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IDEAS+ Swarm Weekly Report 2015/48: 2015/11/23 - 2015/11/29

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 23 November to 29 November 2015.

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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	REASON
1.0	10 Dec 2015	First issue
1.1	05 Jan 2016	Corrections in Sects. 3.3.4 and 4.1 in order to have a consistent description of the investigations done following the VFM-B SEU event on 24/11/2015.

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1. INTRODUCTION

This document refers to the activities carried out in the framework of the Sensor Performance, Products and Algorithms (SPPA) Office [RD.1], and as such, it reports on work related to:

- Algorithms and Processors Development, Maintenance and Evolution: these include all algorithm and software evolution and maintenance aspects for the different components, for both the Operational processors (OP) and Prototypes processors (PP) of L1 and L2 chains.
- Performance Assessment: these include all Quality Control activities (on-line and offline, systematic or on-demand), for the applicable product levels.
- System Calibration: these include the activities related to calibration, from sensor to system level. They also include aspects like cross calibration and handling of external calibration sources.
- Product validation: these include definition and maintenance of product validation plans.
- End-to-end Sensor Dataset Performance: these include activities related to the organisation and coordination of Quality Working Groups and all aspects of the Experimental platform. It also covers the product baseline, coordination and handling of external communities, and all aspects of ADF handling (both for the operational processors and for the prototypes).

This weekly report constitutes a work in progress throughout the mission lifetime, and new parts and complements will be added while the consolidation of knowledge on Swarm data and instruments will progress.

Section 2.1 always gives an overview of the general quality status of the mission instruments and products, while the main observations of the week are summarized in Section 2.2.

The document also includes information on data quality for the three Swarm spacecraft, inferred from automated HTML quality reports, which are produced on daily basis for each product. Please contact the IDEAS+ Swarm team if interested in accessing the reports via web or FTP (all details about interfaces and folder structure available on [RD.2]). Such quality reports represent the core of the Routine Quality Control (Chapter 3). A description of the implemented quality checks is given in [RD.3], and references therein.

Basing on specific findings of the routine quality control, or on-demand from other entities (i.e. Swarm PDGS, FOS, Mission Management, Post-Launch Support Office, Expert Support Laboratories, Quality Working Groups, and user community), anomalies can be triggered. Preliminary characterisations and investigations of such anomalies are given in Chapter 4.The anomalies documented in the Weekly Reports are tracked in the following way:

1. If triggered by ESA Eohelp or within the Service: IDEAS+ action and ticketing system (http://requests-sppa.serco.it/RT3/index.html).

2. If triggered by IDEAS+ Swarm team or other entities:

   2a. If the observation/analysis leads to an anomaly to be addressed to the processor provider (GMV): SPR on EO ARTS (https://arts.eo.esa.int), **SWL1L2DB** project;

   2.b. If the observation/analysis does not lead to an anomaly or the investigation shall be escalated to other entities (PLSO/industry, ESL, PDGS): Action tracked on EO ARTS, **SW-IDEAS** project, then addressed to the proper tracking system if needed (e.g. JIRA for ESLs, SW-CP-AR project on EO ARTS for PDGS).

Information on Level 1B Swarm products can be found in [RD.4].

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1.1 Current Operational configuration of monitored data:

- Processors Version: L1BOP 3.16.p2, L2-Cat2 1.15.p3.
- L0 input products baseline: 02
- L1B baseline: MAGNET and PLASMA 04, ORBATT and ACCELE 03 (for definitions and description of the data baseline concept see https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/swarm/data-access/product-baseline-definition)
- Level 2 – Cat 2 baseline: EEF 01, IBI, FAC and TEC 02
- Input auxiliary files baseline: CCDB 0007 (29/10/2015), ADF 0101
- MPPF-CVQ v.2.14.01

1.2 Reference documents

The following is a list of documents with a direct bearing on the content of this report. Where referenced in the text, these are identified as RD.n, where 'n' is the number in the list below:

[RD.1] Sensor Performance, Products and Algorithms (SPPA), PGSI-GSOP-EOPG-TN-05-0025. Version 2.3.

[RD.2] Swarm PDGS External DMC Interface Control Document, SW-ID-DS-GS-0001, Issue 3.2.

[RD.3] Swarm MPPF-CVQ Monitoring Baseline Document, ST-ESA-SWARM-MBD-0001, Issue 1.7.

[RD.4] Swarm Level 1B Product Definition, SW-RS-DSC-SY-0007, Issue 5.13.

[RD.5] Swarm IDEAS Configuration Management Plan, IDEAS-SER-MGT-PLN-1081 v0.14.

[RD.6] Swarm Quality Control Project Plan, IDEAS-SER-MGT-PLN-1071

[RD.7] SW_L1BOP_status_20141124_MoM

[RD.8] Planned Updates for Level 1b, SW-PL-DTU-GS-008, Rev: 1dC.

[RD.9] IDEAS+ Swarm Weekly Report: 25/08/2014 – 31/08/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20140825_20140831.pdf (ref. for SWL1L2DB-9)

[RD.10] IDEAS+ Swarm Weekly Report: 29/09/2014 – 05/10/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20140929_20141005.pdf (ref. for SW-IDEAS-34)

[RD.11] IDEAS+ Swarm Weekly Report: 06/10/2014 – 12/10/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20141006_20141012.pdf (ref. for SW-IDEAS-36)

[RD.12] IDEAS+ Swarm Weekly Report: 20/10/2014 – 26/10/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20141020_20141026.pdf (ref. for SW-IDEAS-40, GPS sync loss)

[RD.13] IDEAS+ Swarm Weekly Report: 15/09/2014 – 21/09/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20140915_20140921.pdf (ref. for SW-IDEAS-27)

[RD.14] Swarm L1B 03.15 Validation Report, OSMV-OPMT-SRCO-RP-15-3385, Issue 1.3.

[RD.15] IDEAS+ Swarm Weekly Report: 23/03/2015 – 29/03/2015, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_201513_20150323_20150329.pdf.

