



PROBA-V: Europe's small mission for global vegetation monitoring

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BACK IN TIME

- **SPOT VGT:** global daily coverage from 1998-2014
 - Operational mission with thousands of users
 - Optical, low resolution (1km)
 - Multispectral: Blue, Red, NIR and SWIR bands
 - Daily coverage of the terrestrial surface
- **ESA's SENTINEL 3** mission only to be launched end 2015

⇒ *need to ensure continuity
SPOT VGT products*



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ESA'S PROBA-V FILLS THE GAP

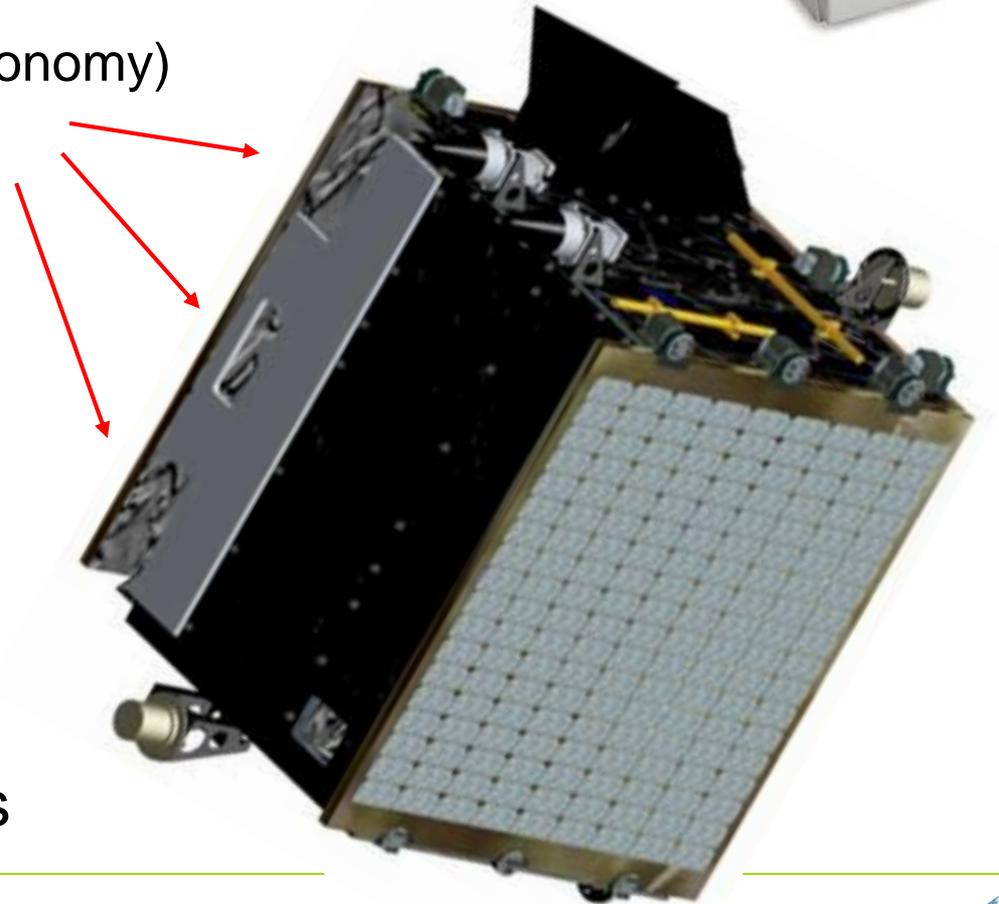


□ Mission Objectives

- Continuation of Vegetation Products Generation (SPOT 4 and 5)
 - Same spectral bands
 - Daily coverage of the Earth
 - Latitudes between 35° and 75° North + Latitudes between 35° and 56° South
- Two-daily Coverage of the Earth
 - Latitudes between 35° North and 35° South
- Spatial Resolution
 - GSD ≤ 1 km in VNIR and SWIR (**mandatory**); **Goal: 300m**
GSD in VNIR + 600m GSD in SWIR (upsampled to 300 m)
- Minimum swath width of 2250 km
- FOV: 102,6°
- LTDN between 10:30-11:30 AM
- Orbital altitude: 820 km

