proba-v

QUARTERLY IMAGE QUALITY REPORT

IQR#031

Reporting period from 16/06/2021 to 15/10/2021

Reference: ***PROBA-V_D9_QIR-031_2021-Q3Q4_v1.0***
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Version: 1.0
Date: 21/12/2021

DOCUMENT CONTROL

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Change record

Release	Date	Pages	Description	Editor(s)/Reviewer(s)
1.0	21/12/2021	All	Initial version	

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1. Radiometric Image Quality

1.1. Summary

We observe very strong seasonal variations in the Libya-4 results for mainly the RIGHT camera (pointing towards the westward direction) with a clear increasing trend during the last two years. It is assumed that this is due to uncertainties in the OSCAR BRDF desert model combined with the orbital drift of PROBA-V. In Niro et al. (2021) it has been shown that the orbital drift creates a positive trend in the surface directional reflectances in the backward scattering direction which is most pronounced for NIR and SWIR bands also seen in the Libya-4 results.

There are 2 new bad pixel identified in this reporting period: : LEFT SWIR1 pixel ID 334 and RIGHT SWIR1 647.

Allthough this report spans over the period until December 2021, it contains results until Nowember 2021. After the end of experimental phase, there is only a very limited number of calibration segments recorded. Currently, only a few of them have been processed. Reporting will be done in the next quarterly report.

1.2. Assessment of the radiometric accuracy

1.2.1. Absolute radiometric accuracy

The absolute radiometric calibration requirement for PROBA-V specifies a 5 % absolute accuracy. This requirement is assessed through vicarious calibration over Libya-4 desert site and Rayleigh calibration zones.

1.2.1.1. Libya-4 desert calibration

Methodology

The nominal approach for assessing the absolute radiometric accuracy relies on the comparison between cloud-free TOA reflectance as measured over the Libya-4 desert site by PROBA-V and the modelled TOA reflectance values, following the approach described in [LIT1]. Validation of the approach using various satellite data (i.e. AQUA-MODIS, MERIS, AATSR, PARASOL, SPOT-VGT) has shown that absolute calibration over the Libya-4 desert is achievable with this approach with an accuracy of 3% [LIT1, LIT2].

Results

In Figure1, Figure3 and Figure 5 the monthly averaged results ($avg(\rho_{TOA}^{k,ProbaV(Acom)}/\rho_{TOA}^{k,model})$) and its standard deviation are given for respectively LEFT, CENTER and RIGHT camera.
The individual area-averaged results are given in Figure2, Figure4 and Figure 6 with a 3 % error bar (as expected uncertainty for an individual result) for respectively VNIR and SWIR strips.

Results are obtained based on the **Collection 1** ICP files.

Similarly as in previous months we observe very strong seasonal variations in the Libya-4 results for mainly the RIGHT camera. We assume that this might be due to uncertainties in the OSCAR desert model combined with the orbital drift of PROBA-V. This is not observed for the CENTER camera, while the LEFT camera a slight increasing trend is observed.

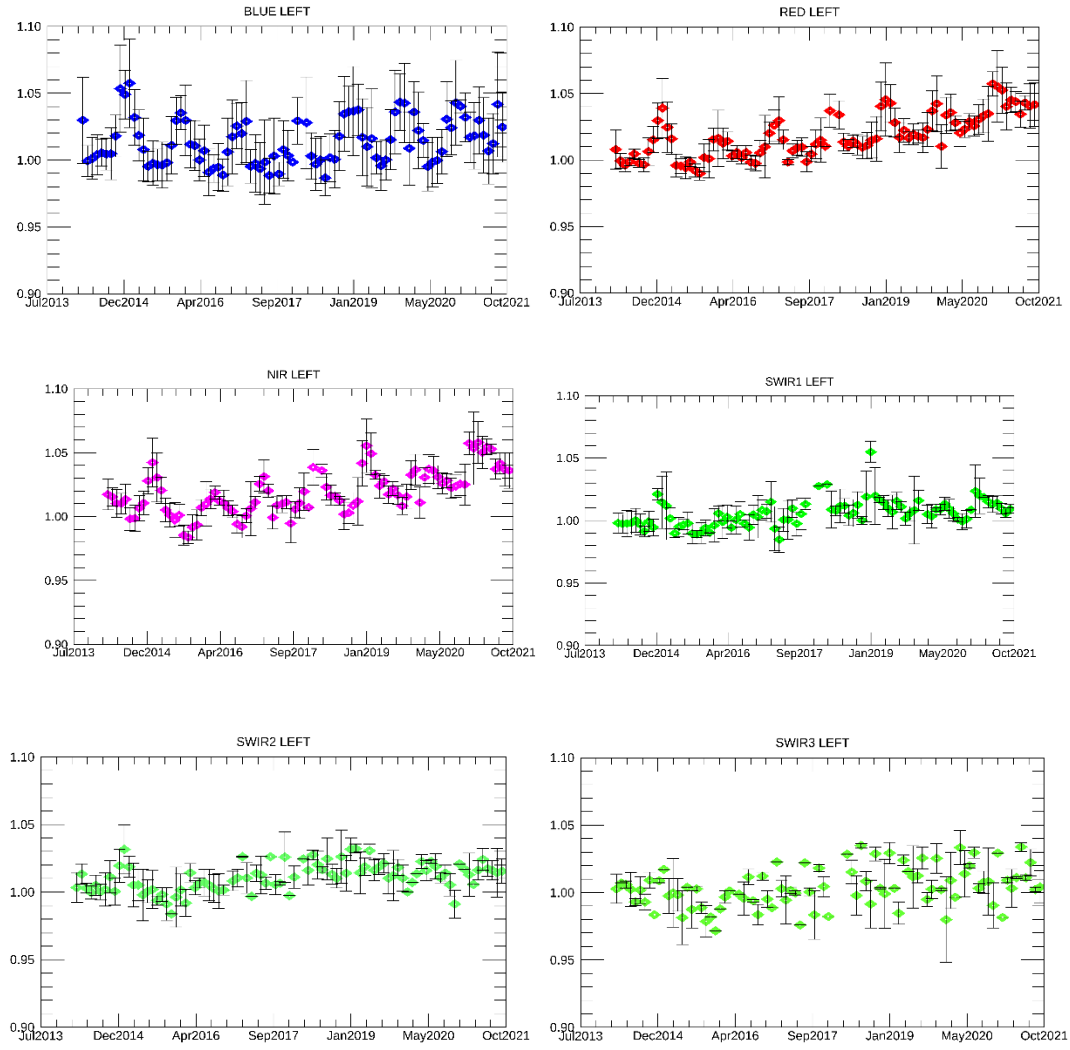


Figure 1. Libya-4 desert calibration results: LEFT monthly averaged results (Collection 1)

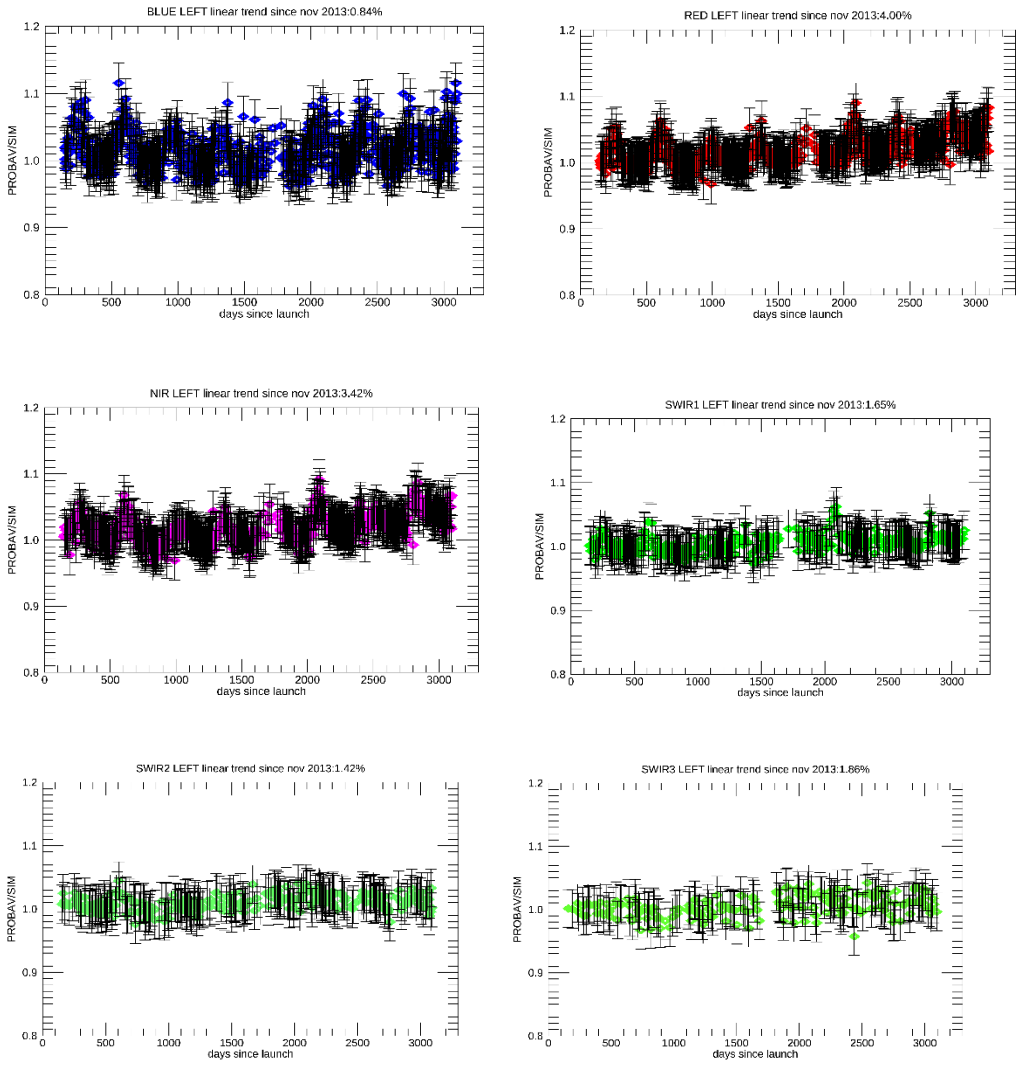


Figure 2. Libya-4 desert calibration results: LEFT individual results (Collection 1)

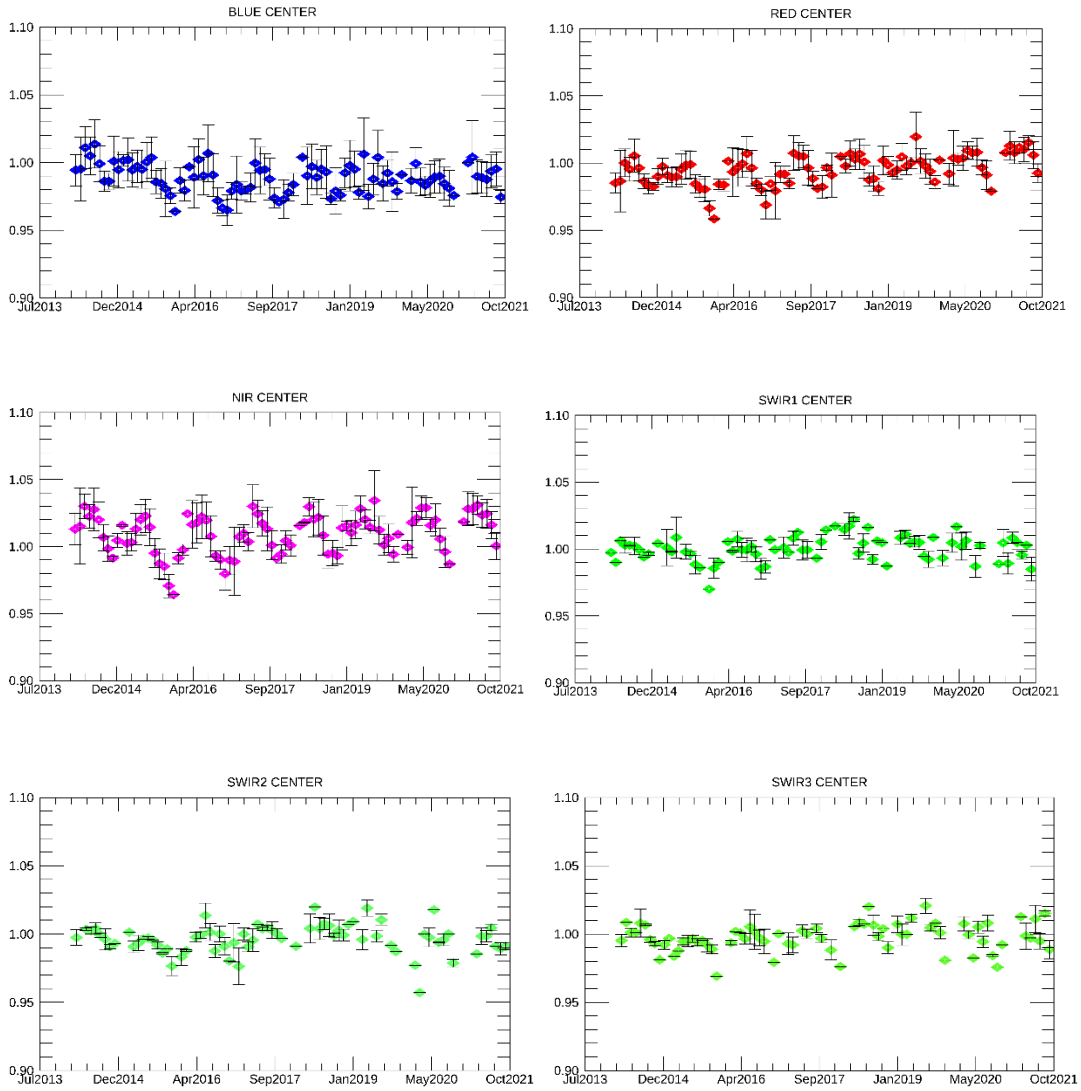


Figure 3. Libya-4 desert calibration results: CENTER monthly averaged results (Collection 1)

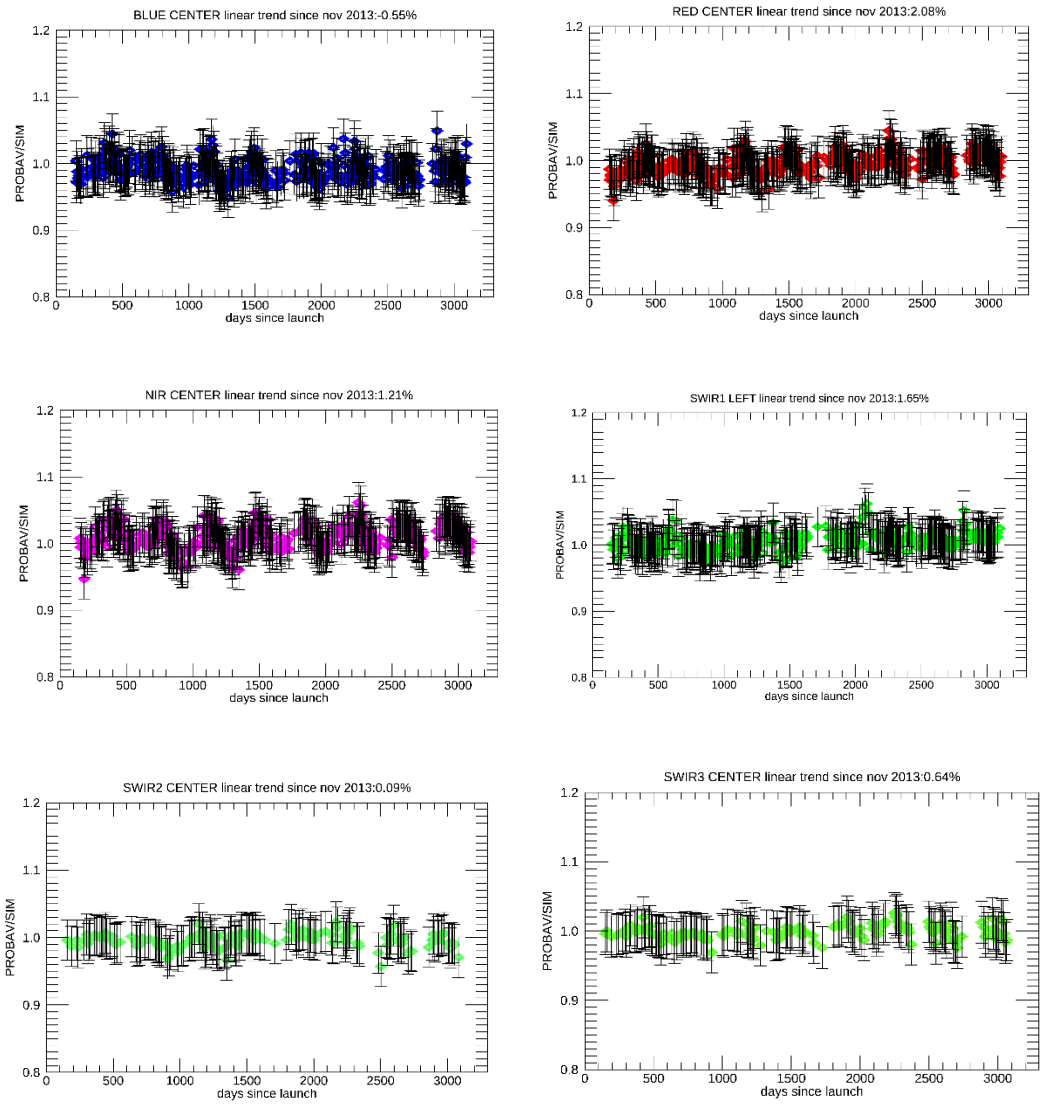


Figure 4. Libya-4 desert calibration results: CENTER individual results (Collection 1)

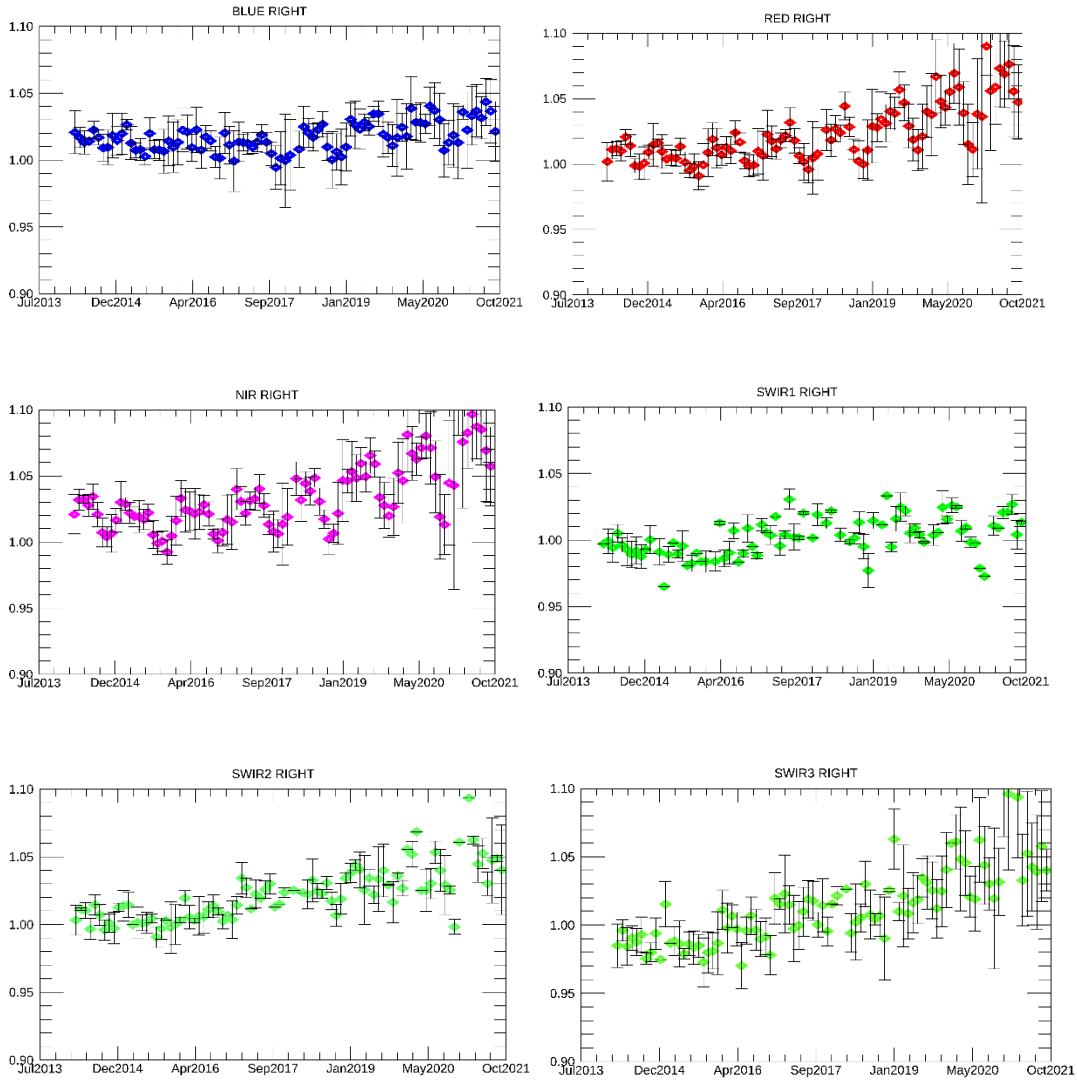


Figure 5. Libya-4 desert calibration results: RIGHT monthly averaged results (Collection 1)

