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IDEAS+ Swarm Weekly Report : 08/12/2014 – 14/12/2014

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 08 to 14 December, 2014.

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TABLE OF CONTENTS

Contents

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	18 Dec 2014	First issue

Due to Christmas holiday time for the quality operators, no IDEAS+/SPPA weekly reports will be issued during the next two weeks. The next weekly report will be issued on January 9, 2015, covering the period 29/12/2014 – 04/01/2015: such report too will be issued on a best effort basis, containing only basic quality information. Starting from January 16, 2015, the weekly report will be regularly issued again, with comprehensive overviews of the non covered periods, where needed.

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 life time, 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 2.4.

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, user community), anomalies can be triggered and 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 3.11p3, L2-Cat2 1.12
- L0 input products baseline: 02
- L1B baseline: 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: 01
- Input auxiliary files baseline: CCDB 0009, ADF 0101
- MPPF-CVQ v.2.12p1

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

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

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

[RD.12] IDEAS+ Swarm Weekly Report: 20/10/2014 – 26/10/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20141020_20141026.pdf

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

2. SUMMARY OF THE OBSERVATIONS

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

The following news has to be reported:

- **ASM for Swarm C is now considered lost for the mission:** after several attempts to switch it on again, and to switch on also the redundant unit that already failed during commissioning phase, the ASM on-board Swarm C is lost. Investigations are still on-going at LETI in order to characterize the point of failure after the tests done in the past weeks, but the hopes to make it functioning again are very faint. Discussions are now in place for trying to understand how to calibrate the VFM C without the ASM. In the meanwhile, the new OP version has implemented a workaround for avoiding MAGNET failures in case of complete lack of ASM data, and for being able to produce at least the VFM "uncalibrated" data.

- **The GPS, Orbit and Attitude data** have been regenerated since the beginning of mission, and are characterized, in the FTP dissemination server, by baseline 03 and counter 02. The regeneration has been motivated by the recent changes (October 2014) on the GPS processing, aimed at producing Level 1B RINEX products as close as possible to the "raw" ones in the Level 0s (i.e. without antenna pattern corrections and carrier phase smoothing). An effect of this is also transferred into the Medium accuracy Orbit Determination process (MOD products). Users will be warned that 0301 and 0302 datasets are not fully interoperable and cannot be used together.

- **The TII first scrubbing cycle** is concluded also for Swarm A and B. University of Calgary claims the improvements are as expected and fully in line with those already observed for Swarm C. During the Christmas time, until the 5th of January 2015, the scrubbing cycle will be repeated for all three S/C following the sequence: *VG at -3 to -15 V in steps of -2 V, one step per day; VMCP = -1900 V; VPHOS = +5000 V. Two calibration orbits each day.* In case of problems, University of Calgary will contact FOS and the only action taken will be to put the S/C in ready state, if needed. For the time being no modification of such procedure is foreseen, as recommended in the last DQW meeting in Potsdam (see Sect. 2.3): in January 2015, after an update of the gain maps for the three S/C, a monitoring period will follow with the S/C operating in nominal mode. Afterward, ESA and Univ. of Calgary will evaluate what should be done.

2.2 Plan for operational processor updates

L1BOP 3.12 and L2-Cat2OP 1.13 have been delivered to PDGS the 28th of November. Verification and integration tests will take place in the next weeks, before the final deployment of the processors in operation in January.

2.3 Quality Working Group and Cal/Val Coordination

The fourth QWG – Cal/Val meeting has been held the 2-5 December 2014 in Potsdam, Germany. Here follows a quick summary of the Quality Working Groups works and decisions:

1. MAGNETIC QWG: Three models have been identified and studied for characterizing and removing the ASM-VFM magnetic residuals. All three models start from the assumption that a solar driven disturbance acts on various elements of the optical bench – VFM ensemble. The final result of each model should be a new "stray field" to be subtracted to the VFM data in order to remove the residual as much as possible: the key point for choosing one model or another (or a combination of them) is the efficiency in taking into account both the evolution of the calibration parameters (TCF.VFM) and the behaviour of the residual. A final decision on which model to use, and how to implement it in the practice in the L1B processing, will be taken by end of February 2015. MAG_CA dataset will be modified too for including "pre-processed" data, not yet cleaned from the residuals. STR side: a temperature dependent model has been prepared by DTU in order to improve the attitude accuracy, while AIRBUS will try to provide an independent model for comparison, basing on platform information. The final goal is to have a fully cross-verified new L1BOP (4.0?) by mid-end May 2015.

2. GPSR and ACCELE QWG:

2a Accelerometers: We are still struggling with the issue of the temperature dependency of the non-gravitational accelerations and the high amount of spikes in the acceleration time series. The modelling of the temperature dependency is very well advanced, but the estimate of the driving parameters is still challenging; as well, the step/spike detection algorithms have been established, but it is not trivial to prepare the right approach for correction. Investigations in the near future will concentrate on the comparison with the POD-derived accelerations for estimating the goodness of the temperature correction models, and the time series of Swarm C will be better assessed in order to understand why "good" periods (less spikes/steps) are good; S/C side, an optimisation of the thermal environment will be tried by means of dedicated on/off campaigns of the heaters which surround the instruments.

2b GPSR: The first calculations of Swarm reduced-dynamic orbits are of good quality (SLR fit < 2 cm), while the Swarm kinematic orbits are not so good yet, even though an improvement has been clearly observed since the GPS data are produced at 1 Hz rate; as gravity field models benefit from better processing and receiver settings, further optimisation of the receivers are being planned, in order to reduce LossOfSync events, increase the field of view, etc...

3. PLASMA QWG:

3a TII: The scrubbing procedure described several times in the past weekly reports proved to be very effective in flattening the gain distribution throughout the detectors. Improvements in the 2nd y moments are dramatic on Swarm C, and start to appear in Swarm A and B too. Nevertheless, a more aggressive approach is proposed, following phosphors and MCP manufacturers recommendations: phosphors operating at a voltage 20% higher than nominal (6000 V) and MCP voltage risen up to 2000 V, in order to "bake" the detectors out in even more efficient way. Concerns still remain ESA side, because the instruments have not been fully qualified for such values in operations. For what concerns data quality, preliminary validations show velocity offsets of about 500 m/s, probably due to a still poor determination of the TII detector centres.

3b LP: Several improvements/evolutions of the algorithms have been performed: 1) The sweep mode results are now in closer agreement with those of the normal mode, thanks to a clever filtering of noise, and a more efficient handling of the electron region overflows and "double knee" features; 2) The electron density in normal mode is now calculated using the ion region current, and this has a strong positive effect on the S/C potential; 3) Encouraging attempts have been done to determine the electron density using the 16 Hz faceplate current. Still the electron temperature requires more "tuning": from preliminary validation studies, there are evidence of overestimates by a factor of 1.5/2.

