Customer	**:**	**ESRIN**	**Document Ref**	**:**	**IDEAS+-SER-OQC-REP-2071**
Contract No	**:**	**4000111304/14/I-AM**	**Issue Date**	**:**	**23 November 2015**
WP No	**:**	**6110**	**Issue**	**:**	**1.0**

IDEAS+ Swarm Weekly Report 2015/46: 2015/11/09 - 2015/11/15

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 11 September to 15 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	23 Nov 2015	First issue

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 2.1.

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].

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

[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

2. SUMMARY OF THE OBSERVATIONS

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

EFI-TII. New tests planned for Swarm Charlie during CW 48 and 49:

- Monday 23/11: Semi-continuous operations: TII on Charlie will be active all day except for 20 minutes across the equator. This is to investigate the “ring” anomaly on Charlie TII, that seems to appear when density increases close to the equator.
- 24-25/11: Ready state (means inactive)
- 26/11 – 02/12 (included): special operation called “Inner Dome scrubbing”: continuous operations with Phosphor voltage close to zero, MCP voltage at 2 kV and grid voltage sweeping through different values. This procedure is decided in order to try to remove as much contaminants (mainly water vapor) as possible which are thought to accumulate on the sensor inner dome cold surface, and so favor the escape of the contaminants through the entrance slit.
- 3/12: Ready state
- 4/12: Active state for 6 orbits. Potentially useful for Science.
- 5/12: Ready state

Next ARB is scheduled for 9/12/2015.

2.2 Plan for operational processor updates

A patch of L2-Cat2 FAC operational processor has been delivered (patch 4) in order to cope with an issue that caused the failure of FAC combined processing on 27/10/2015. The failure occurred because the MAG_LR level 1B inputs for S/C A contained two records with exactly the same latitude value. In the FAC combined processing it is necessary to compute the point that is closest to the pole every hemisphere (half orbit), for that the maximum and minimum latitude (depends on the hemisphere, north or south) are computed, and this should return only one point. A robustness has been introduced in the FAC processor, so that, in case of such latitude duplications, only the first value is kept and the other is discarded. The patch deployment is not very urgent and will be scheduled according to the PDGS team priorities.

The PLASMA cross-verification has been restarted: GMV is waiting from prototype TDS inputs from IRF and Univ. of Calgary that will come around mid-December.

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).

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 46 (11/09 - 15/11)

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

- Multiple gap in all L0 products on SC B on 11/10, more details in 3.1
- Gaps in MAG_CA, MAG_LR and MAG_HR on SC B on 11/11, more details in 3.1

3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

- Multiple gap in all L0 products on SC B on 11/10

Start of time anomaly	End of time anomaly	Anomaly size [s]
10/11 05:56:32	10/11 05:56:34	2
10/11 05:56:42	10/11 05:56:44	2
10/11 05:56:50	10/11 05:56:52	2
10/11 05:56:52	10/11 05:56:54	2
10/11 05:56:58	10/11 05:57:00	2
10/11 05:57:02	10/11 05:57:04	2
10/11 05:57:21	10/11 05:57:23	2

These gaps occurred over Antarctica resulted in L1B gaps of MAGBHR_1B (B_VFM), GPSBNAV_1B_, GPSX_RO_1B, ACCB_PR_1B, ASMBSCI_1A, MAGX_CA_1B, VFMBAUX_1B

- Gaps in HKBNOM0_AOC and HKBNOM0_OPSY resulted in MAG_LR, MAG_HR and MAG_CA gaps on SC B on 11/11 (over south pacific).
- **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 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 46: 11/09 - 15/11.

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	3.1

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 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 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, 11/09 - 15/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
11/09	0.06	-7.1	8.6 (Y)	1.21	
11/10	0.04	-9.2	9.9 (X)	1.24	
11/11	0.09	-9.2 (Y)	7	1.28	
11/12	0.16	-7.3	7.9	1.43	
13/11	0.11	-9.1	7.5	1.19	
14/11	0.04	-6.7 (Y)	6.8	1.11	
15/11	0.08	-9.5	13.5	1.24	
Swarm B, 11/09 - 15/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
11/09	0.1	-7.5	9.9	1.41	
11/10	0.04	-5.7	7	1.25	
11/11	0.15	-6.4	7.4	1.33	
11/12	0.11	-7.6	7.9	1.36	
13/11	0.07	-8.6	6.9 (X)	1.27	
14/11	0.08	-5.2	5.8	1.11	
15/11	0.05	-6.6 (Y)	5.2	1.24	
Swarm C, 11/09 - 15/11, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
11/09	0.06	-7.2	7.3	1.26	
11/10	0.05	-6.7	9.2	1.23	
11/11	0.07	-7.1 (Y)	7.5	1.29	
11/12	0.16	-8.2	7.9 (Y)	1.44	
13/11	0.11	-8.4	6.1	1.23	
14/11	0.05	-7	7.8	1.13	
15/11	0.1	-7.3	14.6	1.25	

