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Global long time series of LAI and FAPAR Essential Climate Variables from the capitalization of current existing products: principles and validation of GEOV1 products

Frederic Baret (1), Marie Weiss (1), Roselyne Lacaze (2), Fernando Camacho (3), Bruno Smets (4), Hassan Makhmara (5), and Philippe Pacholczyk (5)

(1) INRA, EMMAH UMR1114, Avignon, France (baret@avignon.inra.fr, +33 4 32 72 23 62), (2) HYGEOS, Toulouse, France (rl@hygeos.com), (3) EOLAB, Valencia, Spain (fernando.camacho@eolab.es), (4) VITO, Moll, Belgium (bruno.smets@vito.be), (5) CNES, Toulouse, France (hassan.makhmara@cnes.fr)

LAI and fAPAR are recognized as Essential Climate Variables providing key information for the understanding and modeling of canopy functioning. Global remote sensing observations at medium resolution are routinely acquired since the 80's mainly with AVHRR, SEAWIFS, VEGETATION, MODIS and MERIS sensors. Several operational products have been derived and provide global maps of LAI and fAPAR at daily to monthly time steps. Inter-comparison between MODIS, CYCLOPES, GLOBCARBON and JRC-FAPAR products show generally consistent seasonality, while large differences in magnitude and smoothness are observed. The aim of this study that is part of the GEOLAND2 project within the GMES framework is to reconcile discrepancies between such products allowing a more efficient use in a range of application services including Land-Atmosphere Interactions.

Rather than generating an additional product from scratch, the version 1 of GEOLAND2 products (called GEOV1) capitalizes on the existing products by combining them to retain their pros and limit their cons. For these reasons, MODIS and CYCLOPES products were selected since they both include LAI and fAPAR while having relatively close temporal sampling intervals (8 to 10 days). GLOBCARBON products were not used here because of the too long monthly time step inducing large uncertainties in the description of the seasonality. JRC-FAPAR was not selected as well to preserve better consistency between LAI and fAPAR products. MODIS and CYCLOPES products were then linearly combined to take advantage of the good performances of CYCLOPES products for low to medium values of LAI and fAPAR while benefiting from the better MODIS performances for the highest LAI values. A training database representative of the global variability of vegetation types and conditions was thus built. A back-propagation neural network was then calibrated to estimate the new LAI and fAPAR products from VEGETATION preprocessed observations. Efforts were also directed to associate uncertainties to the GEOV1 product values.

Validation results achieved following the principles proposed by CEOS-LPV show that the new product called GEOV1 behaves as expected with good performances over the whole range of LAI and fAPAR in a temporally smooth and spatially consistent manner.

These products are processed and delivered by VITO in near real time at 1 km spatial resolution and 10 days frequency using a pre-operational production quality tracking system. The entire VEGETATION archive, from 1999 is processed to provide a consistent time series over both VEGETATION sensors at the same spatial and temporal sampling. A climatology of products computed over 1999-2009 period will be also delivered at the same spatial and temporal sampling, showing average values, between year variability and possible trends over the decade. Finally, the VEGETATION derived time series starting back to 1999 are currently completed with consistent global products at 4 km spatial resolution derived from the NOAA/AVHRR series to cover the 1981-2010 period.