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IDEAS+ Swarm Weekly Report 2015/15: 2015/04/06 - 2015/04/12

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 06 to 12 April 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	21 Apr 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 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 3.15, 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 (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.

2. SUMMARY OF THE OBSERVATIONS

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

TII status. After further cycles of scrubbing on all S/C during March and April (even with a more aggressive procedure on Charlie, with V_ph = 6000 V and V_mcp = -2200 V), results are still far to be stable and the image anomaly still shows up after few orbits or days following a switch into ready state. Attempts to understand the latitude/longitude dependence of the 2nd – y moments have been done by Univ. of Calgary, but without clear results, for the time being. Now the possibility to manoeuvre one S/C (e.g. Alpha) by 40 deg in slew and then 40 deg in pitch is under discussion, in order to illuminate different regions of the sensors that are normally not much solicited, with ionospheric plasma.

2.2 Plan for operational processor updates

L1BOP 3.15 has been put in operation March 23th, 2015. The data quality with the new processor has been quickly assessed and it is satisfactory ([RD.14]).

The PDGS team concluded the recovery of the failed production due to the bug in L1BOP 3.14, and the generation of the Swarm C magnetic production lost from 6th November (when ASM has fallen down).

An updated Langmuir probe preliminary dataset have been distributed to all Swarm users.

The cross-verification activity for the changes to be implemented in the next version of the processor in May-June is on-going:

1. Lars Toffner-Clausen has produced TEST versions of AUXxL1BPC and AUXxVFM_C CCDB file types in order to include the new look-up tables and updates needed for calculating the db_Sun corrections.

2. PLASMA: the implementation of the changes in the processing introduced in the new LP prototype is on-going. The cross-verification strategy has been defined: a) the full test case scenarios as for the other processing chains will be executed; b) the LP and TII errors will not be cross-verified and will be put to constant values (-99.99) because the calculation is not yet reliable already in the prototypes; c) the baseline for the quality flags will be raised to “20” for the whole dataset (“data to be used with caution”); d) LP_x_CA_1B and TIIx_CA_1B calibration products will be cross-verified as well, outside the GMV comparison tool, by simply comparing “manually” pairs of values (data records contained in such products are very few).

During week 16 (13-17/04) the verification of L2CAT2 OP 1.13 has started within the PDGS.

2.3 Quality Working Group and Cal/Val Coordination

Coordination is in place for organizing the 6th Swarm Data Quality Workshop in Paris (hosted by IPGP) in late September 2015.

Following the QWG recommendations in Potsdam and the scientists need in view of the IUGG conference in June, the preliminary plasma dataset has been released early February 2015.

DTU/ESL shared the final set of corrected data on early April. These corrected data also contain the dBsun correction, providing the users the possibility to access to uncorrected data.

The Task Force meeting was held on 9-10 April in ESTEC. During this meeting the following decisions have been taken:

- ESA and CNES have to be prepared for potential further ASM failures scenarios.
- The corrected data provided by Lesur-Tøffner-Clausen (DTU) will be distributed by ESA to all Swarm users[1]. Soon, the correction will also be implemented in the OP. Meanwhile, the team agreed that the following investigation should be done:
  i. Clarifications of coordinate systems used (and left out) in models. To confirm overall dynamics and time constants / phase shifts.
  ii. Splinter group with Airbus, DTU-MI, and ESA to further coordinate investigations of "secondary" contributions.
  iii. (v x B) further investigations during: 1) the 4-step-360 rotation data, 2) the Alpha-Charlie rotations.
  iv. Test with same sun attitude conditions (excluding manoeuvres) but different plasma conditions or magnetic longitude.
  v. To better quantify (from models) potential plasma-related effects. Link to MAGx_HR.
  vi. Involvement of EFI-TII team.

The next task force meeting is scheduled for **2-3 July 2015**.

2.4 Summary of observations for 2015, Week 15 (06/04 - 12/04)

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

- **Two GPS loss of sync** observed on S/C B during week 15.
- **Several features observed in the MOD-NAV difference:** we often observe deviations from the average values lasting several minutes (SW-IDEAS-34).
- **An event of attitude rejection** is observed for S/C A (SW-IDEAS-67), due to simultaneous occurrence of BBOs on all three cameras.

[1] *The corrected Swarm magnetic data have been distributed to all Swarm users on 13/04 (https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/swarm/news/-/article/corrected-swarm-magnetic-data-now-available).*

3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

- **GPS sync loss events** Two GPS out-of-sync occurred on S/C B on 07/04. Such events cause the related timestamps to be rejected by the Level 1B processor and cause gaps to be present in all the Level 1A products.

  In Figure 1 one can see the occurrence of the two GPS losses as observed in the "SyncStatus" parameter of the GPSBNAV_0_ products. A value "SyncStatus"= 3 means the UTC inferred from GPS is invalid and this happens when there are problems in synchronizing the GPSR synchronization unit and the navigation packet generation. Details on such sync loss intervals are given in Table 1 below.

Start time	Stop time	Length (s)
07/04/2015 01:37:38	07/04/2015 01:37:44	6
07/04/2015 10:14:17	07/04/2015 10:14:43	26

Table 1: Swarm B GPS sync losses during week 15

FOS also reported about a GPS sync loss on Bravo on 08/04/2015, between 03:16:11 and 03:16:22 (FOS Swarm Weekly Operation Report #72, SW-RP-ESC-FS-6168, Reporting Period: 06/04/2015 to 12/04/2015, CW 15). This seems not to be evidenced in figure below, even though a small gap of 1 second is observed in Level 1B magnetic products between 03:16:12 and 03:16:13 UT. Clarifications are ongoing with FOS.

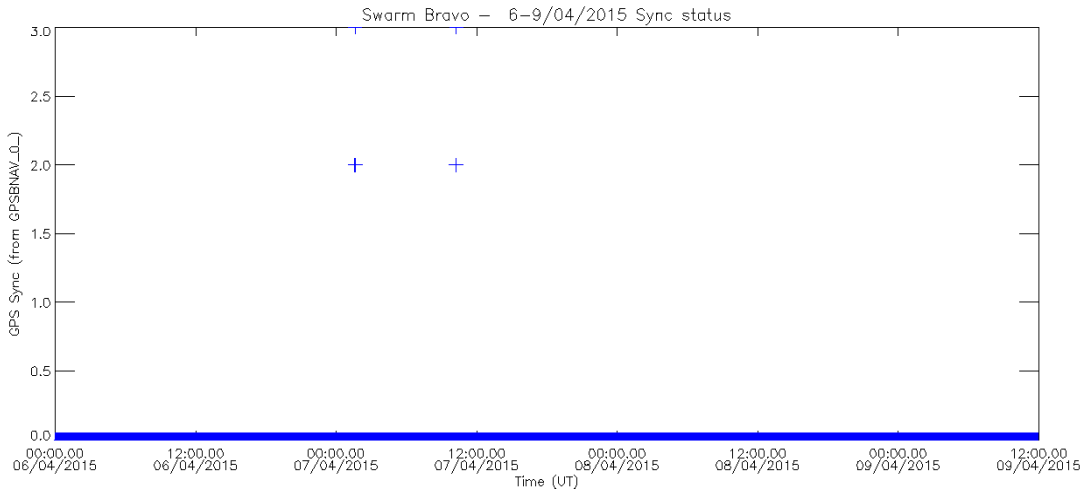

Figure 1: Swarm B GPS sync losses observed during week 15.