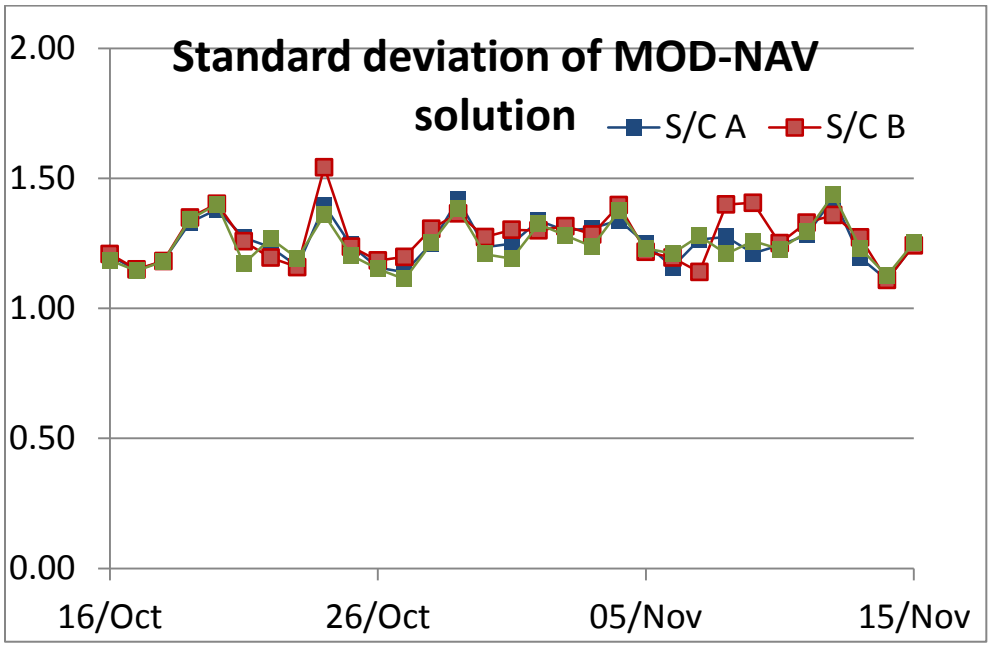

Figure 1 Plot of the standard deviation of the difference between MOD and NAV solutions for all satellites. Plot covers last month of operation.

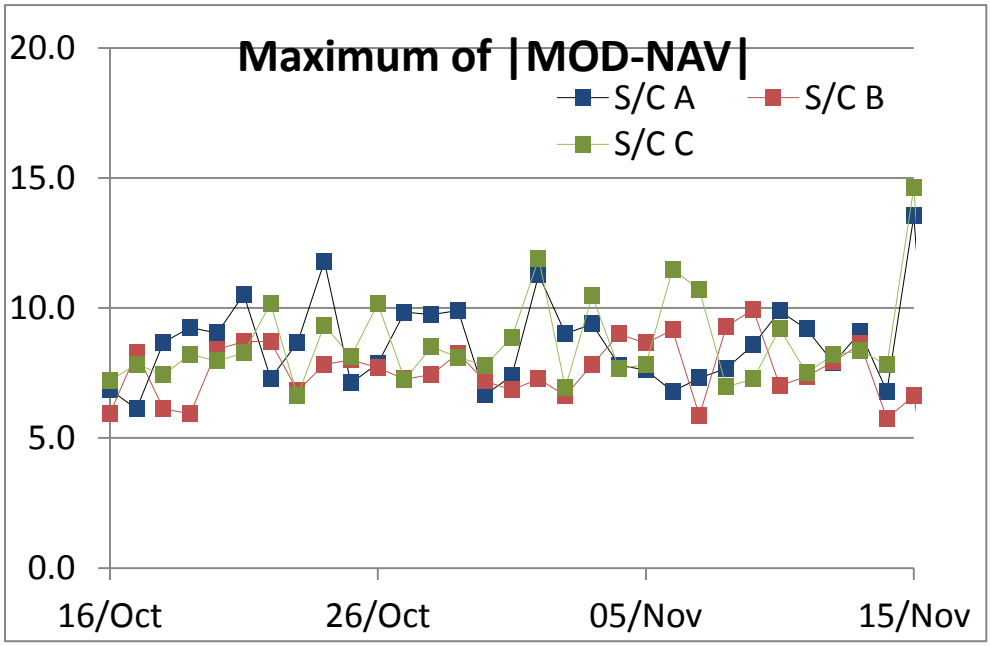

Figure 2 Plot of the maximum difference of the absolute value of the difference between MOD and NAV solutions for all satellites. Plot covers last month of operation.

3.2.1.1 Swarm A

Below a plot example follows of MOD-NAV differences, S/C A, taken at the beginning of the week (09/11, Figure 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].

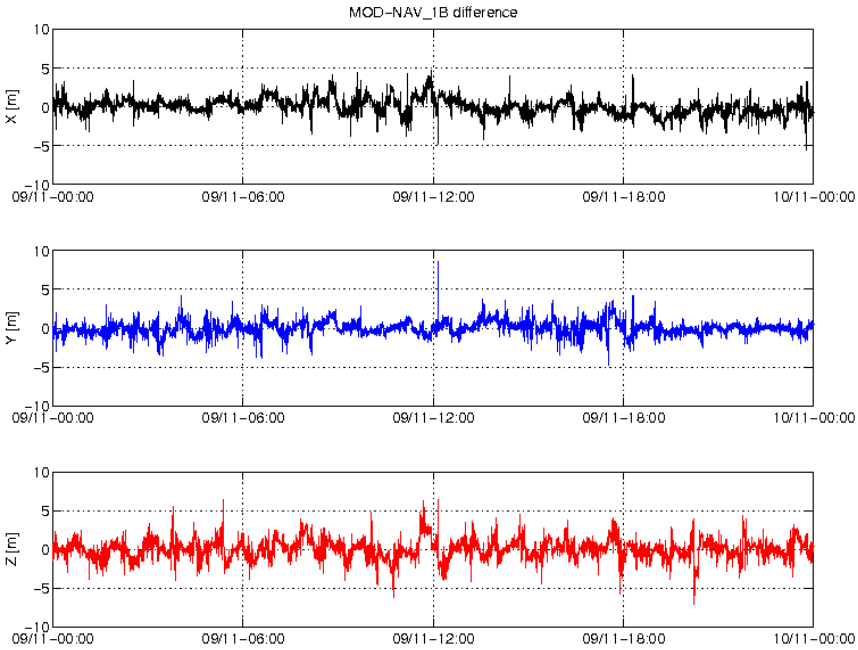

Figure 3: Difference MOD-GPSNAV, S/C A, 09/11. From top to bottom: X, Y and Z-axis

