



24/06/14

# Performance of Proba-V during its first year in orbit

Sindy Sterckx, Stefan Adriaensen

CEOS WGCV IVOS, June 4 - 6 2014, Pasadena, USA

# The commissioning phase SCHEDULE

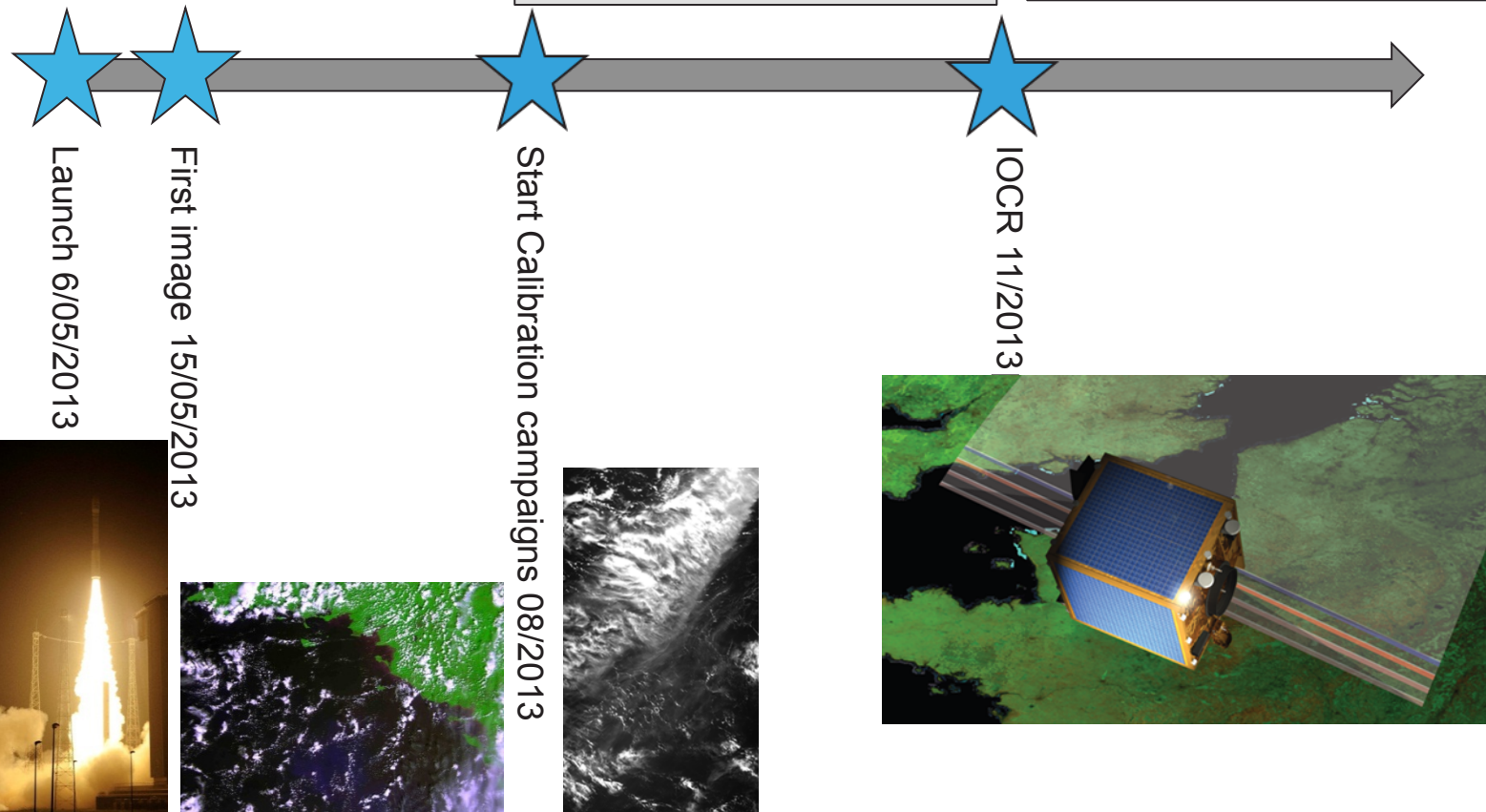
Platform commissioning

Instrument commissioning

User segment commissioning

CAL/VAL commissioning

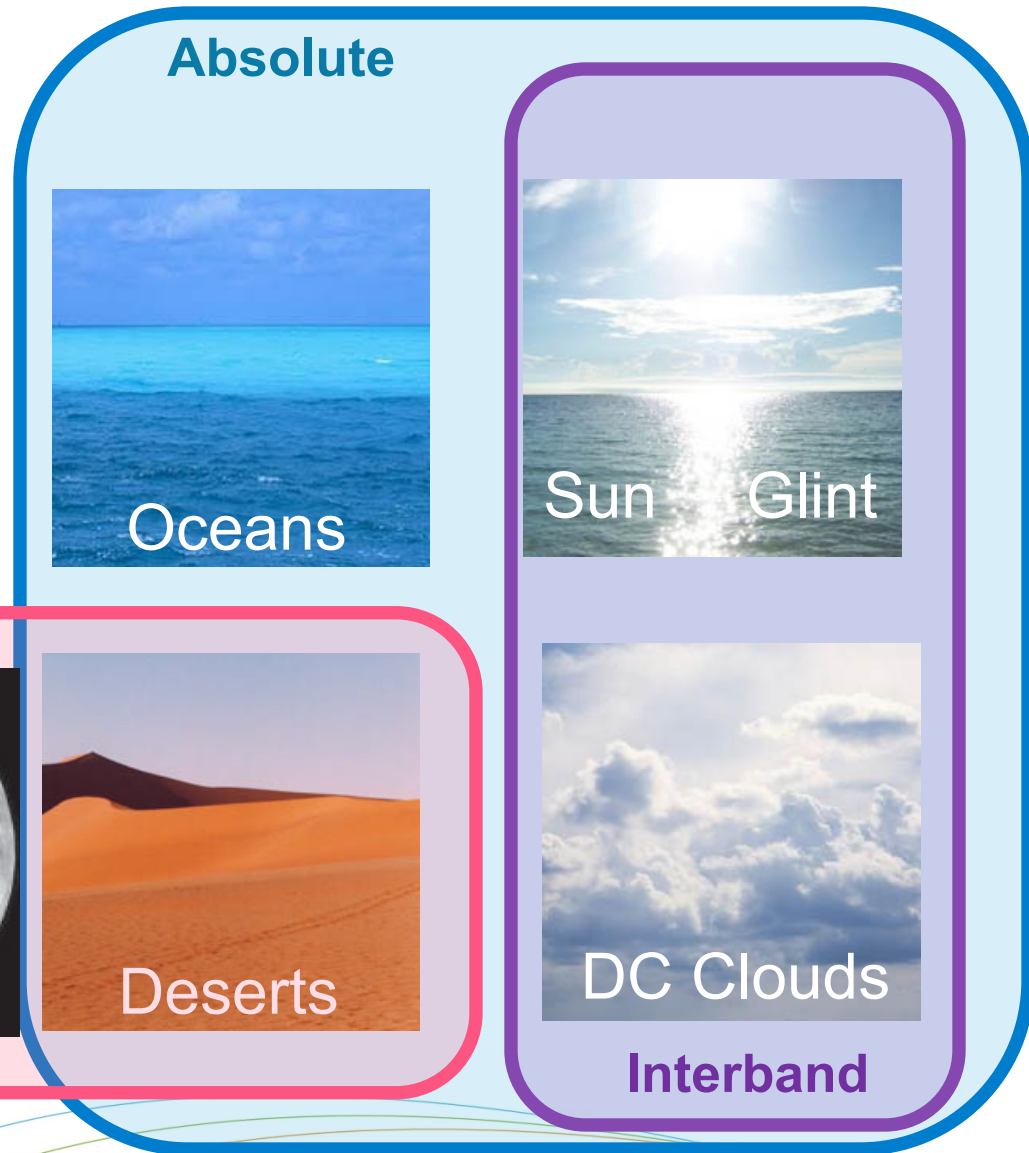
Operational phase



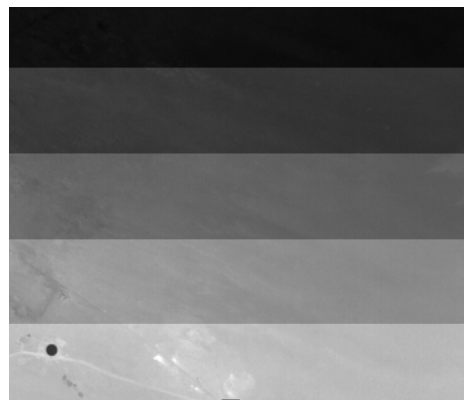
# RC – IQC: Vicarious Calibration Concept

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

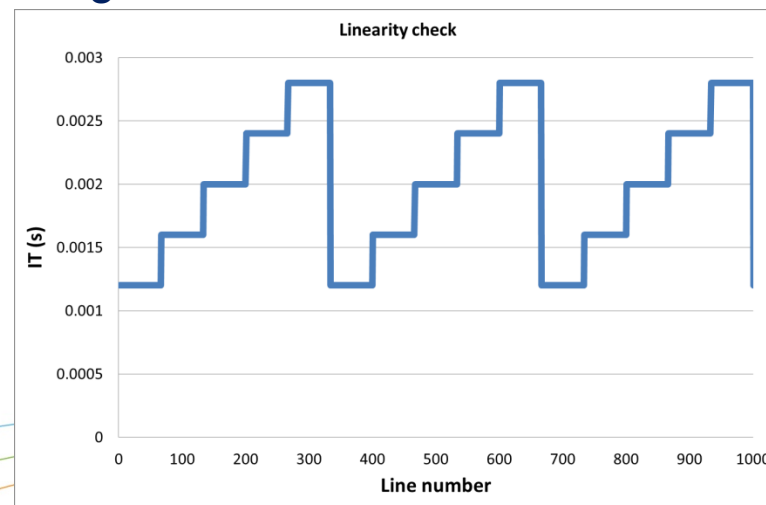
- » Relies on combination of various vicarious calibration methods to reduce uncertainty in the calibration results and to verify the different requirements



