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Title : **IDEAS+ – SMOS Public Monthly Report - September 2017**

Abstract : This document provides a summary of the status and performance of SMOS over the course of the reporting month.

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AMENDMENT POLICY

This document shall be amended by releasing a new edition of the document in its entirety. The Amendment Record Sheet below records the history and issue status of this document.

AMENDMENT RECORD SHEET

ISSUE	DATE	DCI No	REASON
1	23th October 2017	N/A	First release

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1. EXECUTIVE SUMMARY

This is the routine Soil Moisture and Ocean Salinity (**SMOS**) Monthly Public Report containing a summary of the instrument health, product quality status and updates to SMOS processing and auxiliary files during September 2017.

The instrument health during September 2017 was found to be nominal. There were two un-availabilities reported during the reporting period that translate into time intervals with data loss or degraded data. The list of unavailabilities is included in the section 3.2.

The data quality during September 2017 was found to be nominal, with the exceptions listed in section 4.5. These degraded periods have been induced either by instrument anomalies or unavailability of dynamic auxiliary files.

2. INTRODUCTION

2.1 Structure of the Document

After this introduction, the document is divided into a number of major sections that are briefly described below:

1 Executive summary

The executive summary covers the main findings from the report.

2 Introduction

A list of referenced documents and definitions of terms are available.

3 Instrument status

This section covers the instrument health and unavailabilities from this reporting period.

4 Data Summary

This section covers reprocessing, updates to processors and aux files as well as a data coverage summary.

5 Long Term Analysis

Long-term analysis of the instrument calibration and data quality are provided in this section.

2.2 Definitions of Terms

The following terms have been used in this report with the meanings shown.

Term	Definition
CMN	Control and Monitoring Node, responsible for commanding the receivers, reading their physical temperatures and telemetry and the generation of the synchronization signal (local oscillator tone) among receivers.
CCU	Correlator and Control unit, instrument computer on-board
DPGS	Data Processing Ground Segment
ESL	Expert Science Laboratory
IC4EC	Internal Calibration for External calibration. Calibration sequences for the instrument monitoring and calibration of science data acquired in external target pointing.
IDEAS+	Instrument Data quality Evaluation and Analysis Service, reporting to the ESA Data Quality and Algorithms Management Office (EOP-GQ), responsible for quality of

	data provided to users including the data calibration and validation, the data processing algorithms, and the routine instrument and processing chain performances.
IPF	Instrument Processor Facility
L2SM	Level 2 Soil Moisture
MM	Mass Memory
OCM	Orbit Correction Manoeuvre
PMS	Power Measurement System
RFI	Radio Frequency Interference
SPQC	Systematic Product Quality Control facility
N/A	Not applicable

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3. INSTRUMENT STATUS

3.1 Instrument health

The current instrument status is that all the **instrument** subsystems are working correctly. The current configuration of the instrument is that the arm A and the arm B are working in nominal side and arm C is in the redundant side.

Table 3-1 History of instrument problems and mode changes

Start	Stop	Description
11 January 2010 12:07z Orbit 1013	N/A	Arm A changes from redundant to nominal side. That operation is to avoid the malfunction of one of the redundant CMNs of the arm.
12 January 2011 09:15z Orbit 6278	N/A	Arm B changes from redundant to nominal side. That operation is to avoid the malfunction of one of the redundant CMNs of the arm.

3.2 Instrument unavailabilities and anomalies

The unavailabilities and anomalies listed in Table 3-2 occurred during the reporting period. A full list of unavailabilities can be found in the Mission Status section on the SMOS Earthnet website accessible here

During these unavailabilities and anomalies the instrument may have either not collected data or may have collected corrupt data which may not have been processed to higher levels. Table 4-5, Table 4-6 and Table 4-7 provide details of the data which has been affected by gaps and quality degradation respectively.

Table 3-2 SMOS unavailability list

Start Time (UTC)	Stop Time (UTC)	Unavailability Report Reference	Planned	Description
06/09/2017 09:30:25	06/09/2017 09:40:25	FOS-2907	No	CMN Unlock
13/09/2017 17:02:55	13/09/2017 17:15:02	FOS-2924	No	MM Latch-Up

15/09/2017 10:53:34	15/09/2017 11:03:34	FOS-2926	No	CMN Unlock
19/09/2017 06:12:32	19/09/2017 06:16:16	FOS-2934	No	CCU Reset
2017-09-20 14:15:26	20/09/2017 14:52:44	FOS-2908	Yes	Gyro Calibration

4. DATA SUMMARY

4.1 Reprocessing activities

The information regarding to data reprocessing activities (REPR data type) during the reporting period are:

1) The SMOS mission reprocessing for soil moisture L2SM v650 was launched the 23rd of June and ended the 9th of September 2017. The dataset is under validation.

The information regarding to the data regeneration activities (OPER data type) during the reporting period are:

1) No data regeneration activities took place in the reporting period.

The information regarding to past version data reprocessing activities (REPR data type) are:

1) Level 2 sea surface salinity reprocessing for products baseline v662, finished in April 2017, catch-up reprocessing finished in July 2017. The reprocessed dataset has been delivered to the user on 15 May 2017 and a gap filling reprocessed dataset has been delivered on 20 July 2017. Sensing time of the reprocessed data goes from 1st June 2010 to 9th May 2017. For more details see the SMOS news here. The SMOS users are strongly encouraged to consult the level 2 sea surface salinity v662 read-me-first notes before using the SMOS data. The level 2 read-me-first note for sea surface salinity product is available here.

2) Level 2 soil moisture reprocessing for product baseline v620, finished the 31st December 2015. The reprocessed dataset has been delivered to the user on 4 March 2016. Sensing time of the reprocessed data goes from 10th June 2010 to 14th July 2015. For more details see the SMOS news here. The SMOS users are strongly encouraged to consult the level 2 read-me-first notes before using the SMOS data. The level 2 read-me-first note for soil moisture product is available here.

3) The second SMOS mission reprocessing for L1 v62x finished the 25th June 2015. Sensing time of the reprocessed data goes from 12th January 2010 to 05th May 2015. Data set is available for the SMOS user community since 25th June 2015 (see the SMOS news here). The SMOS data users are strongly encouraged to consult the level 1 read-me-first note before using the SMOS data. The level 1 read-me-first note is available here:

The information regarding to the past version V62x data regeneration activities (OPER data type) are:

1) On the 22nd of July 2017, 3 Svalbard passes were received late at ESAC and L0 production was affected. L0 data affected by this anomaly were invalidated and re-generated. The next files and periods were reprocessed: **a)** TLM_MIRA0 files were reprocessed from 20170722T084240 up to 20170722T112655; **b)** MIR_CORD0 files were reprocessed from 20170722T090455 up to 20170722T221455; **c)** MIR_SC_F0 files were reprocessed up to L2 from 20170722T085250 up to 20170722T121657.

2) The 7th of January 2017 Flat Target Transformation correction (FTTF) was produced and incorrectly used for level 1 data processing. Level 1A data from 20170110T104625 up to 20170112T025130 was regenerated up to level 2 with the correct FTTF (i.e. initial one from 2010).

3) Leap second ingestion on the 31th of December 2016 lead to some issues when processing the SMOS data along the 1st of January 2017: one gap appeared and some calibration files were degraded due to some duplicated L0 packets stored inside the L0 database, since they were processed with different ORBPRE files. The next activities were carried on in order to have a proper and consolidated dataset: **a)** Reprocessing of L0 telemetry and science from 20170101T081550 to 20170101T095954; **b)** Invalidation of duplicated MIR_CORD0 and MIR_CSTD1A files; **c)** Regeneration of CSTD1A files from 20161231T154620 to 20170102T041620; **d)** Regeneration of science data and up to level 2 from 20170101T072633 to 20170102T104955

4) A hardware anomaly in DPGS systems introduced a large delay in the production on 05th May 2016. As a consequence, some calibration CSTD1A files where incorrectly consolidated when the production was recovered. This introduced some LO gaps, which impacted the quality of the data severely (no local oscillator calibration) from 20160505T170715z until 20160506T113201z. All the affected data were successfully regenerated from L0 up to L2.

5) Dataset sensed from 20160414T172533 to 20160419T100347 was degraded due to the usage of an out of date long calibration. Period has been regenerated with the proper calibration up to level 2.

6) The data gap from 20160314T095107 to 20160316T211747 originated by the Proteus platform on-board software upgrade operations has been recovered, level 1 and level 2 science data are now available.

7) On December 2015, the next periods were regenerated from level 1C to level2 due to late arrival of ionosphere information (VTEC_P auxiliary file): the period from 20151206T005504 to 20151206T041830 and the period from 20150719T005448 to 20150720T024908.

8) CCU reset on the 25th of November 2015 caused a delay in the data production. As consequence, the calibration CSTD1A files where not processed in the correct order from 20151125T033228 to 20151127T082215. All these affected CSTD1A files have been regenerated and used to regenerate level 1 and level 2 science dataset.

9) On 15th of August 2015 a hardware anomaly caused a TLM_MIRA1A order to fail due to timeout. Therefore, a gap in science and in calibration (CSTD1A) was introduced. The next data types and periods has been regenerated: TLM_MIRA1A at 20150815T031323, CSTD1A files with times between 20150815T003625 and 20150815T214626, affected science level 1 and level 2 between 20150815T023400 and 20150815T050753.

10) A hardware anomaly in DPGS systems introduced a large delay in the data production. As a consequence some CSTD1A orders were dropped due time-out. This introduced bad-consolidated calibration information in the system, with some Local Oscillator (LO) calibration gaps, which has impacted the quality of the data severely. Data from 20150713T194909 until 20150714T032238 was affected. All data were regenerated successfully from level 0 up to level 1; level 2 data was reprocessed and is available as REPR data type.

11) Due to an anomaly in the NIR calibration on the 3rd of June 2015, the next data types has been regenerated from 2015-06-03 06:43z to 2015-06-12 08:14z: MIR_SC_F1A, MIR_SC_F1B, MIR_SCLF1C, MIR_SCSF1C, MIR_BWLF1C and MIR_BWSF1C. Level 2 data was reprocessed and is available as REPR data type.

12) Period from 29 May 2015 to 31 May 2015 have been regenerated since one of the DPGS processing nodes (PWF-5) induced several science and calibration gaps for the reported period. Level 2 data was reprocessed and is available as REPR data type

13) Period from 20170804T011718 to 20170804T053039 has been regenerated from level L1C to level2 due to late arrival of ionosphere information (VTEC_P auxiliary file).

The information regarding the past version V5xx data regeneration and reprocessing activities (OPER and REPR data type) are available in the monthly report of April 2015.

4.2 Processing changes

4.2.1 Processor updates

No processor updates have been conducted during the reporting period.

4.2.2 Processor Status

At the end of the reporting period, the Processing Facility is using the following processors:

Table 4-1 Instrument Processors status

Processor	Version	Deployment date
L1OP	620 (L1a/L1c/NIRCAL) 621 (L1b/CAL_1A)	05/05/2015
L2OS	662	10/05/2017
L2SM	620	05/05/2015

Table 4-2 Pre- and Post-processors status

Processor	Version	Deployment date
ECMWFP	318	07/11/2013
VTECGN	320	18/05/2016
LAI pre-processor (currently not used)	307	18/02/2010
OSCOTT	625	10/05/2017
L2 Post-processors	510	05/05/2015
SNOWP	102	28/10/2016

4.2.3 Schema updates

No updates for product schema in the reporting period.

4.2.4 Schema status

At the end of the reporting period, the schema version of the datablock of the products generated and distributed through SMOS dissemination service is:

Table 4-3 Schema version status

Product type	Version
MIR_SC_F1B	400
MIR_SCSF1C	400
MIR_SCLF1C	400
MIR_BWSF1C	400
MIR_BWLF1C	400
MIR_SMUDP2	400
MIR_OSUDP2	401
AUX_ECMWF_	300

The schema package v07.02.01 is available from the SMOS Global Mapping Tool (GMT) webpage:

https://earth.esa.int/web/guest/software-tools/-/asset_publisher/P2xs/content/gmt-smos-global-mapping-tool

Further information about the product format is available in the level 1 and level 2 Product specification documents available here

4.2.5 Aux file updates

The following quasi-static AUX files were disseminated to the processing stations this reporting period. The status of the quasi-static AUX files at the end of the reporting period is in the section 7.

SM_OPER_AUX_BULL_B_20170702T000000_20170801T235959_120_001_3

Start sensing time at L1 processor: N/A

Justification: Bulletin Update including values from July 2017 and the prediction for August 2017. Its usage is intended for reprocessing.