Decisions taken: 1) The Preliminary Plasma dataset, currently distributed to Cal/Val users only, is mature enough for being distributed to the whole scientific community; this will be done in January, after a careful review of the user note. 2) The LP team will make available to Cal/Val users only the Sweep mode dataset and the Faceplate inferred density (and perhaps plasma velocity) dataset as soon as possible. 3) As soon as the TII image quality will be consolidated, a "Sweep hysteresis test" will be planned in order to better characterize and, possibly, eliminate, the small jumps observed in S/C potential following sweep activation. 4) The old Matlab prototype will be dismissed and the current "sandboxes" in use at Calgary and Uppsala will be put under strict configuration control, and will constitute the new prototype processor: by Mid/end May the OP will be aligned with the new PP and the official PDGS plasma data will be distributed to the users instead of the preliminary dataset.

2.4 Summary of observations for Week 50 (08-14/12/2014)

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

1. **Strange features observed again in the MOD-GPSNAV solution difference:** again we often notice a marked "spiky" behaviour, with deviations from the average which are not normal spikes but lasts for several seconds if not minutes (**SW-IDEAS-34**, [RD.10]).

2. **Failure of ORBATT C, 07-08/12:** SOLACT auxiliary file missing.

3. Noise superimposed on magnetic data (**SW-IDEAS-27** [RD.13]), observed the 08/12.

3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

- **Magnetic production lost on S/C C for the whole week**, because of the ASM switched off.

- **ORBATT failed on all S/C C 12/12/2014 and 13/12/2014,** because of the unavailability of an auxiliary product used for the air drag corrections in the orbit determination (AUX_SOLACT). In order to cope with such situations, which already occurred in the past, a workaround has been implemented in the L1BOP 3.12, so that the productions lost because of this problem will be recovered once the new processor version will be deployed in operations.

3.2 Orbit and Attitude Products

The following events have to be reported:

Observation ID	Description	Affected parameter	Sect. of Obs. Description	Sect. of Obs. analysis
SW-IDEAS-34	OBS_ROUTINE: large number of spiky features observed in the NAV-MOD difference	Orbits (position and velocity)	3.2.1.1	[RD.10]

Table 1: list of events related to attitude and orbit products to be reported in the monitoring for Week 50: 08 - 14/12/2014

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, and reported in tables in the sections below, along with some example 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 Swarm A

3.2.1.1 Position statistics

In Table 2 one can see the statistics of the differences between MOD and on-board solution positions. In the third column the maximum differences (maximum negative and maximum positive) are reported with, in parentheses, the ITRF component affected by such difference. The maximum standard deviation is in the fourth column: it usually refers to the Z component which is always the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm A, 08-14/12/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard deviation (m)**	**Notes**
08/12	0.16	-7.3, 9.5 (Z)	1.4	
09/12	0.06	-10.5, 9.5 (Z)	1.6	
10/12	0.07	-8, 11 (Z)	1.7	
11/12	0.07	-7.6 (Z), 8.7 (X)	1.6	SW-IDEAS-34 [RD.10]
12/12	NN	NN	NN	Data missing (see Sect. 3.1)
13/12	NN	NN	NN	Data missing (see Sect. 3.1)
14/12	0.1	-19, 12 (Z)	1.9	Isolated big spikes in the Z component

Table 2: Swarm A, difference between MOD and on-board solution positions.

Below some plot example follows of such differences taken at the beginning of the week (08/12, Figure 1), in the middle (11/12, Figure 2) and at the end (14/12, Figure 3). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The values are given in Km.

In Figure 2 one can see an example (red-circled area) of **SW-IDEAS-34** ([RD.10]) anomaly occurrence: several spikes depart from the average value of the MOD-NAV solutions difference, keeping higher/lower values for several minutes.

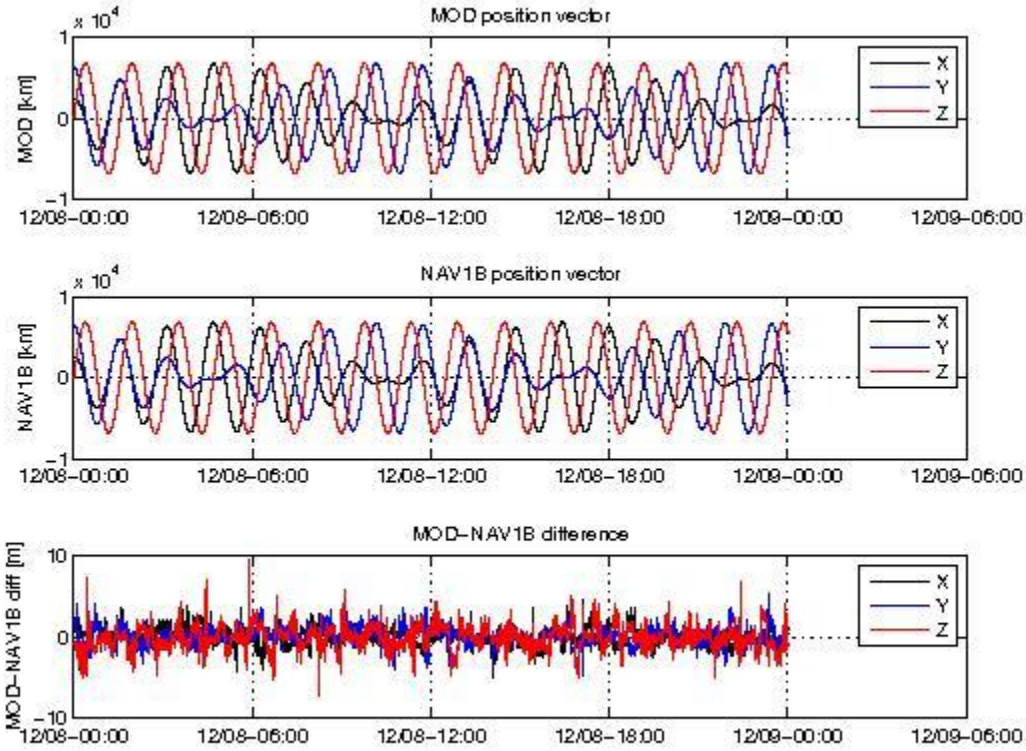

Figure 1: Difference MOD-GPSNAV, sc A, 08/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

