

08/10/2012

The OSCAR (Optical Sensor Calibration with simulated Radiance) Facility for the PROBA-V mission

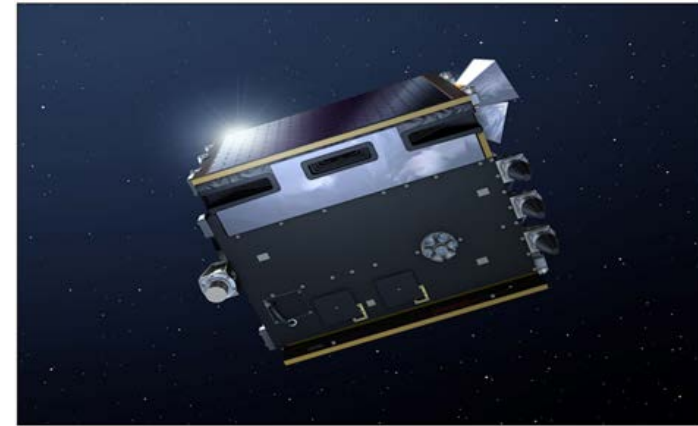
CEOS-IVOS Libya4 workshop, 4-5 October 2012 ,Paris

Sindy Sterckx



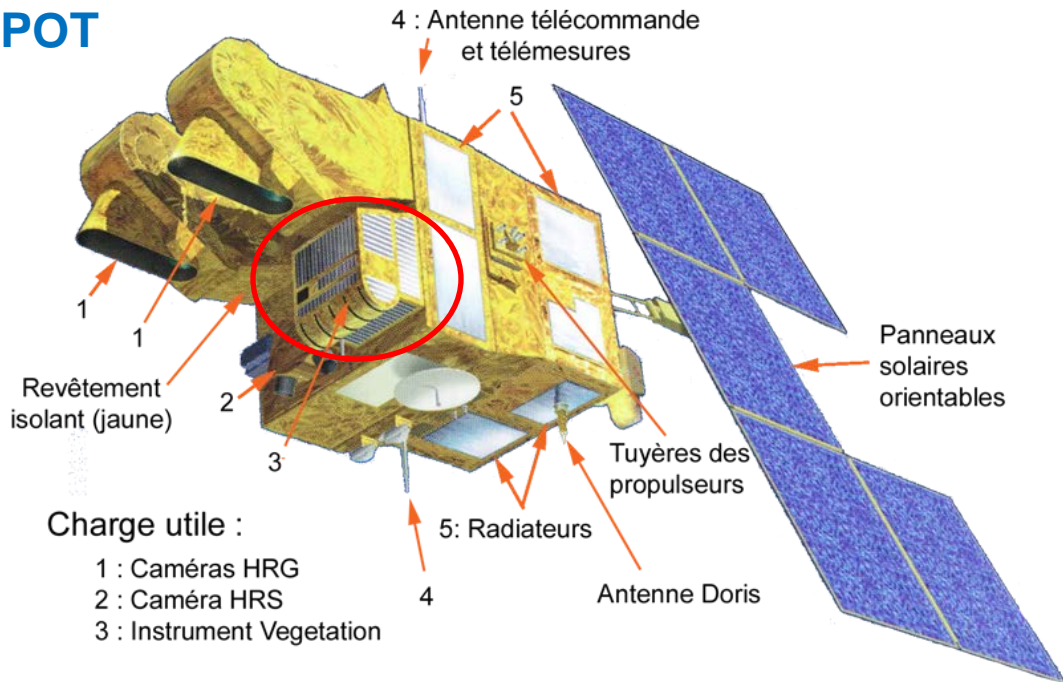
- » Mission objective :
 - » Continuity of SPOT VEGETATION data
 - » 4 spectral bands: B, R, NIR, SWIR
 - » Daily global coverage of land masses
 - » Total swath width 2295 km

- » Launch :
 - » Foreseen March 2013
 - » VEGA launcher



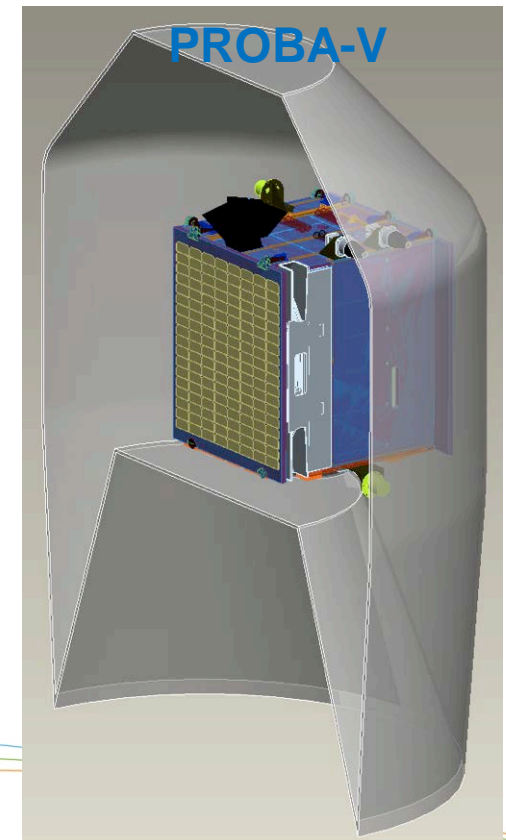
But PROBA-V is not SPOT

SPOT

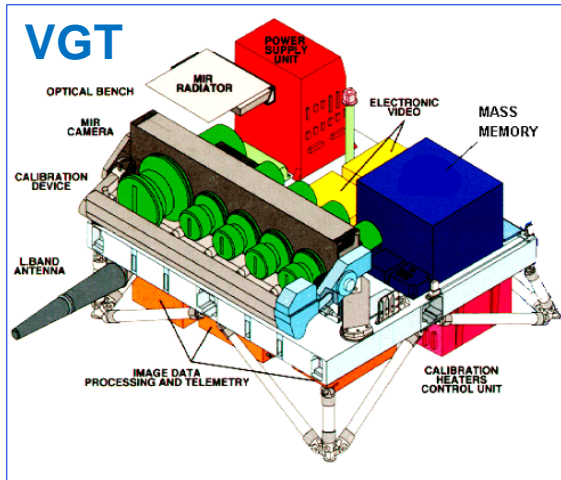


	SPOT-4	SPOT-5	PROBA-V
volume	2x2x5.6 m ³	3.1x3.1x5.7 m ³	0.8x0.8x1 m ³
mass	2760 kg	3 000 kg	160 kg
power	2100 W	2100 W	153 W

