Copernicus Global Land Service: Moving from 1km long time series to 300m

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http://land.copernicus.eu/global

Introduction

The Copernicus Global Land Service provides operationally a series of bio-geophysical products on the status and the evolution of land surface at global scale. The products are used to monitor the vegetation, the energy budget and the water cycle. A large number of these products were initially derived from SPOT-VEGETATION until end of 2013, and have since been based on similar 1km product from PROBA-V. Because PROBA-V provides also daily global data at a spatial resolution of 300m, an evolution for a number of products was initiated to calculate the variables also at 300m resolution. It is likely that in the future, the Service will focus entirely on the 300m spatial resolution, especially because Sentinel-3 will provide data at this resolution.

Challenges

To combine data from different sensors and resolutions, the following issues need to be addressed:

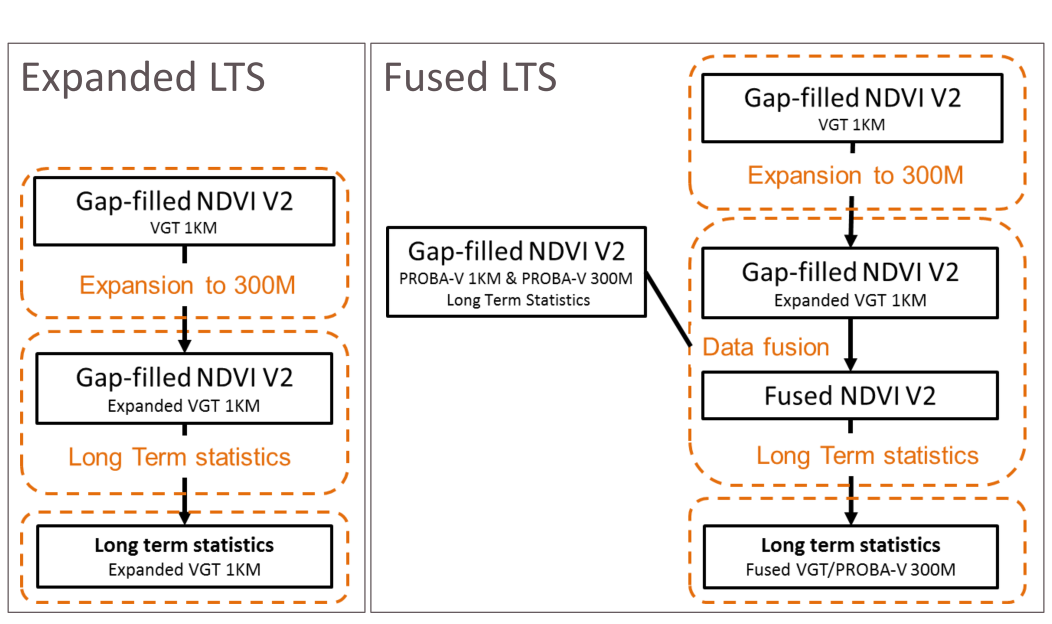
(1) the similarity of the products among the different sensors,
(2) the consistency of the products among the different resolutions, and
(3) the ability to create a 300m resolution archive derived from the VGT 1km products.

The last issue is particularly important to calculate anomalies, which express the performance of the present conditions compared to all known conditions in the past for the same day and location, i.e. the Long Term Statistic (LTS). Currently, the GL Service provides the Vegetation Condition Index (VCI) and the Vegetation Productivity Index (VPI) products which are based on the NDVI.

Transform VGT LTS@1km to 300m

Two options were investigated:

(1) a simple expansion of the 1km pixels into 300m and
(2) a data fusion method that uses the relationship between the PROBA-V 300m and 1km NDVI to derive the LTS at 300m.



Processing scheme for the two methods to derive the 300m NDVI Long Term Statistics

