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IDEAS+ Swarm Weekly Report : 13/10/2014 – 19/10/2014

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period from 13 to 19 October, 2014.

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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	24 Oct 2014	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 3.11p2, 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.2.11p2

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_20141001_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_20140908_20140914.pdf

[RD.10] IDEAS+ Swarm Weekly Report: 15/09/2014 – 21/09/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20140929_20141005.pdf

[RD.11] IDEAS+ Swarm Weekly Report: 22/09/2014 – 28/09/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20141006_20141012.pdf

2. SUMMARY OF THE OBSERVATIONS

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

With respect to the previous reporting period, the following updates have to be reported:

Status of EFI – TII recent operations. The burn-in procedure executed on Swarm C gave promising results: the gain maps seem to considerably improve. The "scrubbing" cycle has been scheduled to be repeated two more times, then the EFI team will evaluate the results and plan the way forward. For what concerns the other S/C: A starts to show degradations and has been scheduled to be powered off on 24/10; B is currently off and will be powered on again around the 29/10. An interesting preliminary analysis has been shown by the Calgary team: the magnitude of the 2nd y moment of the image distribution, which is a good indicator of the image anomaly, has a remarkable dependence on the latitude; it seems it increases a lot at high latitudes while it keeps reasonable values in a strip around the equator.

The GPSR antenna field-of-view has been increased from 80 degrees to 83 degrees on all three satellites, with the following timeline:

- Swarm Alpha - 21/10/2014 (DoY 294) at 10:20 UTC
- Swarm Bravo - 22/10/2014 (DoY 295) at 11:11 UTC
- Swarm Charlie - 22/10/2014 (DoY 295) at 14:31 UTC

The larger antenna field-of-view aims at increasing the number of tracked GPS satellites in situations when only few GPS satellites are tracked.

2.2 Plan for operational processor updates

From the last L1B coordination teleconference the following updates shall be reported:

- The GPS patch (ORBATT 3.11_p3) has been deployed in operations the 23/10. New GPS CCDB have been delivered to the PDGS, to the ESLs and PLSO. No major issues have been encountered and the first operational data following the patch have been produced nominally, with baseline "0302".

2.3 Quality Working Group and Cal/Val Coordination

The third QWG – Cal/Val meeting is being planned for the 2-5 December 2014 at GFZ premises in Potsdam, Germany.

A number of Task forces, each dedicated to an instrument group, continuously co-ordinates the investigation of the various anomalies.

2.4 Summary of observations for Week 42 (13-19/10/2014)

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]); moreover, also this week we observed cases where the solution difference seems to vary systematically in a quasi-sinusoidal way: this effect seems correlated with periods when the GPS clock cannot be determined in the MOD data (**SW-IDEAS-36**, [RD.11]).

2. **Three cases of attitude rejection (Flags_q = 255 in STRxATT_1B products) occurred:** two of them are expected, as come from simultaneous occurrence of BBOs or invalid measurements in the three camera units; one of them (S/C C, 19/10/2014) is under investigation, because it comes from a gap in the STR level 1A product which does not correspond to a gap in the source STR Level 0 product.

3. **Two ORBATT failures occurred**, on 16/10 SC A and 17/10 SC B. The reasons are known and properly reported to the manufacturer through SPRs: a fix to this will be included in the upcoming L1B delivery and the failed productions will be recovered.

4. **ASM-VFM residuals superimposed noise** observed again (**SW-IDEAS-27**, [RD.9]) especially in the second half of the week.

3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

SW-CP-AR-239: ORBATT processing failure: Segmentation fault

On day 16/10/2014 ORBATT on S/C C had a failure. The processor exited with a segmentation fault message. So no product has come out from day 16/10, S/C C.

The issue already documented as internal PDGS anomaly (SW-CP-AR-239) is also reported to the processor manufacturer (SW-L1BOP-SPR-282): the problem will be fixed in the next L1BOP delivery at the end of October.

SW-CP-AR-236: ORBATT processing failure: what(): Decomposition failed

On day 17/10/2014 ORBATT on S/C B had a failure. The processor exited with a segmentation fault message. So no product has come out from day 17/10, S/C B.

The issue already documented as internal PDGS anomaly (SW-CP-AR-236) is also reported to the processor manufacturer (SW-L1BOP-SPR-279): the problem is going to be fixed in the next L1BOP delivery at the end of October.

Both SPRs described above seems to be related to a problem in the STR processing part: a cubic B-spline interpolation is performed in order to align to the same time stamps the measures of the single cameras when they are merged in a single solution. Such interpolation is iteratively reweighted and least-squared in order to minimize the residuals between the model (spline parameters) and measured quaternions. The convergence of the iteration procedure seems to depend on some particular choice of the knot-space spline parameter and investigations are on-going in order to find the optimal choice.

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)	3.2.3.1	[RD.10]
SW-IDEAS-36	OBS_ROUTINE: deviations of MOD-NAV difference and GPS clock deteriorated	Orbits (position and velocity)	3.2.1.1	[RD.11]
SW-IDEAS-38	OBS_ROUTINE: 16/10/2014, STR	STRAATT_1B STRASCI_1A	3.2.1.2	3.2.1.2

	S/C A out of range.			
SW-IDEAS-39	OBS_ROUTINE: 17/10/2014, STR S/C C out of range.	STRCATT_1B STRCSCI_1A	3.2.3.2	3.2.3.2
SW-IDEAS-40	OBS_ROUTINE: 19/10/2014, STR S/C C out of range – ANOMALOUS CASE	STRCATT_1B STRCSCI_1A	3.2.3.2	3.2.3.2

Table 1: list of events related to attitude and orbit products to be reported in the monitoring for Week 42: 13 - 19/10/2014

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, 13-19/10/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard deviation (m)**	**Notes**
13/10	0.11	-12.2 (Z), 10.3 (X)	1.8	SW-IDEAS-34

Swarm A, 13-19/10/2014, Position difference				
				[RD.10]
14/10	0.17	-8.2 (Z), 10.6 (X)	1.6	SW-IDEAS-34 [RD.10]
15/10	0.12	-8.6, 8 (Z)	1.5	
16/10	0.09	-7.2 (Z), 25.6 (Y)	1.5	Single big spike on Z comp. around 17 UT
17/10	0.07	-10, 14 (Z)	1.7	SW-IDEAS-36 [RD.11]
18/10	0.2	-13.4 (Y), 8 (Z)	1.2	
19/10	0.13	-8 (Z), 8 (X)	1.6	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 (13/10, Figure 1), in the middle (17/10, Figure 2) and at the end (19/10, 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 observation of **SW-IDEAS-36**: the red-circled area characterizes the time interval where the pseudo-oscillatory behaviour is observed; the MOD clock (not shown) for the same interval, displays several linearly interpolated segments, as shown in [RD.11].

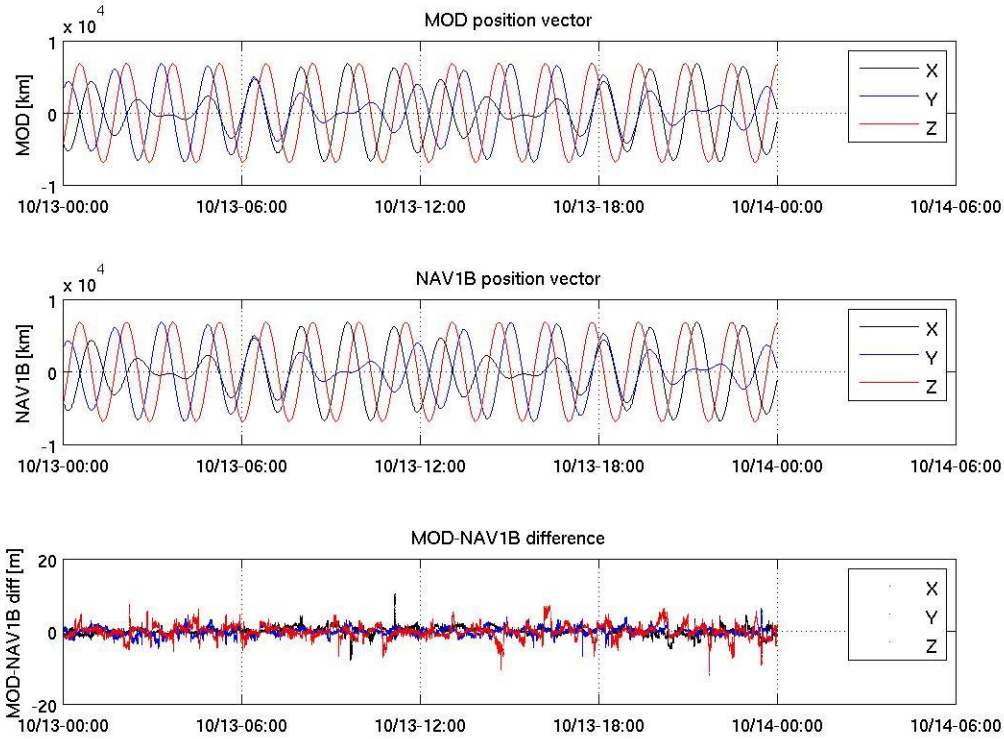

Figure 1: Difference MOD-GPSNAV, sc A, 13/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