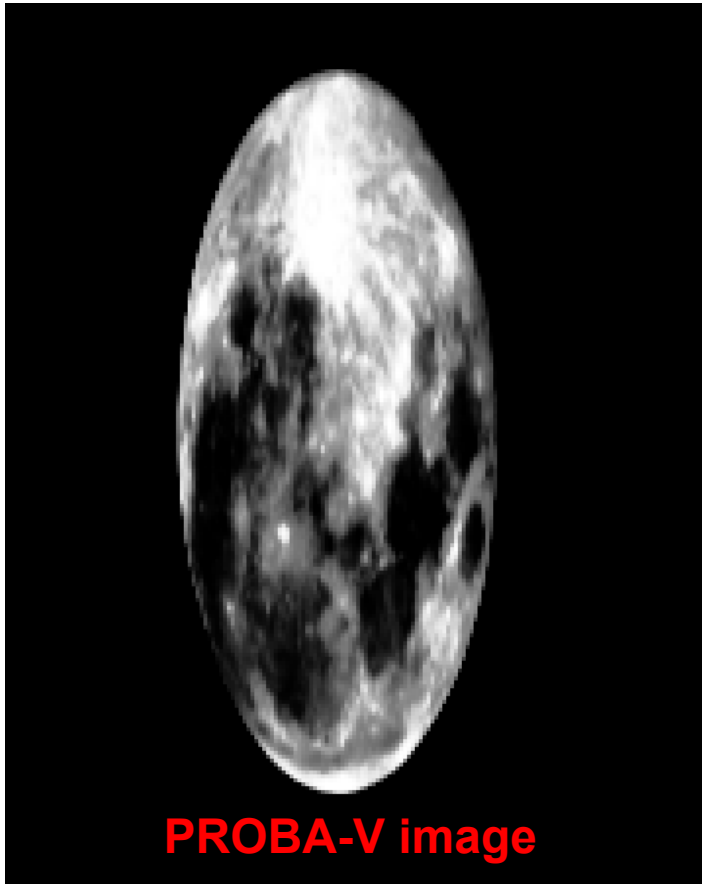
# Experimental calibrations : the linearity check



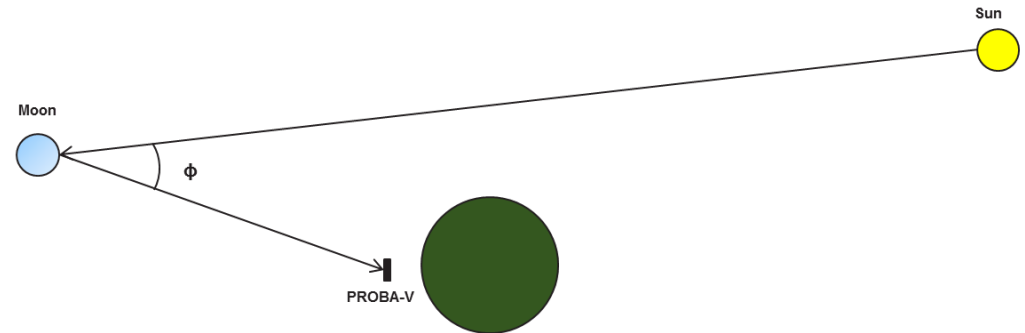
Integration time changes in steps over homogenous areas



# Lunar Calibration



- » Observation of the moon :
  - » Phase angle  $7^\circ \pm 0.5$  degrees (moon - observer - sun angle)
  - » Pitch maneuver : 360 degrees rotation at approx.  $0.2^\circ/\text{s}$
  - » Oversampling of  $\pm 4.0$



# RC- Image Quality Center: HMI

- fully automated image workflows and statistical processing
- View at the database using Graphical User Interface
- Full traceability new instrument calibration parameters updates
- Automated distribution towards PF

The screenshot displays the IQC Calibration Manager HMI interface, which is divided into several sections for managing calibration data and reports.

**Top Section: IQC Calibration Manager**

- Navigation tabs: Results, Reports, Parameters, Requests, Products, Nominal Data Request, Overlap.
- Buttons: Calibrat, Nominal Data Request, Overlap.

**Left Panel: View Calibration**

- start date: 2013-03-19
- type: DE, CA
- Buttons: Initiate new report, Report history.

**Report history**

| Id     | start date          | stop date           | type |
|--------|---------------------|---------------------|------|
| 137192 | 2012-08-01 00:00:00 | 2012-08-01 00:00:00 | All  |
| 557    | 2010-07-01 00:00:00 | 2010-07-01 00:00:00 |      |
| 137195 | 2010-07-01 00:00:00 | 2010-07-01 00:00:00 |      |
| 273829 | 2010-07-01 00:00:00 | 2010-07-01 00:00:00 |      |

**Absolute**

| Strip     | Results    | ICP | %          |
|-----------|------------|-----|------------|
| 2013-SWR1 | 0.99401451 | 10  | -906.02153 |
| 2013-SWR3 | 0.99457314 | 10  | -905.45647 |
| 2013-SWR2 | 0.99653605 | 10  | -903.47599 |
| 2013-NIR  | 0.99524079 | 10  | -904.78196 |
| 2013-BLUE | 0.99383635 | 10  | -906.20187 |
| 2013-RED  | 0.99867459 | 10  | -901.32717 |

**DarkCurrent**

| Strip     | Results    |
|-----------|------------|
| 2013-SWR1 | 0.99401451 |
| 2013-SWR3 | 0.99457314 |
| 2013-SWR2 | 0.99653605 |
| 2013-NIR  | 0.99524079 |
| 2013-BLUE | 0.99383635 |
| 2013-RED  | 0.99867459 |

**Report Details**

**summary**

status: closed  
start date: 08/01/2012

**camera results :**

| Strip | Results    | ICP | %             |
|-------|------------|-----|---------------|
| SWR1  | 0.99401451 | 10  | -906.02153018 |
| SWR3  | 0.99457314 | 10  | -905.45647496 |
| SWR2  | 0.99653605 | 10  | -903.47599145 |
| NIR   | 0.99524079 | 10  | -904.78196583 |
| BLUE  | 0.99383635 | 10  | -906.20187354 |
| RED   | 0.99867459 | 10  | -901.32717323 |

**strip results**

☐ Update BLUE ☐ Update RED ☐ Update NIR

| Method   | Result     | Stdev    | Window[days] | Count |
|----------|------------|----------|--------------|-------|
| CLOUD    | 0.99265... | 24561... | 8            | 9     |
| RAYLEIGH | 0.99469... | 24561... | 8            | 9     |
| SUNGLINT | 0.99488... | 24561... | 8            | 9     |
| DESERT   | 0.99290... | 24561... | 8            | 9     |

☐ Update SWR1 ☐ Update SWR2 ☐ Update SWR3

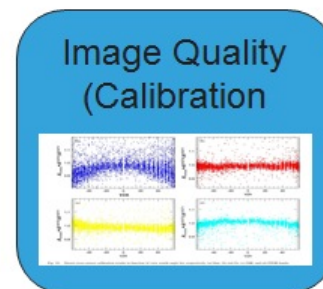
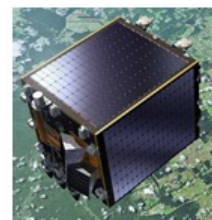
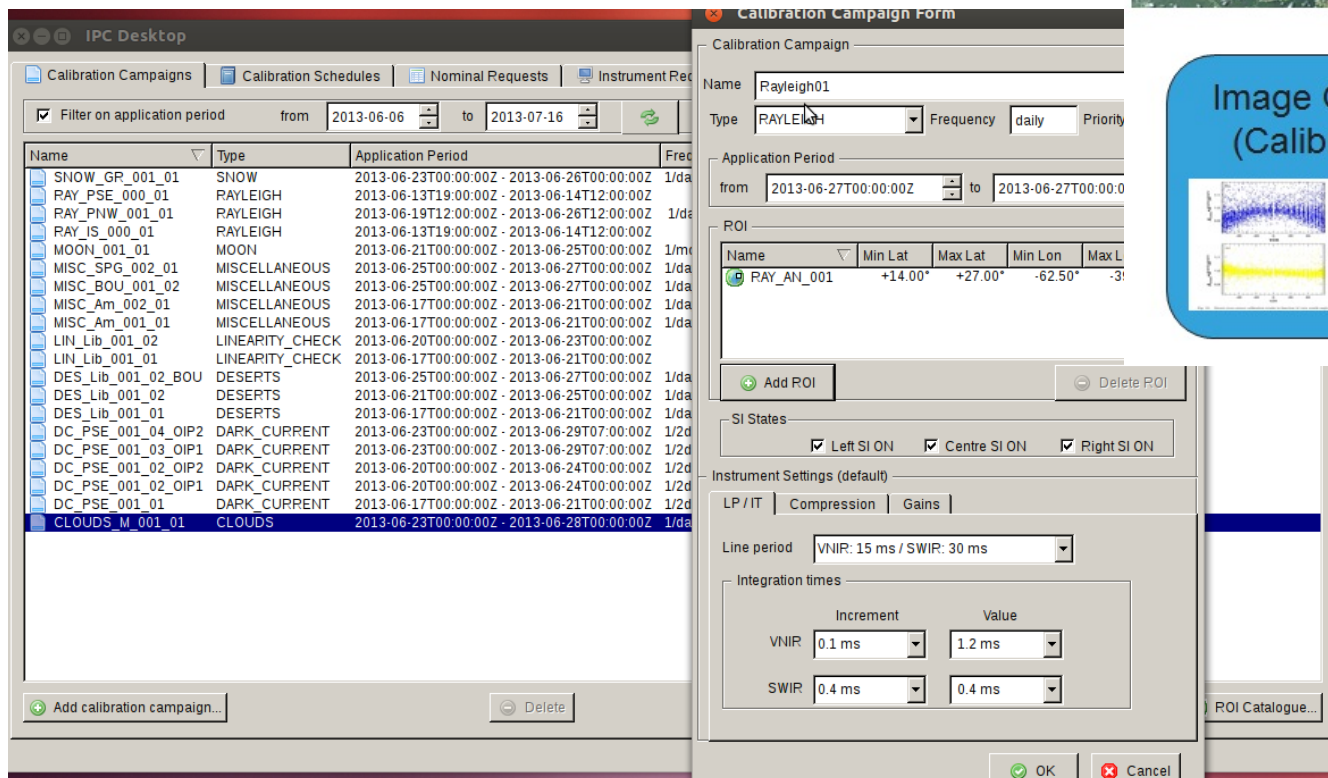
| Method   | Result     | Stdev    | Window[days] | Count |
|----------|------------|----------|--------------|-------|
| SUNGLINT | 0.99897... | 24561... | 8            | 9     |
| DESERT   | 0.99815... | 24561... | 8            | 9     |

