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IDEAS+ Swarm Weekly Report 2015/03 : 12/01/2015 – 18/01/2015

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 12 to 18 January 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	22 Jan 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 3.11p3, 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 (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)

2. SUMMARY OF THE OBSERVATIONS

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

- **EFI TII Updates.** The burn-in procedure carried on in December has been very fruitful, new gain maps have been uploaded for Swarm A and B, while a flat field has been left on Swarm C in order to better characterized regions in the detectors where the scrubbing was not so efficient. Swarm A has been operating nominally for about ten days now, without serious image degradation, and therefore it will continue running without further interventions for a while. In Swarm B spurious signals affect at times the images and, although the scrubbing gave excellent results as well, the new gain maps do not guarantee stable quality processing yet: a new, more aggressive burn-in cycle has been decided, pushing the MCP voltage at -1950 V, close to its qualification limits as from pre-flight tests. In Swarm C, new gain maps shall be uploaded in order to clean-up a bright contamination ring close to the detectors edge: before to do that a power cycle (one day off, one day on) will be carried on.

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.

A L1BOP 3.12 patch will be delivered during week 05 (26/1-1/2) in order to solve a number of SPRs not properly addressed in the delivery.

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 will be released end of January 2015 and the MAGNET QWG will prepare a dataset of vector magnetic data, corrected from the Sun disturbances.

2.4 Summary of observations for 2015, Week 03 (12/01-18/01)

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. **A GPS out-of-sync** has to be reported for SC A, 12/01, which causes a few seconds gap in the attitude and magnetic products (**SW-IDEAS-40**, [RD.12]).

3. **A couple of attitude rejection events** have to be reported for SC A and B, due to simultaneous BBOs on the three cameras.

4. **Anomalous increase** of the residual difference between B_{NEC} and B_{models}, starting at 00 UT of 02/01/2014, particularly marked in the East component. This

is related to a bad treatment of the leap seconds by the L1B processor, and the manufacturer has already found the bug and is testing impacts on the system (**SWL1L2DB-40**).

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.

- **VFM off on SC B** from January 10, 18:17:39 up to January 12**,** 12:33:20. This causes VFMBAUX_1B, ASMBAUX_1B, MAGB_HR_1B, MAGB_CA_1B of day 10/01/2015 to be shorter, while MAGB_LR_1B covers all the day length but from 18:17:39 on, all the parameters that involve a use of the VFM magnetic field are filled with zeros. On day 11/01/2014 all the L1B magnetic production for SC B fails. Due to partial magnetic coverage, also the L1B plasma production for SC B fails for day 11/01/2015. The event is caused by corrupted Science telemetry sent by VFM-B starting from 10/01 on. The instrument provider suggested to power cycle the VFM and, after having done that, the problem disappeared. The causes of the anomaly are still under investigation, but it is likely that radiation hit the software board when passing over the South Atlantic Anomaly.

- **SW-IDEAS-40.** The GPS sync loss already mentioned in Sect. 2.4 affects all the Level 0 products. The Sync Status is = 32 for the interval specified in Sect. 3.2.1.2, also for the ASMAVEC_0_ and VFMANOM_0_ product types affected by such sync loss, and this causes the corresponding records to be rejected and not processed further.
  In the MAGA_HR_1B product type a gap is left corresponding to the a GPS sync loss interval, while in the MAGA_LR_1B product type, in the same interval, all the magnetic values are set to exactly zero (but properly flagged as not good).

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-40	OBS_ROUTINE: STR out of range - ANOMALOUS CASES	STRASCI_1A STRAATT_1B Magnetic products	3.2.1.2	[RD.12]
SW-IDEAS-50	OBS_ROUTINE:	STRBSCI_1A	3.2.2.2	3.2.2.2

	week 12-18/01/2015 STR S/C B out of range.	STRBATT_1B		
SW-IDEAS-51	OBS_ROUTINE: 18/01/2015 STR S/C A out of range.	STRASCI_1A STRAATT_1B	3.2.1.2	3.2.1.2

Table 1: list of events related to attitude and orbit products to be reported in the monitoring for 2015, Week 03: 12/01 - 18/01.

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, 12/01 – 18/01, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard deviation (m)**	**Notes**
12/01	0.09	-9 (Y), 11 (Z)	1.4	
13/01	0.24	-10.6, 8 (Z)	1.5	
14/01	0.16	-7, 10 (Z)	1.4	
15/01	0.16	+/- 9.5 (Z)	1.7	SW-IDEAS-34

Swarm A, 12/01 – 18/01, Position difference				
				[RD.10]
16/01	0.12	-7, 11 (Z)	1.5	
17/01	0.08	-8, 9 (Z)	1.4	SW-IDEAS-34 [RD.10]
18/01	0.11	-8.7 (Y), 6.5 (X)	1.4	SW-IDEAS-34 [RD.10]

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 (12/01, Figure 1), in the middle (15/01, Figure 2) and at the end (18/01, 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 an example of SW-IDEAS-34 ([RD.10]) anomaly is shown (red-circled area): the MOD-NAV solution difference departs from the average value taking higher/lower values for several minutes.

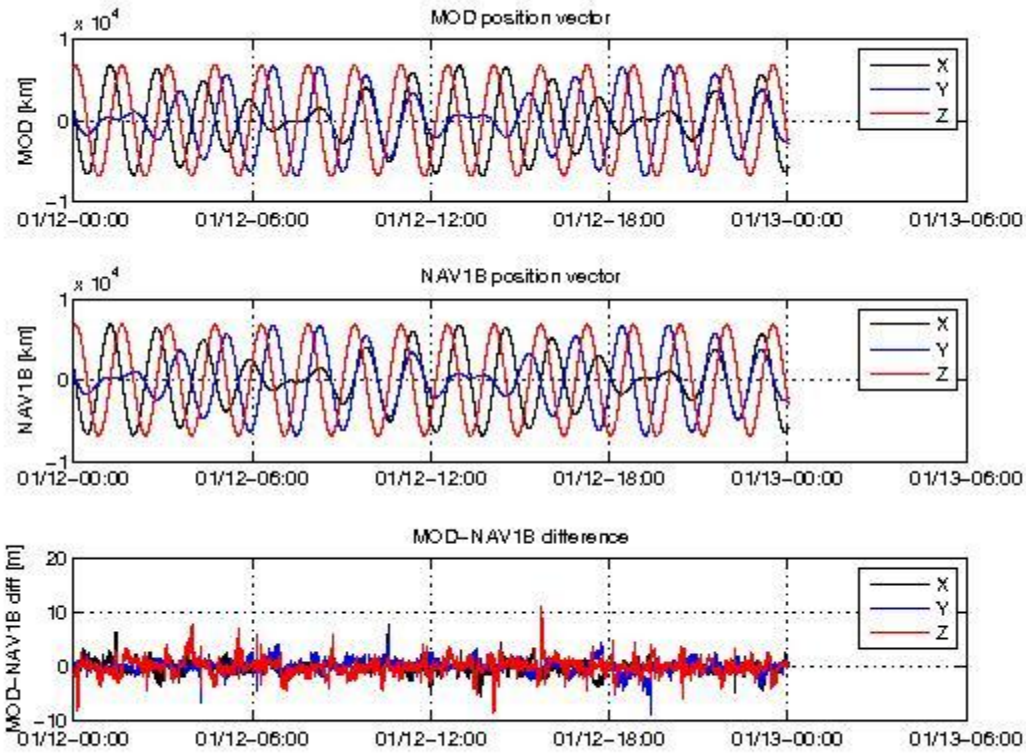

Figure 1: Difference MOD-GPSNAV, sc A, 12/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