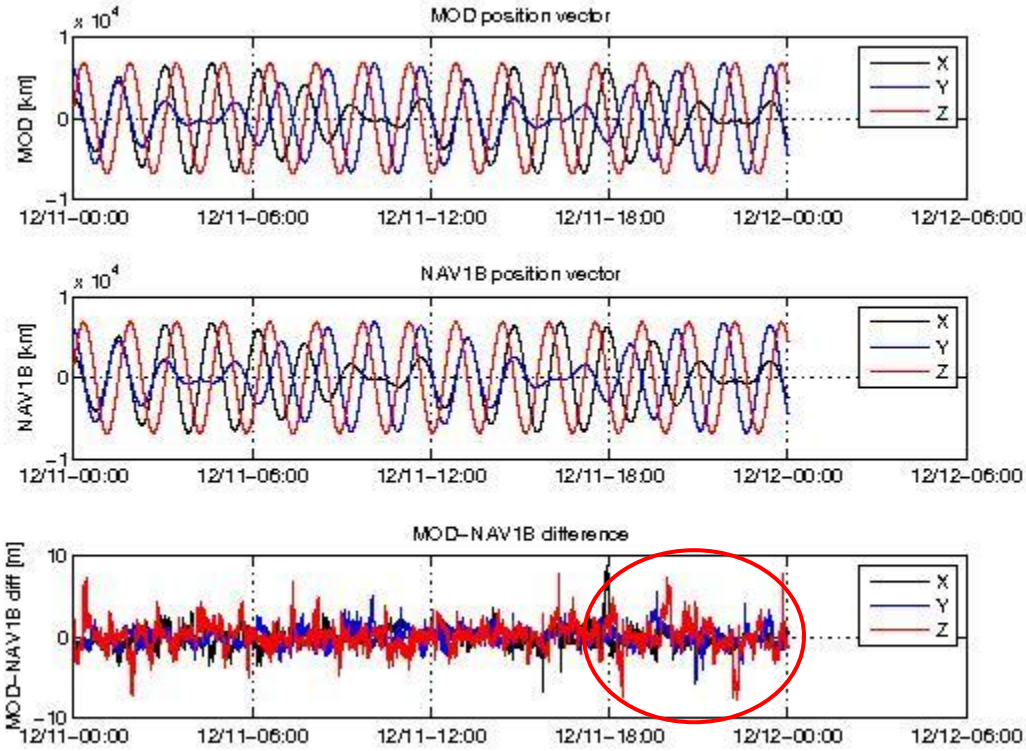

Figure 2: Difference MOD-GPSNAV, sc A, 11/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The red-circled area highlights an interval where **SW-IDEAS-34** ([RD.10]) anomaly occurs.

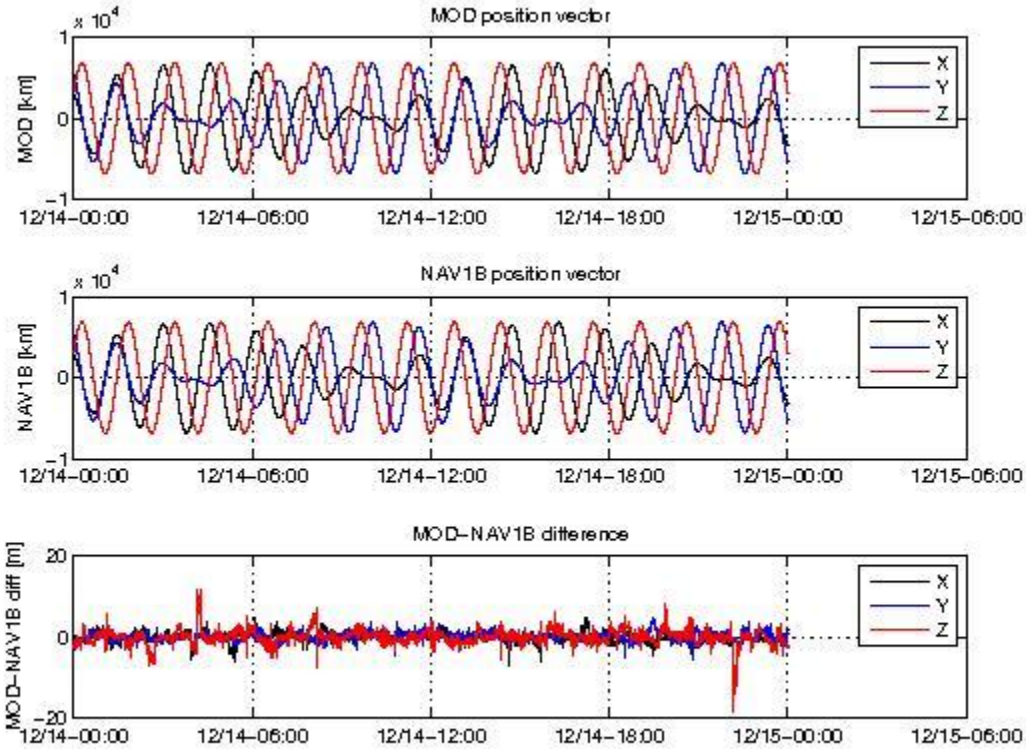

Figure 3: Difference MOD-GPSNAV, sc A, 14/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.1.2 Attitude observations

Nothing to report.

3.2.2 Swarm B

3.2.2.1 Position Statistics

In Table 3 one can see the statistics of the differences between MOD and on-board solution positions. In the third column the maximum differences (maximum negative and maximum positive) are reported with, in parentheses, the ITRF component affected by such difference. The maximum standard deviation is in the fourth column: it usually refers to the Z component which is always the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm B, 08-14/12/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
08/12	0.2	+/- 11.4 (Z)	1.6	
09/12	0.09	+/- 9 (Z)	1.5	SW-IDEAS-34 [RD.10]
10/12	0.18	-13, 10 (Z)	1.8	SW-IDEAS-34 [RD.10]
11/12	0.11	+/- 9	1.5	SW-IDEAS-34 [RD.10]
12/12	NN	NN	NN	Data missing (see Sect. 3.1)
13/12	NN	NN	NN	Data missing (see Sect. 3.1)
14/12	0.06	-15.4, 10 (Z)	1.6	Big isolated spikes observed in the Z component

Table 3: Swarm B, difference between MOD and on-board solution positions.

Below some plot example follows of such differences taken at the beginning of the week (08/12, Figure 4), in the middle (11/12, Figure 5), and at end of the week (14/12, Figure 6). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The values are given in Km.

