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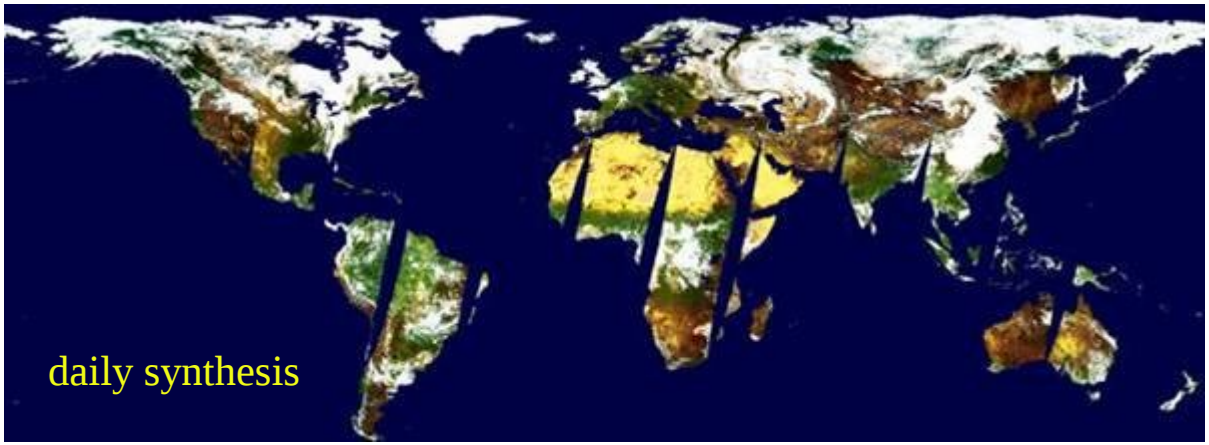
2/3/14

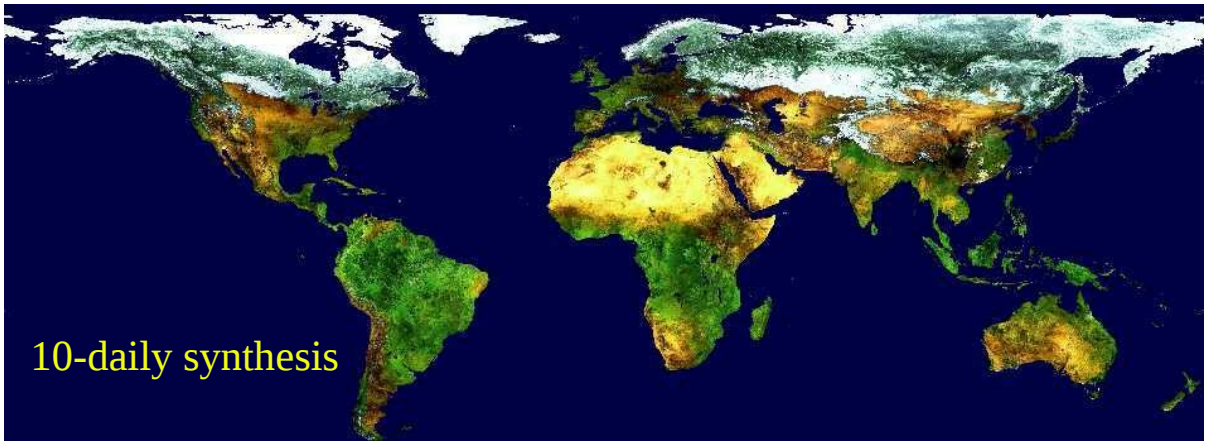
Continuous terrestrial vegetation monitoring since 1998 using SPOT-VEGETATION and Proba-V

E. Swinnen, S. Sterckx, I. Benhadj, B. Deronde, W. Dierckx, T. Van Achteren

5 years SPOT VEGETATION

Daily global vegetation monitoring (1 km)





global world archive since 1998 **www.spot-vegetation.com**

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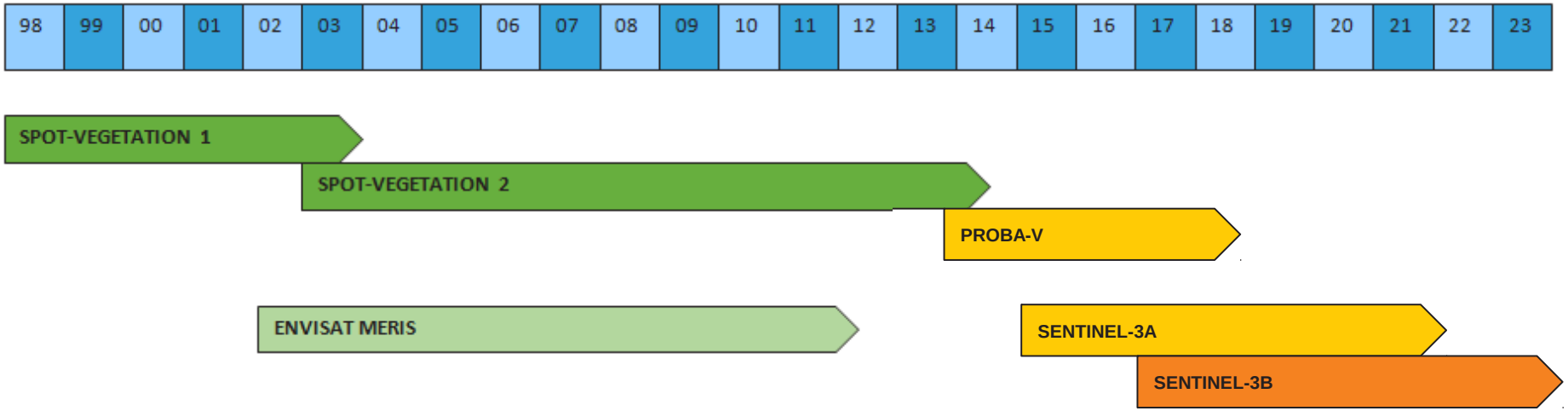
CONTINUITY (1km and 330m)
Daily global vegetation monitoring



