RSHS18-71
Remote Sensing and Hydrology Symposium (ICRS-IAHS)

Estimating turbulent fluxes over heterogeneous vegetation using biophysical variables derived from MODIS and MSG/SERIVI observations in conjunction with aggregation method

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Estimating the turbulent fluxes (i.e. sensible and latent heat fluxes H and LE) at the landscape scale remains a priority in several studies of land-atmosphere-interactions, especially in semi-arid lands. Where the assessment of this term is of crucial importance in weather and climate. Indeed, the heterogeneity caused by the contrast in vegetation, hydric and soil conditions can generate a large spatial variability. In this work we use a thermal-based two-source energy model (TSEB) driven by MODIS (Moderate resolution Imaging Spectroradiometer) and MSG (Meteosat Second Generation) observations in conjunction with an aggregation scheme to derive area-averaged H and LE over a small heterogeneous watershed in Niamey, Niger (Wankama catchment). Data collected in the context of the African Monsoon Multidisciplinary (AMMA) program, including a scintillometry campaign, have been used to test the proposed approach. The model predictions were compared to data acquired by a Large Aperture Scintillometer (LAS) set up over a heterogeneous surface transect of about 3.2 km-long and spanning three vegetation types. Firstly, the impact of aggregating the model inputs is investigated by using an aggregation scheme based on in-situ input data and three aggregation scheme based on satellite products in the order of increasing complexity: a simple averaging of inputs at the MODIS resolution scale, another simple averaging scheme but taking into account scintillometer footprint extent and a weighted average of inputs based on the footprint extent. Moreover, we assess the impact of using land surface temperature based on MSG-SEVIRI measurements combined with MODIS products on H and LE estimated by LAS. Differences are highlighted. The results show that H and LE simulated by using the footprint weighted method are closer to the 1:1 line than for the other aggregation rules. This study open perspectives for the monitoring of convective fluxes over heterogeneous landscape based on medium resolution satellite products.
Keywords: Heterogeneous, TSEB, Aggregation, MODIS, MSG-SEVIRI, Scintillometry