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]
SW-IDEAS-67	OBS_ROUTINE: 2015, week 15 (06-12/04), STR S/C A out of range.	STRASCI_1A STRAATT_1B	3.2.1.2	3.2.1.2

Table 2: List of events related to attitude and orbit products to be reported in the monitoring for 2015, Week 15: 06/04 - 12/04.

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 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. The maximum standard deviation is in the fourth column. Maxima, minima and standard deviations usually refer to the Z component which is often the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm A, 06/04 - 12/04, Position difference					
Day	**Average difference (m)**	**Maximum difference (m)**		**Maximum standard deviation (m)**	**Notes**
06/04	0.18	-9.07	14.04	1.58	SW-IDEAS-34 [RD.10]
07/04	0.09	-8.49	13.09	1.39	
08/04	0.02	-10.34	8.19	1.65	SW-IDEAS-34 [RD.10]
09/04	0.07	-8.53	9.19	1.59	SW-IDEAS-34

Swarm A, 06/04 - 12/04, Position difference					
					[RD.10]
10/04	0.08	-6.52 (Y)	6.87	1.36	
11/04	0.03	-7.73	6.78	1.27	Spike on Z component
12/04	0.05	-8.21 (Y)	7.70	1.27	Spike on Y component

Table 3: Swarm A, difference between MOD and on-board solution positions. If not specified maximum difference and maximum standard deviation refers to the Z axis.

Below some plot example follows of such differences taken at the beginning of the week (06/04, Figure 2) in the middle (09/04, Figure 3) and at the end (12/04, Figure 4). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two. The values of position are given in [km] and the difference between both solutions is given in [m].

In Figure 2, the red-circled area shows an example of SW-IDEAS-34 occurrence ([RD.10]): the MOD-NAV difference departs from the average value and keeps the new higher value for several minutes before to decay to average level again.

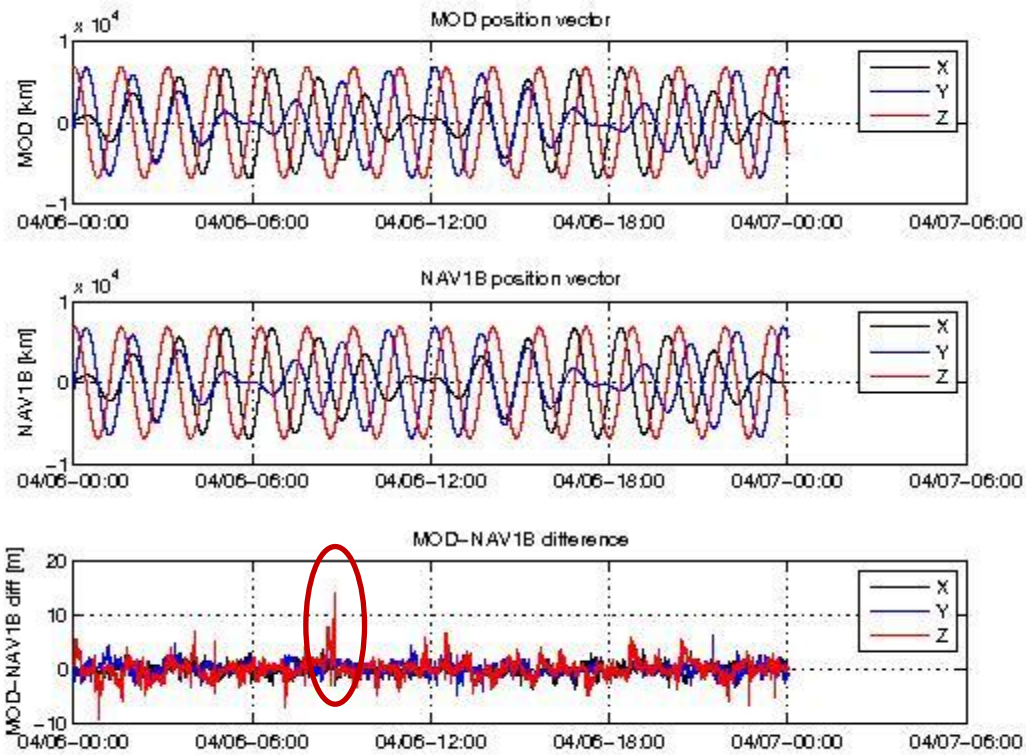

Figure 2: Difference MOD-GPSNAV, S/C A, 06/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two. The red circled area shows an example of SW-IDEAS-34 occurrence ([RD.10]).

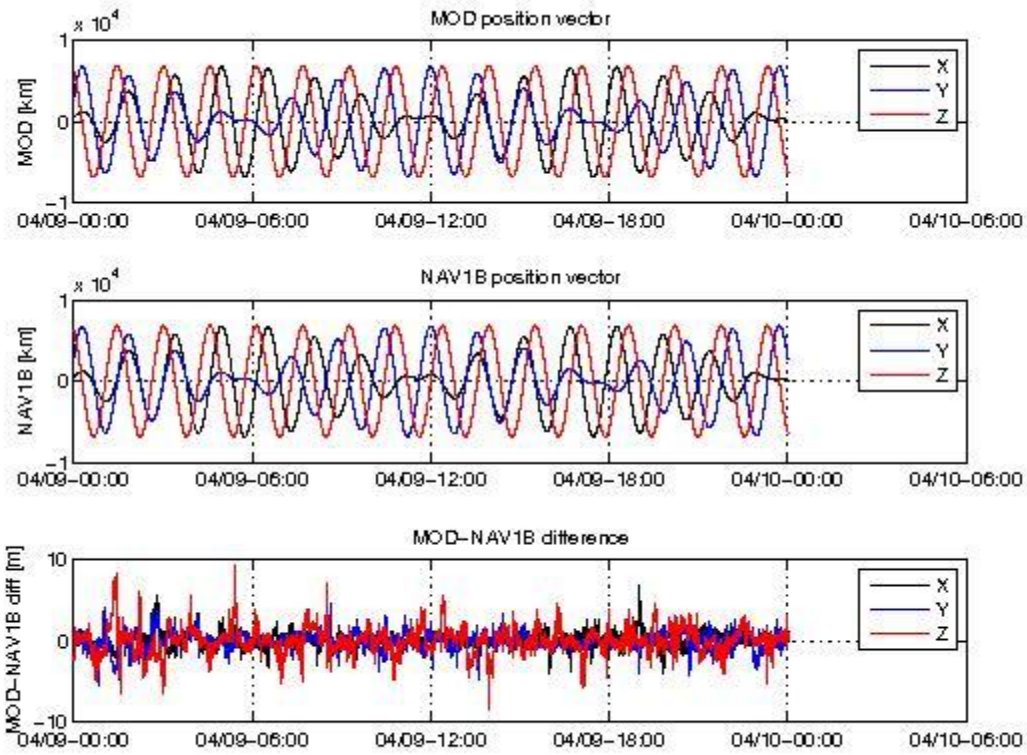

Figure 3: Difference MOD-GPSNAV, S/C A, 09/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