SM_OPER_AUX_BULL_B_20170702T000000_20500101T000000_120_001_3

Start sensing time at L1 processor: 2017-09-04 10:20:52z

Justification: Bulletin Update including values from July 2017 and the prediction for August 2017. Its usage is intended for the nominal production.

4.3 Calibration Events Summary

The following table summarizes the major calibration activities conducted during the reporting period. The Local Oscillator calibration is not included in the table since occurs periodically every 10 minutes. The short calibrations are acquired weekly since 2011-03-24 and they are currently used in the nominal processing chain.

Table 4-4 Calibration summary

Date	Start Time	Stop Time	Calibration	Comments
07/09/2017	08:25:00	08:26:44	Short	Nominal
13/09/2017	15:38:38	17:00:51	NIR-Warm	Brightness temperature: 4.0271 K RMS: 0.8319 K Moon Elevation: -14.015 Sun Elevation: 9.997565 Right Ascension: 109.15 Declination: -55.41
14/09/2017	08:52:30	08:54:14	Short	Nominal
21/09/2017	09:20:30	09:22:14	Short	Nominal
27/09/2017	13:17:05	14:39:18	NIR-Warm	Brightness temperature: 4.060 K RMS: 0.8944 K Moon Elevation: -1.1983 Sun Elevation: 5.055704 Right Ascension: 104.06 Declination: -67.44
28/09/2017	08:07:30.	08:09:14	Short	Nominal

4.4 Data Coverage Summary

Where instrument unavailabilities or anomalies have occurred during this reporting period, gaps in data coverage may have occurred. A list of the gaps due to a permanent data loss is given in Table 4-5 by product level. On the other hand, a list of gaps due to operational problems is given in Table 4-6. The latter gaps may be recovered when the problem is fixed.

The science data gaps due to the execution of calibration activities are not listed in this section.

Table 4-5 Data loss summary

Start	Finish	Data Level	Comments
13/09/2017 17:02	13/09/2017 17:15	All	Latch-Up
19/09/2017 06:12	19/09/2017 06:16	All	CCU Reset
20/09/2017 13:11	20/09/2017 14:52	All	Gyro Calibration[1]

1: Data acquired during the manoeuvre is flagged as external pointing and not available as nominal data.

Table 4-6 Operational gaps summary

Start	Finish	Data Level	Comments
N/A	N/A	N/A	N/A

4.5 Summary of degraded data

In September 2017, SMOS data was affected by the following instrument and processing anomalies which have had a detrimental effect on the data quality.

Table 4-7 Summary of degraded data

Start	Finish	Affected products	Problem Description
06/09/2017 09:30	06/09/2017 09:40	All	CMN Unlock
15/09/2017 10:53	15/09/2017 11:03	All	CMN Unlock

4.6 Product Quality Disclaimers

The following product disclaimers affects the data generated in the reporting period:

Table 4-8 Summary of product quality disclaimers

Date	Product level	
From: beginning of the mission To: 1st September 2016	L1 L2	Due to a software anomaly in the Level 0 processor, the *Cycle, orbit relative and orbit absolute* fields in all the product headers are incorrectly set. Those values are annotated in the headers of all the higher level products. The anomaly was fixed on 1st September 2016 with the deployment in the processing facility of a new version (v308) of the L0 processor.
From: 18th of August 2016 (16:36z) To: 20thSeptember 2016 (08:26z)	L1	Brightness temperature generated with calibration occurred on 2nd July instead of calibration occurred on 18th August. The impact of wrongly consolidated calibrated visibilities (UAVD1A) is negligible. In relation to the impact in the brightness temperature of the degraded PMS gain and offset (CRSD1A) the analysis had shown a small bias of +/- 0.25K in the image

From: 21st June 2017 (06:05:53z) To: 21st June 2017 (07:28:07z)	L1	Due to CCU reset side effect science data was acquired with instrument pointing in external target looking at deep sky.

5. LONG-TERM ANALYSIS

5.1 Calibration Analysis

The calibration parameters are under monitoring. During the reporting period, there have been two Warm-NIR calibrations event on the 13th and 27th of September 2017.

NIR calibration executed the 13th was incorrectly consolidated with the previous one, combining the first calibration sequences with older calibration sequences from the previous valid calibration. This led to the opening of L1P-PR-0595. Nevertheless, the impact in calibration is negligible as this file was promptly replaced with a proper ANIR file, containing all calibration sequences from the 13th NIR calibration.

The evolution of the noise temperature of the reference noise diodes Tna and Tnr computed with processor baseline V62x since the beginning of the mission is shown from figures from Figure 1 to Figure 4. The evolution of the temperature parameters, which are related to the internal diode stability, are stable in particular for the NIR CA which is the only one used for the level 1 data calibration. The small deviation in the NIR calibration on 3rd June 2015 was due to a Radio Frequency Interference (RFI) that has corrupted the measurement. This calibration should not be used for the scientific processing of the data from 2015-06-03 06:43z to 2015-06-12 08:14z. Deviations in NIR calibration can be also seen on 2016-04-06, 2016-04-20, 2016-05-04, 2016-05-18, 2016-08-24, 2016-09-07, 2017-02-11, 2017-02-17, 2017-03-29 due to proximity of the equinox. These calibrations have failed the quality control checks and were not used for the scientific processing of the data.

The seasonal evolution of the calibration parameters: Tna and Tnr present in the previous processor baseline V5xx (see for an example the monthly report for April 2015) had been largely mitigated by the new calibration algorithm which decouple the variation of the antenna losses and the drift of the reference diode. This approach allows to compensate each drift separately improving the diode stability monitoring and increasing the accuracy of the consequent calibration correction. Further improvements in the calibration stability were achieved by implementing the “warm NIR calibration” since 15th of October 2014. During “warm NIR calibration” the Noise Injection Radiometer (NIR) calibration is performed with a Sun elevation of 10 degrees above the antenna plane in order to maintain a stable thermal environment of the instrument through the calibration sequence. The impact on the final brightness temperature is a more stable long term measurement.

Figure 5 and Figure 6 present the evolution of the NIR Observed brightness temperature (BT) since the beginning of the mission for the V620x baseline. Small variation of few Kelvin, in the observed BT are due to slightly different region of the Sky sensed during the calibration manoeuvre. This parameter is used only for monitoring purpose.

The leakage and cross-coupling factors of the NIR channels shown in Figure 7 and Figure 8 remain small and no problems can be observed apart from a peak in the phase of the NIR-AB cross-coupling term on 11 April 2012. That peak corresponds to an anomaly in the NIR-AB that did not have impact on the data.

Figure 1 Tna evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the H-channel since the beginning of the mission. Thresholds in dashed lines

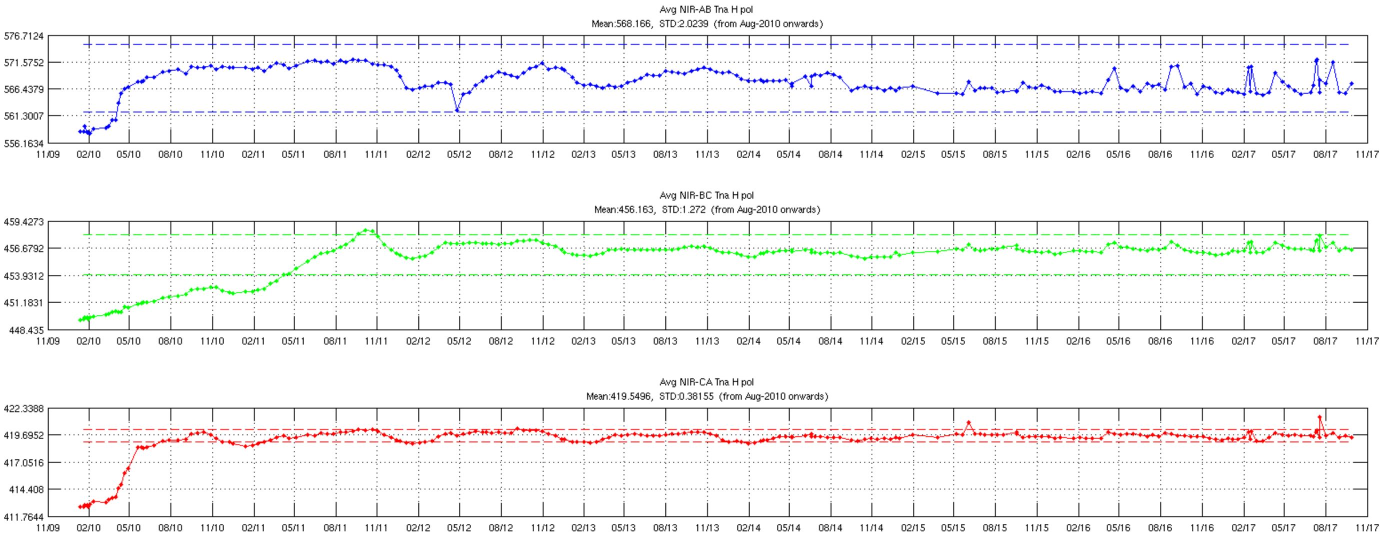


Figure 2 Tna evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the V-channel since the beginning of the mission. Thresholds in dashed lines

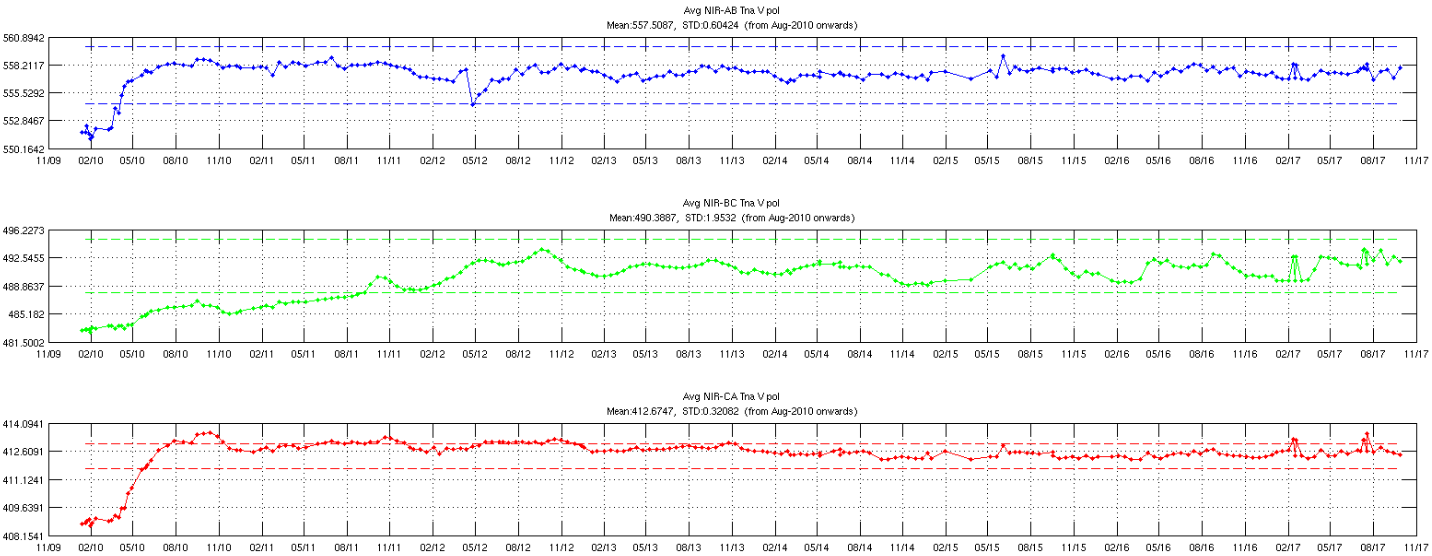


Figure 3 Tnr evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the H-channel since the beginning of the mission.