[RD.16] SWARM Weekly Operations Report #76, SW-RP-ESC-FS-6172

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[RD.17] Olsen, N., H. Luhr, C.C. Finlay, T.J. Sabaka, I. Michaelis, J. Rauberg and L. Tøffner-Clausen, The CHAOS-4 geomagnetic field model, Geophys. J. Int. 197, 815–827, 2014

[RD.18] IDEAS+-SER-IPF-PLN-2272, Swarm Level 1B Operational Processor Verification Plan, IDEAS+-SER-IPF-PLN-2272_L1BOP_316_v1.5_final.pdf

[RD.19] Swarm Level 1B Processor Algorithms, SW-RS-DSC-SY-0002, Issue 6.10

[RD.20] SW-RP-ESC-FS-6201_Swarm_Weekly_Operations_Report#105_23-11-2015_29-11-2015

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2. SUMMARY OF THE OBSERVATIONS

2.1 General status of Swarm instruments and Level 1B products quality

Nothing to report.

2.2 Plan for operational processor updates

A new delivery of the L1BOP is foreseen for end 2015/beginning 2016 in order to cope with the following issues:

1. RINEX correction due to a better alignment of the Instrument Measurement Time,
2. Fixing ORBATT bugs (related to Leap second handling and SPRs SWL1L2DB-75 and 84, see Sect. **Error! Reference source not found.** for a more detailed description)
3. Separating the time dependent calibration corrections and the external disturbance effects in the VFM data: introduction of “s_beta” (scale factor depending on elevation angle Beta) and “s_exp” (“aging” scale factor modelled as an exponential function) in the scale calibration.
4. Correction of STR Inter-Boresight Angles
5. Possibly, a correction in the conversion from Level 0s into Level 1B of the Langmuir Probe offset parameters.

A new delivery of the Level 2 – Cat 2 EEF processor expected by January 2016 in order to be able to produce EEF data also for Swarm C after the ASM stop.

2.3 Quality Working Group and Cal/Val Coordination

Following the decisions of the 5th QWG in Paris, these activities will be carried on in order to better understand the origin of the ASM-VFM residuals:

- Investigation on boom alignment error budget (from industry) that could help in developing a thermos-elastic correction approach.

- Investigation on plasma-induced stray field in order to focus on any possible current flow near the VFM (and not the ASM), because the intensity of such a current may be stronger near the VFM due to the accumulation of charged plasma particles near the STR baffles.

In the meantime, DTU will deliver an ASM-VFM residual dataset to be distributed to all the Swarm users through the ESA FTP server (/Advanced folder).

Following the decisions of the 5th QWG in Paris, University of Calgary has delivered to the benefit of expert users through the ESA FTP server (/Advanced folder), the 16 Hz TII raw image moments for selected periods during 2013 and 2014 for all S/C.

IRF is about to deliver three new datasets, for the benefit of expert users (/Advanced folder):

- 16 Hz Faceplate currents and derived electron density (by end November)
- Single-probe derived electron temperatures and S/C potential (by end November)
- Sweep mode derived electron density and temperature and S/C potential (by end December).

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Moreover, investigations are on-going with the help of GFZ, on the spike occurrences on the electron temperature: we have provided GFZ with HK_BUS_1A products in CDF, containing the solar panel currents, in order to investigate possible correlation of the spikes with solar illumination and/or currents activations.

2.4 Summary of observations for 2015, Week 48 (23/11 - 29/11)

During the monitored week the following events have been found and investigated:

- **Several few seconds gaps in MAGx_CA_1B products** throughout the week. Some of them seem not to be associated to gaps in telemetry. Monitoring on-going.
- **MAG_HR gap** of 2 minutes duration on S/C B, more details in 3.1

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3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

- **VFM gap** due to power cycle on SC B on 25-Nov-2015 11:44:07-11:46:39. Explanation of the power cycle need given in Section 4.1.4
- **Several few seconds gaps in MAGx_CA_1B products** throughout the week. Some of them seem not to be associated to gaps in telemetry. Monitoring on-going.

3.2 Orbit and Attitude Products

In Table 1Table 1 are listed events that have to be reported.

Table 1: List of events related to attitude and orbit products to be reported in the monitoring for 2015, Week 48: 23/11 - 29/11.

Observation ID	Description	Affected parameter	Sect. of Obs. Description	Sect. of Obs. Analysis

The relevant parameters that have been monitored are:

- Position difference between calculated Medium Accuracy orbits (**MODx_SC_1B**) and on-board solution (**GPSxNAV_0**). Threshold values for such differences have not been assessed yet: we have just monitored the average values and maximum variations around the week. They are reported in tables in the sections below. In addition, some example plots are given from the HTML daily reports. For the time being we evaluated an anomaly should be raised if one (or more) of the following conditions occurs:
    - The **average difference** on a given day exceeds the position accuracy requirement for the mission (1.5 m),
    - The variability around the average is quite high: **standard deviation** threshold has been arbitrarily chosen to be twice the position accuracy requirement for the mission (2-sigma = 3 m).
    - At least 4-5 spikes are observed on a given day, exceeding +/- 50 m.
- Visual inspection of Star Tracker characterisation flags (**STRxATT_1B**)
- Deviation of the quaternion norm from unity (deviation threshold = +/- 10^{-9})
- Visual inspection of Euler Angles derived from quaternions.

3.2.1 Position Statistics

In Table 2Table 2, one can see the statistics of the differences between MOD and on-board solution positions for S/C A, B and C respectively. In the third column the maximum differences (maximum negative and maximum positive) are reported. The maximum standard deviation is in the fourth column. Maxima, minima and standard deviations usually refer to the Z component that is often the most disturbed; in case another component is most affected, it will be specified in parentheses. Figure 1 shows a cumulative trend of the maximum daily standard deviation for the past 30 days of operations of the MOD-NAV difference, while Figure 2 shows the daily maximum

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difference, in absolute value, of the MOD-NAV difference, always for the past 30 days of operations.

Table 2: Swarm A, B and C, difference between MOD and on-board solution positions. If not specified maximum difference and maximum standard deviation refers to the Z-axis.