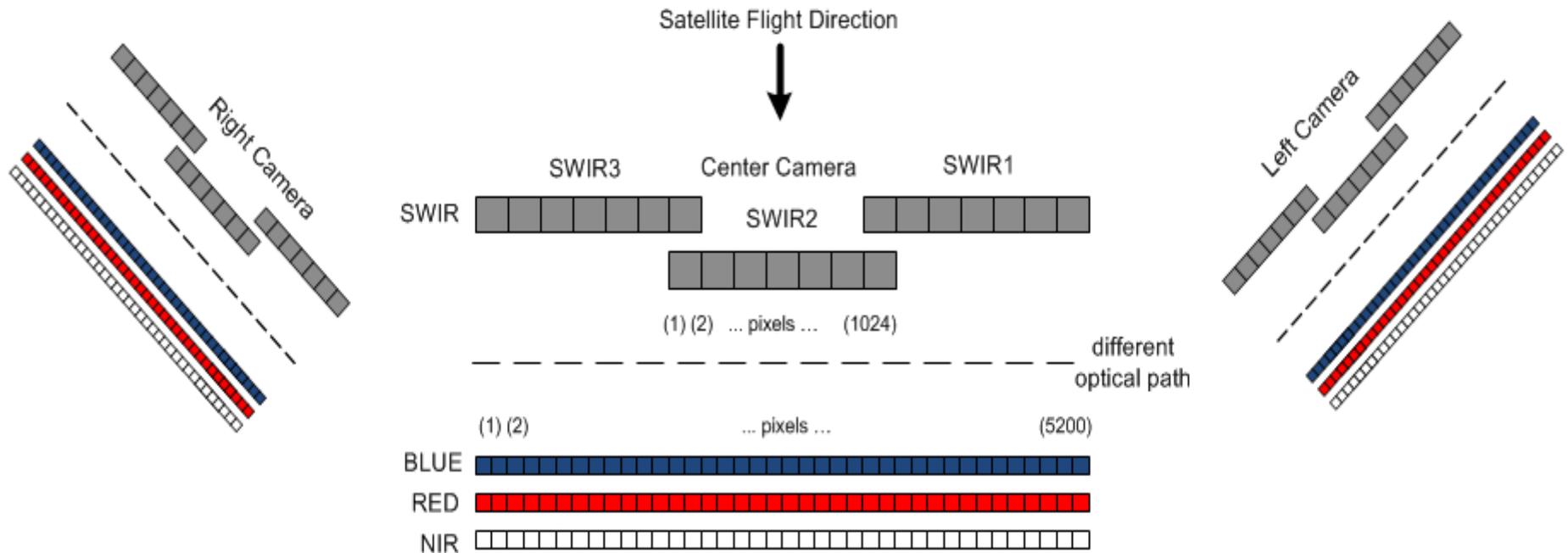
SATELLITE DESIGN

- *Choice for compact, fast, cheap!*
- Satellite based on ESA's PROBA small sat bus design
(Project for On-Board Autonomy)
- Mass: 160 kg
- Dimensions:
765x730x840 mm³
- Three axis-stabilised
- Body mounted Solar Array
- Platform H-structure
- 3 identical instruments



INSTRUMENT

- 3 camera's
- 9 SWIR strips



MANAGEMENT AND OPERATIONS

- Mission responsibility within ESA's Earthwatch programme
- Data processing, archiving and distribution carried out by VITO
- Co-financing scheme:
 - ESA : receiving station, ground station, 1 km product
 - Belgium (BELSPO) 300 m product
 - Luxemburg partner within Earthwatch

TIMELINE

- Launch : 7 May 2013
- Nominal operation since December 2013
- Nominal mission *lifetime* 2.5 years reached - has been *extended* in September 2015 *until May 2018*

THE INITIAL PRODUCTS

| | | |
|--------------------|--|---|
| L1C Product | <p>Raw variable resolution 100-350m (VNIR), 200-660m (SWIR) Central camera with swath of 517 km @ 100m (VNIR) and 200m (SWIR) raw resolution</p> | <p>radiometrically corrected raw data, given per strip/camera</p> |
| S1 TOA | <p>300 m and 1 km resolution</p> | <p>product resolution data, best-quality daily synthesis</p> |
| S1 TOC | <p>300 m and 1 km resolution</p> | <p>data corrected for atmospheric effects</p> |
| S10 TOC | <p>300 m and 1 km resolution</p> | <p>decadal synthesis of S1s</p> |

DATA ACCESS AND POLICY

- Download data via <http://www.vito-eodata.be> portal:

The screenshot shows the VITO Earth Observation Product Distribution Portal. The page features the VITO logo (vision on technology) and logos for belspo and esa. The main heading is "PRODUCT DISTRIBUTION PORTAL". Below this, there is a section for "Free Satellite Imagery" with three product collections: "PROBA-V 1 KM SYNTHESSES NEAR REAL-TIME", "PROBA-V SEGMENTS", and "PROBA-V 300 M SYNTHESSES (OLDER THAN 1 MONTH)". Each collection is represented by a satellite image and the PROBA-V logo. On the right side, there is a "Fast HTTP Access" section with links for "PROBA-V User Manual" and "Product Customization Tool", and a "View the PDF instruction movie" link. A "News" section is also visible, listing dates and titles of recent updates. The browser's address bar shows the URL "http://www.vito-eodata.be/PDF/portal/Application.ht".