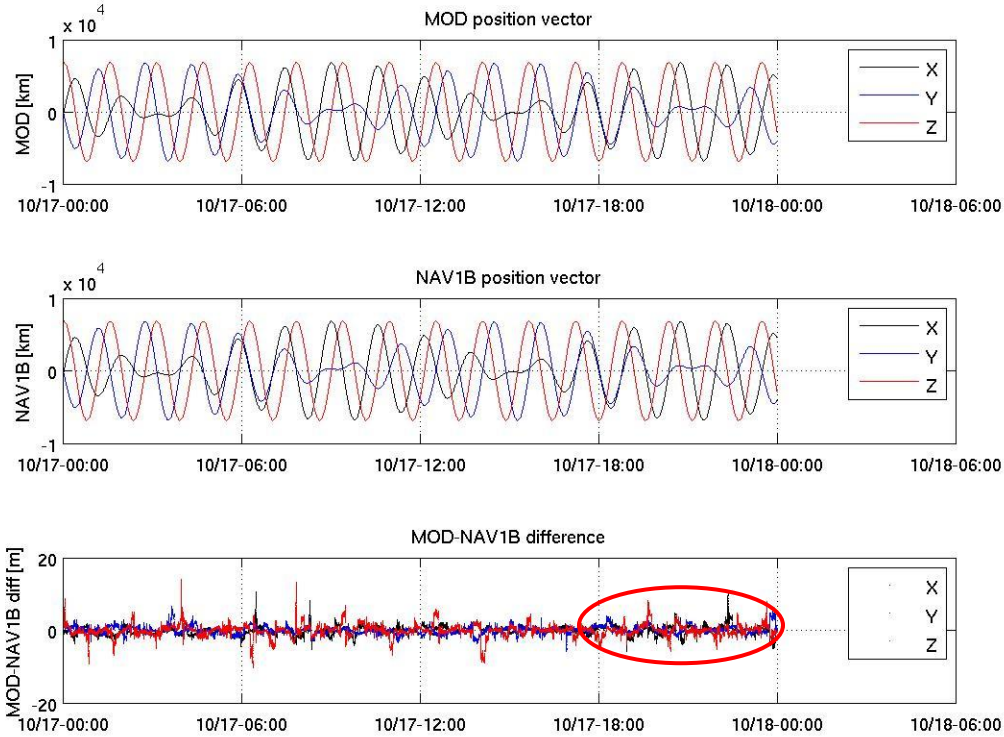

Figure 2: Difference MOD-GPSNAV, sc A, 17/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The red-circled area characterizes the time interval where the pseudo-oscillatory behaviour is observed.

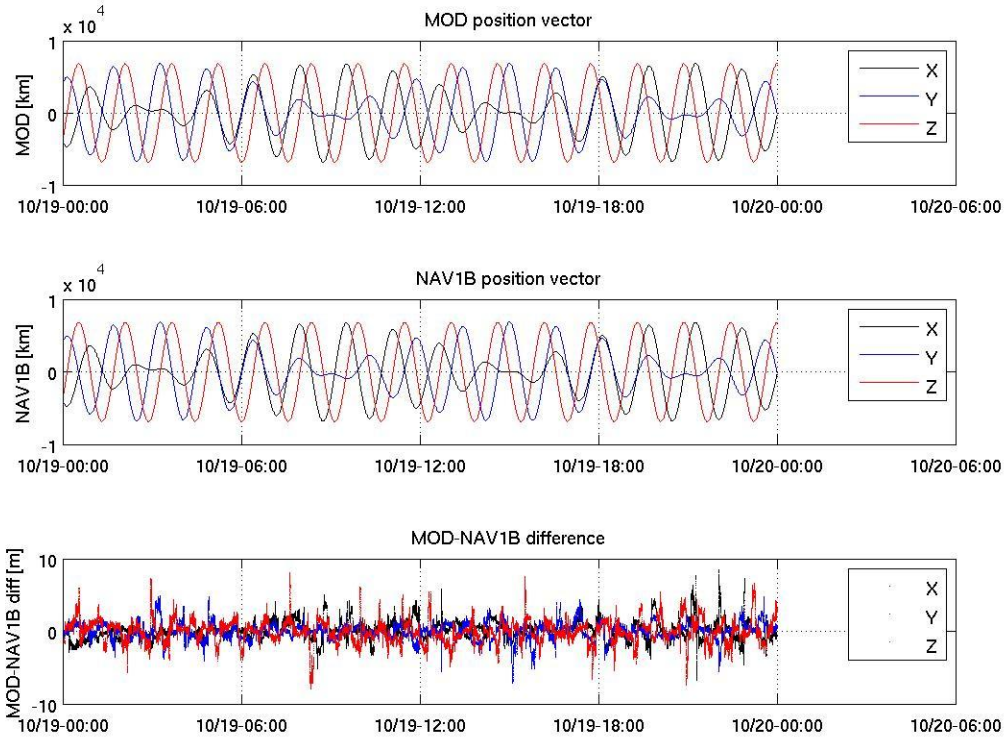

Figure 3: Difference MOD-GPSNAV, sc A, 19/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.1.2 Attitude observations

- **SW-IDEAS-38**
  Affected product:
  SW_OPER_STRAATT_1B_20141016T000000_20141016235959_0301

  9 seconds out of range (Flags_q=255, no attitude available).
  See Table 3 for details.

Start Out-of-range	Stop Out-of-range	Duration (s)	Value
16OCT2014 01:35:25	16OCT2014 01:35:29	5	255
16OCT2014 01:35:54	16OCT2014 01:35:57	4	255

Table 3: Attitudes out-of-range, S/C A, 16/10/2014

The cause of such rejected attitudes is the simultaneous occurrence of BBOs on camera units 1 and 2 and invalid measurements on camera unit 3 for the specified interval.

3.2.2 Swarm B

3.2.2.1 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 B, 13-19/10/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
13/10	0.13	-10.7, 13 (Z)	1.8	SW-IDEAS-34 [RD.10]
14/10	0.12	-14.5, 9 (Z)	2	SW-IDEAS-34 [RD.10]
15/10	0.05	-7.2 (Y), 14 (Z)	1.4	
16/10	0.08	-11.7, 7.7 (Z)	1.6	SW-IDEAS-34 [RD.10]
17/10	No data	No data	No data	See Sect. 3.1
18/10	0.2	-5.7, 7.2 (Z)	1.1	SW-IDEAS-34 [RD.10]
19/10	0.04	-9 (Z), 7.3 (X)	1.5	SW-IDEAS-34 [RD.10]

Table 4: 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 (13/10, Figure 4), in the middle (16/10, Figure 5), and at end of the week (19/10, 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.

