PROBA-V Commissioning: Radiometric Calibration

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Belgian-ESA mission

Mission objective:

» Continuity of SPOT VEGETATION data (Blue, Red, NIR, SWIR)
» Daily global coverage of land masses (56°S 78°N)
» 100m at-nadir resolution
» 1/3km and 1km products

Launch:

» May 7th 2013 (02:06 GMT)
» VEGA VV-02 flight, perfect launch
» 5-year mission
PROBA-V is not SPOT

- 200 x smaller
- 20 x lighter
- Developed in only 5 years
- Cost of only 60M€
- TMA instrument (3 cameras)
- No on-board calibration devices!
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RC – IQC: Vicarious Calibration Concept

**OSCAR*** (Optical Sensor Calibration with simulated Radiances)

» Combines methods (Livens *et al.*, 2010)

» Verifies requirements

*Sterckx *et al.* IJRS, in Press
RC-IQC: First results

» Work in progress!
» First calibration report by end of August
» Focus on Deserts, Clouds trends
» Special calibrations: Linearity check, Moon

Requirements

» 5 % absolute accuracy
» 3 % relative accuracy
  » inter-band
  » multi-temporal
Desert calibration

Target: stable, homogenous desert sites

Method: compare TOA radiances to simulated values

Usage: Operational absolute calibration for all bands, cross mission calibration, multi-temporal

Adriaensen et al., 2012 (CEOS report); Govaerts et al., RSL 2013
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Deep Convective Clouds calibration

**Target:** reflection of deep convective clouds over oceans

**Method:** Compare PROBA-V TOA data to *simulated* data using RED reference band to retrieve cloud optical thickness”

**Usage:** inter-band (absolute if combined)
Clouds/Desert calibration (inter-band)

Clouds Right Camera (18/06 - 08/08)

Desert Right Camera (18/06 - 08/08)
Desert calibration (absolute)

Desert Right Camera (18/06 - 08/08)

- All observations on Libya-4
- Blue and Red: some deviation but very stable (3%)
- NIR: stronger deviation and more scattered (5%)
- SWIR: few observations (ROI extraction issue)
Clouds/Desert calibration (inter-band)

Clouds Left Camera (18/06 - 08/08)

Desert Left Camera (18/06 - 08/08)
Clouds/Desert calibration (inter-band)

Same trend in Clouds as in Desert
Rayleigh calibration

**Target:** stable, homogenous oceans

**Method:** compare TOA radiances to *simulated* values, using NIR band to retrieve aerosol optical thickness

**Usage:** Operational absolute calibration, for RED and BLUE combine with inter-band to transfer results to NIR, SWIR

Sterckx *et al.* TGARS, 2013
Experimental calibrations: the linearity check

Integration time changes in steps over homogenous areas

PROBA-V image 17/06
Linearity check (libya-4 desert)

» Left plot: Sweeps of line averages

» Right plot: Average result per integration time, and linear fit

» 0.067% dynamic = 2.7 out of 4095

» Still to be done for Blue and SWIR
Lunar Calibration

Moon = stable over thousands of years

Usage: stability monitoring

Implementation:
- Compare full disc reflectance and compare with lunar model (like ROLO)
- Monthly acquisition at same phase angle to reduce uncertainty

Other usage:
- MTF
- Dark current validation
- Straylight assessment
Lunar MTF assessment

- Based on MODIS approach (Wang et al., SPIE 2011)
- Adapted by ESA (edge oversampling on a circular edge)
SWIR multi-angular issue

- Striping noticed in the SWIR data
- Analysed by instrument partner as a PRNU effect. Correction proposed
- 70% of such striping pixels also has larger dark current
- About 0.6% of all pixels affected
- New dark current and PRNU coefficients provided by instrument partner
- Currently stability monitoring is being done
RC-IQC: Ongoing tasks

» Desert, clouds: More statistics
» Sun Glint calibration and Rayleigh
» Multi-angular calibration (SWIR!)
» MTF comparison with Landsat-8
» Special calibrations: Multi-temporal analysis on moon

Requirements

» 5 % absolute accuracy
» 3 % relative accuracy
  » inter-band
  » multi-temporal
Questions?

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Publications
Thank you!

The VITO PROBA-V team
From 1km to 1/3 km resolution:
Sumatra fires with plume extending over Singapore and Malaysia

SPOT-VGT 1 km

PROBA-V 1/3 km
SPOT- VGT
15 May 2013
1km projected

Proba-V first image
15 May 2013
100m unprojected