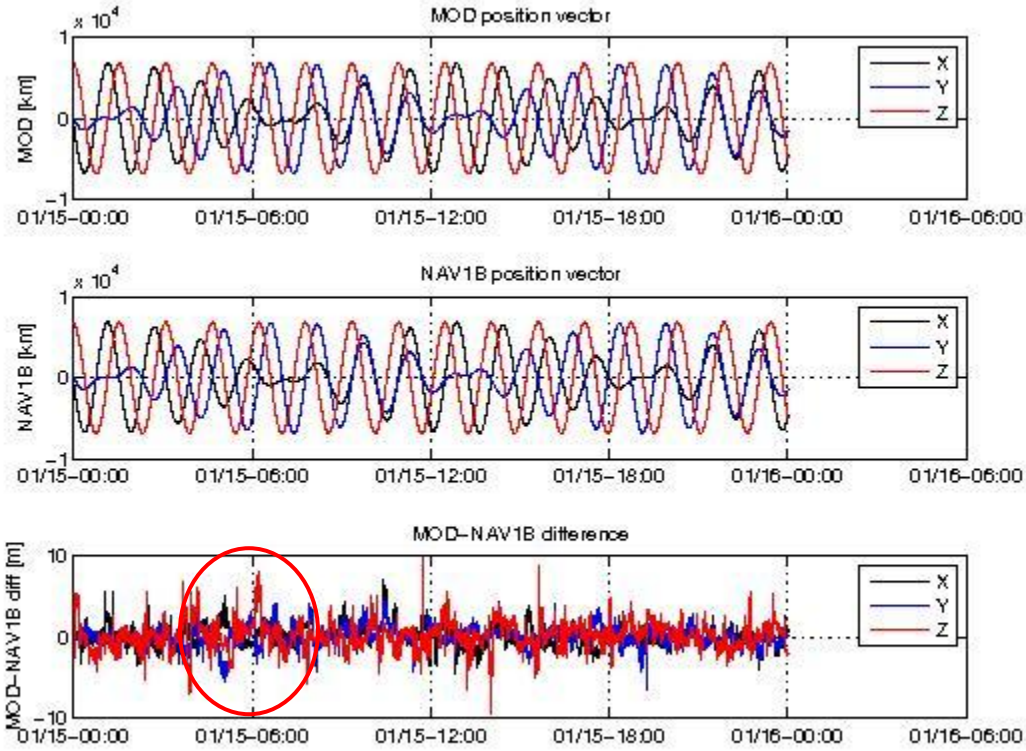

Figure 2: Difference MOD-GPSNAV, sc A, 15/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The red-circled area evidences a time interval characterized by SW-IDEAS-34 ([RD.10]) anomaly occurrence.

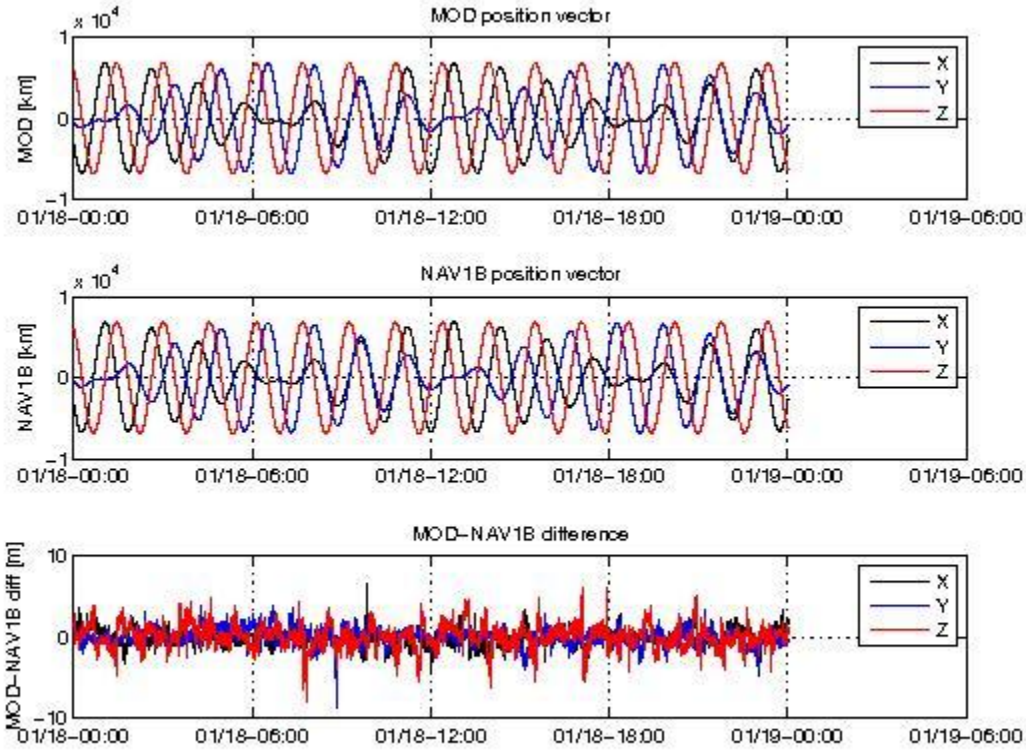

Figure 3: Difference MOD-GPSNAV, sc A, 18/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.1.2 Attitude observations

- **SW-IDEAS-40**

  During week 03 a GPS out-of-Sync was detected on SC A. As explained in [RD.12], this affects the STR data, causing rejection of packets in the Level 1A products and filling gaps with zero quaternions and Flags_q = 255 in the Level 1B products. In Table 3 below, more details are given.

Start Out-of-range	Stop Out-of-range	Duration (s)
12JAN2015 19:22:38	12JAN2015 19:22:52	14

Table 3: Attitudes out-of-range due to GPS sync loss, S/C A, 2015, week 03.

- **SW-IDEAS-51**

  Affected products:

  SW_OPER_STRAATT_1B_20150118T000000_20150118T235959_0302

  27 seconds out of range (Flags_q=255, no attitude available). See details in Table 4 below.

Start Out-of-range	Stop Out-of-range	Duration (s)
18JAN2015 21:56:03	18JAN2015 21:56:30	27

Table 4: Attitudes out-of-range, S/C A, 2015, week 03.

The cause of such rejected attitudes is the simultaneous occurrence of BBOs on all cameras for the specified interval.

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 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, 12/01 - 18/01, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
12/01	0.07	-8 (Y), 9.4 (Z)	1.3	SW-IDEAS-34 [RD.10]
13/01	0.12	-10.7, 6.7 (Y)	1.5	
14/01	0.13	-7.4, 9.4 (Z)	1.3	
15/01	0.09	-10 (X), 12.4 (Z)	1.9	SW-IDEAS-34 [RD.10]
16/01	0.2	-15.6, 9 (Z)	1.5	
17/01	0.08	-8 (Y), 9 (Z)	1.3	SW-IDEAS-34 [RD.10]
18/01	0.23	-6.6 (X), 7 (Z)	1.3	SW-IDEAS-34 [RD.10]

Table 5: 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 (12/01, Figure 4), in the middle (15/01, Figure 5), and at end of the week (18/01, 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.

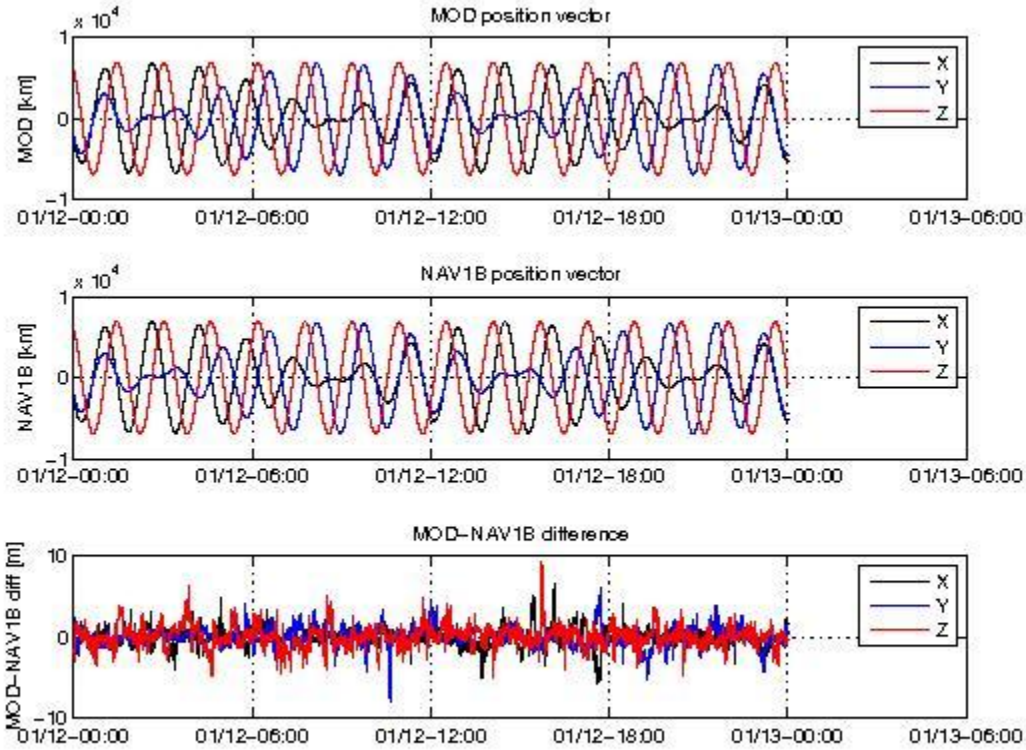

Figure 4: Difference MOD-GPSNAV, sc B, 12/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