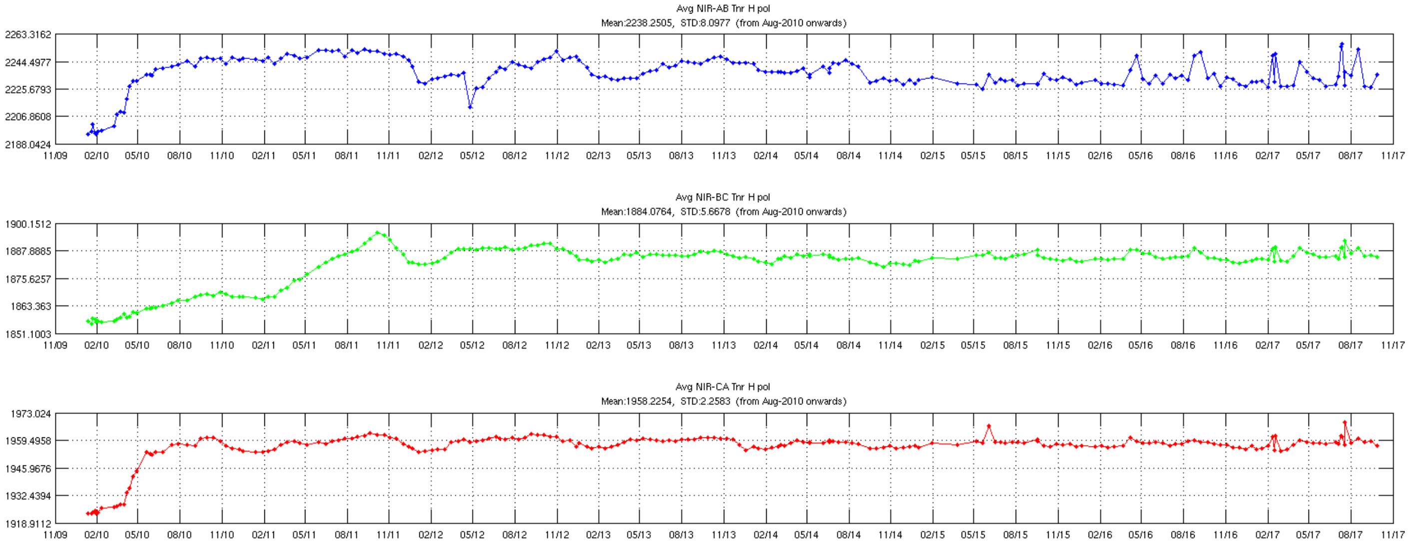


Figure 4 Tnr evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the V-channel since the beginning of the mission.

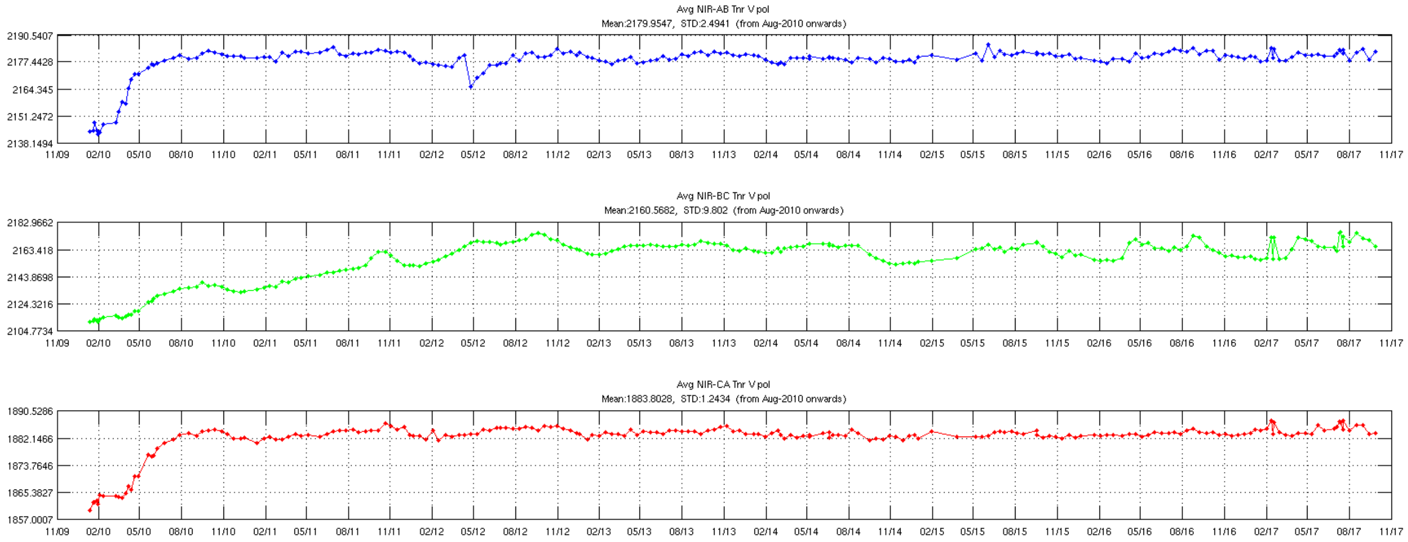


Figure 5 NIR Observed BT evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the H-channel since the beginning of the mission. Thresholds in dashed lines

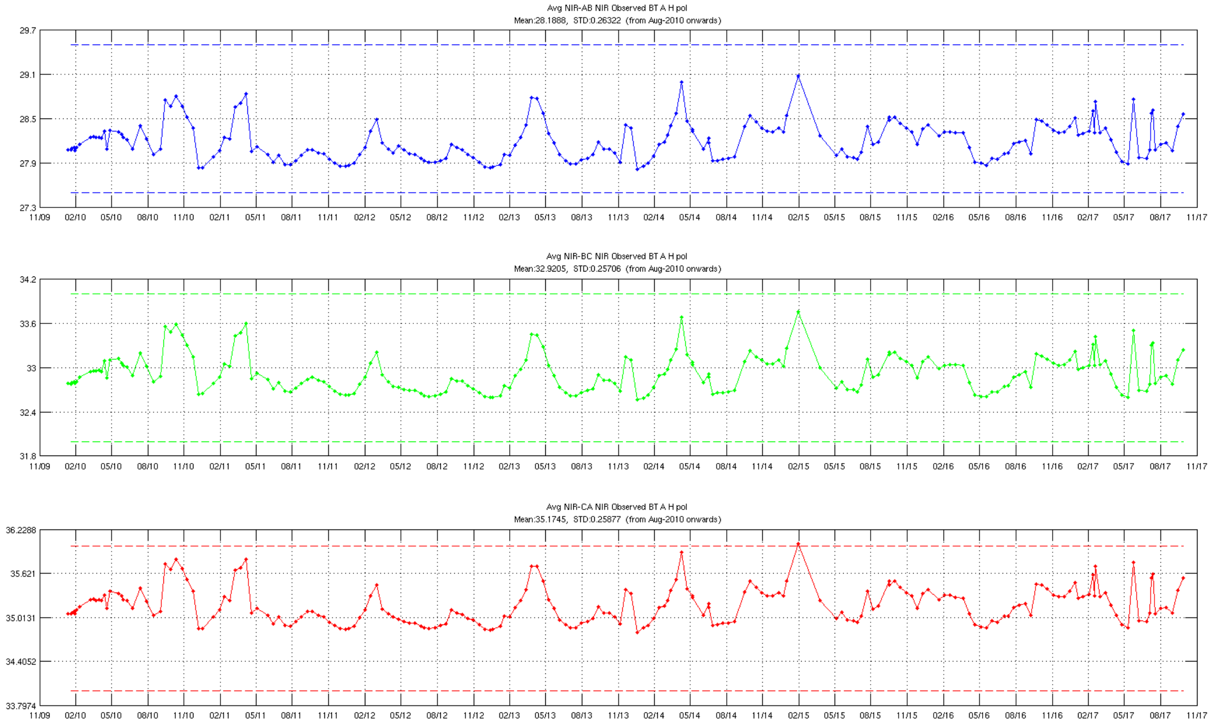


Figure 6 NIR Observed BT evolution of NIR AB (blue), NIR BC (green) and NIR CA (red) in the V-channel since the beginning of the mission. Thresholds in dashed lines

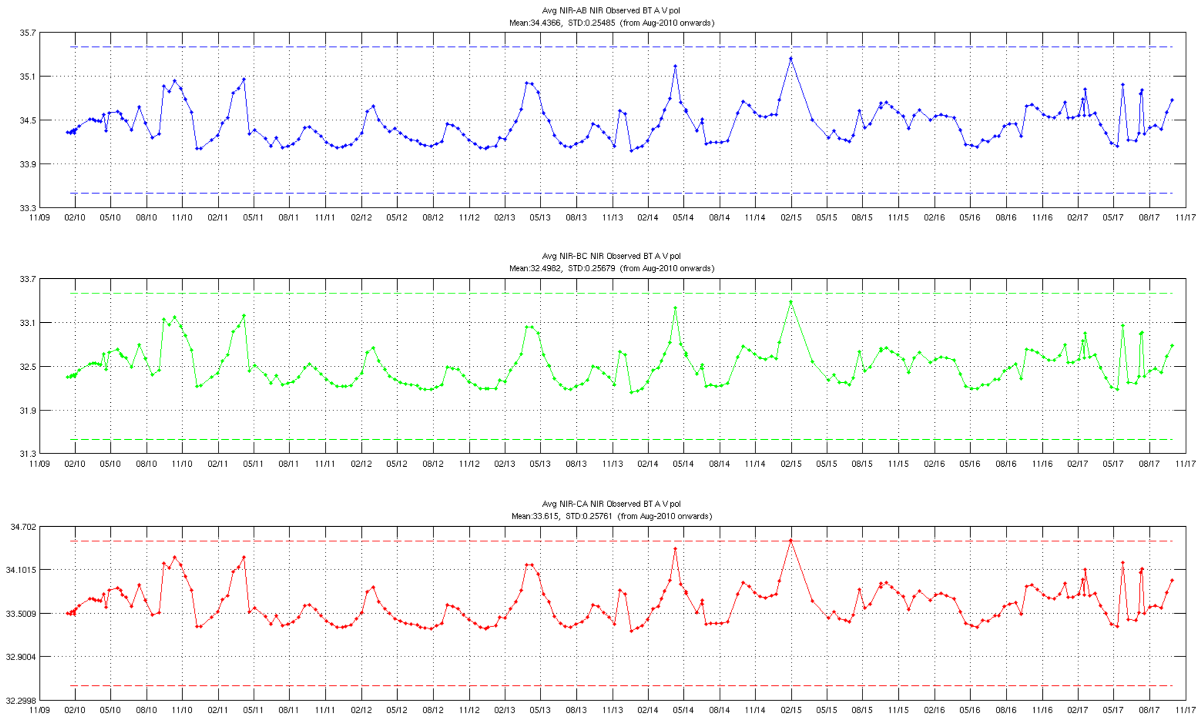


Figure 7 Cross-coupling evolution in amplitude and phase of NIR AB (blue), NIR BC (green) and NIR CA (red) since the beginning of the mission

