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Improving the representation of Leaf Area Index in a numerical weather prediction model

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The Hungarian Meteorological Service has been involved in the simulation and assimilation of vegetation properties since 2008. During two EU-funded projects (Geoland2 and ImagineS) a Land Data Assimilation System (LDAS) was applied to monitor the above-ground biomass, surface fluxes (carbon and water) and the associated root-zone soil moisture at the regional scale in quasi real time. In this system the Surfex model is used (in offilne mode), which applies the ISBA-A-gs photosynthesis scheme to describe the evolution of vegetation. An Extended Kalman Filter (EKF) method is used to assimilate Leaf Area Index (LAI, from SPOT/Vegetation and Proba-V) and Soil Wetness Index (SWI, from ASCAT/Metop) satellite measurements. Simulations were compared to observations (LAI and soil moisture satellite measurements) over the whole country and also at a selected site in West Hungary (Hegyhátsál), results show that the LDAS system is capable to simulate the evolution of vegetation with an acceptable accuracy.

In current state-of-the-art numerical weather prediction (NWP) models LAI is considered as an external parameter where monthly values are derived from long-term averages. Such an approach is not capable of describing vegetation anomalies e.g. during severe droughts, when LAI values (especially over non-irrigated grasslands and croplands) could be considerably lower than long-year averages of the selected month. A solution for this inaccuracy could be to implement satellite observed vegetation parameters in the NWP model. The main difficulty with such an approach is that high resolution (e.g. that of Proba-V) satellite vegetation products have a time lag of 10 days. To overcome this the following is planned: satellite vegetation observations are assimilated in an offline LDAS (like the ImagineS system described above) which is capable to deliver a soil and vegetation state analysis 10 days prior the actual date (T-10d). From T-10d we integrate the offline surface model with prognostic vegetation until the current date; and the resulting vegetation state (at time T) could be merged with the operational analyses of the AROME NWP model. Some first results of this method will be presented and the impact on the AROME forecasts will be studied.