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MISSION OBJECTIVE:

continuity of SPOT Vegetation data

global daily coverage of land masses
(above 35°)

LAUNCHED on May 6th, **2013**
(lifetime 2,5 years, extension to 5 years)

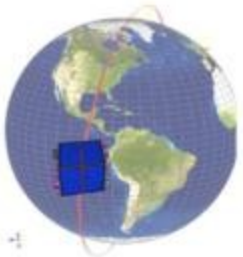
CHARACTERISTICS

like SPOT VGT:

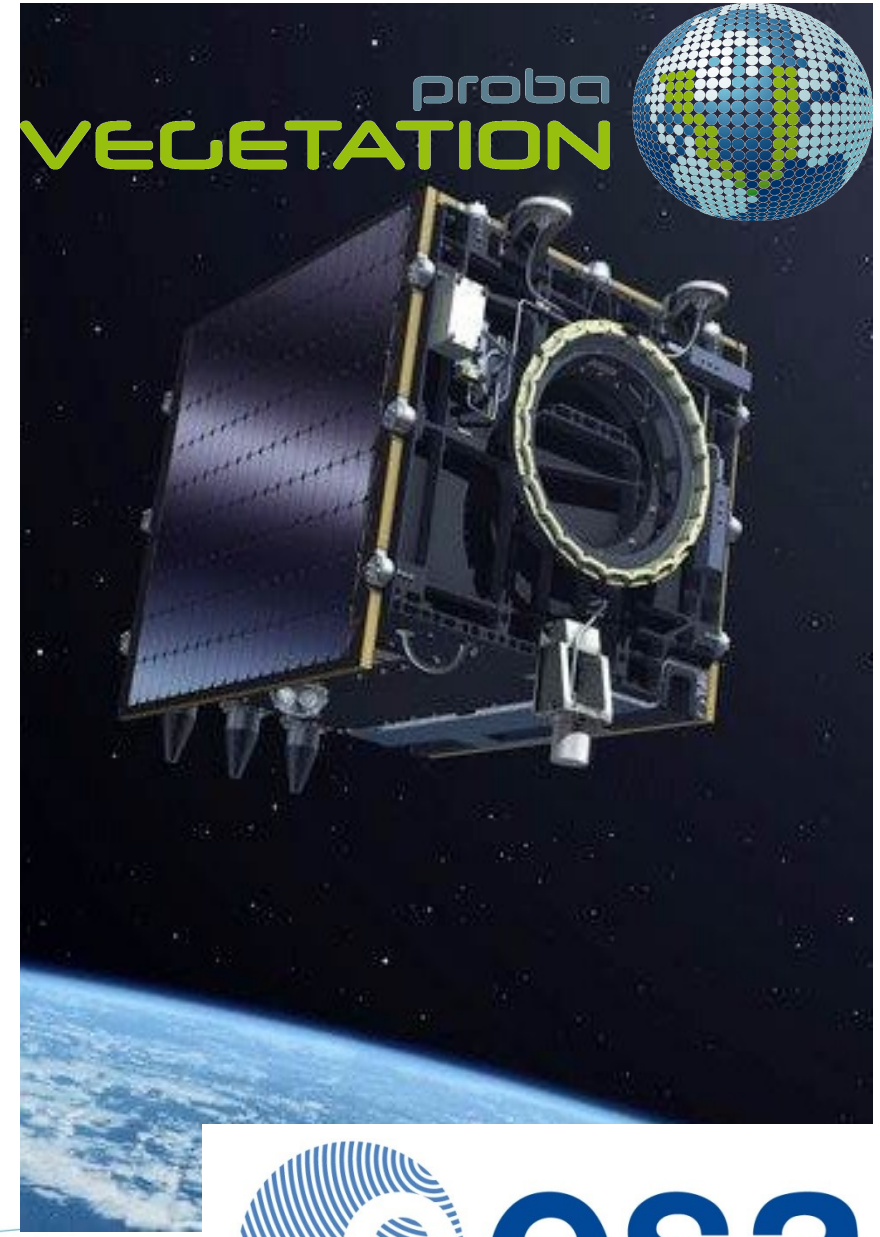
- SWATH width = 2250 km
- 14 near polar orbits per day, @820km
- 4 spectral bands (Blue, Red, NIR, SWIR)