3.2.1.2 Swarm B

Below a plot example follows of MOD-NAV differences, S/C B, taken at the beginning of the week (09/11, 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].

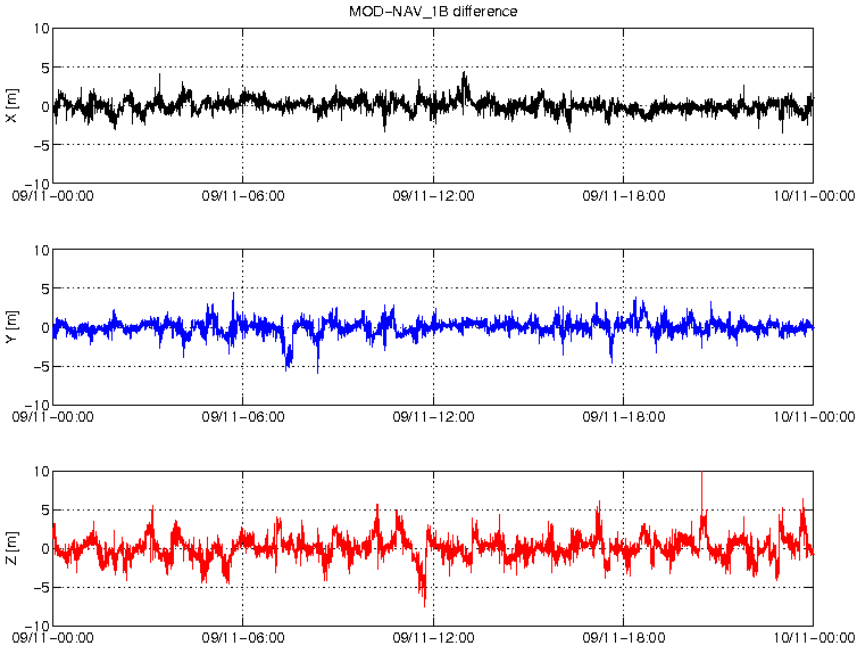

Figure 4: Difference MOD-GPSNAV, S/C B, 09/11. From top to bottom: X, Y and Z-axis

3.2.1.3 Swarm C

Below a plot example follows of MOD-NAV differences, S/C C, taken at the beginning of the week (09/11, 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].

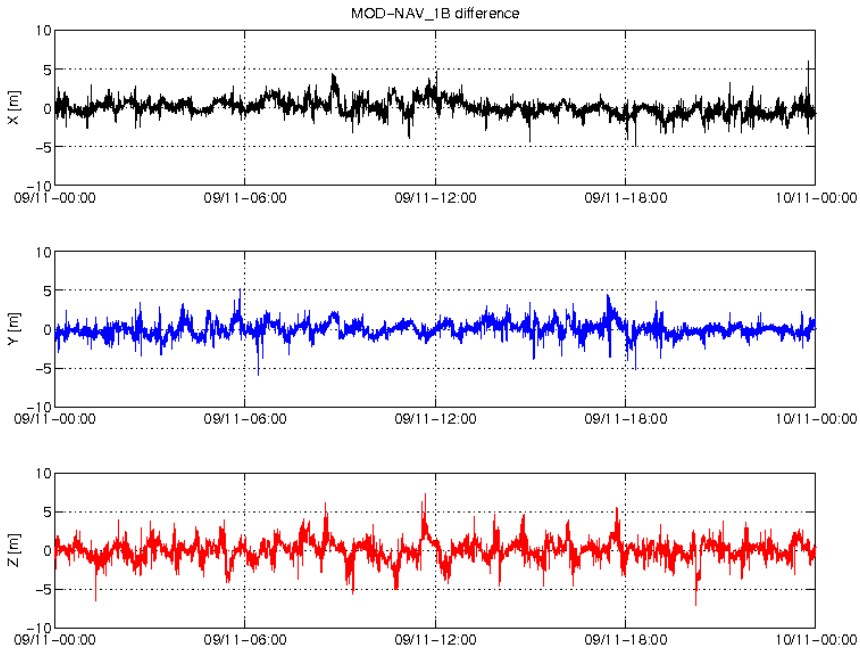

Figure 5: Difference MOD-GPSNAV, S/C C, 09/11. From top to bottom: X, Y and Z-axis

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
- 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

3.3.2 ASM-VFM difference statistics

In Table 3, 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 from the deployment of the new L1B processor on (18/07) for Swarm A and Swarm B respectively. The only remarkable feature is a peak on the residual standard deviation for Swarm B, which reaches a 400 pT maximum around the 20 of August. The experts at DTU claim this is not a cause of concern.

Table 3 Swarm A and B, difference between magnetic field absolute value measured by ASM and by VFM.

