Project:
GEOCARBON

Project full title:
Operational Global Carbon Observing System

European Commission - FP7
Collaborative Project (large scale integrating project) - for specific cooperation actions (SICA) dedicated to international cooperation partner countries
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Deliverable name: FPAR monthly time-series for the period 1982-2011
Version: V1
WP no: 6
Lead beneficiary: MPG
Delivery date from Annex I (project month): 12
Actual delivery date (project month): 12

1. Introduction

1.1 Short summary

The objective is to provide a ready-to use monthly FAPAR time series. The key innovation is that we tile the FAPAR data according to vegetation types. This data will hence, provide the grounds for attributing the hotspots of interannual variability (IAV, cf. WP7) to different land-ecosystems.

1.2 Rationale for this deliverable

Monitoring biophysical vegetation properties via remote sensing opens unprecedented opportunities for spatial and temporal analyses of the terrestrial biosphere. The “Fraction of Absorbed Photosynthetically Active Radiation” FAPAR, a spatiotemporal indicator of how much solar radiation energy in the PAR domain is absorbed by vegetation and available for photosynthesis (Pinty et al. 2009; McCallum et al. 2010). FAPAR is considered an Essential Climate Variable, ECV (Global Terrestrial Observing System 2008), since it supports a plethora of studies on the states and variability of the biosphere (e.g. Knorr et al. 2007; Verstraete et al. 2008). Hence, the respective data streams play an increasingly important role in the investigation of the global biogeochemical cycles (in particular carbon and water fluxes). For instance, FAPAR has been used as independent reference for the evaluation of prognostic terrestrial ecosystem models (Knorr et al. 2007; Weber et al. 2009), or to constrain parameters of process based phenology models. Moreover, FAPAR serves as input to diagnostic biosphere models (Seixas et al. 2009; Carvalhais et al. 2010), and provides the basis for empirical estimates of gross primary productivity, GPP (Beer et al. 2010) and other relevant ecosystem-atmosphere fluxes e.g. evapotranspiration (ET; Jung et al. 2010).

The idea of this task was to provide a statistically harmonized time-series of global, spatially distributed fAPAR for the needed duration and resolution of the GEOCARBON project. In this process statistical uncertainties will be elaborated, which can be used.

1.3Problems encountered and envisaged solutions

The original idea was to take data from AVHRR, MODIS, SeaWIFS and MERIS fAPAR products equally into consideration and merging them into a single product. So far, however, we are still struggling with the incompatibility of quality flags and harmonization schemes that render the merging unsuitable if the target is the evaluation of high-resolution spatial patterns. An update will be published in the project database asap.

2 Full description

2.1 Basic preparation

In the current version, we obtained FAPAR based on different land cover types from high resolution FAPAR included in the JRC-TIP product developed by Pinty et al (2011a, 2011b). We created FAPAR composites per quarter degree grid cells. Quality flags were used to decide which data to use (e.g. 'inversion ok' or 'no snow cover'). The aggregation was performed for each single land cover type. Land cover at 1kmSq is defined as the majority of landcover types from MCD12Q1 v005 Land Cover Data (original resolution 500m). The data currently span more than one decade.

2.2 Gap-filling

Different aspects like cloud cover, instrument malfunction or maintenance or unfavourable climate conditions (e.g. snow cover for FPAR data) cause spatial and temporal gaps in the data. Calculations like budgets and several statistical methods, however, require gap free data to yield unbiased results. To achieve this, global FPAR data were first screened for periodic gaps during winter periods, which were filled with random data from the lower 20%tile of the data range. This prefilling is necessary, as strongly periodic gaps would lead to biases in the prediction capability of the subsequently applied gap filling method.

In a second step we filled the remaining gaps in each individual time series with an iterative SSA (Singular Spectrum Analysis) scheme (Kondrashov and Ghil, 2006), which detects periodic components in the signal to interpolate gap values. Remaining gaps are either at the margins of the series or comprise over 50% of the individual series length. Both scenarios generally lead to strong biases in the gap predictions and were hence omitted from the gap filling.

2.2 The product

The current version of these data/deliverable can be obtained via the GEOCARBON data portal: http://www.bgc-jena.mpg.de/geodb/geocarbon/Home.php

We can now use these data as a baseline to explore various aspects of global vegetation activity in the respective landcover type. For instance, below we show figures on the interannual variability of evergreen broadleaved forests and the mosaics of natural vegetation and C4 crops. These data will hence, play an important role in the synthesis activity when it comes to the identification of hotspots of interannual variably.