Swarm A, 23/11 - 29/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
23/11	0.06	-6.4	11.7	1.3	
24/11	0.08	-7.8	6.2	1.17	
25/11	0.06	-9.9	6	1.34	
26/11	0.15	-8.6	9.1	1.34	
27/11	0.09	-7.5	9.5	1.2	
28/11	0.16	-7.7	5.7	1.15	
29/11	0.04	-7.5	7.9	1.26	
Swarm B, 23/11 - 29/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
23/11	0.07	-6.7	5.2	1.29	
24/11	0.15	-6.1	5.7	1.25	
25/11	0.13	-8.1	7.4	1.36	
26/11	0.1	-10.7	7.2	1.29	
27/11	0.12	-8	6.6	1.23	
28/11	0.13	-6.3	5.9	1.11	
29/11	0.15	-6	5.5	1.36	
Swarm C, 23/11 - 29/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
23/11	0.07	-8	6.4 (X)	1.27	
24/11	0.1	-5.5	5.4 (Y)	1.12	
25/11	0.05	-7.7	7.5	1.28	
26/11	0.12	-8.8	7.1 (X)	1.27	
27/11	0.1	-7.5	9.8	1.2	
28/11	0.14	-8.8	6.2	1.12	
29/11	0.05	-7.8	7.3	1.26	

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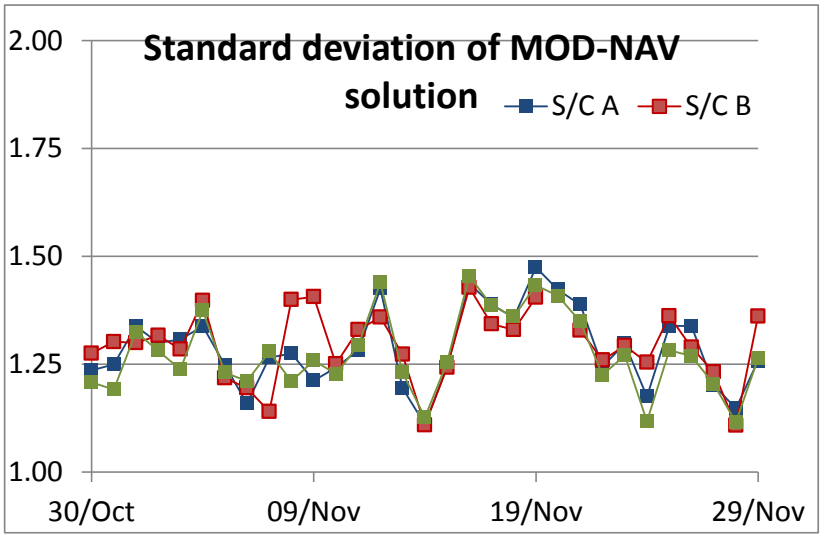

Figure 1: Plot of the standard deviation of the difference between MOD and NAV solutions for all satellites. Plot covers last month of operation.

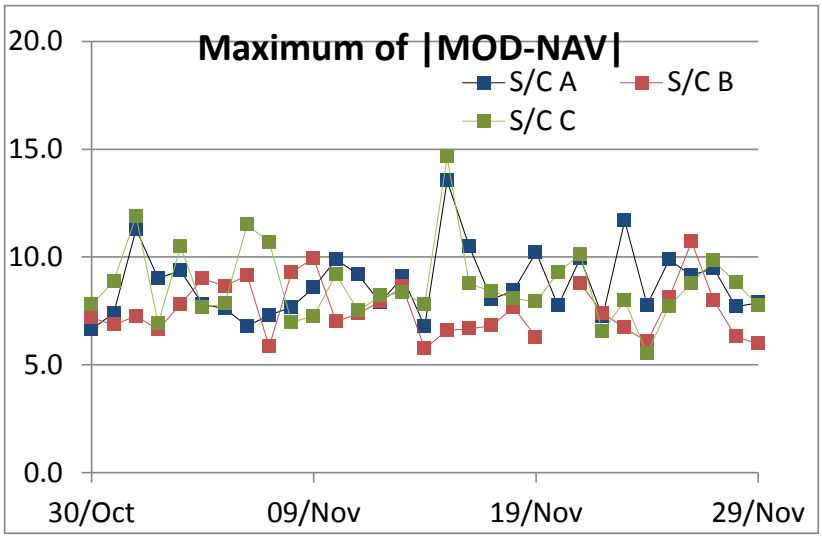

Figure 2: Plot of the maximum difference of the absolute value of the difference between MOD and NAV solutions for all satellites. Plot covers last month of operation.

3.2.1.1 Swarm A

Below some plot example follows of MOD-NAV differences, S/C A, taken at the beginning of the week (23/1123/11, Figure 3Figure 3). From top to bottom, the plots show of MOD-NAV differences in ITFR reference frame: on X, Y and Z-axis respectively. The difference between both solutions is given in [m].

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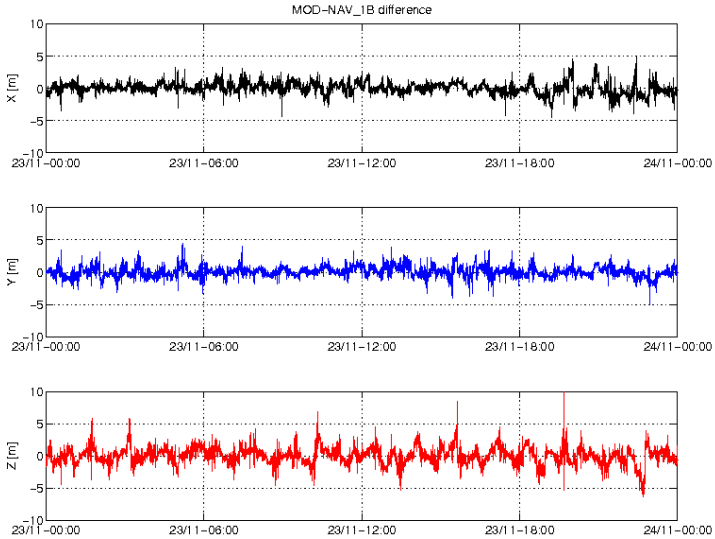

Figure 3: Difference MOD-GPSNAV, S/C A, 23/11. From top to bottom: X, Y and Z-axis

3.2.1.2 Swarm B

Below some plot example follows of MOD-NAV differences, S/C B, taken at the beginning of the week (23/11, Figure 4). From top to bottom, the plots show of MOD-NAV differences in ITFR reference frame: on X, Y and Z-axis respectively. The difference between both solutions is given in [m].