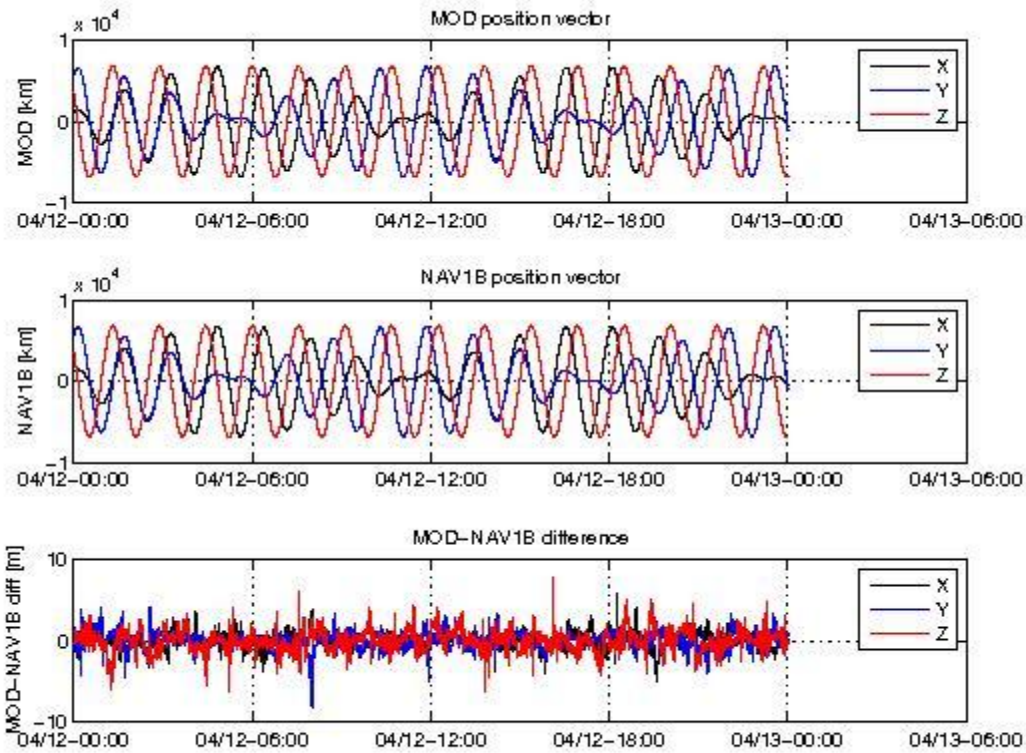

Figure 4: Difference MOD-GPSNAV, S/C A, 12/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

3.2.1.2 Attitude observations

- **SW-IDEAS-67**

We observe an interval of rejected attitudes for S/C A, on 07/04/2015 (Flags_q=255). The reason for such rejection is the presence of BBOs simultaneously on all the three cameras. In Table 4 below, such interval is detailed.

Start time	Stop time	Length (s)
07/04/2015 18:26:48	07/04/2015 18:28:01	74

Table 4: Attitudes out-of-range on S/C A, week 15.

3.2.2 Swarm B

3.2.2.1 Position Statistics

In Table 5 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. The maximum standard deviation is in the fourth column. Maxima, minima and standard deviations usually refer to the Z component which is often the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm B, 06/04 - 12/04, Position difference					
Day	**Average Difference (m)**	**Maximum difference (m)**		**Standard Deviation (m)**	**Notes**
06/04	0.15	-7.02	8.19	1.52	SW-IDEAS-34 [RD.10]
07/04	0.15	-14.37 (X)	19.12 (Y)	1.47	Spike on Y component
08/04	0.06	-14.09	10.93	1.88	SW-IDEAS-34 [RD.10]
09/04	0.06	-8.27 (Y)	11.92	1.66	SW-IDEAS-34 [RD.10]
10/04	0.12	-8.79	7.32	1.33	SW-IDEAS-34 [RD.10]
11/04	0.09	-9.0	7.87 (X)	1.31	SW-IDEAS-34 [RD.10]
12/04	0.08	-6.76	8.96	1.45	SW-IDEAS-34 [RD.10]

Table 5: Swarm B, difference between MOD and on-board solution positions. If not specified maximum difference and maximum standard deviation refers to the Z axis.

Below some plot example follows of such differences taken at the beginning of the week (06/04, Figure 5), in the middle (09/04, Figure 6), and at end of the week (12/04, Figure 7). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two. The values of position are given in [km] and the difference between both solutions is given in [m].

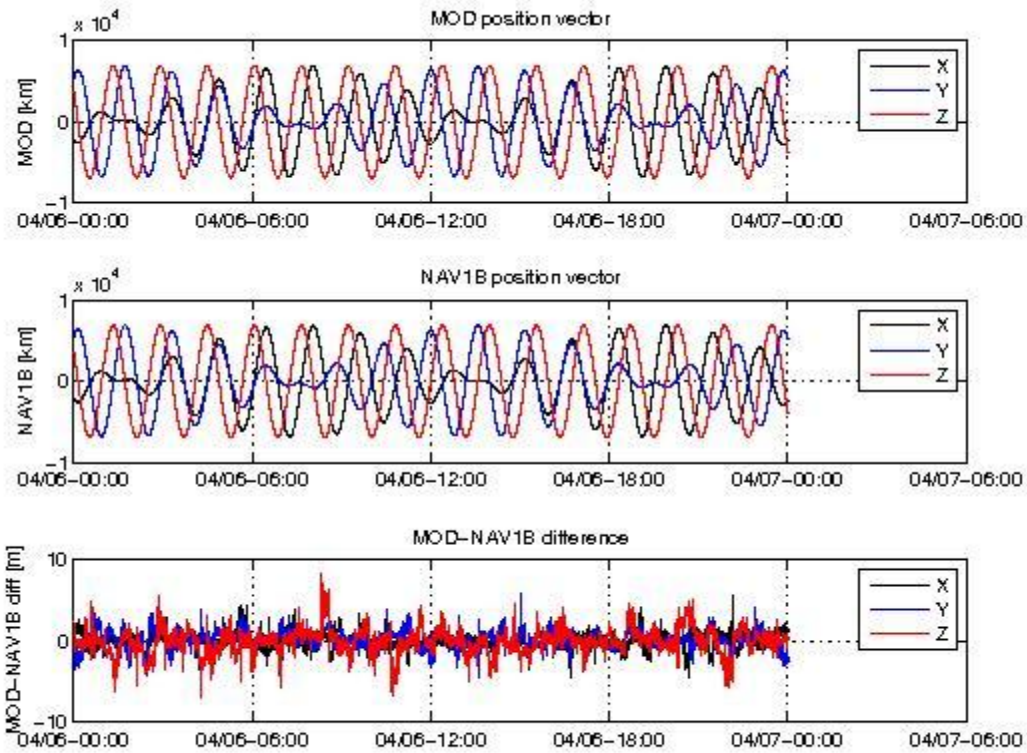

Figure 5: Difference MOD-GPSNAV, S/C B, 06/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