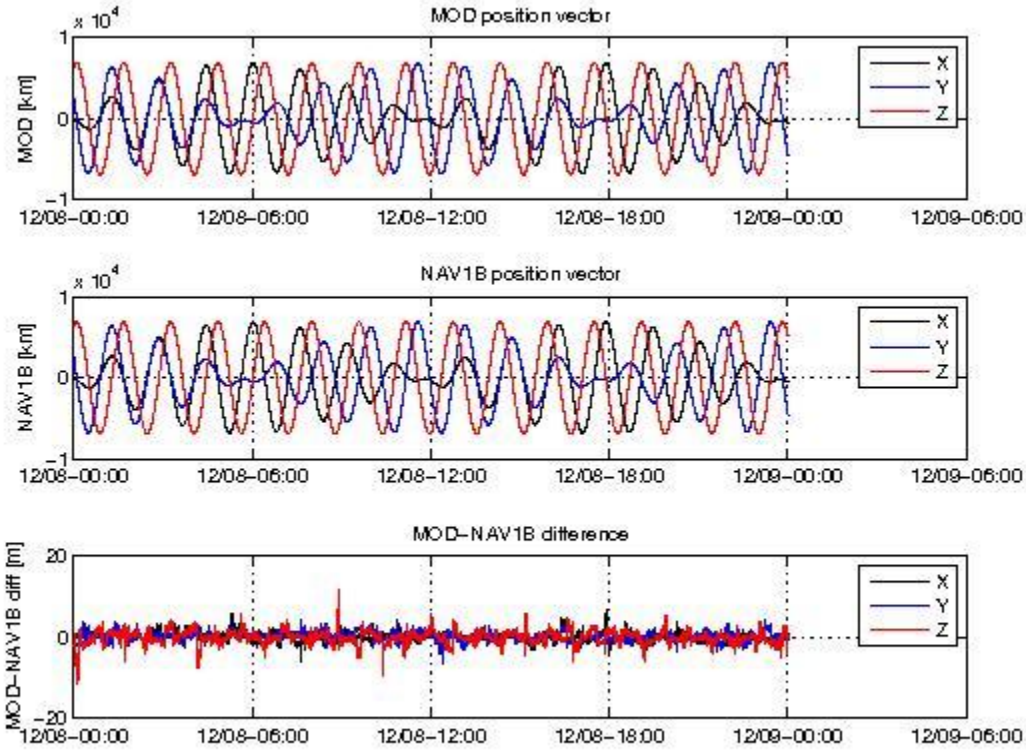

Figure 4: Difference MOD-GPSNAV, sc B, 08/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

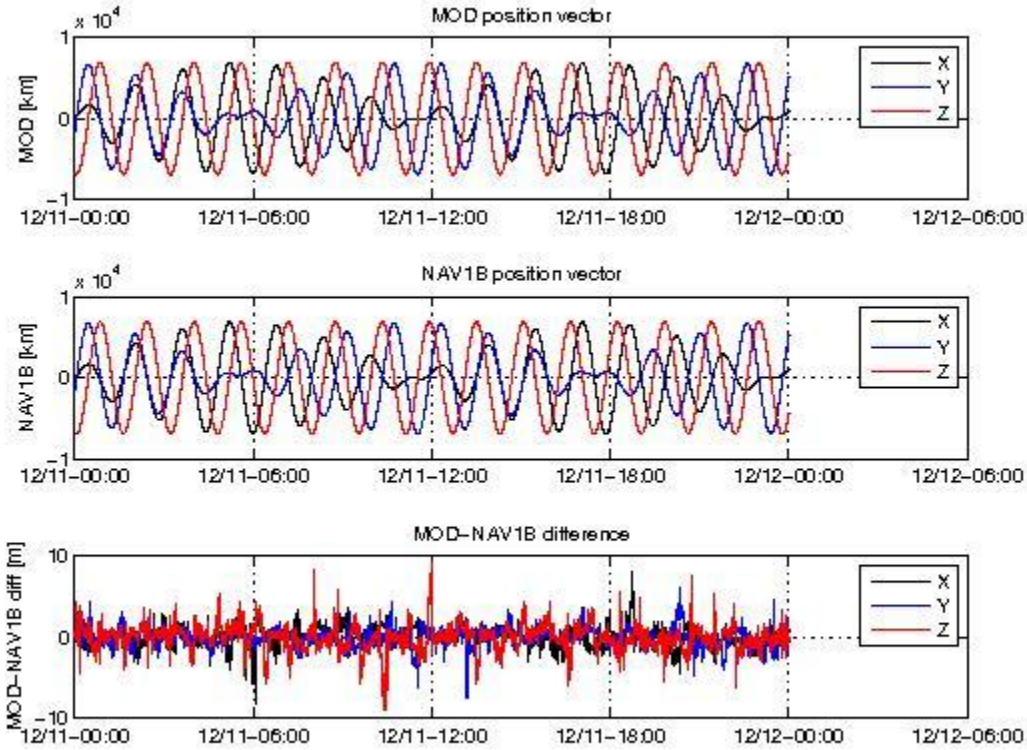

Figure 5: Difference MOD-GPSNAV, sc B, 11/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

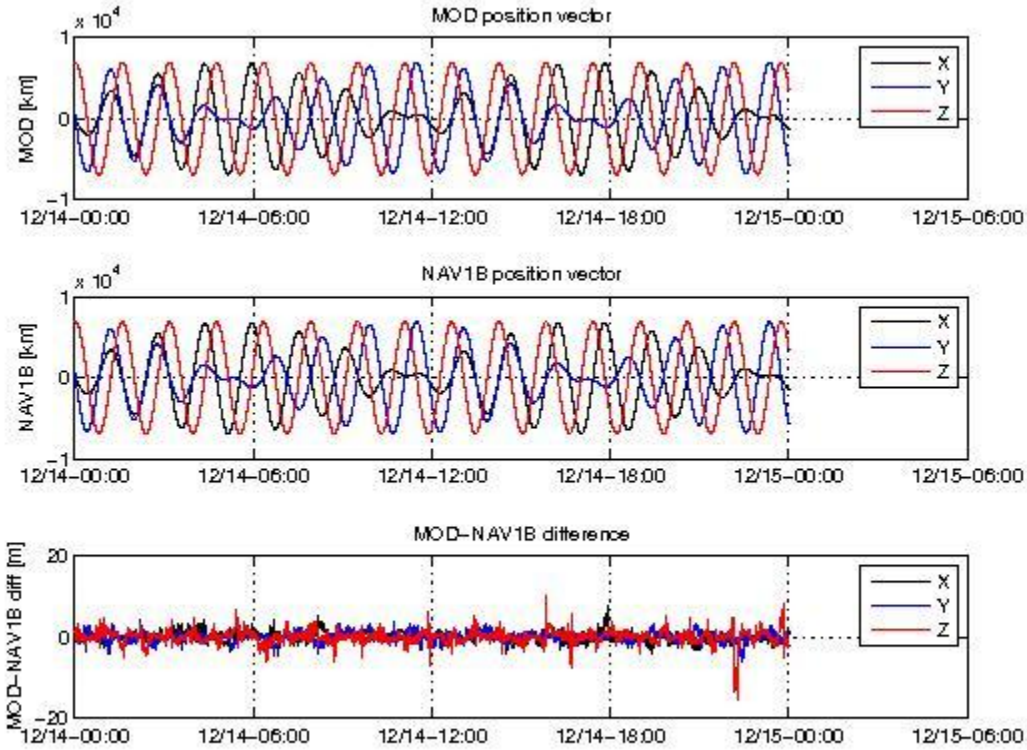

Figure 6: Difference MOD-GPSNAV, sc B, 14/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.2.2 Attitude observations

Nothing to report.