**Bottom Section: Data Table**

| Series  | Method | Result              | Stdev      | Window[days] | Count      |
|---------|--------|---------------------|------------|--------------|------------|
| Series1 | CLOUD  | 2012-08-07 00:07:11 | 0.99901317 | 0.00643951   | 0.00912279 |
| Series1 | CLOUD  | 2012-08-08 00:07:11 | 0.99961125 | 0.00904738   | 0.00448404 |

# Instrument Programming Center (IPC)

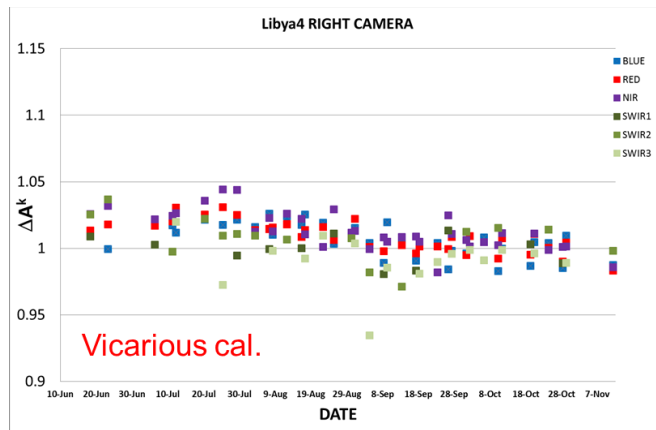
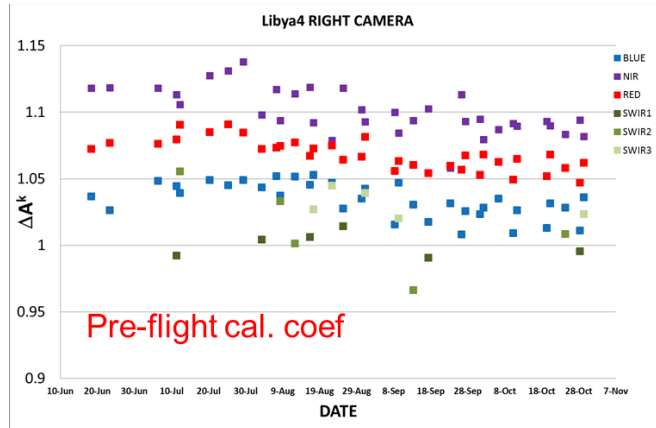
- Communication with Mission Control Center (MCC) for acquisitions
  - with specific instrument settings
  - over non-nominal sites
  - with maneuvers



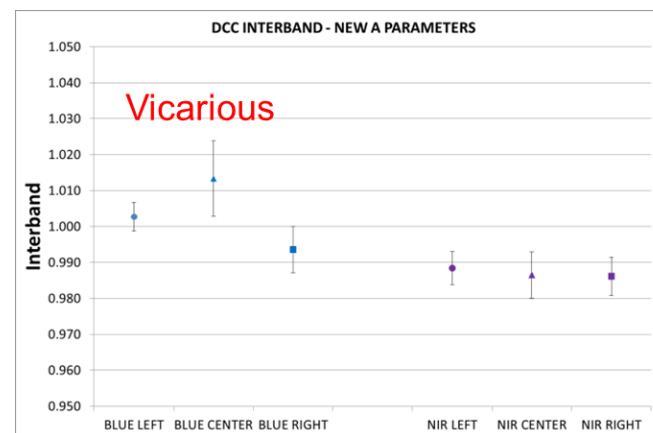
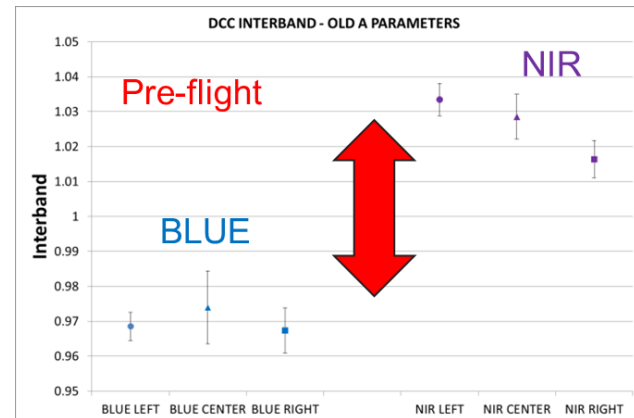
# COMMISSIONING

# Absolute calibration coefficient

## Assessment absolute calibration

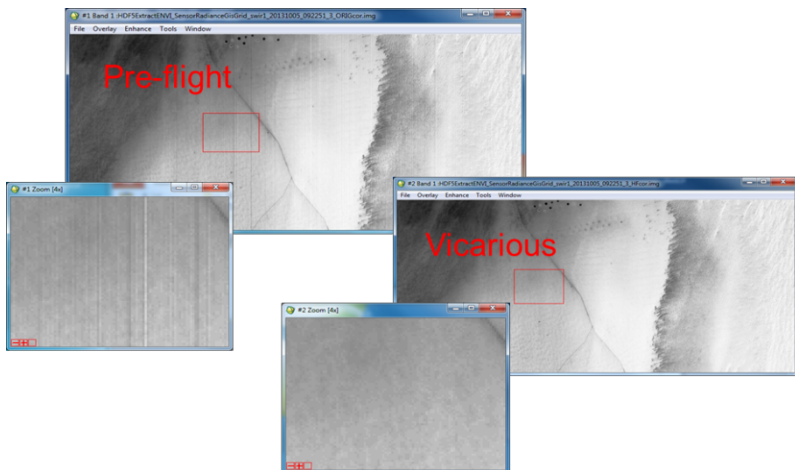


## Assessment interband calibration



## Equalisation

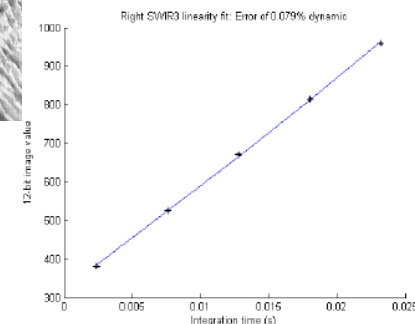
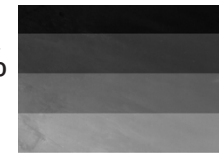
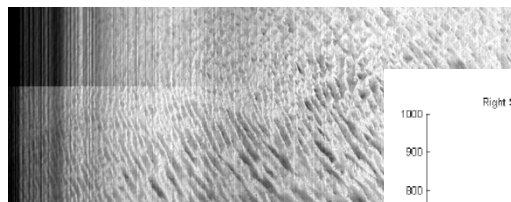
- Reduction of SWIR stripes



- A few bad SWIR pixels identified + some marked as suspect

## Non-linearity

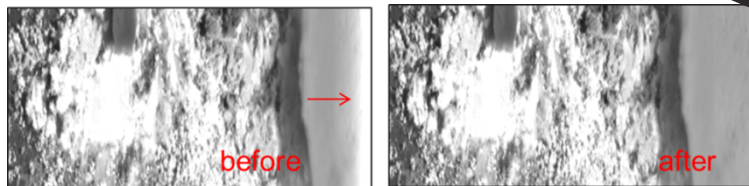
- SWIR detector non linearity for DN > 3300 => IT reduced
- Observed linearity VNIR below 1 %
- Observed linearity SWIR below 0.4 %