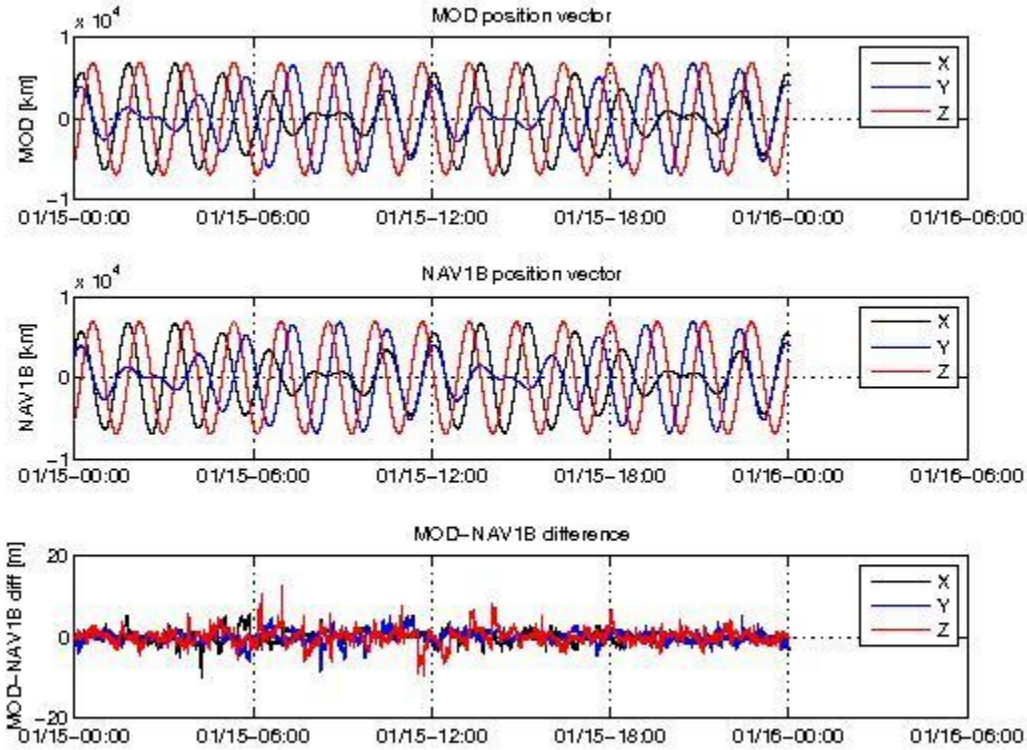

Figure 5: Difference MOD-GPSNAV, sc B, 15/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

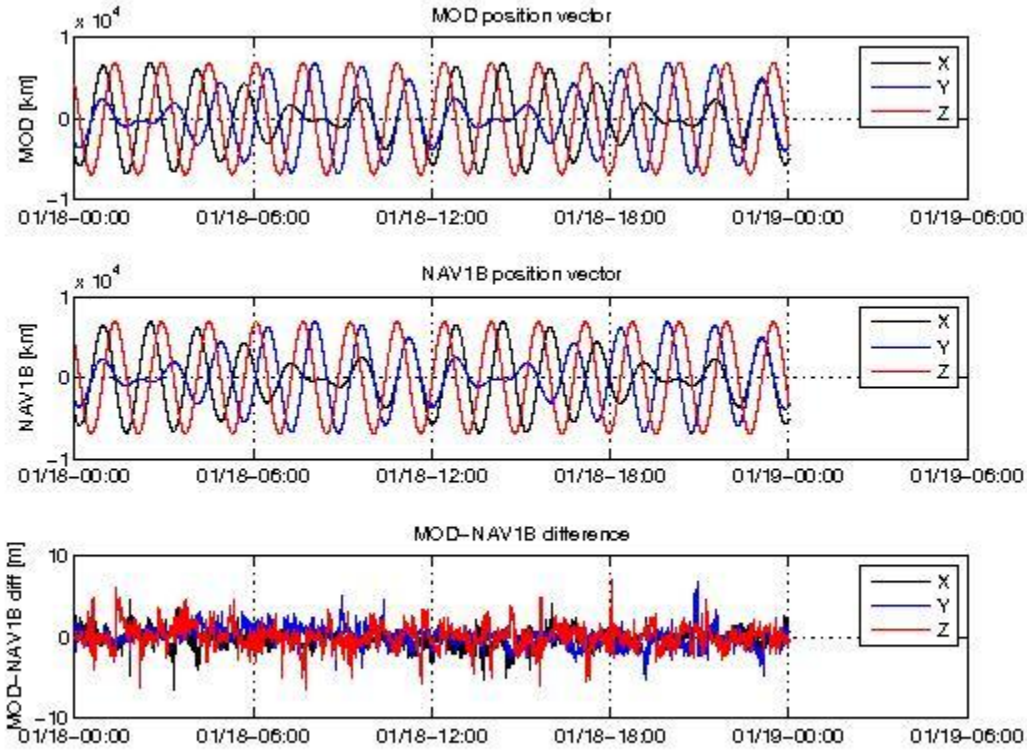

Figure 6: Difference MOD-GPSNAV, sc B, 18/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.2.2 Attitude observations

- **SW-IDEAS-50**

  Affected products:

  SW_OPER_STRBATT_1B_20150113T000000_20150113T235959_0302

  24 seconds out of range (Flags_q=255, no attitude available). See details in Table 6 below.

Start Out-of-range	Stop Out-of-range	Duration (s)
13JAN2015 08:06:11	13JAN2015 08:06:35	24

Table 6: Attitudes out-of-range, S/C B, 2015, week 03.

The cause of such rejected attitudes is the simultaneous occurrence of BBOs on all cameras for the specified interval.

3.2.3 Swarm C

3.2.3.1 Position Statistics

In Table 7 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, 12/01 - 18/01, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
12/01	0.09	-9, 8 (Z)	1.3	SW-IDEAS-34 [RD.10]
13/01	0.18	-11.5, 6 (Z)	1.4	
14/01	0.2	-8, 9 (Z)	1.3	
15/01	0.17	-9.4, 10 (Z)	1.5	
16/01	0.14	-7.3, 10.3 (Z)	1.4	
17/01	0.08	-7, 9 (Z)	1.3	SW-IDEAS-34 [RD.10]
18/01	0.2	+/- 6 (Z)	1.2	

Table 7: 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 (12/01, Figure 7), in the middle (15/01, Figure 8) and at the end (18/01, 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.

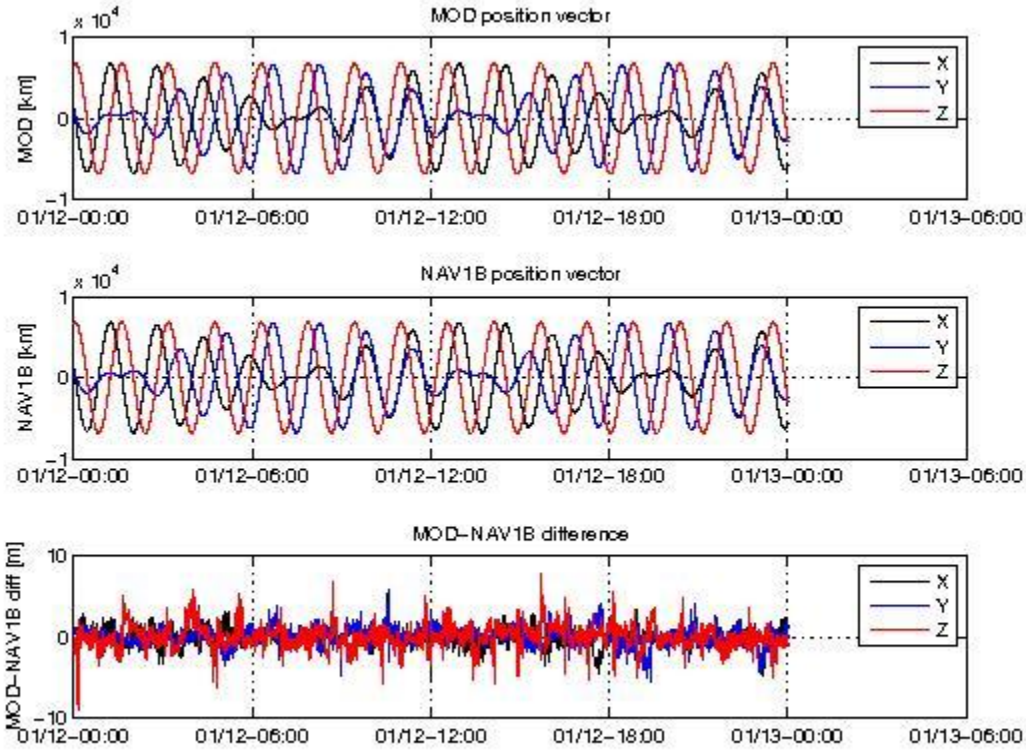

Figure 7: Difference MOD-GPSNAV, sc C, 12/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