3.2.3 Swarm C

3.2.3.1 Position Statistics

In Table 4 one can see the statistics of the differences between MOD and on-board solution positions. In the third column the maximum differences (maximum negative and maximum positive) are reported with, in parentheses, the ITRF component affected by such difference. The maximum standard deviation is in the fourth column: it usually refers to the Z component which is always the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm C, 08-14/12/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
08/12	0.2	-10.4 (Z), 6 (Y)	1.4	
09/12	0.14	-8 (Z), 8.6 (X)	1.4	SW-IDEAS-34 [RD.10]
10/12	0.07	-10, 9 (Z)	1.6	
11/12	0.05	-14, 7.5 (Z)	1.5	
12/12	NN	NN	NN	Data missing (see Sect. 3.1)
13/12	NN	NN	NN	Data missing (see Sect. 3.1)
14/12	0.12	-9, 11 (Z)	1.5	SW-IDEAS-34 [RD.10]

Table 4: Swarm C, difference between MOD and on-board solution positions.

Below some plot example of such differences follows, taken at the beginning of the week (08/12, Figure 7), in the middle (11/12, Figure 8) and at the end (14/12, Figure 9). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The values are given in Km.

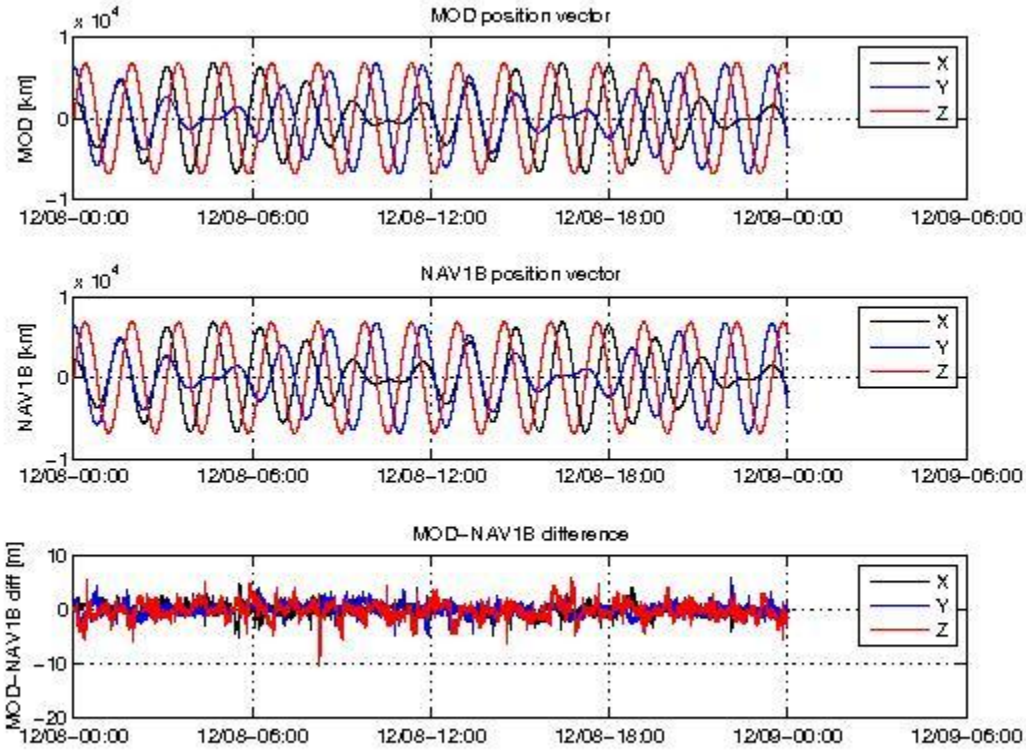

Figure 7: Difference MOD-GPSNAV, sc C, 08/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

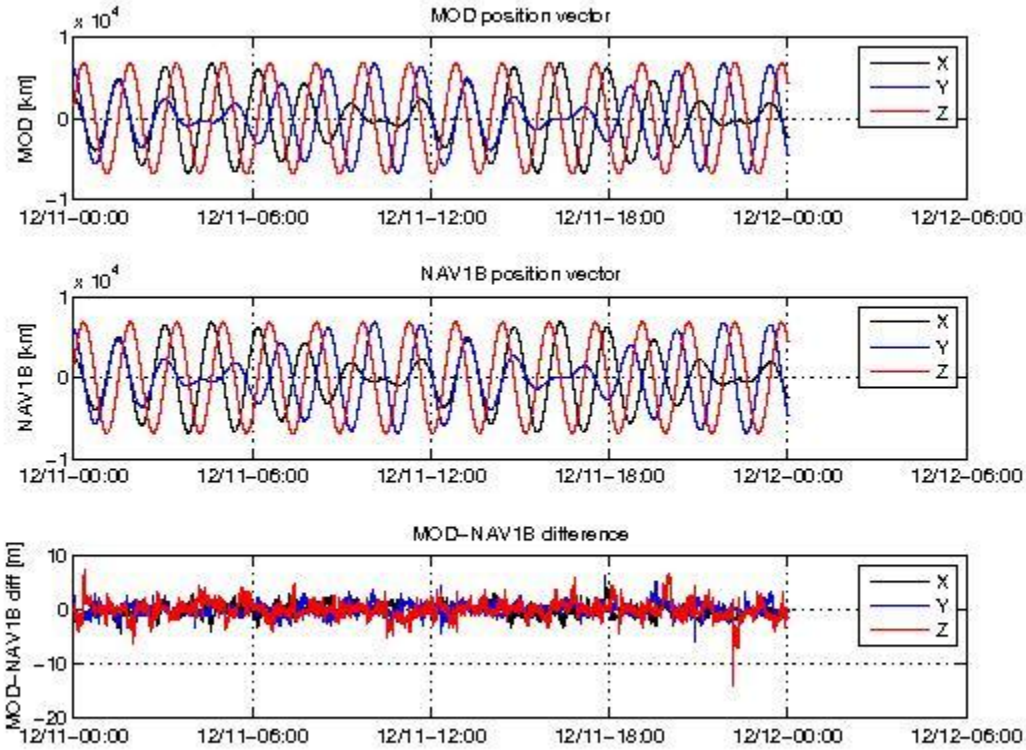

Figure 8: Difference MOD-GPSNAV, sc C, 04/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