## Dark current

- Monitoring of stability
- Identification bad & suspect pixels

## Vignetting



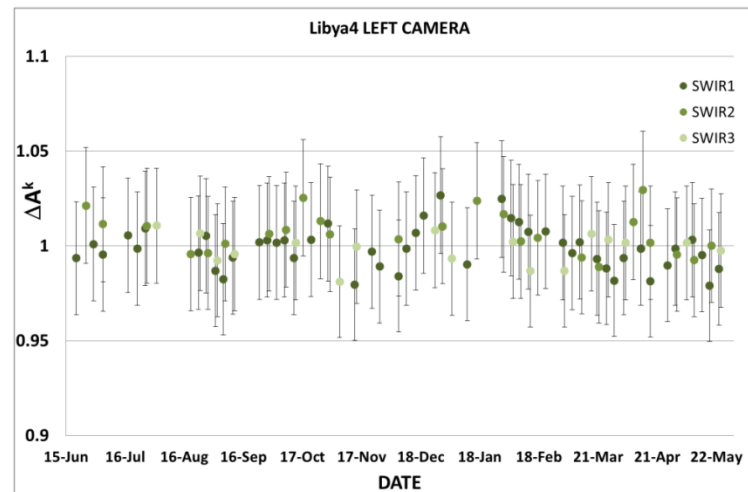
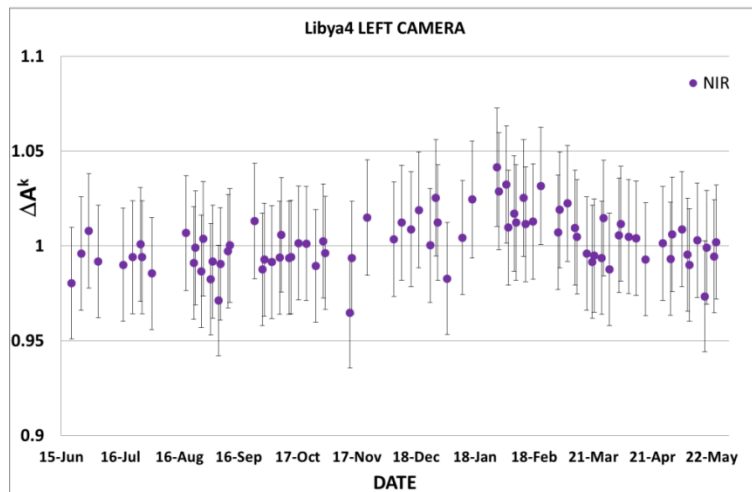
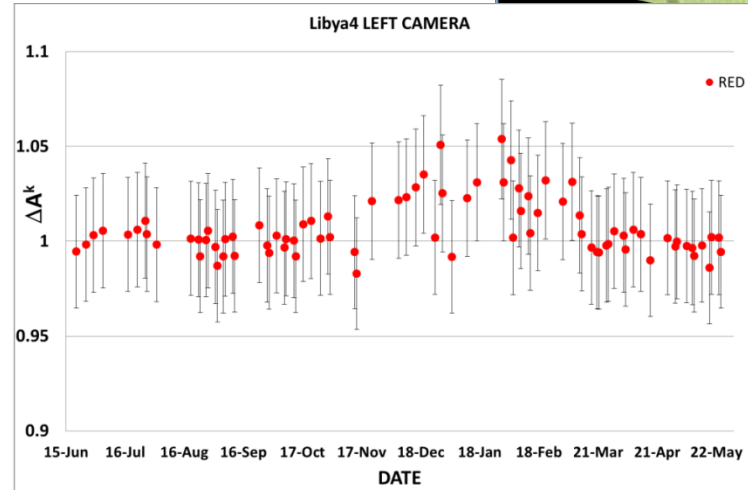
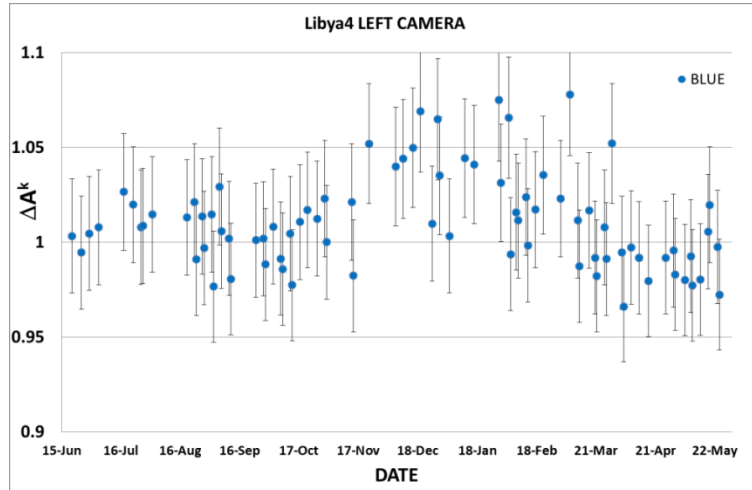
## List of bad pixels

List of 10 SWIR  
bad pixels

| CAMERA | STRIP | BAD (commis) |
|--------|-------|--------------|
| LEFT   | SWIR1 | 352          |
| LEFT   | SWIR2 | 711,863      |
| LEFT   | SWIR3 | 438,759      |
| CENTER | SWIR1 | 1021         |
| CENTER | SWIR2 | 769          |
| CENTER | SWIR3 | 890          |
| RIGHT  | SWIR1 |              |
| RIGHT  | SWIR2 | 14,438       |
| RIGHT  | SWIR3 |              |