Swarm A, 11/09 - 15/11, ASM-VFM difference					
Day	**Max (nT)**	**Min (nT)**	**Standard deviation (nT)**	**Mean (nT)**	**Notes**
11/09	0.86	-0.77	0.32	0.05	
11/10	0.85	-0.77	0.32	0.05	
11/11	0.99	-0.91	0.36	0.09	
11/12	0.9	-0.88	0.34	0.06	
13/11	0.84	-0.87	0.33	0.07	
14/11	0.97	-0.81	0.32	0.07	
15/11	0.95	-0.77	0.31	0.05	
Swarm B, 11/09 - 15/11, ASM-VFM difference					
Day	**Max (nT)**	**Min (nT)**	**Standard deviation (nT)**	**Mean (nT)**	**Notes**
11/09	0.61	-0.65	0.22	-0.04	
11/10	0.66	-0.62	0.23	-0.05	
11/11	0.53	-7.32	0.2	-0.05	
11/12	0.46	-0.65	0.2	-0.05	
13/11	0.63	-0.71	0.24	-0.03	
14/11	0.72	-0.74	0.3	-0.02	
15/11	0.66	-0.75	0.28	-0.01	

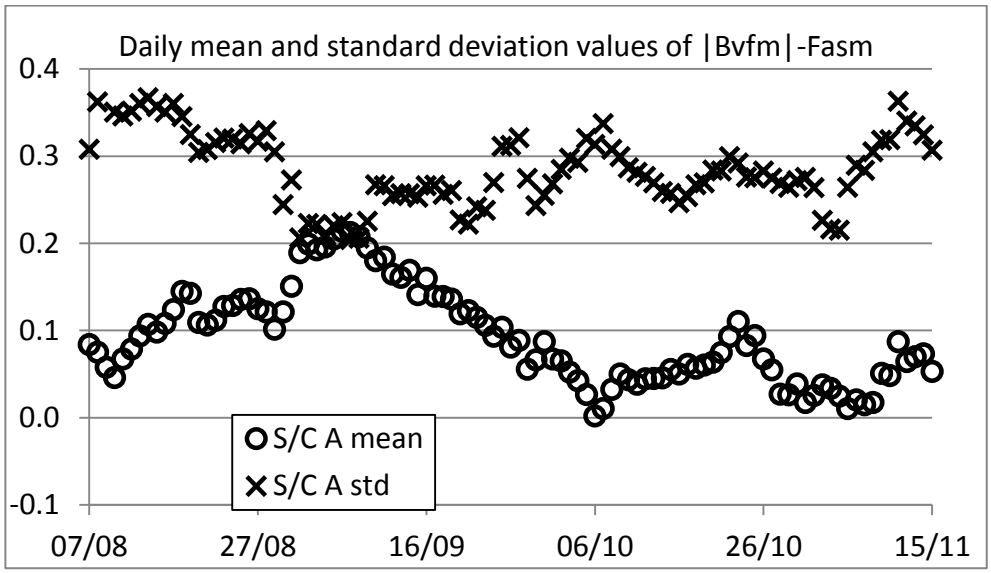

Figure 6 Daily mean and standard deviation values of ASM-VFM residuals (defined as $dF=|B_{VFM}|-F_{ASM}$) for S/C A.

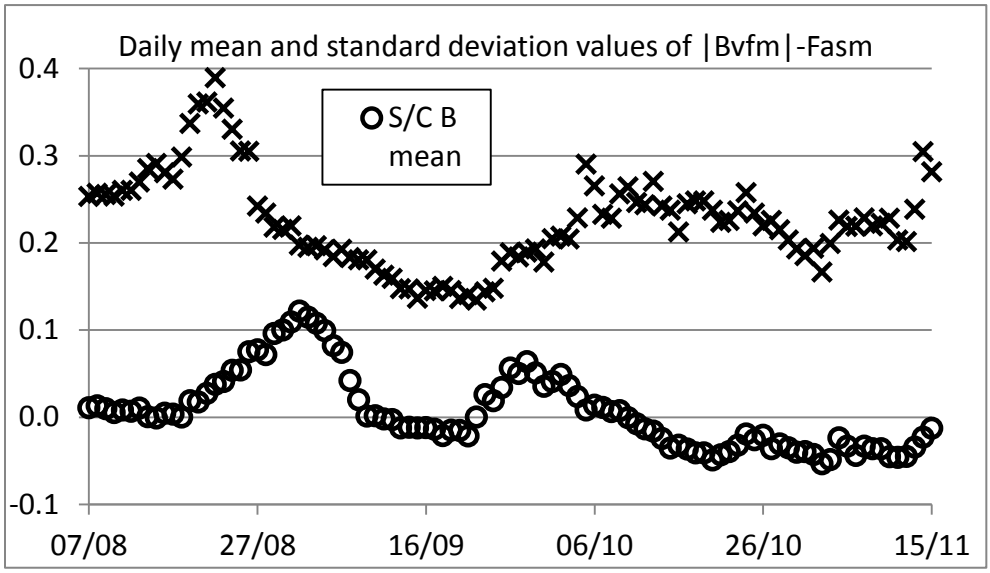

Figure 7 Daily mean and standard deviation values of ASM-VFM residuals (defined as $dF=|B_{VFM}|-F_{ASM}$) for S/C B.

3.3.2.1 Swarm A

The daily peak-to-peak difference around the week stays within [-0.9, 1]. Below two example plots of such differences for the days: 09/11 (Figure 8), and 15/11 (Figure 9).