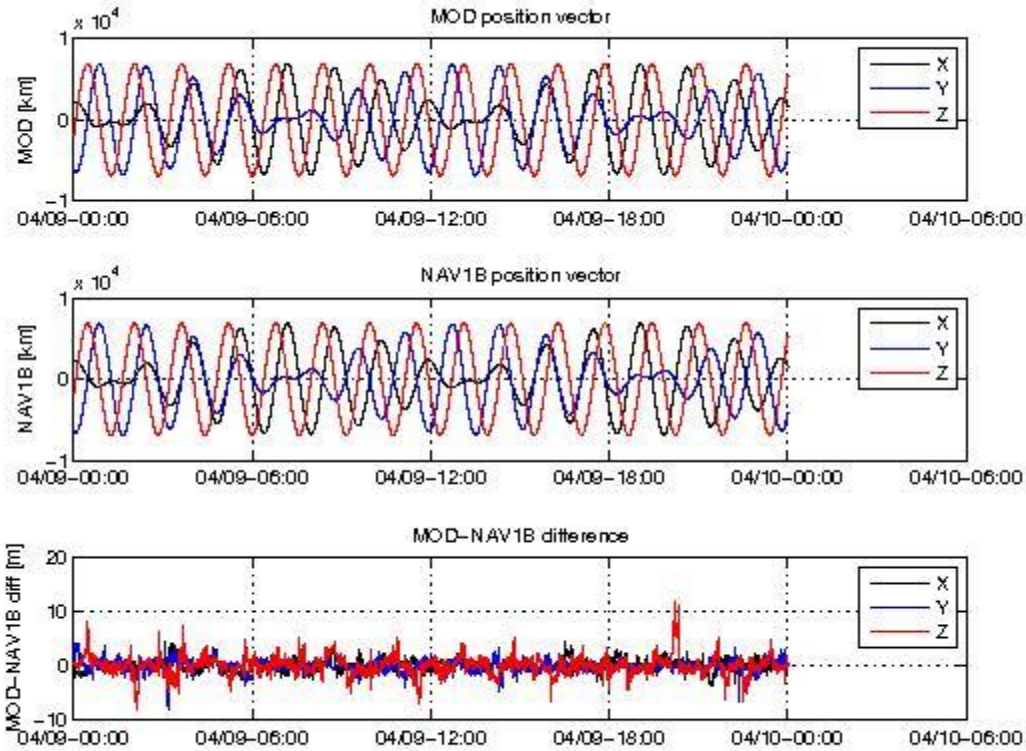

Figure 6: Difference MOD-GPSNAV, S/C B, 09/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

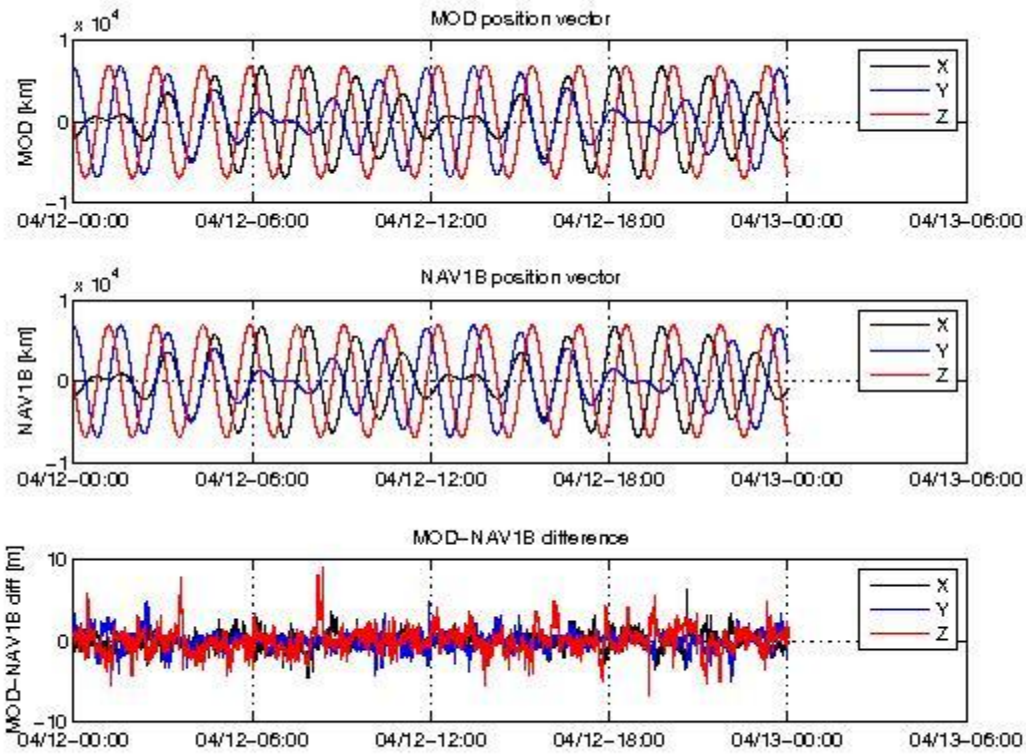

Figure 7: Difference MOD-GPSNAV, S/C B, 12/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

3.2.2.2 Attitude observations

Nothing to report.

3.2.3 Swarm C

3.2.3.1 Position Statistics

In Table 6 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. The maximum standard deviation is in the fourth column. Maxima, minima and standard deviations usually refer to the Z component which is often the most disturbed; in case another component is most affected, it will be specified in parentheses.

Swarm C, 06/04 - 12/04, Position difference					
Day	**Average Difference (m)**	**Maximum difference (m)**		**Standard Deviation (m)**	**Notes**
06/04	0.11	-7.32	8.28	1.43	SW-IDEAS-34 [RD.10]

Swarm C, 06/04 - 12/04, Position difference					
07/04	0.15	-7.04	8.01	1.31	SW-IDEAS-34 [RD.10]
08/04	0.11	-7.62 (X)	6.07	1.39	SW-IDEAS-34 [RD.10]
09/04	0.07	-6.72	9.78	1.43	SW-IDEAS-34 [RD.10]
10/04	0.07	-7.94	6.11 (Y)	1.25	
11/04	0.06	-8.42	7.86	1.29	
12/04	0.08	-7.45 (Y)	8.38	1.25	

Table 6: Swarm C, difference between MOD and on-board solution positions. If not specified maximum difference and maximum standard deviation refers to the Z axis.

