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Ground-Based Observations for Validation (GBOV) of Copernicus Global Land Products

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The Copernicus Global Land Service (CGLS) operates a "a multi-purpose service component" that produces a series of qualified bio-geophysical products on the status and evolution of the land surface at global scale. The land surface parameters produced from the CGLS include the Leaf Area Index (LAI), the Fraction of Absorbed Photosynthetically Active Radiation absorbed by the vegetation (FAPAR), the surface albedo, the Land Surface Temperature, the soil moisture, etc. The European Commission sponsored Ground-Based Observations for Validation (GBOV) project is developing a pre-operational infrastructure for validation of EO land products using a worldwide network of ground-based tower sites. The EO land products of particular interest here are those from the CGLS biophysical and radiative variables. This study deals with the validation of the energy/radiation aspects.

The CGLS provides surface reflectance and albedo products derived from the VEGETATION instrument and nowadays from the Proba-V sensors. It includes the Top of Canopy Reflectance (TOC-R) at 10:00 local time, the Directional Hemispherical Reflectance (DHR) at local solar noon and the Bi-Hemispherical Reflectance (BHR) datasets, which are updated every 10 days using a 30-day window. The reflectance and albedo data are projected onto a regular latitude/longitude grid with a resolution of 1/112° (approx. 1km at the equator) covering the area from 180°E to 180°W and from 75°N to 60°S. In the GBOV project, the CGLS reflectance and albedo data are validated between 2012 and 2016 at 19 tower sites which are part of the FLUXNET, SURFRAD and BSRN networks, located over Europe, North America, South America and Australia. The Reference Measurements (RMs) from tower albedometers, which consist of the downward shortwave radiative flux, upward shortwave radiative flux, and downward diffuse shortwave radiative flux, are employed to validate the CGLS reflectance and albedo products. Multi-angular radiation data from time-series of tower measurements are combined to retrieve the Bidirectional Reflectance Distribution Function (BRDF) parameters, which are then used to derive the TOC-R. A new method is presented here to derive DHR and BHR directly from tower measured downwelling, upwelling and diffuse shortwave radiation. The reflectance and albedo results from tower measurements are compared with the CGLS products using a point-to-pixel time-series analysis. In the end, the tower measured small Field of View reflectance and albedo data are upscaled using high resolution Landsat and Sentinel data to a coarse-resolution (1/112°), which allows a direct comparison between the CGLS products. We will present the detailed methods to derive TOC-R, DHR and BHR from in situ tower measurements, as well as the results of validation with the CGLS products. A parallel paper will discuss the application of these methods to the validation of MODIS, MISR and CGLS albedo products (see Kharbouche, Song, Muller this congress)

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