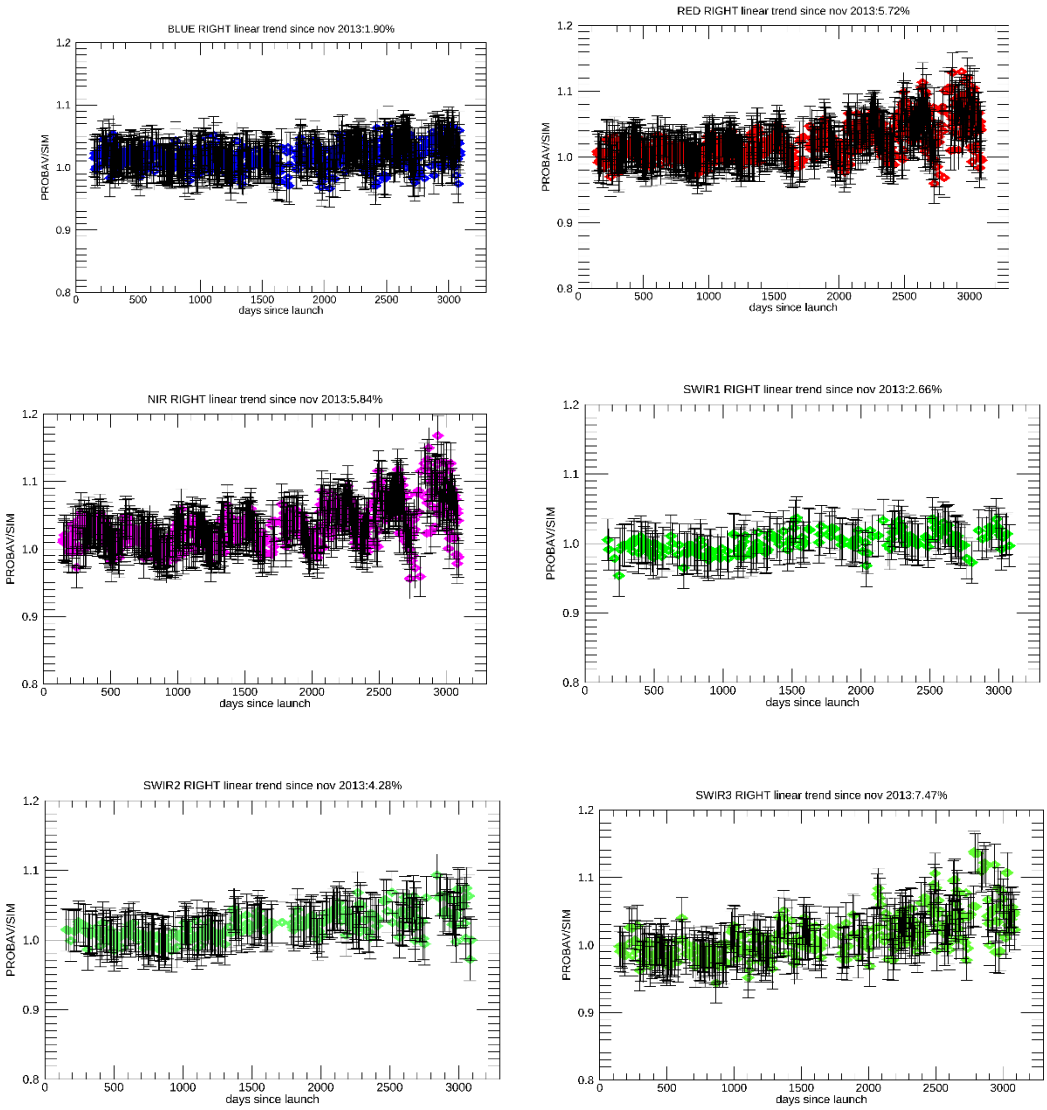


Figure 6. Libya-4 desert calibration results: RIGHT individual results (Collection 1)

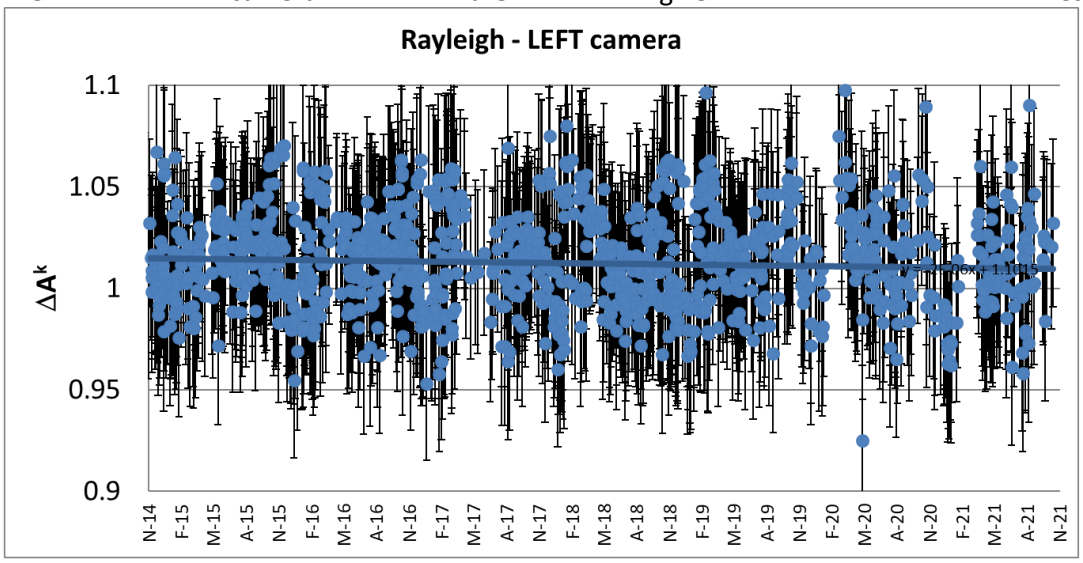
1.2.1.2. Rayleigh calibration

Methodology

The Rayleigh calibration approach is an absolute calibration method for BLUE and RED bands. The primary assumption of the approach is that the ocean does not contribute to the Top-Of-Atmosphere (TOA) signal in the NIR. The contribution of aerosol scattering is derived from the ***NIR reference band*** where molecular scattering is negligible. The aerosol content estimated from the NIR band is then transferred to the BLUE and RED band to model the TOA radiance with a radiative transfer code. The simulated radiance values are then compared with the measured values.

Results

The scene averaged Rayleigh results ($(\rho_{TOA}^{k,ProbaV(Acom)}/\rho_{TOA}^{k,model})$) (with a 4 % error bar as rough indication of uncertainty of one individual result) obtained since January 2014 for LEFT, CENTER and RIGHT camera are given in respectively



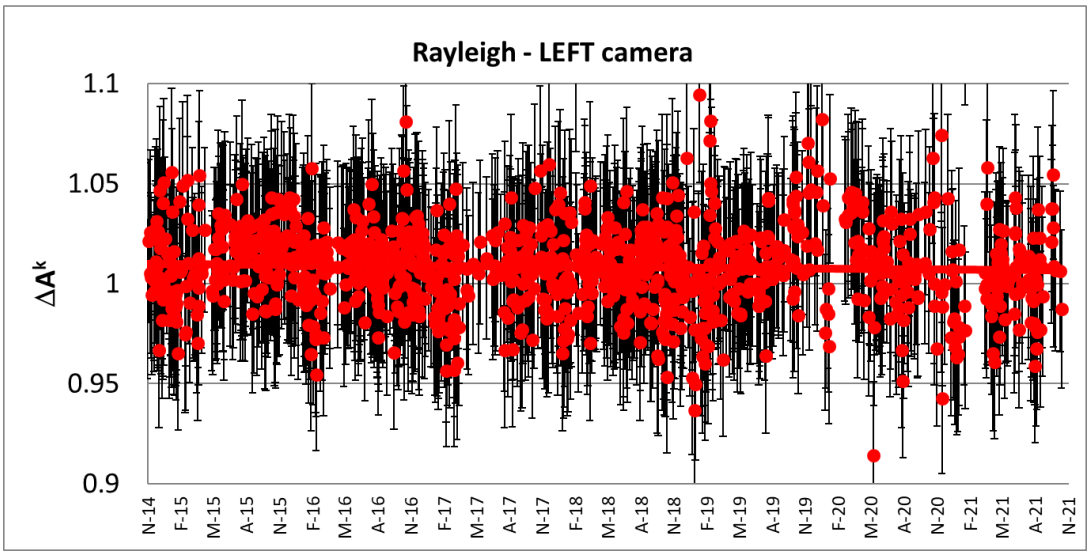


Figure 7, Figure 8 and Figure 9.

Results are obtained using the **Collection 1 ICP** files.

No significant trend is visible in the Rayleigh calibration results.

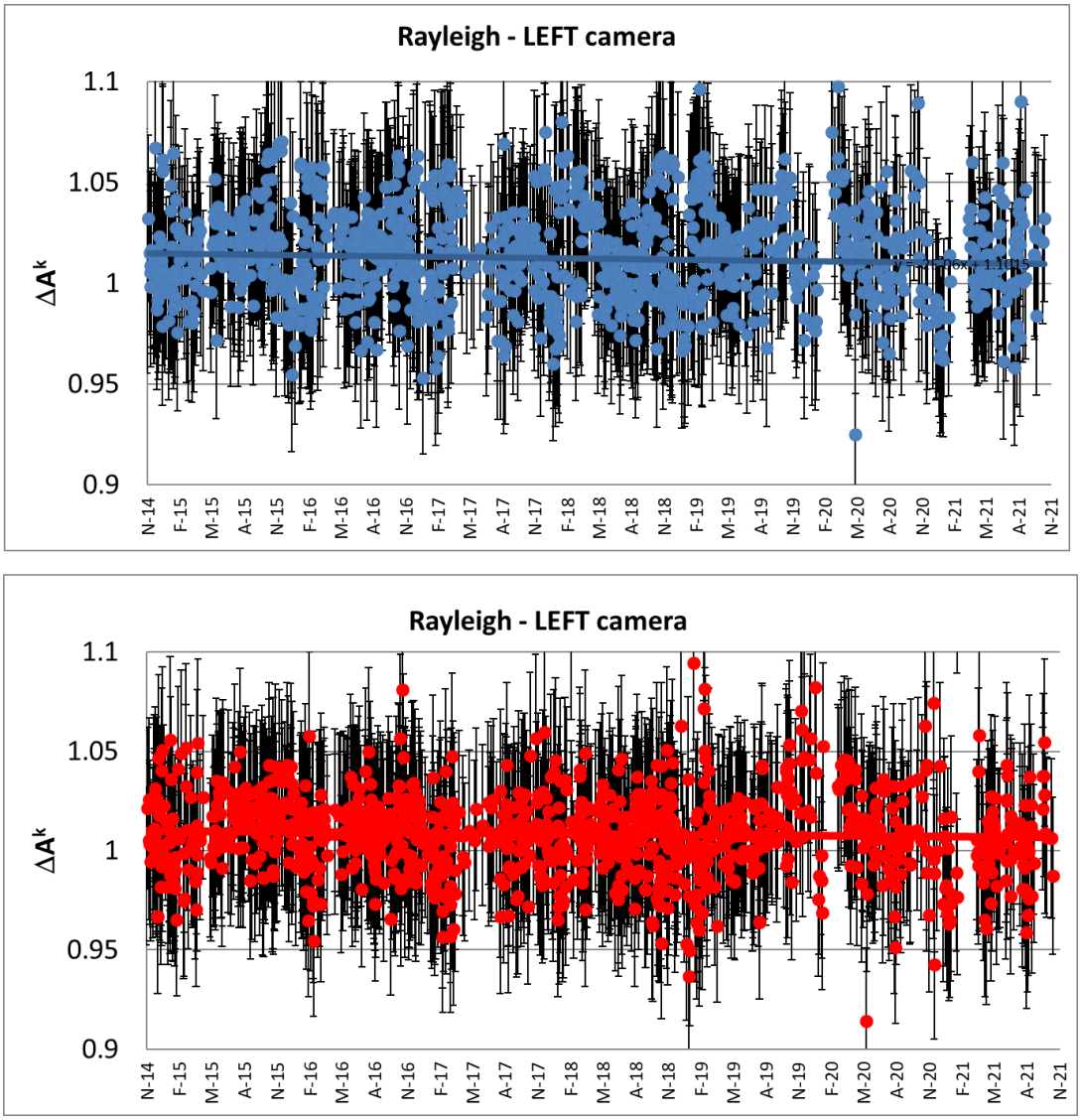


Figure 7. Rayleigh absolute calibration results: LEFT camera (Collection 1)

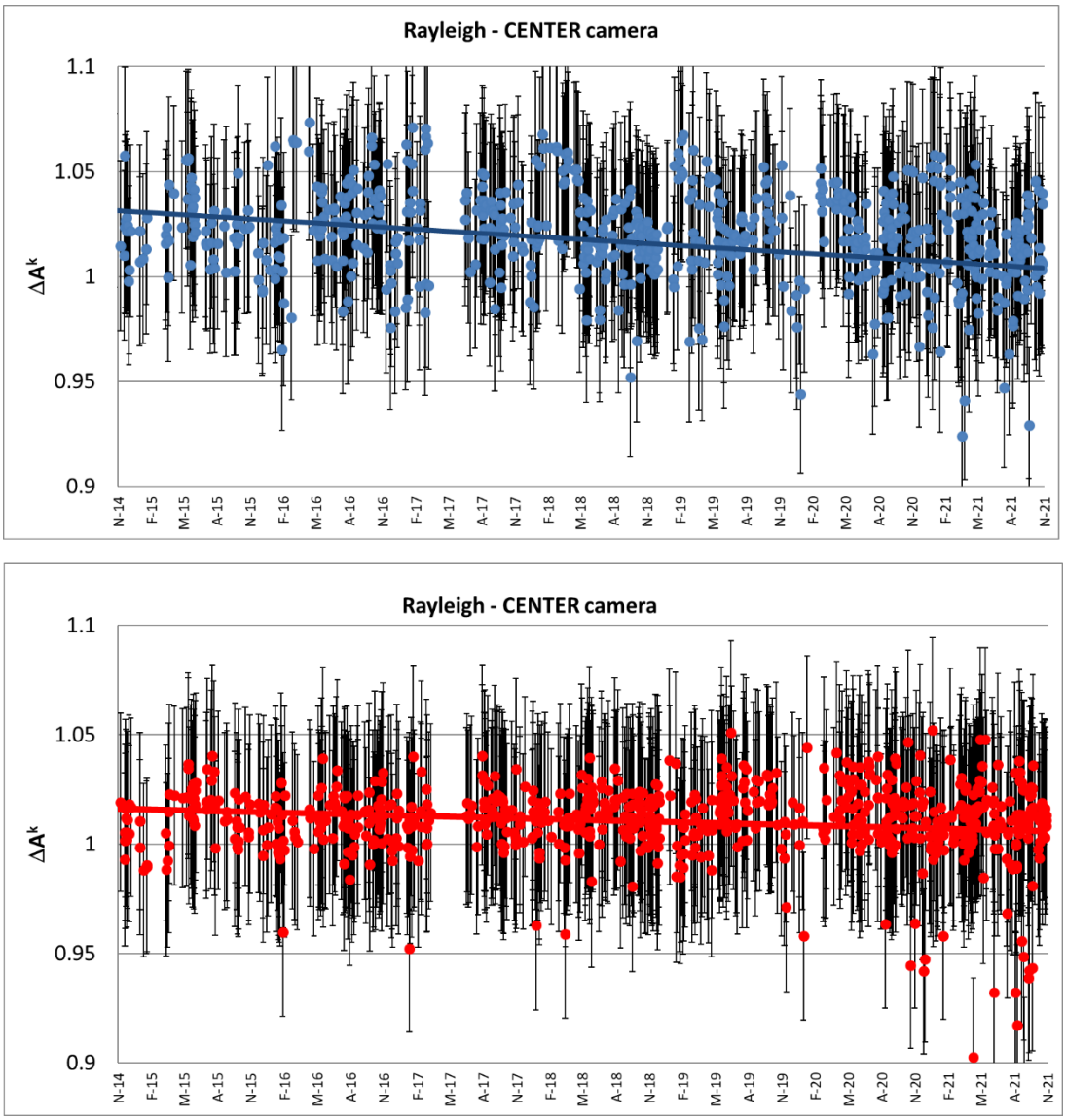


Figure 8. Rayleigh absolute calibration results: CENTER camera (Collection 1)

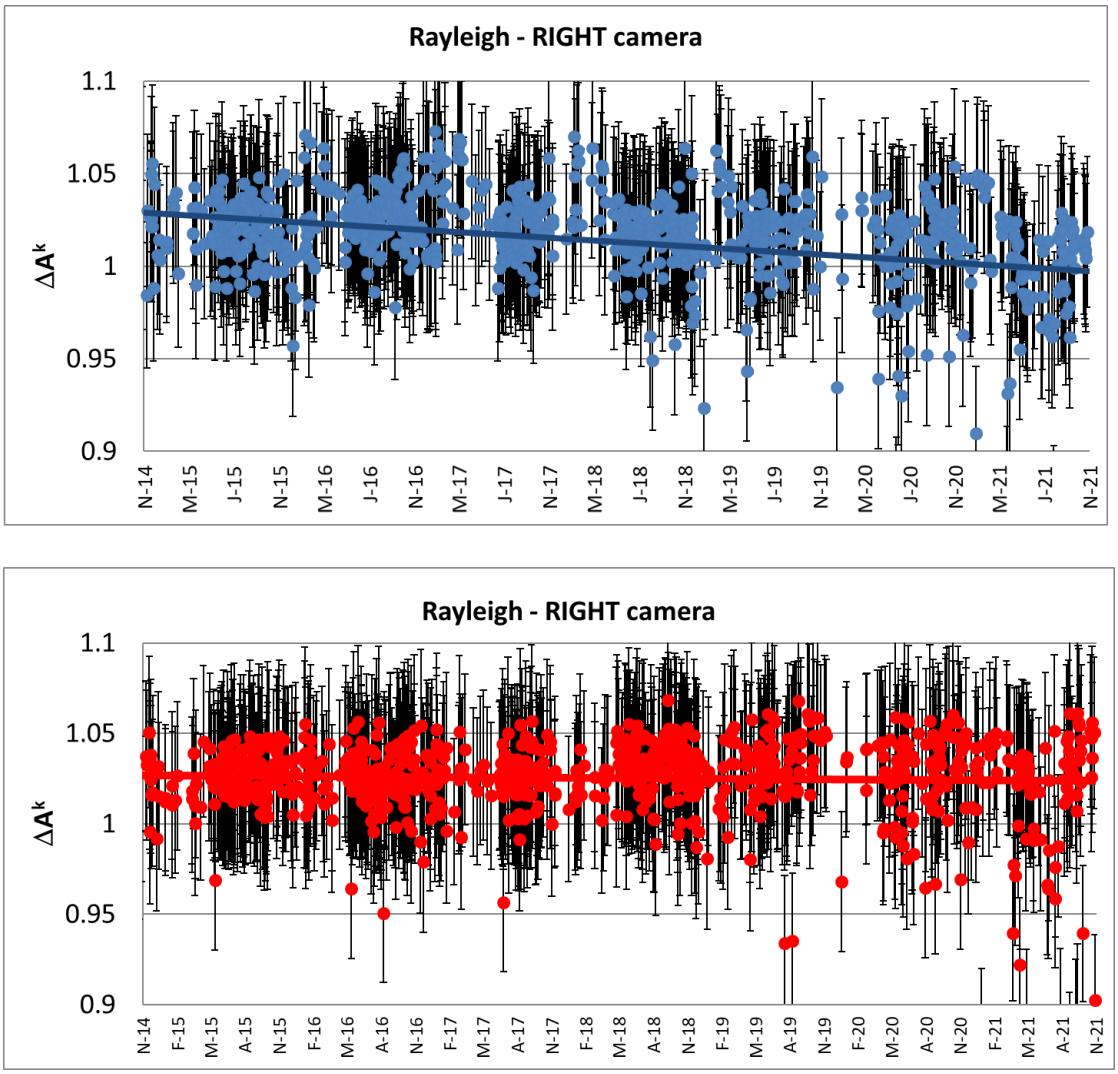


Figure 9. Rayleigh absolute calibration results: RIGHT camera (Collection 1)

1.2.2. Inter-band radiometric accuracy

The inter-band radiometric calibration requirement for PROBA-V specifies a 3 % inter-band accuracy. This requirement is assessed through vicarious calibration over deep convective clouds.