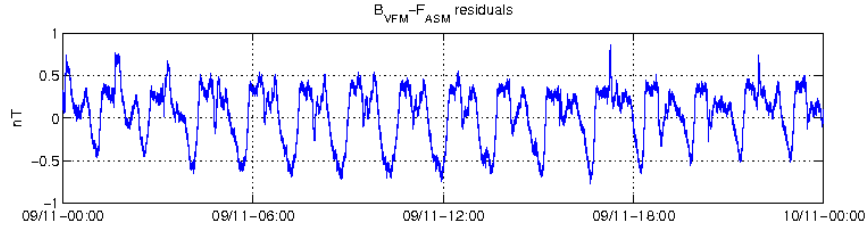

Figure 8: ASM-VFM residuals for S/C A, 09/11.

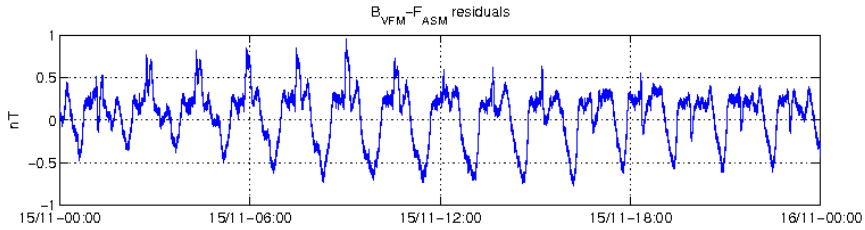

Figure 9: ASM-VFM residuals for S/C A, 15/11.

3.3.2.2 Swarm B

The daily peak-to-peak difference around the week is, on average: [-0.7, 0.7] nT. Below two example plots follows of such differences: 09/11 (Figure 10), and 15/11 (Figure 11).

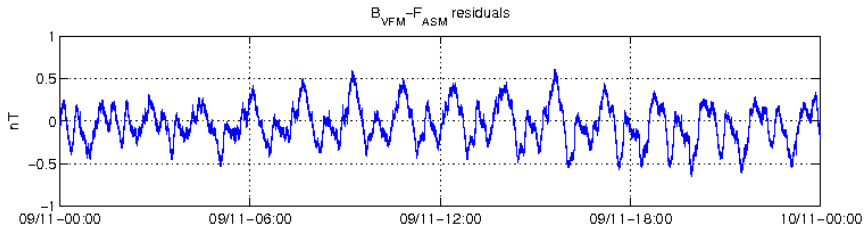

Figure 10: ASM-**VFM** residuals for S/C B, 09/11.

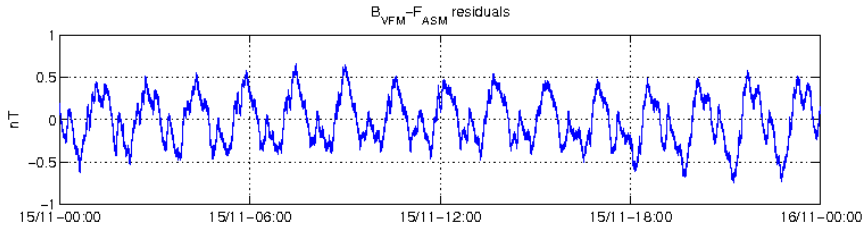

Figure 11: ASM-VFM residuals for S/C B, 15/11.

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.

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 (15/11) can be seen in Figure 12 below.

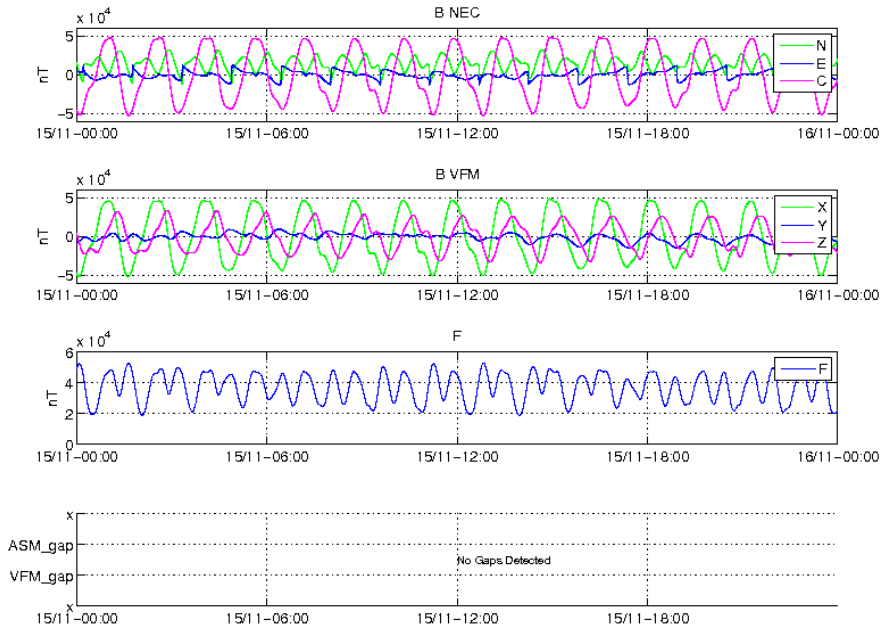

Figure 12: Time series of the geomagnetic field, for 15/11, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.5.2 Swarm B

An example of representative magnetic field time series for S/C B (15/11) can be seen in Figure 13 below.