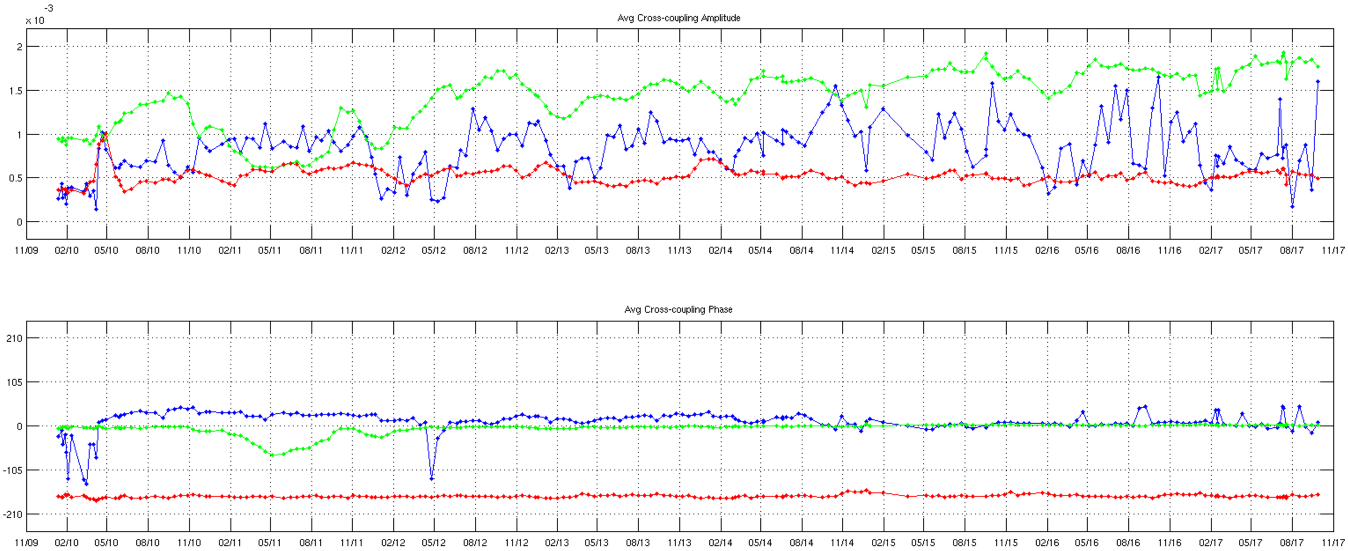
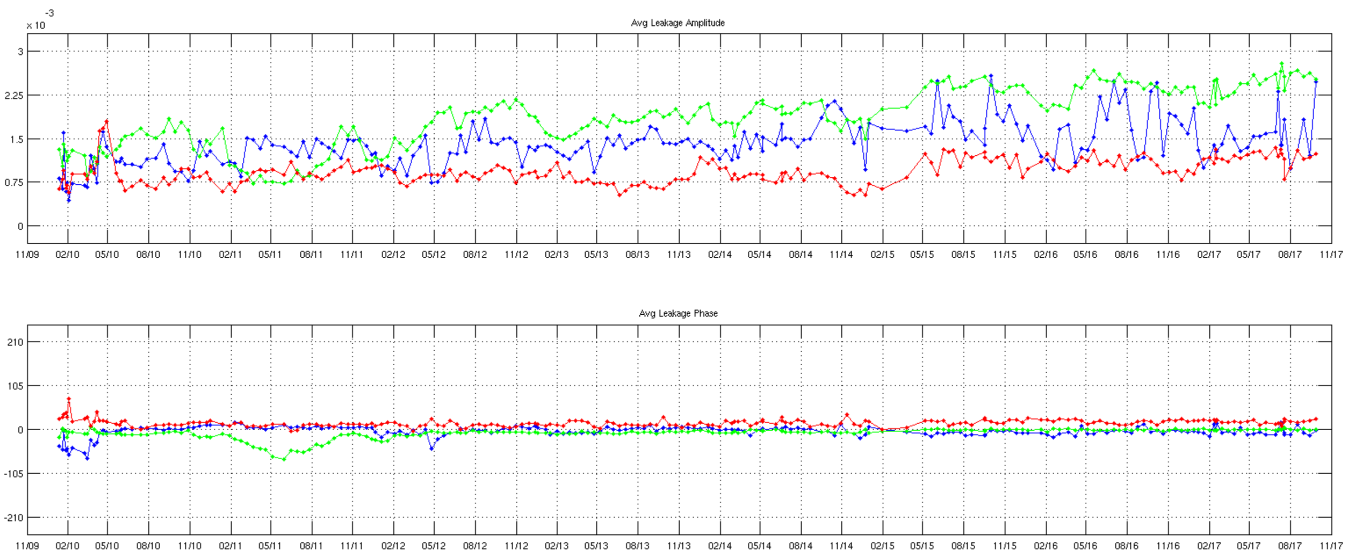


Figure 8 Leakage factor evolution in amplitude and phase of NIR AB (blue), NIR BC (green) and NIR CA (red) since the beginning of the mission



The LICEF calibration status is updated by long (every 8 weeks) and short (weekly) on-board calibration activities. No Long calibration has been executed in the reporting period.

LICEF PMS gain is derived during the long calibration activity and figures from Figure 9 to Figure 20 show the evolution (V62x algorithm baseline) of the deviations of the PMS gain with respect to its average over time. Note that PMS gain depends on the physical temperature of the receivers, PMS calibration is performed at slightly different physical temperature due to calibration time (season effect) and position of the receiver (LICEF) in the instrument (arms and central hub). In order to compare the calibration results the gains and offsets obtained during the calibration are normalised to 21 degrees Celsius temperature by using the receiver PMS gain and offset temperature sensitivity parameter (one value for each LICEF).

Apart from receiver (LICEF) LCF_A_18, LCF_C_11, LCF_C_19, which have shown a clear evolution from the main trend (see Figure 12, 19, 20) the others PMS gains are stable. The seasonal PMS gain variation present in some LICEFs is mainly due to the PMS gain temperature sensitivity parameters which needs refinement for some LICEFs.

The LCF_A_10 PMS gain evolution in the period January-March 2016 as been further analysed. The evolution in the PMS gain computed at 21C is mainly due to the usage of the temperature sensitivity parameter for that LICEF rather than a change in the receiver itself due to the slightly temperature increase occurred on 10th January 2016. The computation of the PMS gain at 21C with a more refined temperature sensitivity parameter does not show such evolution.

The usage of refined temperature sensitivity parameters for all the LICEFs is under evaluation by the calibration team and it might be introduced in the next version of the level 1 processor to further improve the level 1 data calibration.

Figures from Figure 21 to Figure 32 show the evolution of the PMS offsets (V62x algorithm baseline) derived during the short calibration activity.

Figure 33 shows the evolution of the average over all the baselines of the Fringe Washing Function (FWF) amplitude in the origin derived during the long calibration. The amplitude of the FWF at the origin does not show any drift and their values are inside the ranges defined in the routine calibration plan.

The evolution of the visibility average offsets (Figure 34 and Figure 35) had an unexpected peak on the 2nd of February 2017. Accordingly to preliminary analysis, this seems related to RFI. The quality impact on the data is small with a peak-to-peak bias of about 0.1K in brightness temperature.