1.2.2.1. Calibration over deep convective clouds (DCC)

Methodology

The DCC approach is an inter-band calibration method. It makes use of bright, thick, high altitude, convective clouds over oceanic sites. Their reflective properties are spectrally flat in visible and near-infrared and the only contributions to the observed signal are from the cloud reflectance, molecular scattering and ozone absorption which can be modelled with a radiative transfer code.
The cloud reflectance in the non-absorbing VNIR bands is mainly sensitive to the cloud optical thickness. The DCC method uses the TOA reflectance in the 'reference' RED band to estimate cloud optical thickness assuming a fixed ice particle model. The derived cloud optical thickness is then used to model using a radiative transfer code the TOA reflectance for the BLUE and NIR band.

The method is not suited for the SWIR band as clouds are no longer spectrally uniform in this spectral region.

Results

The DCC inter-band calibration is defined by reference to the used RED reference band. The average DCC inter-band calibration result per month (from March 2015 to October 2021) is given in Figure 10 for all cameras using the **collection 1 ICP files**.

The DCC calibration results show a decrease in responsivity of the BLUE bands of all cameras, even after May 2017 when the degradation model for BLUE LEFT/CENTER strips was implemented (see 1.2.4). This trend is much larger than the slight negative trend observed in the Libya-4 BLUE LEFT/CENTER calibration data. The trend observed in the DCC BLUE band results is thought to be due to the increase of responsivity in the RED band as observed in the Libya-4 results for all cameras as well as in the moon calibration results for the CENTER camera. As the BLUE band DCC results, are inter-band calibration results, expressed relatively to the RED band, an increase in responsivity of the RED band (and not for the BLUE band) will result in a decrease of the BLUE band DCC inter-band calibration results.

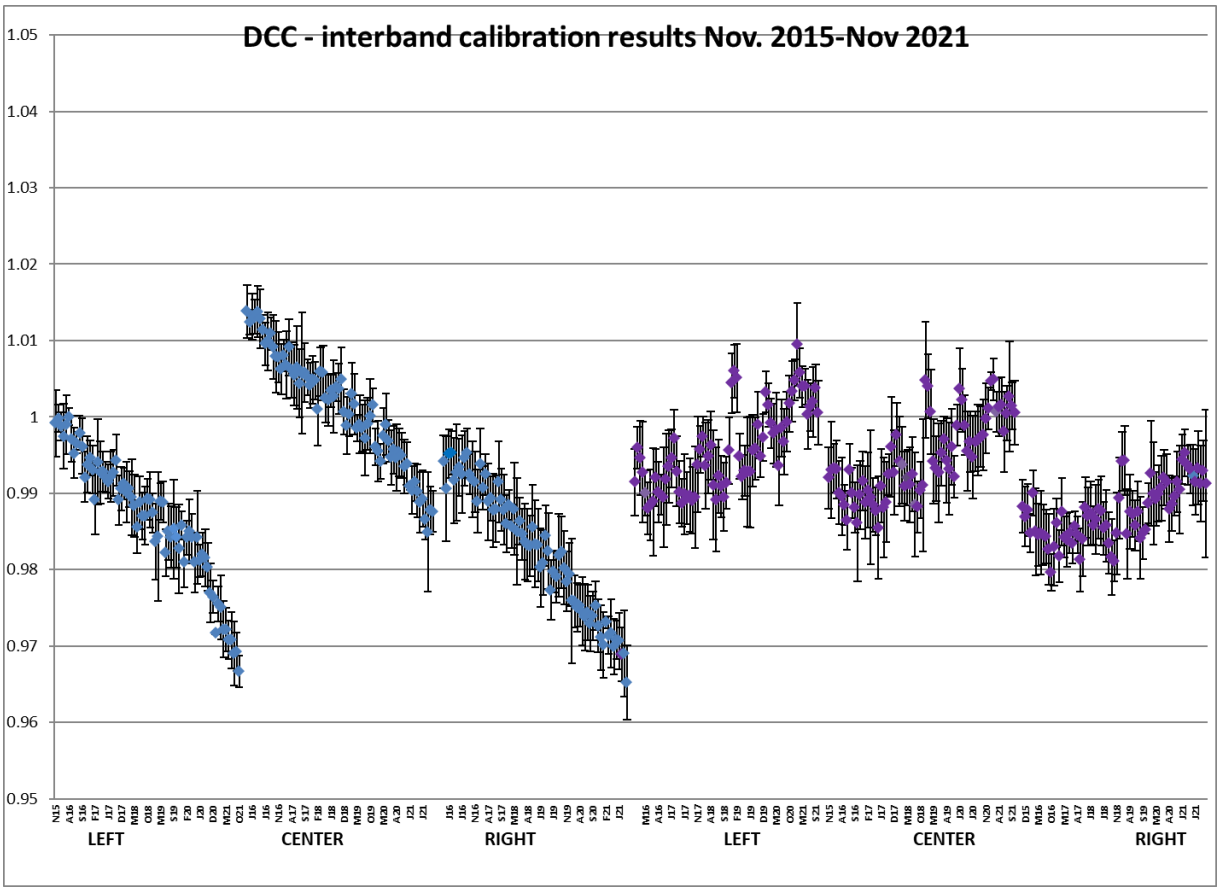


Figure 10. DCC inter-band calibration results: LEFT, CENTER and RIGHT camera

1.2.3. PROBA-V Multi-temporal Lunar calibration results

The Lunar calibration results for the VNIR CENTER camera bands are given in Figure 11. The results are given based on the **collection 1 ICP** files. In each plot the results are given on basis of the new LIME model being developed within the ESA lunar irradiance project based on upon lunar measurements acquired with the CE318-TP9 instrument.

Over the entire mission the BLUE band lunar calibration results show a decreasing trend while for the RED and NIR a decreasing trend is observed. This is in line with the observations over the Libya-4 desert.

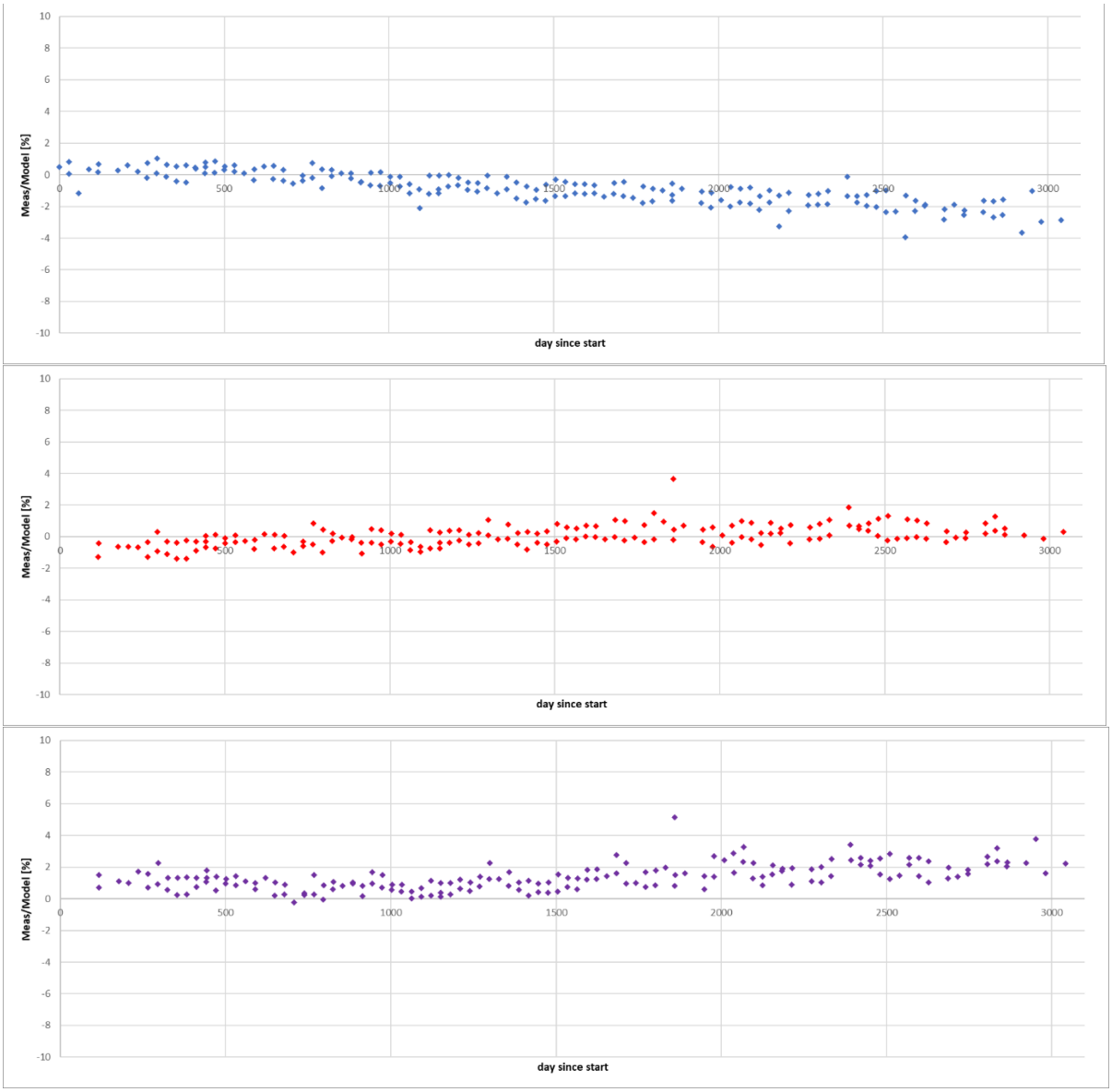


Figure 11. Lunar Calibration results CENTER camera based on the LIME model

1.2.4. Degradation model

Since October 2018 a degradation model is no longer applied to the SWIR absolute calibration coefficients as the current linear model resulted in an overcorrection of the degradation in the SWIR. Once ICP files are updated for the non-uniformities as quantified on the basis of the yaw maneuver, the Libya-4 desert results will be reprocessed in order to better quantify the degradation for the various SWIR strips and to re-evaluate the degradation model for the SWIR strips to be used in the reprocessing (collection 2).

In Table 1 the applied degradation model correction is given. This linear degradation model is being applied for collection 1 since start of the operational phase (i.e. October 2013). A re-evaluation of the coefficients of the SWIR degradation model was performed in summer 2017. Since Jan 2018 a degradation model is no longer applied to the RIGHT SWIR strips. From October 2018 onwards, absolute calibration coefficients for the SWIR strips are not updated.

Table 1 SWIR degradation model: applied linear trend/month

	Degradation model ICP			
	Start- aug 2017	Sept 2017-Dec 2018	Jan 2018-Sept 2018	Oct 2018-..
SWIR1 LEFT	-0.087	-0.087	-0.087	NA
SWIR2 LEFT	-0.104	-0.104	-0.104	NA
SWIR3 LEFT	-0.097	-0.097	-0.097	NA
SWIR1 CENTER	-0.093	-0.093	-0.093	NA
SWIR2 CENTER	-0.092	-0.092	-0.092	NA
SWIR3 CENTER	-0.086	-0.086	-0.086	NA
SWIR1 RIGHT	-0.106	-0.077	NA	NA
SWIR2 RIGHT	-0.143	-0.122	NA	NA
SWIR3 RIGHT	-0.122	-0.078	NA	NA

A degradation model is used to update the absolute calibration coefficients of the LEFT and RIGHT BLUE since May 2017. A re-evaluation of the coefficients of the degradation model was performed in summer 2017. Since then no changes have been made to the model. In Table 2 the coefficients are given.

Table 2 Degradation model BLUE LEFT and CENTER camera: applied linear trend/month

	Linear trend/month (%)	
	Degradation model ICP	Degradation model ICP
STRIP	May 2017-aug 2017	since sept 2017
BLUE LEFT	-0.028	-0.036
BLUE CENTER	-0.011	-0.034

1.3. Dark current

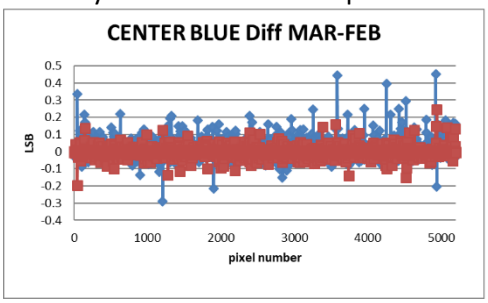
1.3.1. Methodology

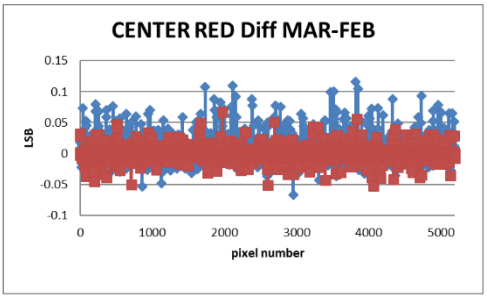
- Monthly difference plots:
  - All dark current results obtained during a period of one month for observations performed with a long integration time are averaged per pixel. This gives for each pixel the monthly averaged dark current, expressed **in LSB/s**, and its standard deviation.
  - The dark current results and its standard deviation expressed in LSB/s are converted to **LSB** using a maximum Integration Time for nominal acquisitions. For VNIR strips **0.006s** is used. For SWIR strips **0.02s.**
  - The differences between months (i.e. Month3-Month2, Month2-Month1) are calculated. This is done for both the dark current and the stdev. Differences are visualized in plots in blue the dark current difference in LSB is plotted, in red the standard deviation difference. This latter is an indicator of changes in the dark current noise between months.

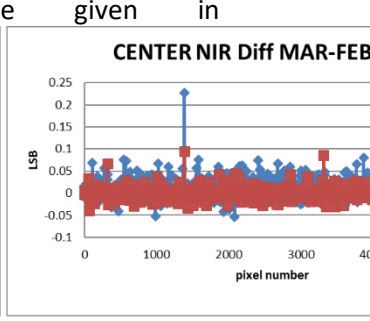
As mentioned in the previous quarterly report (IQR#005) the integration time used for the SWIR dark current acquisitions has been decreased from 3s to 0.2 s since 2015.

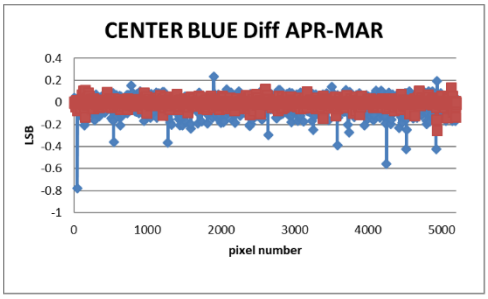
1.3.2. VNIR results

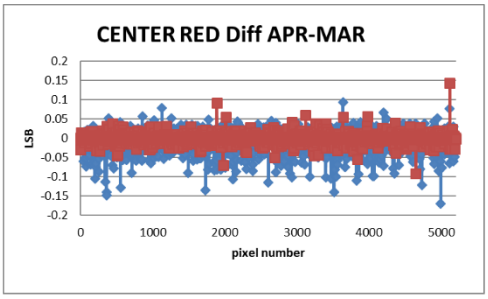
Monthly difference plots for VNIR dark currents are given in

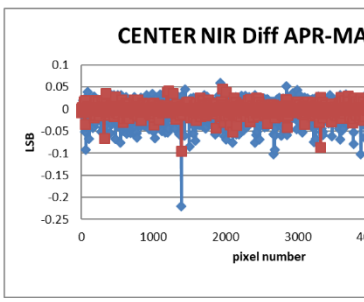


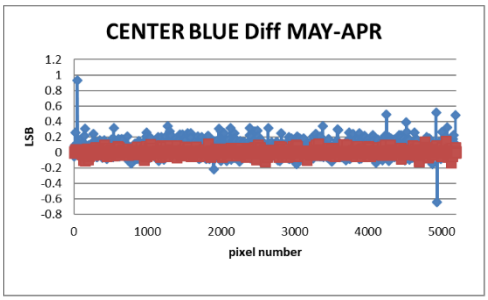


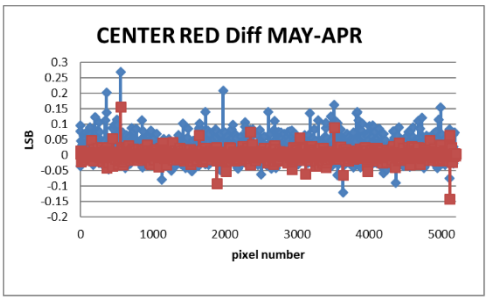












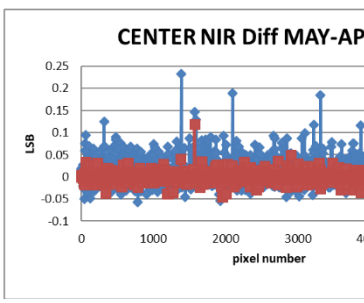
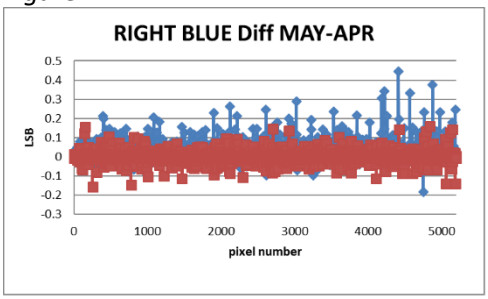
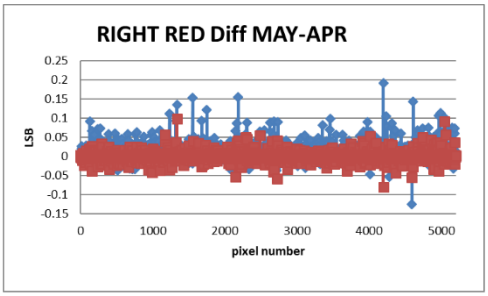


Figure *13*,





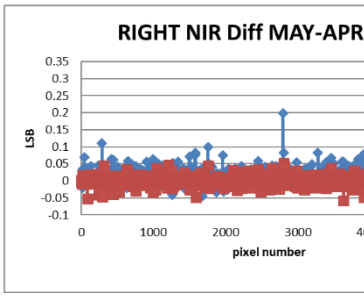
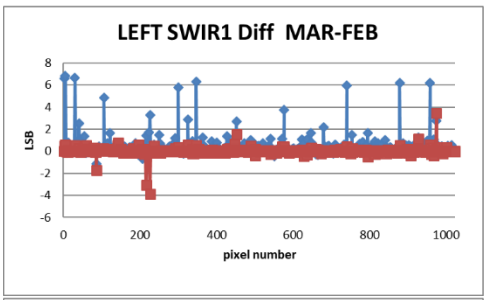
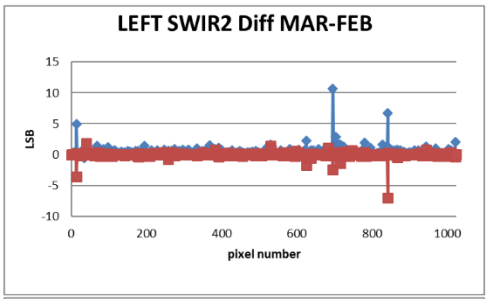
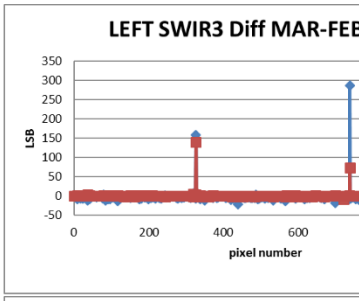
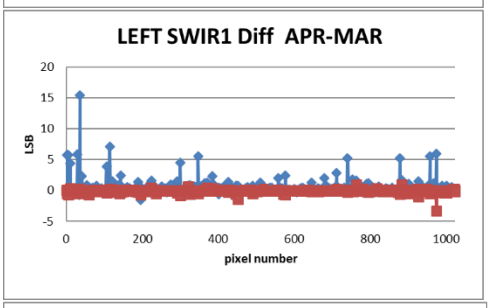


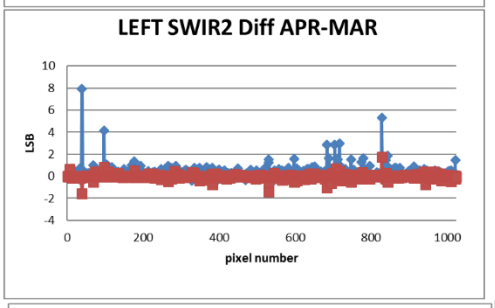
Figure *14* and

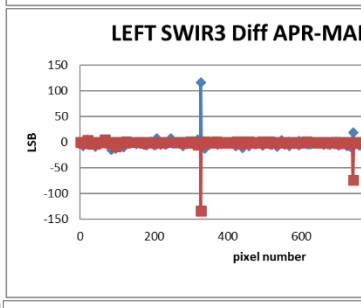


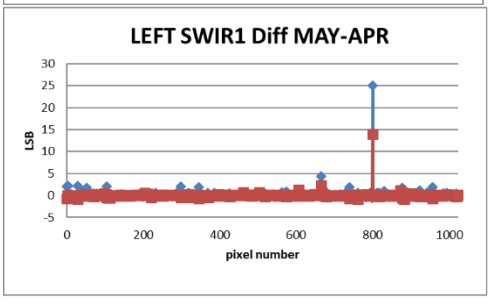


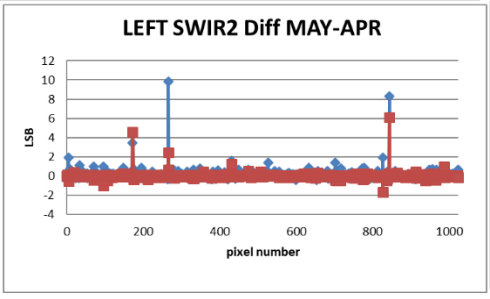












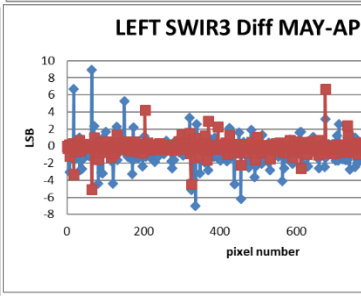


Figure 15 for respectively LEFT, CENTER and RIGHT camera.