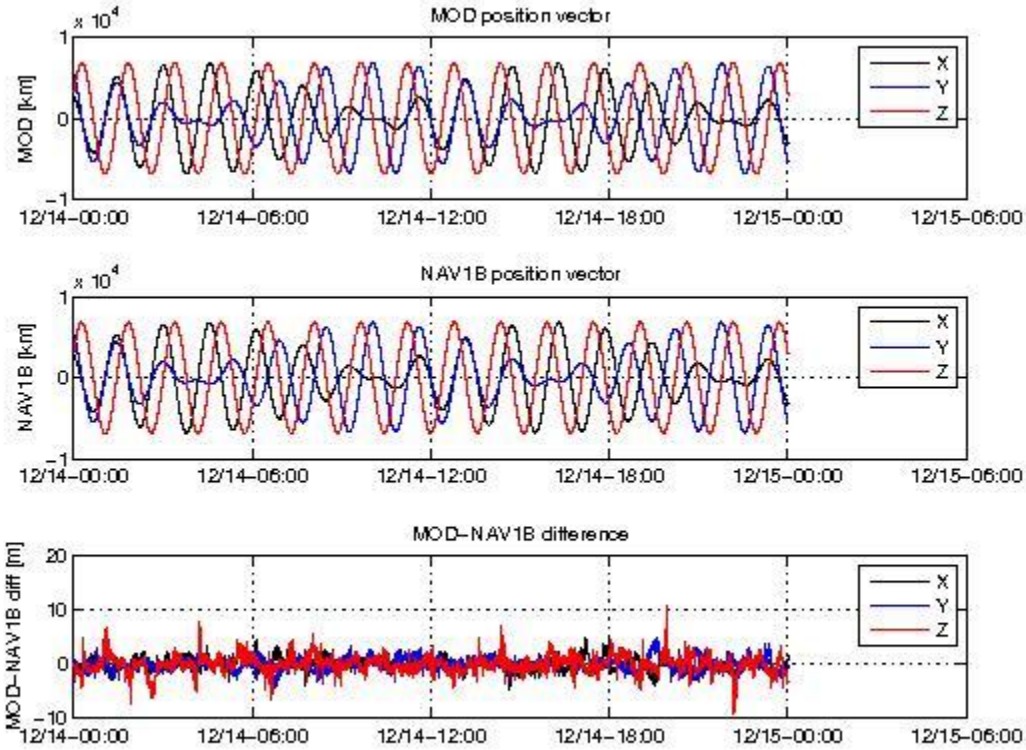

Figure 9: Difference MOD-GPSNAV, sc C, 14/12/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.3.2 Attitude observations

Nothing to report.

3.3 Magnetic Products

For the magnetic products the weekly monitoring consists in:

- Visual inspection of daily time series of magnetic field intensity F, $\mathbf{B_{NEC}}$ and $\mathbf{B_{VFM}}$. 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 **VFM-ASM known anomaly**: visual inspection of $|B_{NEC}|$ - F and recording of daily maximum variations. If +/- 5 nT are exceed on a given day, an alert is raised.

- TCF.VFM parameters monitoring (VFM calibration parameters): series of biases, scales, non-orthogonality factors and RMS. **This check is performed on monthly basis.**

SW-IDEAS-27 [RD.13]: Noise superimposed on the magnetic time series is observed in both SC A and B, the 08/12/2014. The noise is evidenced as an increase in the power

spectral density in the frequency band 0.04 – 0.1 Hz. This phenomenon is usually related to periods of high geomagnetic activity, as it is the case for this event too: the Kp index during 08/12 stays between 3 and 4, mainly due to substorm activity in the auroral regions (AE index often above 1000 nT).

3.3.1 Swarm A

3.3.1.1 Magnetic time series visual inspection

An example of representative magnetic field time series for S/C A can be seen in Figure 10 (14/12/2014).

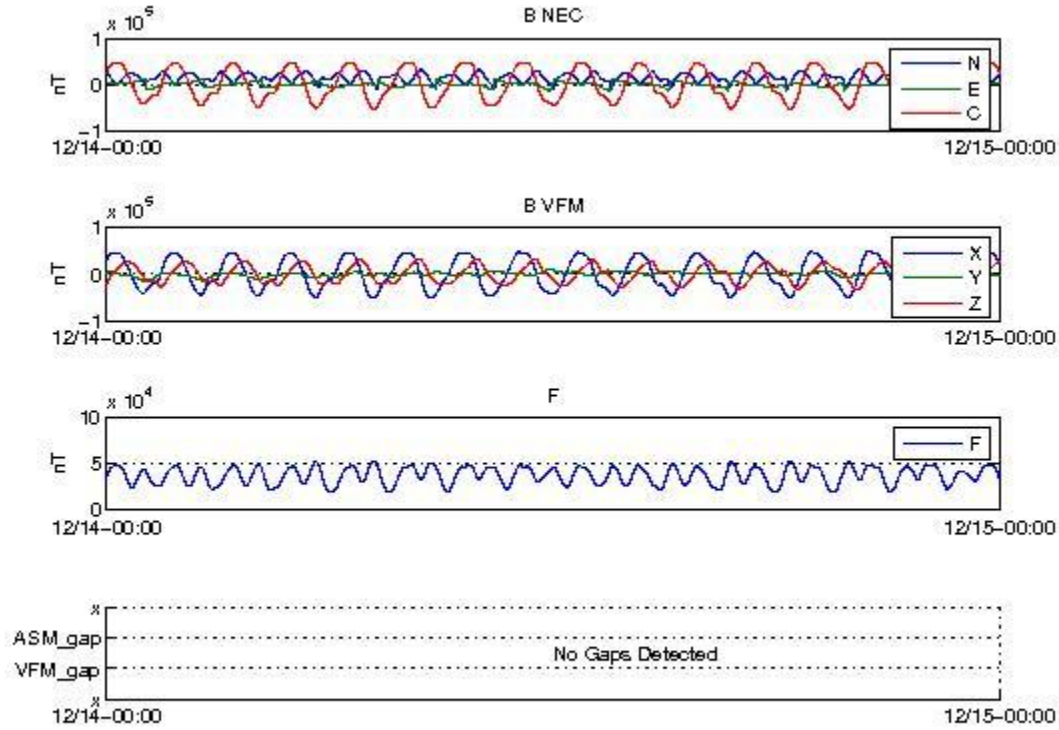

Figure 10: Time series of the geomagnetic field, for 14/12/2014, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.1.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-2, 2] nT, with occasional spikes of about 6 nT.