# LATEST STATUS

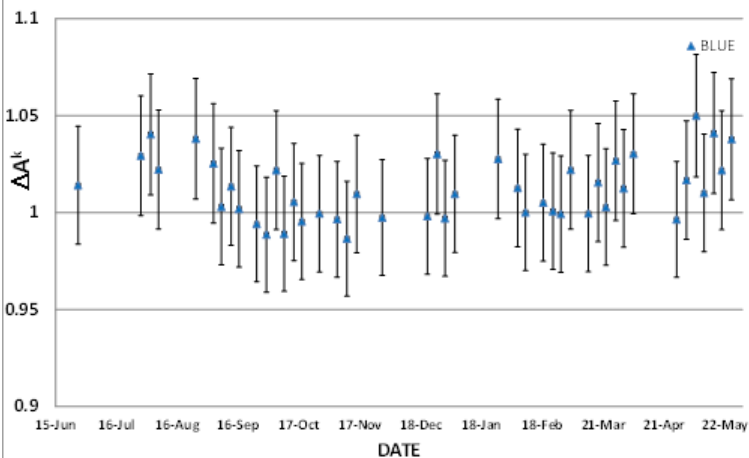
# Oscar Libya-4 calibration - LEFT



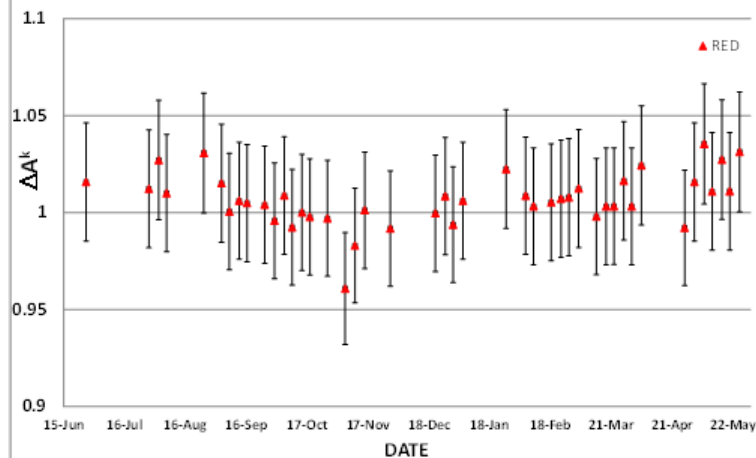
# Oscar Libya-4 calibration - CENTER



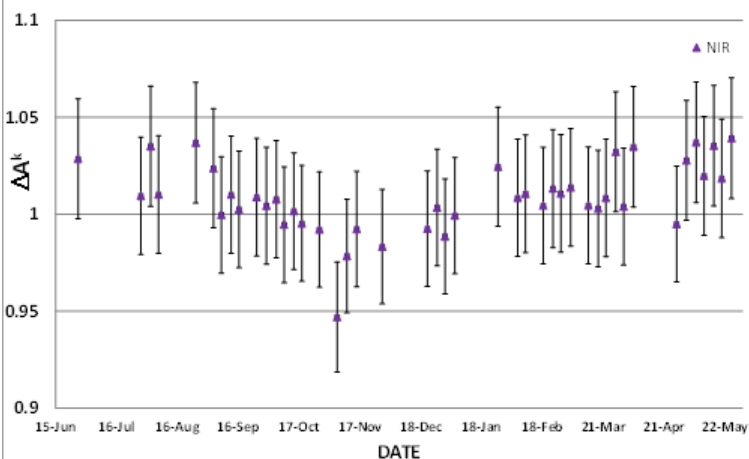
Libya4 CENTER CAMERA



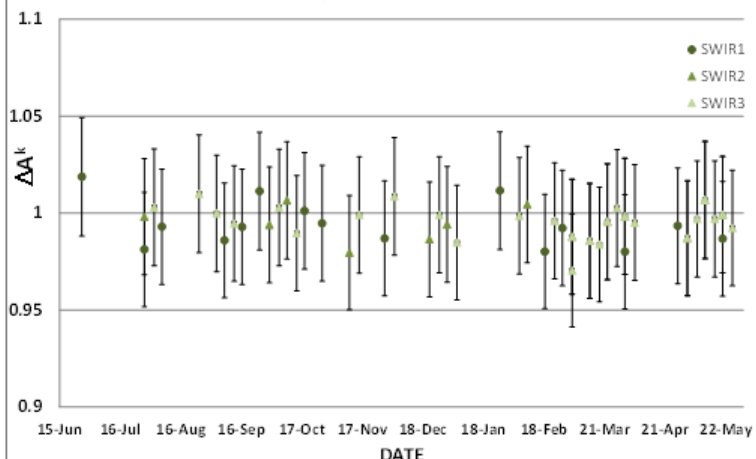
Libya4 CENTER CAMERA



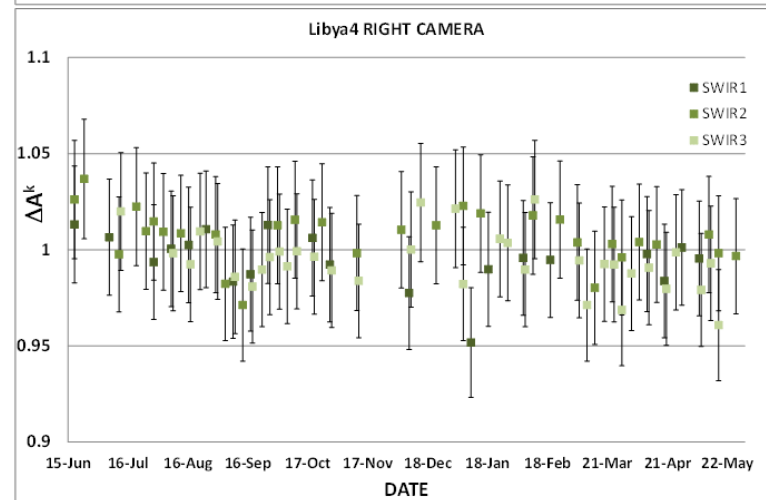
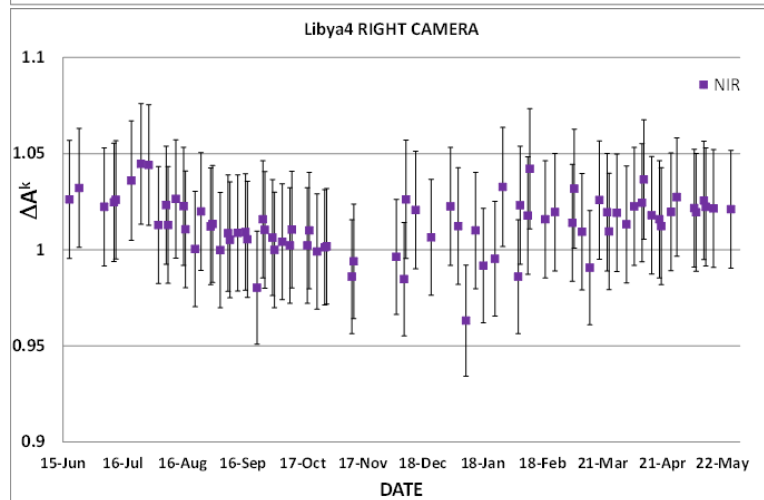
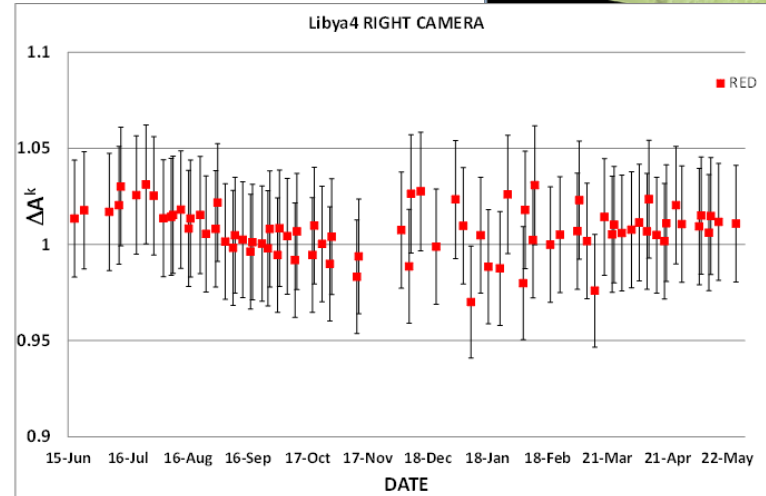
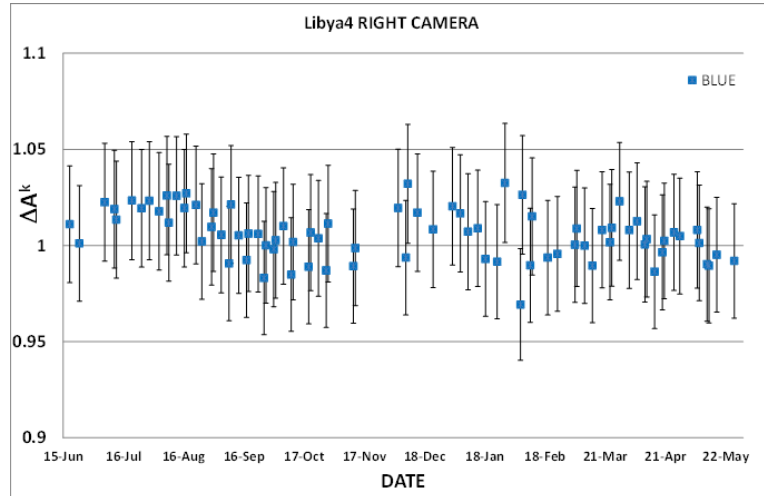
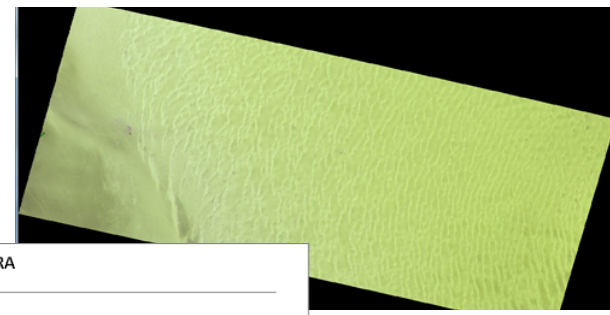
Libya4 CENTER CAMERA

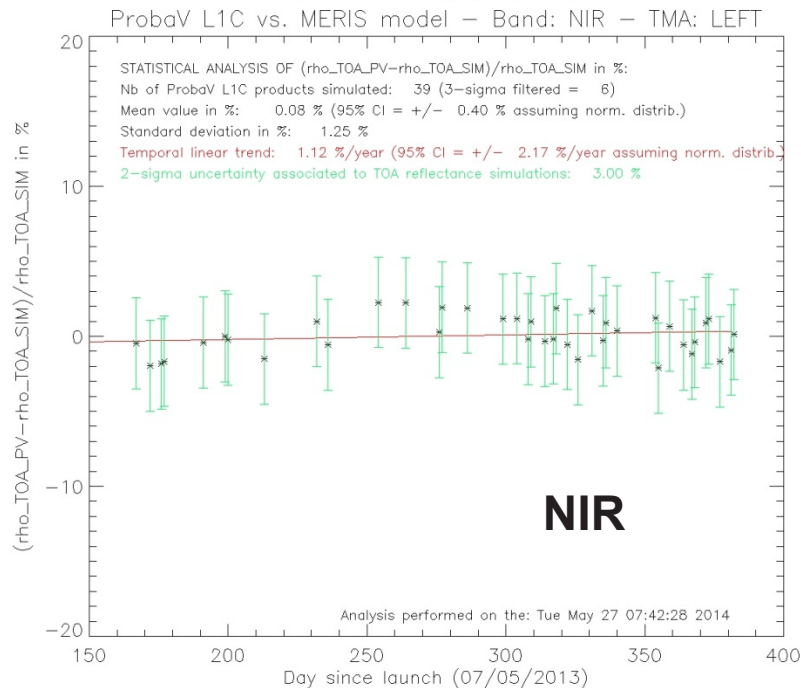
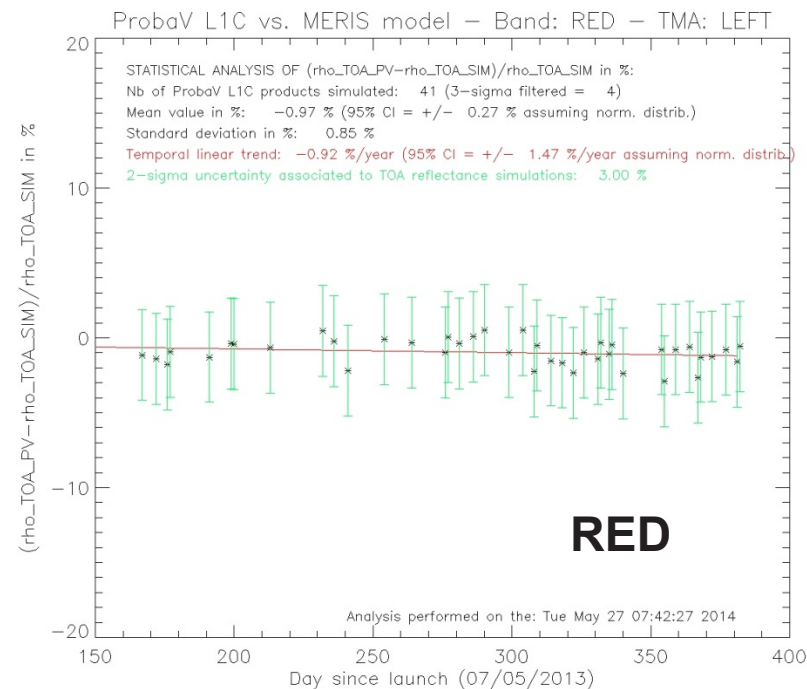
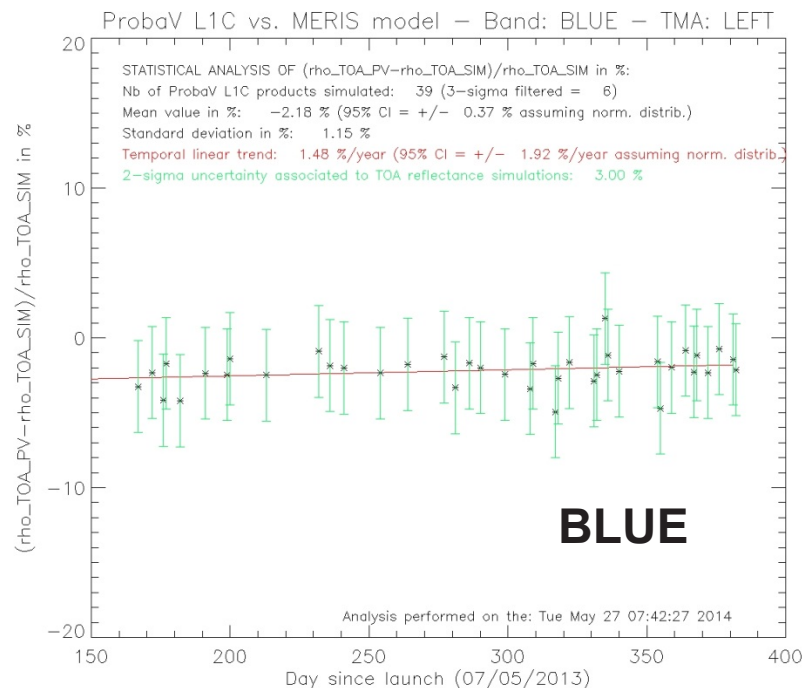