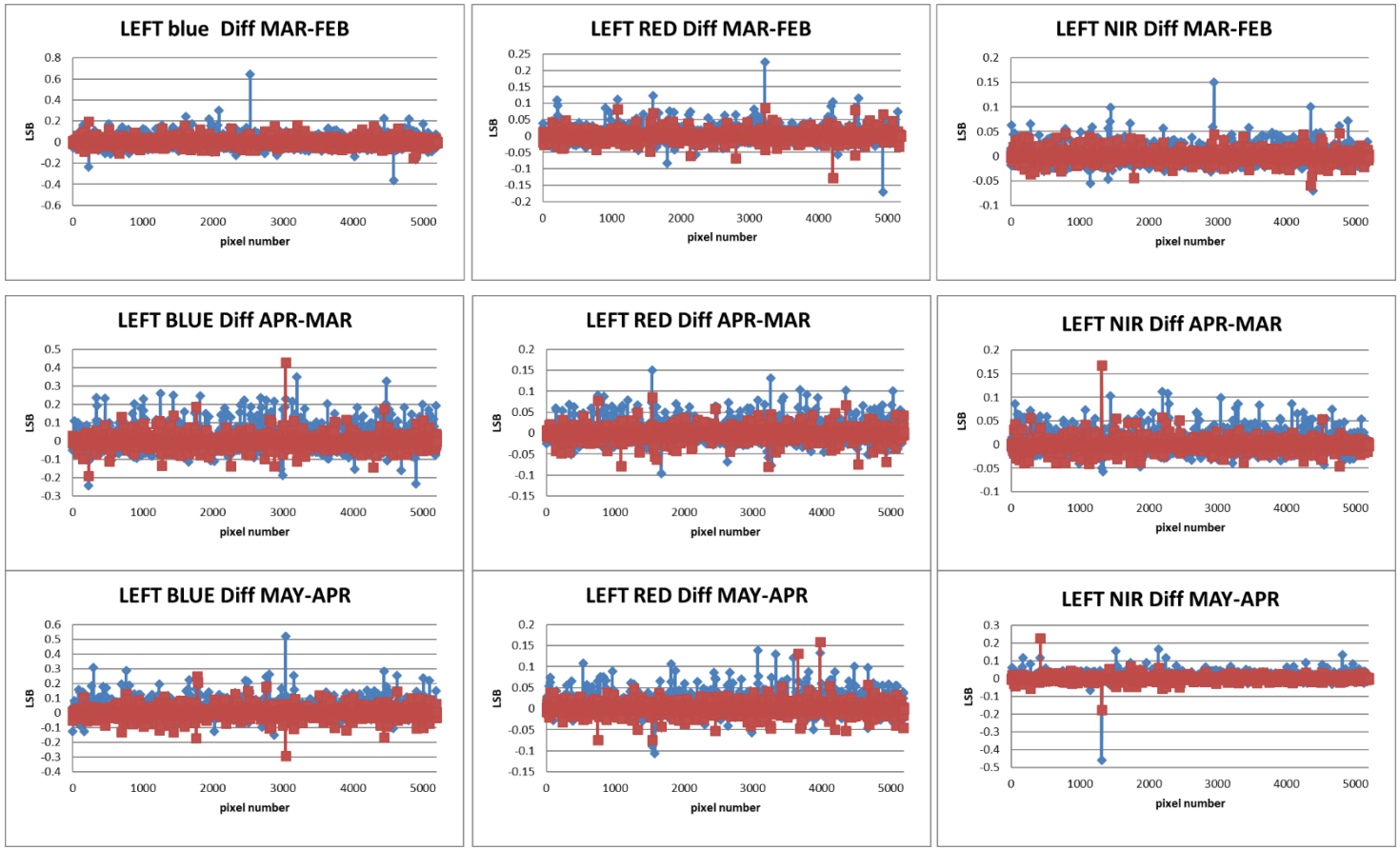


Figure 12. LEFT camera VNIR: Monthly difference (FEB2021 – MAY2021) in dark current (Blue) and standard deviation (Red)

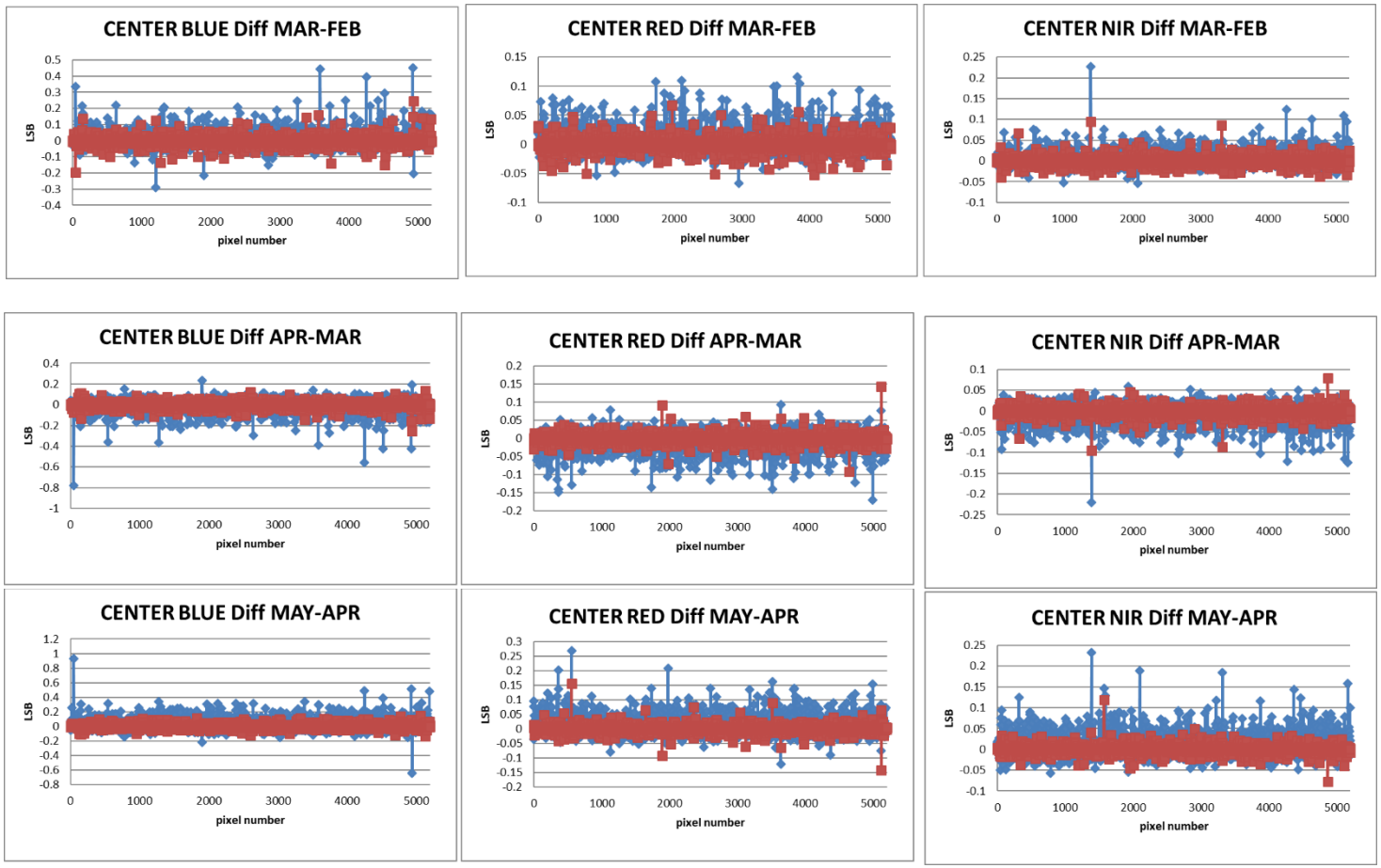


Figure 13. CENTER camera VNIR: Monthly difference (FEB2021 – MAY2021*) in dark current (Blue) and standard deviation (Red) of the monthly averaged results.*

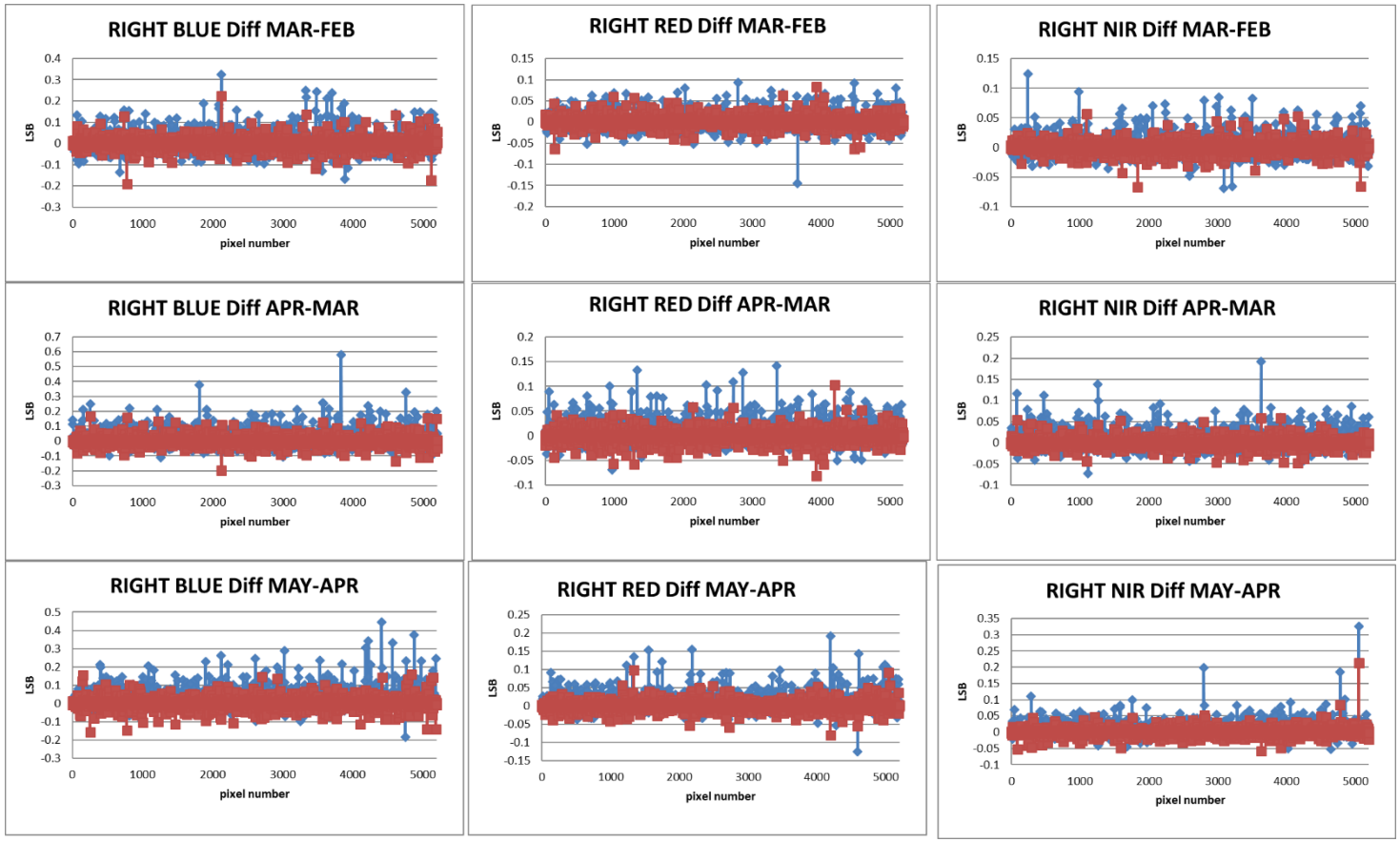


*Figure 14. RIGHT camera VNIR: Monthly difference (*FEB2021 – MAY2021*) in dark current (Blue) and standard deviation (Red) of the monthly averaged results.*

1.3.3. SWIR results

Monthly difference plots for SWIR dark currents are given

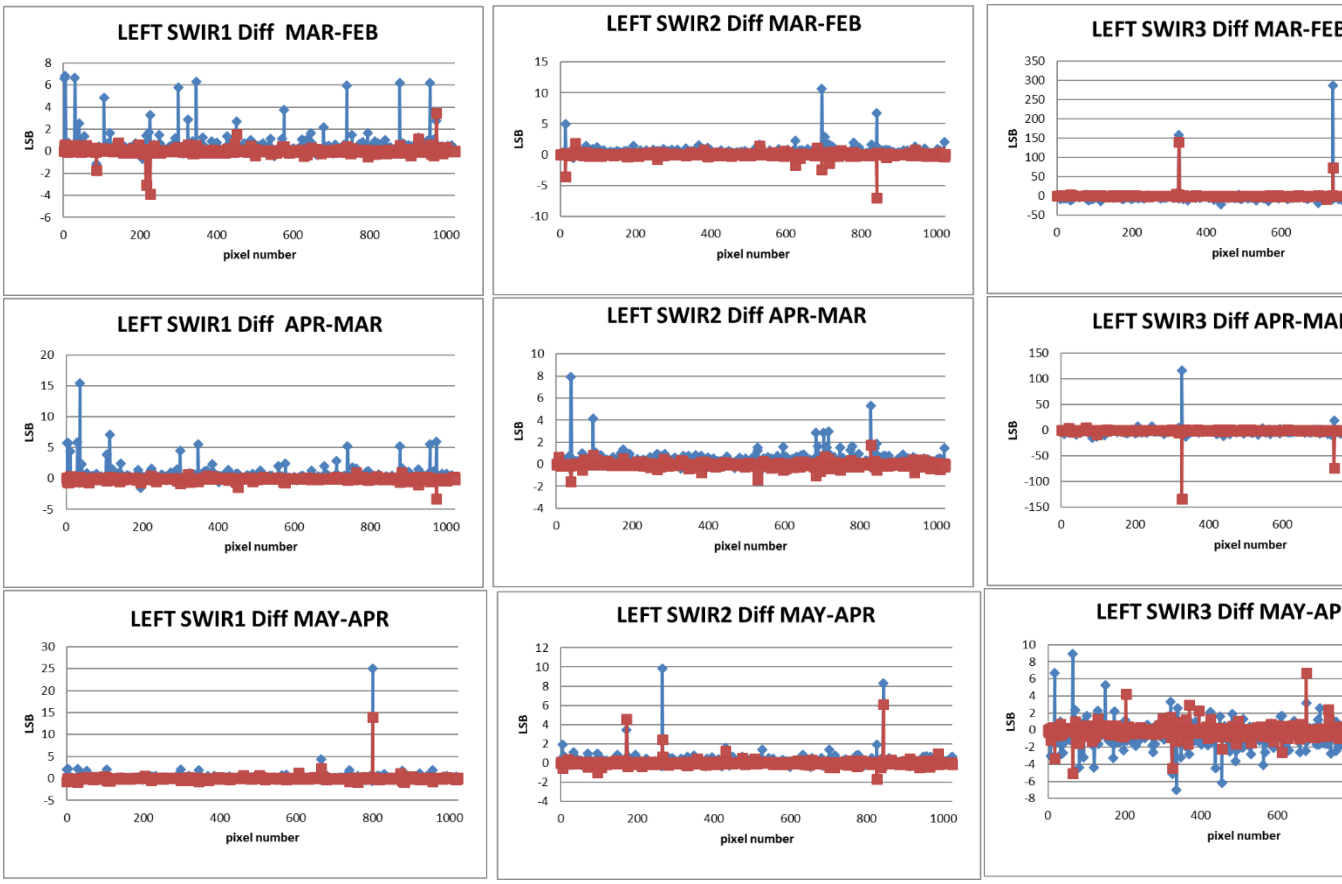
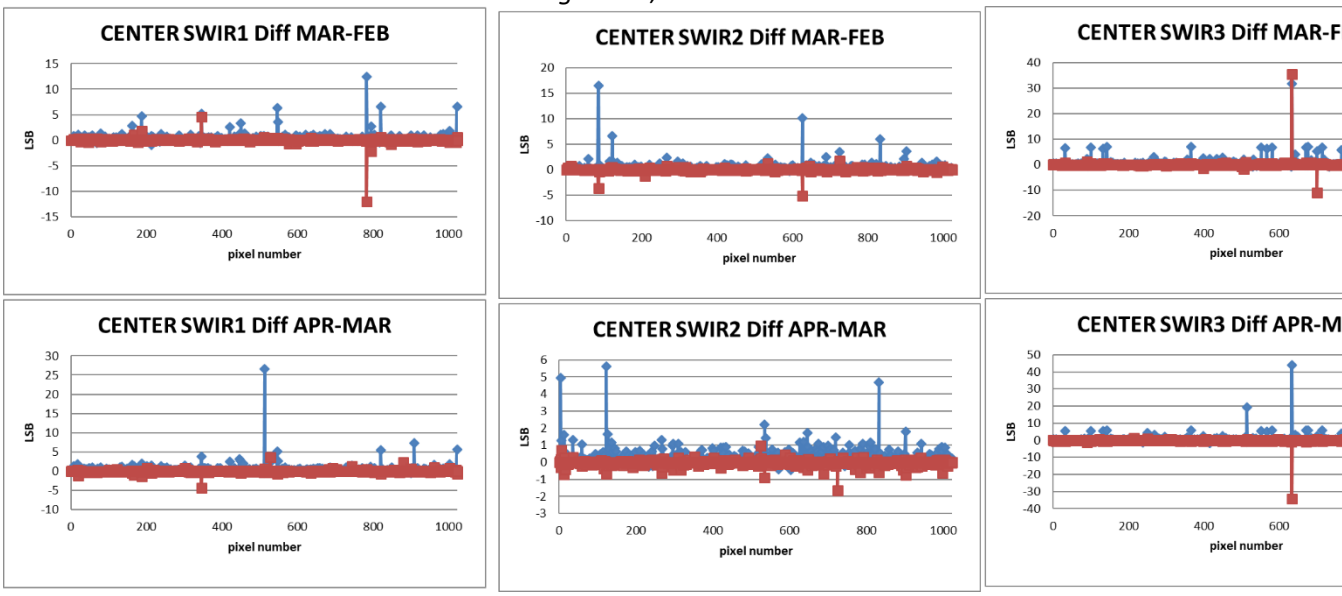


