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Simulation and assimilation of vegetation and natural carbon fluxes over Hungary

B. Szintai and L. Kullmann
Hungarian Meteorological Service, Budapest, Hungary (szintai.b@met.hu)

In the framework of the Land Carbon Core Information Service of the geoland2 project a Land Data Assimilation System (LDAS) is operated at the Hungarian Meteorological Service (HMS) to monitor the surface fluxes (carbon and water) and the associated root-zone soil moisture at the regional scale (spatial resolution of 10km x 10km) in quasi real time. In this system the SURFEX model is used in offline mode, which applies the ISBA-A-gs photosynthesis scheme to describe the evolution of vegetation. The LDAS is forced using the outputs of the ALADIN numerical weather prediction model run operationally at HMS. SURFEX is running in cycling mode, which means that one run produces a 24 hour forecast and the next run is started on the next day. The prognostic fields are initialized from the output of the previous cycle, except for Leaf Area Index (LAI) and soil moisture content which are analyzed using Kalman Filer assimilation method.

Validation of open-loop model simulations (without assimilation) was done for the years 2003-2008 in one dimension at specific Fluxnet sites. Results show that the model is able to describe the seasonal cycle of LAI and carbon fluxes qualitatively, however, the model underestimates LAI in the growing season and overshoots during summer. In contrast, Gross Primary Production (GPP) is underestimated by the model during summer. To improve the simulation, assimilation of LAI and soil moisture was applied. Two types of the Kalman Filer assimilation methods, the Extended Kalman Filter (EKF) and the Simplified Extended Kalman Filter (SEKF) were tested and compared to open-loop runs. Simulations were performed for the years 2008 and 2010. The anomalous time evolution of vegetation parameters during the extremely wet year of 2010 is analyzed in details for two dimensional model runs.