Figure 9 Evolution of the Δ PMS Gain of the LICEFS in CMN H1

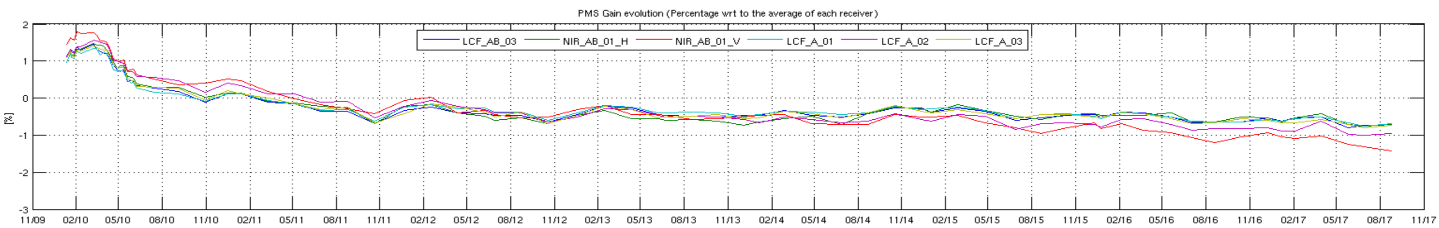


Figure 10 Evolution of the Δ PMS Gain of the LICEFS in CMN A1

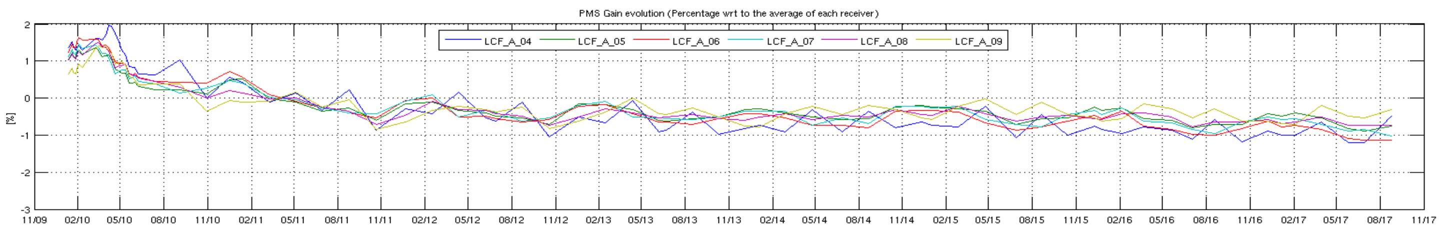


Figure 11 Evolution of the Δ PMS Gain of the LICEFS in CMN A2

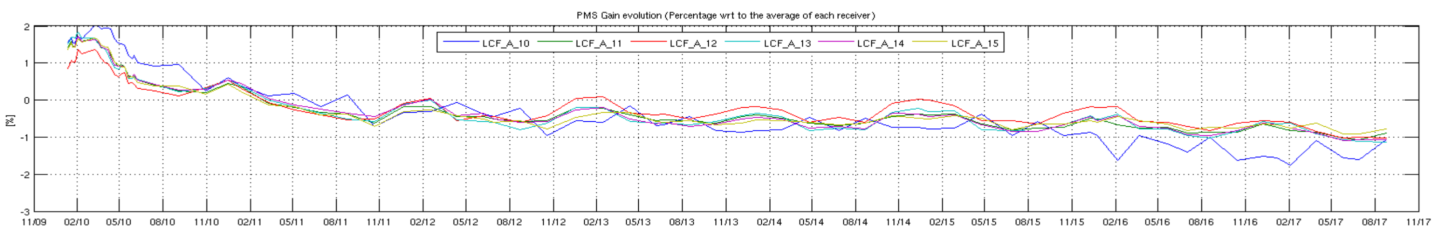


Figure 12 Evolution of the Δ PMS Gain of the LICEFS in CMN A3

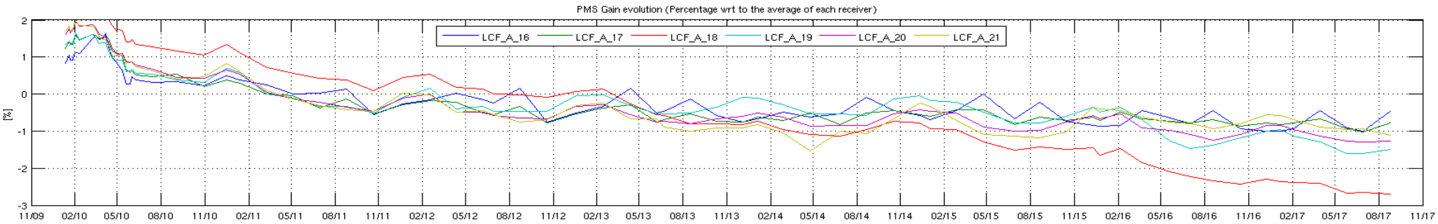


Figure 13 Evolution of the Δ PMS Gain of the LICEFS in CMN H2

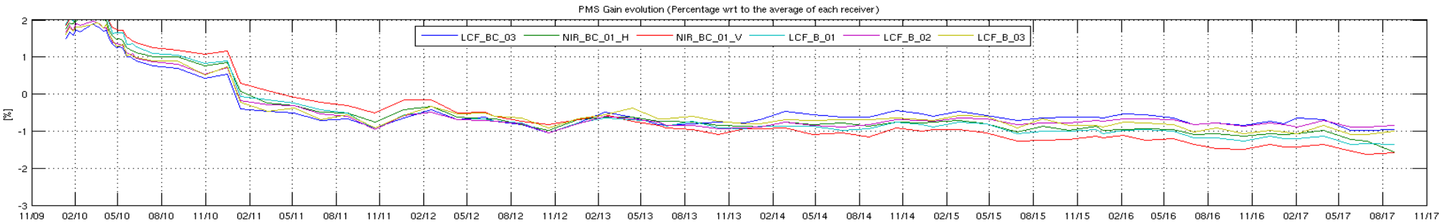


Figure 14 Evolution of the Δ PMS Gain of the LICEFS in CMN B1

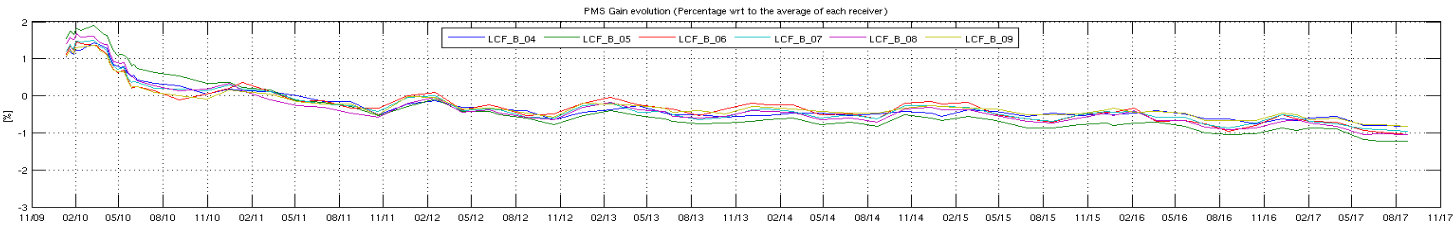


Figure 15 Evolution of the Δ PMS Gain of the LICEFS in CMN B2

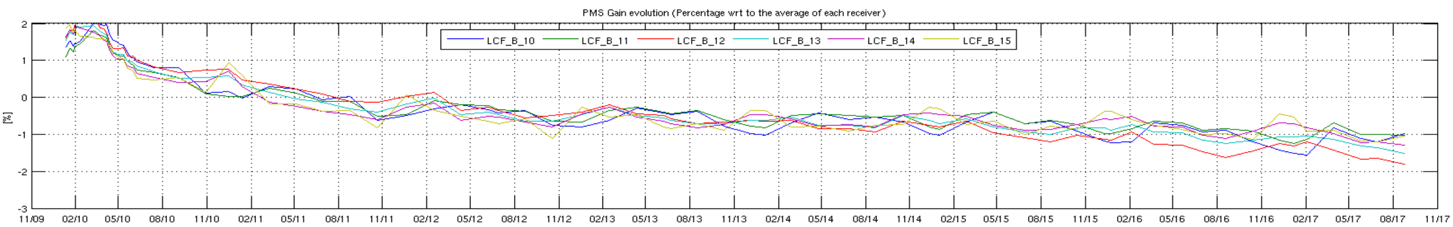


Figure 16 Evolution of the Δ PMS Gain of the LICEFS in CMN B3

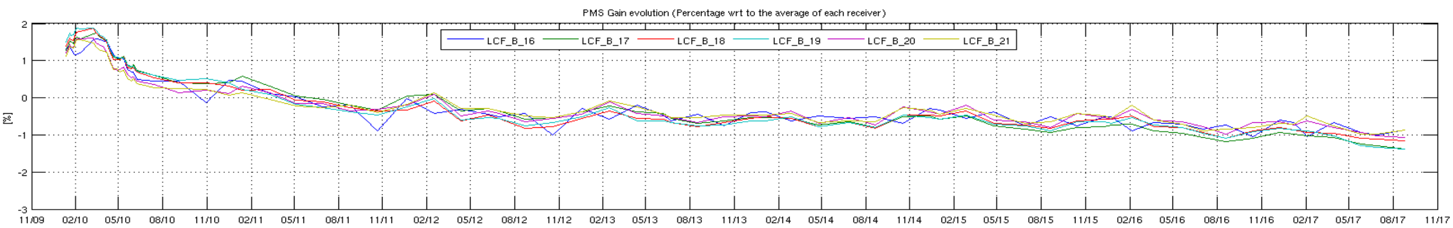


Figure 17 Evolution of the Δ PMS Gain of the LICEFS in CMN H3

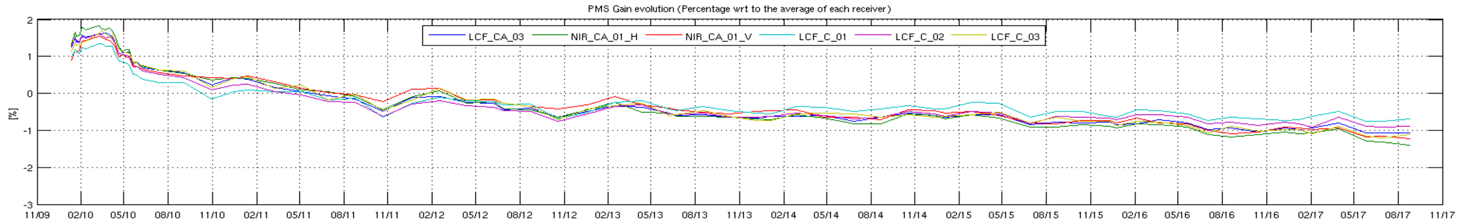


Figure 18 Evolution of the Δ PMS Gain of the LICEFS in CMN C1

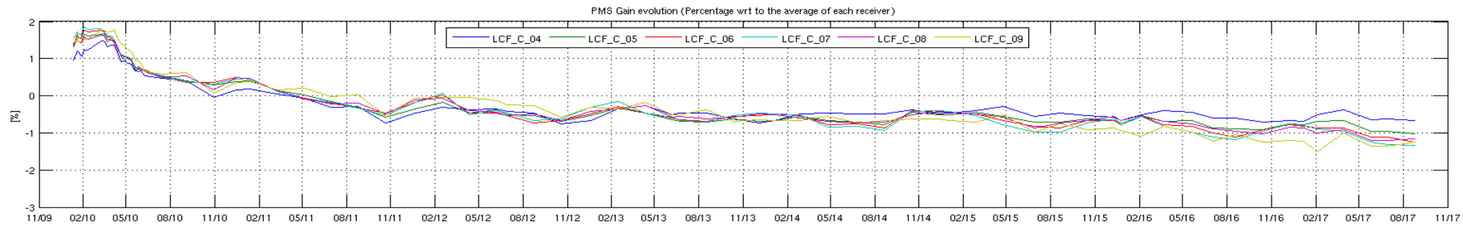


Figure 19 Evolution of the Δ PMS Gain of the LICEFS in CMN C2

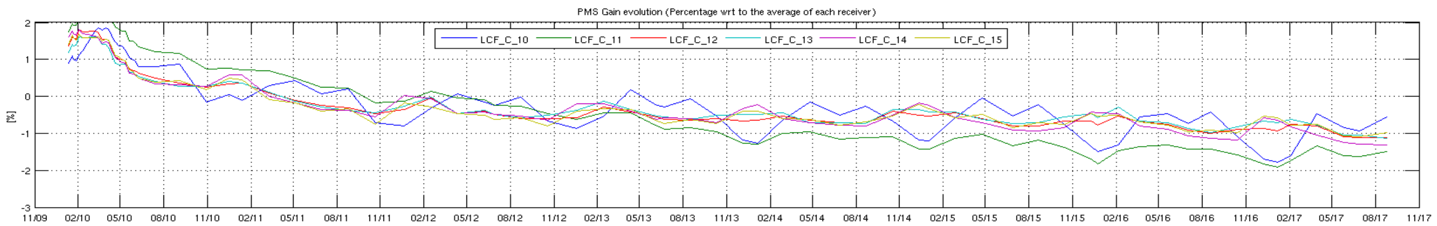


Figure 20 Evolution of the Δ PMS Gain of the LICEFS in CMN C3

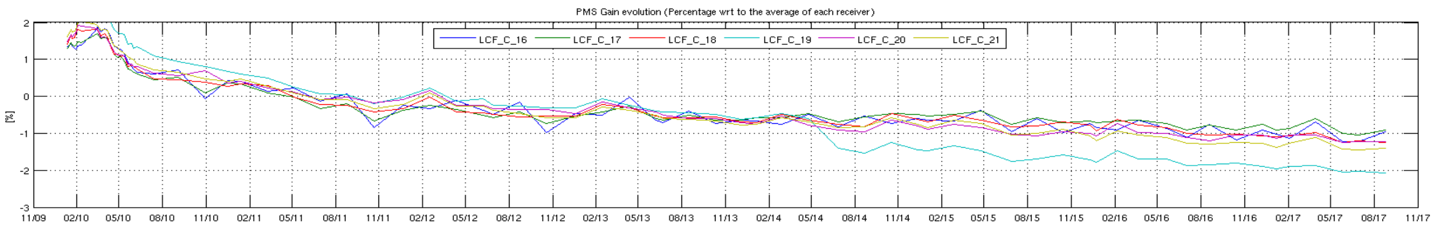


Figure 21 Evolution of the Δ PMS Offset of the LICEFS in CMN H1

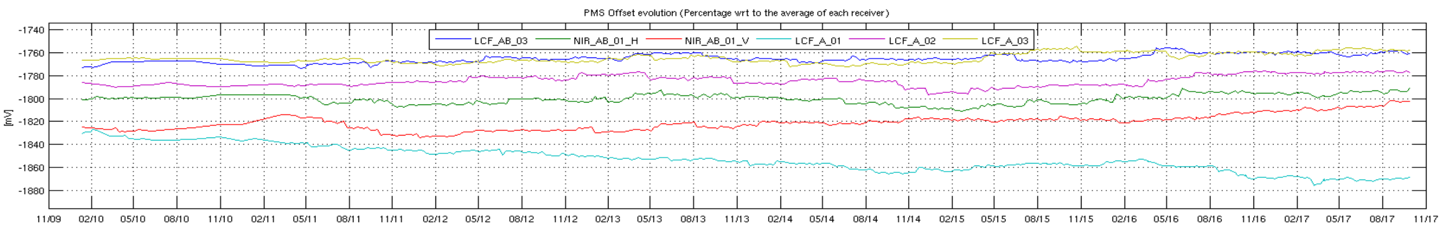


Figure 22 Evolution of the Δ PMS Offset of the LICEFS in CMN A1

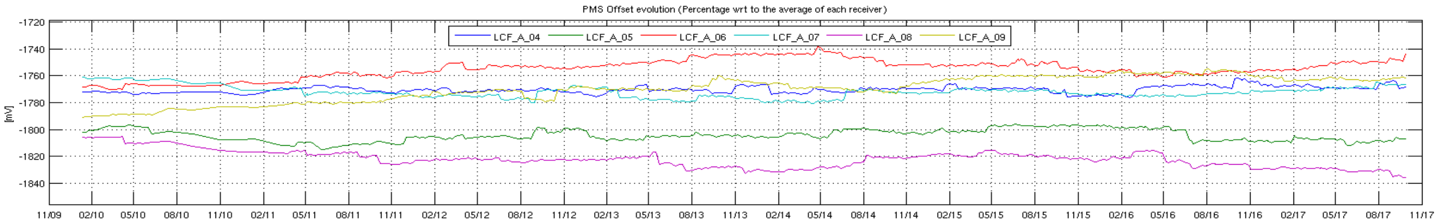


Figure 23 Evolution of the Δ PMS Offset of the LICEFS in CMN A2

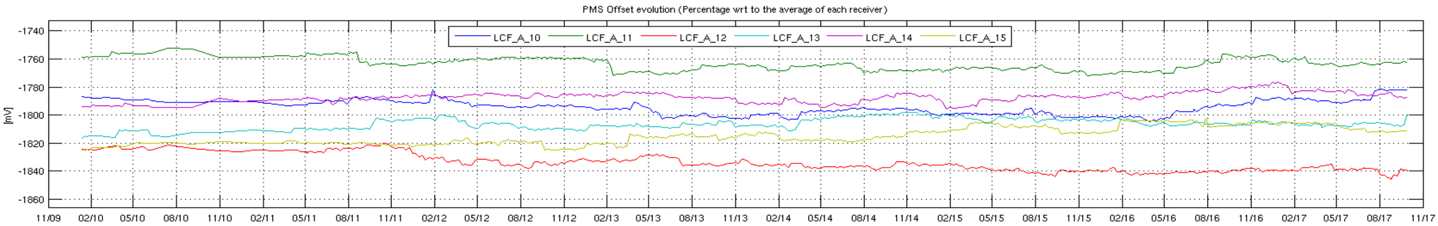