- 1 km are freely available
- 300 m products and L1C products are free for scientific use.

RIGOROUS DATA QUALITY CONTROL

Radiometric Calibration

- *Continuously monitoring* to ensure the delivery of stable, reliable, and consistent data over its full mission lifetime.
- The absolute and inter-band *accuracy* of the absolute calibration coefficient is evaluated through the use of three independent *vicarious calibration methods*:
 - Absolute calibration over the bright Libya-4 desert site
 - Absolute calibration over Rayleigh calibration zones
 - Inter-band calibration over Deep Convective Clouds
- The *instrument stability* over time is furthermore assessed through monthly lunar observations.

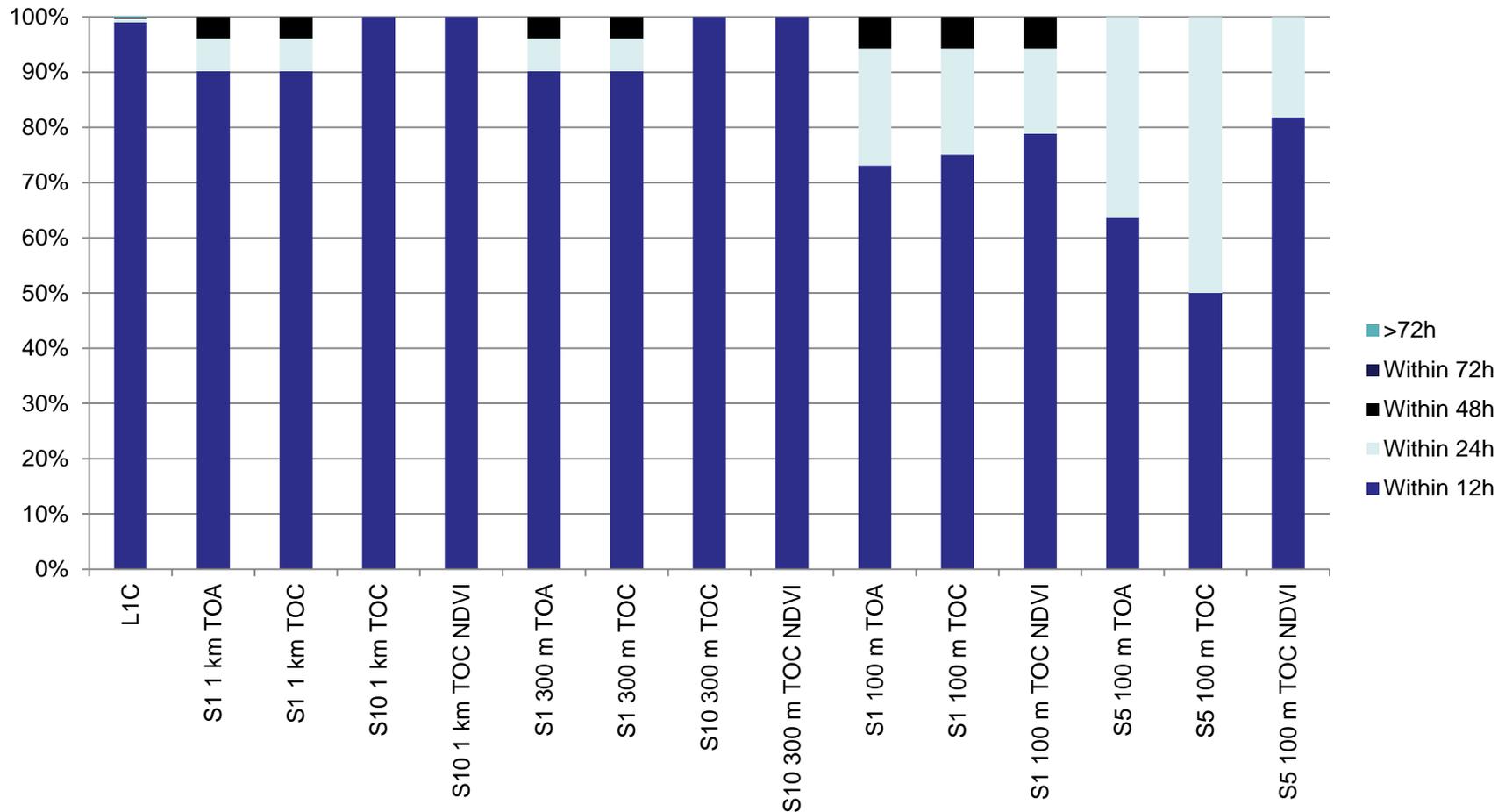


DATA QUALITY CONTROL

Geometric Calibration

- To maximise PROBA-V product's geolocation accuracy, a continuous and highly autonomous calibration/validation software has been implemented.
- The geometrical parameters are estimated using a large number of globally distributed *Ground Control Points* (GCP), *a priori* extracted from the *Landsat Global Land Survey GLS 2010* cloud-free *dataset*