> 200 x smaller
> 20 x lighter



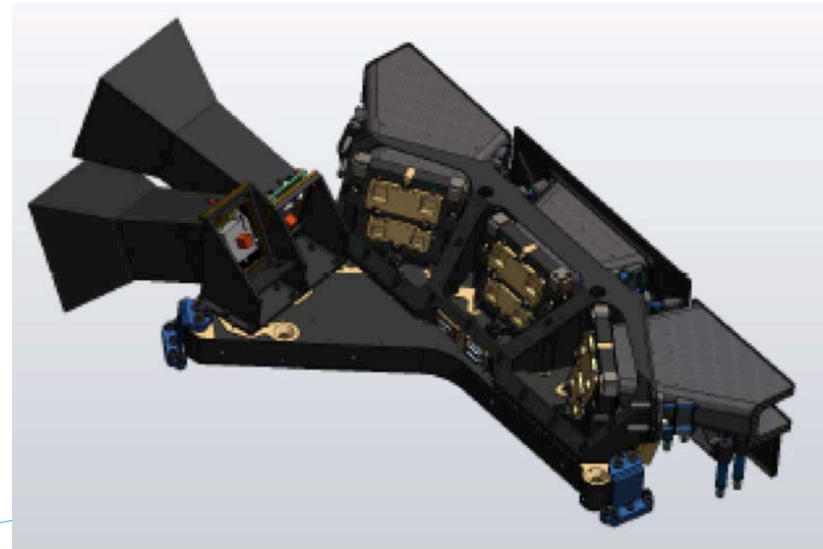
And the instruments are not the same



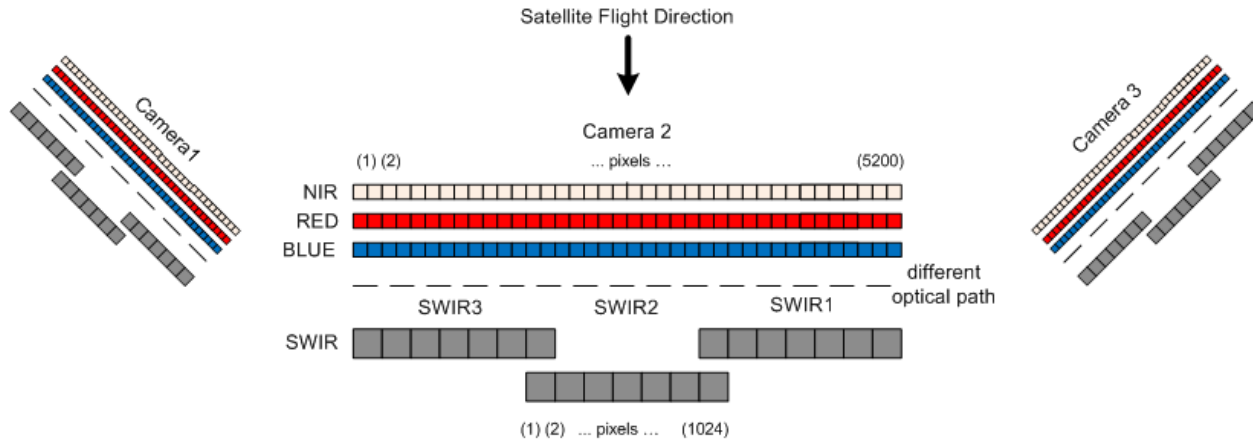
The PROBA-V Payload

- Mass: 33.3 kg [20% of total]
- Dimensions: 0.2x0.8x0.4 m³
- Three imagers, TMA concept

PROBA-V



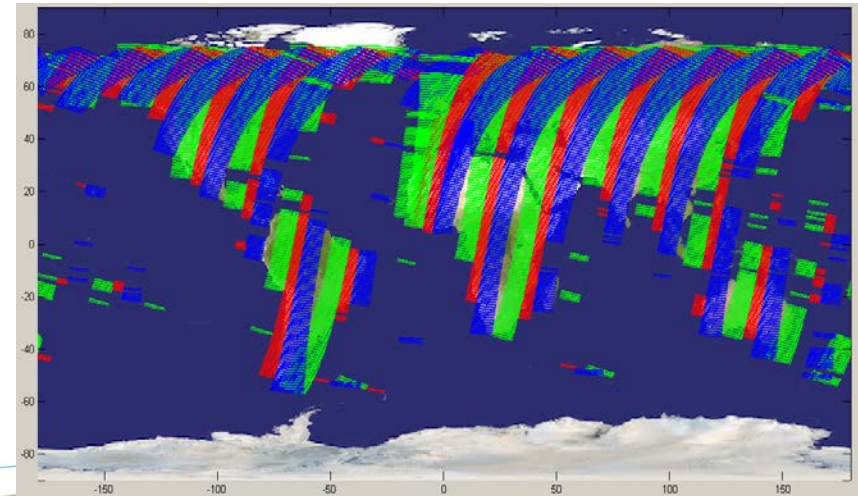
The PROBA-V bands



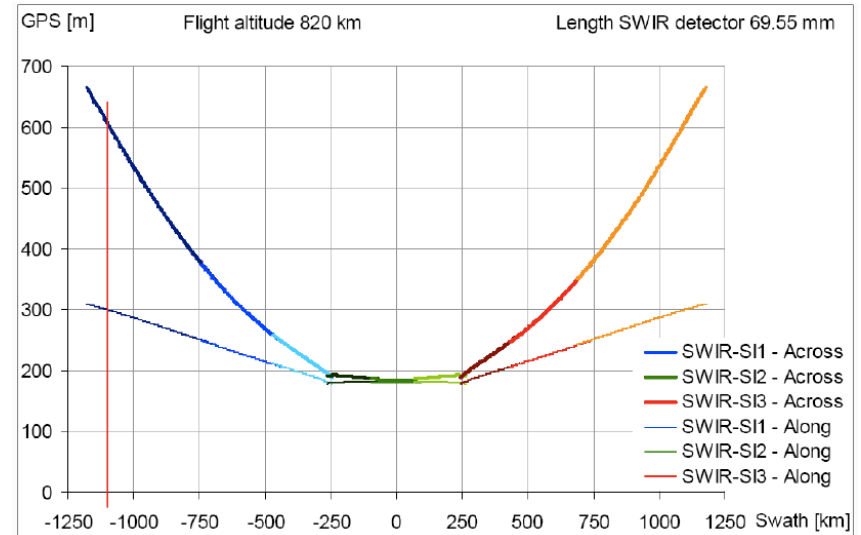
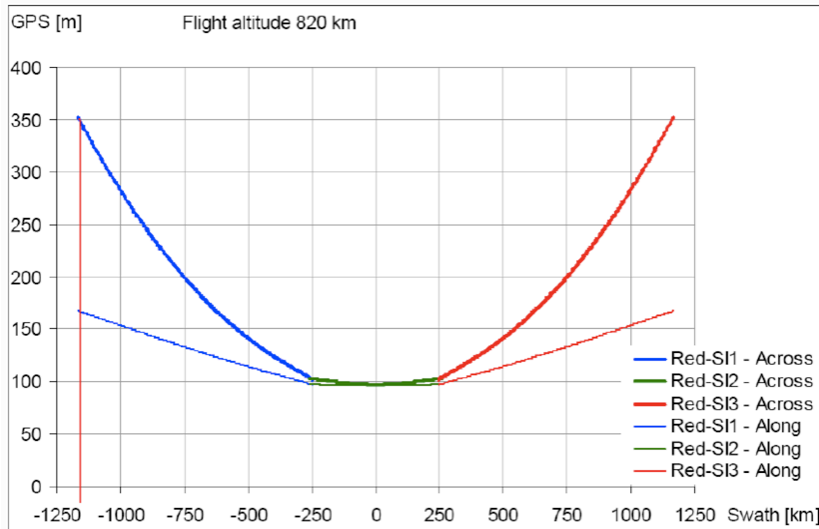
2 focal planes:

VNIR with 3 bands

SWIR with 1 band

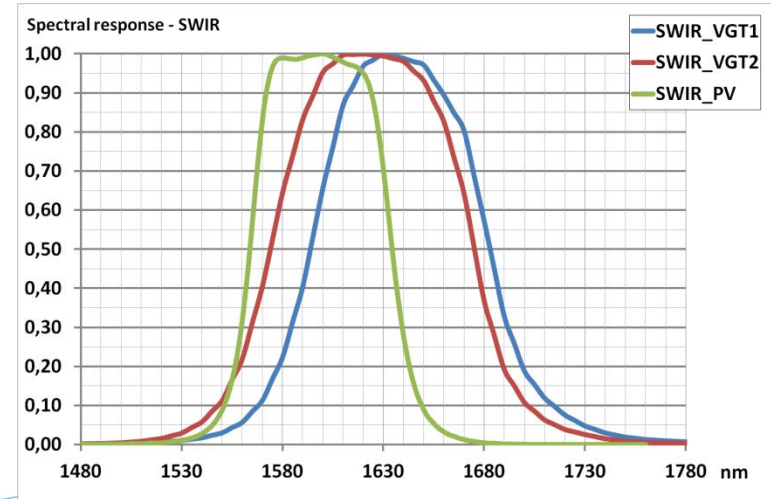
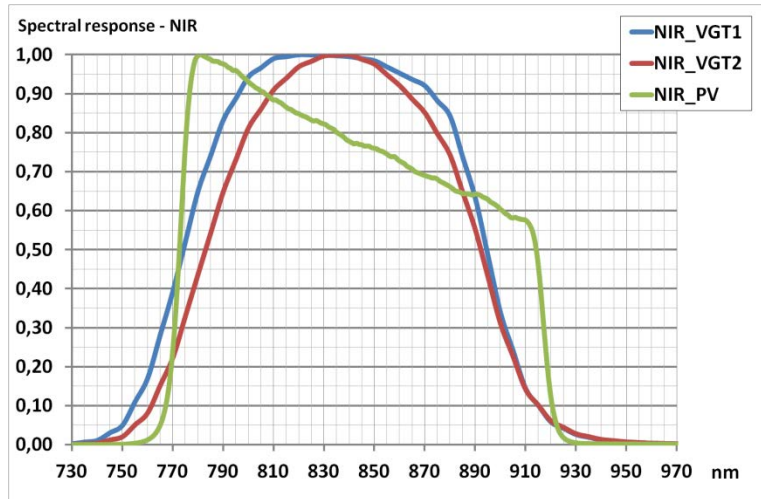
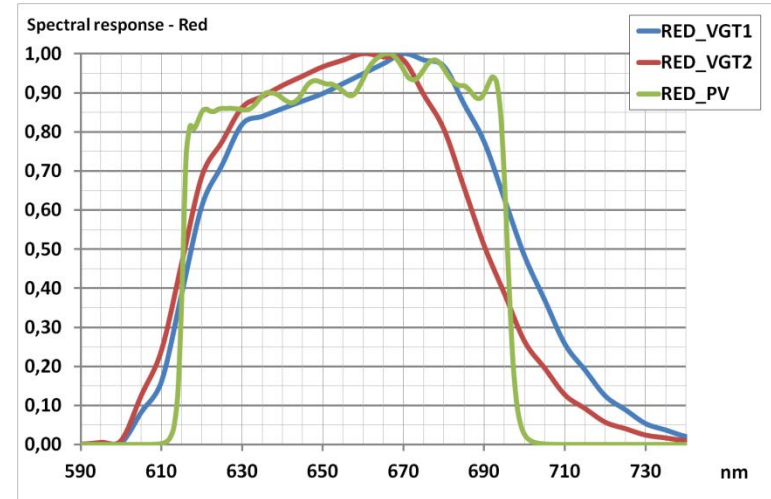
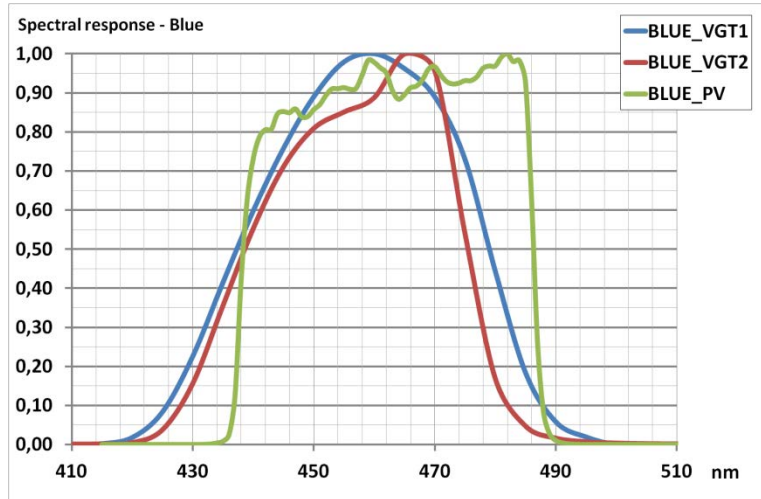


Geometric performance - Spatial resolution



- Product resolution: 1km and 300m
- VNIR Ground Sampling Distance is 100 m in centre, 350 m at edge
- SWIR Ground Sampling Distance is 200 m in centre, 700 m at edge
- Total swath: 2295km
- Central camera more than 500km swath
- Each edge camera more than 900km swath