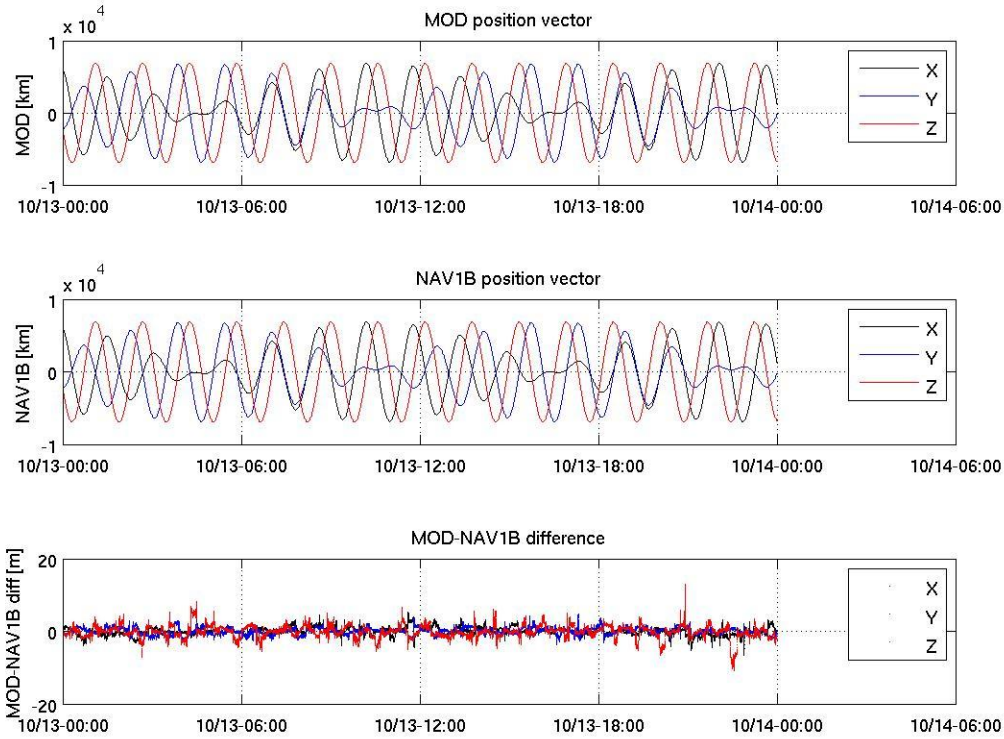

Figure 4: Difference MOD-GPSNAV, sc B, 13/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

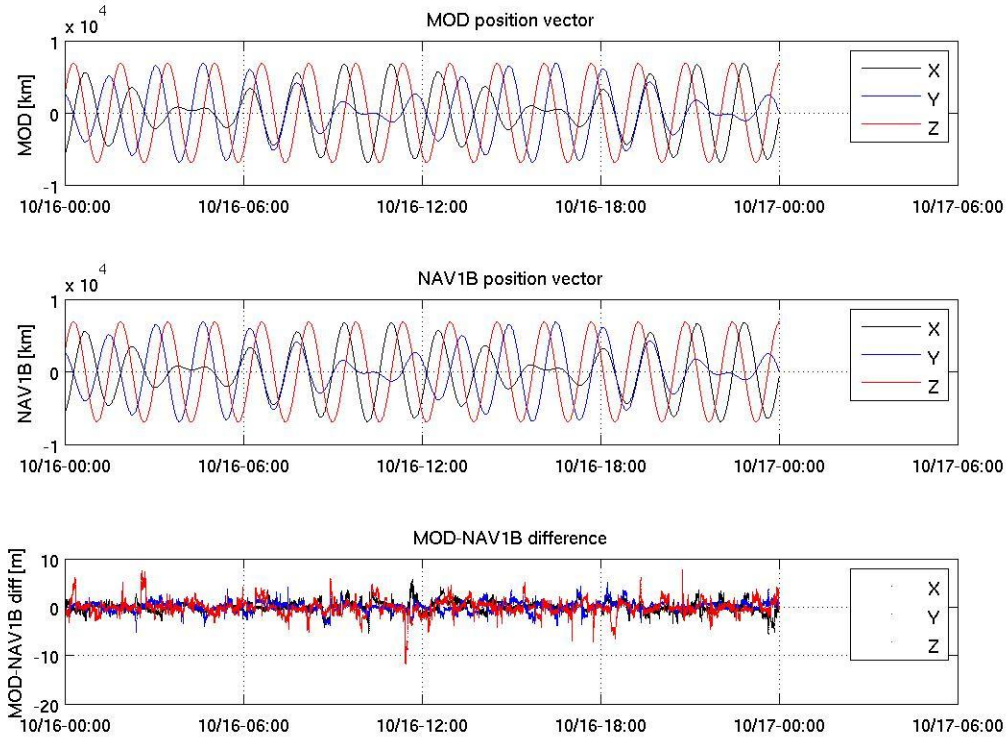

Figure 5: Difference MOD-GPSNAV, sc B, 16/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

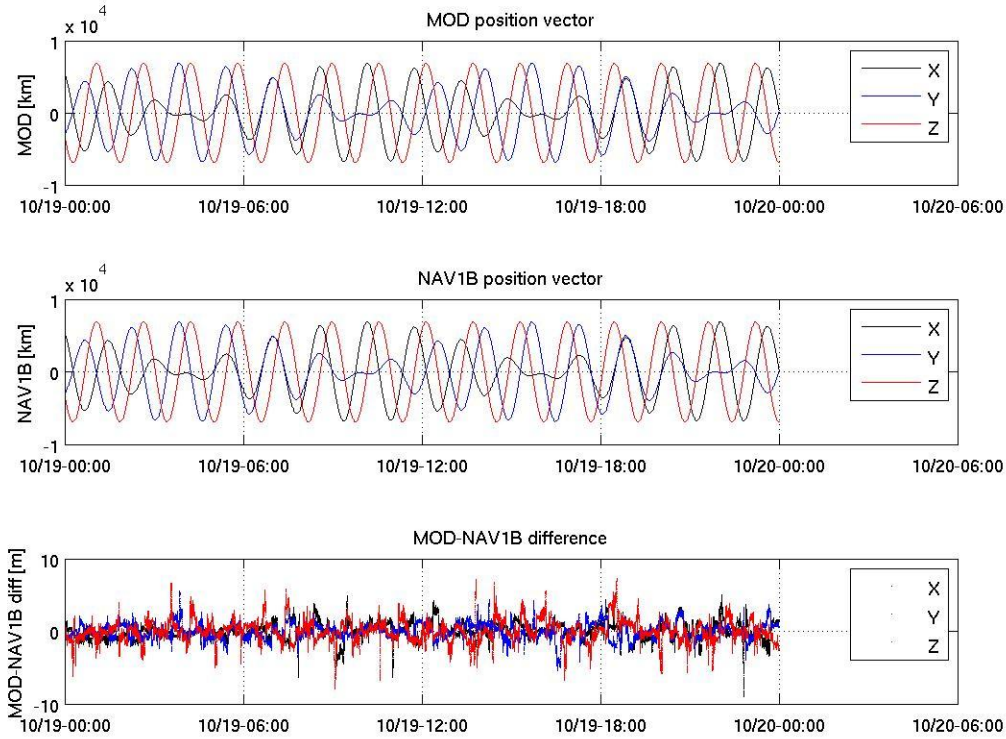

Figure 6: Difference MOD-GPSNAV, sc B, 19/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.2.2 Attitude observations

Nothing to report.

3.2.3 Swarm C

3.2.3.1 Position Statistics

In Table 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 C, 13-19/10/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
13/10	0.08	-12.6, 8.7 (Z)	1.8	SW-IDEAS-34

Swarm C, 13-19/10/2014, Position difference				
				[RD.10]
14/10	0.16	-8, 8.5 (Z)	1.6	
15/10	0.1	-9 (X), 10.7 (Z)	1.4	
16/10	No Data	No Data	No Data	See Sect. 3.1
17/10	0.17	-12.3, 15 (Z)	1.7	SW-IDEAS-34 [RD.10]
18/10	0.2	-15.5 (Z), 6.5 (Y)	1.2	
19/10	0.16	-8, 9.6 (X)	1.6	SW-IDEAS-34 [RD.10]

Table 5: 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 (13/10, Figure 7), in the middle (17/10, Figure 8) and at the end (19/10, 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.

In Figure 8: **Difference MOD-GPSNAV, sc C, 17/10/2014. 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 areas highlight regions characterized by "spiky" features (SW-IDEAS-34).** one can see examples of "spiky" features (red-circled area), of the kind described in [RD.11] for **SW-IDEAS-34**: the MOD-NAV difference steeply departs from its average and keeps a higher/lower value for several minutes.