Improvements

a lot lighter and smaller



spatial resolution:
products: 300m (600m for SWIR)
in addition to 1km like VGT



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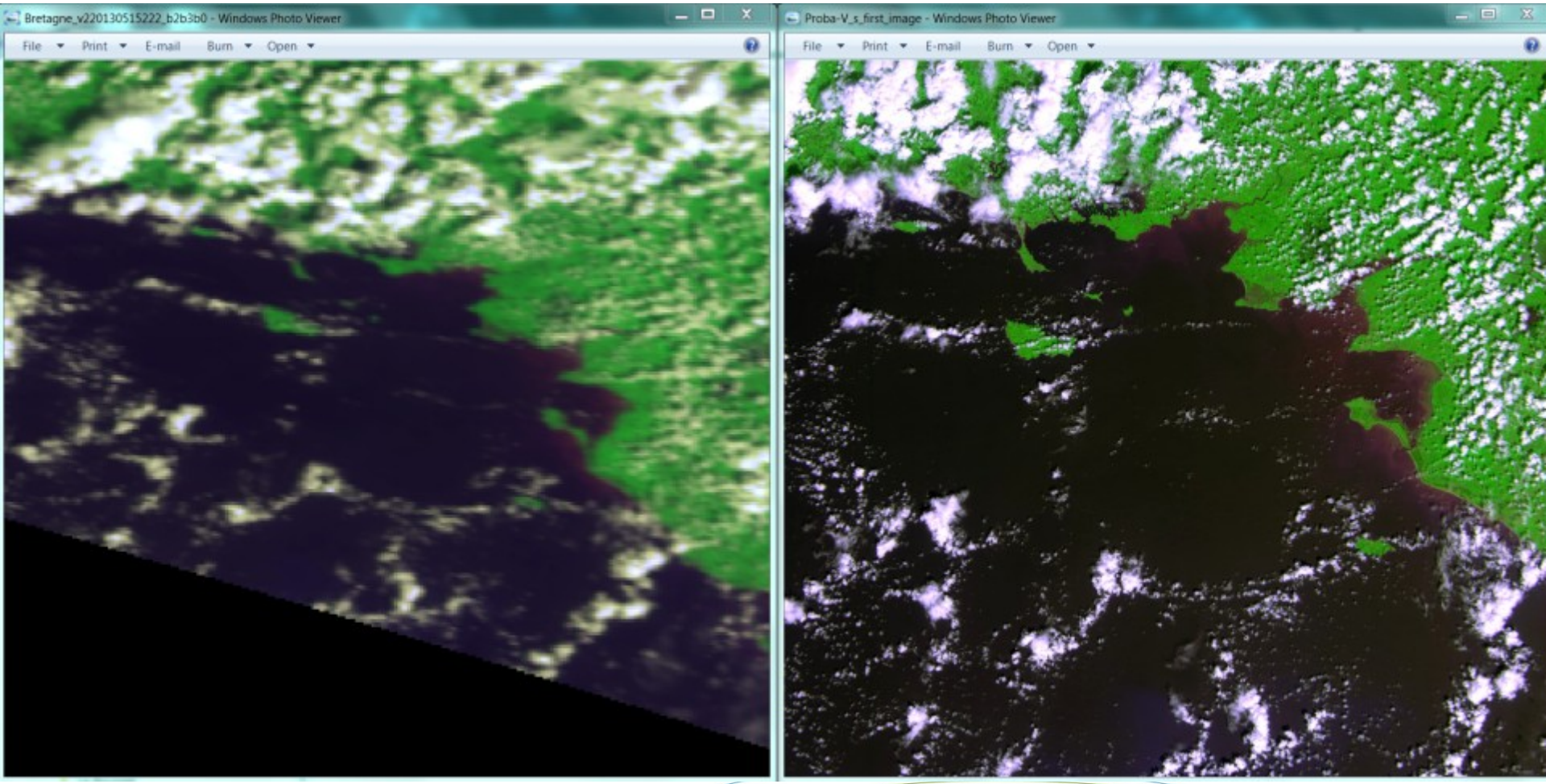

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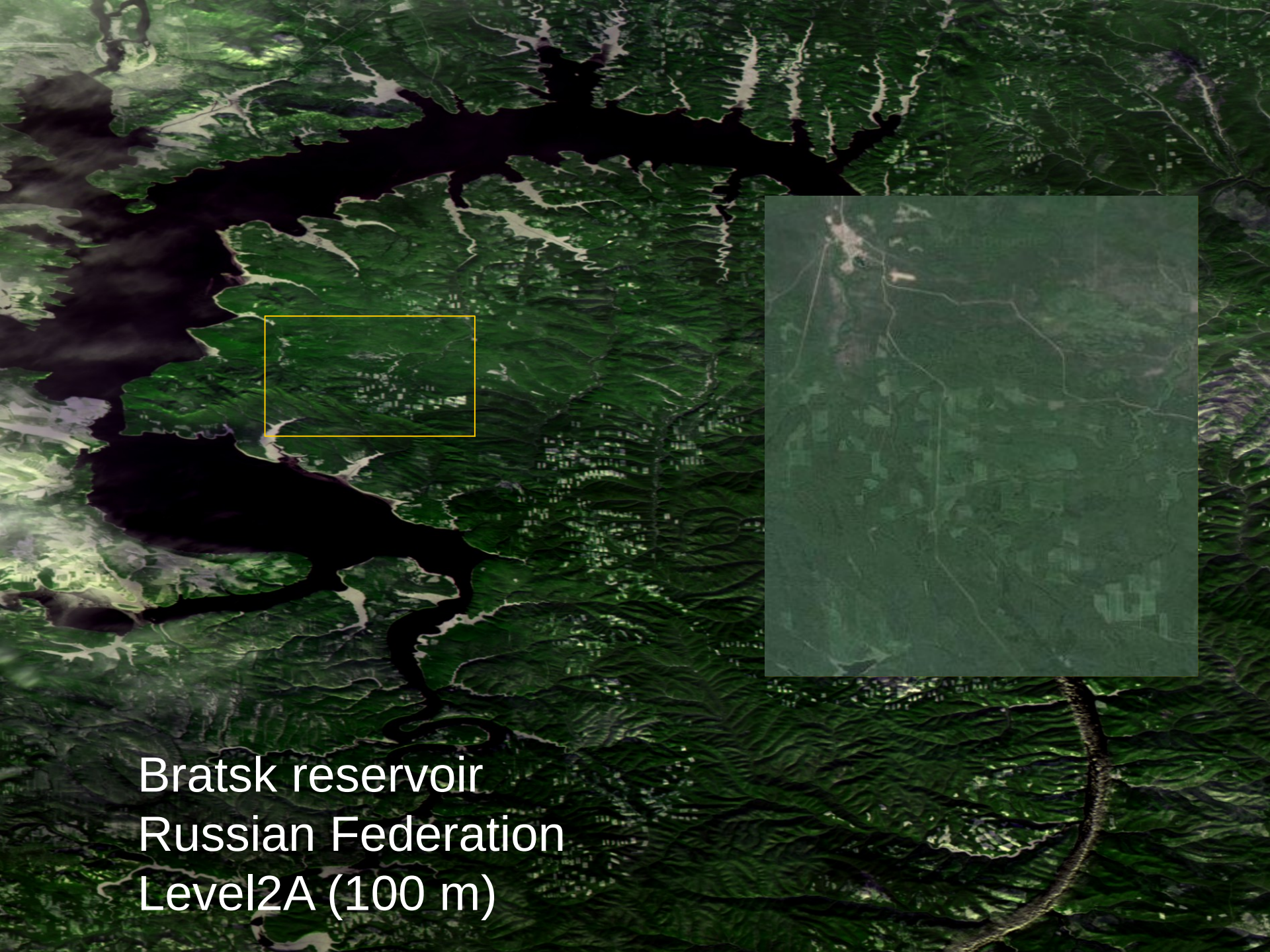
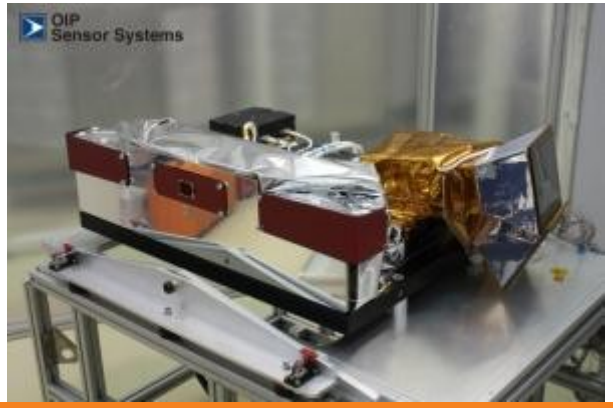
15 May 2013