Spectral performance – Spectral responses



Radiometric Performance

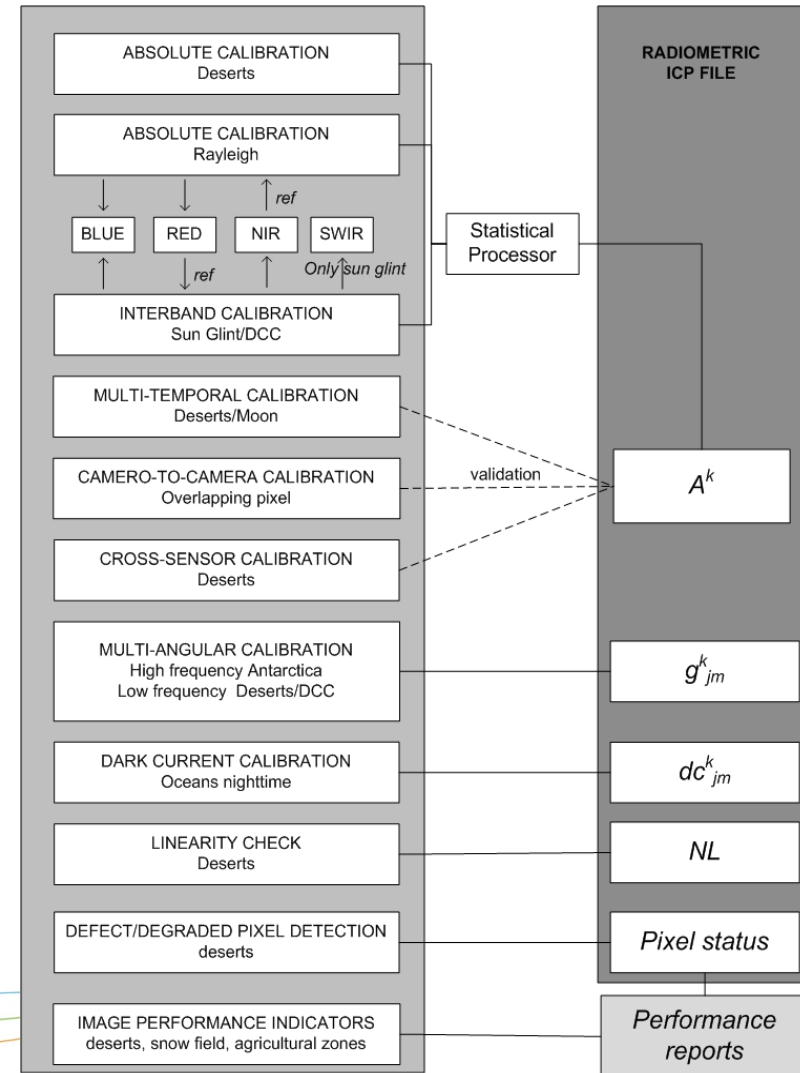
» SNR

Radiometry		
CWL (nm)	FWHM (nm)	SNR @Lref(W/m ² .sr.um)
463	46	155 @111
655	79	430 @110
845	144	529 @106
1600	73	475 @20

- » The radiometric calibration requirements for PROBA-V specify
 - » 5 % absolute accuracy
 - » 3 % relative accuracy
 - » inter-band
 - » multi-temporal

VITO OSCAR cal/val facility

- » OSCAR* (Optical Sensor Calibration with simulated Radiances)
 - » Relies on combination of various vicarious calibration methods to reduce uncertainty in the calibration results and to verify the different requirements
 - » Calibration over Deep Convective Clouds (DCC)
 - » Calibration over Rayleigh scattering
 - » Calibration over sun glint
 - » Calibration over stable deserts



*Sterckx et. al The PROBA-V mission: Image Processing and Calibration. International Journal of Remote Sensing. Special Issue SPOT-VEGETATION - Fifteen years of success: What's next? (In review)

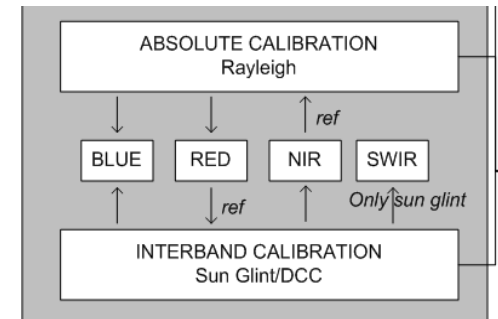
DCC, Rayleigh, Sun glint

» Advantages :

- » Covering large dynamic range
- » Through combinations of methods all bands can be calibrated
- » DCC interband calibration uncertainty very low

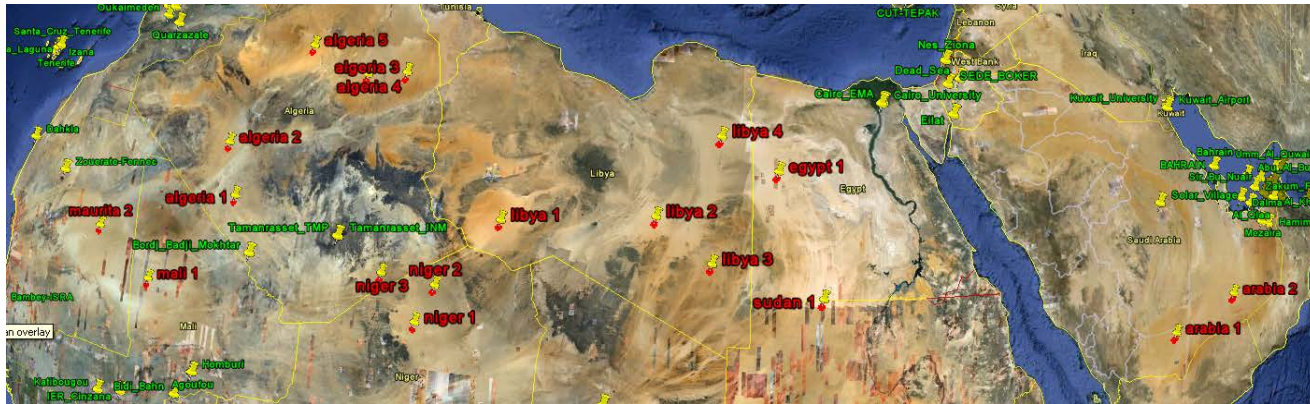
» Drawbacks :

- » Acquisitions with non-nominal IT (! Linearity should be OK)
- » Rayleigh: low signal – effect straylight ?
- » Sun glint : effect sun-viewing geometry difference
- » Reference band needed : uncertainty in reference band ?