Below some plot example of such differences follows, taken at the beginning of the week (06/04, Figure 8), in the middle (09/04, Figure 9) and at the end (12/04, Figure 10). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two. The values of position are given in [km] and the difference between both solutions is given in [m]

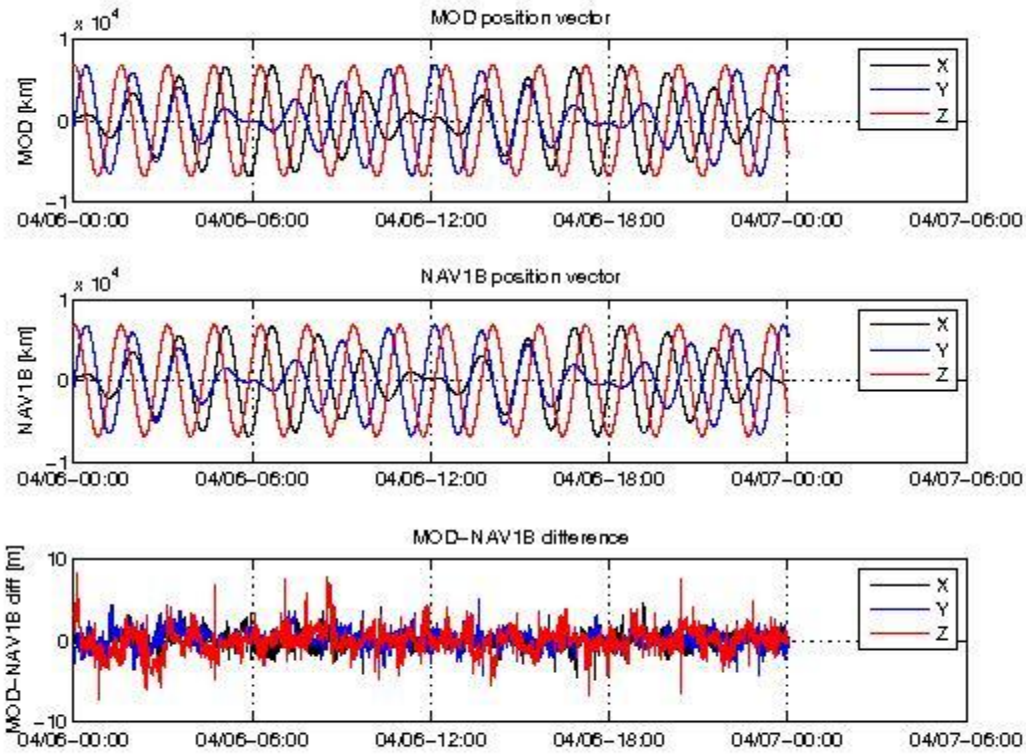

Figure 8: Difference MOD-GPSNAV, S/C C, 06/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

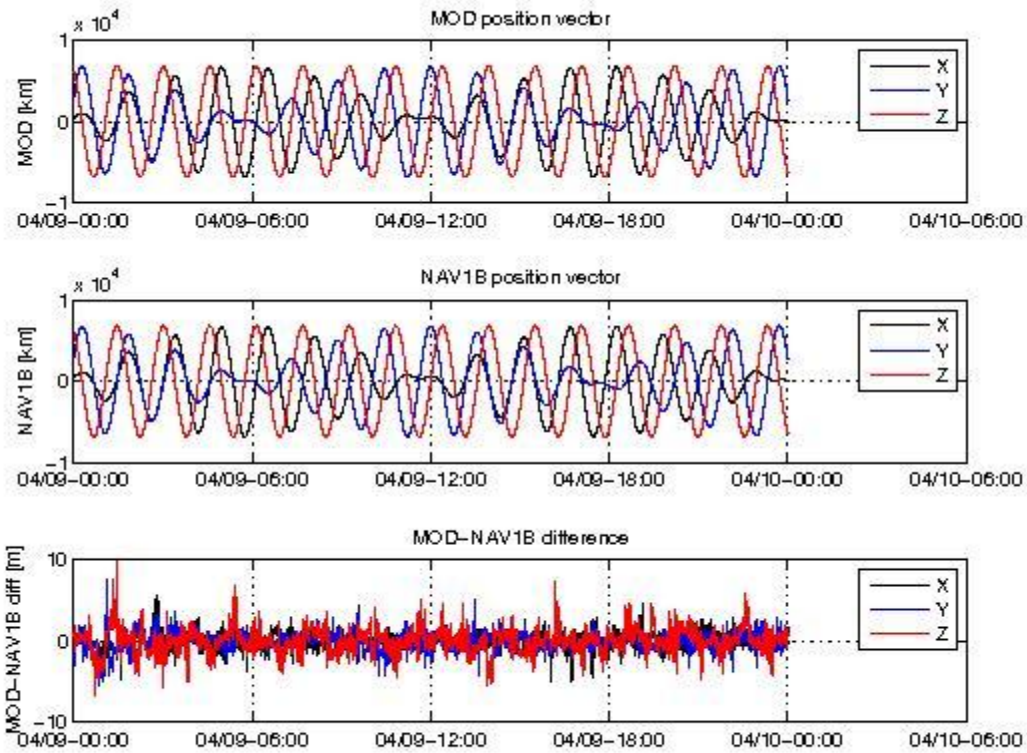

Figure 9: Difference MOD-GPSNAV, S/C C, 09/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