Libya4 CENTER CAMERA



# Oscar Libya-4 calibration - RIGHT





**Libya-4 - LEFT**

**PROBA-V vs MERIS 3rd repr.**

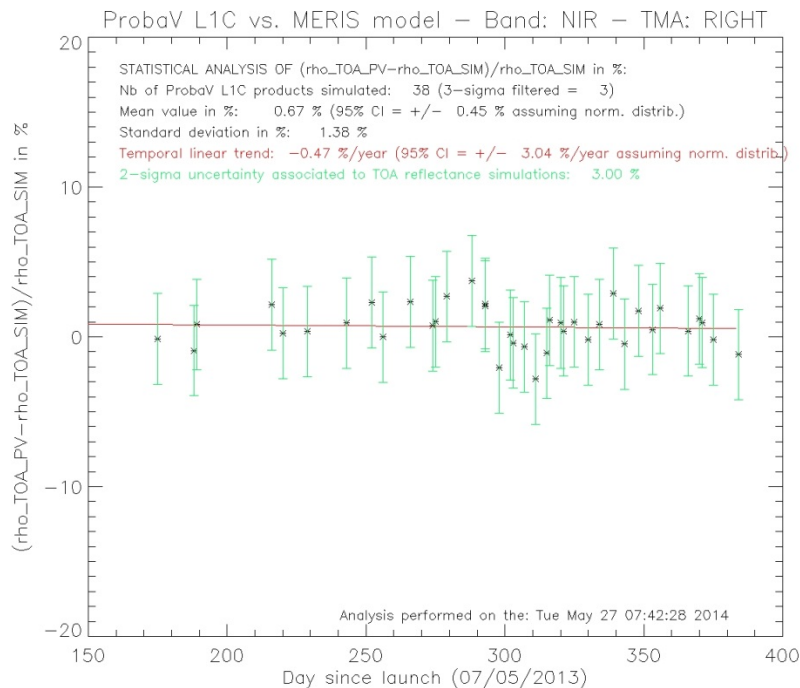
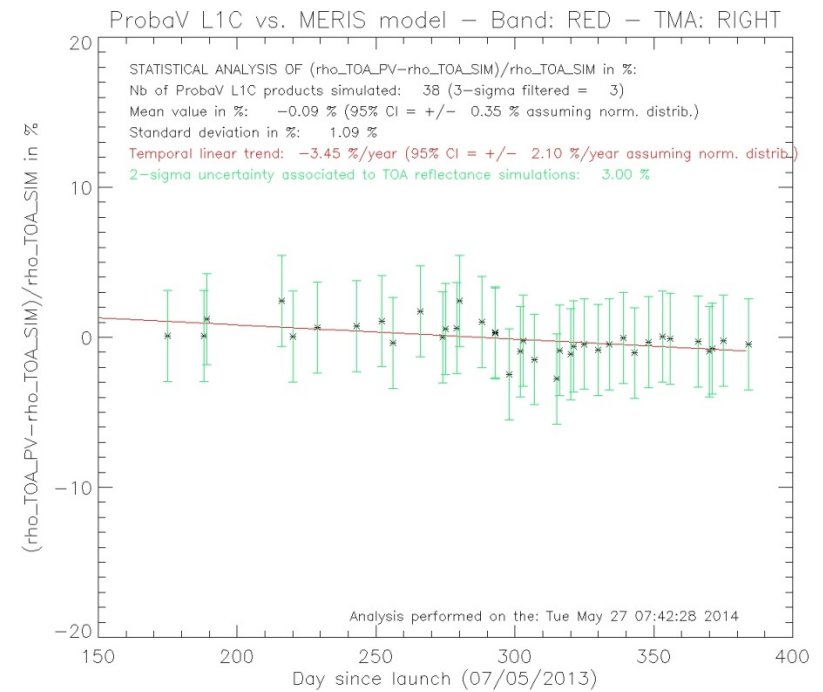
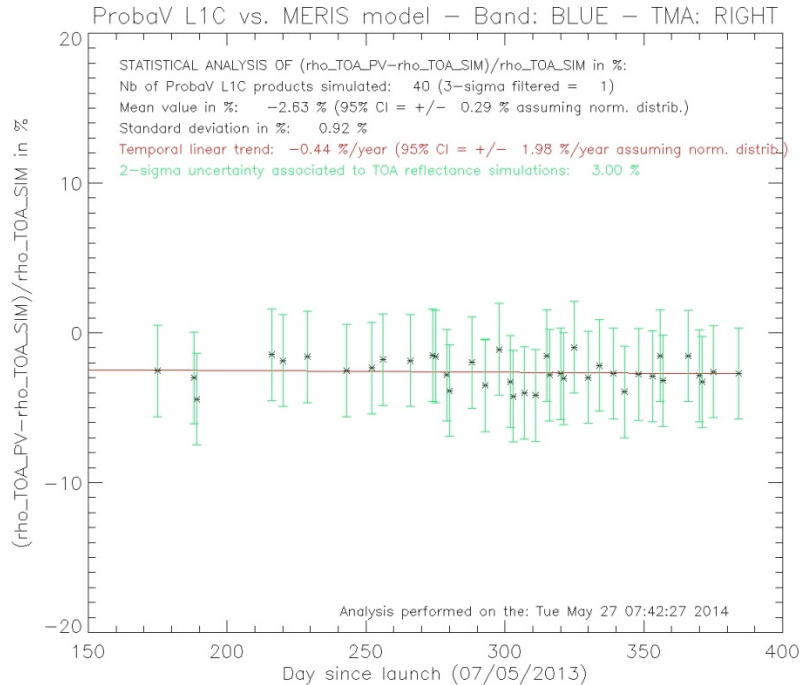
**Bouvet M., RSE,140, 2014.**



24/06/14

© 2014, VITO NV

15



**Libya-4 - RIGHT**

**PROBA-V vs MERIS 3rd repr.**

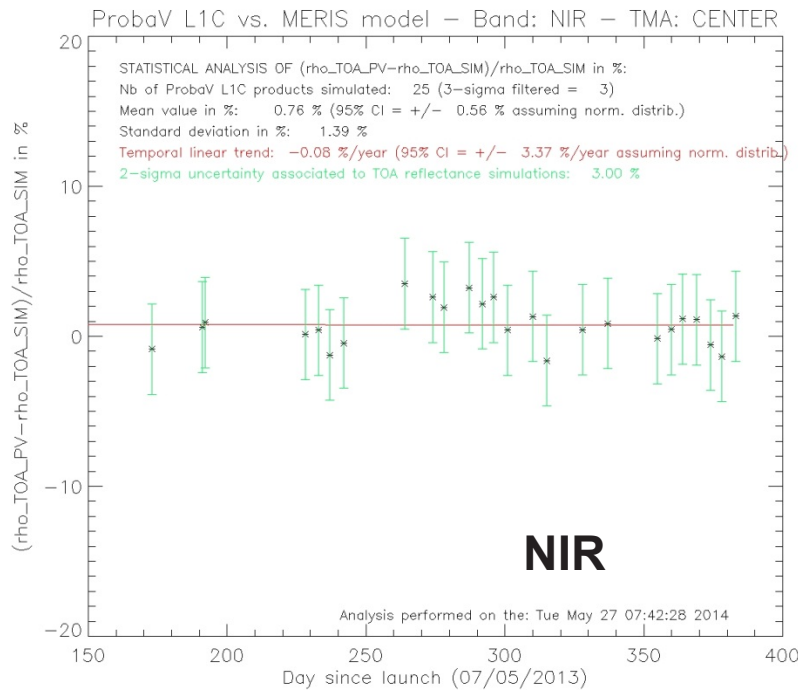
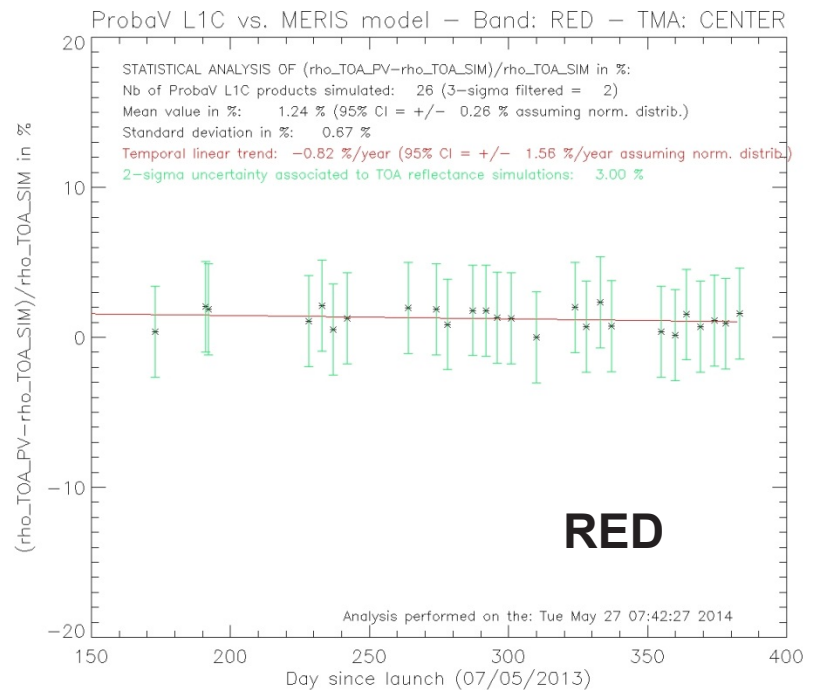
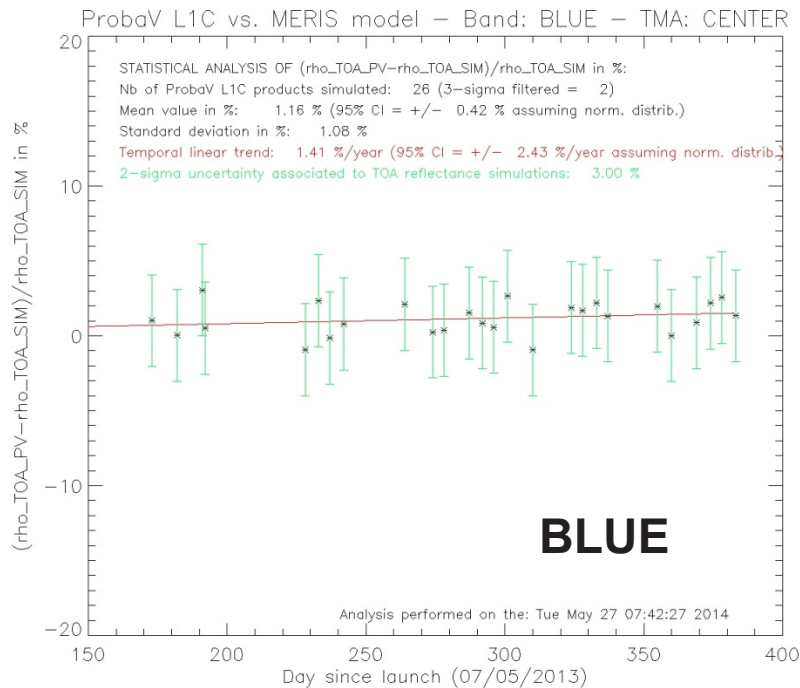
**BOUVET M., RSE,140, 2014.**