Bratsk reservoir
Russian Federation
Level2A (100 m)

Vegetation Instruments



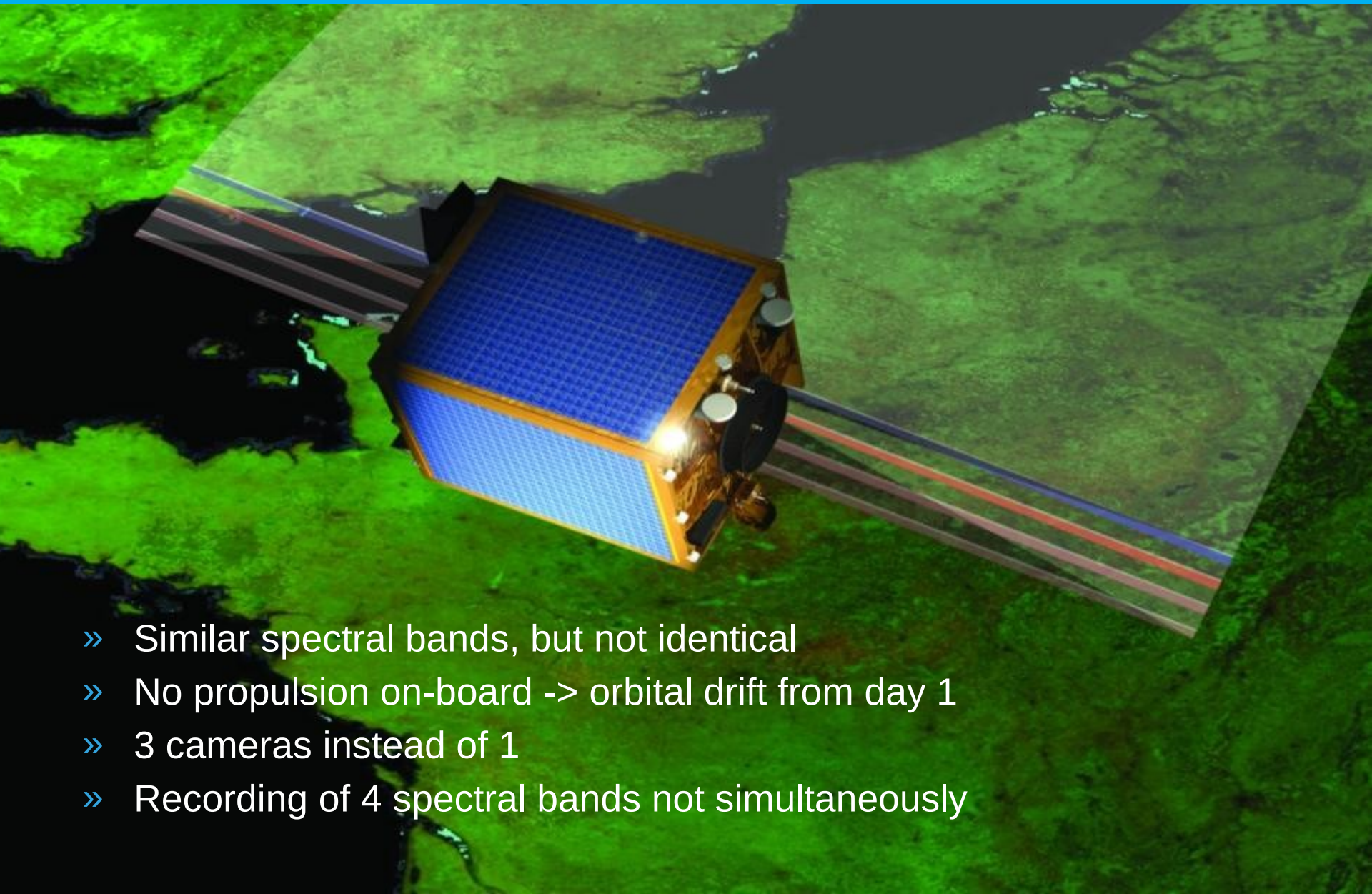
Spec	Vegetation on SPOT5	Vegetation Instrument on ProbaV
Size	1000x1000x700mm3	800x600x200mm3
Mass	150kg	Max 34kg
Power	Max. 160W	Average +-21W; Max. 41W
FOV/Swath	101°/2250km	102.6°/>2250km
Spectral bands	B0(Blue) – B2(Red) – B3(NIR) – B4(SWIR)	B0(Blue) – B2(Red) – B3(NIR) – B4(SWIR)
IQ (MTF)	>0.3	>0.3
GSD	1000m	VNIR: 100m Nadir - 360m edge SWIR: 200m Nadir – 685m edge

