Geophysical Research Abstracts,
Vol. 11, EGU2009-11803, 2009
EGU General Assembly 2009

Estimation of Land Surface Water and Energy Balance Closure Relation Using Conditional Sampling

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Numerical models of heat and moisture diffusion in the soil- vegetation- atmosphere continuum are linked through a closure relationship that characterizes soil moisture limits on moisture flow (e.g., root-extraction limitations, relative evaporation efficiency or beta functions, soil relative humidity or alpha functions, etc.) . The
performance of various models of water and energy is highly dependent on the nature of these closure relationships, but as important as they are, they remain largely invalidated especially across diverse soil and vegetation conditions. In this presentation a new approach for estimating the functional form for the water and energy closure relationship is proposed. The approach is scalable to diverse climates and land surface conditions using remotely sensed measurements. Parameters of the system (water balance and Energy balance) are estimated by developing objective functions that link atmospheric forcing, surface state and unknown parameters. This approach is based on conditional averaging of heat and moisture balance equations. Conditioning states are land surface temperature and moisture states which will ultimately be obtained from global remote sensing measurements. Based on conditional averaging, a single objective
function is expressed that measures the moisture and temperature dependent errors solely in terms of observed forcings (e.g. precipitation, radiation) and surface states (moisture and temperature). This objective function can be minimized with respect to
parameters to identify evaporation and drainage models and estimate water and energy balance. Validity of this approach is tested using synthetic data obtained from the Simultaneous Heat and Water (SHAW) model and real data obtained from SCAN (Soil Climate Analysis Network).