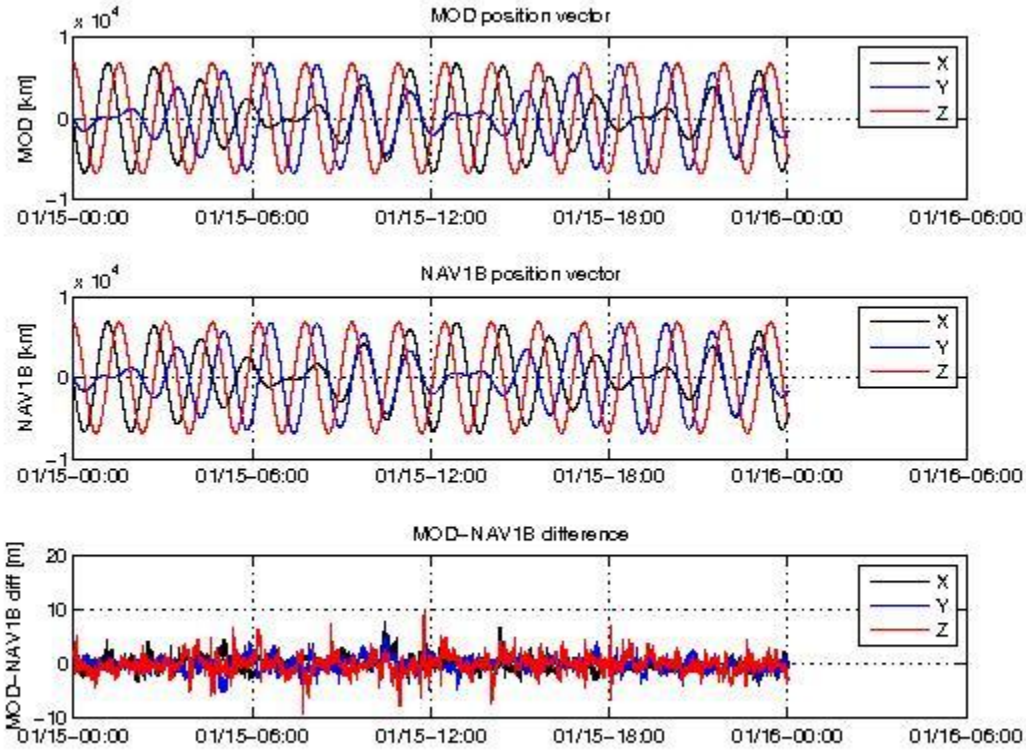

Figure 8: Difference MOD-GPSNAV, sc C, 15/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

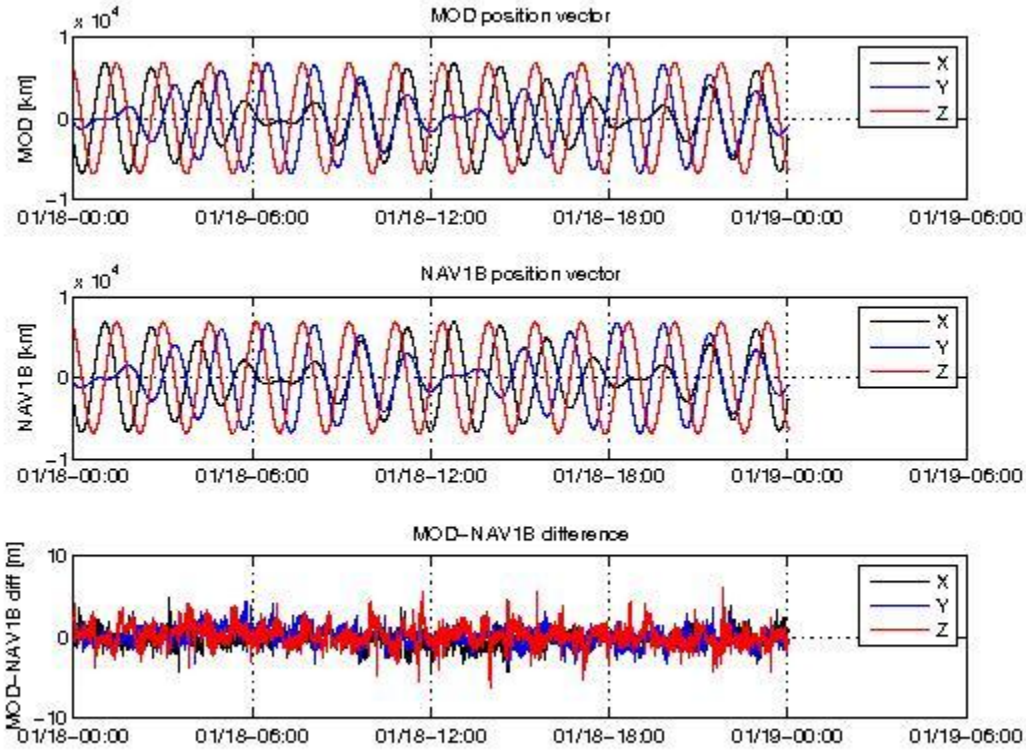

Figure 9: Difference MOD-GPSNAV, sc C, 18/01/2015. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

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]: Geomagnetic activity is low throughout the week and we do not observed high level of noise in the high frequency region of the spectra.

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 (17/01/2015).

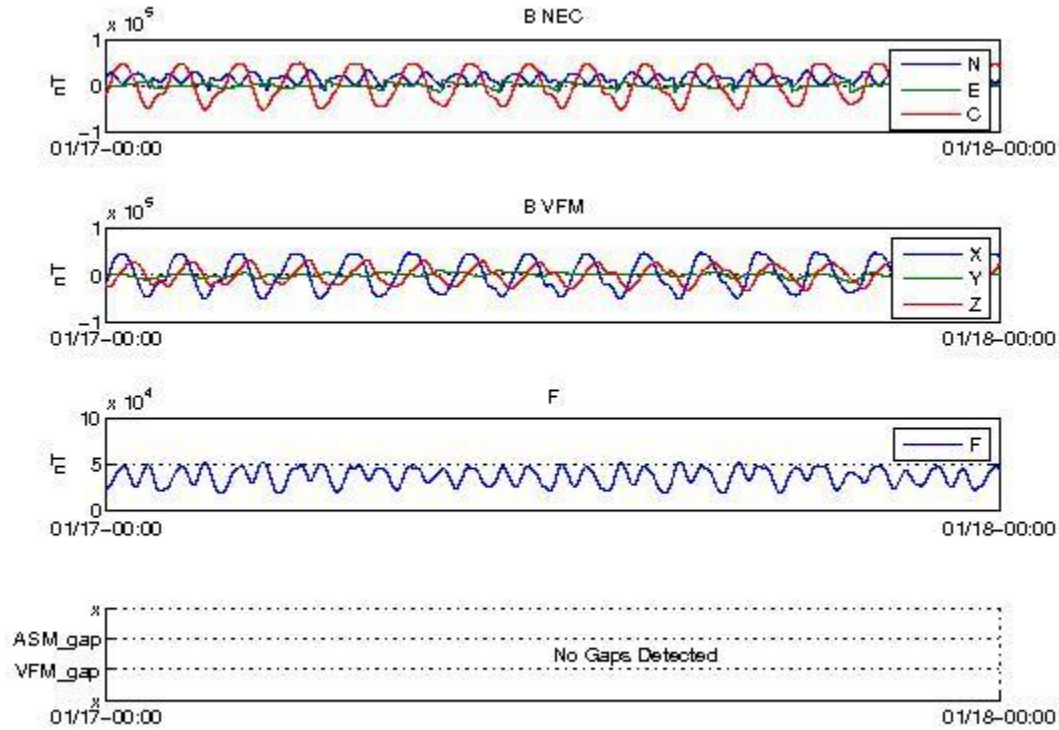

Figure 10: Time series of the geomagnetic field, for 17/01/2015, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.1.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-3, 4.5] nT, with occasional spikes up to about 6 nT.