Resolution better with very compact system

Proba-V products

Products		
L1C Product	Raw variable resolution 100-350m (VNIR), 200-660m (SWIR) Central camera with swath 500km @ 100m (VNIR) and 200m (SWIR) raw resolution	radiometrically corrected raw data, given **per strip/camera**
S1 TOA Product	1/3km product, 1km product	product resolution data, **best-quality daily synthesis**
S1 TOC Product	1/3km product, 1km product	data corrected for **atmospheric** effects
S10 TOC Product	1/3km product, 1km product	**decadal synthesis** of S1's

Differences between SPOT-VGT and PROBA-V



- Similar spectral bands, but not identical
- No propulsion on-board -> orbital drift from day 1
- 3 cameras instead of 1
- Recording of 4 spectral bands not simultaneously

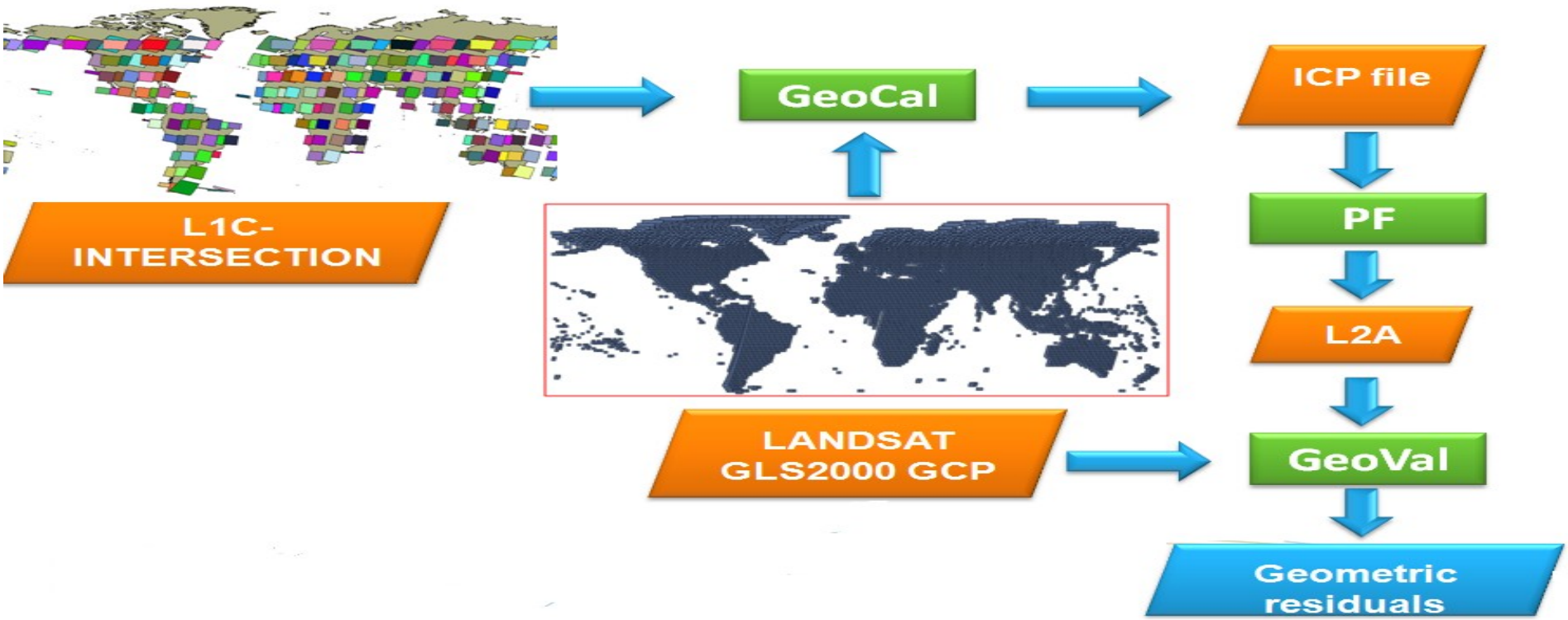
Validation and quality assessment

- **Image Quality Center (IQC)**
  - IQC processing is performed in an automated way
  - Evaluation of IQC results on daily (commissioning) or weekly (nominal) basis
  - Image Quality System Components
  - Radiometric Calibration
  - Geometrical Calibration
- **Continuity between SPOT-VGT and Proba-V**
- **The global component of the Copernicus Land Service / IMAGINES (FP7)**
  - Validation and Quality Monitoring of derived products

Geometric image quality - Requirements

geolocation type	mandatory accuracy (95%)
Interband (VNIR) Interband(VNIR + SWIR)	300 m
Absolute (VNIR) Absolute (VNIR + SWIR)	1000 m
Multi-temporal (VNIR) Multitemporal (VNIR + SWIR)	500 m

Geometric image quality - Process



Geometric image quality - Results

- Absolute geolocation error ~ 110m std = 40 m for all bands
- More information:

