Intercomparison of remote sensing derived fAPAR datasets

D'Odorico *et al.* (2013) Intercomparison of fraction of absorbed photosynthetically active radiation products derived from satellite data over Europe. *Remote Sensing of Environment*, **142**: 141-154.

Level 1

Key points:

- Ecosystem modellers and end-users have a choice of several global fAPAR datasets, which can significantly differ in magnitudes and distribution of values.
- An intercomparison and uncertainty analysis of three remote sensing derived FAPAR datasets over Europe for the period 2009-2011 should help to identify and quantify differences.
- Findings show highest disagreement in the north-eastern part of Europe characterised by boreal forest regions and transition regions to the tundra biome. Uncertainties show similar distributions but significantly differed in their magnitudes.

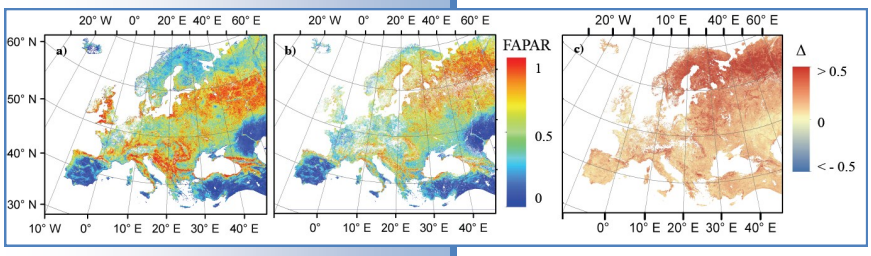

Figure 1. a) the JRC-TIP (Joint Research Centre Two-stream Inversion Package) fAPAR derived from the MODIS, b) the Boston University fAPAR derived from MODIS, c) the difference fAPAR map between a) and b). Datasets are for July (monthly composite) 2011 .

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Executive summary

The *Fraction of Absorbed Photosynthetically Active Radiation* (fAPAR) is one of a few remote-sensing derived Essential Climate Variables (ECV) which were designated by the UNFCCC and the IPCC for global systematic observation. Its importance stems from its critical role in the energy and carbon balance of ecosystems.

A number of global fAPAR datasets, obtained using different approaches, have been available for several years. Thus, ecosystem modellers and end-users are faced with a choice between similarly defined products that are not always equivalent.

The authors performed a spatiotemporal intercomparison and uncertainty analysis of three remote sensing fAPAR products, over Europe, for the period 2009-2011, in order to document existing differences among datasets. This intercomparison also represents an important starting point for any validation endeavour, identifying regions requiring investigation in the field.

The study covered the conterminous European continent, however the methodology and the majority of findings are transferable to the global scale. A period of three meteorologically representative years (2009-2011) were considered in the analysis.

Scientists of the Joint Research Centre (JRC) of the European Commission and of Boston University, responsible for each product, were involved in the research and provided useful contributions for the analysis of the data and the interpretation of results.

The study findings are relevant for ecosystem modellers using fAPAR as one of their input datasets, end-user relying on fAPAR maps for interpretation of, or correlation with, other data and validation teams going into the field to assess products' accuracy.

The three investigated global fAPAR products are: (i) the JRC-TIP (Joint Research Centre Two-stream Inversion Package) fAPAR derived from the Moderate-resolution Imaging Spectroradiometer (MODIS), (ii) the ESA/JRC fAPAR obtained using the MEdium Resolution Imaging Spectrometer (MERIS) Global Vegetation Index (MGVI), and (iii) the Boston University fAPAR derived from MODIS.

The differences and similarities evidenced by the intercomparison suggest that algorithm assumptions are likely to have greater influence than product definitions, sensor characteristics and input data on the fAPAR retrievals. The findings suggest that differences in absolute values and inconsistencies in uncertainty representation among fAPAR products are still too high for these products to be reliably fed into existing biogeochemical process models (BPMs) or used interchangeably across applications. Standardization frameworks quantifying the impact of different radiative transfer formulations on the estimation of biophysical variables, independent uncertainty estimation methods and well-defined ground measurement protocols, need to be put in place before fAPAR products can be reliably fed into existing BPMs.