Below two example plots of such differences follows: taken at the beginning of the week 13/01 (Figure 11) and 15/01, (Figure 12). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

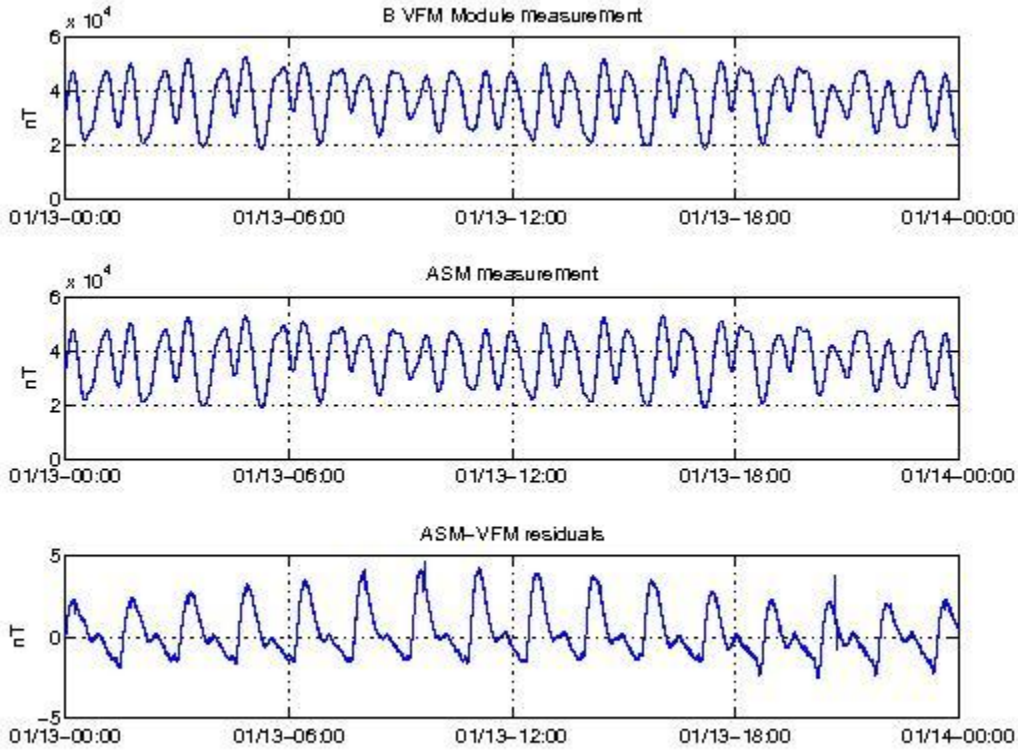

Figure 11: VFM module, ASM module and ASM-VFM residuals for S/C A, 13/01/2015.

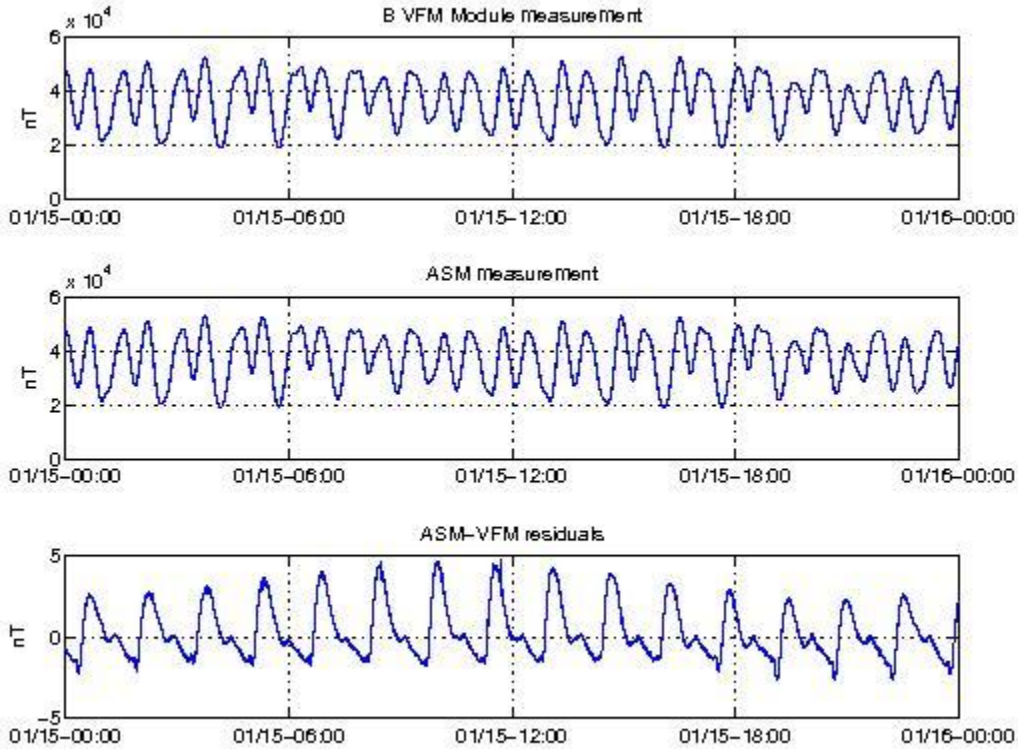

Figure 12: VFM module, ASM module and ASM-VFM residuals for S/C A, 15/01/2015.

3.3.1.3 TCF.VFM monitoring

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

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 (17/01/2015) can be seen in Figure 13 below.

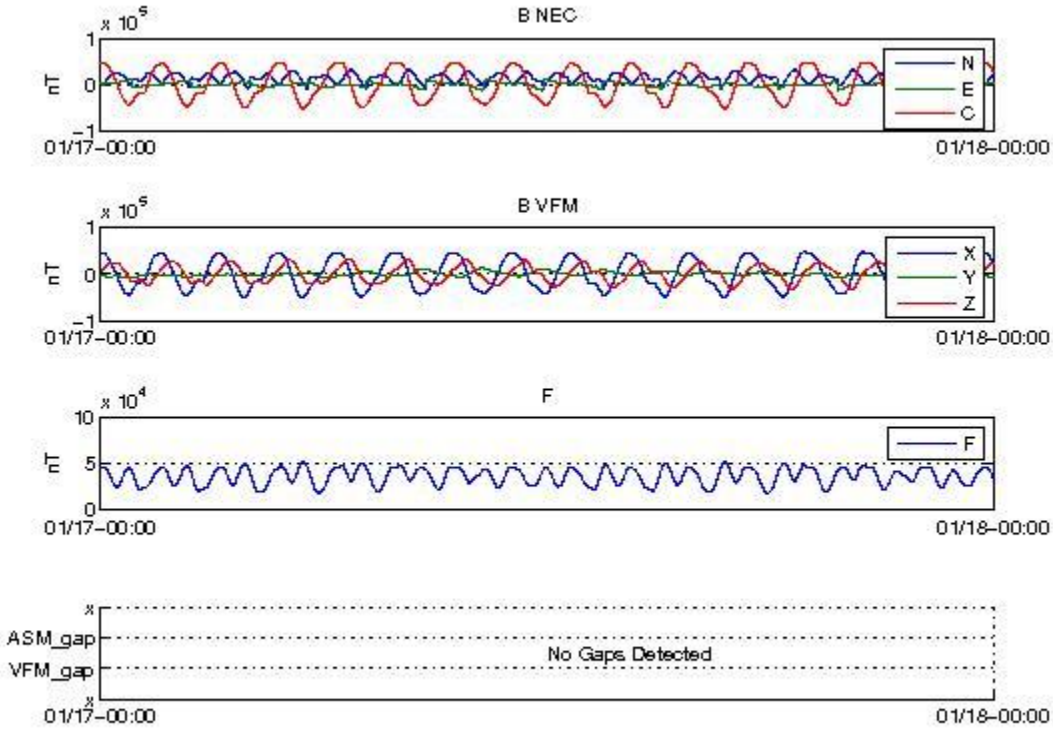

Figure 13: Time series of the geomagnetic field for 17/01/2015, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.2.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-1.5, 2] nT, with peaks of about 8 nT.