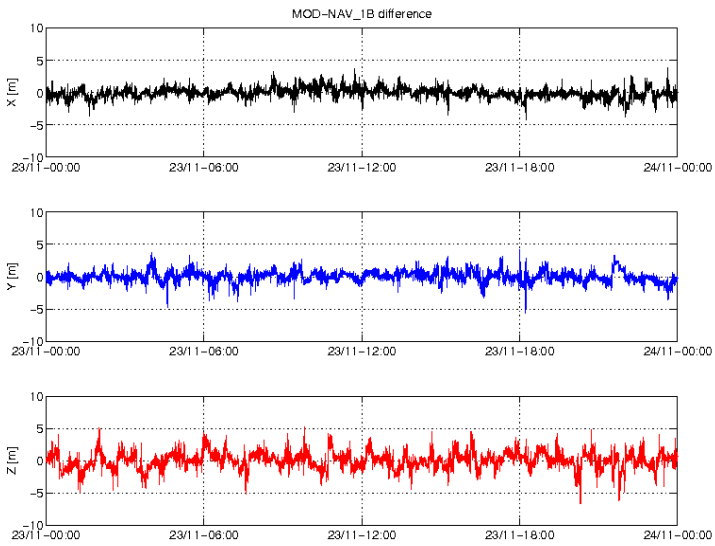

Figure 4: Difference MOD-GPSNAV, S/C B, 23/11. From top to bottom: X, Y and Z-axis

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3.2.1.3 Swarm C

Below some plot example follows of MOD-NAV differences, S/C C, taken at the beginning of the week (23/11, Figure 5). From top to bottom, the plots show of MOD-NAV differences in ITFR reference frame: on X, Y and Z-axis respectively. The difference between both solutions is given in [m].

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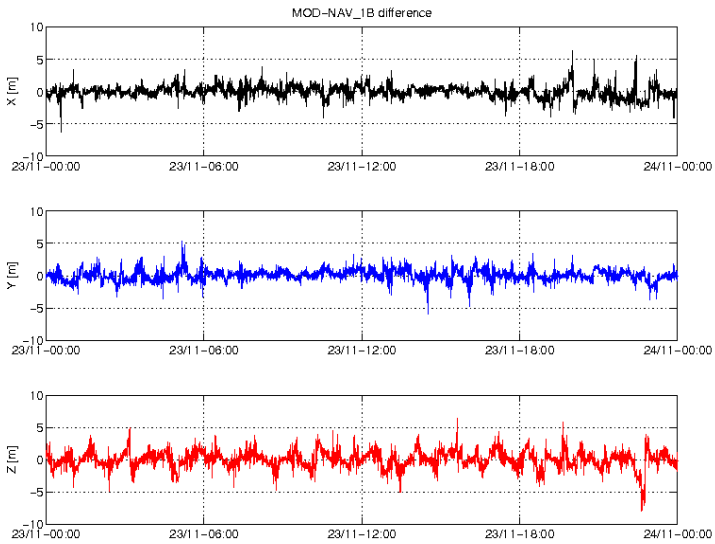

Figure 5: Difference MOD-GPSNAV, S/C C, 23/11. From top to bottom: X, Y and Z-axis

3.2.2 Attitude observations

3.2.2.1 Swarm A

Nothing to report.

3.2.2.2 Swarm B

Nothing to report.

3.2.2.3 Swarm C

Nothing to report.

3.3 Magnetic Products

For the magnetic products, the weekly monitoring consists in:

- ASM instrument monitoring: quartz frequency and ASM temperature
- VFM instrument monitoring: temperatures

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- Visual inspection of daily time series of magnetic field intensity F, B_{NEC} and B_{VFM}. Looking for gaps (or zero values in case of MAGx_LR_1B products), out-of-threshold values (i.e. exceeding +/- 60000 nT), and other strange features.
- Monitoring of the ASM-VFM known anomaly: visual inspection of $|B_{VFM}|$ - F taken from MAGx_CA_1B products and recording of daily maximum variations and standard deviations. If +/- 1 nT are exceed on a given day, an alert is raised.
- Comparison of magnetic data (B_{NEC}) with a model (Chaos4plus)

3.3.1 VFM-ASM anomaly

In Table 3 are listed events that have to be reported.

Table 3: List of events related to magnetic products to be reported in the monitoring for 2015, Week 48: 23/11 - 29/11.

Observation ID	Description	Affected parameter	Sect. of Obs. Description	Sect. of Obs. Analysis
SW-IDEAS-63	OBS_ROUTINE: MAGx_CA_1B gaps	MAGx_CA_1B	3.1	NA

On day 24/11 and 25/11, on Swarm B, we have observed an increase in ASM-VFM residuals starting from about 18 UT. This seems to be affected by a SEU “Single Event Upset”, which occurred that moment. Details of the event are given in [RD.20] on page 40. The increase in ASM-VFM residuals is explained in Section 4.

3.3.2 ASM-VFM difference statistics

In Table 4, one can see the statistics of the differences between magnetic field absolute value measured by ASM and by VFM. In the second and third column are reported the maximum differences, maximum negative and maximum positive respectively. The maximum standard deviation is in the fourth column.

The ASM-VFM difference is defined as follow:

$dF = |B_{VFM}| - F_{ASM}$

Figure 6 and Figure 7 shows the daily mean (circles) and standard deviation (crosses) of dF for Swarm A and Swarm B respectively.

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Table 4 Swarm A and B, difference between magnetic field absolute value measured by ASM and by VFM.