  FIRST RESULTS OF PROBA-V IN-FLIGHT GEOMETRIC CALIBRATION

  Iskander Benhadja, Stefano Micab, Veljko Jovanovicd, Jan C. Driesa, Joe Zenderc, Stefano Santandreac, Karim Mellabc

- Multi-temporal geolocation < 200 m

Radiometric Image Quality

The radiometric calibration requirements

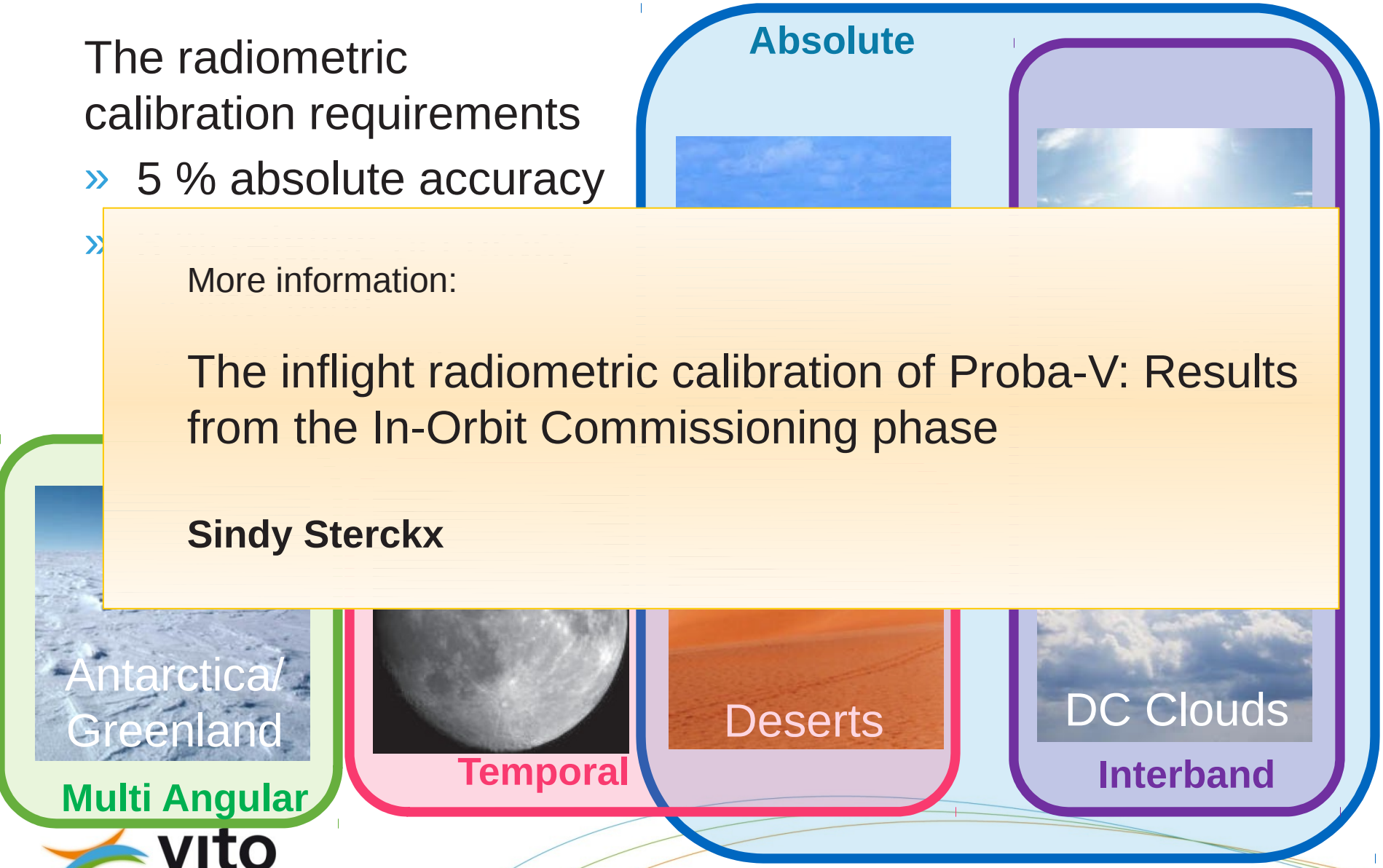
» 5 % absolute accuracy

»

More information:

The inflight radiometric calibration of Proba-V: Results from the In-Orbit Commissioning phase

Sindy Sterckx



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Continuity between SPOT-VGT and Proba-V

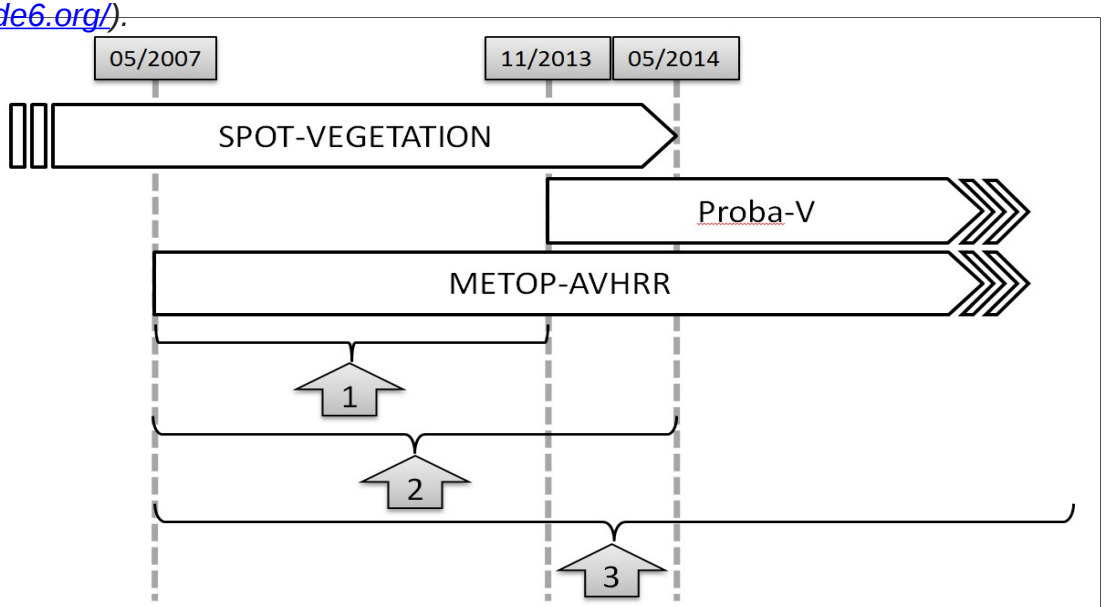
- Key questions
  - Can we substitute SPOT-VGT by PROBA-V?
  - How similar are the data?
  - Impact of orbital drift on the time series?