Figure 15,



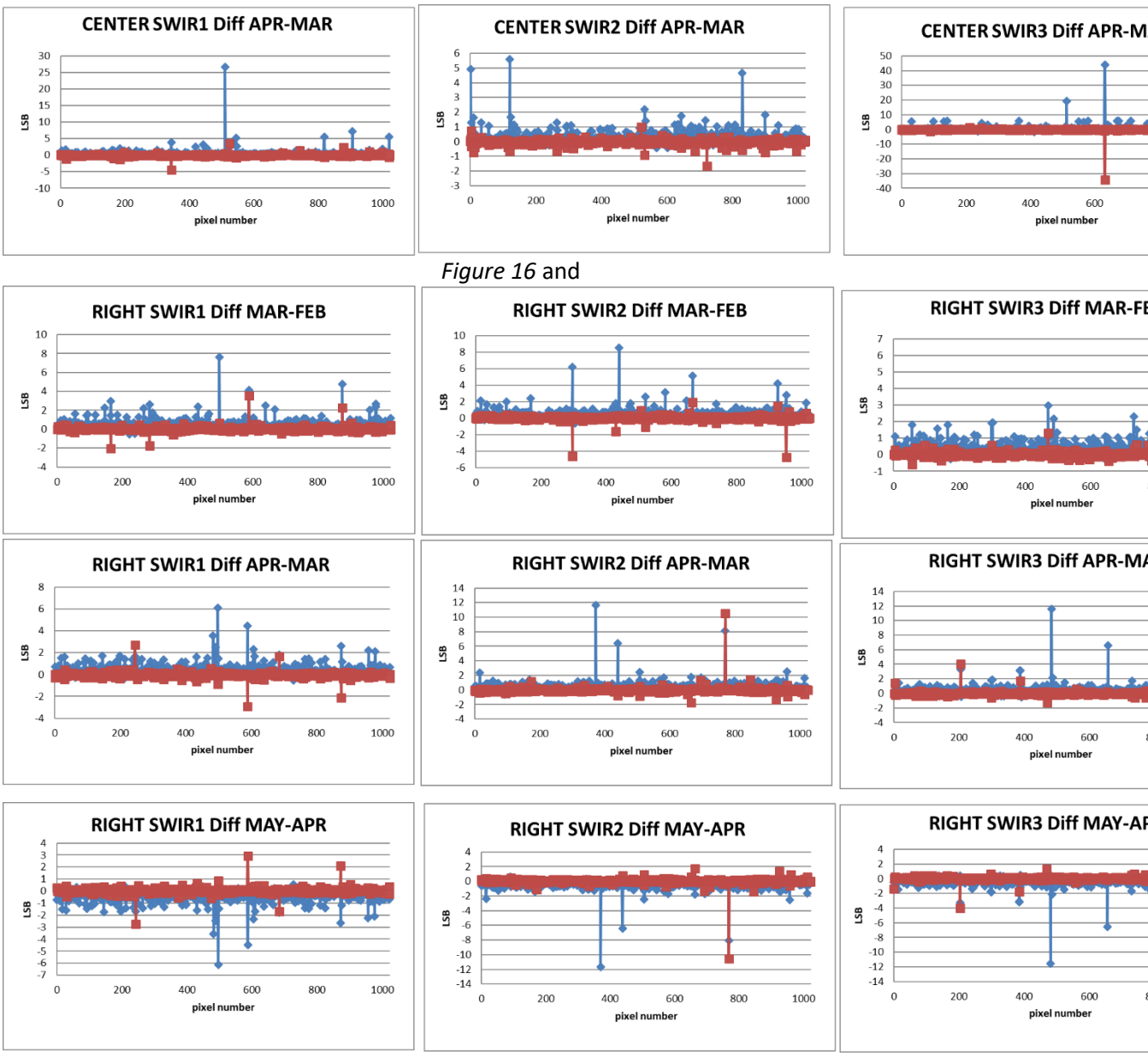


Figure 16 and *Figure 17* for respectively LEFT, CENTER and RIGHT camera.

A dark current outlier analysis is performed for pixels having for at least one month a dark current expressed in LSB larger than the DC THRESHOLD. This DC THRESHOLD is set to 4 LSB. For those pixels the following dark current pixel statuses are given:

- Both monthly differences > 4 LSB ? **Quality is "H DC BAD"**
- One monthly difference > 4 LSB ? **Quality is "H DC NOK"**.
- Both monthly differences < 4 LSB ? **Quality is "H DC OK"**

In Table 3, Table 4,Table 5 the resulting SWIR dark current status during the last months is reported for respectively LEFT, CENTER and RIGHT camera.

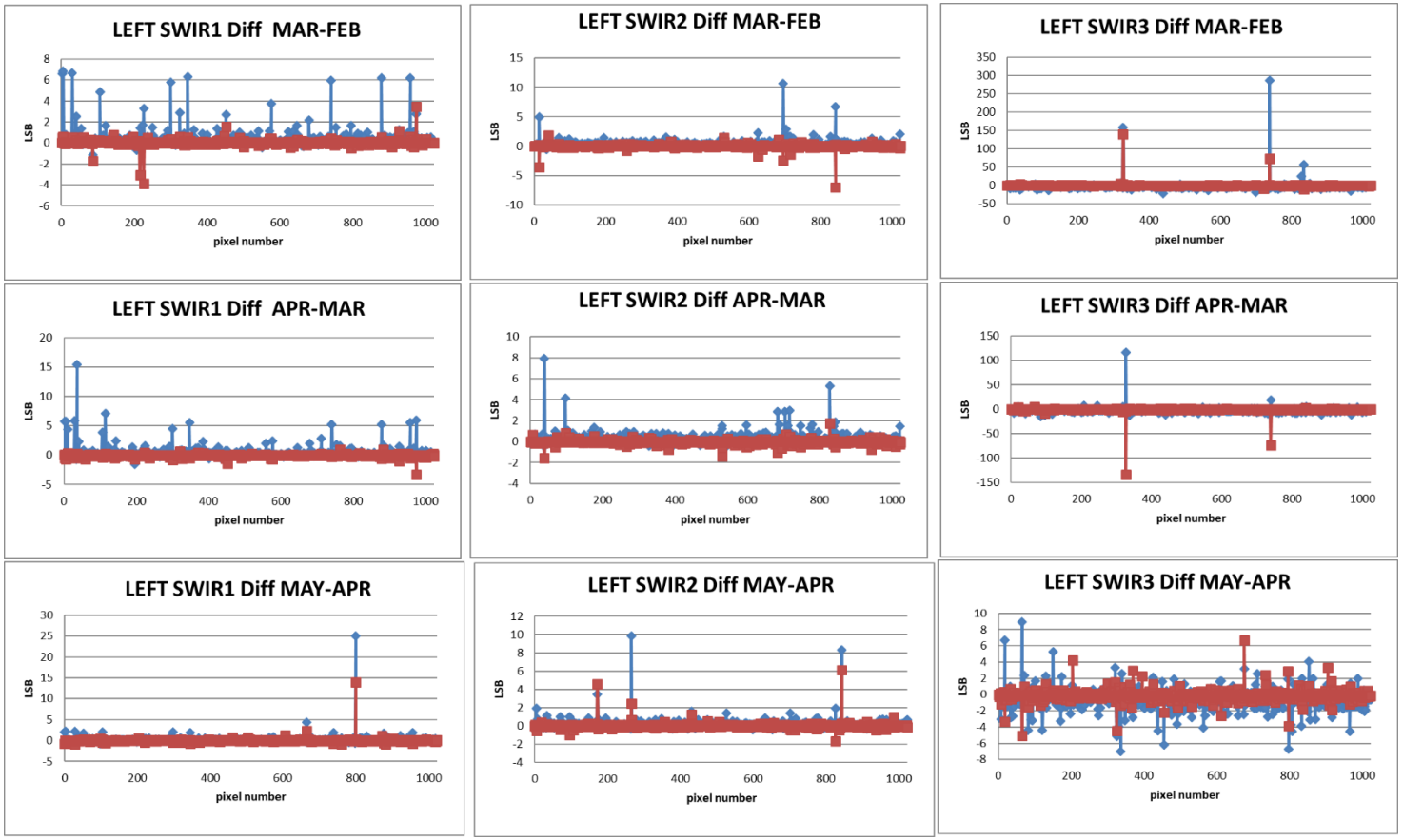


Figure 15. LEFT camera SWIR: Monthly difference (FEB2021 – MAY2021) in dark current (Blue) and standard deviation (Red) of the monthly averaged results.

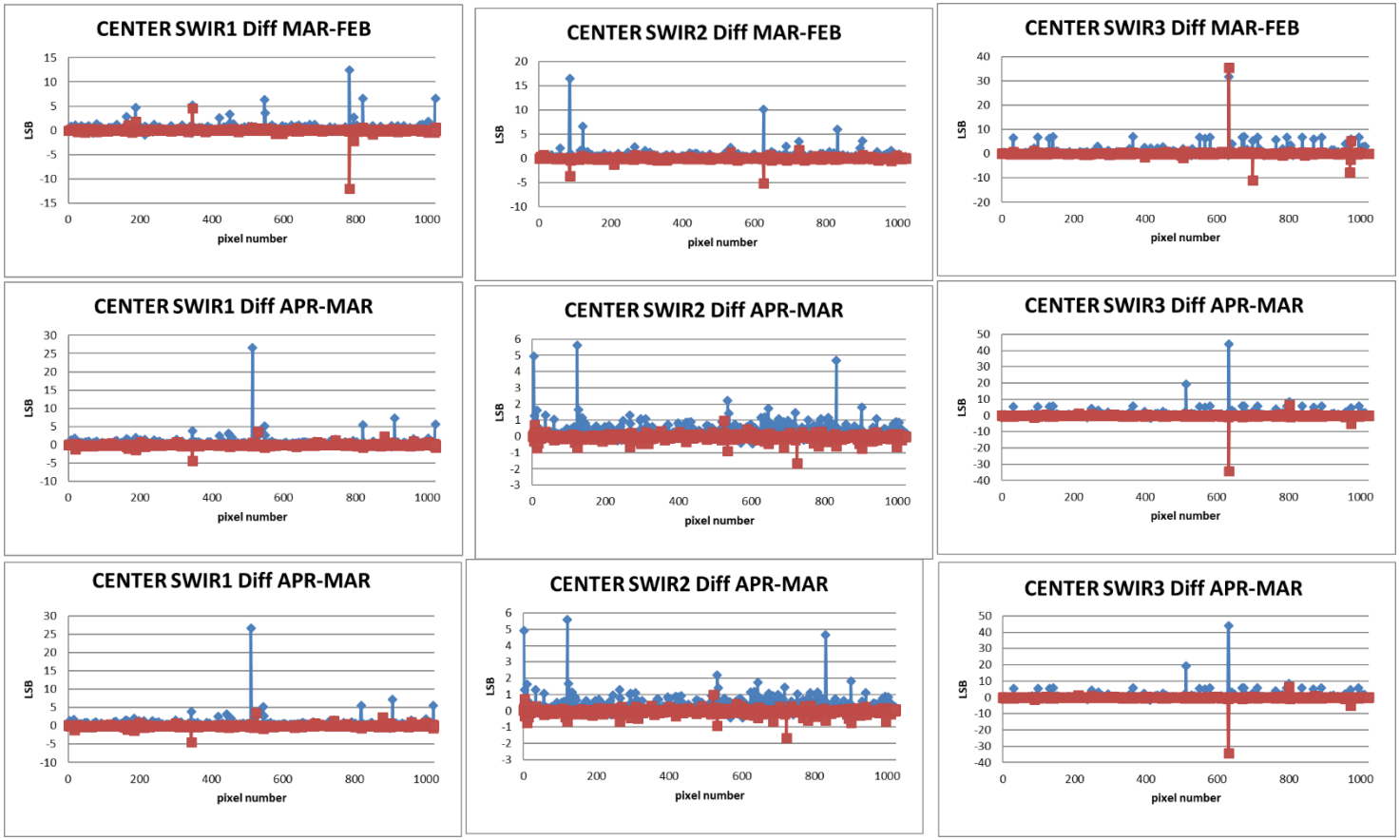


Figure 16. CENTER camera SWIR: Monthly difference (FEB2021 – MAY2021) in dark current (Blue) and standard deviation (Red) of the monthly averaged results.

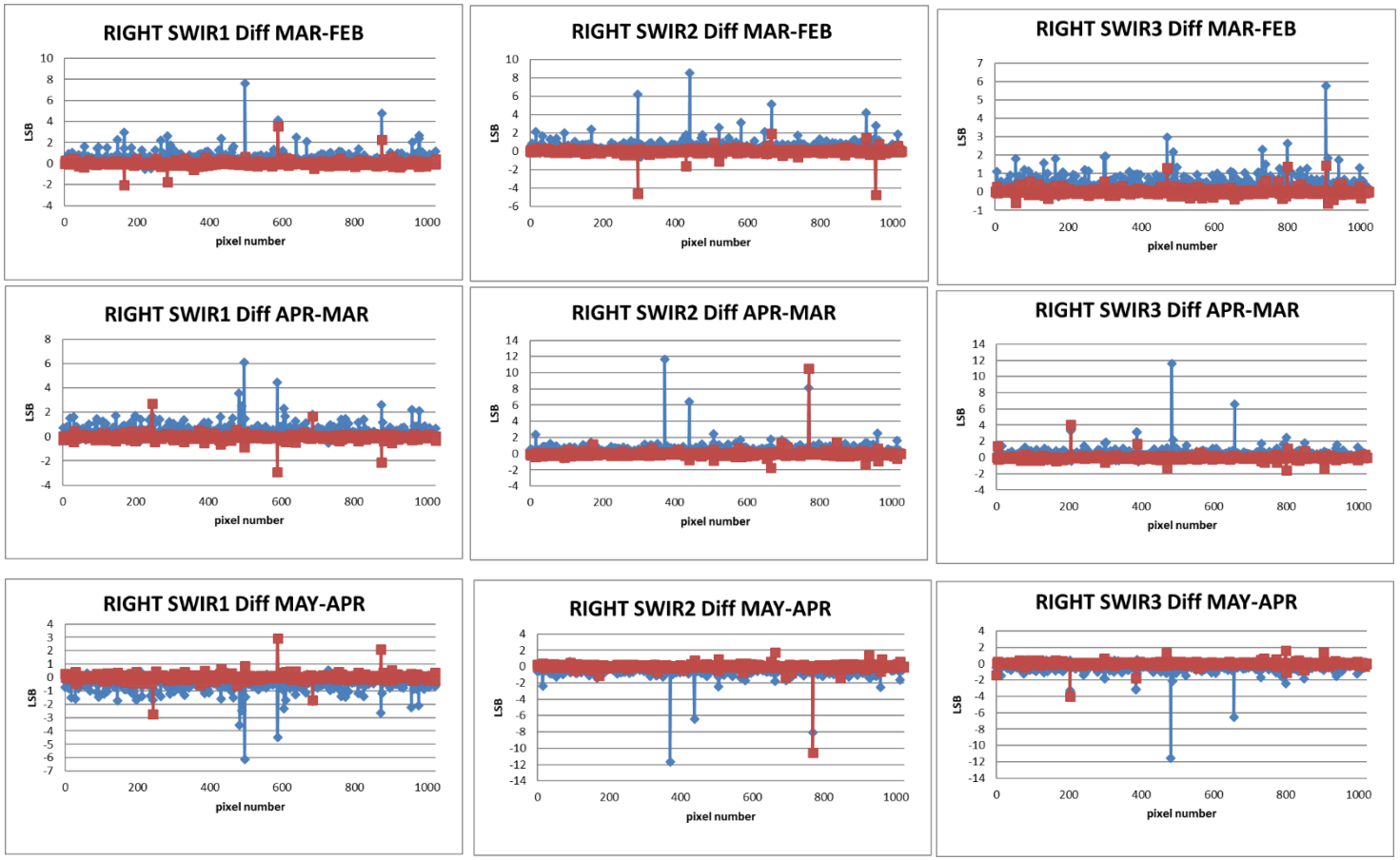


Figure 17. RIGHT camera SWIR: Monthly difference (FEB2021 – MAY2021) in dark current (Blue) and standard deviation (Red) of the monthly averaged results.

LEFT																		
JAN-FEB-MAR						FEB-MAR-APR						MAR-APR-MAY						
SWIR1		SWIR2		SWIR3		SWIR1		SWIR2		SWIR3		SWIR1		SWIR2		SWIR3		
739	H DC BAD	840	H DC BAD	90	H DC BAD	0	H DC BAD	12	H DC NOK	68pixels	H DC BAD	0	H DC NOK	37	H DC NOK	18	H DC BAD	
0	H DC NOK	12	H DC NOK	115	H DC BAD	3	H DC BAD	37	H DC NOK	49pixels	H DC NOK	3	H DC NOK	95	H DC NOK	82	H DC BAD	
3	H DC NOK	623	H DC NOK	482	H DC BAD	28	H DC BAD	95	H DC NOK	898 pixels	H DC OK	9	H DC NOK	265	H DC NOK	121	H DC BAD	
28	H DC NOK	694	H DC NOK	564	H DC BAD	298	H DC BAD	694	H DC NOK			28	H DC NOK	826	H DC NOK	325	H DC BAD	
84	H DC NOK	524 pixels	H DC OK	568	H DC BAD	345	H DC BAD	826	H DC NOK			34	H DC NOK	844	H DC NOK	336	H DC BAD	
104	H DC NOK			669	H DC BAD	739	H DC BAD	840	H DC NOK			113	H DC NOK	553pixels	H DC OK	438	H DC BAD	
214	H DC NOK			673	H DC BAD	877	H DC BAD	538pixels	H DC OK			298	H DC NOK			455	H DC BAD	
224	H DC NOK			698	H DC BAD	956	H DC BAD					345	H DC NOK			564	H DC BAD	
298	H DC NOK			943	H DC BAD	9	H DC NOK					665	H DC NOK			798	H DC BAD	
345	H DC NOK			101pixels	H DC NOK	34	H DC NOK					739	H DC NOK			807	H DC BAD	
877	H DC NOK			897 pixels	H DC OK	104	H DC NOK					800	H DC NOK			966	H DC BAD	
956	H DC NOK					113	H DC NOK					877	H DC NOK			74pixels	H DC NOK	
336pixels	H DC OK					973	H DC NOK					956	H DC NOK			929 pixels	H DC OK	
						346pixels	H DC OK					973	H DC NOK					
												358pixels	H DC OK					

Table 3. LEFT SWIR dark current pixel outliers (ID L1A).

CENTER																		
JAN-FEB-MAR						FEB-MAR-APR						MAR-APR-MAY						
SWIR1		SWIR2		SWIR3		SWIR1		SWIR2		SWIR3		SWIR1		SWIR2		SWIR3		
781	H DC NOK	625	H DC NOK	698	H DC NOK	545	H DC BAD	121	H DC BAD	30	H DC BAD	511	H DC NOK	2	H DC NOK	801	H DC BAD	
185	H DC NOK	2	H DC NOK	969	H DC NOK	819	H DC BAD	831	H DC BAD	99	H DC BAD	526	H DC NOK	121	H DC NOK	30	H DC NOK	
246	H DC NOK	2	H DC NOK	30	H DC NOK	1021	H DC BAD	2	H DC NOK	131	H DC BAD	545	H DC NOK	441	H DC NOK	99	H DC NOK	
344	H DC NOK	2	H DC NOK	99	H DC NOK	185	H DC NOK	84	H DC NOK	141	H DC BAD	819	H DC NOK	831	H DC NOK	131	H DC NOK	
545	H DC NOK	2	H DC NOK	131	H DC NOK	344	H DC NOK	625	H DC NOK	364	H DC BAD	880	H DC NOK	464pixels	H DC OK	141	H DC NOK	
819	H DC NOK	2	H DC NOK	141	H DC NOK	511	H DC NOK	453pixels	H DC OK	550	H DC BAD	907	H DC NOK			249	H DC NOK	
1021	H DC NOK	2	H DC NOK	364	H DC NOK	781	H DC NOK			565	H DC BAD	1021	H DC NOK			364	H DC NOK	
348 pixels	H DC OK	435pixels	H DC OK	396	H DC NOK	907	H DC NOK			579	H DC BAD	369 pixels	H DC OK			390	H DC NOK	
				550	H DC NOK	359 pixels	H DC OK			631	H DC BAD					512	H DC NOK	
				565	H DC NOK					669	H DC BAD					550	H DC NOK	
				579	H DC NOK					674	H DC BAD					565	H DC NOK	
				631	H DC NOK					712	H DC BAD					579	H DC NOK	
				640	H DC NOK					794	H DC BAD					631	H DC NOK	
				669	H DC NOK					836	H DC BAD					669	H DC NOK	
				674	H DC NOK					868	H DC BAD					674	H DC NOK	
				712	H DC NOK					890	H DC BAD					712	H DC NOK	
				763	H DC NOK					973	H DC BAD					794	H DC NOK	
				794	H DC NOK					994	H DC BAD					836	H DC NOK	
				836	H DC NOK					249	H DC NOK					868	H DC NOK	
				868	H DC NOK					512	H DC NOK					890	H DC NOK	
				890	H DC NOK					640	H DC NOK					973	H DC NOK	
				957	H DC NOK					698	H DC NOK					994	H DC NOK	
				973	H DC NOK					763	H DC NOK					234 pixels	H DC OK	
				994	H DC NOK					801	H DC NOK							
				209 pixels	H DC OK					957	H DC NOK							
										969	H DC NOK							
										224 pixels	H DC OK							

Table 4. CENTER SWIR dark current pixel outliers (ID L1A)

RIGHT																		
JAN-FEB-MAR						FEB-MAR-APR						MAR-APR-MAY						
496	H DC NOK	295	H DC BAD	85	H DC NOK	597	H DC BAD	438	H DC BAD	482	H DC NOK	496	H DC BAD	370	H DC BAD	482	H DC BAD	
587	H DC NOK	438	H DC NOK	904	H DC NOK	719	H DC BAD	295	H DC NOK	656	H DC NOK	587	H DC BAD	438	H DC NOK	656	H DC BAD	
873	H DC NOK	664	H DC NOK	560pixels	H DC OK	873	H DC NOK	370	H DC NOK	904	H DC NOK	598pixels	H DC OK	769	H DC NOK	596pixels	H DC OK	
597pixels	H DC OK	838	H DC NOK			597pixels	H DC OK	664	H DC NOK	595pixels	H DC OK			723pixels	H DC OK			
		925	H DC NOK					769	H DC NOK									
		951	H DC NOK					925	H DC NOK									
		1012	H DC NOK					720pixels	H DC OK									
		690pixels	H DC OK															

Table 5. RIGHT SWIR dark current pixel outliers (ID L1A)

1.4. Bad pixels

There are two new bad pixel identified in this reporting period.