Figure 24 Evolution of the Δ PMS Offset of the LICEFS in CMN A3

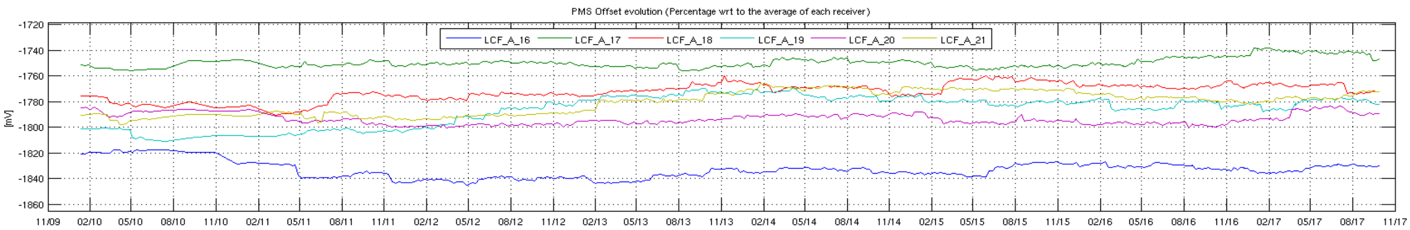


Figure 25 Evolution of the Δ PMS Offset of the LICEFS in CMN H2

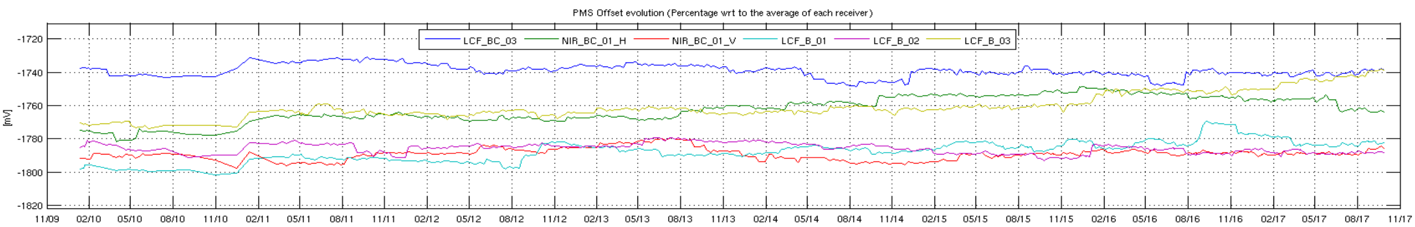


Figure 26 Evolution of the Δ PMS Offset of the LICEFS in CMN B1

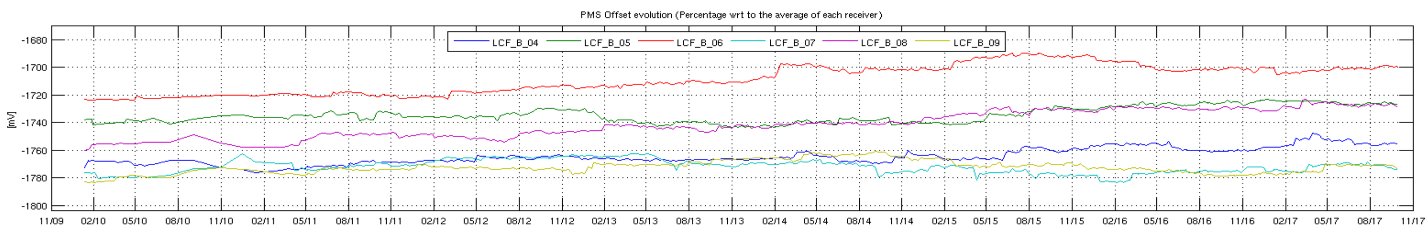


Figure 27 Evolution of the Δ PMS Offset of the LICEFS in CMN B2

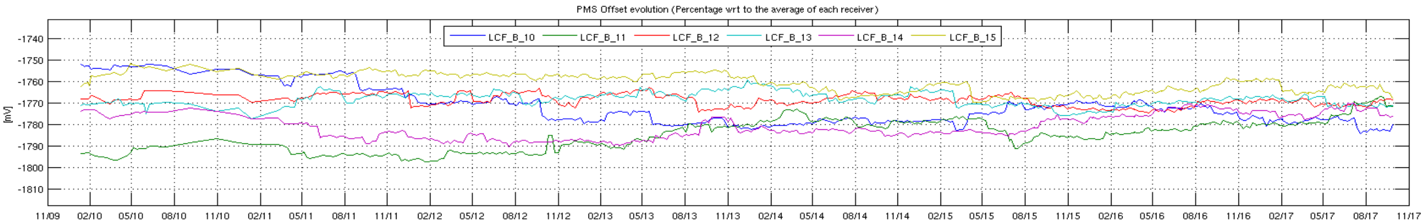


Figure 28 Evolution of the Δ PMS Offset of the LICEFS in CMN B3

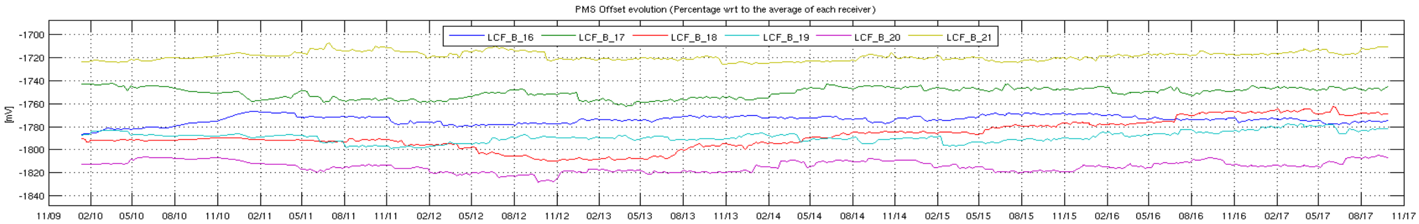


Figure 29 Evolution of the Δ PMS Offset of the LICEFS in CMN H3

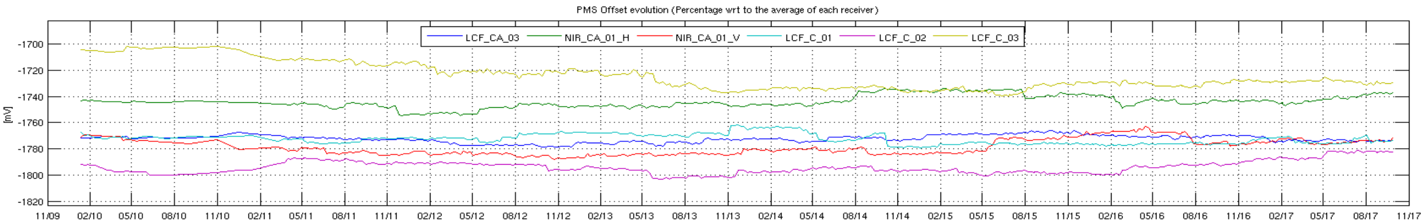


Figure 30 Evolution of the Δ PMS Offset of the LICEFS in CMN C1

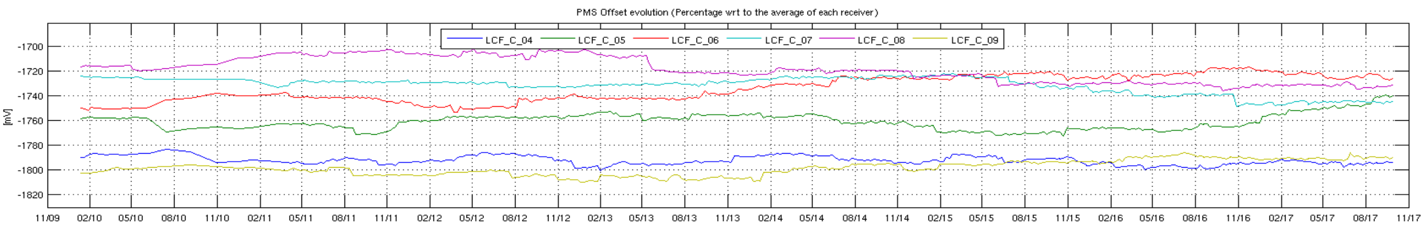


Figure 31 Evolution of the Δ PMS Offset of the LICEFS in CMN C2

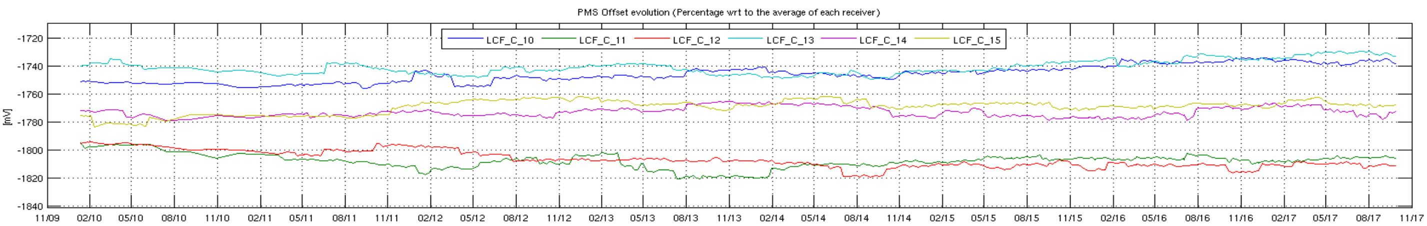


Figure 32 Evolution of the Δ PMS Offset of the LICEFS in CMN C3

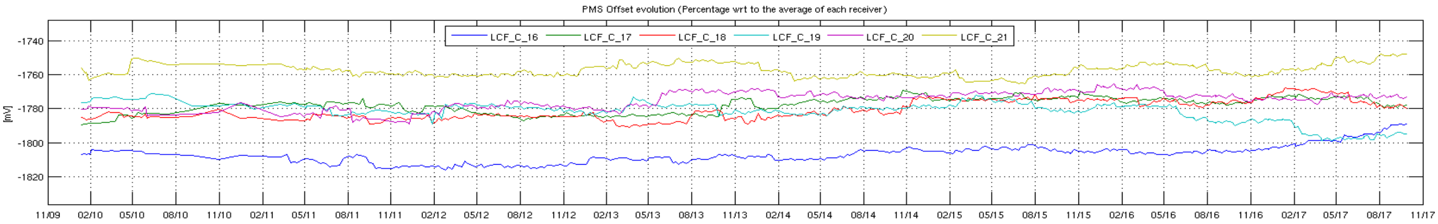
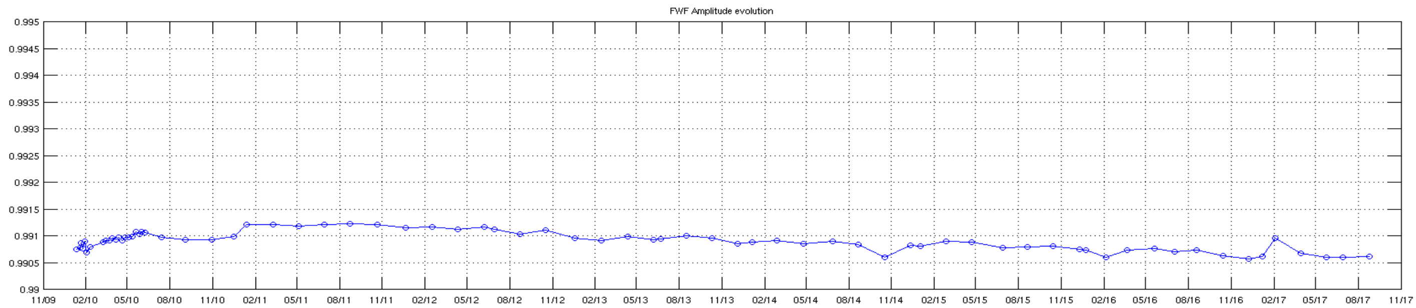


Figure 33 Evolution of the average of the FWF Amplitude at the origin



The evolution of the average of the correlator offsets does not show any significant drift. Also, the correlation offsets between receivers that do not share local oscillator remains much smaller than the correlation offsets between receivers sharing local oscillator. This result is expected since any residual correlated signal arriving to a pair of receivers, arrives through the local oscillator signal.

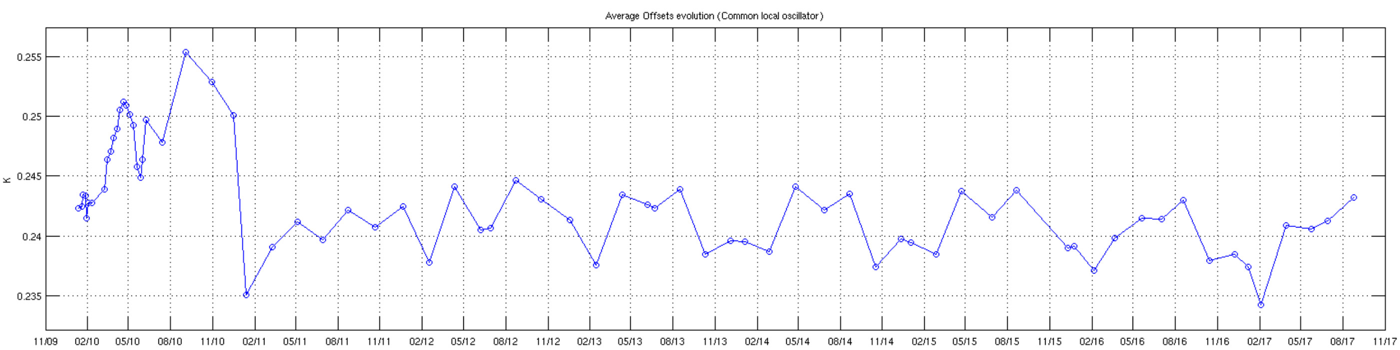


Figure 34 Evolution of the average of the Correlator offsets for the baselines which share local oscillator