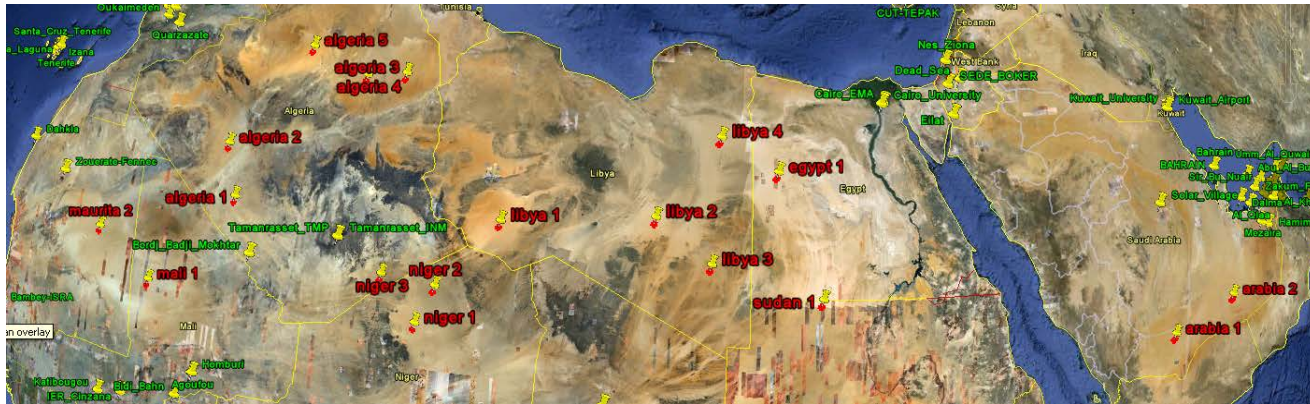
* *Sterckx S., Adriaensen S., Livens S., Rayleigh, Deep Convective Clouds and Cross Sensor Desert vicarious calibration validation for the PROBA-V mission TGARS (in revision)*

Calibration over stable deserts



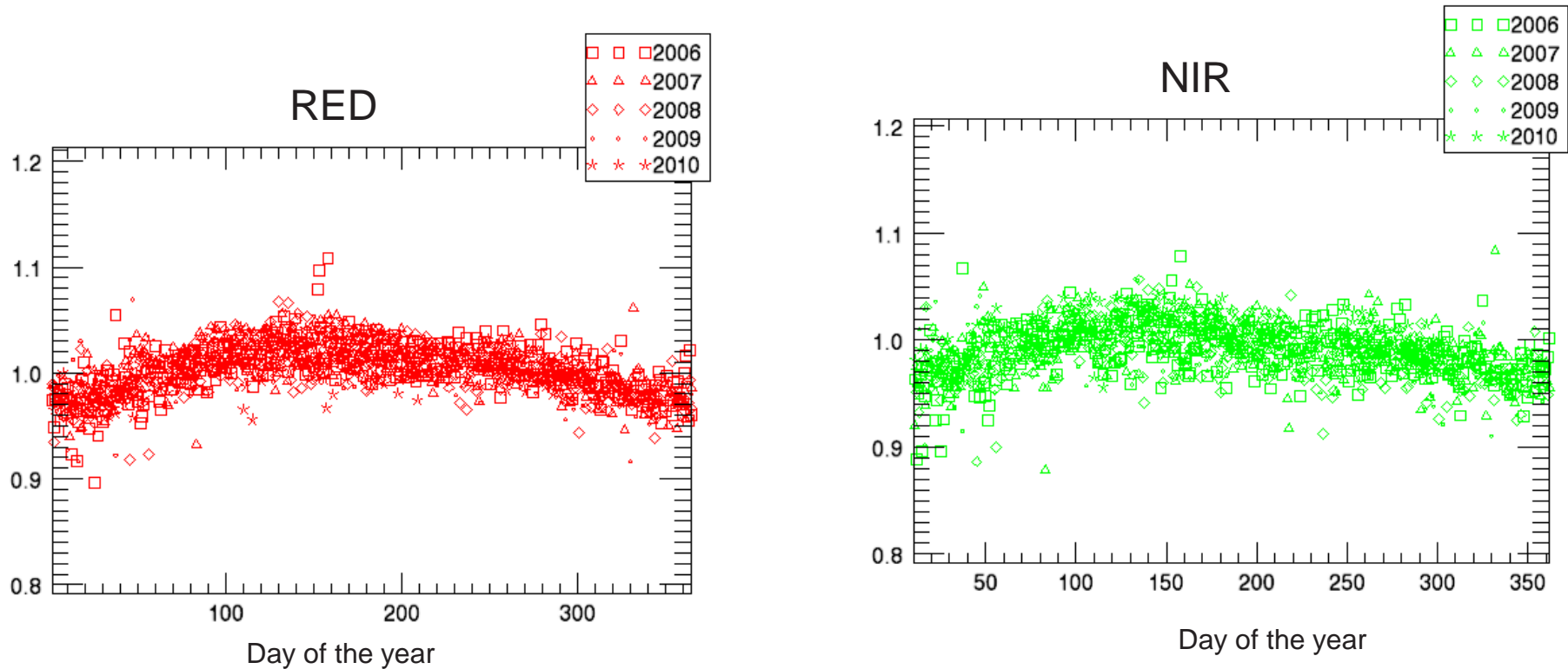
- » Advantages :
 - » Nominal acquisitions
 - » For all bands including SWIR
 - » Absolute, interband and cross-sensor calibration (no simult. acquis. required)
- » Drawbacks
 - » Seasonal effects ?