Below two example plots follows of such differences: 13/01 (Figure 14), and 15/01 (Figure 15). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

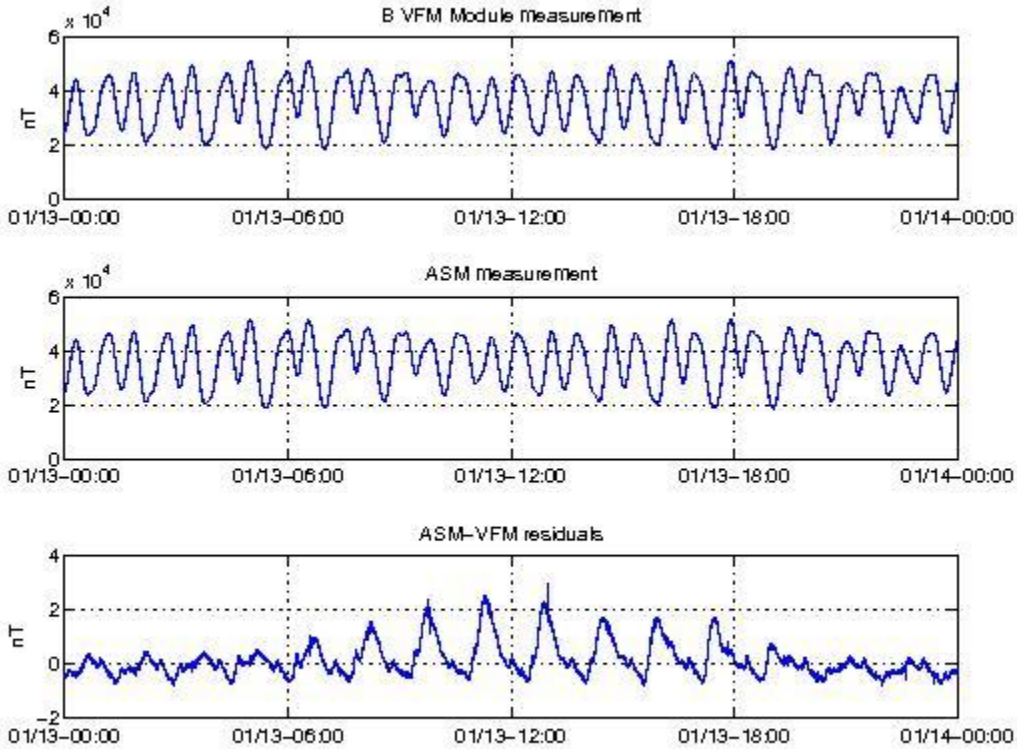

Figure 14: VFM module, ASM module and ASM-VFM residuals for S/C B, 13/01/2015

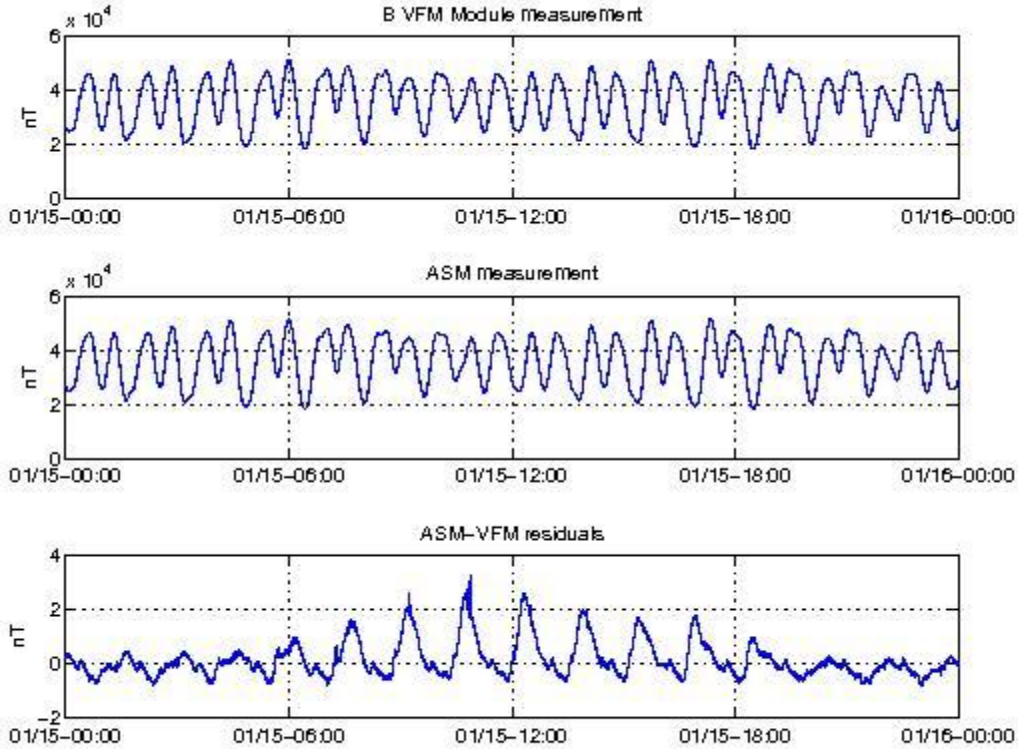

Figure 15: VFM module, ASM module and ASM-VFM residuals for S/C B, 15/01/2015.

3.3.2.3 TCF.VFM monitoring

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

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 January.

4. ON-DEMAND ANALYSIS

4.1 SWL1L1DB-40: $B_{NEC} - B_{models}$ residual increase follow-up.

GMV has discovered the source of the issue in the processor code. This seems due to the initialization of EOP class. EOP EarthOrientation class is a generic function used to compute the rotation matrix to convert ICRF to ITRF, and, because of a bug, discrepancies in the rotation are introduced when a new leap second entry is added. A fix has been already committed, and will be part of a patch to the L1B 3.12 processor, to be delivered at the beginning of next week (26 or 27/01).

In the meanwhile, the PDGS has put a workaround in place, replacing the updated USLEAP auxiliary file (file counter 0002), with its previous version (file counter 0001) starting from the production of day 18/01.

In Figure 16 and Figure 17 one can see comparison plots from day 17/01, when still the USLEAP used in the processing was the updated one (0002), and from day 18/01, when the old USLEAP has been put in place, for Swarm A. It is clear that the residual on the east component decreases and goes back to values in line with the expectations.

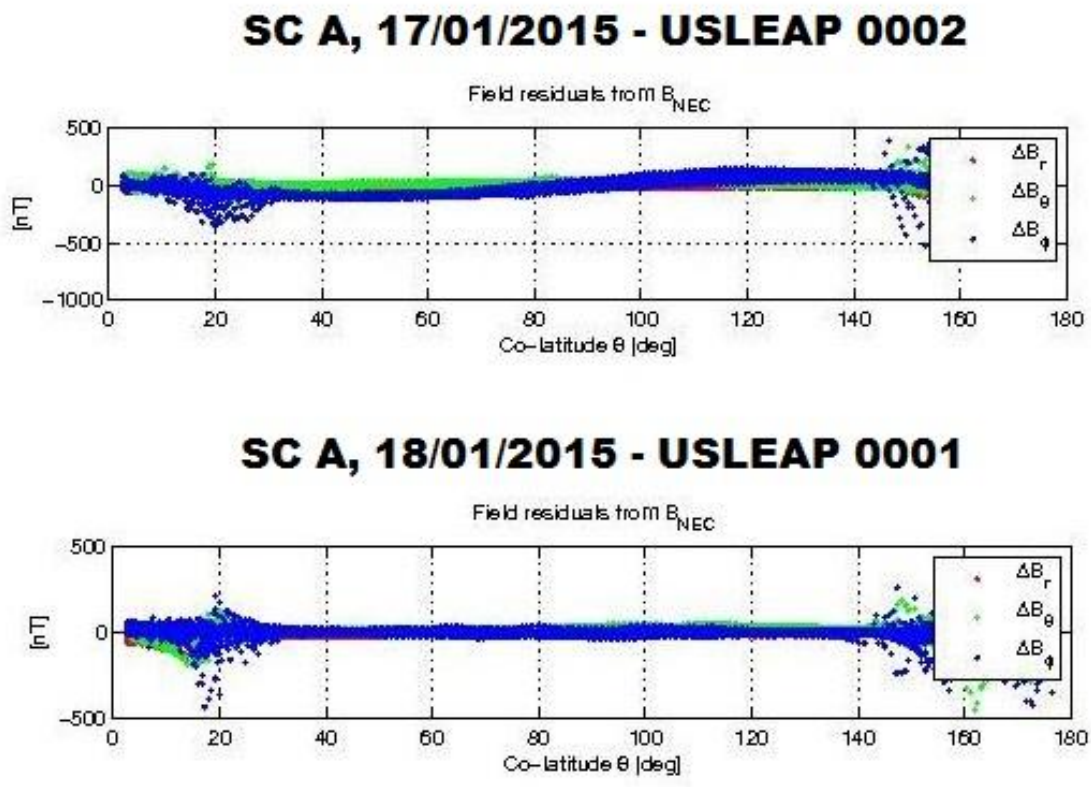

Figure 16: B_{NEC} - B_{CHAOS}, as a function of colatitude.

