# THE EFFECT OF LAND - ATMOSPHERE FEEDBACKS ON THE SPATIAL STRUCTURE OF LAND SURFACE FLUXES OVER HETEROGENEOUS TERRAIN

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The ability to understand and accurately map land surface fluxes at the spatial resolutions of human activity can support efforts to define the impact of anthropogenic induced land cover changes on hydrological and ecological processes. While remote sensors can map the surface states, the scientific problem arises from an incomplete knowledge of how heterogeneous surface states excite heterogeneity in the states of the lower atmosphere, which feedback on the exchange rates of mass, energy, and momentum across these heterogeneous land surfaces. Through the development and implementation of a framework for merging remotely sensed land surface data into a Large Eddy Simulation (LES) model of the atmospheric boundary layer, a procedure now exists for evaluating the typical ecohydrological modeling assumption of homogeneous atmospheric variables (i.e. decoupled from surface heterogeneity) over a study region. Ignoring consideration of the feedback effects can lead to erroneous flux estimation since most landscapes are inherently heterogeneous. The LES model of *Albertson* (1996) has been fully dynamically coupled with an adapted version of the Two-Source Model (TSM) soil vegetation atmosphere transfer scheme described by *Norman et al.* (1995). The coupled model was applied off-line (i.e. with static uniform atmospheric variables) and on-line (i.e. with dynamic spatially distributed atmospheric variables) over the Barrax test site in Spain using ASTER soil temperature imagery. In this paper we present a simple scale-dependent method based on wavelet decomposition techniques to account for surface-atmosphere coupling in the estimation of land surface fluxes from remotely sensed data over heterogeneous terrain. First results of the LES-SVAT simulations confirm the results of *Albertson et al.,* (2001) indicating that the correlation between time-averaged surface and air temperatures is dependent on the length scale of the surface features, with a maximum efficiency in the energy transfer at the scale of variability greater than 500 – 1000 m. While the feedback mechanism between surface temperature and air temperature acts to limit the spatial variability in the surface fluxes, as found by *Kustas and Albertson* (2003), is observed here a more complex interaction between surface properties and surface wind field which tend to increase the spatial variance of surface fluxes.