Below some plot example of such differences follows, taken at the beginning of the week (08/12, Figure 11) and at the end (14/12, Figure 12). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

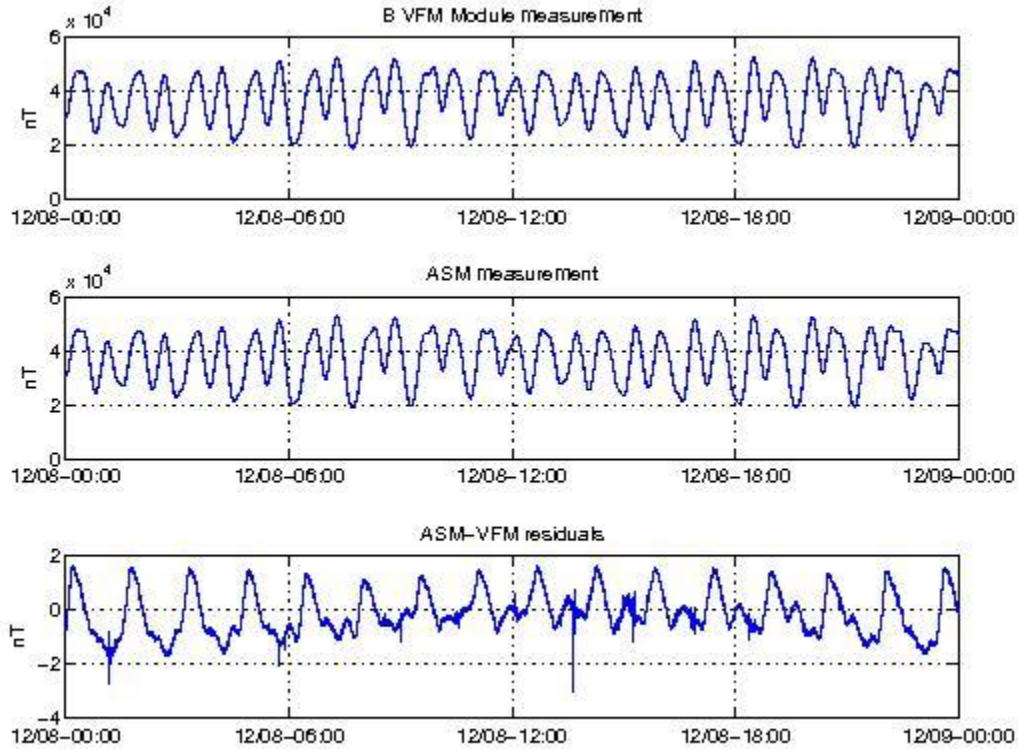

Figure 11: VFM module, ASM module and ASM-VFM residuals for S/C A, 08/12/2014.

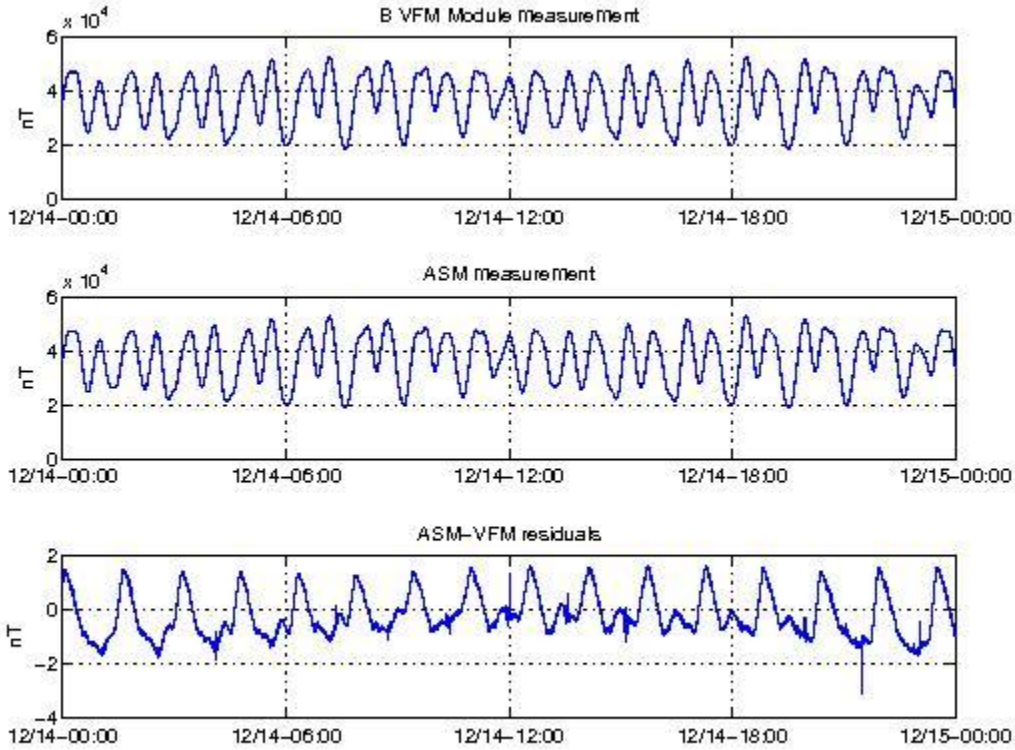

Figure 12: VFM module, ASM module and ASM-VFM residuals for S/C A, 14/12/2014.

3.3.1.3 TCF.VFM monitoring

The TCF.VFM analysis will be included in the last report of December.

3.3.2 Swarm B

3.3.2.1 Magnetic time series visual inspection

Nothing relevant to report. An example of representative F time series for S/C B (14/12/2014) can be seen in Figure 13 below.

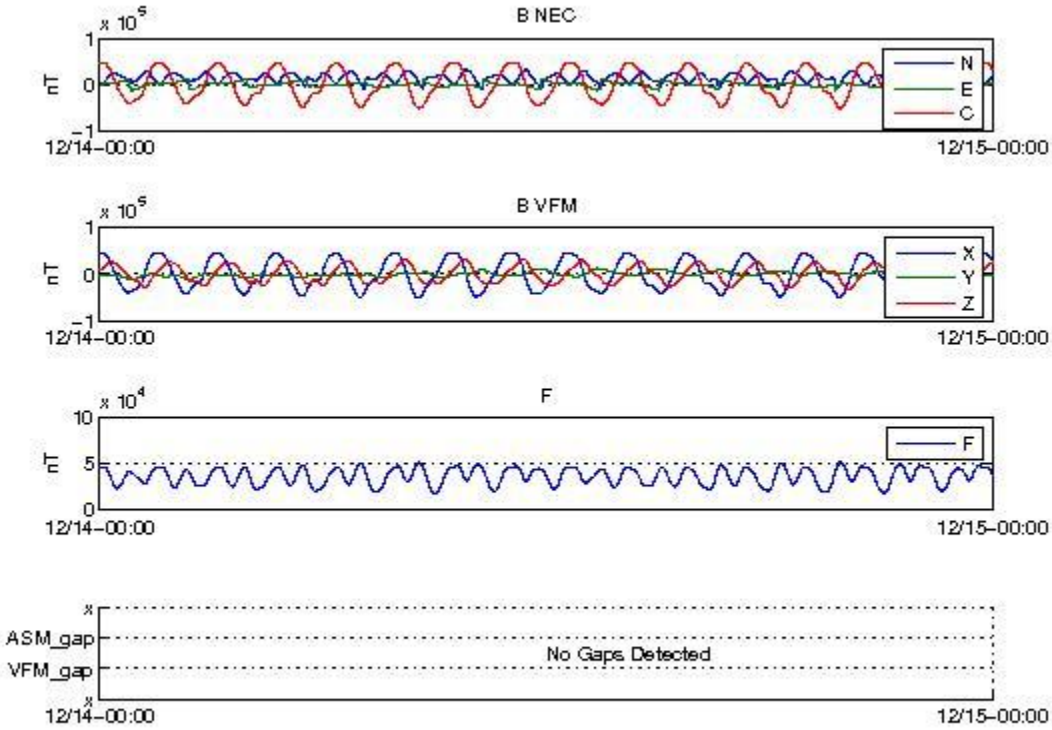

Figure 13: Time series of the geomagnetic field for 14/12/2014, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.2.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-2, 2] nT.