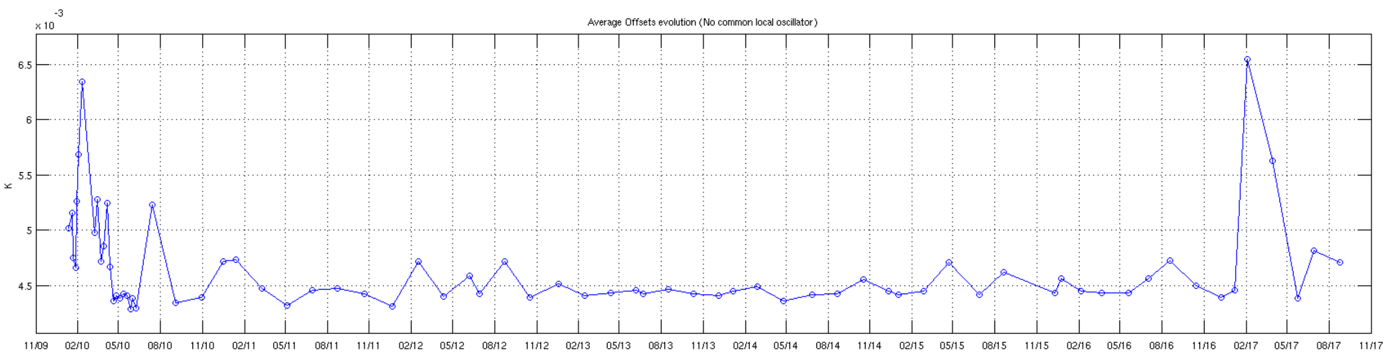


Figure 35 Evolution of the average of the Correlator offsets for the baselines which do not share local oscillator

5.2 Brightness Temperatures Trends over Dome-C Point (Antarctic)

The result of the monitoring of the evolution of the SMOS brightness temperature over Dome-C is shown in the Figure 36 (X and Y polarization at antenna frame for all the incidence angles) and in Figure 37, Figure 38 (H and V polarization at surface level for 42.0 degrees incidence angle for different areas of the Field Of View). The values are averaged every 18 days to reduce the noise and the value for July 2010 is subtracted and used as relative reference. In figure 37 are also shown in situ measurements (dome-C) from the DOMEX experiment averaged on the same period of the SMOS data.

The evolution of the brightness temperature trend over Dome-C does not show any significant drift except for the beginning of 2015 in H polarization. This drift was due to a change on surface geophysical condition: accumulation of snow since November 2014 and rapidly evolution of snow density on 22 March 2015 when a strong wind has changed the surface condition. This event has impacted the emissivity of the ice that was confirmed by on-site L-band measurement (Dome-x experiment) and from the Aquarius data set.

The brightness temperature V polarization measurements are quite stable since the beginning of the mission. The brightness temperature H polarization measurements are less stable and impacted by geophysical condition at surface level.

Figure 36: Dome-C X and Y polarization trends (all incidence angles)

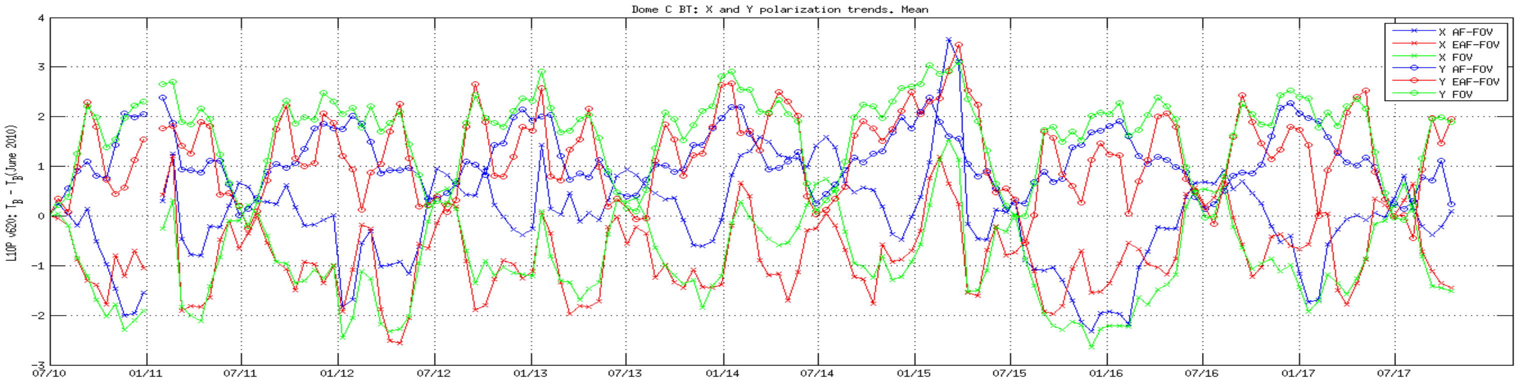


Figure 37: Dome-C H and V polarization trends in Alias Free zone (incidence angle 42°)

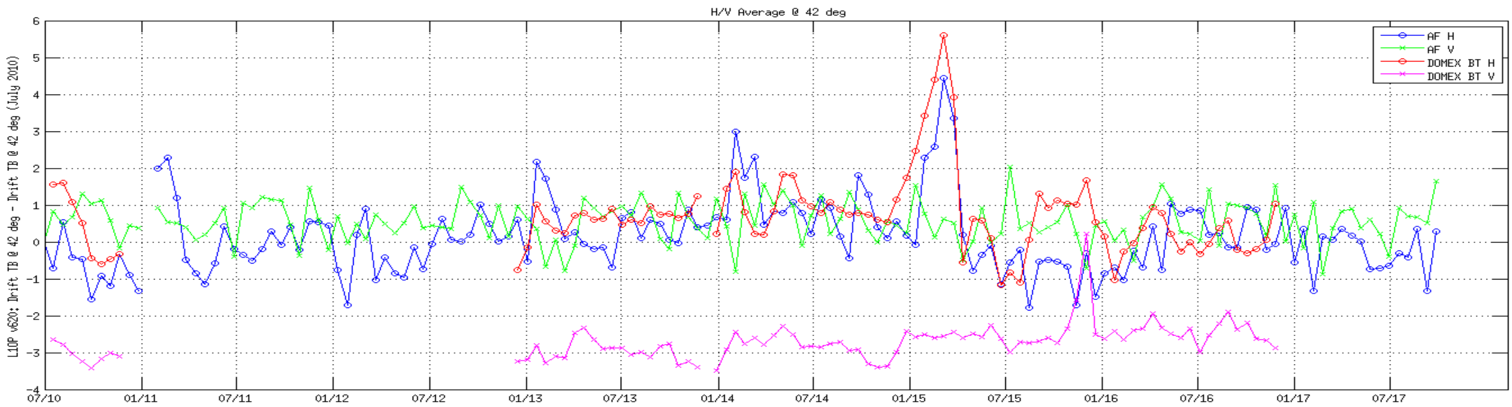
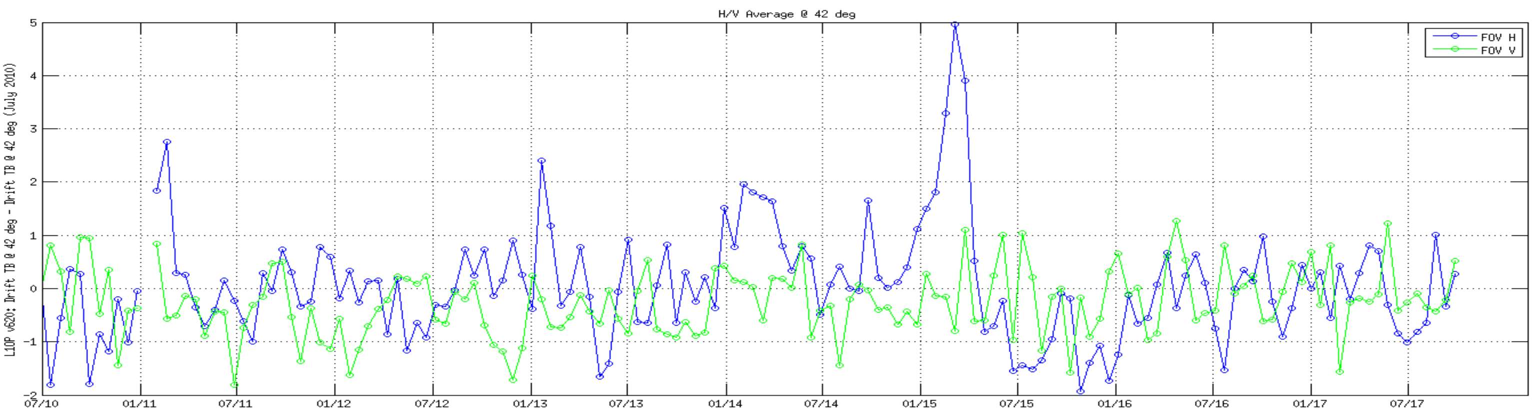


Figure 38: Dome-C H and V polarization trends in Extended Alias Free zone (incidence angle 42°)



5.3 L2OS Ocean Target Transformation (OTT) Orchestration Analysis

The OTT correction is used by the L2OS processor for sea surface salinity retrieval. The correction is computed roughly on a daily basis by accumulating previous SMOS L1C measurements. The proper usage of the OTT correction is monitored and results are present in Figure-39 since June 2010. Figure-39 shows the OTT delay defined as the delta time between the L2OS science product sensing time and the OTT correction validity time and averaged over 1 day period. As the validity time of the OTT correction depends on the dataset used to compute the correction, this OTT delay represents a quality indicator for the selection of the best OTT correction (i.e. the better correction is achieved by using an OTT with validity time closer to the L2OS sensing time).

Nominal OTT delay interval goes from 4 to 8 days of delay. The most of the OTT delays fall in the middle of such values, 5-6 days. OTT delays outside the nominal interval reveals anomalies either in the data selection policy or problems in accumulating L1C dataset (i.e. data rejection due to bad quality or presence of RFI).

For the current SMOS L2OS v662 dataset, the next anomaly periods affecting the OTT delay (i.e. delay above 8 days) have been found:

1) From 21/12/2010 to 08/01/2011: Electrical Stability Test and Temperature Reading anomalies with consequent unavailability of L1C data and increased OTT delay

2) From 01/04/2014 to 08/04/2014 OTT delays above 8 days due to L1C rejected data for OTT correction. Data rejection was due to corrupted L1C measurement affected by RFI.

A detailed list of OTT delays is available in the L2OS Quality Control reprocessing report accessible here.

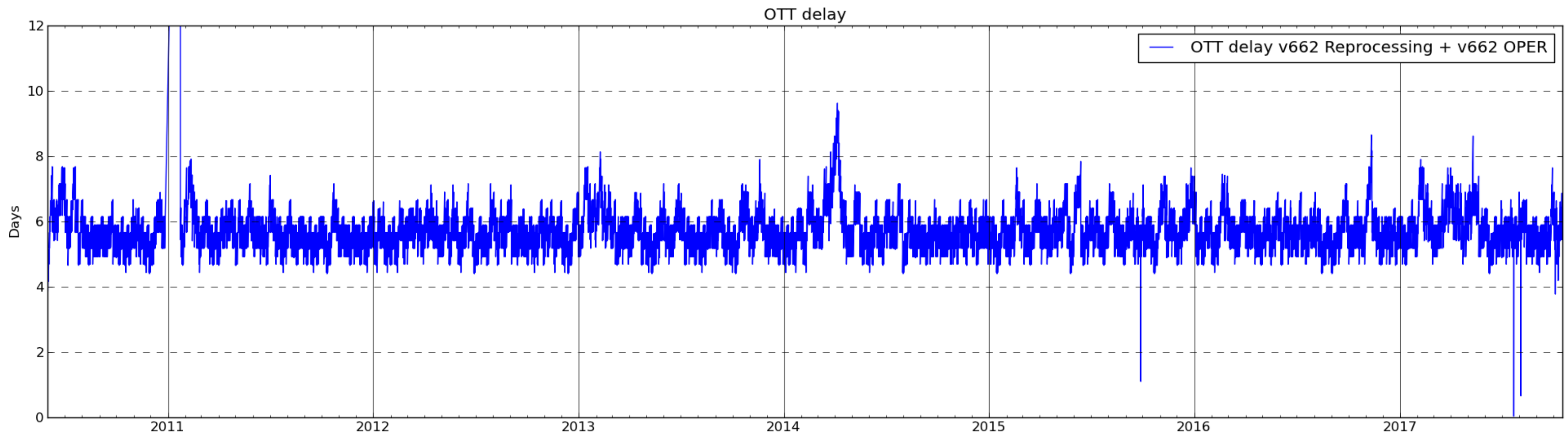


Figure 39: OTT delay per semi-orbit (Delta time between each L2OS product start time and the OTT correction validity start time file).