- Three types of geometric errors (absolute, inter-band, and multi-temporal) are monitored on a regular basis to ensure the highest geometric accuracy at any ground location.
- *PROBA-V has shown an impressive radiometric and geometric performance stability.*

DATA TIMELINESS



Period September 1, 2015 – October 22, 2015

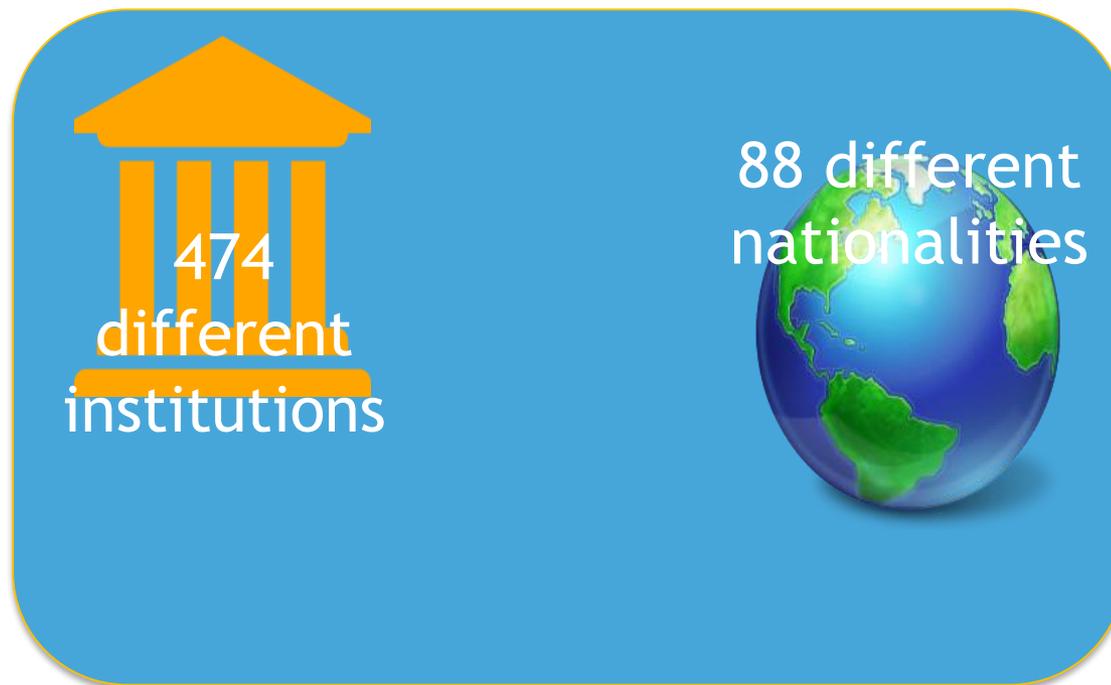
QUALITY WORKING GROUP (QWG)

- ESA's QWG is a team of scientists, experts and key users who work **as a collective** in order to **ensure and maintain the highest products quality throughout the mission lifetime**
- The main objectives of the QWG are:
 - **Review and assess mission end-to-end performances** (flight and ground segment)
 - Provide **recommendations** to the **Mission Manager** for **improvements on algorithm and products quality**, and **Cal/Val** methods
 - Drive **corrective actions** in case of anomalies or degradation, or propose **optimizations** to current operations
 - Drive the **algorithm improvement cycle**