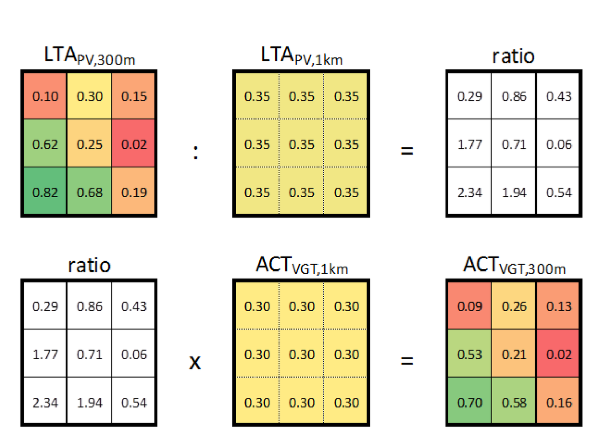


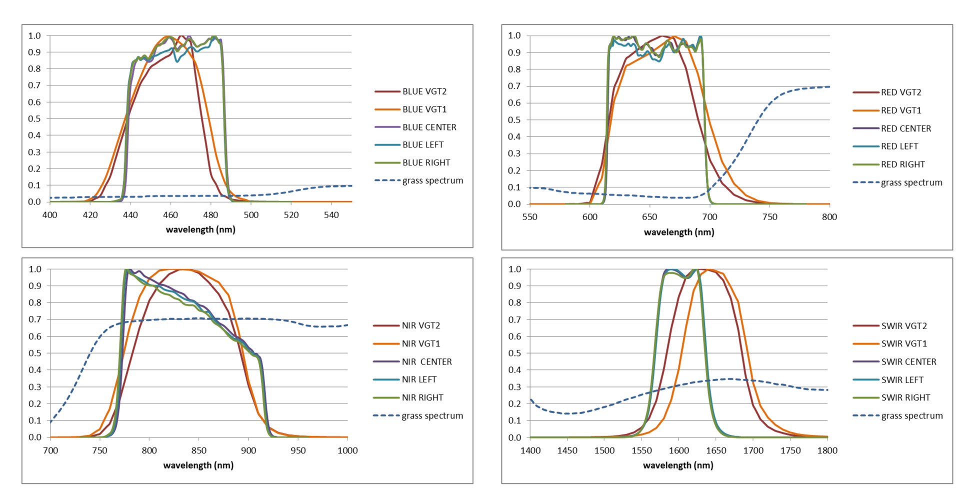
Illustration of the fusion method, which is based on the ratio between expanded PROBA-V 300m and PROBA-V 1km long term averages.

$$ACT_{VGT,300m} = \frac{LTA_{PV,300m}}{LTA_{PV,1km}} ACT_{VGT,1km}$$

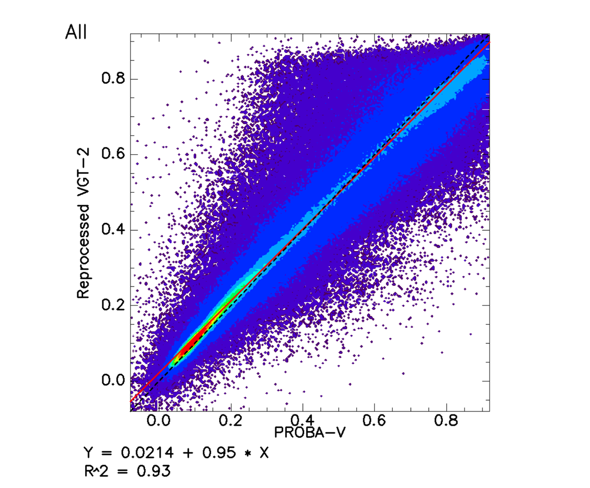
The current results indicate that both methods are performing similarly, probably because the time series to base the fusion method on is currently too short (only one year used).

Consistency among sensors

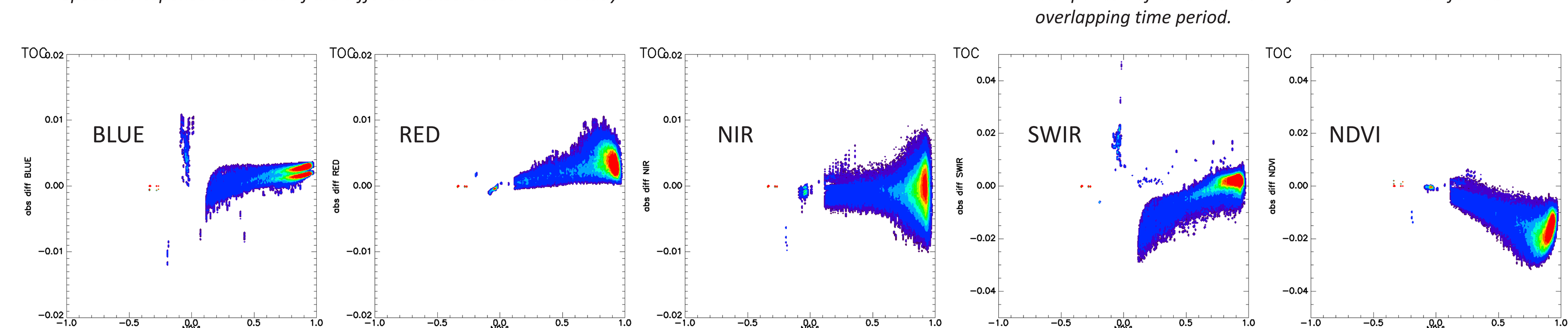
Harmonization for difference in Spectral Response Functions between VGT and PROBA-V