5.4 L2OS Retrievals assessment

Analysis on the overall quality of the L2OS dataset is based on the evolution of the number of ‘good quality’ retrievals as shown in Figure-40.

These ‘Good Quality’ retrievals are taken into account for two different areas: Open Ocean (more than 800km away from coastline) and Near Coast (within 800 km from the coastline).

Also, retrievals have been computed for the land-sea contamination corrected and uncorrected Sea Surface Salinity (SSS_corr, SSS_uncorr) and averaged on a daily basis, providing an estimation of the average number of retrievals per product. The average number of good quality retrievals is around 25k in open ocean and 4k near coast, as expected by the ESL. The seasonal variation is more evident in near coast than in open ocean.

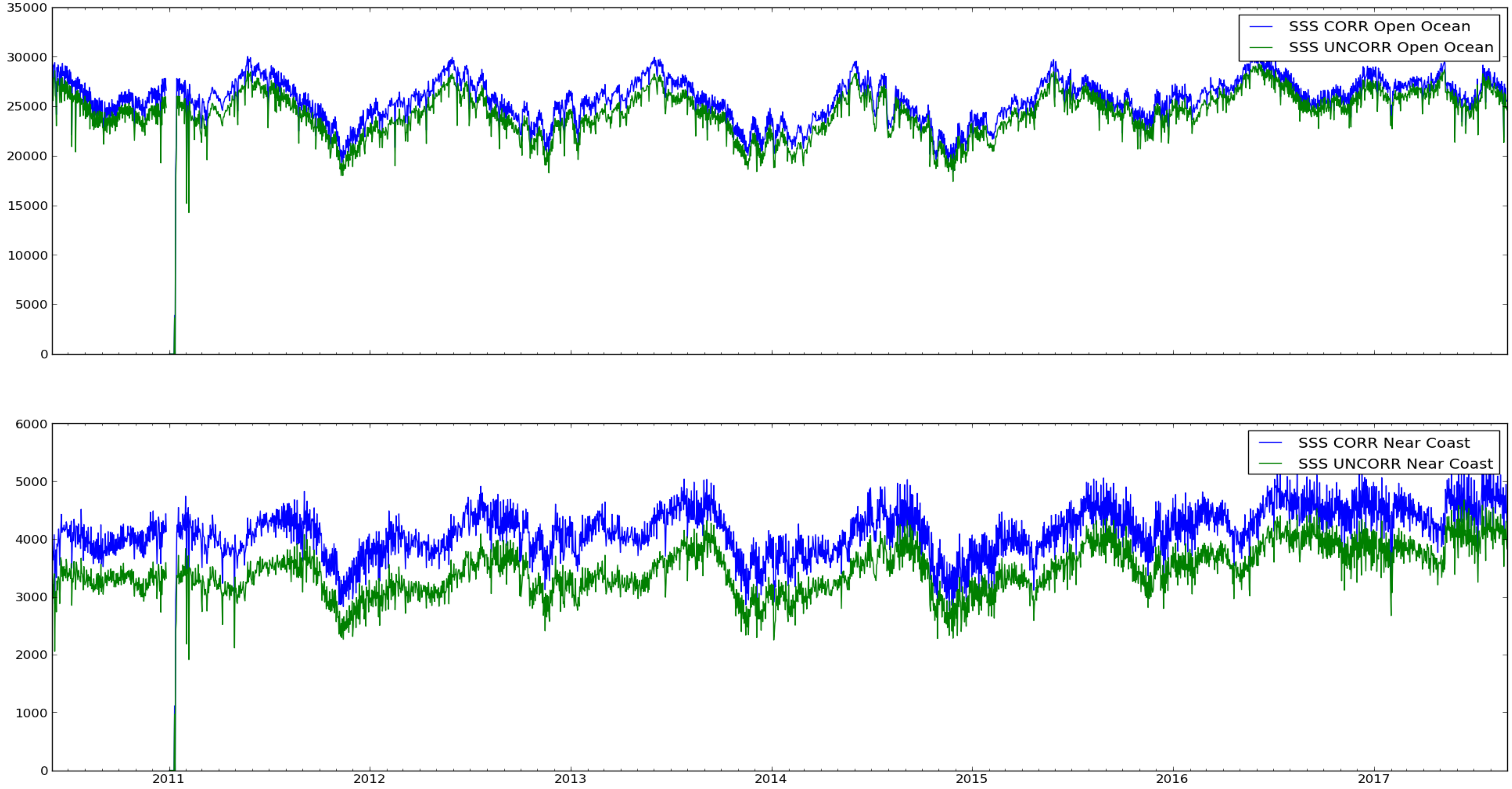


Figure 40: Open Ocean and Near Coast L2OS Good Quality Retrievals

6. PRODUCT QUALITY ANALYSIS

Level 1 data quality for September has found to be nominal except in the time intervals listed in the section 4.5. Weekly maps for ascending and descending passes for the Stokes 1, Stokes 3 and Stokes 4 in videos format can be found at:

https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/content/-/asset_publisher/t5Py/content/data-quality-7059

All the artificial patterns in the maps can be explained by the presence of RFIs.

Level 2 Soil Moisture data quality for September has found to be nominal. Weekly maps for ascending and descending passes for the soil moisture in videos format can be found at:

https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/content/-/asset_publisher/t5Py/content/data-quality-7059

Since 19th December 2016 auxiliary dataset from the NOAA Interactive Multisensor Snow and Ice Mapping System (IMS) is used by the SMOS soil moisture level 2 processor to represent the snow cover extent. The NOAA IMS, based on data acquired by various sensors, provides a better representation of the snow cover compared to previously snow density information from ECMWF forecast. Globally the impact in terms of soil moisture is not significant.

Level 2 Sea Surface Salinity data quality is nominal in the reporting period. Weekly maps for ascending and descending passes for good retrieved sea surface salinity in videos format can be found at:

https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/content/-/asset_publisher/t5Py/content/data-quality-7059

The lack of good retrieval at descending passes during the boreal winter season is less evident for winter 2016 and 2017, This fact points out that thermal effect on the instrument due to eclipse is only one contributor and others sources (e.g. L-band Sun signal direct or reflected) impacting the number of good retrieval are under investigation by the calibration team and level 2 expert support laboratory.

For more details on soil moisture and sea surface salinity retrieval algorithms and caveats in data usage see the level 2 Algorithm Theoretical Baseline Documents and the read-me-first note available here:

https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/content/-/asset_publisher/t5Py/content/data-processors-7632

7. ADF CONFIGURATION AT THE END OF THE REPORTING PERIOD

ADF File Type	Operational ADF Version (DPGS Baseline)	Updated
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AUX_ATMOS_	SM_OPER_AUX_ATMOS__20050101T000000_20500101T000000_001_010_3.EEF	No
AUX_BFP___	SM_OPER_AUX_BFP____20050101T000000_20500101T000000_340_004_3.EEF	No
AUX_BNDLST	SM_OPER_AUX_BNDLST_20050101T000000_20500101T000000_300_001_3	No
AUX_BSCAT_	SM_OPER_AUX_BSCAT__20050101T000000_20500101T000000_300_003_3	No
AUX_BULL_B	**SM_OPER_AUX_BULL_B_20170702T000000_20500101T000000_120_001_3**	Yes
AUX_BWGHT_	SM_OPER_AUX_BWGHT__20050101T000000_20500101T000000_340_006_3.EEF	No
AUX_CNFFAR	SM_OPER_AUX_CNFFAR_20050101T000000_20500101T000000_100_002_3.EEF	No
AUX_CNFL0P	SM_OPER_AUX_CNFL0P_20050101T000000_20500101T000000_001_005_3.EEF	No
AUX_CNFL1P	SM_OPER_AUX_CNFL1P_20110206T010100_20500101T000000_620_051_3.EEF	No
AUX_CNFNRT	SM_OPER_AUX_CNFNRT_20050101T000000_20500101T000000_620_010_3.EEF	No
AUX_CNFOSD	SM_OPER_AUX_CNFOSD_20050101T000000_20500101T000000_001_024_3.EEF	No
AUX_CNFOSF	SM_OPER_AUX_CNFOSF_20050101T000000_20500101T000000_001_026_3.EEF	No
AUX_CNFSMD	SM_OPER_AUX_CNFSMD_20050101T000000_20500101T000000_001_014_3.EEF	No
AUX_CNFSMF	SM_OPER_AUX_CNFSMF_20050101T000000_20500101T000000_001_014_3.EEF	No
AUX_DFFFRA	SM_OPER_AUX_DFFFRA_20050101T000000_20500101T000000_001_005_3	No
AUX_DFFLMX	SM_OPER_AUX_DFFLMX_20050101T000000_20500101T000000_001_006_3	No
AUX_DFFSOI	SM_OPER_AUX_DFFSOI_20050101T000000_20500101T000000_001_002_3	No
AUX_DFFXYZ	SM_OPER_AUX_DFFXYZ_20050101T000000_20500101T000000_001_003_3	No
AUX_DGG___	SM_OPER_AUX_DGG____20050101T000000_20500101T000000_300_003_3	No
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AUX_DISTAN	SM_OPER_AUX_DISTAN_20050101T000000_20500101T000000_001_011_3	No
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AUX_ECMCDF	SM_OPER_AUX_ECMCDF_20101109T000000_20500101T000000_001_001_3.EEF SM_OPER_AUX_ECMCDF_20050101T000000_20101109T000000_001_002_3	No
AUX_FAIL__	SM_OPER_AUX_FAIL___20050101T000000_20500101T000000_300_004_3.EEF	No
AUX_FLTSEA	SM_OPER_AUX_FLTSEA_20050101T000000_20500101T000000_001_010_3.EEF	No
AUX_FOAM__	SM_OPER_AUX_FOAM___20050101T000000_20500101T000000_001_011_3	No
AUX_GAL_OS	SM_OPER_AUX_GAL_OS_20050101T000000_20500101T000000_001_011_3	No
AUX_GAL_SM	SM_OPER_AUX_GAL_SM_20050101T000000_20500101T000000_001_003_3	No
AUX_GAL2OS	SM_OPER_AUX_GAL2OS_20050101T000000_20500101T000000_001_016_3	No
AUX_GALAXY	SM_OPER_AUX_GALAXY_20050101T000000_20500101T000000_300_004_3	No
AUX_GALNIR	SM_OPER_AUX_GALNIR_20050101T000000_20500101T000000_300_003_3	No
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AUX_MISP__	SM_OPER_AUX_MISP___20050101T000000_20500101T000000_300_004_3.EEF	No
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AUX_MOONT_	SM_OPER_AUX_MOONT__20050101T000000_20500101T000000_300_002_3	No
AUX_N256__	SM_OPER_AUX_N256___20050101T000000_20500101T000000_504_002_3	No
AUX_NIR___	SM_OPER_AUX_NIR____20050101T000000_20500101T000000_500_010_3.EEF	No
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AUX_OTT1D_	SM_OPER_AUX_OTT1D__20120504T203936_20500101T000000_624_001_1 Initialization file for the deployment of the L2OS V62x processor. Since level 2 OS processor V62x the new file is generated on routine basis by the level 2 post processor	No
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AUX_PMS___	SM_OPER_AUX_PMS____20050101T000000_20500101T000000_600_011_3.EEF	No
AUX_RFI___	SM_OPER_AUX_RFI____20050101T000000_20500101T000000_300_003_3	No
AUX_RFILST	Since level 1 processor version V62x the file is generated by CATDS on monthly basis	No
AUX_RGHNS1	SM_OPER_AUX_RGHNS1_20050101T000000_20500101T000000_001_015_3	No
AUX_RGHNS2	SM_OPER_AUX_RGHNS2_20050101T000000_20500101T000000_001_013_3	No
AUX_RGHNS3	SM_OPER_AUX_RGHNS3_20050101T000000_20500101T000000_001_015_3.EEF	No
AUX_SGLINT	SM_OPER_AUX_SGLINT_20050101T000000_20500101T000000_001_011_3	No
AUX_SOIL_P	File discontinued since level 2 SM processor V62x SM_OPER_AUX_SOIL_P_20050101T000000_20500101T000000_001_002_3	No
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APPENDIX A. CONFIGURATION DOCUMENT LIST

The list of internal documents used for the generation of this report is:

- Unavailability.xls
- Details_Calibrations.xls
- SMOS-CEC-VEG-IPF-REP-0609_v1.81_SMOS_Auxiliary_Data_File_List.pdf

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