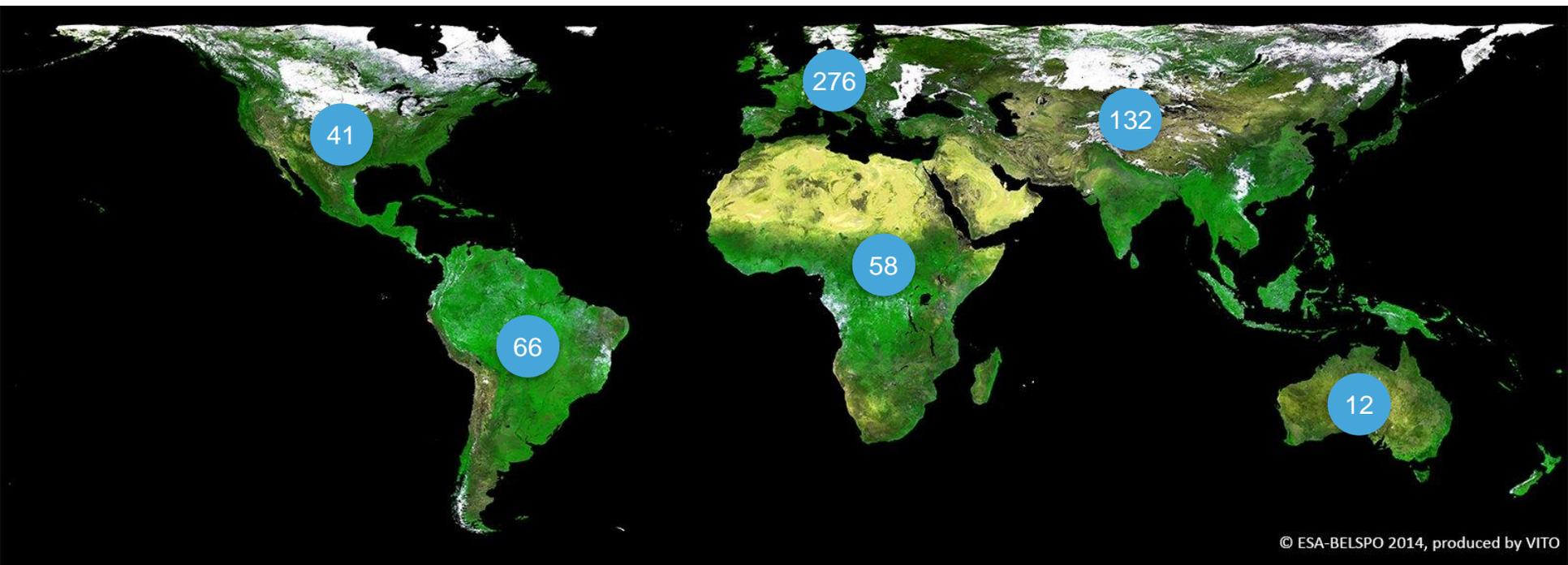


DATA USE

- Special user: *Copernicus global land service*
 - 640 registered users (GIO PDF portal)
- Registered EUMETCAST users: 582
- Via VITO's eo portal:

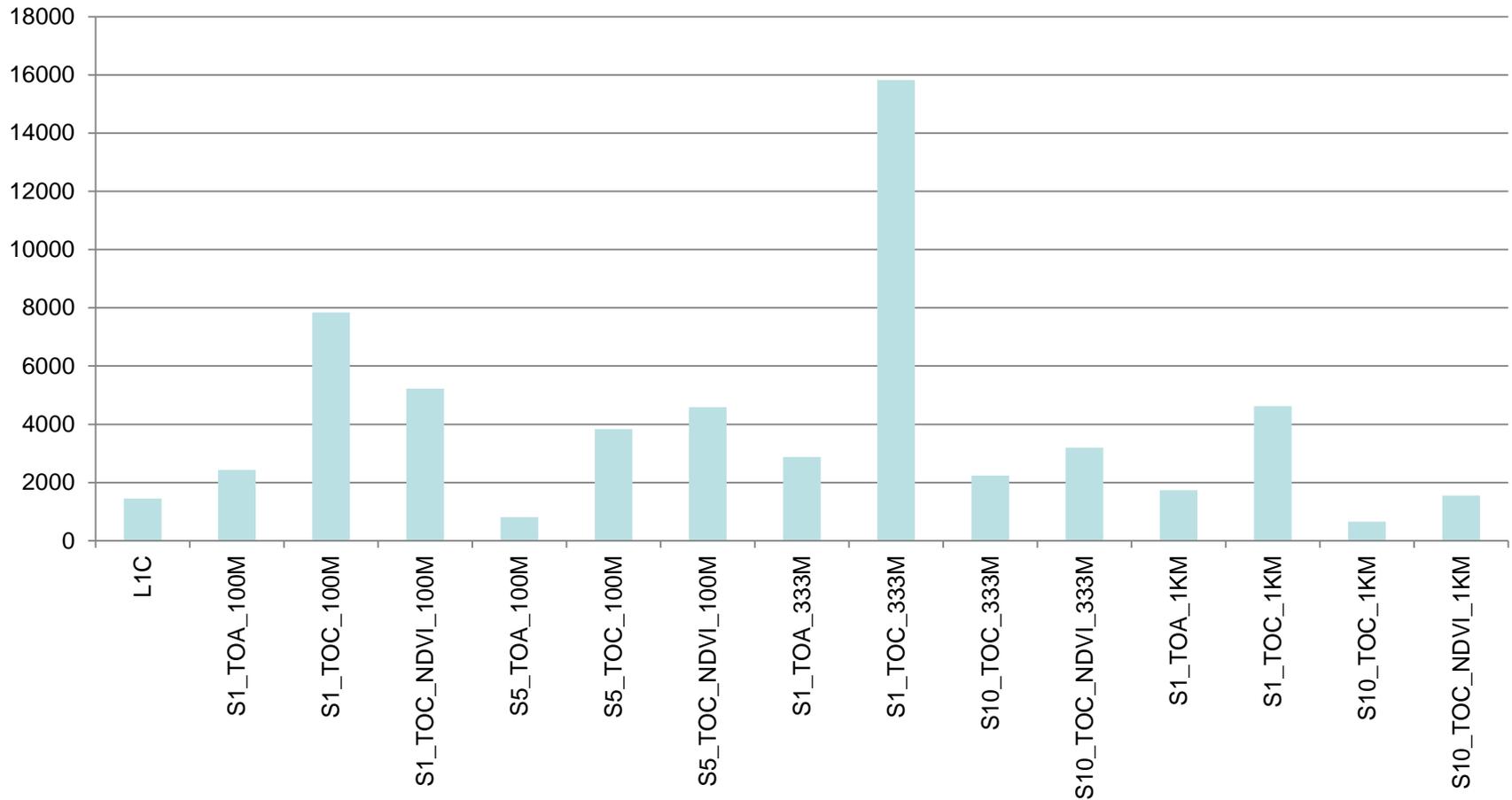


DATA USE



AMOUNT OF DOWNLOADED PRODUCTS IN 2015

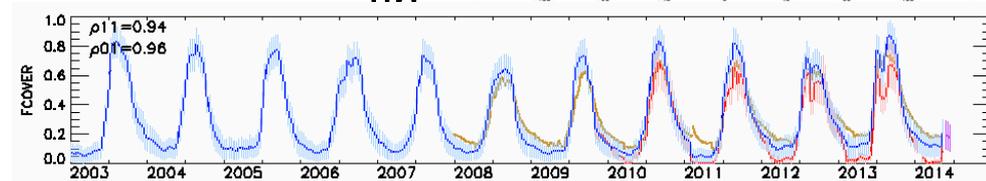
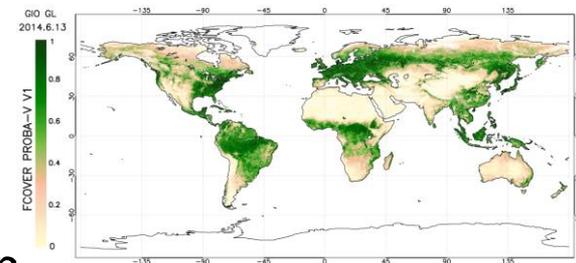
Delivered



GLOBAL LAND SERVICE

The Global component of Copernicus Land service

- A global systematic monitoring service
 - Production of bio-geophysical variables
 - NRT delivery (hourly -> dekad)
 - Global coverage
 - Consistent historical (15+ years)
 - Quality control
 - Archiving & re-processing
 - Dissemination & support



GLOBAL LAND SERVICE: PRODUCTS

| Variable | Temporal resolution | Spatial resolution | Spatial coverage | NRT | | | Archive |
|--------------------------|---------------------|--------------------|------------------|---------------|-----------------|------------|---------------|
| | | | | Sensor | Status | Timeliness | Sensor |
| Land Surface Temperature | 1 hour | 0.05° | Global | Σ Geo | Operational | 1 day | Σ Geo |
| Soil Water Index | 1 day | 0.1° | Global | Metop / ASCAT | Operational | 1 day | Metop / ASCAT |
| NDVI | 10 days | 1/112° | Global | PROBA-V | Pre-operational | 3 days | SPOT/VG T |
| VCI / VPI | 10 days | 1/112° | Global | PROBA-V | Demonstration | 3 days | SPOT/VG T |
| Dry Matter Productivity | 10 days | 1/112° | Global | PROBA-V | Demonstration | 3 days | SPOT/VG T |
| LAI / FAPAR / FCover | 10 days | 1/112° | Global | PROBA-V | Demonstration | 3 days | SPOT/VG T |
| Burnt Area | 1 day | 1/112° | Global | PROBA-V | Demonstration | 3 days | SPOT/VG T |
| TOC Reflectance | 10 days | 1/112° | Global | PROBA-V | In dvlpt | 3 days | SPOT/VG T |
| Surface Albedo | 10 days | 1/112° | Global | PROBA-V | In dvlpt | 3 days | SPOT/VG T |
| Water bodies | 10 days | 1/112° | Global* | PROBA-V | In dvlpt | 3 days | SPOT/VG T |