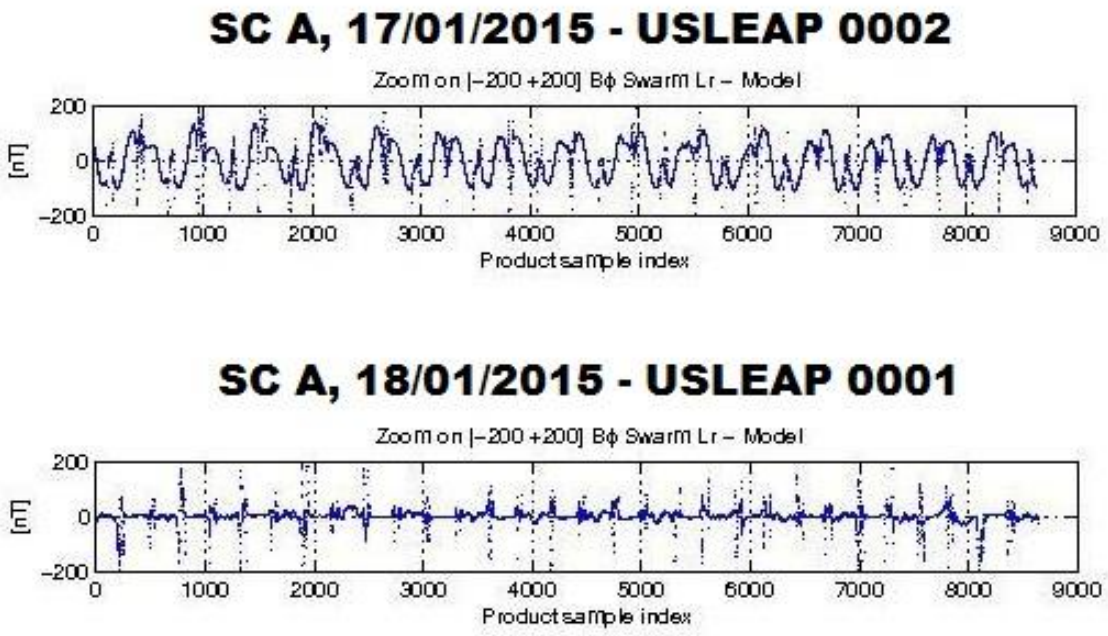

Figure 17: B_{NEC} - B_{CHAOS}, time series of the east component.

5. YEAR 2014, WEEK 52 (22/12 – 28/12): SUMMARY OF THE OBSERVATIONS

Week 52 production was smooth and without relevant issues. We report here a quick summary of the main observations.

5.1 Swarm A

5.1.1 Orbit and Attitude Products

- **MOD-NAV difference:** no major issues. Usual occurrence of several SW-IDEAS-34 ([RD.10]) events throughout all the week. The average difference is around 0.15 m, with a standard deviation on the Z component of about 1.5 m on average. An example for day 28/12/2014 is shown in Figure 18 below.

- **Attitudes:** nothing to report.

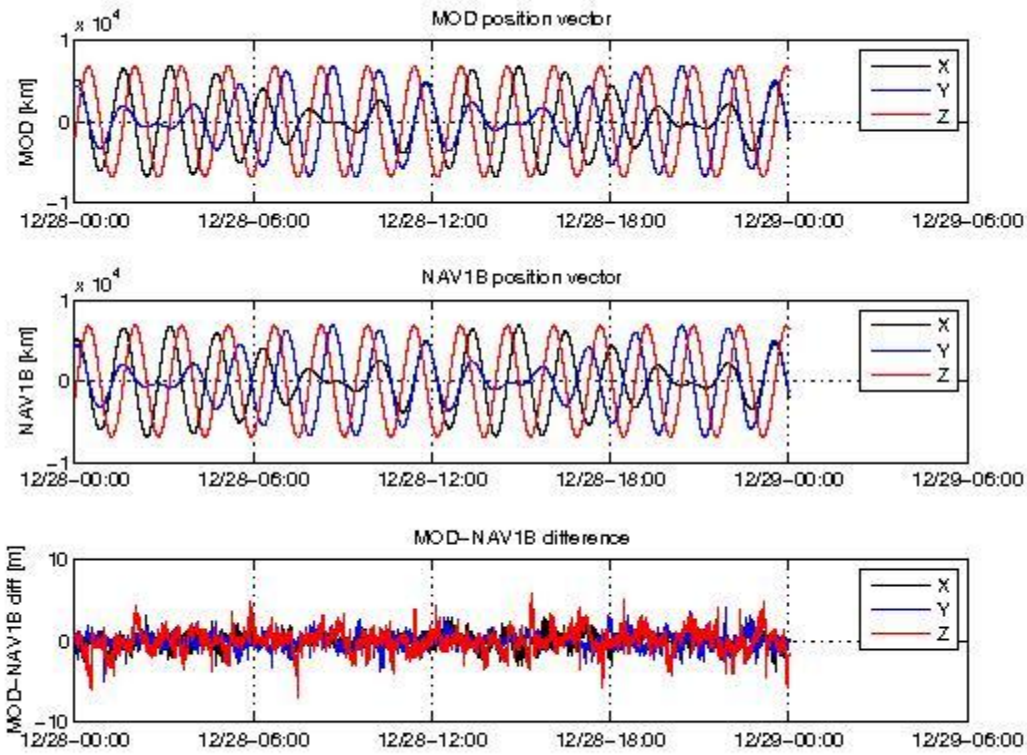

Figure 18: MOD-NAV solution difference for SC A, 28/12/2014.

5.1.2 Magnetic Products

Nothing special to report. In Figure 19 below, an example of ASM-VFM residual for day 25/12/2014 is shown. On average the residual is in the range [-2, 1.8] nT, with occasional spikes that reach up to 6 nT. The high-frequency noise during the week is moderate to low (**SW-IDEAS-27**, [RD.13]).

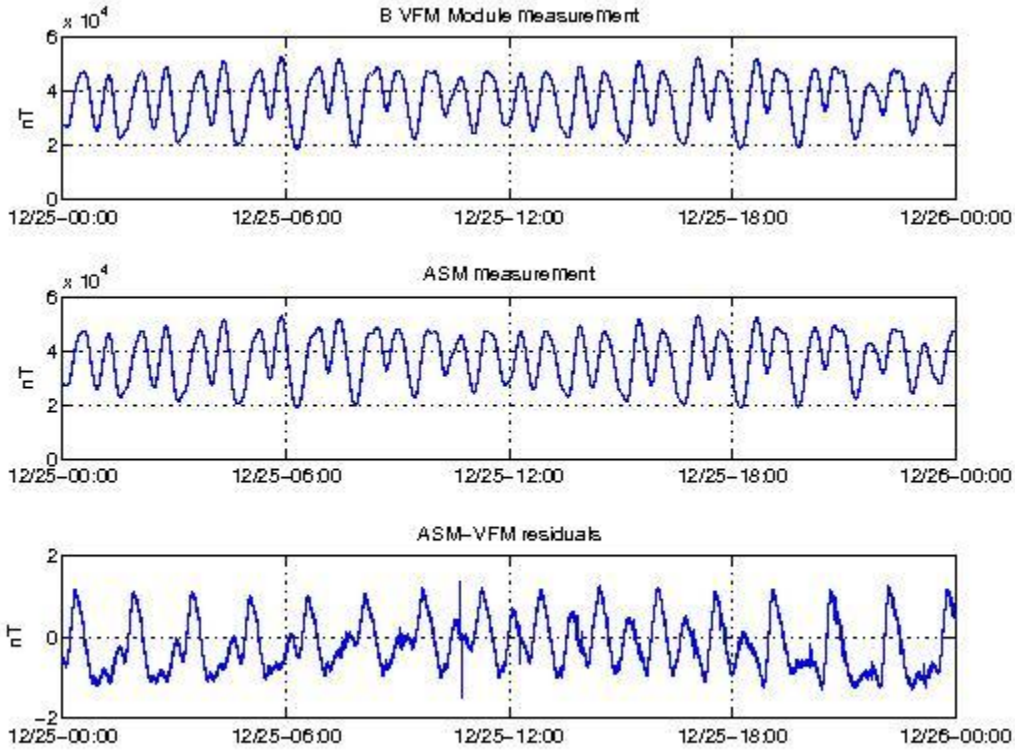

Figure 19: VFM module, ASM module and ASM-VFM residuals for S/C A, 25/12/2014.

5.2 Swarm B

5.2.1 Orbit and Attitude Products

- **MOD-NAV difference:** no major issues. Usual occurrence of several SW-IDEAS-34 ([RD.10]) events throughout all the week. The average difference is around 0.13 m, with a standard deviation on the Z component of about 1.4 m on average. An example for day 28/12/2014 is shown in Figure 20 below.

- **Attitudes:** nothing to report.