Swarm A, 23/11 - 29/11, ASM-VFM difference					
Day	**Max (nT)**	**Min (nT)**	**Standard deviation (nT)**	**Mean (nT)**	**Notes**
23/11	0.65	-0.49	0.24	0.07	
24/11	0.62	-0.53	0.24	0.06	
25/11	0.57	-0.66	0.24	0.05	
26/11	0.59	-0.58	0.24	0.05	
27/11	0.64	-0.61	0.3	0.05	
28/11	0.59	-0.56	0.25	0.04	
29/11	0.65	-0.51	0.24	0.06	
Swarm B, 23/11 - 29/11, ASM-VFM difference					
Day	**Max (nT)**	**Min (nT)**	**Standard deviation (nT)**	**Mean (nT)**	**Notes**
23/11	0.67	-0.53	0.22	0.05	
24/11	1.45	-1.86	0.51	-0.03	SEU see Section 4
25/11	10.43	-1.67	0.63	-0.02	SEU see Section 4
26/11	0.73	-0.68	0.25	0.05	
27/11	0.73	-0.77	0.24	0.03	
28/11	0.7	-0.84	0.27	0.02	
29/11	0.61	-0.91	0.27	0.02	

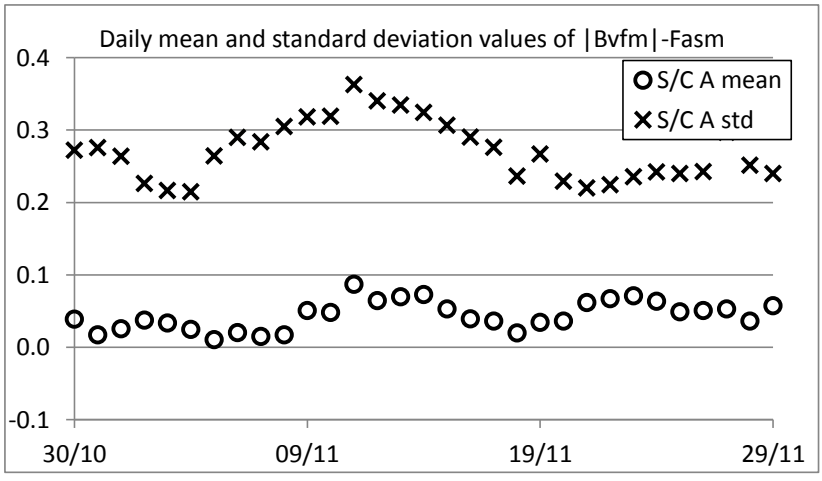

Figure 6: Daily mean and standard deviation values of ASM-VFM residuals (defined as $dF=|B_{VFM}|-F_{ASM}$) for S/C A.

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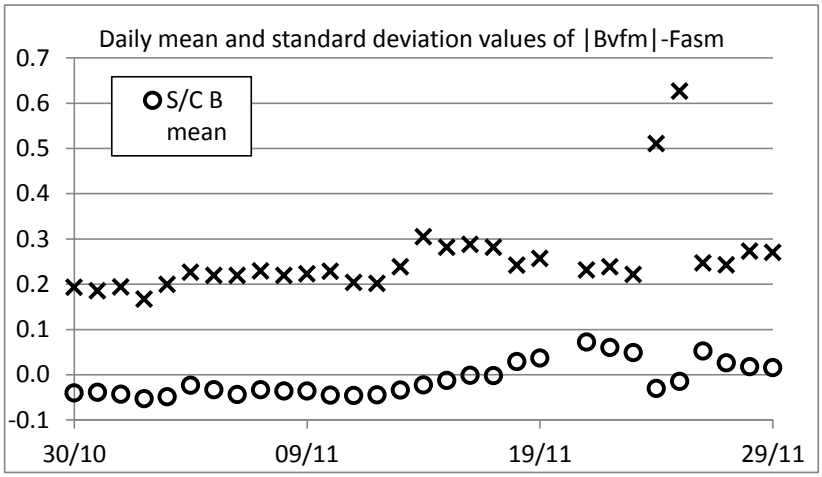

Figure 7 Daily mean and standard deviation values of ASM-VFM residuals (defined as $dF=|B_{VFM}|-F_{ASM}$) for S/C B.

3.3.2.1 Swarm A

The daily peak-to-peak difference around the week stays within [-0.6, 0.6] nT. Below two example plots of such differences for the days: 23/11 (Figure 8), and 29/11 (Figure 9).

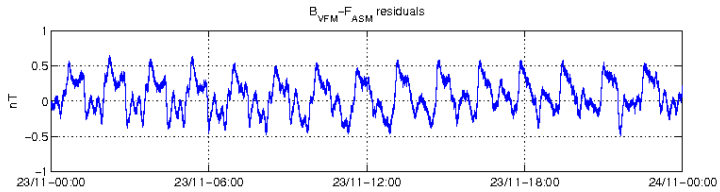

Figure 8: ASM-VFM residuals for S/C A, 23/11.

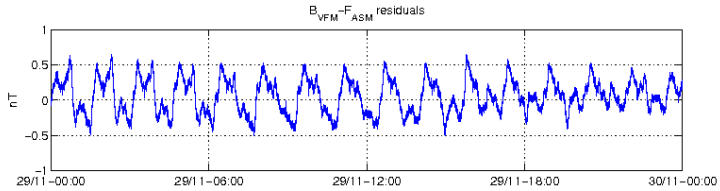

Figure 9: ASM-VFM residuals for S/C A, 29/11.

3.3.2.2 Swarm B

The daily peak-to-peak difference around the week is, on average: [-0.9, 0.7] nT, with an exception for 24/11 and 25/11 when VFM instrument was affected by SEU. Below two example plots follows of such differences: 24/11 (Figure 10), and 25/11 (Figure 11).

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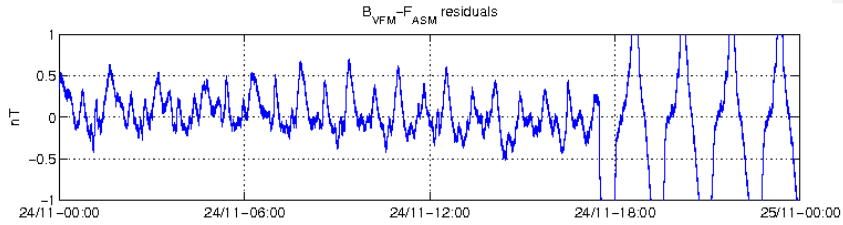

Figure 10: ASM-VFM residuals for S/C B, 24/11. At this day SEU happened, and starting from 17:50 UT the ASM-VFM residuals increased.