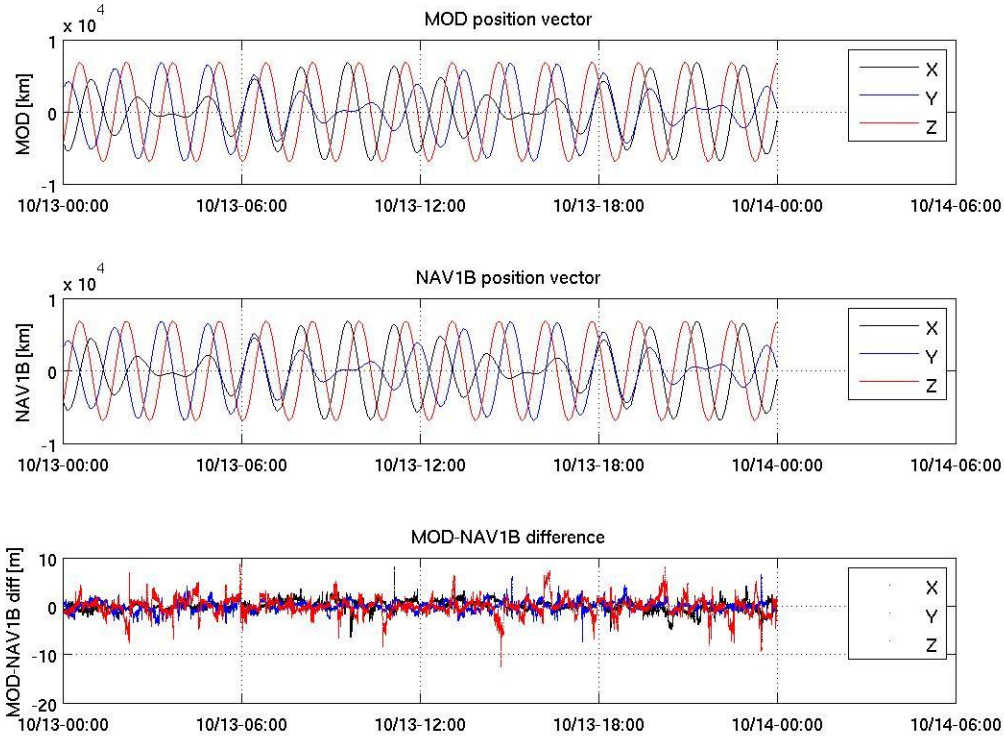

Figure 7: Difference MOD-GPSNAV, sc C, 13/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

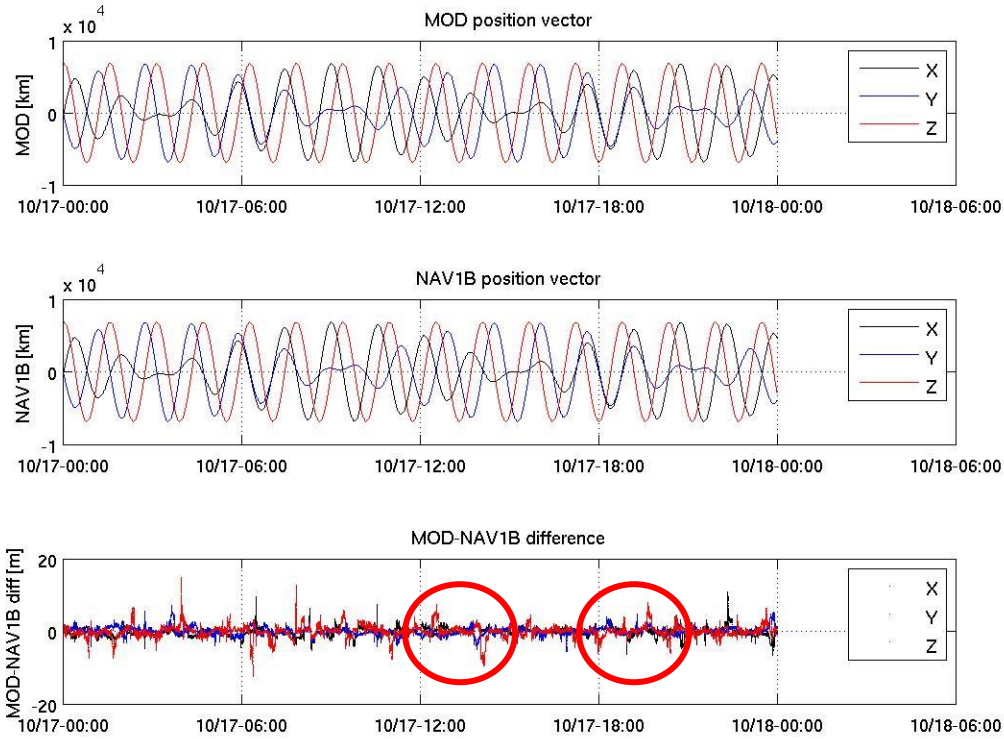

Figure 8: Difference MOD-GPSNAV, sc C, 17/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The red-circled areas highlight regions characterized by "spiky" features (SW-IDEAS-34).

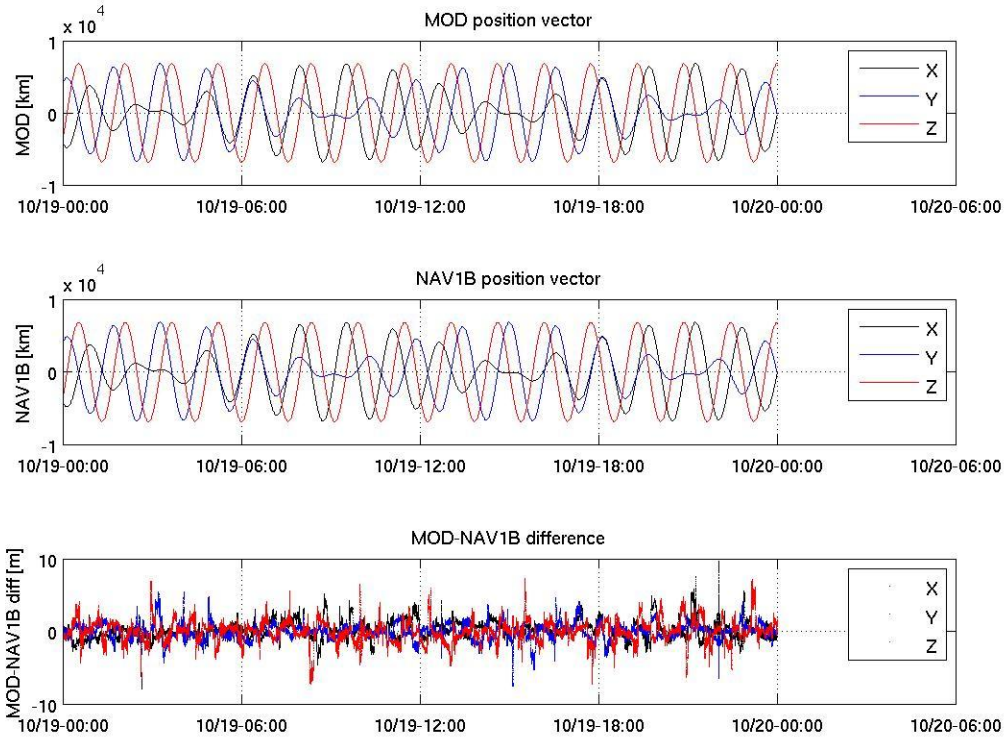

Figure 9: Difference MOD-GPSNAV, sc C, 19/10/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.3.2 Attitude observations

- **SW-IDEAS-39**

Affected product:

SW_OPER_STRCATT_1B_20141017T000000_20141017235959_0301

44 seconds out of range (Flags_q=255, no attitude available).

See Table 6 for details.

Start Out-of-range	Stop Out-of-range	Duration (s)	Value
17OCT2014 01:00:52	17OCT2014 01:01:35	44	255

Table 6: Attitudes out-of-range, S/C C, 17/10/2014

The cause of such rejected attitudes is the simultaneous occurrence of BBOs on camera units 2 and invalid measurements on camera units 1 and 3 for the specified time interval.

- **SW-IDEAS-40**

Affected product:

SW_OPER_STRCATT_1B_20141019T000000_20141019235959_0301

20 seconds out of range (Flags_q=255, no attitude available).

