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

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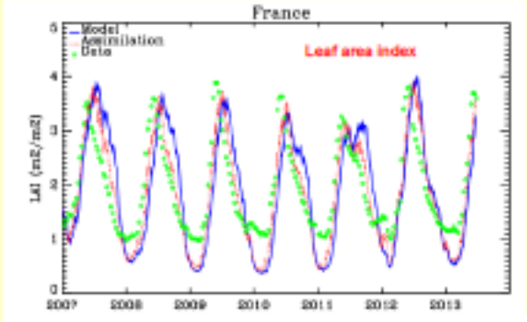
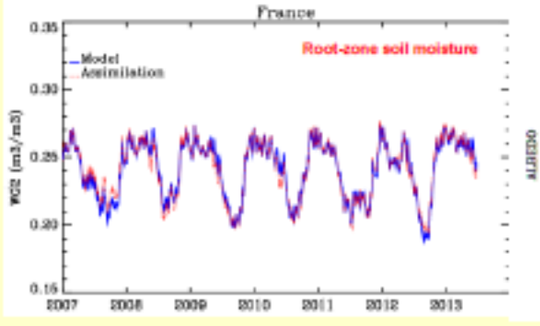
Long time series of satellite-derived LAI, FAPAR, surface albedo, and soil moisture products are now available. The direct validation of such Climate Data Records (CDR) is not easy, as in situ observations are limited in space and time. Therefore, indirect validation has a key role. It consists in comparing 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. Meteo-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.

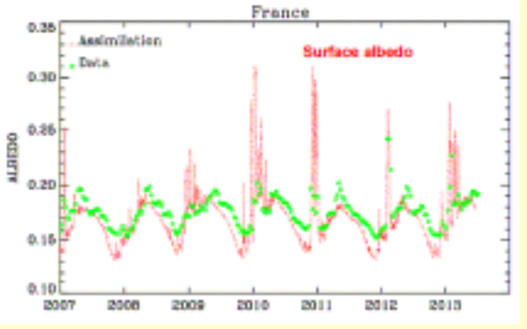
The LDAS will be upgraded in order to assimilate FAPAR and surface albedo, and it will be extended to a global scale.



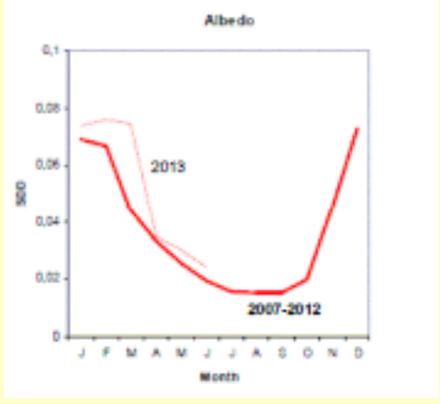
LAI scores

Period	Benchmark	N	CC	RMSD (m^2/m^2)	SDD (m^2/m^2)	Bias (*) (m^2/m^2)
01.01.2007 31.12.2012	Model	1683342	0.54	1.15	1.15	0.02
01.01.2007 31.12.2012	Analysis	1683342	0.88	0.55	0.55	-0.01





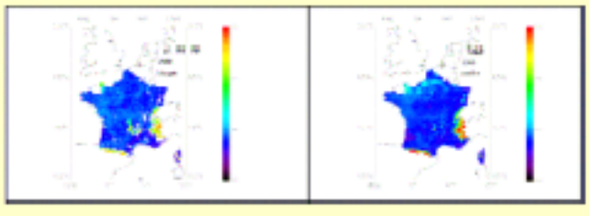
The product scores/behavior in 2013 are consistent with the past time series. Surface albedo at wintertime (snow): RMSD and SDD are multiplied by ~4



Including the geographical dimension:

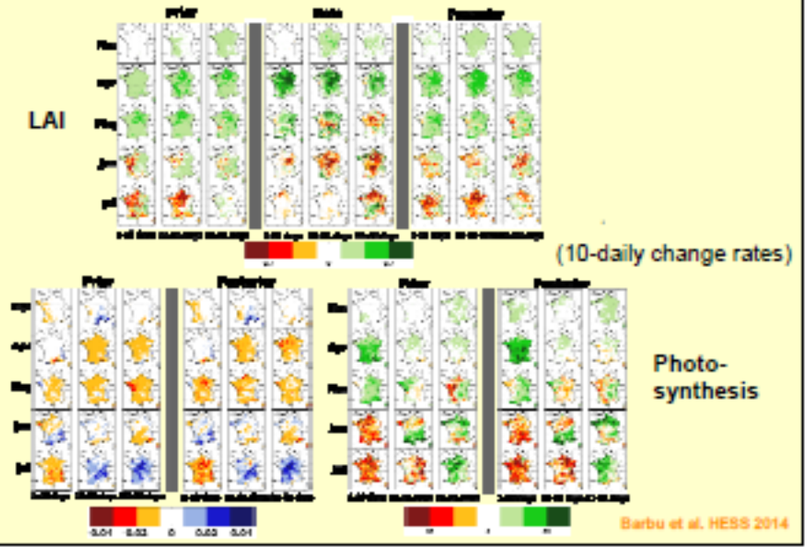
Monthly scores are driven to a large extent by the difference in spatial distribution of the considered variable over France

Example: surface albedo in March 2013



Satellite product Analysis

Impact of the assimilation during the spring drought of 2011



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