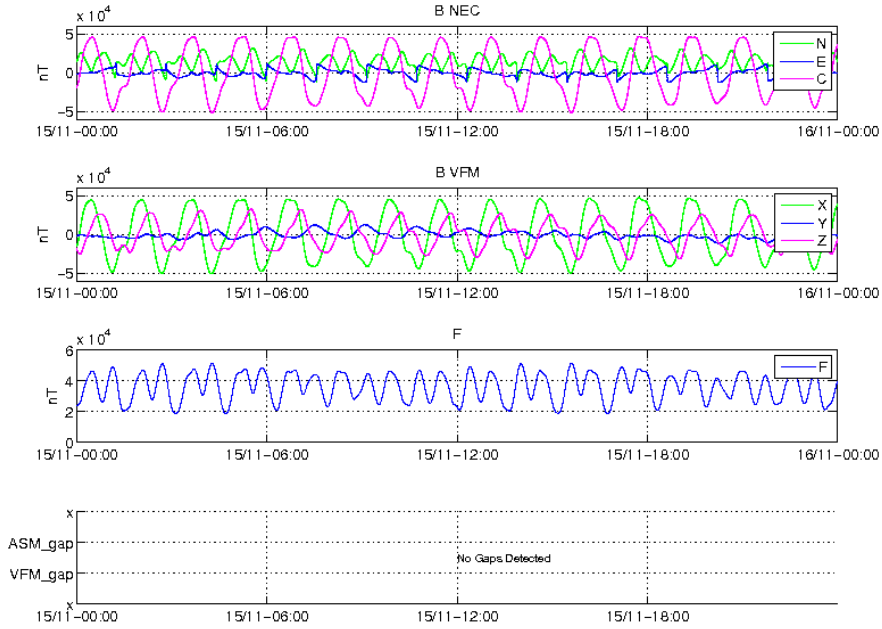

Figure 13: Time series of the geomagnetic field for 15/11, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.5.3 Swarm C

An example of magnetic field time series for S/C C (15/11) can be seen in Figure 14.

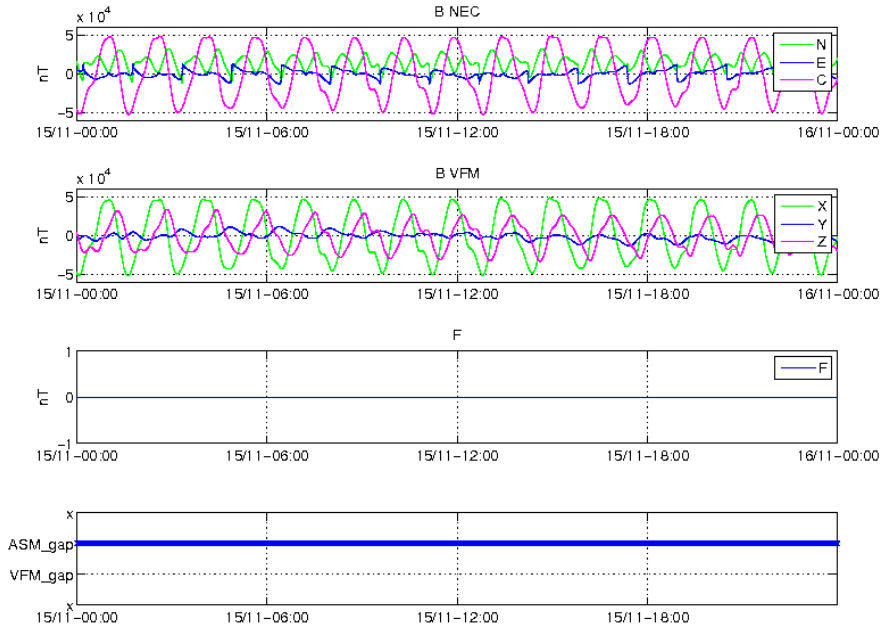

Figure 14: Time series of the geomagnetic field for 15/11, S/C C. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the

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 11/09 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 B_{θ_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.

3.3.6.1 Swarm A

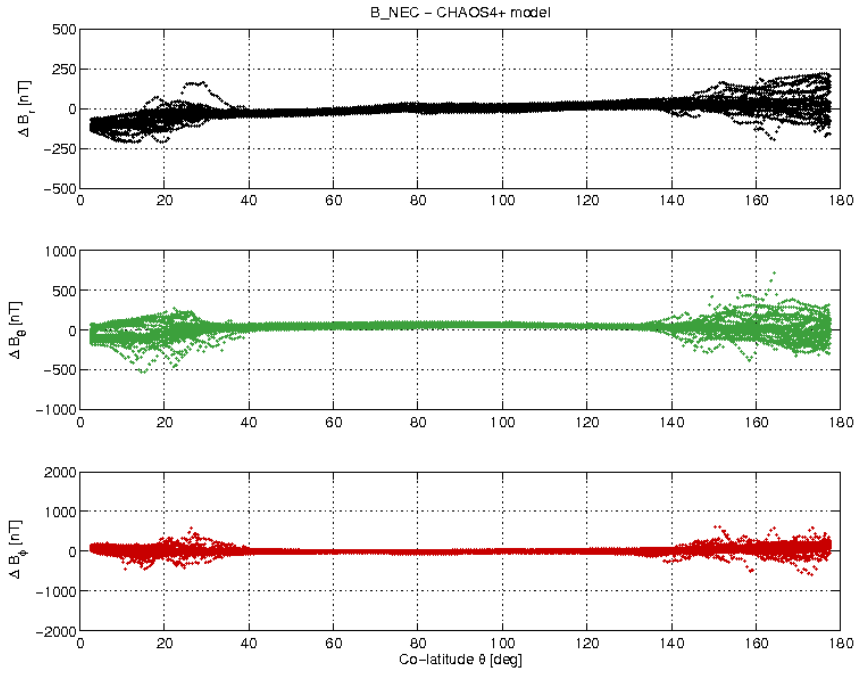

Figure 15: Swarm A day 09/11 B_NEC - B_Chaos vs colatitude.