Reporting period mid-June2021 - Mid-Oct 2021																														
CAMERA	STRIP	pixel numbers (ID L1 A)																												
		NEW BAD	BAD (from previous periods)																											
left	swir1	334	3	28	39	84	104	298	345	352	644	877	956																	
left	swir2		711	717	841	863																								
left	swir3		4	82	90	172	250	325	370	419	438	568	737	759	761	890														
center	swir1		448	819	1021																									
center	swir2		57	114	121	295	769	831	900																					
center	swir3		29	30	99	131	141	291	413	448	476	529	550	565	579	631	640	669	674	712	763	794	804	836	889	890	917	938	994	
right	swir1	647	364	496																										
right	swir2		14	438	470																									
right	swir3		496																											

Table 6: Overview Bad pixels

1.5. Radiometric ICP file

The updates to the radiometric ICP file used within the user segment for the processing of the nominal PROBA-V data by PF are listed in the Table 9 for collection 1.

PROBAV_X_R_000_YEARMN01_**101**.xml*	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20161201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20161201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20161201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20161201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20170101_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20170120_01.xml	SWIR status map updated : 1 bad pixel added
PROBAV_X_R_000_20170201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20170220_01.xml	SWIR status map updated : 1 bad pixel added

PROBAV_X_R_000_20170301_01.xml	Update dark currents Update of SWIR absolute following linear degradation model**
PROBAV_X_R_000_20170401_01.xml	Update dark currents Update of SWIR absolute following linear degradation model** SWIR status map updated : 1 bad pixel added
PROBAV_X_R_000_2017051_01.xml	Update dark currents Update of SWIR absolute following linear degradation model** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model***
PROBAV_X_R_000_20170601_01.xml	Update dark currents Update of SWIR absolute following linear degradation model** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model***
PROBAV_X_R_000_20170701_01.xml	Update dark currents Update of SWIR absolute following linear degradation model** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model*** SWIR status map updated : 1 bad pixel added
PROBAV_X_R_000_20170801_01.xml	Update dark currents Update of SWIR absolute following linear degradation model** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model*** SWIR status map updated : 2 bad pixel added
PROBAV_X_R_000_20170901_01.xml	Update dark currents Update of SWIR absolute following linear degradation model***, new coef applied for RIGHT SWIR strips***** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** SWIR status map updated : 2 bad pixel added

PROBAV_X_R_000_20171001_01.xml	Update dark currents Update of SWIR absolute following linear degradation model***, new coef applied for RIGHT SWIR strips***** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20171101_01.xml	Update dark currents Update of SWIR absolute following linear degradation model***, new coef applied for RIGHT SWIR strips***** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20171201_01.xml	Update dark currents Update of SWIR absolute following linear degradation model***, new coef applied for RIGHT SWIR strips***** Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180101_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180201_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180301_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients

	following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180401_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180501_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180601_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180701_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20180801_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****

PROBAV_X_R_000_20180821_01.xml	SWIR status map updated : 1 bad pixel added for SWIR2 center camera + correction for assignment of bad pixel status to wrong pixel ID
PROBAV_X_R_000_20180901_01.xml	Update dark currents Update of LEFT and CENTER SWIR absolute following linear degradation model***; **No update of RIGHT SWIR absolute cal**.. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20181001_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20181101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20181201_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20190101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_2010201_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****

PROBAV_X_R_000_20190301_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20190401_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20190501_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One new bad pixel added : left SWIR3 PixelID 82 (0-based)
PROBAV_X_R_000_20190601_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** Two new bad pixel added : left SWIR2 PixelID 717 (0-based) and CENTER SWIR1 PixelID 448
PROBAV_X_R_000_20190701_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** Update equalization coefficients LEFT and RIGHT SWIR strips based on Yaw maneuver analyses.
PROBAV_X_R_000_20190801_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20190901_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****

PROBAV_X_R_000_20191001_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20191101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20191201_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** Two new bad pixel added : CENTER SWIR3 Pixel ID 529 (0-based)) and RIGHT SWIR1 Pixel ID 364(0-based)).
PROBAV_X_R_000_20200101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20200204_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20200222_01.xml	One new bad pixel added : CENTER SWIR3 Pixel ID CENTER SWIR3 Pixel ID 836 (0-based))

PROBAV_X_R_000_20200301_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20200318_01.xml	Three new bad pixel added : CENTER SWIR3 Pixel ID 413 (0-based), Pixel ID 550 (0-based), Pixel ID 565 (0-based)
PROBAV_X_R_000_20200402_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20200502_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** Three new bad pixel added : Center SWIR3 Pixel ID 669 and Pixel ID 674 (0-based), LEFT SWIR3 PixelD 4 (0-based).
PROBAV_X_R_000_20200601_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20200704_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** Three bad pixels Center SWIR3 Pixel ID 141 (0-based), LEFT SWIR1 PixelD 84 (0-based), LEFT SWIR3 PixelD 890 (0-based),
PROBAV_X_R_000_20200801_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One bad pixel: Center SWIR3 Pixel ID 712 (0-based).

PROBAV_X_R_000_20200901_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One bad pixel: Left SWIR2 Pixel ID 841 (0-based).
PROBAV_X_R_000_20201001_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20201101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20201201_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One bad pixel: : pixel ID496 in the Right SWIR3 (0-based).
PROBAV_X_R_000_20210101_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One bad pixel: pixel ID496 in the Right SWIR1 (0-based).
PROBAV_X_R_000_20210201_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20210401.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** 3 new bad pixels: • LEFT SWIR3 strip Pixel ID 325 • LEFT SWIR3 strip Pixel ID 737 • CENTER SWIR3 strip Pixel ID 631

PROBAV_X_R_000_20210501_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20210601_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** ****
PROBAV_X_R_000_20210701_01.xml	Update dark currents. Update of LEFT BLUE and CENTER BLUE absolute calibration coefficients following linear degradation model **with new coef** **** One bad pixel has been identified: CENTER SWIR3 pixel ID 291

Table 7: Radiometric ICP-file updates Collection 1

2. Geometric Image Quality

2.1. Summary

The quarterly Average Location Error (ALE) over the period 16/6/2021 – 31/10/2021 was 65 m (1σ = 86 m) for all spectral bands (combined cameras). Compared to the previous reporting period, the ALE has increased by 2 m (+3%). The total number of Ground Control Points used increased by 42% compared to previous quarter and was 8,790,034 in total. The daily Average Location Error compliance (ALE < 300 m) was 99.15%, which is 0.02% lower than in the previous quarter.

For the combined cameras, the inter-band geometric accuracy range was 19 – 55 m (standard deviation range 5 – 10 m), which is 0.06 – 0.17 of a pixel (333 m). The average inter-band RED-NIR registration accuracy was 21 m, which is equal to the previous reporting period.

The multi-temporal geometric accuracy was 88.15% (0.17% higher compared to previous quarter) for the VNIR and 95.98% (1.19% higher compared to previous quarter) for the combined VNIR/SWIR. The multi-temporal accuracies over the last full year are 87.47% and 95.13% for VNIR and VNIR/SWIR, respectively.

The geometric ICP file generated on 5/3/2021, valid from 1/1/2021 has remained valid throughout the reporting period.

2.2. Assessment of the geometric accuracy on L1C data

The absolute location error (ALE) and accompanying standard deviation of the Level1C data is presented in the tables below for each camera, spectral band/strip and reporting month.

CAMERA 1 Mean and standard deviation ALE [m]				
Strip\Period	**16/06/2021 - 15/07/2021**	**16/07/2021 - 15/08/2021**	**16/08/2021 - 15/09/2021**	**16/09/2021 – 31/10/2021**
BLUE	43.82, σ = 24.00	49.88, σ = 26.85	50.71, σ = 26.82	55.09, σ = 29.07
RED	44.00, σ = 25.20	48.49, σ = 27.31	48.14, σ = 26.53	51.60, σ = 29.15
NIR	49.34, σ = 26.70	51.92, σ = 28.80	52.42, σ = 28.25	55.20, σ = 30.07
SWIR1	81.91, σ = 49.76	75.82, σ = 47.35	72.90, σ = 46.36	69.74, σ = 43.96
SWIR2	49.48, σ = 27.40	49.61, σ = 27.85	47.97, σ = 26.69	48.84, σ = 27.57
SWIR3	43.52, σ = 23.89	52.17, σ = 27.45	50.88, σ = 26.85	55.64, σ = 29.95

Table 8: Mean absolute location error and standard deviation (σ) for camera 1.

CAMERA 2 Mean and standard deviation ALE [m]				
Strip\Period	**16/06/2021 - 15/07/2021**	**16/07/2021 - 15/08/2021**	**16/08/2021 - 15/09/2021**	**16/09/2021 – 31/10/2021**
BLUE	38.79, σ = 20.88	44.82, σ = 25.46	41.73, σ = 23.14	43.36, σ = 26.86
RED	38.76, σ = 20.96	45.49, σ = 25.85	42.46, σ = 23.41	44.29, σ = 27.69
NIR	39.06, σ = 21.30	46.11, σ = 25.98	43.41, σ = 24.04	46.43, σ = 28.45
SWIR1	43.88, σ = 23.94	48.80, σ = 27.68	45.20, σ = 25.26	48.30, σ = 28.91
SWIR2	43.98, σ = 24.27	49.70, σ = 28.19	46.74, σ = 26.00	50.28, σ = 29.87
SWIR3	47.49, σ = 26.28	53.20, σ = 29.95	49.64, σ = 27.04	54.08, σ = 32.00

Table 9: Mean absolute location error and standard deviation (σ) for camera 2.

CAMERA 2 Mean and standard deviation ALE [m]				
Strip\Period	**16/06/2021 - 15/07/2021**	**16/07/2021 - 15/08/2021**	**16/08/2021 - 15/09/2021**	**16/09/2021 – 31/10/2021**
BLUE	50.65, σ = 27.00	53.35, σ = 27.79	49.24, σ = 26.51	53.53, σ = 31.22
RED	54.09, σ = 29.20	55.14, σ = 29.16	50.36, σ = 27.10	53.84, σ = 31.67
NIR	52.85, σ = 29.00	55.88, σ = 29.53	51.65, σ = 27.98	57.25, σ = 33.10
SWIR1	52.16, σ = 28.10	54.00, σ = 29.73	49.18, σ = 26.72	53.49, σ = 30.81
SWIR2	56.59, σ = 30.35	60.13, σ = 31.73	57.15, σ = 30.40	64.72, σ = 36.92
SWIR3	83.71, σ = 48.10	80.84, σ = 45.94	77.76, σ = 46.47	83.17, σ = 51.20

Table 10: Mean absolute location error and standard deviation (σ) for camera 3.

In the reporting period, the average L1C location error data was 53 m, which is 3 m (6%) higher than in the previous quarter.

2.3. Assessment of the geometric accuracy on L2 data

2.3.1. Absolute geometric accuracy

The daily summary of the L2 data absolute location error for all spectral bands is presented in the tables and figures below for the three reporting months:

- from 16/06/2021 – 15/07/2021
- from 16/07/2021 – 15/08/2021
- from 16/08/2021 – 15/09/2021
- from 16/09/2021 – 31/10/2021

The tables list:

- The day of the measurement in format dd-mm-yy
- The daily achieved compliance (%B) for the BLUE band (% of GCP where ALE ≤ 300m)
- The daily achieved compliance (%R) for the RED band (% of GCP where ALE ≤ 300m)
- The daily achieved compliance (%N) for the NIR band (% of GCP where ALE ≤ 300m)
- The daily achieved compliance (%S) for the SWIR band (% of GCP where ALE ≤ 450m)

- The number of GCP per day (NB-B) used to derive the absolute location error ALE for the BLUE band
- The daily average ALE (in m) for the BLUE band (MU-B)
- The daily ALE standard deviation (in m) for the BLUE band (STD-B)

- The number of GCP per day (NB-R) used to derive the absolute location error ALE for the RED band
- The daily average ALE (in m) for the RED band (MU-R)
- The daily ALE standard deviation (in m) for the RED band (STD-R)

- The number of GCP per day (NB-N) used to derive the absolute location error ALE for the NIR band
- The daily average ALE (in m) for the NIR band (MU-N)
- The daily ALE standard deviation (in m) for the NIR band (STD-N)

- The number of GCP per day (NB-S) used to derive the absolute location error ALE for the SWIR band
- The daily average ALE (in m) for the SWIR band (MU-S)
- The daily ALE standard deviation (in m) for the SWIR band (STD-S)

Day	%B	%R	%N	%S	NB-B	MU-B	STD-B	NB-R	MU-R	STD-R	NB-N	MU-N	STD-N	NB-S	MU-S	STD-S
16/06/2021	98.71	99.35	99.4	99.64	16476	67.49	109.14	18213	60.35	92.59	19182	56.94	83.35	16453	64.32	89.74
17/06/2021	97.99	99.08	99.08	99.58	18336	74.59	98.92	20474	66.39	86.87	21867	62.36	89.6	18246	67.17	94.27
18/06/2021	98.51	99.13	99.27	99.67	18352	70.26	86.87	21142	62.74	83.57	23415	58.48	83.99	18888	64.47	81.49
19/06/2021	98.47	99.29	99.38	99.71	17733	69.88	92.74	20658	61.43	69.49	21266	58.97	73.47	18375	63.99	78.07
20/06/2021	98.18	99.3	99.41	99.72	17727	70.5	91.59	20465	63.61	77.16	21976	59.45	67.14	18988	65.18	78.28
21/06/2021	98.35	99.02	99.24	99.72	19046	70.82	106.46	21331	64.78	96	22631	61.25	81.56	19313	64.15	80.01
22/06/2021	98.43	99.09	99.13	99.6	20338	69.74	103.43	23044	62.31	80.97	23898	61.28	81.8	19638	66.34	87.31
23/06/2021	98.66	99.24	99.24	99.62	19074	66.5	95.96	22484	61.41	85.91	22862	60.06	80.29	18492	65.79	85.82
24/06/2021	98.75	99.3	99.3	99.61	19026	64.27	93.84	22492	58.2	81.28	22370	56.04	75.64	19997	61.92	79.26
25/06/2021	98.85	99.36	99.39	99.77	17626	64.38	90.18	20670	59.18	85.53	20403	56.48	74.56	18948	61.52	75.97
26/06/2021	98.41	99.25	99.21	99.68	19250	71.82	107.14	21969	62.51	75.81	21520	60.83	76.17	18888	66.01	84.81
27/06/2021	98.49	99.13	99.13	99.53	20611	70.28	104.23	22743	62	87.88	22368	61.15	84.74	18466	65.55	84.2
28/06/2021	98.68	99.22	99.3	99.67	18677	67.26	101.37	21378	61.4	83.74	21492	58.17	71.62	18319	62.74	79.72
29/06/2021	98.66	99.22	99.31	99.65	16898	68.31	96.55	19653	63.32	89.95	20820	58.73	75.13	18199	66.54	89.91
30/06/2021	98.63	99.25	99.13	99.65	17513	66.61	101.57	19661	60.58	78.53	18236	60.62	87.32	13001	65.65	94.25
01/07/2021	98.25	98.88	99.03	99.48	20181	71.79	101.58	22915	64.95	88.99	23764	63.06	85.86	19773	68.77	87.78
02/07/2021	98.38	98.94	99.03	99.59	19680	71.66	111.94	23225	64.22	89.54	24632	61.5	87.83	19304	67.67	89.66
03/07/2021	98.85	99.3	99.45	99.66	17770	67.39	97.45	21593	60.47	77.28	22619	57.39	75.85	18617	64.91	78.52
04/07/2021	98.52	99.38	99.32	99.62	15904	67.31	98.52	19952	59.26	79.13	22544	56.33	82.26	18195	63.55	80.77
05/07/2021	98.76	99.21	99.17	99.66	18882	66.37	93.76	22094	59.1	77.06	24054	57.03	86.8	19192	61.83	80.48
06/07/2021	98.79	99.24	99.34	99.7	19206	65.17	80.25	22712	57.9	78.27	23854	55.03	68.11	18928	60.89	66.85
07/07/2021	98.86	99.11	99.28	99.68	17383	63.08	96.47	21086	57.45	81.33	21117	54.96	72.04	17627	61.33	77.72
08/07/2021	98.78	99.42	99.52	99.77	16752	63.6	91.45	20887	56.5	71.92	22096	53.59	69.75	19754	59.8	73.61
09/07/2021	98.9	99.28	99.32	99.7	15857	66.82	91.64	19108	61.07	84.61	20144	57.88	79.02	18131	62.9	81.02
10/07/2021	98.31	99.02	99.06	99.49	14234	71.32	110.03	17323	61.53	92.86	18061	58.63	95.34	15446	63.69	91.68
11/07/2021	98.62	99.03	99.12	99.61	16757	67.44	89.74	20010	62	81.27	19586	59.56	76.25	16486	65.37	82.55
12/07/2021	98.91	99.16	99.28	99.69	16883	64.74	98.11	20338	60.2	88.41	20267	56.35	76.04	18562	61.53	74.3
13/07/2021	98.49	99.29	99.35	99.59	15557	66.19	94.52	18912	59.86	82.34	19766	56.28	73.05	18239	61.95	88.39
14/07/2021	98.42	99.09	99.2	99.59	16100	67.74	95.34	18859	60.52	80.97	19995	56.42	74.73	17609	60.78	87.27
15/07/2021	98.8	98.53	98.94	99.42	3092	74.25	117.72	3470	70.53	120.28	3861	67.24	116.29	3436	71.26	110.4
Averages	**98.58**	**99.17**	**99.24**	**99.64**	**520921**	**68.25**	**98.28**	**608861**	**61.53**	**84.32**	**630666**	**58.74**	**80.19**	**533510**	**64.25**	**83.8**

Table 11: Daily achieved compliance and the daily average location error (in m) for all spectral bands in the period 16/06/2021 – 15/07/2021.

