optical properties of leaves and soil can be related to biochemical parameters which determine processes such as photosynthesis. In this study we explore the potential of the model to predict energy fluxes, comprising of net radiation, sensible heat, latent heat and soil heat, for a forest and for agricultural crops.