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LAI, FAPAR and FCOVER products derived from AVHRR long time series: principles and evaluation

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Continuous and long term global monitoring of the terrestrial biosphere has draught an intense interest in the recent years in the context of climate and global change. Developing methodologies for generating historical data records from data collected with different satellite sensors over the past three decades by taking benefits from the improvements identified in the processing of the new generation sensors is a new central issue in remote sensing community. In this context, the Bio-geophysical Parameters (BioPar) service within Geoland2 project (http://www.geoland2.eu) aims at developing pre-operational infrastructures for providing global land products both in near real time and off-line mode with long time series.
In this contribution, we describe the principles of the GEOLAND algorithm for generating long term datasets of three key biophysical variables, leaf area index (LAI), Fraction of Absorbed Photosynthetic Active Radiation (FAPAR) and cover fraction (FCOVER), that play a key role in several processes, including photosynthesis, respiration and transpiration. LAI, FAPAR and FCOVER are produced globally from AVHRR Long Term Data Record (LTDR) for the 1981-2000 period at 0.05º spatial resolution and 10 days temporal sampling frequency. The proposed algorithm aims to ensure robustness of the derived long time series and consistency with the ones developed in the recent years, and particularly with GEOLAND products derived from VEGETATION sensor. The approach is based on the capacity of neural networks to learn a particular biophysical product (GEOLAND) from reflectances from another sensor (AVHRR normalized reflectances in the red and near infrared bands). Outliers due to possible cloud contamination or residual atmospheric correction are iteratively eliminated. Prior information based on the climatology is used to get more robust estimates. A specific gap filing and smoothing procedure was applied to generate continuous and smooth time series of decadal products. Finally, quality assessment information as well as tentative quantitative uncertainties were proposed. The comparison of the resulting AVHRR LTDR products with actual GEOLAND series derived from VEGETATION demonstrates that they are very consistent, providing continuous time series of global observations of LAI, FAPAR and FCOVER for the last 30-year period, with continuation after 2011.