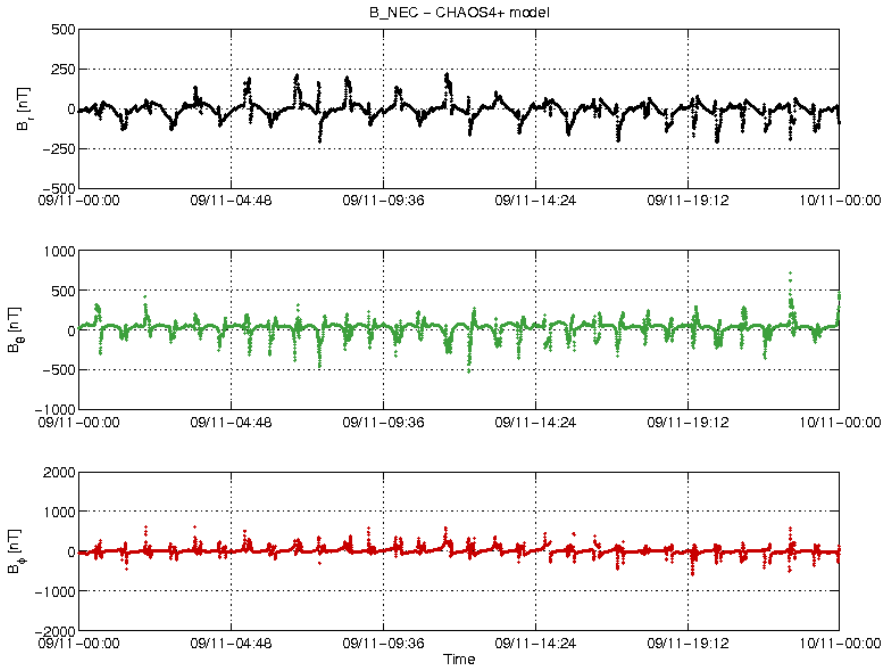

Figure 16: Swarm A day 09/11: time series of B_NEC – B_Chaos residuals.

3.3.6.2 Swarm B

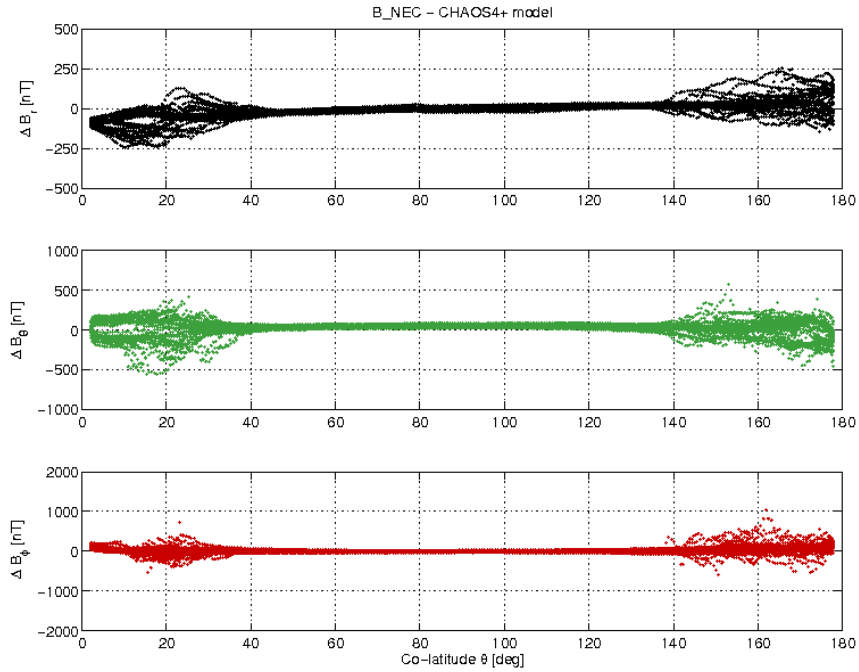

Figure 17 Swarm B day 09/11 B_NEC - B_Chaos difference vs colatitude.