See Table 7 for details.

-

Start Out-of-range	Stop Out-of-range	Duration (s)	Value
19OCT2014 02:38:49	19OCT2014 02:39:07	20	255

Table 7: Attitudes out-of-range, S/C C, 19/10/2014

The cause of such rejected attitudes is a time gap in the Level 1A product:

SW_OPER_STRCSCI_1A_20141018T235500_20141020T000459_0301

The Level 0 source file:

SW_OPER_STRCNOM_0__20141018T115507_20141019T063806_0201 seems not to have time gaps in the corresponding interval.

This seems rather strange, because apparently no operations such as data selections, trimming or rejection is done from Level 0 into Level 1A, except in case of corrupted packets (L0 CRC flag different from 0), which seems not the case here. The anomaly has been put to the L1B processor manufacturer attention.

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

Nothing relevant to report. An example of representative magnetic field time series for S/C A can be seen in Figure 10 (19/10/2014):

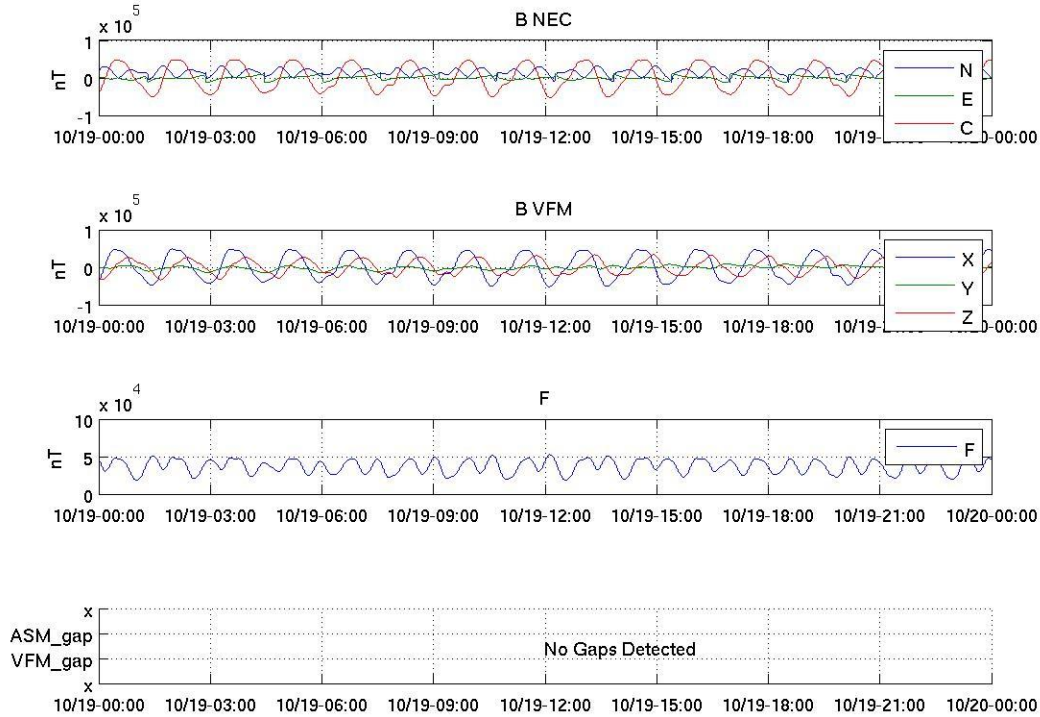

Figure 10: Time series of the geomagnetic field, for 19/10/2014, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.1.2 VFM-ASM anomaly

- **SW-IDEAS-27 (monitoring of the anomaly):** During week 42 we do observe events of noise increase in the ASM-VFM residuals from 17/10 on. A moderate geomagnetic activity is observed especially at high latitudes (AE index at times exceeding 1000 nT).

The daily peak-to-peak difference around the week is, on average: [-1.5, 1.7] nT, with some isolated spike which reaches up to 8 nT.

Below some plot example of such differences follows, taken at the beginning of the week (14/10, Figure 11) middle of week (16/10, Figure 12), and end of the week (19/10, Figure 13). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

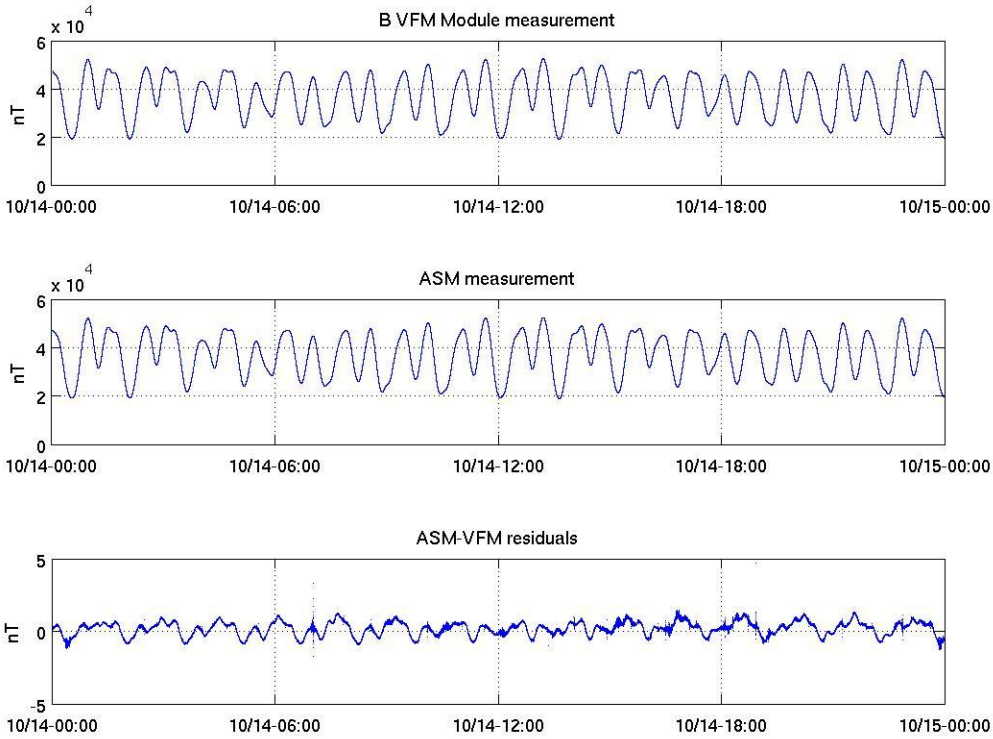

Figure 11: VFM module, ASM module and ASM-VFM residuals for S/C A, 14/10/2014.

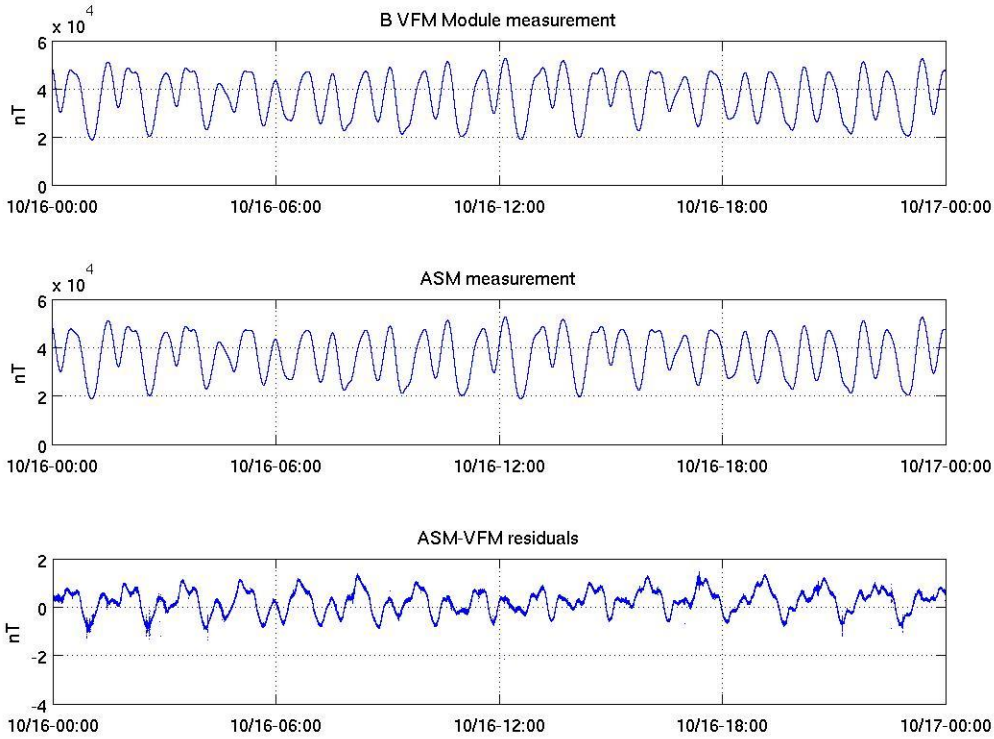

Figure 12: VFM module, ASM module and ASM-VFM residuals for S/C A, 16/10/2014.

