Influence of thermal component derivation for dual source energy flux estimates over a drip-irrigated vineyard

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Abstract

The evaluation of the spatial and temporal variability in hydrological and land surface processes is of prime interest in disciplines such as agriculture, hydrology and climatology. The extension of this analysis from point/detail to regional scale, focusing on the interconnections and feedbacks between hydrological variables and regional hydrometeorology, have resulted in the increased use of remote sensing, to determine the partitioning of available energy into sensible and latent heat fluxes at the earth's surface. This partitioning depends on the proportion of vegetation and bare soil occupying the observed area. Due to the heterogeneity of most landscapes, energy balance models that distinguish between soil or substrate and vegetation contributions to the radiative and turbulent fluxes have proven to be most reliable. During the last few decades these physically based models have evolved into an operational mode, in particular the Two-Source Energy Balance (TSEB) model which has been validated over a range of landscapes. Despite being physically based, still a number of assumptions and experimental parameterizations are used, which are not easily available or measured, nor is their influence on the obtained model output always known. Generally these type of models use resistance schemes where the turbulent fluxes are determined by the ratio of a concentration difference between the air and the surface over an aerodynamic resistance. The component (soil and canopy) temperatures generally are derived from a single observation of directional radiometric temperature, in combination with an estimate of the ground fractional vegetation cover. When only one observation of the directional temperature is available the soil and canopy temperatures are obtained from an iterative process within TSEB, where it is uncertain whether the proper solution is obtained. However, when observations under multiple angles are available the component temperatures can be directly derived and used as such.

The objective of this study, conducted over the Las Tiesas agricultural test site in Barrax (Spain), is to explore how a physically based retrieval of the representative soil and canopy component temperatures influences the estimates of the turbulent fluxes, their components and the model parameters. To achieve this goal first the single angle version of the TSEB model, as it is commonly used, was validated over several landcover units at the Barrax site. Secondly the soil and canopy components were extracted from multiple angle airborne observations, which were then input in the dual angle version of the TSEB model. The last step concerned the inter-comparison of the output and parameters produced by the different versions of the model. Results will be shown for a vineyard in the center of the Barrax site, using data from the EODIX-2011 and REFLEX-2012 airborne campaigns, demonstrating the effect of implementing observed soil and canopy component temperatures on the estimation of turbulent flux exchange at the earth's surface.

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