24/06/14

© 2014, VITO NV

16



**Libya-4 - CENTER**

**PROBA-V vs MERIS 3rd repr.**

**BOUVET M., RSE,140, 2014.**

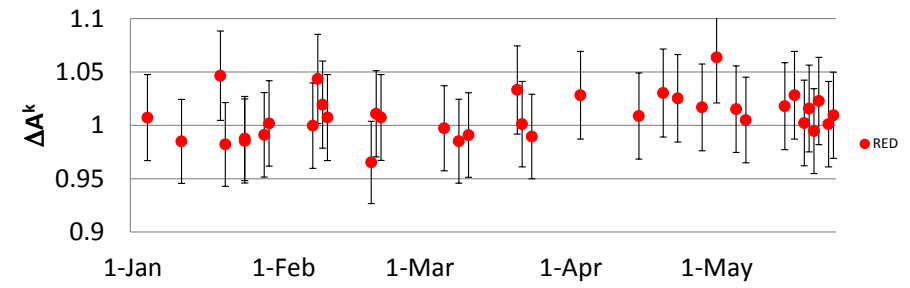
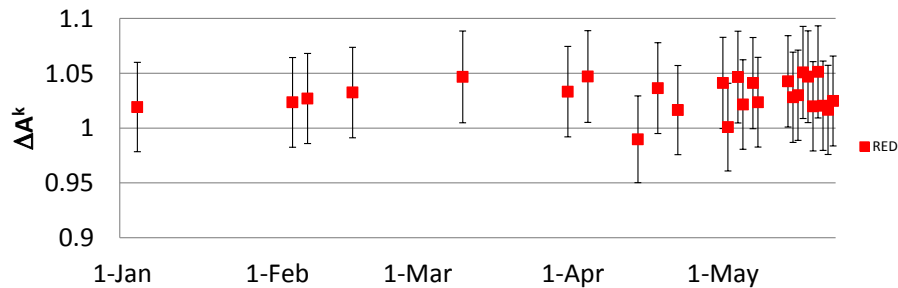
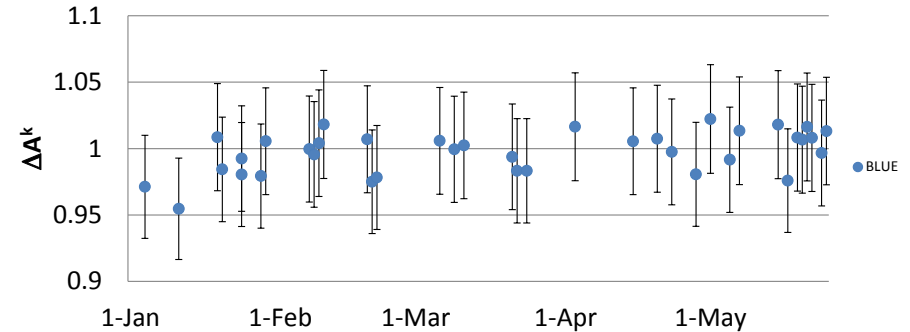
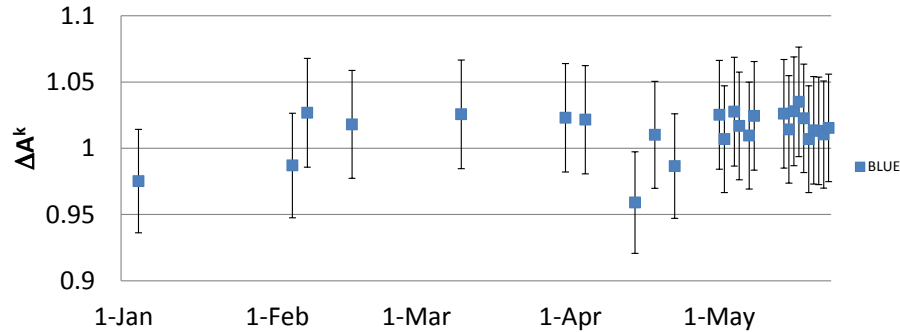


24/06/14

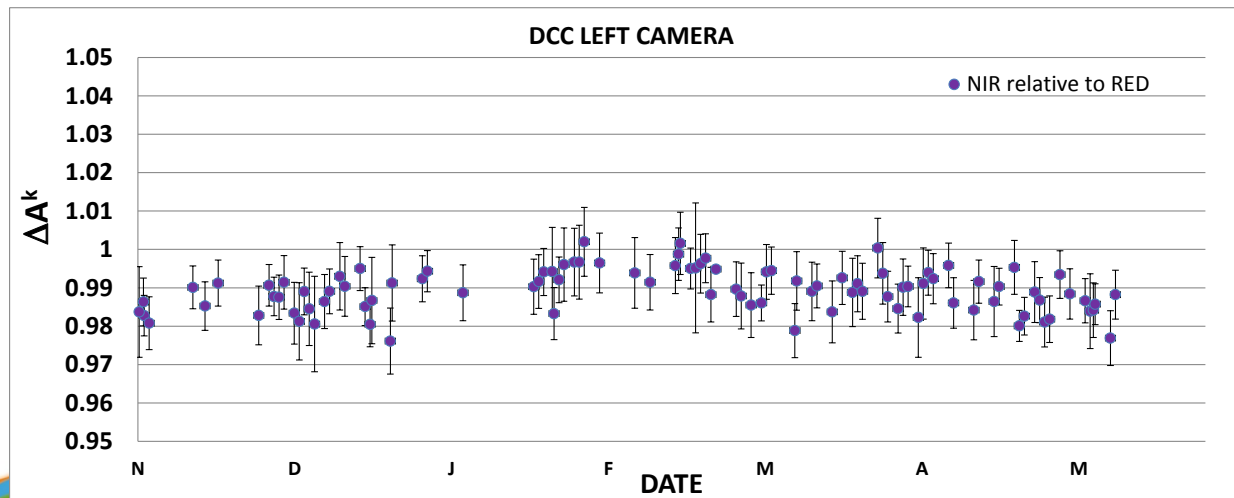
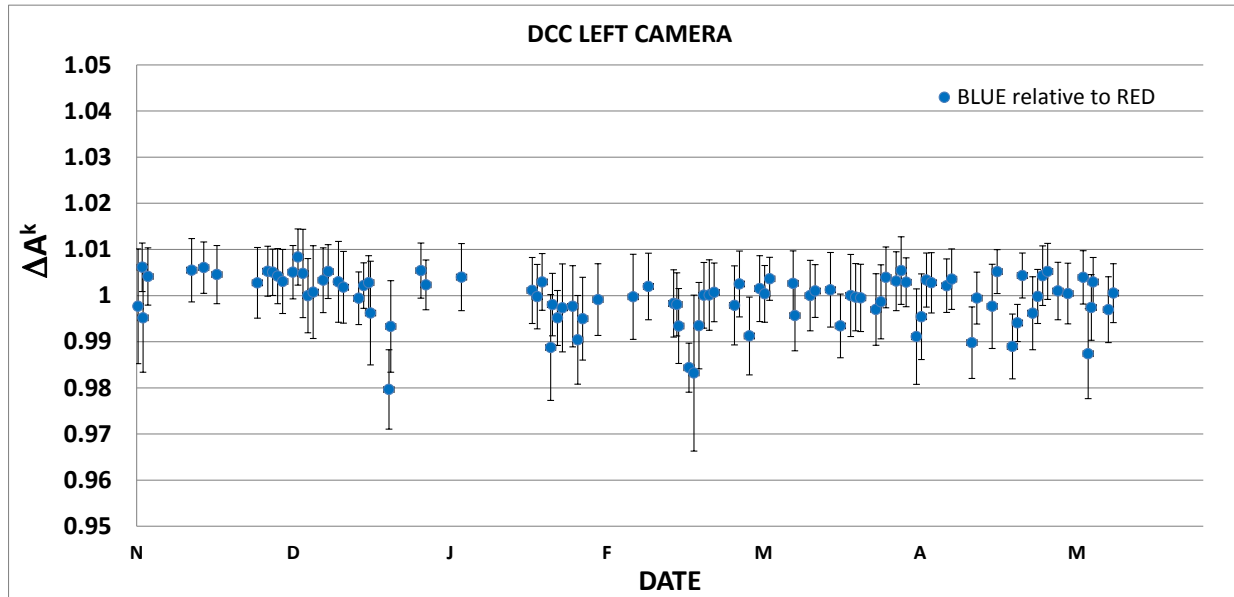
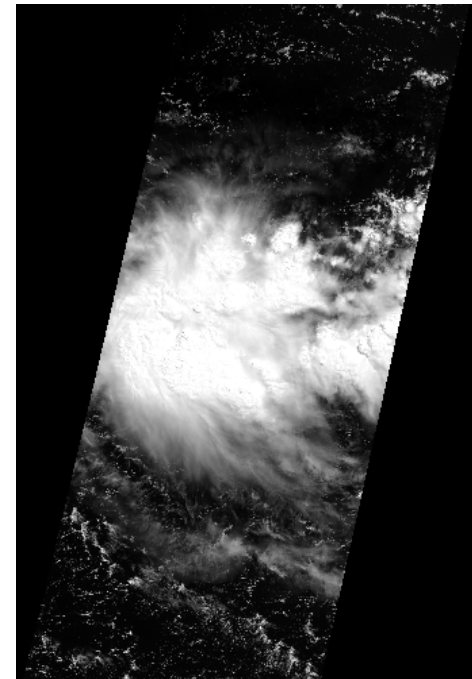
© 2014, VITO NV