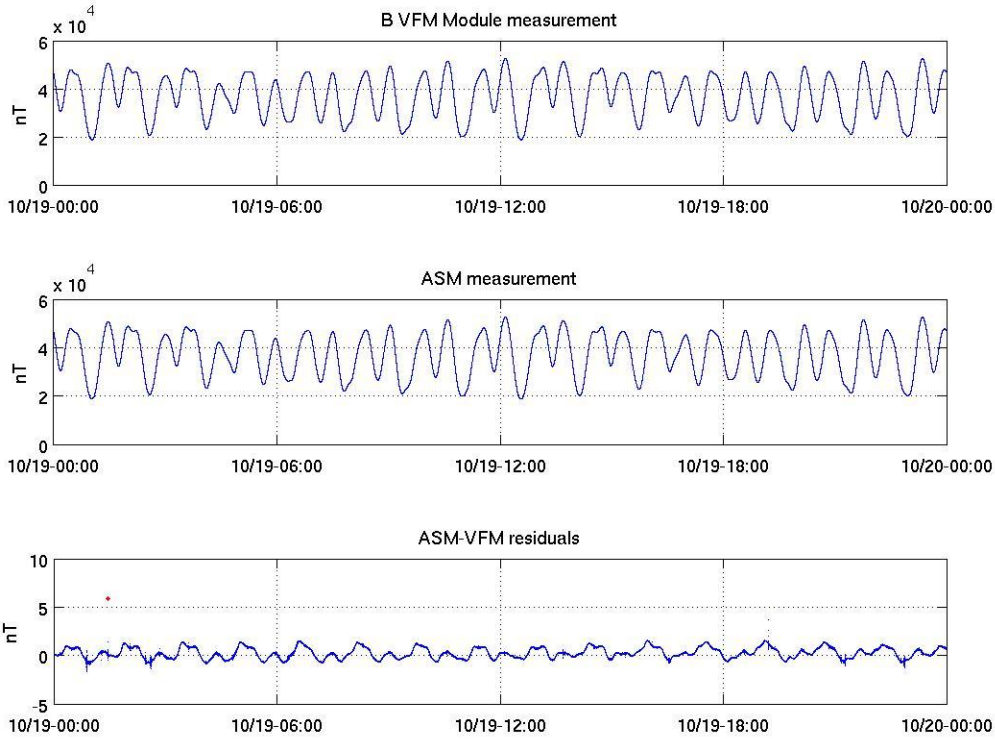

Figure 13: VFM module, ASM module and ASM-VFM residuals for S/C A, 19/10/2014.

3.3.1.3 TCF.VFM monitoring

Output will be provided in the last report of the month.

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 (19/10/2014) can be seen in Figure 14 below.

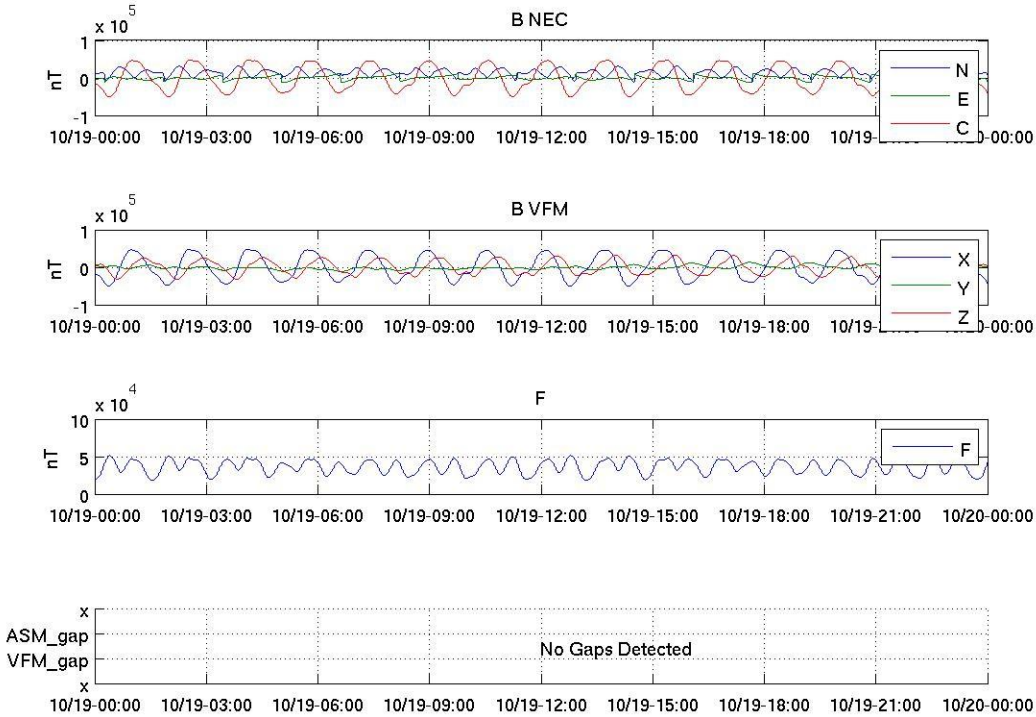

Figure 14: Time series of the geomagnetic field for 19/10/2014, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.2.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-2, 2] nT, with isolated spikes (gradients) that reaches up to 10 nT.

Below some plot example follows of such differences taken at the beginning of the week (13/09, Figure 15), middle of the week (16/10, Figure 16) and at the end of the week (19/10, Figure 17). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