Calibration over stable deserts

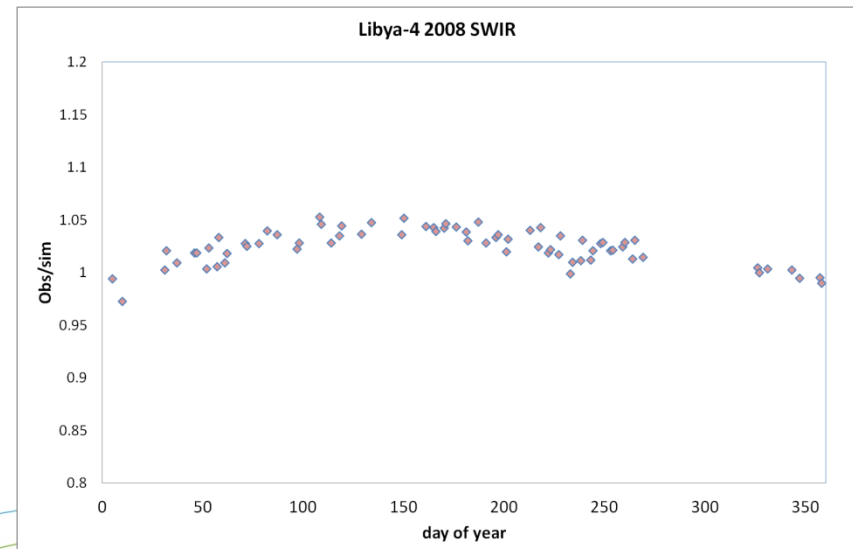
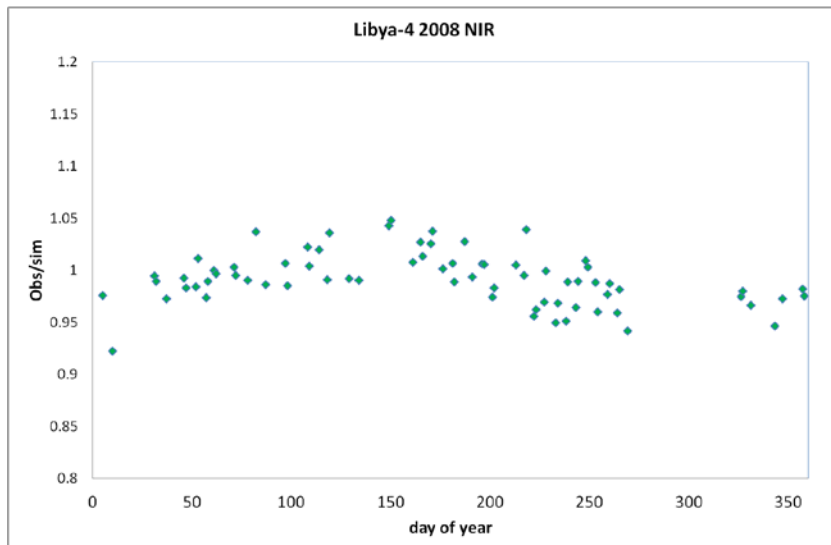
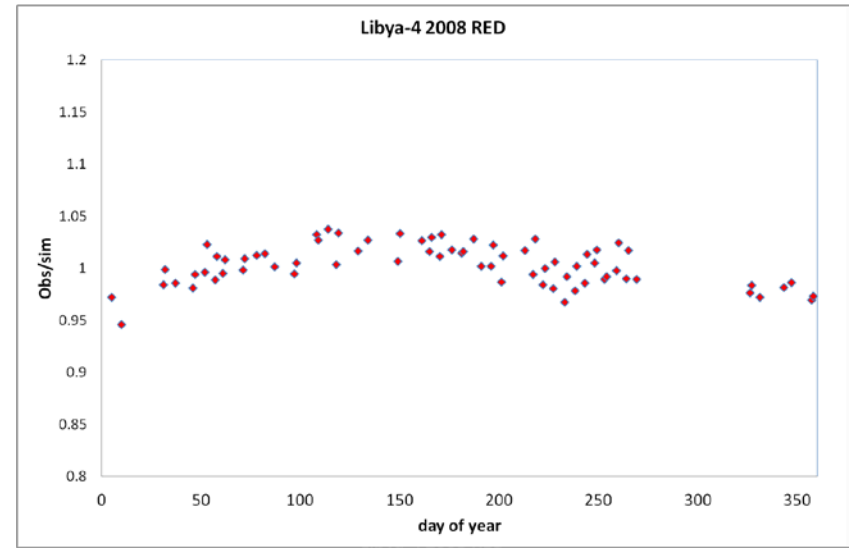
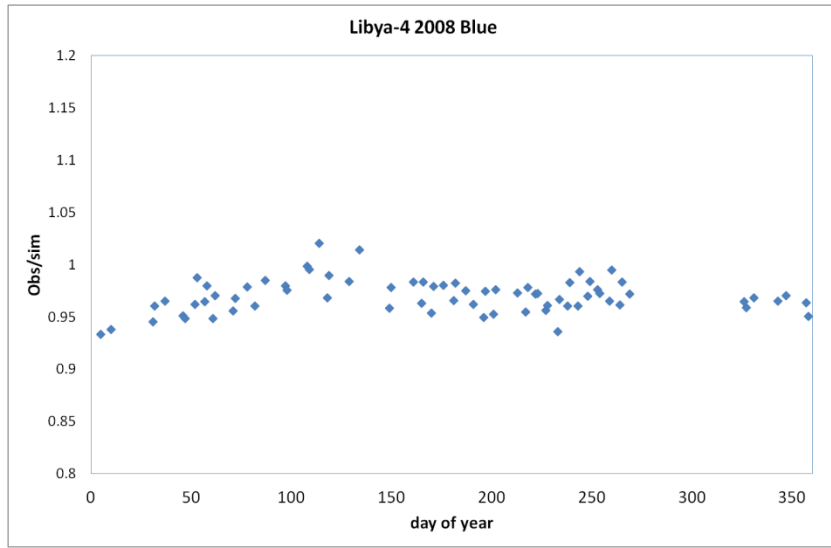


- » **Original** implementation in OSCAR PROBA-V facility:
 - » 6SV RTF simulations using as input
 - » The surface BRDF (RPV model) reflectance characteristics following *Govaerts and Clerici (2004)*
 - » ECMWF (P, O3, H2O)
 - » *Standard 6SV desert aerosol model*
 - » Monthly variable AOT
 - » The terrain altitude