FROM FILLING THE GAP TO FINDING A NEW NICHE: 100 m products



100 M PRODUCTS

- *S1 TOA, S1 TOC, S5 TOA and S5 TOC Products released since March 2015*



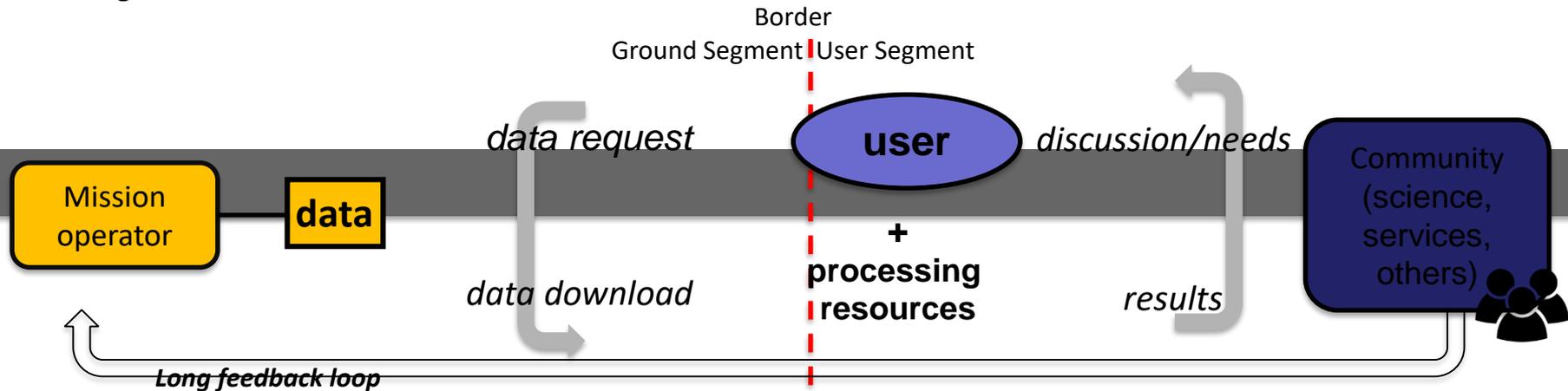
RECENT EVOLUTIONS

- Both HDF5 and GeoTIFF format available since August
- Improved radiometric and geometric correction
- New cloud detection algorithm
- Acquisition up to $87,3^\circ$ SZA
- ...

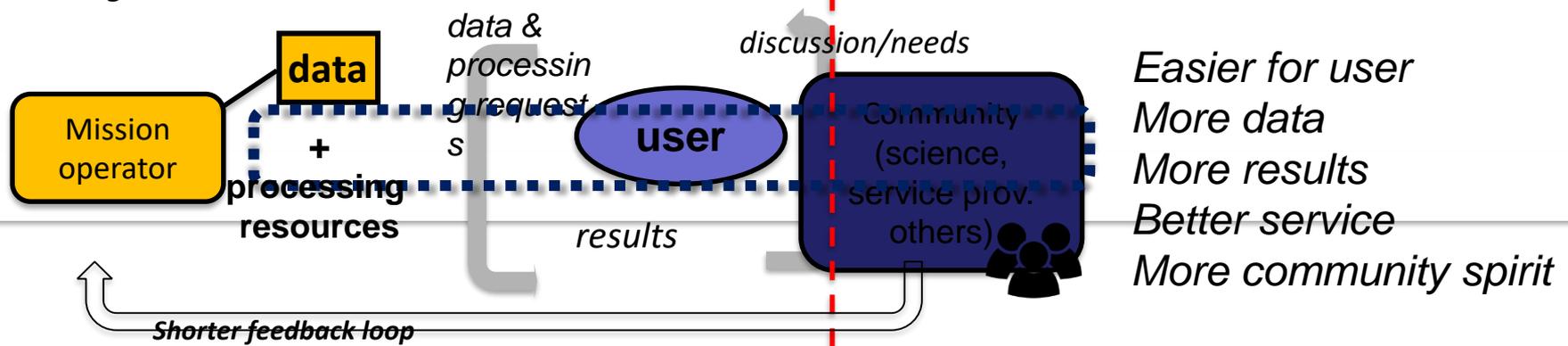


MEP (MISSION EXPLOITATION PLATFORM): ANOTHER WAY OF DEALING WITH DATA

Current: "bring the data to users"