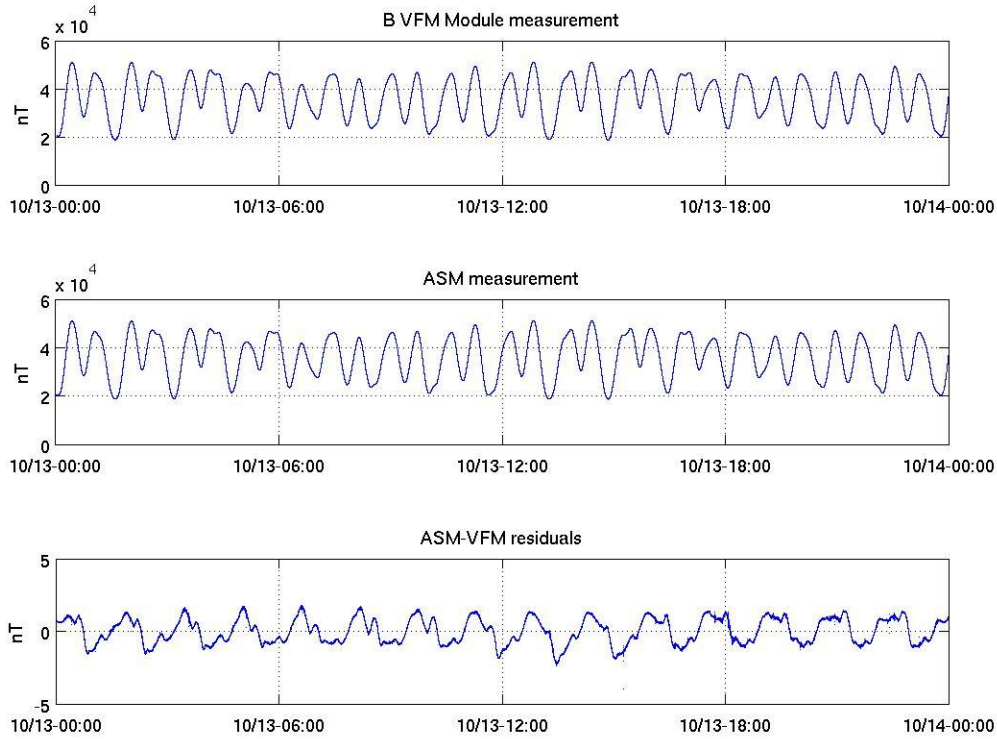

Figure 15: VFM module, ASM module and ASM-VFM residuals for S/C B, 13/09/2014

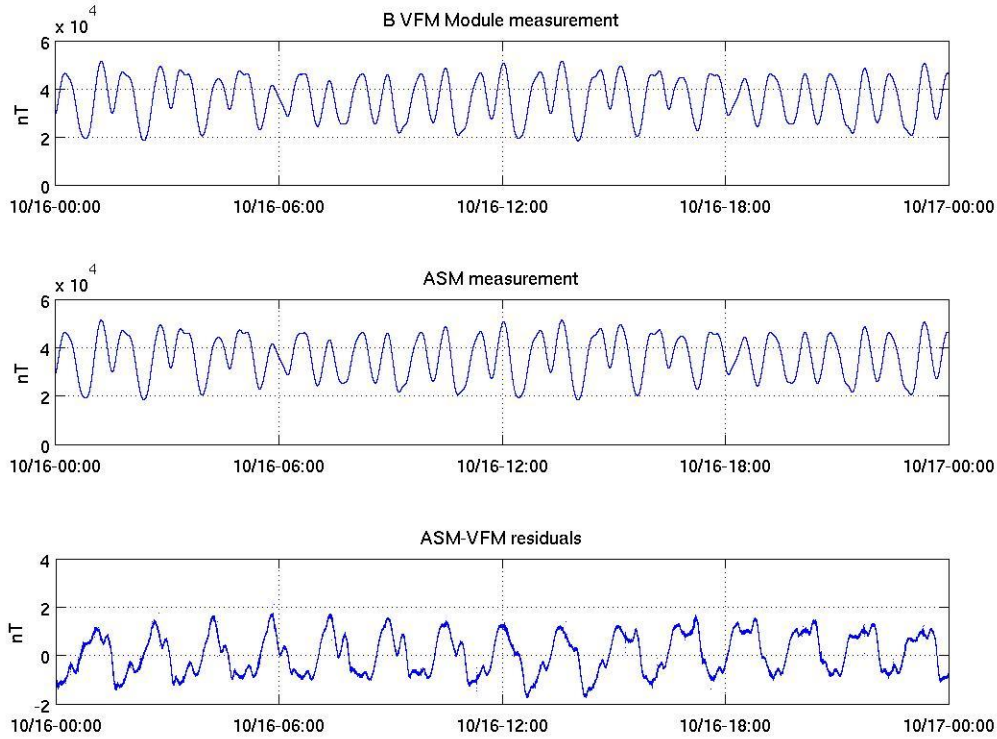

Figure 16: VFM module, ASM module and ASM-VFM residuals for S/C B, 16/10/2014.

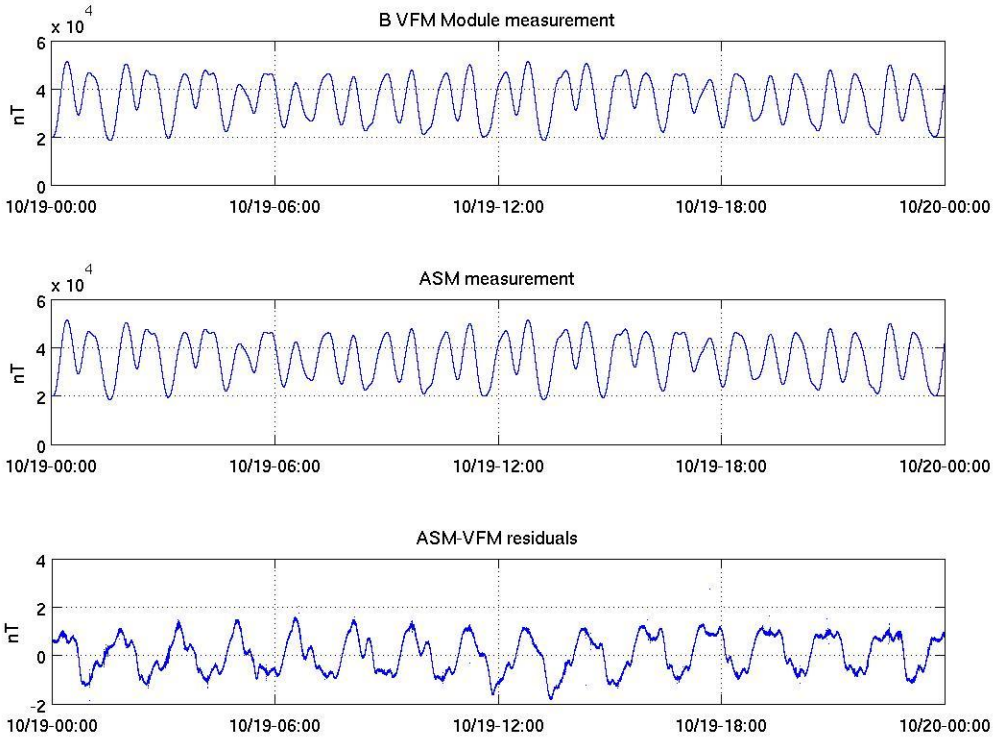

Figure 17: VFM module, ASM module and ASM-VFM residuals for S/C B, 19/10/2014.

3.3.2.3 TCF.VFM monitoring

Output will be provided in the last report of the month.

3.3.3 Swarm C

3.3.3.1 Magnetic time series visual inspection

Nothing relevant to report. An example of representative F time series for S/C C (18/10/2014) can be seen in Figure 18 below.

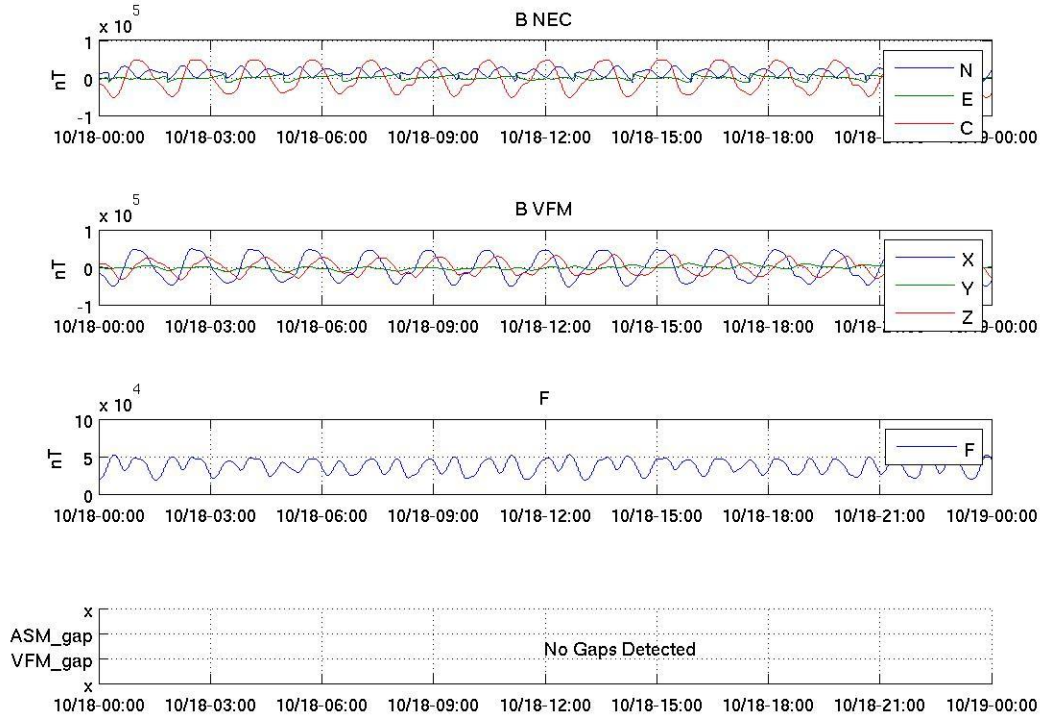

Figure 18: Time series of magnetic field intensity, F, for 18/10/2014, S/C C. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.3.2 VFM-ASM anomaly

The daily peak-to-peak difference around the week is, on average: [-1.5, 1.5] nT, with isolated spikes which reaches up to 3 nT.