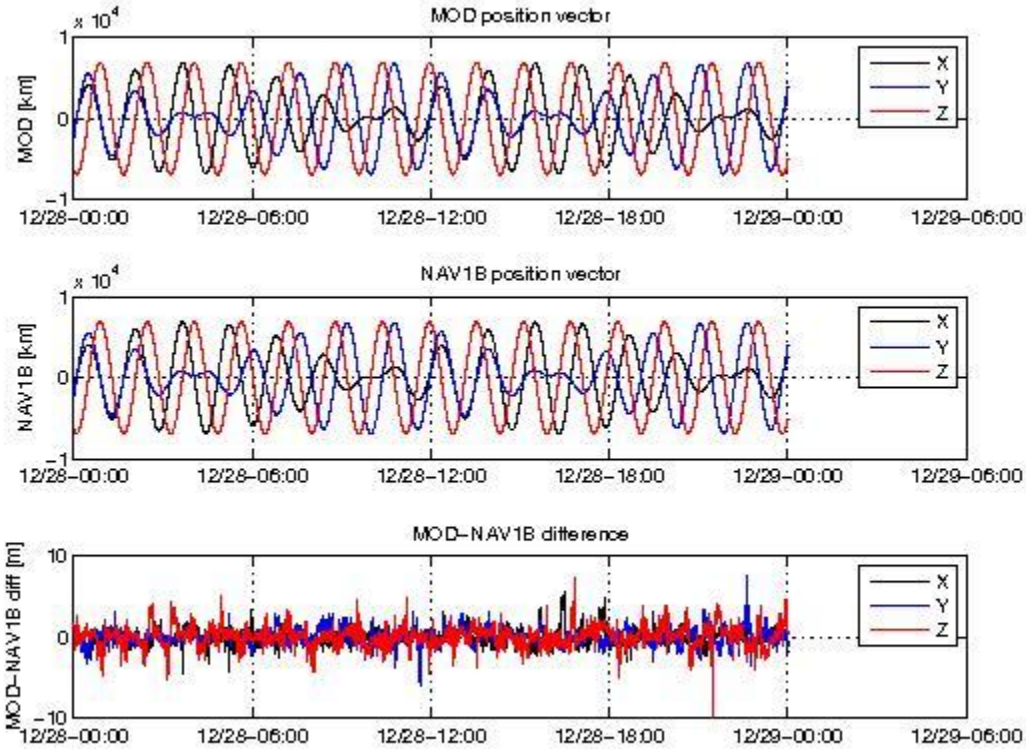

Figure 20: MOD-NAV solution difference for SC B, 28/12/2014.

5.2.2 Magnetic Products

Nothing special to report. In Figure 21 below, an example of ASM-VFM residual for day 25/12/2014 is shown. On average the residual is in the range [-1.5, 2] nT, with occasional spikes that reach up to 9 nT. The high-frequency noise during the week is moderate to low (**SW-IDEAS-27**, [RD.13]).

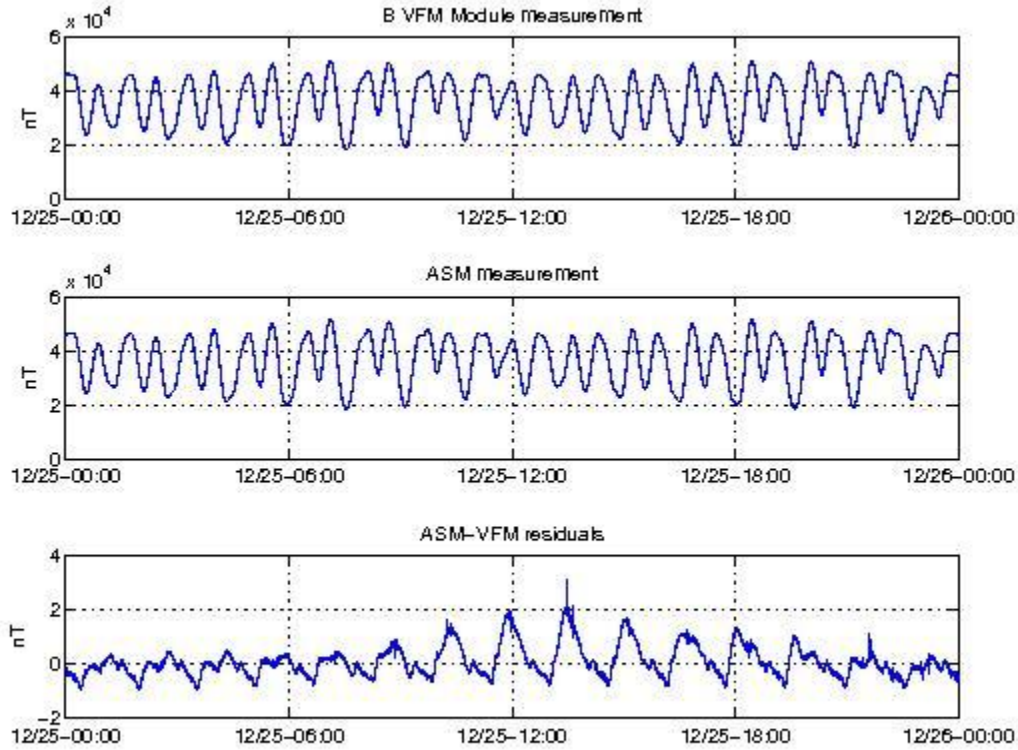

Figure 21: VFM module, ASM module and ASM-VFM residuals for S/C B, 25/12/2014.

5.3 Swarm C

5.3.1 Orbit and Attitude

- **MOD-NAV difference:** no major issues. Usual occurrence of several SW-IDEAS-34 ([RD.10]) events throughout all the week. The average difference is around 0.12 m, with a standard deviation on the Z component of about 1.4 m on average. An example for day 28/12/2014 is shown in Figure 22 below.

- **Attitudes:** One event of out-of-range attitudes (flags_q=255), to be reported the 28/12/2014. Attitudes rejected for 6 seconds between 13:08:13 and 13:08:19 UT because of the simultaneous occurrence of BBOs on CU 1 and 2 and invalid measurements on CU 3.

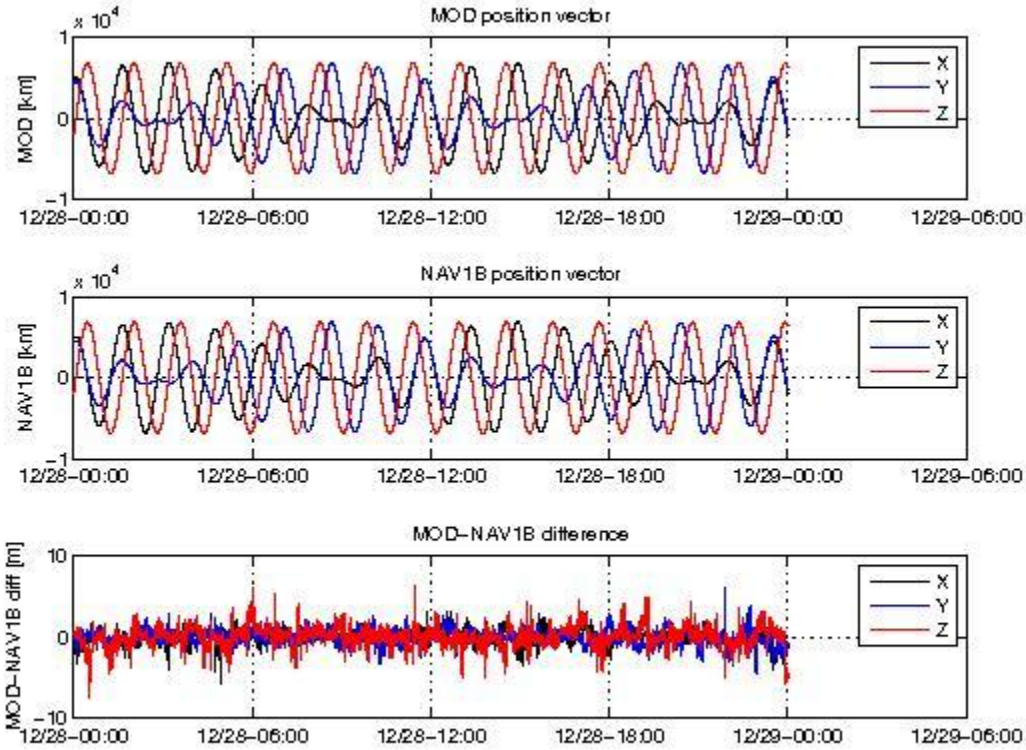

Figure 22: MOD-NAV solution difference for SC C, 28/12/2014.

End of Document