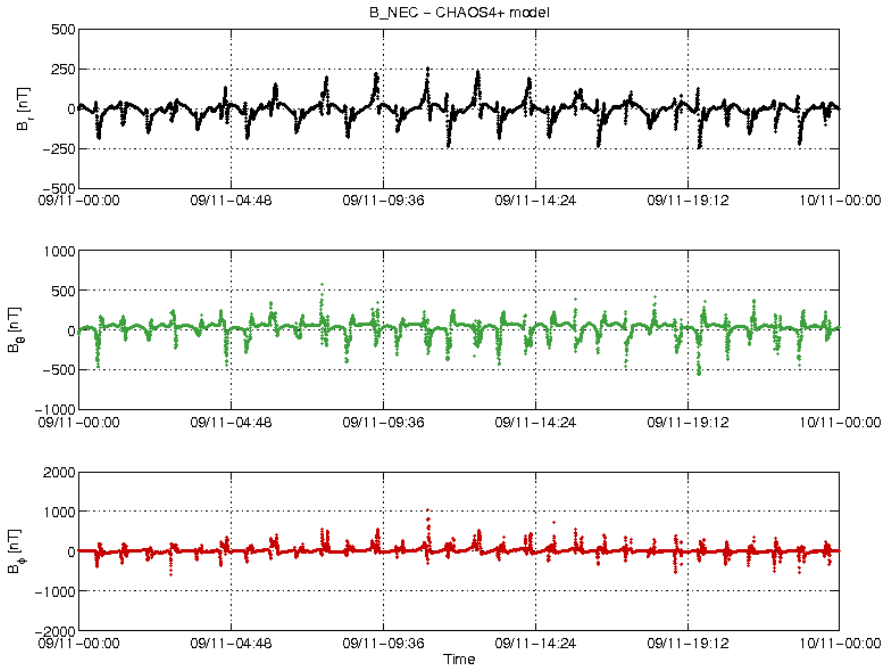

Figure 18 Swarm B day 09/11 time series of B_NEC – B_Chaos residuals.

3.3.6.3 Swarm C

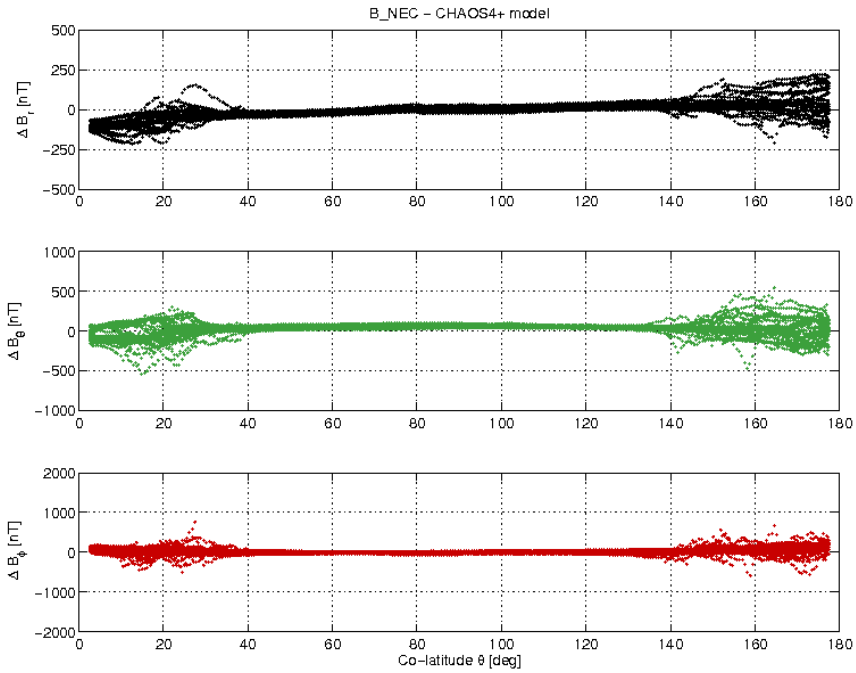

Figure 19 Swarm C day 09/11 B_NEC - B_Chaos difference vs colatitude.

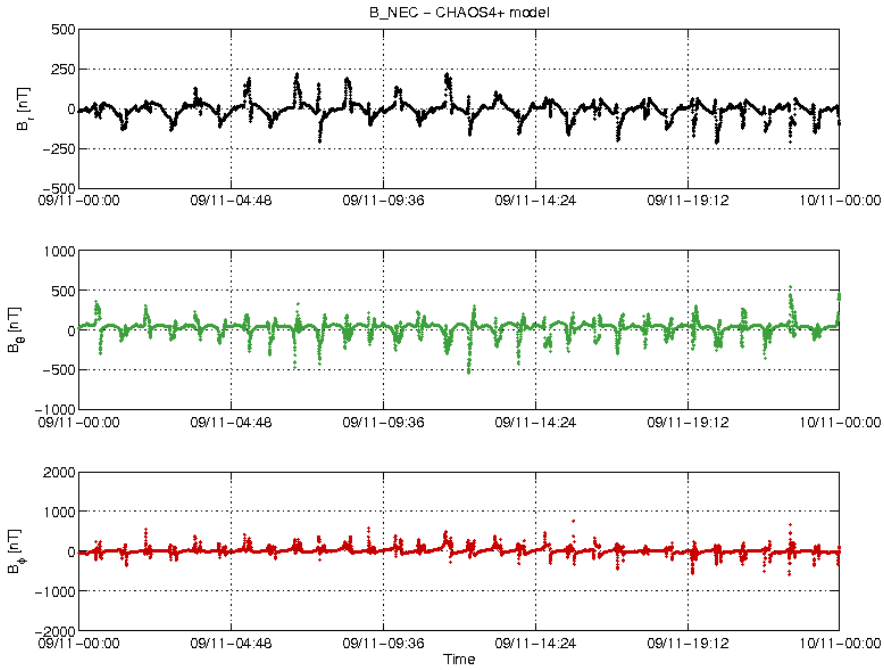

Figure 20 Swarm C day 09/11 time series of B_NEC – B_Chaos residuals.

4. ON-DEMAND ANALYSIS

Nothing to report.

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