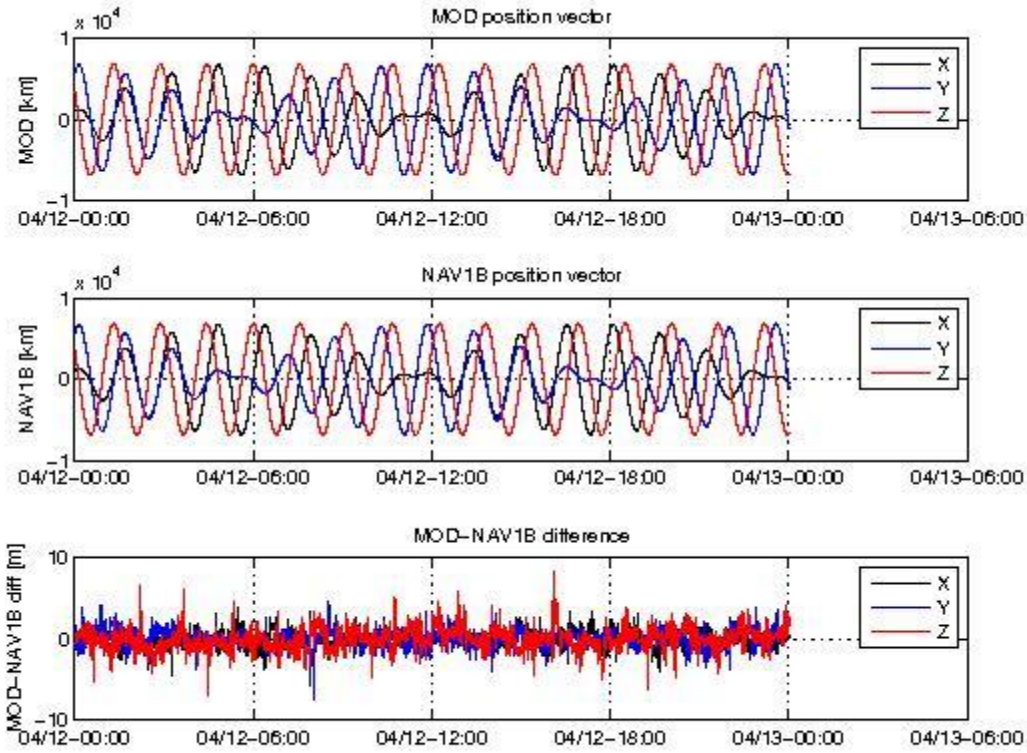

Figure 10: Difference MOD-GPSNAV, S/C C, 12/04. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, and the difference between the two.

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.**

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 B (12/04) can be seen in Figure 11 below.

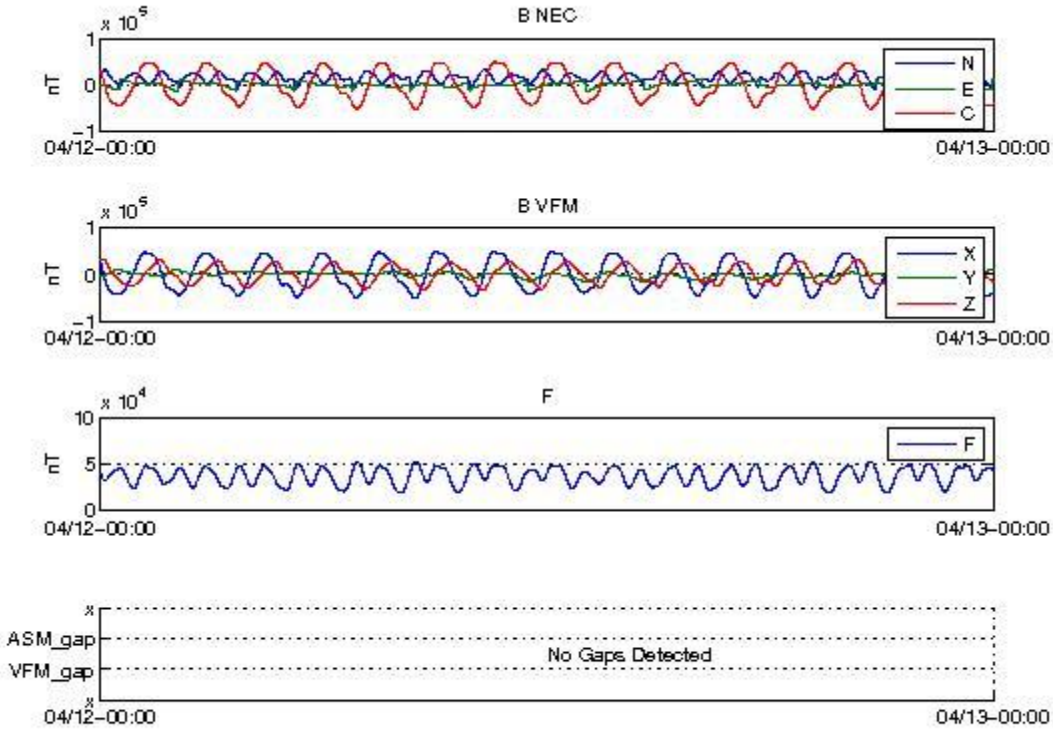

Figure 11: Time series of the geomagnetic field, for 12/04, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.1.2 VFM-ASM anomaly

The daily peak-to-peak difference for the only available day during current week stays within [-4, +2.3] nT with one spike exceeding -5nT.

Below two example plots follows of such differences: 07/04 (Figure 12), and 12/04 (Figure 13). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM

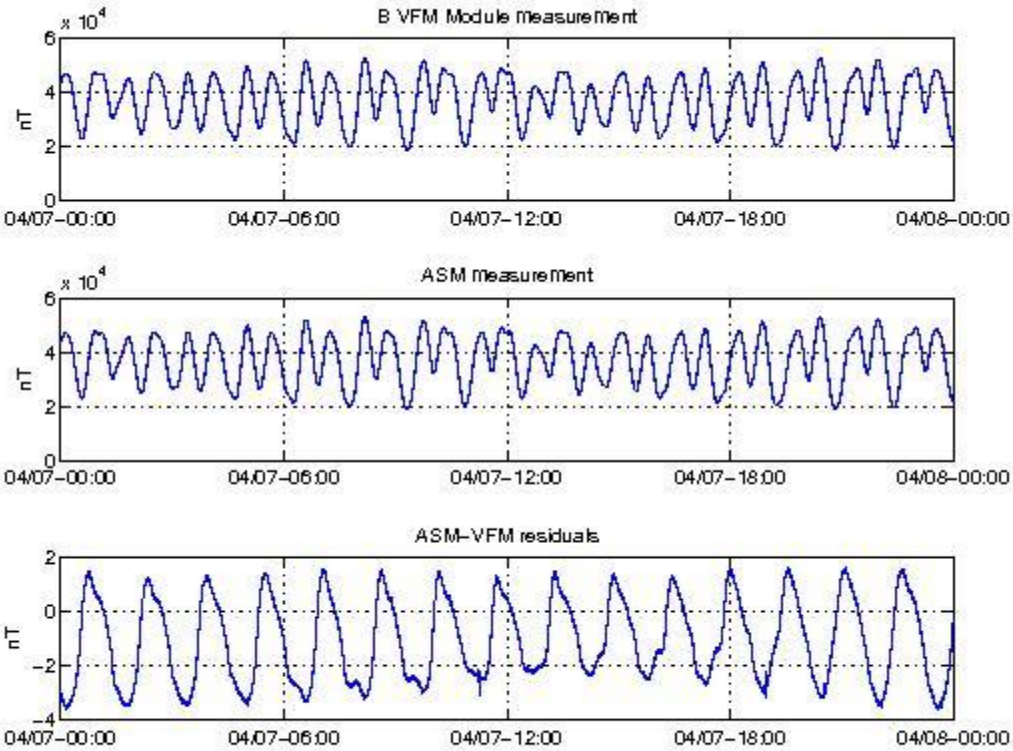

Figure 12: VFM module, ASM module and ASM-VFM residuals for S/C A, 07/04.

