Geophysical Research Abstracts, Vol. 8, 08670, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08670

Assimilation of Optical and Radar data in a Simple Land Surface Model over Sahel with a Multi-Criterion Evolution Strategies Algorithm

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Among surface characteristics, vegetation conditions are of prime importance for both local population that relies on subsistence agriculture and water fluxes monitoring. This paper presents an original method to control the trajectory of a simple land surface model devoted to Sahelian grasslands (the "STEP" model) thanks to a multi-criterion evolution strategies algorithm.

Two sets of data were used for this purpose, during the 2005 season: (1) the NDVI (Normalized Difference Vegetation Index) index measured by the VEGETATION sensor on board SPOT 4 and 5 satellite (1km^2 spatial resolution with a daily global cover), and (2) the backscattering coefficient observations from the ASAR instrument in wide swath mode at HH polarisation on board ENVISAT platform (150m spatial resolution, with an irregular 3-day time sampling).

Two radiative transfer models are coupled to the STEP model: the SAIL model and the KARAM model allowing for a direct assimilation of NDVI optical index and radar measurements respectively. The simulated LAI and surface water content are constrained thanks to a parameter identification method based on a multi-criterion evolution strategies algorithm.

Simulated above-ground herbaceous mass and soil moisture profile after data assimilation are compared to ground measurements performed at the Agoufou super-site of the AMMA project (Gourma region, Mali). Simulated water fluxes are analysed. Finally, an uncertainty analysis to climatic forcing variables is performed.