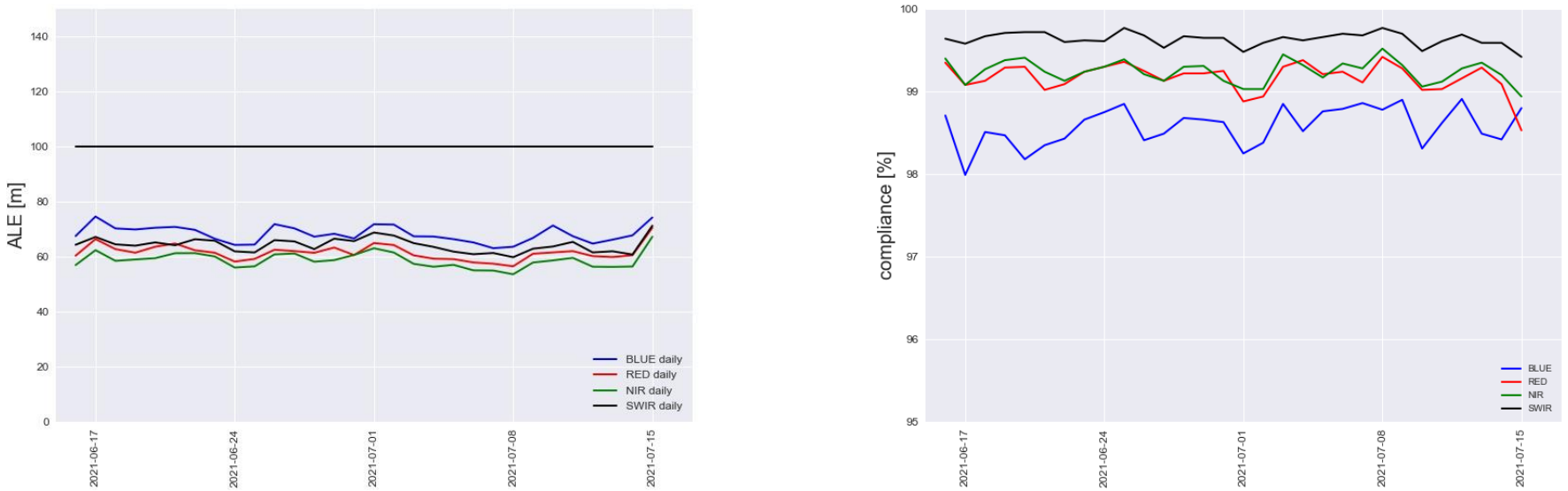


Figure 18: Daily average location error in the period from 16/06/2021 – 15/07/2021 (left) and the average daily compliance of the spectral bands (right).

Day	%B	%R	%N	%S	NB-B	MU-B	STD-B	NB-R	MU-R	STD-R	NB-N	MU-N	STD-N	NB-S	MU-S	STD-S
16/07/2021	98.67	98.91	99.15	99.7	15243	69.12	89.51	19420	65.29	88.15	19438	63.31	68.52	16661	67.54	82.43
17/07/2021	99	99.15	99.22	99.71	14437	66.33	87.3	17627	64.74	88.75	18193	62.67	76.05	16180	67.3	69.15
18/07/2021	98.52	98.87	98.8	99.59	12740	75.76	106.61	15610	72.97	99.09	15697	74.56	101.93	14358	72.98	91.23
19/07/2021	98.56	99.1	99.11	99.59	15023	72.41	116.09	17518	65.82	83.24	17131	65.11	85.9	14968	68.2	90.34
20/07/2021	98.18	98.85	99	99.62	14240	71.43	91.92	16655	66.9	89.81	16581	64.35	79.99	13911	68.38	82.92
21/07/2021	98.85	99.09	99.16	99.53	13372	66.36	94.68	14217	62.66	84.04	12350	63.42	92.22	8860	69.19	95.49
22/07/2021	98.86	99.38	99.49	99.65	11632	65.06	94.99	13173	59.69	82.92	13706	58.19	81.28	8583	65.38	86.85
23/07/2021	98.95	99.28	99.15	99.72	8255	66.83	92	9443	58.97	91.49	9019	60.49	101.6	8184	61.77	75.04
24/07/2021	98.18	98.89	99.16	99.59	10510	72.31	97.15	12036	66.81	81.53	12485	63.69	73.05	10524	69.75	94.89
25/07/2021	98.55	99.06	99.29	99.61	14610	70.81	94.27	17212	65.8	86.72	17794	65.17	75.77	14940	68.65	81.01
26/07/2021	98.69	99.44	99.45	99.72	14469	71.75	89.06	17019	63.84	67.63	17714	63.34	71.4	15820	68.47	77.45
27/07/2021	98.69	99.27	98.88	99.43	4743	78.24	116.94	5865	70.05	78.92	5457	75.2	115.8	6008	74.55	98.03
28/07/2021	98.62	99.05	99.21	99.64	15763	73.37	90.84	18843	66.82	79.85	19073	64.42	81.04	16440	67.9	82.44
29/07/2021	98.31	98.92	99.02	99.6	13145	73.71	92.15	15165	68.41	83.44	14539	67.82	85.05	12298	74.38	85.3
30/07/2021	98.84	99.3	99.4	99.74	16412	63.72	94.64	18699	57.83	75.85	17957	55.38	74.29	16285	61.55	75.55
31/07/2021	99.1	99.15	98.8	99.57	556	58.44	68.66	703	58.02	53.77	752	61.35	126.38	699	68.65	112.38
01/08/2021	98.88	99.31	99.22	99.72	16429	63.68	89.71	18887	58.1	76.09	17770	58.12	80.53	16642	61.2	75.5
02/08/2021	98.33	99.21	99.21	99.64	16290	72.29	113.36	18792	61.83	84.19	18255	61.99	77.21	16038	65.7	79.35
03/08/2021	98.74	99.18	99.25	99.65	15260	67.08	103.61	18057	61.03	88.59	17535	59.62	82.28	14887	66.12	82.84
04/08/2021	98.83	99.34	99.44	99.68	14577	65.54	95.92	17325	61.15	87.06	17566	58.17	68.34	15437	65.1	86.19
05/08/2021	98.8	99.18	99.14	99.7	15054	73.04	94.97	18011	67.94	84.32	18387	67.43	82.97	16735	68.72	81.89
06/08/2021	98.33	98.9	99.02	99.67	16191	74.77	90.94	18849	69.15	91.9	19118	68.96	88.1	16383	69.67	82.85
07/08/2021	98.52	98.87	99.07	99.65	16568	73.14	98.39	19359	66.68	86.3	19345	65.1	79.18	15517	68.42	94.36
08/08/2021	98.69	99.03	99.03	99.54	14545	68.93	89.75	17197	64.12	85.71	16420	63.17	75.85	14222	67.54	86.71
09/08/2021	98.92	99.44	99.31	99.69	14645	64.23	89.24	17421	59.65	79.88	16698	59.54	81.27	15895	63.81	78.07
10/08/2021	98.56	99.31	99.32	99.71	16393	67.66	94.07	19239	60.9	82.96	18777	59.8	81.9	17434	61.81	82.54
11/08/2021	98.15	98.94	99.03	99.64	15266	74.39	106.27	17642	64.74	85.25	17695	62.54	82.74	14892	65.3	88.38
12/08/2021	98.63	99	99.23	99.68	16186	67.76	93.18	18543	63.64	87.36	18518	60.58	76.92	15623	65.91	84.23
13/08/2021	98.81	99.41	99.43	99.73	14343	65.89	85.12	16826	60.45	86.84	16800	57.1	79.07	15502	62.05	78.67
14/08/2021	98.79	99.25	99.38	99.67	14843	66.23	90.63	17572	61.47	85.12	17119	60.04	81.79	16001	63.97	76.69
15/08/2021	98.05	98.9	99.08	99.38	12802	77.17	106.57	8365	67.3	94.98	6281	65.71	104.55	5151	75.65	123.61
Averages	**98.63**	**99.13**	**99.18**	**99.64**	**424542**	**69.6**	**95.44**	**491290**	**63.96**	**83.93**	**484170**	**63.11**	**84.29**	**421078**	**67.28**	**85.88**

Table 12: Daily achieved compliance and the daily average location error (in m) for all spectral bands in the period 16/07/2021 – 15/08/2021.

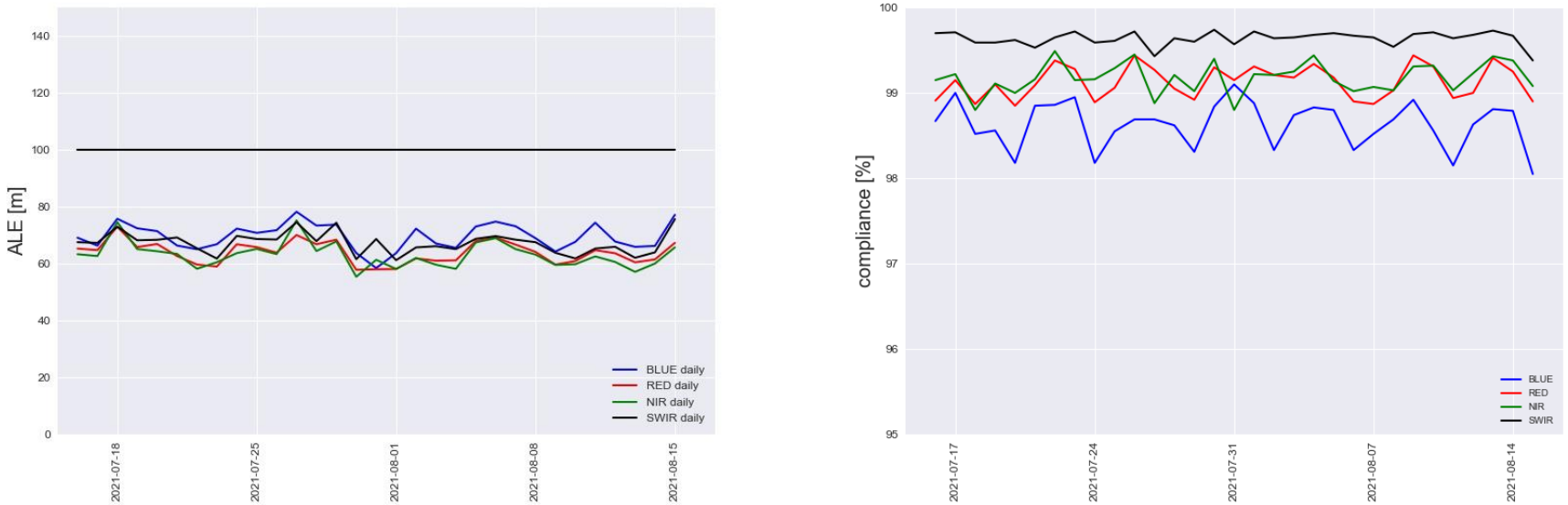


Figure 19: Daily average location error in the period from 16/07/2021 – 15/08/2021 (left) and the average daily compliance of all spectral bands (right).

Day	%B	%R	%N	%S	NB-B	MU-B	STD-B	NB-R	MU-R	STD-R	NB-N	MU-N	STD-N	NB-S	MU-S	STD-S
16/08/2021	98.34	98.98	99.06	99.66	15866	71.88	96.97	17918	65.08	83.96	17646	63.65	77.97	14661	66.5	83.03
17/08/2021	98.67	99.13	99.16	99.63	13948	66.17	96.84	16090	60.87	83.5	15335	59.98	71.36	13653	64.57	71.97
18/08/2021	98.92	99.42	99.39	99.74	14029	63.93	84.27	17015	58.83	80.18	16159	56.77	73.8	16044	60.98	81.14
19/08/2021	98.63	99.4	99.27	99.72	16001	66.35	105.81	18602	58.43	77.2	17758	57.41	80.56	16740	60.86	81.26
20/08/2021	98.51	99.24	99.16	99.62	15856	70.59	102.75	17615	62.07	86.03	16929	62.92	92.65	14916	65.04	90.69
21/08/2021	98.58	99.13	99.27	99.61	17155	68.06	83.04	19689	62.37	83.98	20135	59.97	70.21	16622	66.88	90.56
22/08/2021	98.9	99.28	99.27	99.67	14993	65.79	96.99	17246	59.6	82.47	17167	59.36	76.47	15308	62.81	77.63
23/08/2021	99.02	99.27	99.19	99.53	14692	69.54	96.43	16766	65.15	80.09	15994	65.78	75.09	15252	68.59	86.93
24/08/2021	98.46	99.23	99.16	99.62	15105	70.83	101.09	17278	63.17	75.9	16227	63.58	83.5	14641	64.95	87.24
25/08/2021	98.56	98.91	98.96	99.5	15380	70.28	96.56	17111	63.15	87.94	17190	62.9	88.9	13994	66.4	94.48
26/08/2021	98.55	99.02	99.17	99.62	13002	64.11	87.94	15133	59.9	86.9	14519	58.57	71.62	13052	61.56	91.94
27/08/2021	98.77	99.23	99.26	99.62	13951	64.71	84.89	16783	59.72	81.71	17160	56.45	71.47	15886	61.93	79.53
28/08/2021	98.7	99.21	99.19	99.64	15503	68.96	103.81	18986	62.28	93.14	18559	60.67	91.04	17948	62.11	83.37
29/08/2021	98.57	99.16	99.13	99.61	17236	73.9	101.29	20042	66.34	77.48	20079	66.44	90.67	18324	68.24	82.7
30/08/2021	98.55	99.05	99.09	99.59	15613	71.65	79.82	18032	68.35	86.27	18472	67.72	82.45	15320	71.35	91.78
31/08/2021	98.89	99.35	99.34	99.64	14630	68.77	80.01	13874	63.44	75.74	10695	61.85	70.82	9239	65.98	75.23
01/09/2021	99.05	99.44	99.38	99.67	14815	66.93	89.95	16481	62.97	86.12	16640	61.92	78.5	15200	65.44	82.37
02/09/2021	98.79	99.29	99.09	99.58	16087	69.93	96.63	17994	65.03	80.74	17591	65.45	80.68	15683	67.04	88.71
03/09/2021	98.59	99.14	99.17	99.6	13019	71.15	97.24	14604	63.41	84.42	14759	63.13	86.39	12505	66.27	86.55
04/09/2021	98.61	99.19	99.38	99.65	14198	65.5	89.37	16362	60.44	84.38	17479	55.59	62.35	14760	60.59	75.01
05/09/2021	98.85	99.5	99.4	99.68	12925	65.2	98.52	15143	58.46	75.67	15374	56.97	68.4	14584	60.59	77.41
06/09/2021	97.82	98.76	98.95	99.6	7474	79.1	114.43	9193	68.47	87.72	8854	66.69	79.8	9338	65.7	87.4
07/09/2021	98.02	98.8	98.95	99.46	13902	81.15	109.61	15716	73.69	104.08	15594	72.89	94.68	13375	75.41	104.74
08/09/2021	98.52	99.04	99.24	99.73	14085	71.72	97.67	15863	66.33	94.01	16505	63.32	70.64	14263	66.32	81.33
09/09/2021	99.12	99.48	99.47	99.71	6460	64.13	80.27	7162	60.3	76.63	7317	60.08	72.17	7347	62.41	66.37
10/09/2021	99.11	99.35	99.37	99.6	13374	64.37	100.08	15957	59.91	80.78	16564	57.51	82.98	15851	60.05	88.46
11/09/2021	98.85	99.3	99.3	99.75	16304	66.91	104.95	18938	59.75	80.28	18415	59.35	84.6	17658	59.82	69.17
12/09/2021	98.61	99.24	99.19	99.61	15709	69.58	106.17	18461	61.22	88.03	18295	60.67	86.72	15218	62.94	88.43
13/09/2021	99.11	99.37	99.43	99.75	13516	61.49	91.39	16194	56.92	81.06	16268	55.04	67.75	13778	58.31	72.82
14/09/2021	98.83	99.23	99.31	99.65	14912	64.49	90.79	17171	59.49	86	16993	59.06	81.75	15914	61.66	84.69
15/09/2021	98.96	99.34	99.28	99.67	16028	64.64	88.3	17838	60.24	86.05	16916	61.99	84.41	16558	61.73	82.46
Averages	**98.69**	**99.21**	**99.23**	**99.64**	**445768**	**68.45**	**95.29**	**511257**	**62.43**	**83.82**	**503588**	**61.41**	**79.05**	**453632**	**64.29**	**83.40**

Table 13: Daily achieved compliance and the daily average location error (in m) for all spectral bands in the period 16/08/2021 – 15/09/2021.

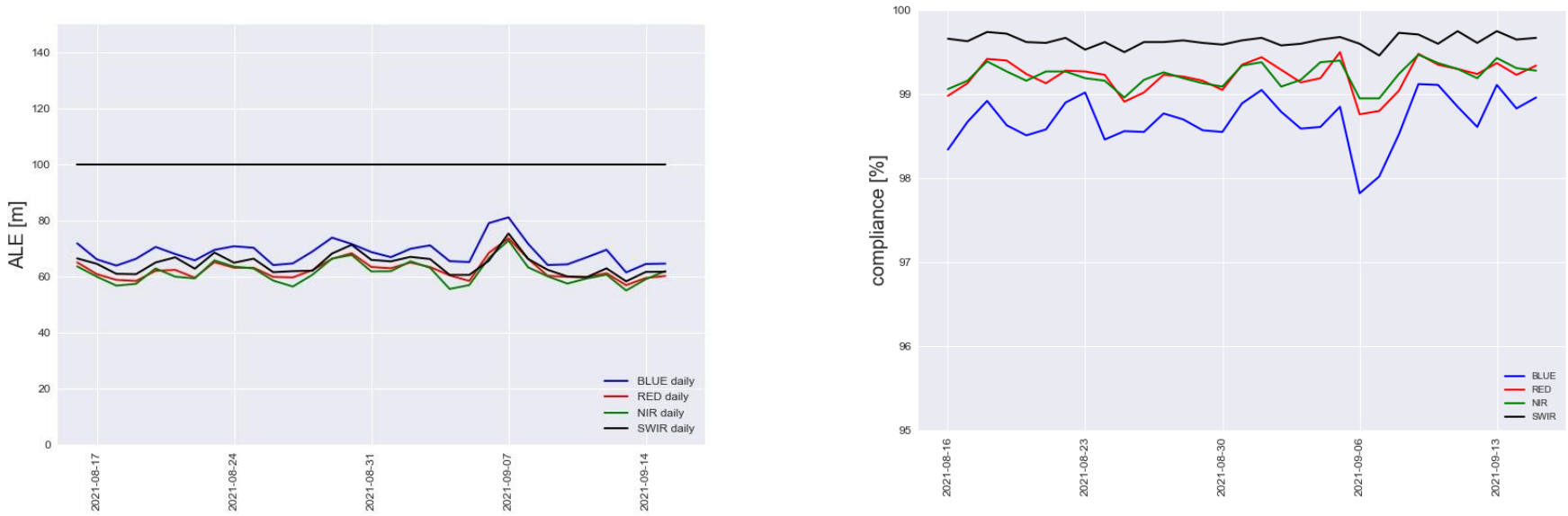


Figure 20: Daily average location error in the period from 16/08/2021 – 15/09/2021 (left) and the average daily compliance of all spectral bands (right).