Below some plot example follows of such differences taken at the beginning of the week (13/10, Figure 19), at the middle of the week (15/10, Figure 20), and at the end of the week (18/10, Figure 21). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

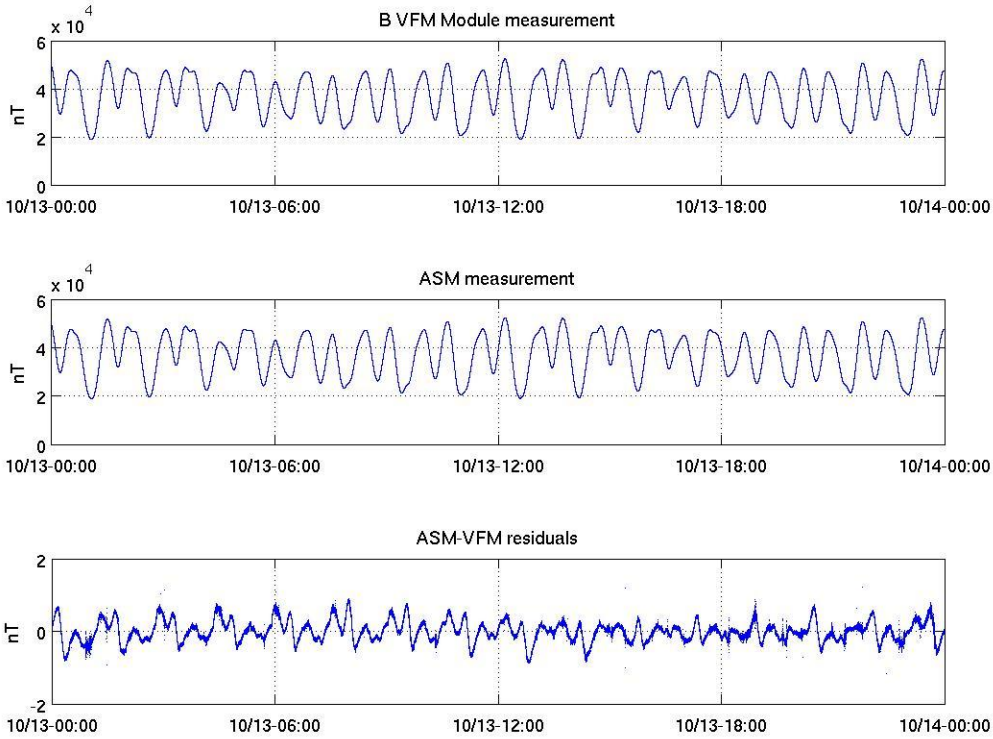

Figure 19: VFM module, ASM module and ASM-VFM residuals for S/C C, 13/10/2014.

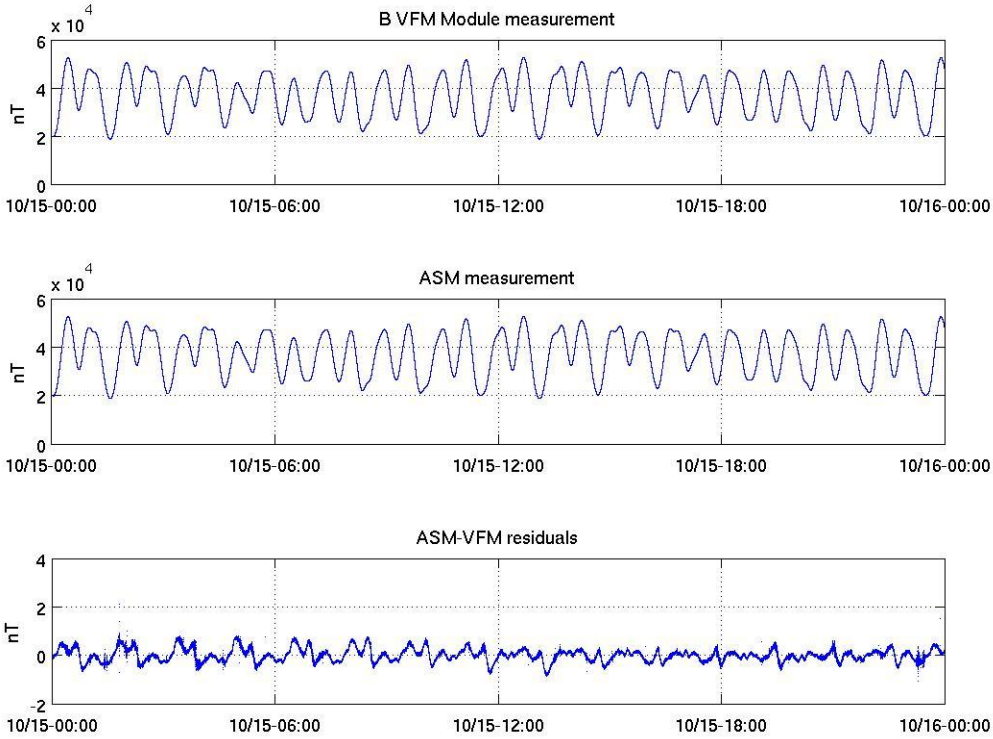

Figure 20: VFM module, ASM module and ASM-VFM residuals for S/C C, 15/10/2014.

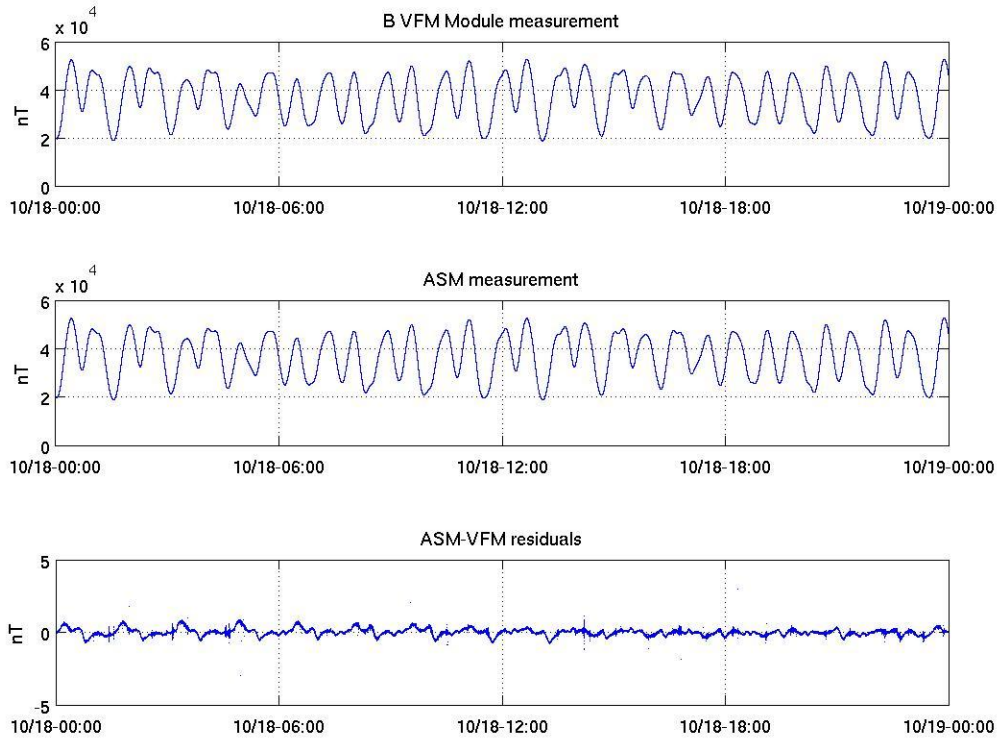

Figure 21: VFM module, ASM module and ASM-VFM residuals for S/C C, 18/10/2014.

3.3.3.3 TCF.VFM monitoring

Output will be provided in the last report of the month.

3.3.4 Summary of TCF behaviour for the three S/C

Output will be provided in the last report of the month.

4. ON-DEMAND ANALYSIS

Nothing to report.

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