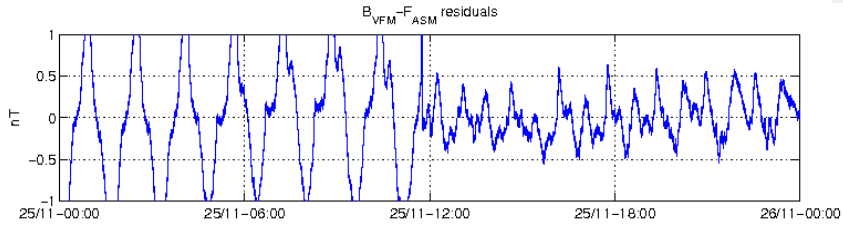

Figure 11: ASM-VFM residuals for S/C B, 25/11. Power cycle at 11:44 helped to recover proper VFM operation.

3.3.2.3 Swarm C

No data because ASM is switched off.

3.3.3 ASM Instrument parameters: quartz frequency and ASM temperature (ASMAVEC_0)

For S/C A and B, the temperature and quartz frequency behaved as expected.

3.3.4 VFM Instrument parameters: VFM temperatures (MAG_CA)

The VFM instrument parameters important for monitoring the instrument health are the VFM sensor temperatures: T_CDC, T_CSC and T_EU.

For S/C A~~, B~~ and C, or reported period, the temperatures behaved as expected.

For S/C B we report an anomalous behaviour for T_CDC and T_CSC, between 24 and 25/11/2015, which is related to the SEU event that led to a VFM power cycle. The anomaly is described in detail in Sect. 4.1.

3.3.5 Magnetic time series visual inspection

3.3.5.1 Swarm A

An example of representative magnetic field time series for S/C A (29/11) can be seen in Figure 12~~Figure 12~~ below.

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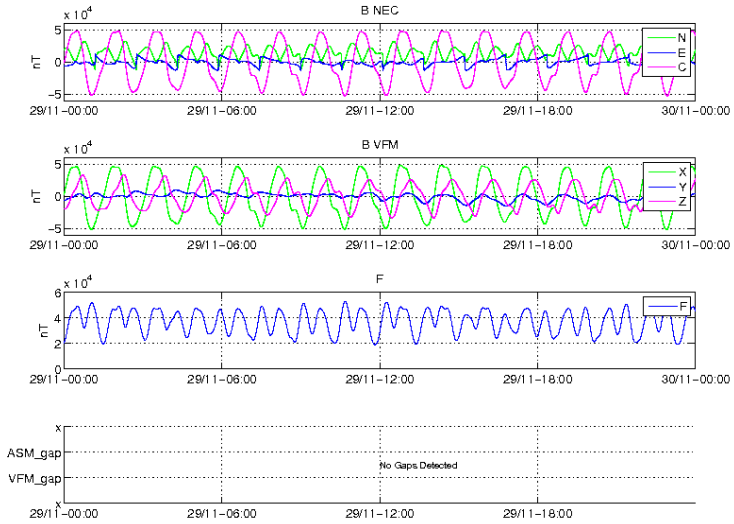

Figure 12: Time series of the geomagnetic field, for 29/11, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.5.2 Swarm B

An example of representative magnetic field time series for S/C B (29/11) can be seen in Figure 13~~Figure 13~~ below.

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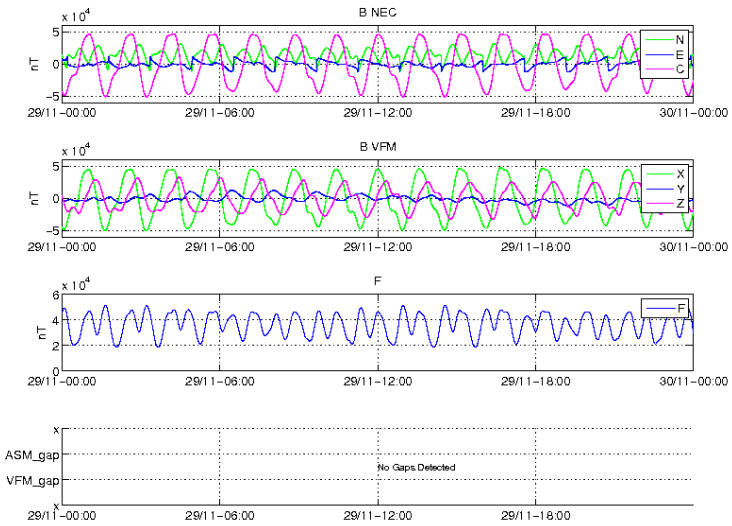

Figure 13: Time series of the geomagnetic field for 29/11, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.5.3 Swarm C

An example of magnetic field time series for S/C C (29/11) can be seen in Figure 14Figure 14.

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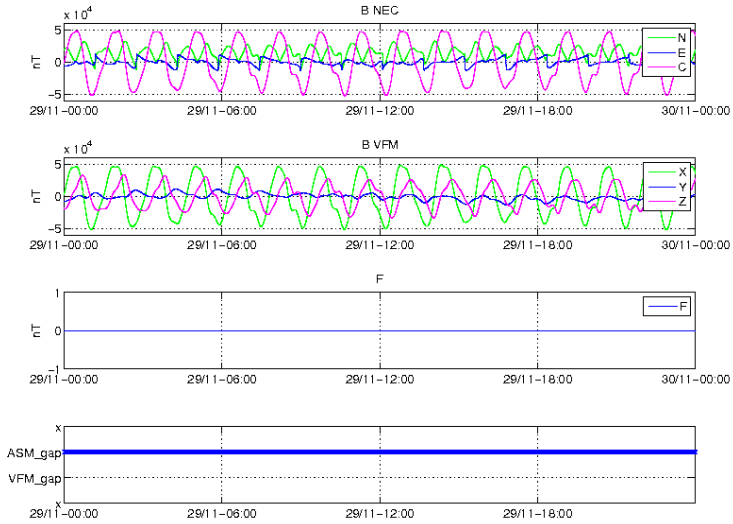

Figure 14: Time series of the geomagnetic field for 29/11, S/C C. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM (no data here because ASM it is off) and location of gaps.