Future: "bring the users to the data"



*Easier for user
More data
More results
Better service
More community spirit*

User segment is within the Ground segment

PROBA-V MEP

- ESA initiative
- PROBA-V testbed for other missions

First phase:

1. Data Analytics and Visualization
2. Data Manager
3. Processing Middleware / Services
4. Web Portal & Collaboration Tools

Benefits:

1. Widen PROBA-V data exploitation
2. Widen the links with other missions on-going, past and future
3. Widen the community and networking capability with further expansion of the potential of such community in the future

WHAT'S NEXT?

- Follow-up mission under investigation, specifically targeted at agriculture
- 100m daily global coverage with both optical and thermal information
 - *Optical instrument gives information on vegetation conditions*
 - *Thermal information gives additional information on e.g. soil moisture*
 - *High frequency ensures at least 1 image every week (crucial for crop monitoring)*



INFORMATION ABOUT PROBA-V

- <http://proba-v.vgt.vito.be/>

The screenshot shows the ESA Earth Online website interface. At the top, there is the ESA logo and the text "Earth Online". A search bar with "Google™ Custom Search" is visible. Navigation tabs include "Data Access", "Missions", "Earth Topics", and "PI Community". A breadcrumb trail reads "You are here Home > Missions > ESA EO Missions > Proba-V". The main content area features a dark blue header for "Proba-V" and an image of the satellite. The text describes the mission's purpose: providing multispectral images to study vegetation evolution. A sidebar on the right lists various missions, with "Proba-V" highlighted. Social media icons for Twitter, Facebook, and others are also present.

esa Earth Online

Login My Earthnet Register Google™ Custom Search

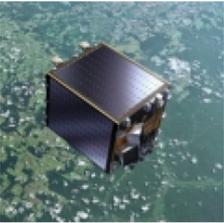
Home > Missions > ESA EO Missions > Proba-V

Data Access Missions Earth Topics PI Community Explore more...

You are here Home > Missions > ESA EO Missions > Proba-V

Follow Share f t e p

Proba-V



The Proba-V mission provides multispectral images to study the evolution of the vegetation cover on a daily and global basis. The 'V' stands for Vegetation. This mission is extending the data set of the long-established Vegetation instrument, flown as a secondary payload aboard France's SPOT-4 and SPOT-5 satellites launched in 1998 and 2002 respectively. The latter satellite's Vegetation instrument remains operational to this day, and is expected to remain operational until Q1/2015.

The mission, developed as part of [ESA's Proba Programme](#), is an ESA EO mission providing global coverage every two days, with latitudes 35-75°N and 35-56°S covered daily, and between 35°N and 35°S every 2 days. The Proba-V imager's continent-spanning 2250 km field of view collects light in the blue, red, near-infrared and mid-infrared wavebands, ideal for monitoring plant and forest growth as well as inland water bodies. The Vegetation instrument can distinguish between different land cover types and plant species, including crops, to reveal their health, as well as detect water bodies and vegetation burn scars.

The SPOT Vegetation dataset has close to 10,000 registered users around the globe and has contributed to hundreds of scientific papers over 15 years. But with further SPOT satellites lacking the capacity to carry Vegetation instruments, Proba-V has been designed to meet the future needs of this group.

The Proba-V mission has been developed in the frame of the ESA General Support Technology Program (GSTP). The Contributors to the Proba-V mission are Belgium, Luxembourg and Canada.

The ESA Earth Watch Programme provides 1km data, which is complemented by a National Programme supplying

Missions

- Missions Home
- ESA EO Missions
 - Sentinel-1
 - Swarm
 - Proba-V**
 - FAQs
 - Image of the Week
- CryoSat
- SMOS
- GOCE
- Envisat
- Proba-1
- ERS

ESA Future Missions
3rd Party Missions
ESA Earth Observation Campaigns Data
ESA/EUMETSAT
ESA Mission Continuity
ESA Mission News
ESA User Services News

Proba-V technical site

proba
VEGETATION



> **PROBA-V Symposium 2016**

26 - 28 January 2016
Ghent, Belgium

<http://congrexprojects.com/2016-events/16c01>

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Thank you for your attention!