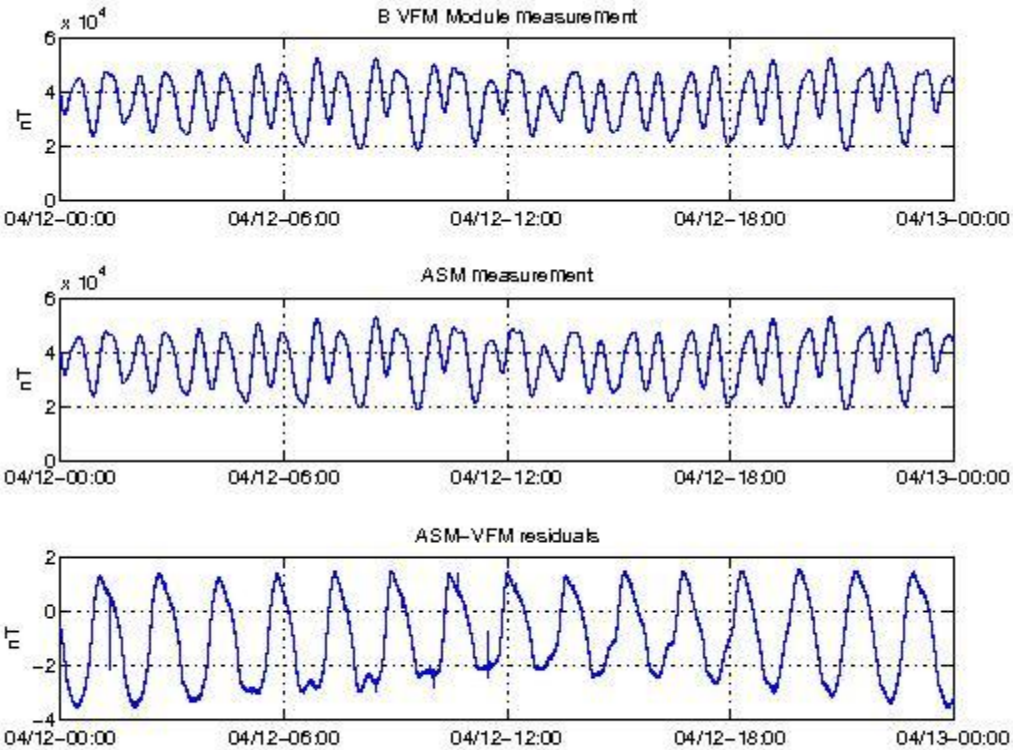

Figure 13: VFM module, ASM module and ASM-VFM residuals for S/C A, 12/04.

3.3.1.3 TCF.VFM monitoring

The TCF.VFM monitoring is a monthly check and will be contained in the first report of May, related to April 2015.

3.3.2 Swarm B

3.3.2.1 Magnetic time series visual inspection

An example of representative magnetic field time series for S/C B (12/04) can be seen in Figure 14 below.

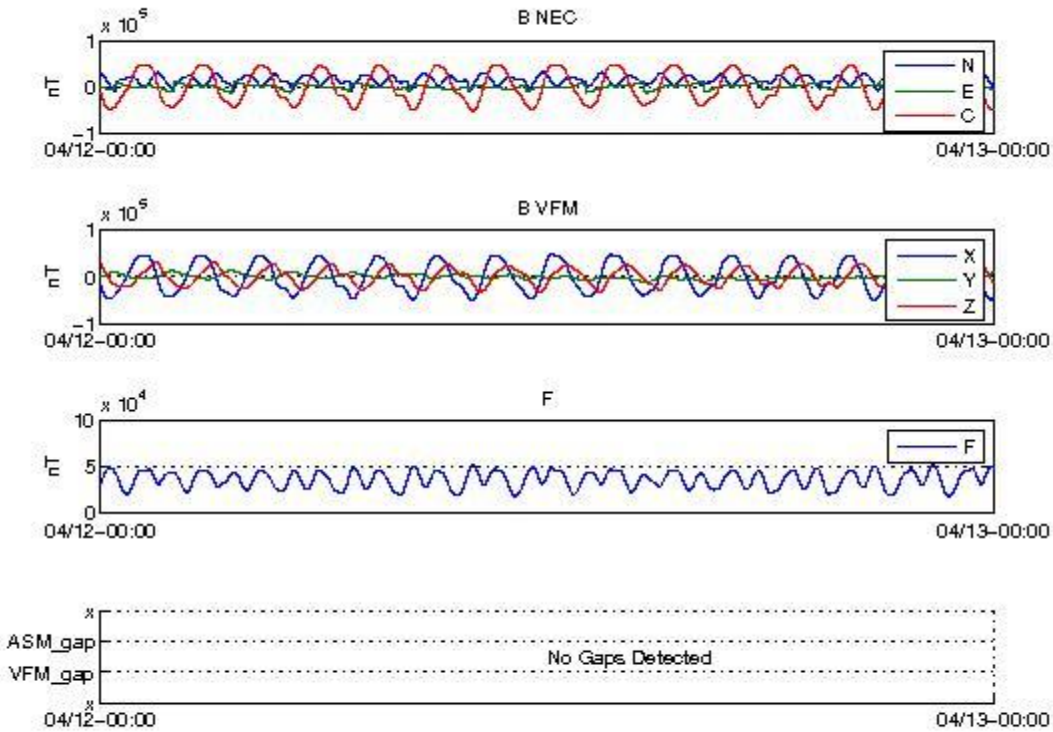

Figure 14: Time series of the geomagnetic field for 12/04, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.2.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-2.5, 2.5] nT, with a few peaks of about 7 nT.

Below two example plots follows of such differences: 06/04 (Figure 15), and 12/04 (Figure 16). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

