

Neural Network Estimation of LAI, fAPAR, fCover and LAI×Cab, from Top of Canopy MERIS Reflectance Data: Principles and Validation

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Abstract

A neural network is developed to operationally estimate biophysical variables over land surfaces from the observations of the ENVISAT- MERIS instrument: the leaf area index (LAI), the fraction of absorbed photosynthetically active radiation (fAPAR), the fraction of vegetation cover (fCover), and the canopy chlorophyll content (LAI×Cab). The neural network requires as input the geometry of observation and the top of canopy reflectances, corrected from the atmospheric effects, in eleven spectral bands. It is trained on a reflectance database made of radiative transfer model simulations. The principles underlying the generation of the database and the design of the network are first presented. The estimated variables are then compared to other existing products, LAI- and fAPAR-MODIS and MGVI-MERIS, and validated against ground measurements performed in the framework of the VALERI project. Results show remarkable consistency of the temporal dynamics between the several products with however some differences in the range of variation. When compared to actual VALERI ground measurements, the proposed algorithm shows the best performances for LAI (RMSE=0.47) and fAPAR (RMSE =0.09).

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