



## **Cross-validation of satellite products over France through their integration into a land surface model**

Jean-Christophe Calvet, Alina Barbu, Dominique Carrer, and Catherine Meurey

CNRM-GAME (Météo-France, CNRS), GMME/VEGEO, Toulouse, France (jean-christophe.calvet@meteo.fr)

Long (more than 30 years) time series of satellite-derived products over land are now available. They concern Essential Climate Variables (ECV) such as LAI, FAPAR, surface albedo, and soil moisture. The direct validation of such Climate Data Records (CDR) is not easy, as in situ observations are limited in space and time. Therefore, indirect validation has a key role. It consists in comparing the products with similar preexisting products derived from satellite observations or from land surface model (LSM) simulations. The most advanced indirect validation technique consists in integrating the products into a LSM using a data assimilation scheme. The obtained reanalysis accounts for the synergies of the various upstream products and provides statistics which can be used to monitor the quality of the assimilated observations. Météo-France develops the ISBA-A-gs generic LSM able to represent the diurnal cycle of the surface fluxes together with the seasonal, interannual and decadal variability of the vegetation biomass. The LSM is embedded in the SURFEX modeling platform together with a simplified extended Kalman filter. These tools form a Land Data Assimilation System (LDAS). The current version of the LDAS assimilates SPOT-VGT LAI and ASCAT surface soil moisture (SSM) products over France (8km x 8km), and a passive monitoring of albedo, FAPAR and Land Surface temperature (LST) is performed (i.e. the simulated values are compared with the satellite products). The LDAS-France system is used in the European Copernicus Global Land Service (<http://land.copernicus.eu/global/>) to monitor the quality of upstream products. The LDAS generates statistics whose trends can be analyzed in order to detect possible drifts in the quality of the products: (1) for LAI and SSM, metrics derived from the active monitoring (i.e. assimilation) such as innovations (observations vs. model forecast), residuals (observations vs. analysis), and increments (analysis vs. model forecast); (2) for albedo, LST, and FAPAR, metrics derived from the passive monitoring such as the Pearson correlation coefficient, z-score, RMSD, SDD, mean bias. The results obtained over the 2007-2013 period are presented. The added value of computing a prognostic FAPAR is shown, as this quantity can be used to better estimate the LAI observation error used by the LDAS. In the near future, the LDAS will be upgraded in order to assimilate FAPAR and surface albedo, and it will be extended to a global scale. At the same time, the coupling to hydrological models (now in a testing phase) will be consolidated, and this will allow the use of in situ river discharge observations for the validation of the whole system.