Validation SPOT- VGT : original implementation



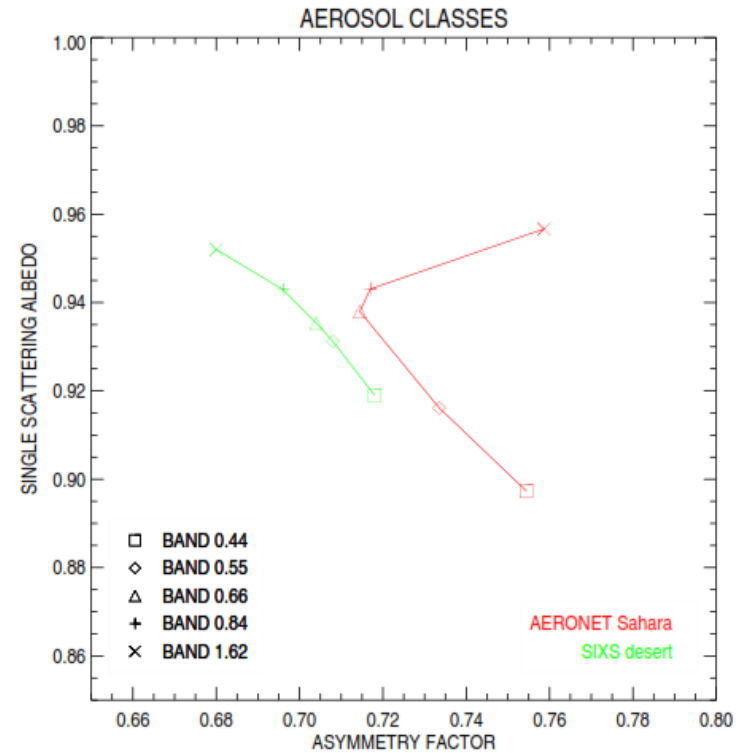
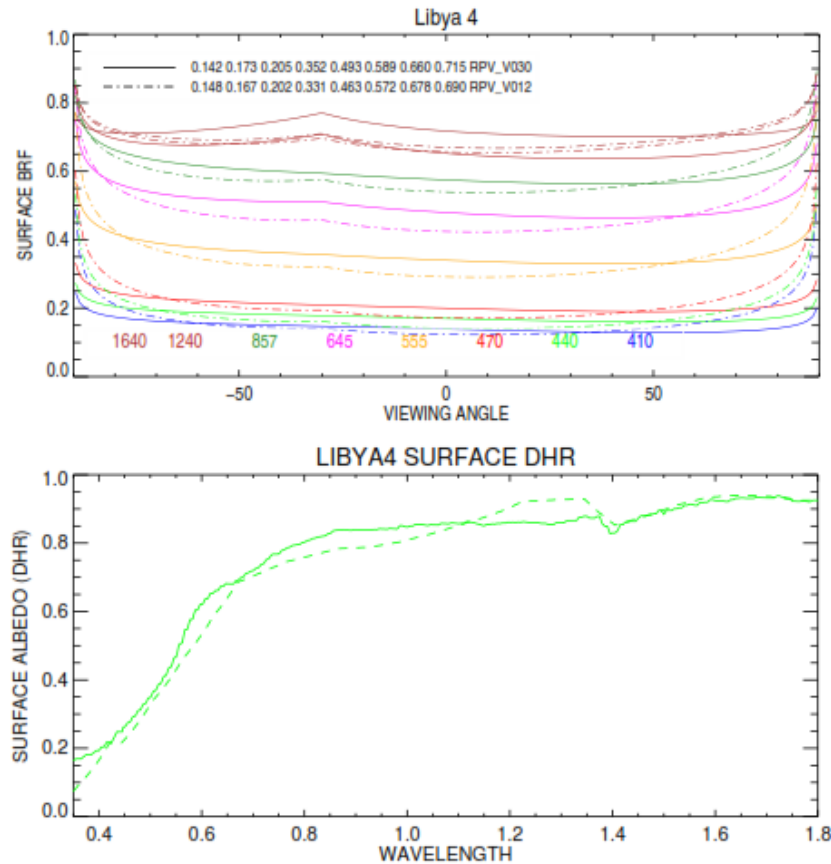
Validation SPOT- VGT : original implementation



Improvements to approach

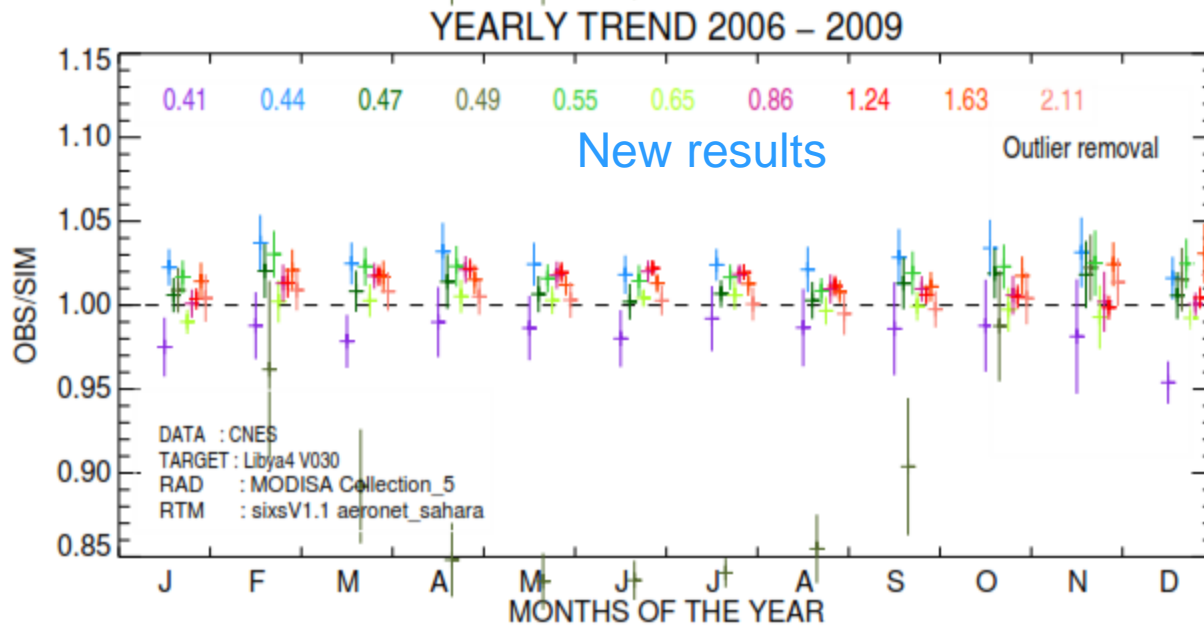
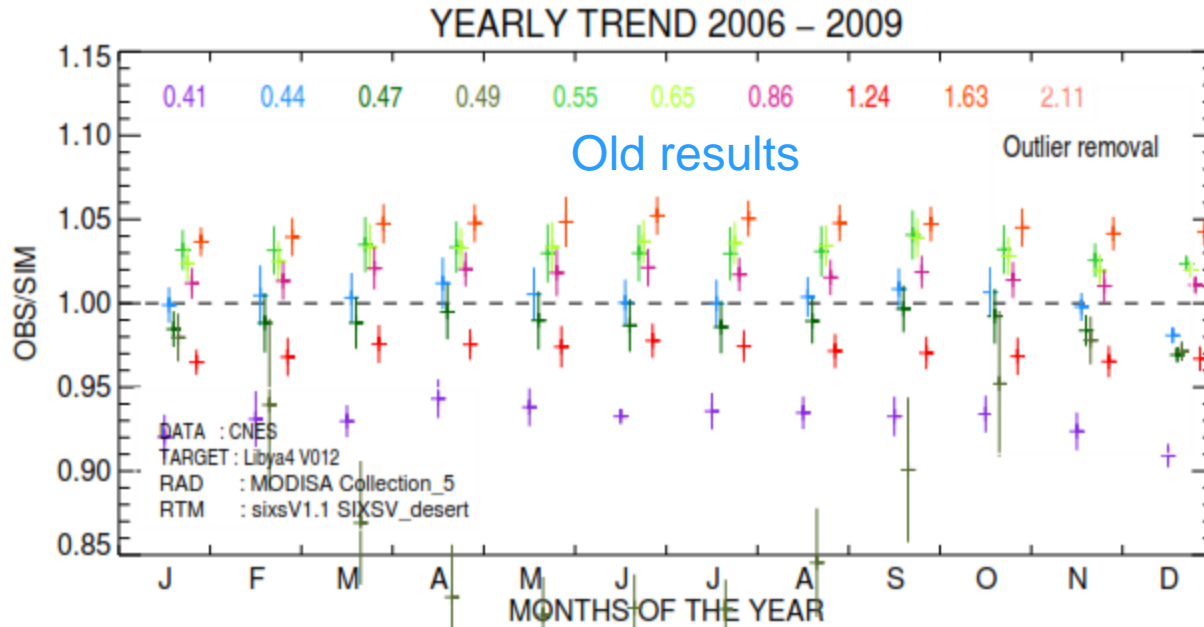
Surface characterisation improvement