3.3.6 B_{NEC} vs Chaos4plus model residuals

Figure 15, Figure 17 and Figure 19 show field residuals $dB=B_{NEC} - B_{Chaos}$ (all versus co-latitude in degrees), from top to bottom: 1) Br, 2) Bθ and 3) Bφ.

As a general feature one can see the field residuals to be steady and usually below 50 nT at low and middle latitudes, up to |55| - |60| degrees; then the residual increases at high latitudes because the Chaos model does not take into account the contribution from the external field ([RD.17]).

Figure 16, Figure 18 and Figure 20 shows, from top to bottom, the time series on 23/11 of: (1-2-3) residuals of B_{NEC}-B_{CHAOS} by components, related to S/C A, B and C respectively.

The component most affected by residual spikes and variations is Bθ_NEC, i.e. the component that shows the variations of the field wrt to co-latitude. At high latitudes, the order of magnitude of the variability is about +/- 200 nT.

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3.3.6.1 Swarm A

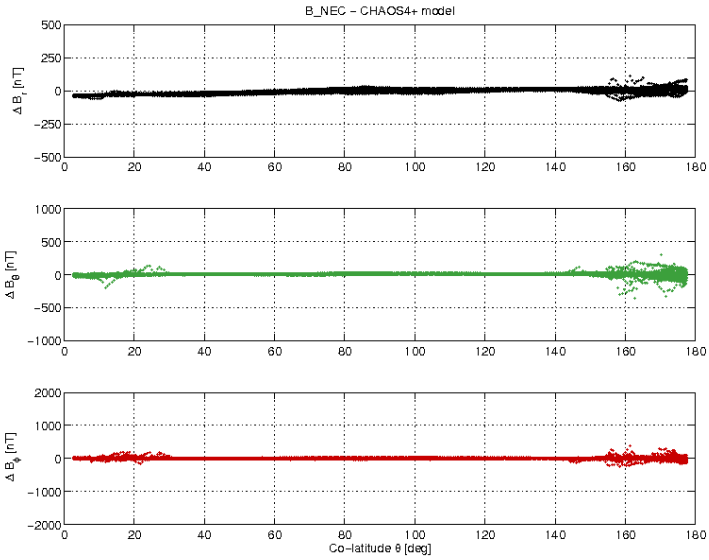

Figure 15: Swarm A day 23/11 B_NEC - B_Chaos vs colatitude.

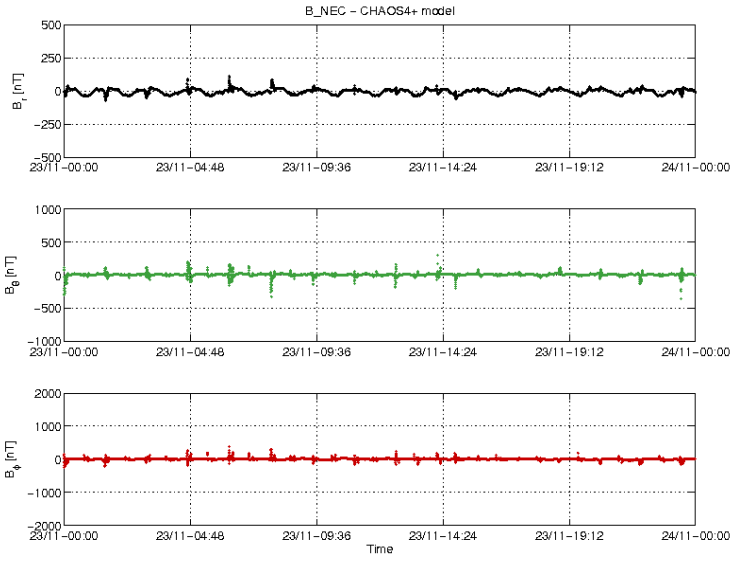

Figure 16: Swarm A day 23/11: time series of B_NEC – B_Chaos residuals.

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3.3.6.2 Swarm B

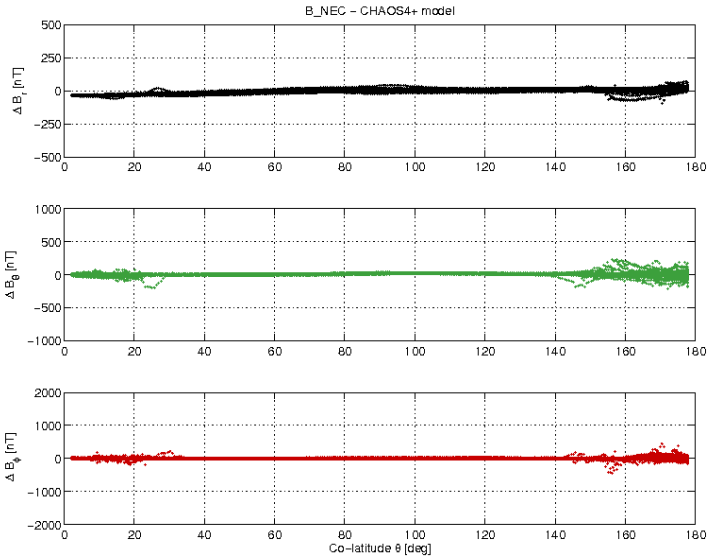

Figure 17: Swarm B day 23/11 B_NEC - B_Chaos difference vs colatitude.

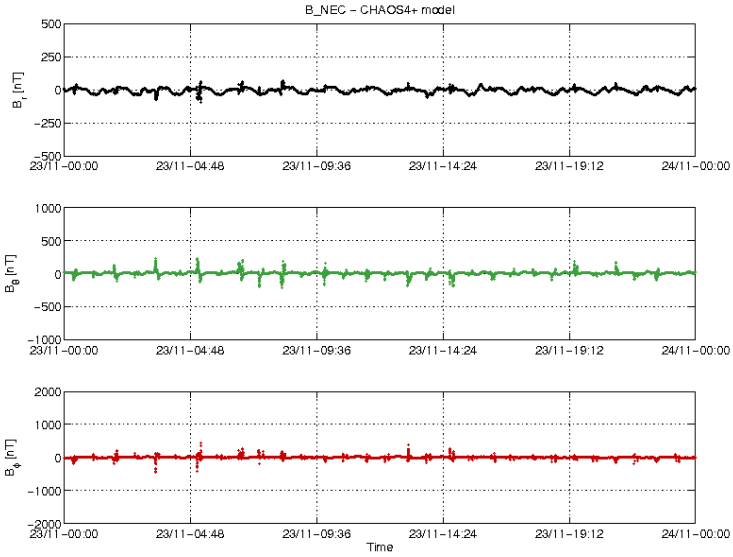

Figure 18: Swarm B day 23/11 time series of B_NEC – B_Chaos residuals.