17

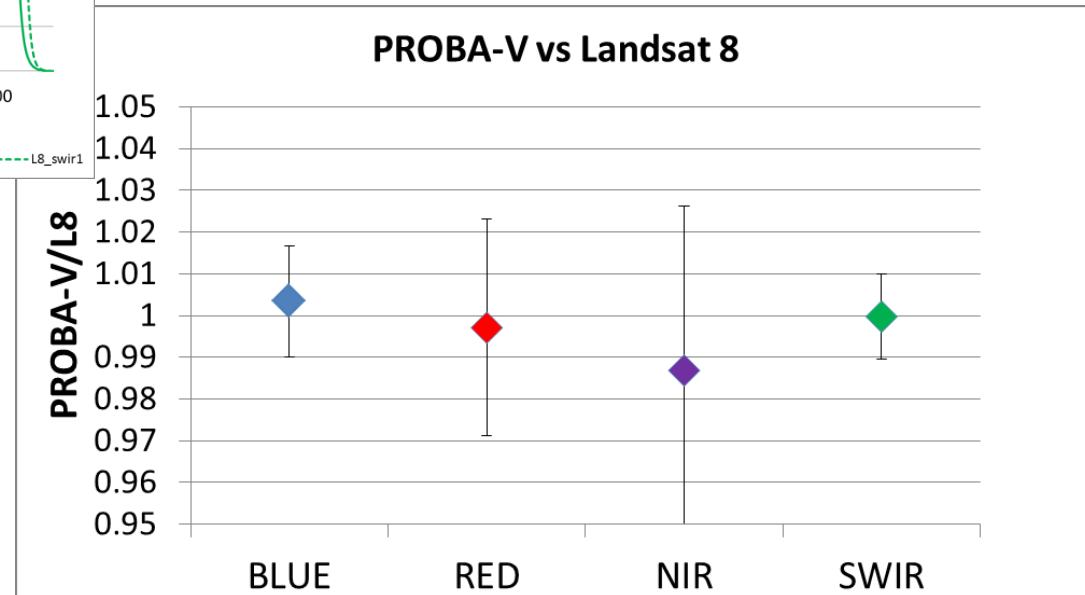
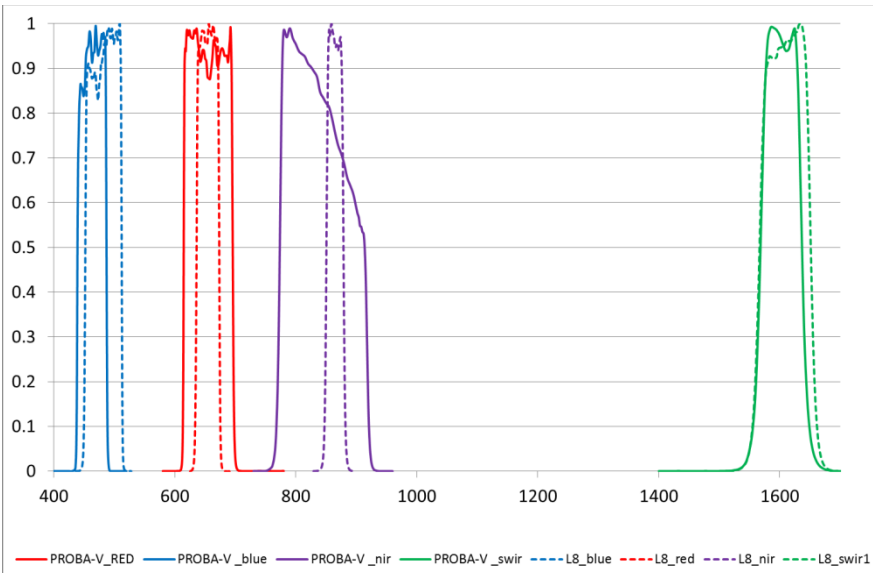
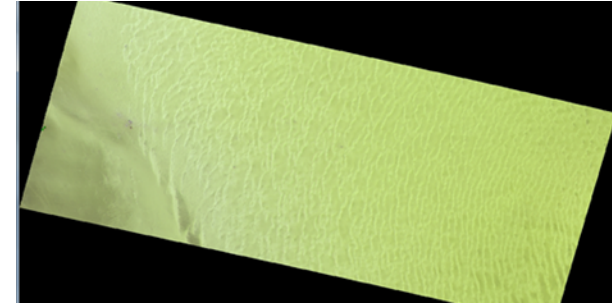
# RAYLEIGH



# DCC Inter-band



# Proba-V versus Landsat8



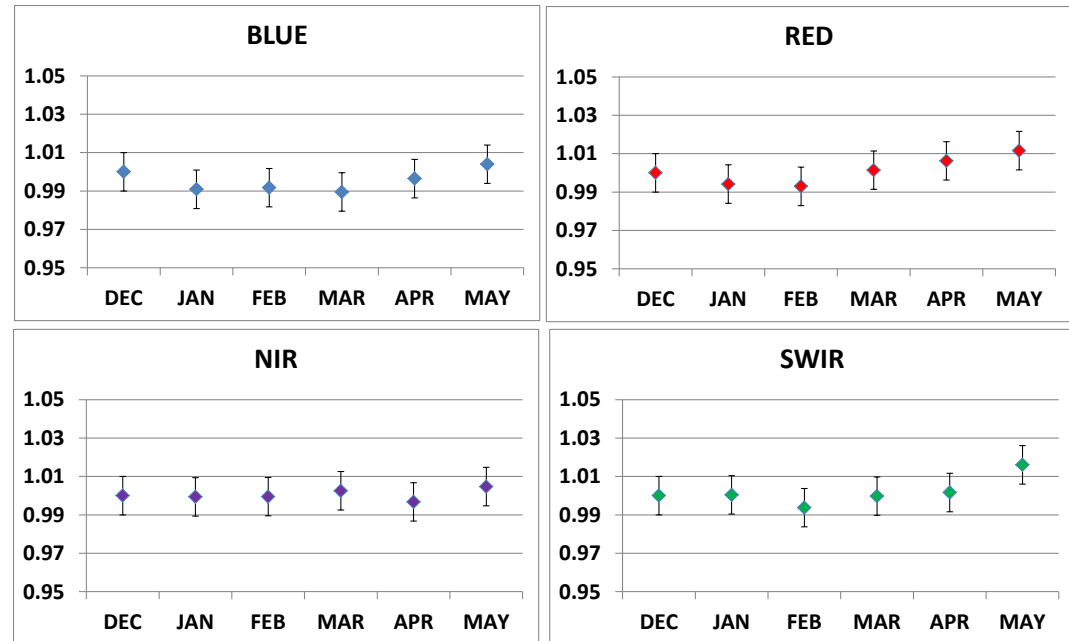
Landsat 8 Libya-4 data  
Dennis Helder & Nischal  
Mishra, South Dakota State  
University

# Stability monitoring lunar observations

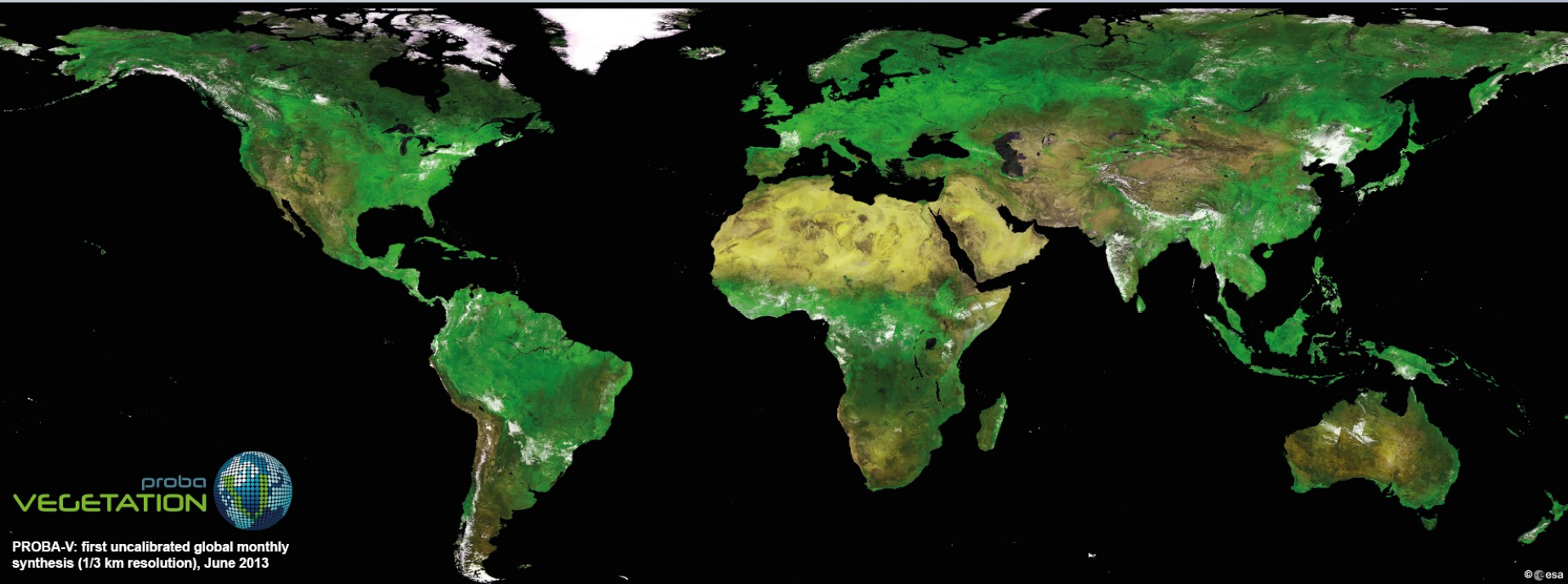


- » USGS **ROLO model** implemented (311g)
  - » **Kiefer and Stone, 2005**
  - » Based on thousands of automated lunar observations
- » Model Input parameters :
  - » Phase angle
  - » Sun selenographic longitude
  - » Observer selenographic lat and lon
- » Model returns 'disc equivalent reflectance'
  - » Smoothed to Apollo sand reflectance
  - » Corrected for distance observer – moon and sun – moon

## Proba-V stability plots ( relative to DEC)



# Thank you!



## The VITO PROBA-V team