- Challenges
  - Short period of overlap: Nov 2013 – May 2014
  - Long term evolution
  - SPOT-VGT: orbital drift (Swinnen, et al. E., S. Verbeiren, B. Deronde and P. Henry, 2014, Assessing the impact of the orbital drift of SPOT-VGT1 by comparing with SPOT-VGT2 data, IJRS, vol. 5, *in press*)

Continuity between SPOT-VGT and Proba-V

- Approach
  - External reference: global METOP-AVHRR 10-daily composites
  - NDVI (EPS 10-daily NDVI LSA SAF http://www.metops10.vito.be/), RED & NIR

Eerens H, Baruth B, Bydekerke L, Deronde B, Dries J, Goor E, Heyns W, Jacobs T, Ooms B, Piccard I, Royer A, Swinnen E, Timmermans A, Van Roey T, Vereecken J & Verheijen Y, 2009, Ten-Daily Global Composites of Metop-AVHRR, *Proc. of the 6th International Symposium on Digital Earth, Beijing, 9-12 September 2009 (http://www.isde6.org/)*.

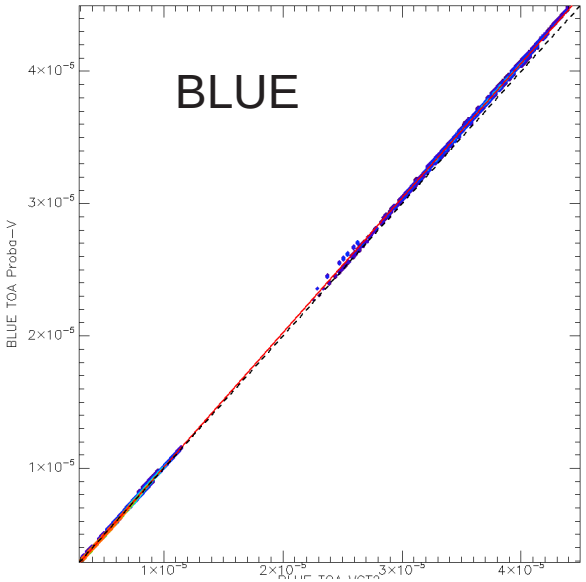


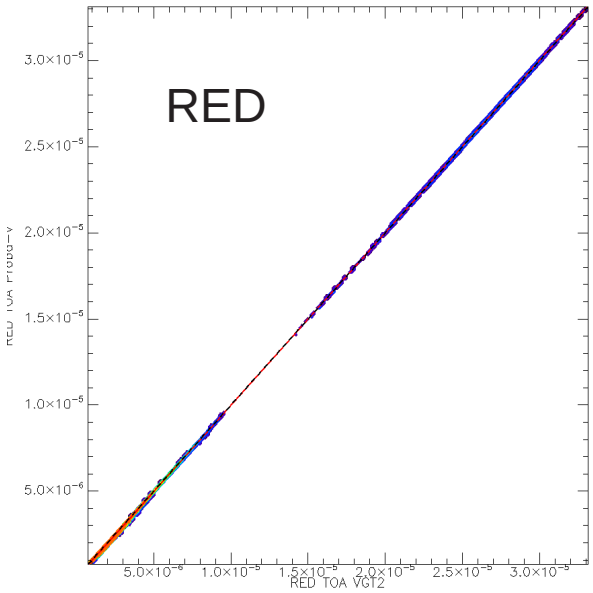
Re-processing of SPOT-VGT archive

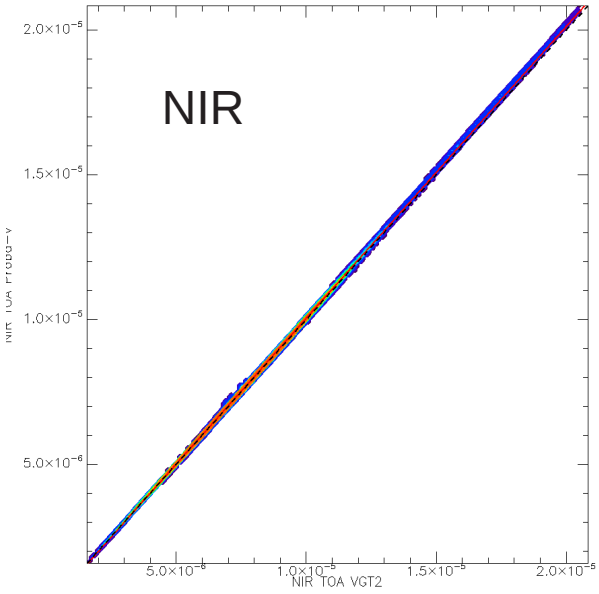
- **Improvements:**
  - Corrected radio-modeling (taking correct sun-earth distance into account)
  - Application of new cloud and ice/snow detection algorithm
  - High freq. calibration (stripes)
  - Low frequency calibration (smile effect)
  - Absolute radiometric calibration