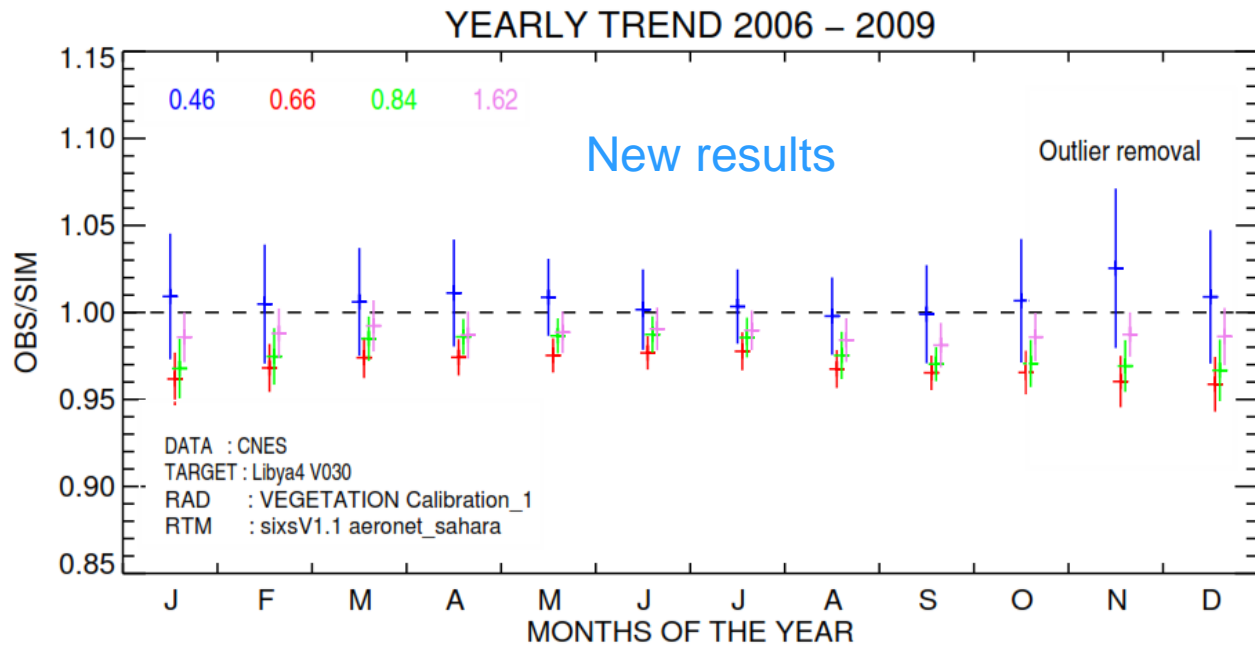
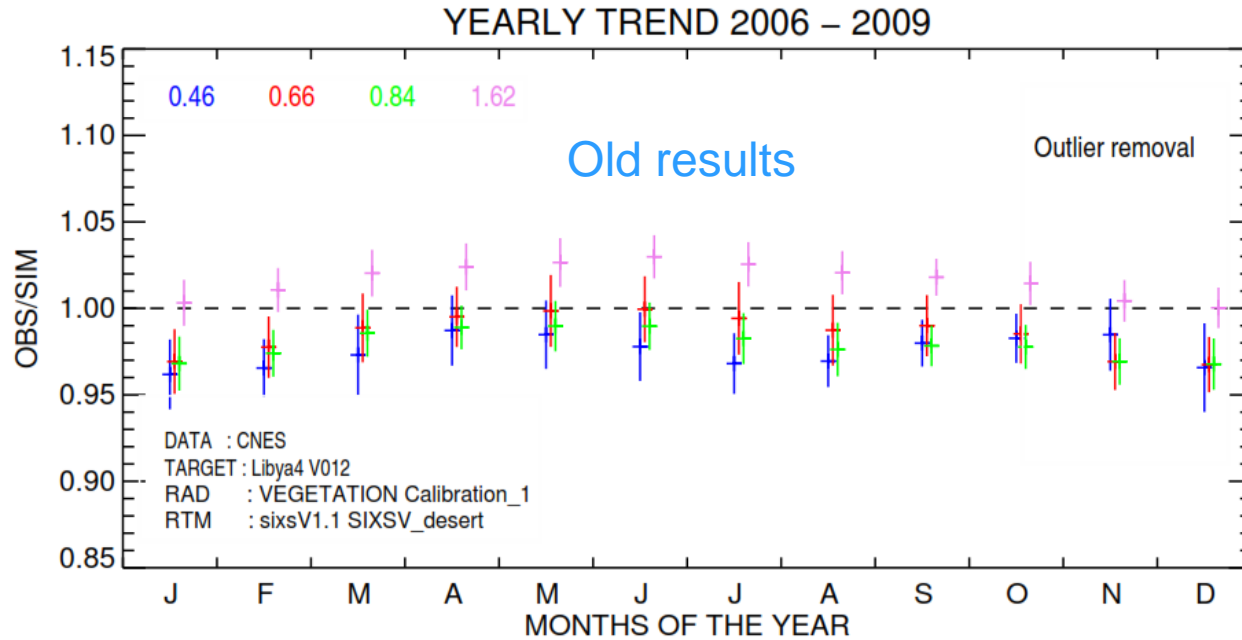
Aerosol characterisation



Govaerts, Y., Sterckx, S., Adriaensen. *Optical sensor calibration using simulated radiances over desert sites. Proceedings IGARSS 2012.*

MODIS-A





Conclusions

- » With OSCAR facility - using combination of different methods-radiometric accuracy requirements achievable
- » But, other factors influencing achievable accuracy:
 - » Straylight
 - » Non-linearity
 - » Instrument radiometric stability
 - » Polarization