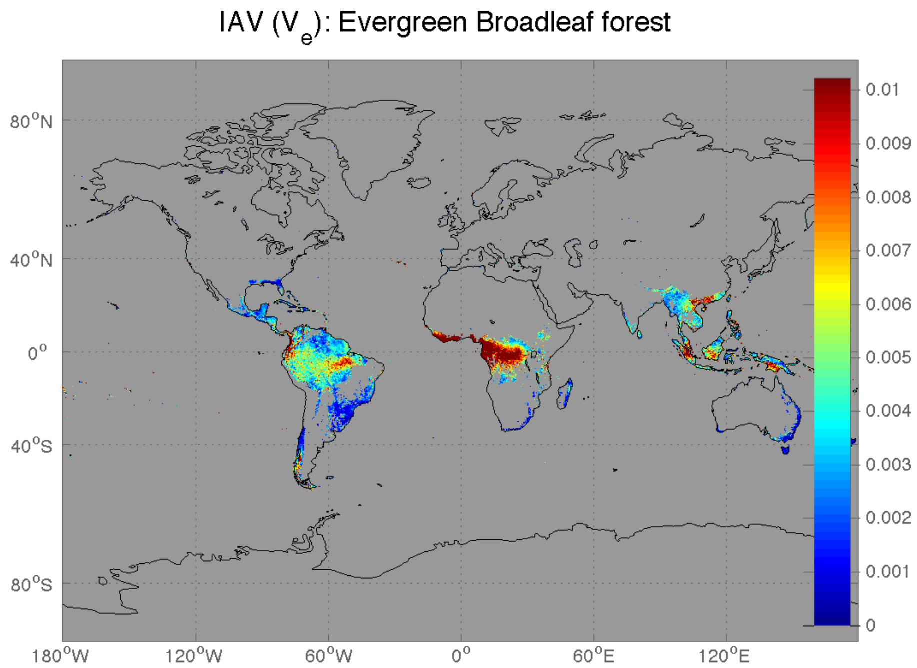

Figure 1 Interannual variability (IAV) of FAPAR in evergreen broadleaved forests based on the prepared data.

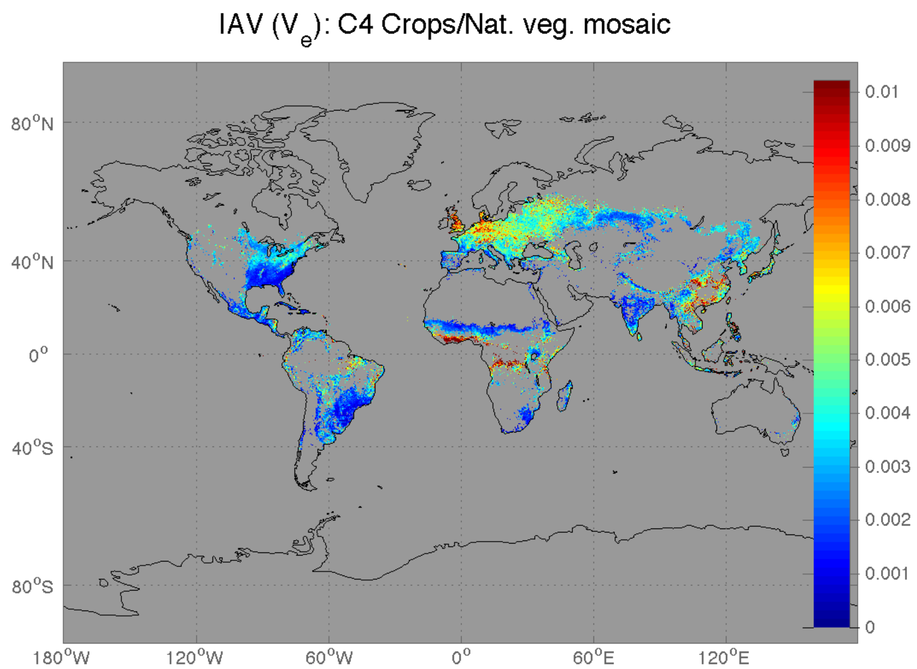

Figure 2 Interannual variability (IAV) of FAPAR in areas where we have a mosaic of C4 crops and natural vegetation.

3 References

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