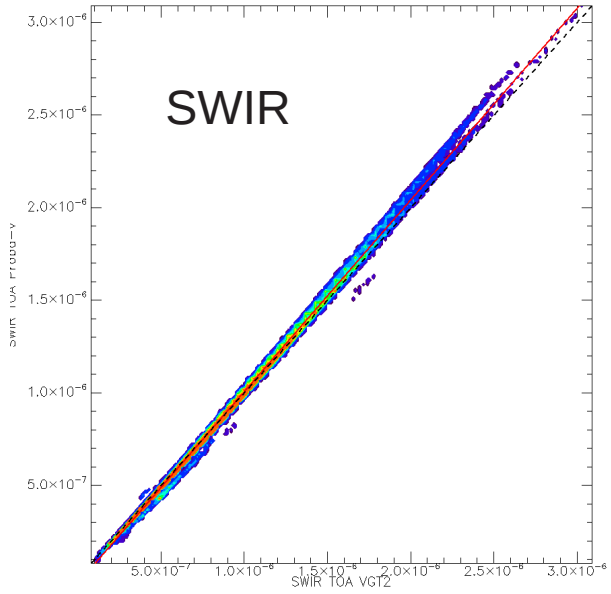
- **Planning:**
  - Finalisation of the processing chain + testing with CNES => January - February 2014
  - Integration of archiving and dissemination services => February 2014
  - Start of re-processing => June 2014

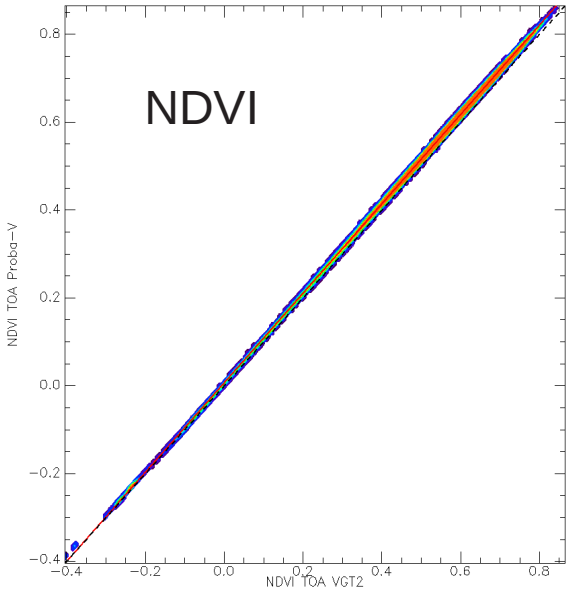
Spectral similarity (TOA) from simulations











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Global Land-I consortium

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HYGEOS

ipma

METEO FRANCE

ZAMG Zentralanstalt für Meteorologie und Geodynamik

Associates:

EOLAB

INRA Institut National de la Recherche Agronomique

CREAF

UCL Université catholique de Louvain

University of Leicester

TU VIENNA

Portfolio

Bio-geophysical variables

Variable	Temporal Coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor	Theme
LAI/FAPAR/FCover	1999 – present	10 days	Global	1km	SPOT/VGT	Vegetation
NDVI/VCI/VPI	1999 – present	10 days	Global	1km	SPOT/VGT	
Dry Matter Productivity	2009 – present			1km	SPOT/VGT	
Burnt Area	1998 – present			1km	SPOT/VGT	
TOC Reflectance	2013 – present	10 days	Global	1km	SPOT/VGT	Energy budget
Surface Albedo	1999 – present	10 days	Global	1km	SPOT/VGT	
Land Surface Temperature	2009 – present	1 hour	Global	0.05°	Σ Geo	
Soil Water Index	2007 – present	1 day	Global	0.1°	Metop / ASCAT	Water

* Currently Africa

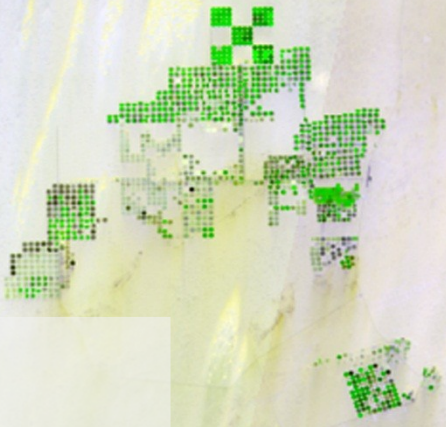
Scientific quality control

- Per variable: following the guidelines, protocols and metrics defined by the Land Product Validation group of CEOS.
  - **Quality Assessment**: exhaustive evaluation of new products before operational production
  - **Quality Monitoring**: check continuously operational products quality is stable along time
  - Lighten procedure
  - Focus on metrics and criteria that can be easily automated

- Cross-cutting: consistency across variables using a Land Data Assimilation System
  - Assimilation of LAI, SWI, and optionally the surface Albedo
  - Passive monitoring of FAPAR and LST (simulated FAPAR and LST are compared to satellite products)

Other presentations / poster

- **Roselyne Lacaze** "*Global Land Service: validation and evolution*"
- **Fernando Camacho** "*Quality Assessment and Continuous Quality Monitoring of SPOT/VGT LAI, FAPAR global products in the Copernicus Global Land Service*. "
- **Jorge Sanchez** "*Continuous Quality Monitoring of Copernicus Global Land Albedo products based on SPOT/VGT observations.*"
- **Fred Baret** "*On Line Validation Exercise (OLIVE): a web based service for the validation of medium resolution land products.*"



Thank you

http://www.proba-v.vgt.vito.be

http://earth.esa.int