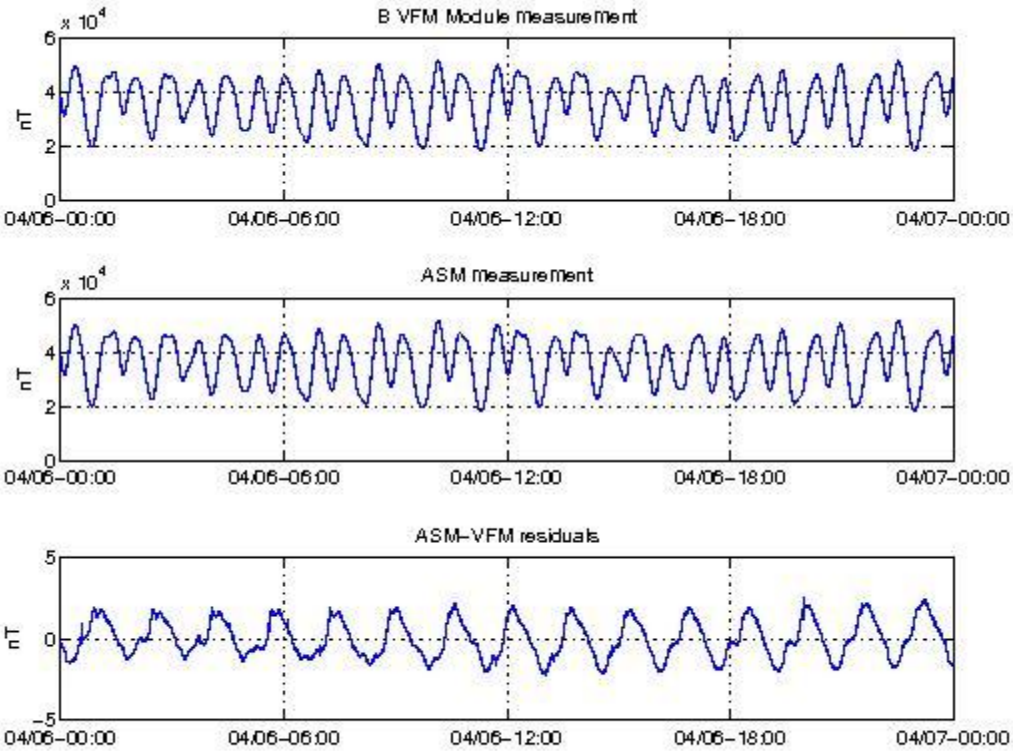

Figure 15: VFM module, ASM module and ASM-VFM residuals for S/C B, 06/04.

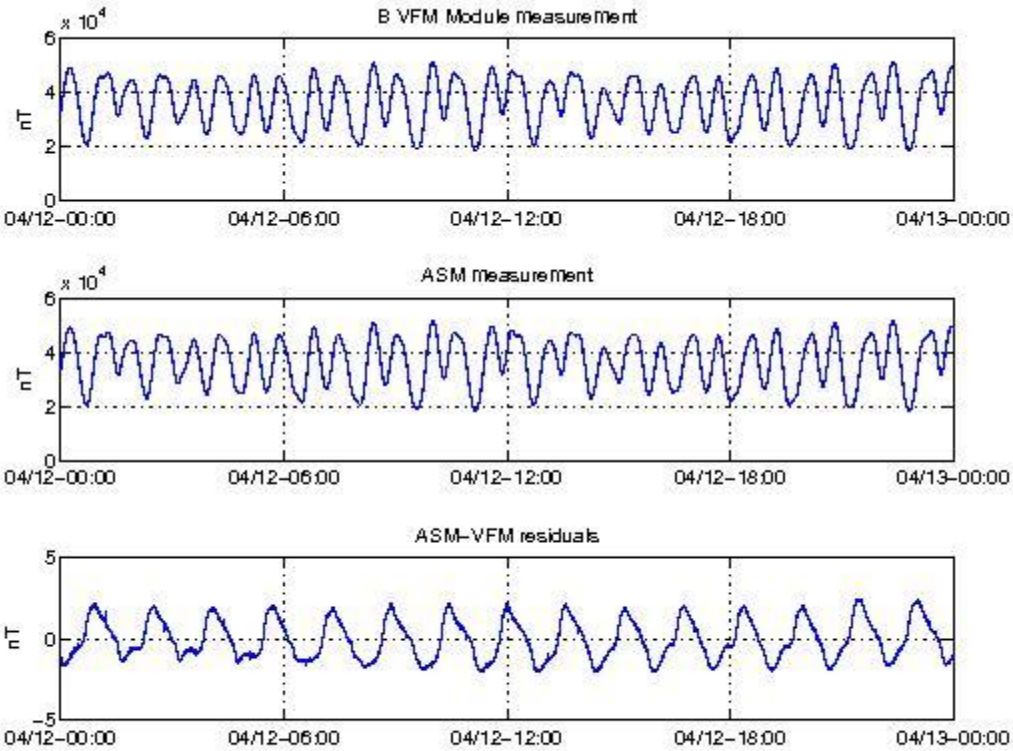

Figure 16: VFM module, ASM module and ASM-VFM residuals for S/C B, 12/04.

3.3.2.3 TCF.VFM monitoring

The TCF.VFM monitoring is a monthly check and will be contained in the first report of May, related to April 2015.

3.3.3 Swarm C

3.3.3.1 Magnetic time series visual inspection

An example of magnetic field time series for S/C C (12/04) can be seen in Figure 17.

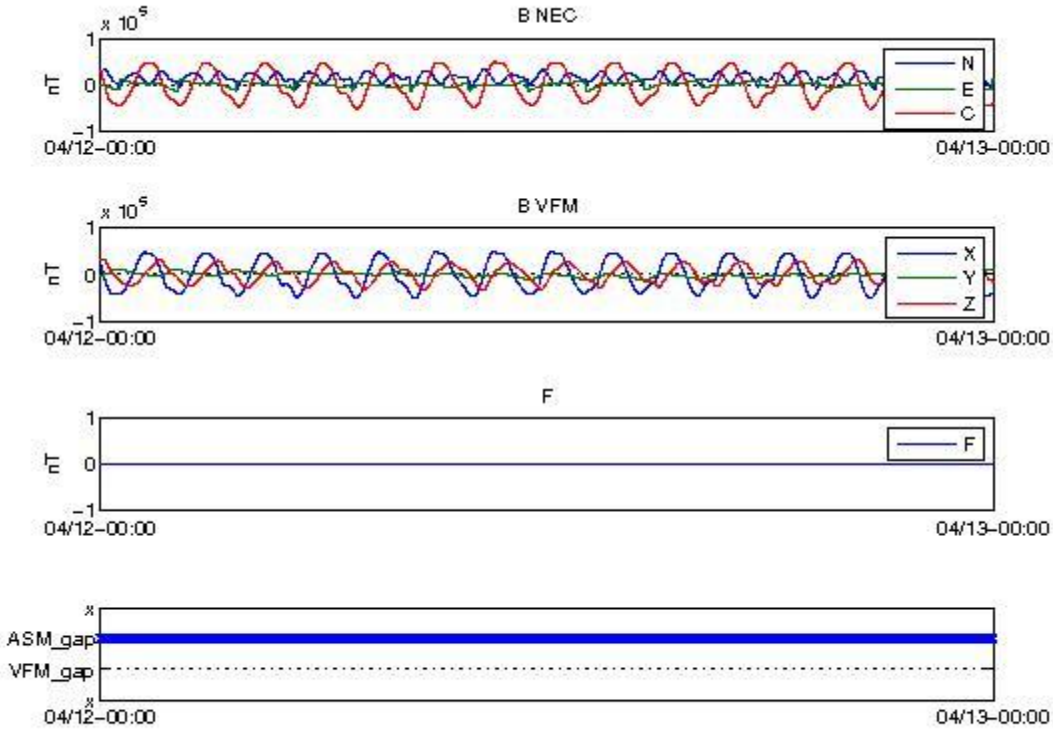

Figure 17: Time series of the geomagnetic field for 12/04, S/C C. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM (no data here because ASM it is off) and location of gaps.

3.3.3.2 VFM-ASM anomaly

No data because ASM is 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 monitoring is a monthly check and will be contained in the first report of May, related to April 2015.

4. ON-DEMAND ANALYSIS

Nothing to report.

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