Day	%B	%R	%N	%S	NB-B	MU-B	STD-B	NB-R	MU-R	STD-R	NB-N	MU-N	STD-N	NB-S	MU-S	STD-S
16/09/2021	98.91	99.25	99.12	99.6	11179	76.35	101.51	12161	70.73	93.01	11643	72.68	98.72	10275	73.1	89.29
17/09/2021	98.54	98.99	99.02	99.74	15429	75.45	102.29	17265	69.4	83.92	17361	68.85	79.31	14249	69.74	83.03
18/09/2021	99.1	99.25	99.32	99.65	14287	65.64	73.46	16057	63.34	74.53	16713	63.14	71.27	14059	65.84	89.84
19/09/2021	98.88	99.4	99.3	99.65	13736	66.69	95.14	15445	61.39	82.76	14909	62.54	85.32	14001	63.55	78.34
20/09/2021	98.82	99.18	99.11	99.63	15000	67.76	105.35	16961	59.78	82.17	16481	60.67	82.71	15183	61.32	84.07
21/09/2021	98.48	99.21	99.2	99.67	16741	71.53	97.58	18566	61.48	77.86	18443	61.68	78.34	14949	65.04	80.48
22/09/2021	99.09	99.25	99.49	99.74	16341	65.31	76.88	18444	60.01	81.95	18243	58.52	65.66	15204	62.9	73.34
23/09/2021	98.95	99.44	99.53	99.78	14989	63.84	97.81	16828	56.99	81.28	16665	54.98	62.29	15155	60.75	74.96
24/09/2021	98.99	99.34	99.28	99.56	13757	66.5	100.92	15722	60.89	90.54	15076	61.51	83.87	13953	64.83	96.06
25/09/2021	99.08	99.51	99.31	99.66	11256	66.17	93.35	11899	57.75	85.34	10949	59.35	69.07	9992	61.79	80.28
26/09/2021	98.61	99.01	99.16	99.69	15162	67.87	82.35	16830	63.27	82.08	16929	61.21	80.14	14423	63.4	77.69
27/09/2021	99.04	99.23	99.31	99.64	16540	66.21	86	18519	61.53	83.45	18519	60.18	72.24	16218	64.92	94.34
28/09/2021	98.83	99.21	99.27	99.62	14844	68.71	98.14	17062	65.47	94.52	17792	62.63	80.82	16456	66.99	88.85
29/09/2021	98.74	99.35	99.26	99.68	16154	64.82	103.67	18112	55.08	68.95	17824	55.84	71.11	16222	58.41	78.87
30/09/2021	98.78	99.36	99.3	99.51	11331	68.01	89.95	12282	58.67	82.83	12119	60.35	88.78	9966	66.12	100.95
01/10/2021	98.96	99.37	99.42	99.82	15127	63.84	89.91	17255	57.38	71.05	17458	56.9	63.22	14849	60.53	66.59
02/10/2021	99.06	99.36	99.39	99.63	14198	62.43	90.77	15901	56.31	71.6	15790	55.19	69.21	13911	59.84	77.14
03/10/2021	99.19	99.35	99.41	99.74	14889	65.26	85.11	16709	61.5	92.8	16810	58.33	68.29	16052	62.5	83.12
04/10/2021	98.68	99.01	98.95	99.71	15654	83	99.28	17309	76.94	82.18	17312	77.51	79.56	15674	78.68	79.38
05/10/2021	97.78	98.5	98.67	99.67	15564	96.79	94.5	17186	94.43	83.01	17058	95.56	76.6	14056	96.97	97.98
06/10/2021	98.74	99.11	98.99	99.68	15288	86.25	85.83	16478	84.36	76.2	16566	85.46	66.92	14287	86.34	76.41
07/10/2021	98.76	98.95	99.09	99.76	14647	87.44	91.3	16553	84.54	73.99	15948	84.33	65.85	16124	85.78	83.4
08/10/2021	98.88	99.15	99.2	99.68	16963	69.06	82.12	18393	64.33	82.45	17752	64.56	73.77	17855	66.95	85.07
09/10/2021	98.7	99.33	99.21	99.67	15835	71.42	105.19	17689	63.65	74.95	17488	64.93	79.02	15605	67.95	78.93
10/10/2021	98.85	99.39	99.51	99.83	16116	62.55	90.82	18398	56	70.54	17767	54.89	63.98	15679	57.76	67.9
11/10/2021	99.14	99.48	99.47	99.74	13677	58.62	80.64	15245	51.95	65.33	15084	50.79	63.59	14195	55.08	61.03
12/10/2021	99	99.4	99.43	99.68	13778	62.55	103.83	15524	55.93	91.8	15061	54.43	76.96	14573	58.62	86.61
13/10/2021	98.77	99.25	99.26	99.7	16360	66.47	100.86	18210	58.22	78.81	17328	58.44	82.43	16008	60.71	84.58
14/10/2021	98.72	99.16	99.07	99.68	16022	69.53	99.82	17426	62.05	71.5	16927	62.41	78.63	14254	64.64	76.5
15/10/2021	99.26	99.4	99.35	99.7	24229	61.44	72.53	26970	57.3	72.32	22149	57.47	76.55	15273	60.96	76.67
16/10/2021	99.13	99.48	99.35	99.72	18586	65.35	93.46	17814	59.17	79.93	17451	60.39	83.66	16703	64.61	83.9
17/10/2021	98.51	99.04	98.98	99.6	13258	69.31	104.77	15266	62.7	86.84	14475	63.55	88.73	13815	64.97	87.7
18/10/2021	98.4	99.19	99.17	99.62	15840	71.46	100.45	17348	62.73	83.65	17552	62.32	80.81	15079	64.5	87.58

19/10/2021	98.82	99.39	99.48	99.71	14522	65.58	85.41	16019	58.89	63.89	15815	58.6	62.02	12584	64.44	82.18
20/10/2021	98.98	99.33	99.51	99.73	11421	67.47	95.45	13041	60.69	73.52	12747	59.11	47.82	11653	64.42	72.47
21/10/2021	98.88	99.39	99.2	99.71	11996	64.05	93.52	13372	58.27	88.14	13024	59.57	93.02	12850	60.45	73.14
22/10/2021	98.4	98.92	98.91	99.57	15302	77.02	104.05	16533	70.07	84.91	15546	71.62	94.56	14723	71.2	94.31
23/10/2021	98.39	98.85	99.08	99.67	14690	77.4	103.11	15685	70.92	90.26	15218	69.91	71.51	13238	69.35	79.24
24/10/2021	90.68	89.6	90	99.01	13056	126.02	128.03	13746	126.2	127.2	13339	124.85	128.13	11865	120.37	128.88
25/10/2021	99.04	99.23	99.25	99.7	12202	68.22	97.63	13085	63.09	79.68	12645	63.27	90.52	12737	66.53	80.24
26/10/2021	98.9	99.35	99.15	99.67	12503	65.41	93.61	13071	58.4	79.88	12532	61.33	94.44	12303	60.75	77.96
27/10/2021	98.57	99.1	99.21	99.54	12400	72.47	114.42	13282	63.89	97.24	12747	62.71	81.11	10980	65.32	92.75
28/10/2021	98.93	99.36	99.39	99.84	11524	66.05	92.59	12339	58.08	80.61	12343	57.91	87.2	9894	60.04	61.06
29/10/2021	98.95	99.4	99.37	99.72	10599	63.22	91.64	12202	56.07	70.41	11805	55.06	75.77	10481	61.41	73.98
30/10/2021	99.27	99.43	99.39	99.73	10866	61.73	76.63	12215	58.03	74.65	11772	57.49	82.05	12000	61.45	83.53
31/10/2021	99.03	99.33	99.28	99.73	11878	63.9	80.64	13261	57.14	67.61	12439	57.88	77.19	12118	59.12	78.26
Averages	**98.66**	**99.03**	**99.05**	**99.67**	**665736**	**70.26**	**94.18**	**735678**	**64.24**	**81.13**	**717614**	**64.15**	**78.10**	**641723**	**66.76**	**82.37**

Table 14: Daily achieved compliance and the daily average location error (in m) for all spectral bands in the period 16/09/2021 – 31/10/2021.

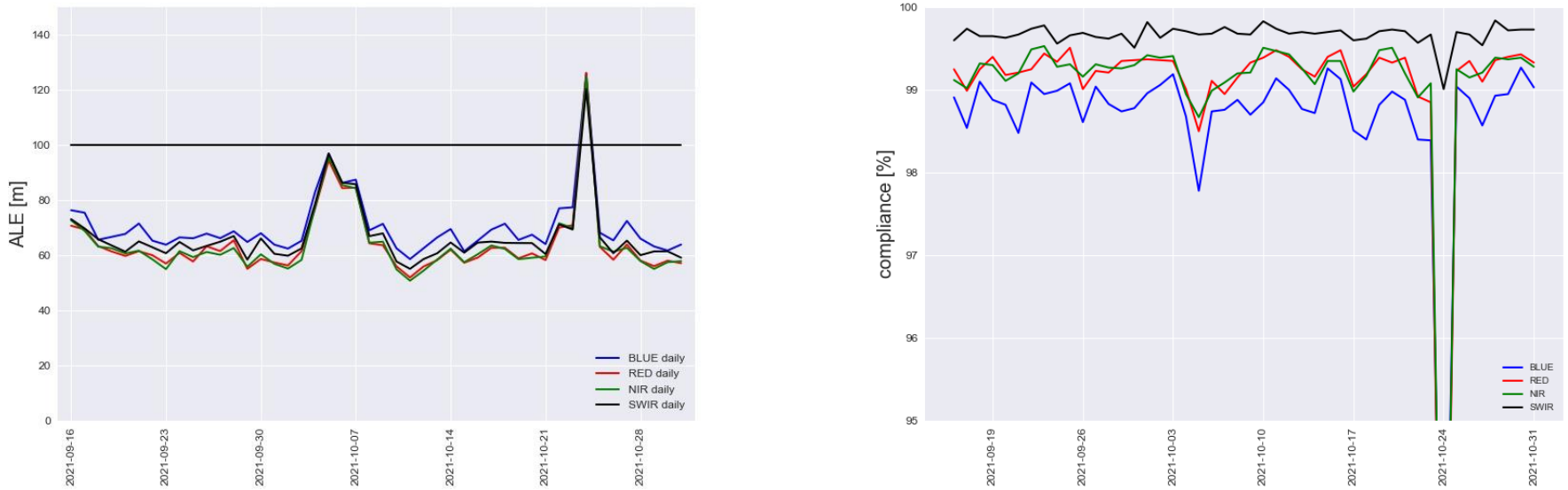


Figure 21: Daily average location error in the period from 16/09/2021 – 31/10/2021 (left) and the average daily compliance of all spectral bands (right).

2.3.2. Inter-band geometric accuracy

The monthly average inter-band geolocation error for all spectral band combinations was as follows:

Band pair	Inter-band error [m]
BLUE-RED	36.11, σ = 7.85
BLUE-NIR	45.80, σ = 9.87
BLUE-SWIR	52.19, σ = 8.56
RED-NIR	21.14, σ = 4.83
RED-SWIR	39.48, σ = 5.34
NIR-SWIR	38.50, σ = 5.04

Table 15: Inter-band geolocation accuracy and standard deviation for period 16/06/2021 – 15/07/2021 for the combined cameras, at 95% confidence level.

Band pair	Inter-band error [m]
BLUE-RED	38.01, σ = 7.84
BLUE-NIR	48.02, σ = 10.01
BLUE-SWIR	54.74, σ = 8.98
RED-NIR	21.95, σ = 5.42
RED-SWIR	41.94, σ = 5.85
NIR-SWIR	41.35, σ = 5.62

Table 16: Inter-band geolocation accuracy and standard deviation for period 16/07/2021 – 15/08/2021 for the combined cameras, at 95% confidence level.

Band pair	Inter-band error [m]
BLUE-RED	36.32, σ = 7.34
BLUE-NIR	45.72, σ = 8.60
BLUE-SWIR	51.63, σ = 7.82
RED-NIR	21.16, σ = 5.37
RED-SWIR	39.72, σ = 5.19
NIR-SWIR	39.68, σ = 5.39

Table 17: Inter-band geolocation accuracy and standard deviation for period 16/08/2021 – 15/09/2021 for the combined cameras, at 95% confidence level.

Band pair	Inter-band error [m]
BLUE-RED	35.19, σ = 6.63
BLUE-NIR	42.94, σ = 8.24
BLUE-SWIR	49.32, σ = 7.65
RED-NIR	19.35, σ = 5.29
RED-SWIR	37.30, σ = 5.77
NIR-SWIR	37.39, σ = 6.33

Table 18: Inter-band geolocation accuracy and standard deviation for period 16/09/2021 – 31/10/2021 for the combined cameras, at 95% confidence level.

For the combined cameras, the inter-band geometric accuracy range was 19 – 55 m (standard deviation range 5 – 10 m), which is 0.06 – 0.17 of a pixel (333 m). The average inter-band RED-NIR registration accuracy was 21 m, which is equal to the previous reporting period.

2.3.3. Multi-temporal geometric accuracy

During this reporting period the multi-temporal compliance of the geometric accuracy was:

- 88.15% for the VNIR sensor (60,623 GCPs used),
- 95.98% for the VNIR/SWIR combined (67,029 GCPs used).

The compliance values are 0.17% and 1.19% higher than in the previous quarter for VNIR and VNIR/SWIR, respectively. The multi-temporal accuracies over the last full year for VNIR and VNIR/SWIR are 87.47% and 95.13%, respectively.

The spatial maps indicating the multitemporal geometric compliance (green=compliant, red=not compliant) are presented in Figure 22 and Figure 23 for VNIR and VNIR/SWIR, respectively.

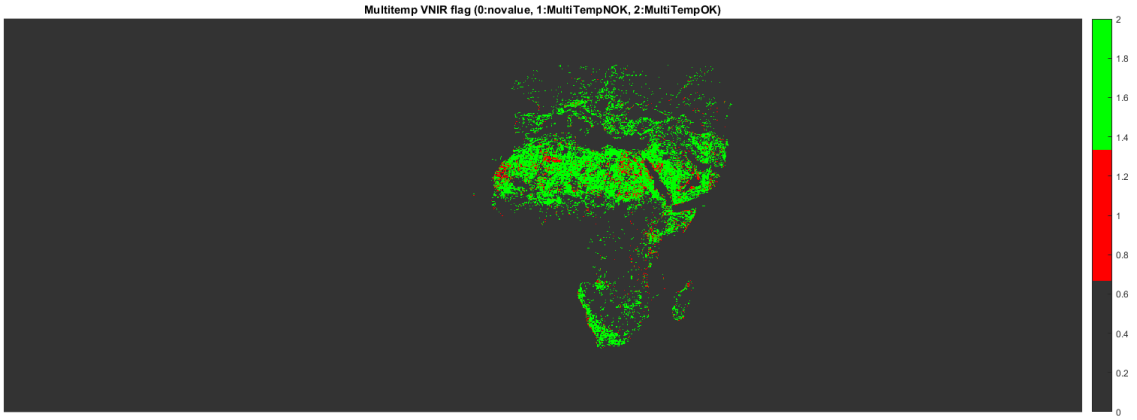


Figure 22: Multi-temporal geometric accuracy for the VNIR sensor for 16/06/2021 – 31/10/2021. Compliant areas are marked in green; areas with accuracy below 95% are marked in red. Grey areas represent no data.

For the combined VNIR/SWIR the multi-temporal geometric accuracy is compliant with the requirements. A map of regions with decreased multi-temporal geometric accuracy is presented in Figure 23.

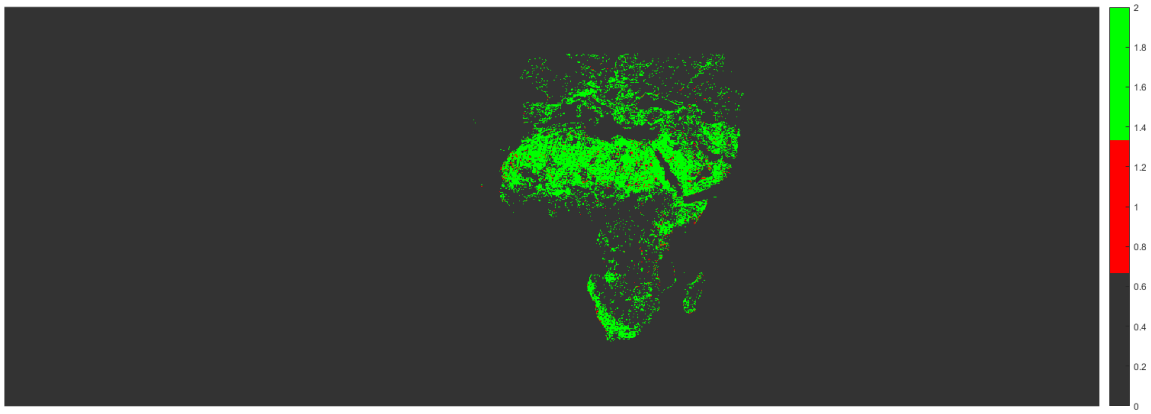


Figure 23: Multi-temporal geometric accuracy for the VNIR/SWIR combined sensors for 16/06/2021 – 31/10/2021. Compliant areas are marked in green; areas with accuracy below 95% are marked in red. Grey areas represent no data.

2.4. Geometric ICP file

On 05.03.2021 new ICP files with validity date set to 01.01.2021 were created.

ICP filename	Description
PROBAV_ICP_GEOMETRIC#LEFT_20210101_V01 PROBAV_ICP_GEOMETRIC#CENTER_20210101_V01 PROBAV_ICP_GEOMETRIC#RIGHT_20210101_V01	Although still within the requirements, an increasing ALE trend necessitated generating new ICP files.

3. Maintenance acquisitions

3.1. Introduction

For the next phase in its lifetime, PROBA-V will acquire only a limited amount of segments, for accommodating instrument sanity, while it is in a hibernate condition. The instrument is kept in stand-by for reasons the thermal stability.
A limit number of calibration images will be acquired to monitor both radiometric and geometric sanity of the instrument. The acquisitions will serve both methods 'at once' as much as possible.

3.2. Calibration Plan - 'hibernate'

For radiometry it is decided that lunar measurements over the full cycle will be continued every month. As an addition to this, few dark current (DC) acquisitions will be done to allow for the automated monitoring of the dark signal and bad pixel detection. The DC will be acquired for all 3 cameras. The amount of calibrations in a month will be 19 form lunar and 2 for DC resulting in < 1GByte in data.

To combine acquisitions for absolute radiometric and geometric calibration, a survey is still on-going to identify the appropriate location/site. The calibration region needs to contain both a radiometric reference in the absolute scale and sufficient geometric features. A good candidate is currently being investigated : Railroad Valley, which is an instrumented RadCalNet-site. The wider range area also contains quite a few geometric features to be used to perform a limited geometric assessment.

Figure 24: Railroad Valley area

Figure 25: Close-up of the site

3.3. Planning

Currently the following planning is been executed or waiting to be executed on board. Only 4 of them are processed upto level 1A products, therefore the analysis will be done after completing the campaign and the setup of the different sub-systems of DIF/PF and IQC.

Timestamp	Phase	Type	Status
11/11/2021 04:26:15	90	MOON	EXECUTED
12/11/2021 00:43:05	80	MOON	EXECUTED
12/11/2021 19:18:55	70	MOON	EXECUTED
13/11/2021 15:35:50	60	MOON	EXECUTED
14/11/2021 11:52:15	50	MOON	EXECUTED
15/11/2021 08:08:35	40	MOON	EXECUTED
16/11/2021 06:05:35	30	MOON	EXECUTED
17/11/2021 02:21:00	20	MOON	EXECUTED
19/11/2021 23:30:40	10	MOON	EXECUTED
20/11/2021 09:37:25	7	MOON	EXECUTED
20/11/2021 16:21:55	10	MOON	EXECUTED
21/11/2021 14:16:05	20	MOON	EXECUTED
22/11/2021 12:10:00	30	MOON	EXECUTED

23/11/2021 10:04:05	40	MOON	EXECUTED
23/11/2021 13:26:15	50	MOON	EXECUTED
24/11/2021 09:48:00	60	MOON	EXECUTED
25/11/2021 07:49:20	70	MOON	EXECUTED
26/11/2021 05:48:50	80	MOON	EXECUTED
27/11/2021 02:06:05	90	MOON	EXECUTED
10/12/2021 17:14:10	90	MOON	EXECUTED
11/12/2021 13:31:30	80	MOON	EXECUTED
12/12/2021 09:49:20	70	MOON	EXECUTED
13/12/2021 06:06:20	60	MOON	EXECUTED
14/12/2021 04:04:10	50	MOON	EXECUTED
15/12/2021 02:01:35	40	MOON	EXECUTED
16/12/2021 18:31:50	30	MOON	EXECUTED
17/12/2021 03:36:00	N/A	DARK_CURRENT	EXECUTED
17/12/2021 18:08:40	20	MOON	EXECUTED
18/12/2021 16:03:35	10	MOON	EXECUTED
20/12/2021 03:26:25	7	MOON	EXECUTED
20/12/2021 10:10:40	10	MOON	UPLINKED
21/12/2021 08:04:30	20	MOON	UPLINKED
22/12/2021 05:58:35	30	MOON	UPLINKED
23/12/2021 05:38:05	40	MOON	UPLINKED
24/12/2021 02:04:15	50	MOON	UPLINKED
24/12/2021 13:52:55	60	MOON	UPLINKED
25/12/2021 03:59:00	N/A	DARK_CURRENT	UPLINKED
25/12/2021 00:02:30	70	MOON	UPLINKED
25/12/2021 20:20:25	80	MOON	UPLINKED
26/12/2021 16:37:25	90	MOON	UPLINKED

Table 19 Executed and planned maintenance calibrations

Every month, an new planning will be forwarded to the space segment.

4. Reference documents

RD-1	PROBA-V Commissioning Report Annex 1-Radiometric Calibration Results [N77D7-PV02-US-20-CRPT-Annex1-RadiometricCalibartion-v1_3]
RD-2	PROBA-V Commissioning Report Annex 2-Geometric Calibration Results [N77D7-PV02-US-20-CRPT-Annex2-GeometricCalibartion-v1_3]
LIT1	Govaerts Y., Sterckx S. and Adriaensen S. (2013) "Use of simulated reflectances over bright desert target as an absolute calibration reference" Remote Sensing Letters, Vol. 4, Iss. 6, 2013.
LIT2	S. Adriaensen, K. Barker, L. Bourg , M. Bouvet, B. Fougnie, Y. Govaerts, P. Henry, C. Kent, D. Smith, S. Sterckx. "CEOS IVOS Working Group 4: Intercomparison of vicarious calibration methodologies and radiometric comparison methodologies over pseudo-invariant calibration sites A Report to the CEOS/IVOS Working Group", 2012
LIT3	Sterckx S., Adriaensen S., Livens, L., "Rayleigh, Deep Convective Clouds and Cross Sensor Desert vicarious calibration validation for the PROBA-V mission." IEEE Transactions on Geoscience and Remote Sensing. Inter-Calibration of Satellite Instruments Special Issue. Vol.51:3, 1437 – 1452.

Table 20: Reference Documents