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3.3.6.3 Swarm C

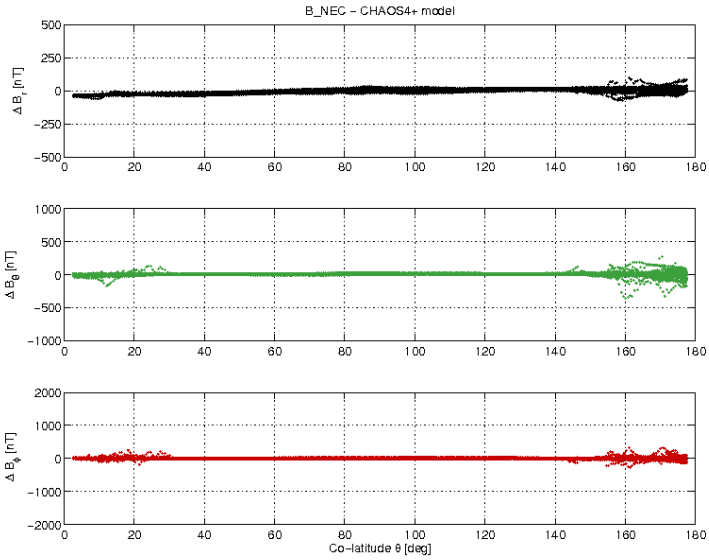

Figure 19: Swarm C day 23/11 B_NEC - B_Chaos difference vs colatitude.

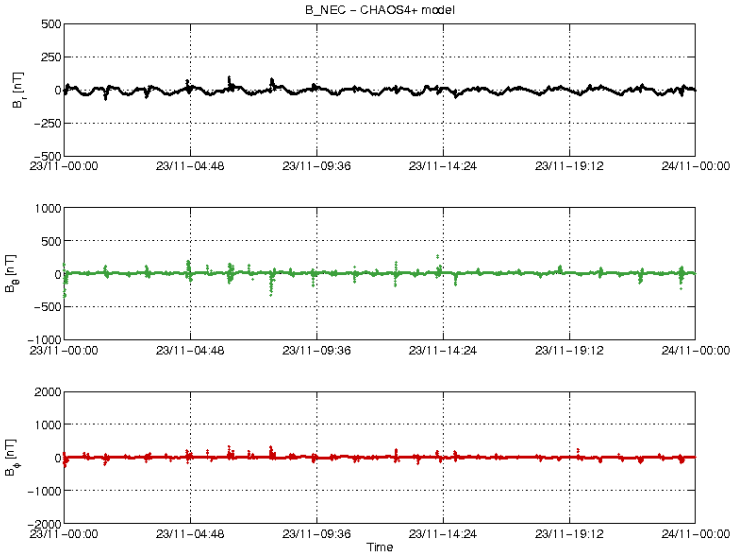

Figure 20: Swarm C day 23/11 time series of B_NEC – B_Chaos residuals.

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4. ON-DEMAND ANALYSIS

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4.4.1 SEU event and VFM power cycle on Swarm B, 24/11/2015

Most probably SEU on SC B has affected the ADC converter that measures the channels for HK (temp and voltages). For that reason the temperature T_CSC (Figure 21) for the time span form SEU to power cycle was constant.

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Another affected parameter was T_{CDC} temperature (Figure 22). Referring to the Level 1b Algorithm Document ([RD.19]), the temperature T_{CDC} influences the bias vector (**b**) of the VFM, i.e. it has an impact also on Level_1bInst.**VFM** parameter. T_{CDC} influences also the diagonal scaling matrix ([RD.19]). Scaling matrix also has an impact on Level 1bInst.**VFM** vector. This dependency could be the explanation of the abrupt increase clearly visible in the B_{VFM}-F_{ASM} trend (Figure 23).

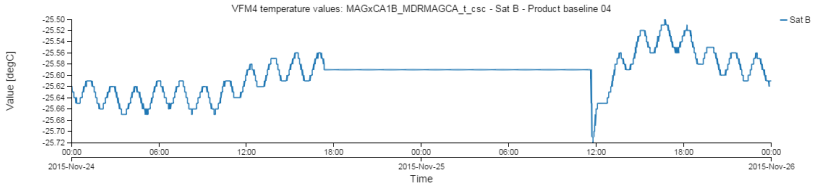

Figure 21: Trend of T_{CSC} temperature from 24/11 to 26/11.

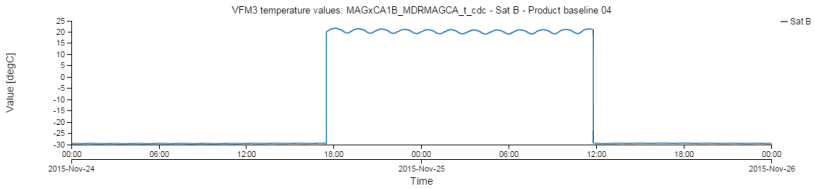

Figure 22: Abrupt increase in T_{CDC} temperature after SEU, the power cycling of VFM device resulted in drop of the temperature to pre-event values.

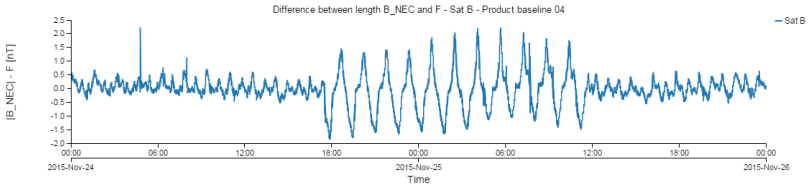

Figure 23: B_{VFM}-F_{ASM} from 24/11 to 26/11. In the figure it is clearly seen the influence of SEU on the measurement.

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