Spectral Response Functions of the different sensors used in this study



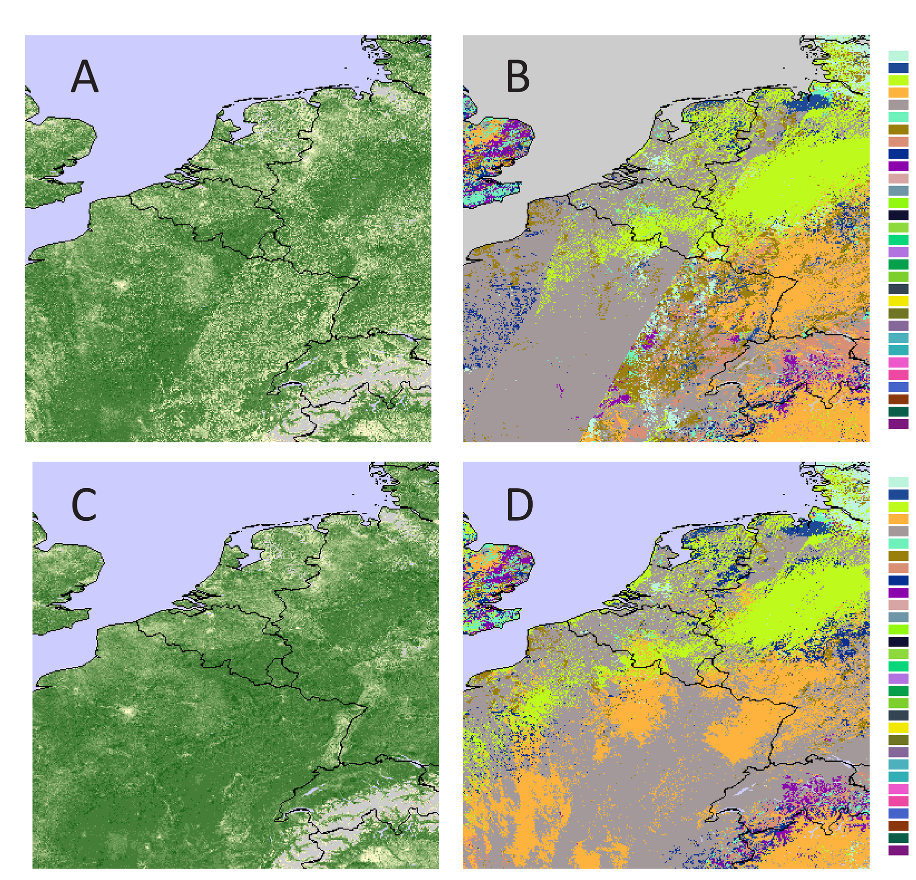
Comparison of observed NDVI of PROVA-V and VGT for their overlapping time period.



% difference in spectral response between PROBA-V and VGT in function of the NDVI based on a large set of PRO4SAIL simulations

Consistency among different resolutions

PROBA-V data is distributed in multiple resolutions (1km, 300m and 100m). The compositing method of the 1km data differs from that of the 300m data. The latter takes applies a constraint on viewing and solar angles to preferentially select near-nadir pixels with high solar position. The impact of this compositing difference is clearly visible in the data.



Example of NDVI of 20140501 for PROBA-V 300m (A) and corresponding day of registration (B), and the same for PROBA-V 1km (C,D)

General conclusions

The integration of the data sets of the different sensors and resolutions faces a number of challenges. For the NDVI from PROBA-V, a large problem is the difference in compositing method among the resolutions. To integrate the time series from VGT and PROBA-V, the difference in overpass time poses the largest problem. Both issues can be solved by performing a BRDF-normalization that removes the angular dependencies in the NDVI. This is currently under investigation.

The same consistency analysis will be done for fAPAR, which is derived from bidirectional normalized reflectances. A higher consistency in these datasets will confirm our hypothesis.

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