Below some plot example follows of such differences taken at the beginning of the week (08/12, Figure 14), and at the end of the week (14/12, Figure 15). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

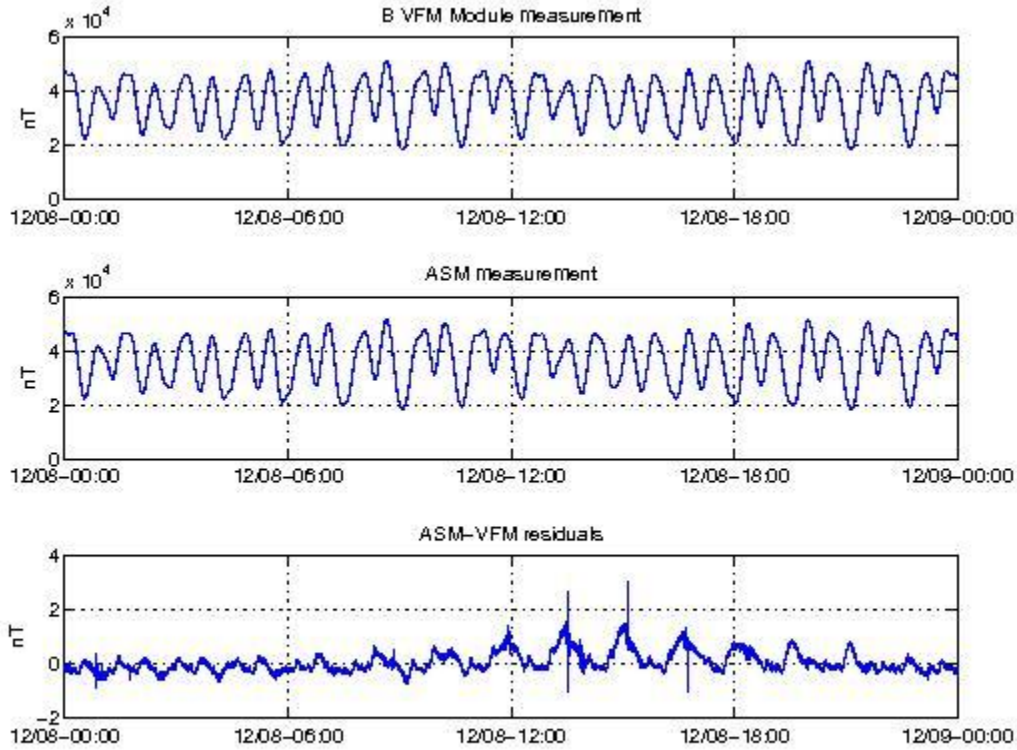

Figure 14: VFM module, ASM module and ASM-VFM residuals for S/C B, 08/12/2014

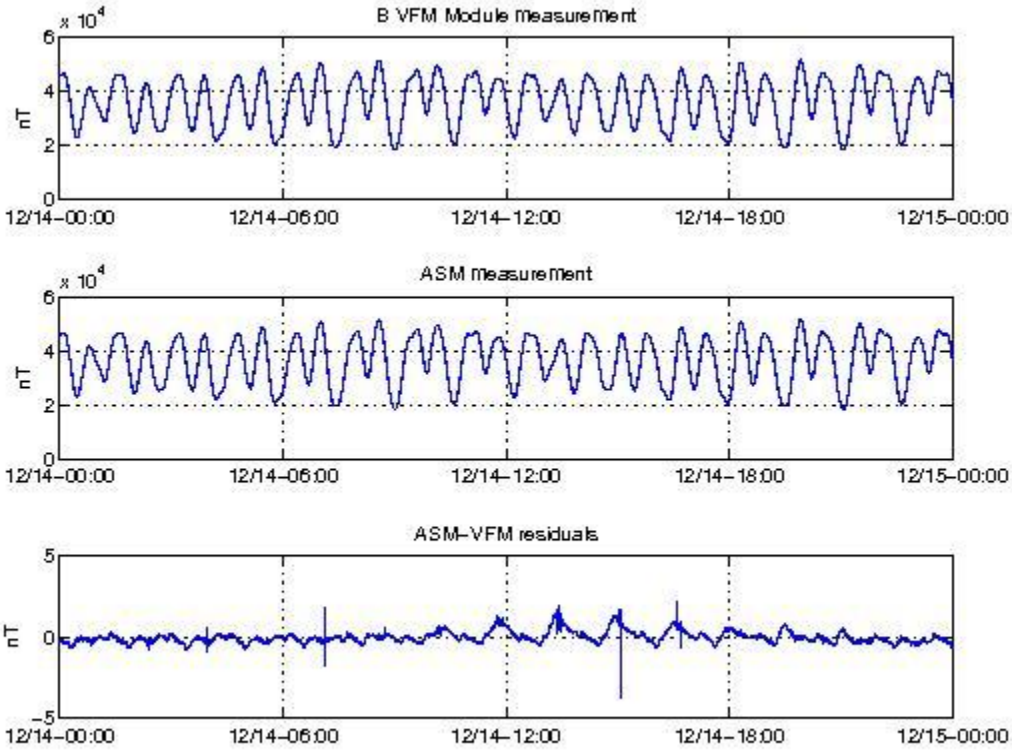

Figure 15: VFM module, ASM module and ASM-VFM residuals for S/C B, 14/12/2014.

3.3.2.3 TCF.VFM monitoring

The TCF.VFM analysis will be included in the last report of December.

3.3.3 Swarm C

3.3.3.1 Magnetic time series visual inspection

No data because ASM is still switched off

3.3.3.2 VFM-ASM anomaly

No data because ASM is still switched off

3.3.3.3 TCF.VFM monitoring

No data because ASM is still switched off

3.3.4 Summary of TCF behaviour for the three S/C

The TCF.VFM analysis will be included in the last report of December.

4. ON-DEMAND ANALYSIS

Nothing to report.

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