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IDEAS+ Swarm Weekly Report : 15/09/2014 – 21/09/2014

Abstract : This is the **Instrument Data quality Evaluation and Analysis Service Plus** (IDEAS+) Swarm Weekly report on Swarm products quality, covering the period 15 to 21 September, 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	26 Sep 2014	First issue
2.0	26 Sep 2014	Correction on Sect. 3.2.3.1: two figures were placed interleaved in the text by mistake and they have been removed.

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:

- Processor Version: L1BOP 3.11p2
- 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_20140924_MoM

[RD.8] Planned Updates for Level 1b, SW-PL-DTU-GS-008, Rev: 1dC.

[RD.9] IDEAS+ Swarm Weekly Report: 08/09/2014 – 14/09/2014, IDEAS+-SER-OQC-REP-2071_SPPA_SwarmWeeklyReport_20140908_20140914.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. After EFI Anomaly Review Board #4 the following decisions have been taken: TII on Swarm A remains in active state; TII on Swarm B remains in ready state until Univ. of Calgary provides new gain maps and corrected AGC parameters, then it will be put in active state commanding a calibration cycle; TII on Swarm C will be commanded alternatively on and off with 24 hours duty cycle (one day on, one day off, etc...) in order to have more usable images for characterising the instrument quality.

2.2 Plan for operational processor updates

From the last L1B coordination teleconference the following updates shall be reported [RD.7]:

- Technical University of Delft has confirmed the test RINEX data obtained without carrier phase smoothing and without antenna pattern corrections lead to Precise Orbits determined with better quality (as compared with SLR measurements). Nevertheless an objection has been raised by ESL to wait for the ORBATT patch preparation and delivery until an assessment of impact has been done throughout the other Level 2 communities which potentially use RINEX data.

- The PLASMA cross-verification has been delayed because of a technical problem with the generation of the reference prototype data. Such data will be hopefully available at the beginning of c. week 40 (29/9-3/10). This delay could preclude the inclusion of the new PLASMA processor in the delivery of October: discussions are on-going before to take the final decision.

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 38 (15-21/09/2014)

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

1. **An observation of attitude rejection** occurred on S/C A (10 attitudes rejected the 19/09) caused by simultaneous occurrence of Big Bright Objects on all the three camera units of the S/C. The rejections are nominal, i.e. follow the nominal rules given by processing algorithms and cannot be therefore classified as anomalies. The observation is nonetheless tracked in the IDEAS+ ARTS repository for purposes of monitoring instruments health.

2. **New occurrence of increase in the time series noise of the ASM-VFM difference** already reported and described past week [RD.9]. The observation

occurred during 19/09 for all S/C, and seems to be an effect of the increases geomagnetic activity.

3. ROUTINE QUALITY CONTROL

3.1 Gaps analysis

No telemetry gaps are reported for the period.

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-30	OBS_ROUTINE: 19/09/2014, STR S/C A out of range.	Flags_q, quaternions, B_{NEC}	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 Week 38: 15/09 - 21/09/2014

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, 15-21/09/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard deviation (m)**	**Notes**
15/09	0.08	-10, 6 (Z)	1.6	
16/09	0.08	-6.3, 12.7 (Z)	1.3	
17/09	0.11	-10.8,10.45 (Z)	1.6	
18/09	0.07	-9.8, 9.9 (Z)	1.6	
19/09	0.02	-11.4, 6.5 (Z)	1.5	
20/09	0.11	-8.4, 8.2 (Z)	1.5	
21/09	0.08	-6.5, 8.2 (Z)	1.5	

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 (15/09, Figure 1), in the middle (18/09, Figure 2) and at the end (21/09, 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.

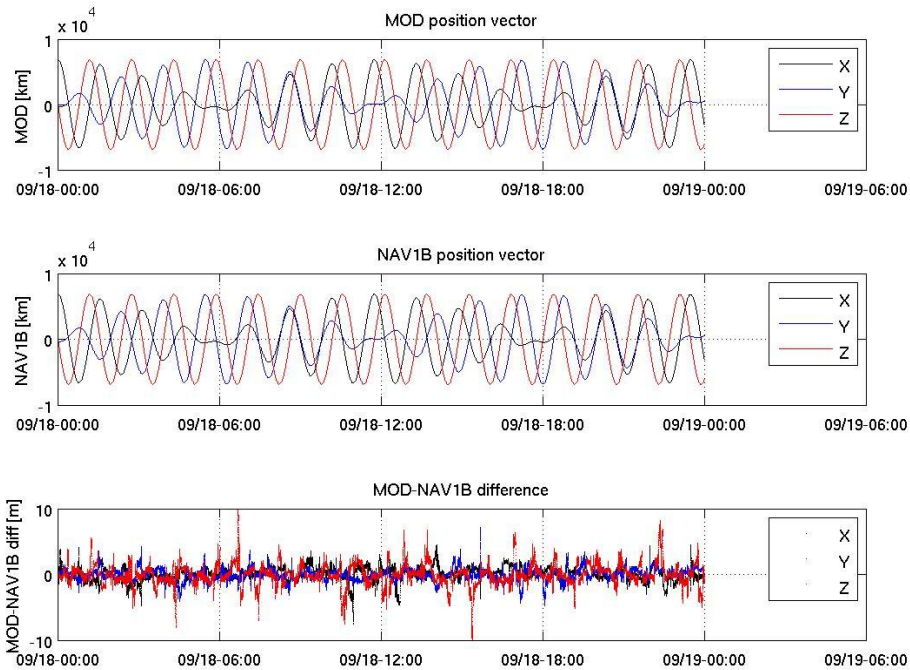

Figure 1: Difference MOD-GPSNAV, sc A, 15/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

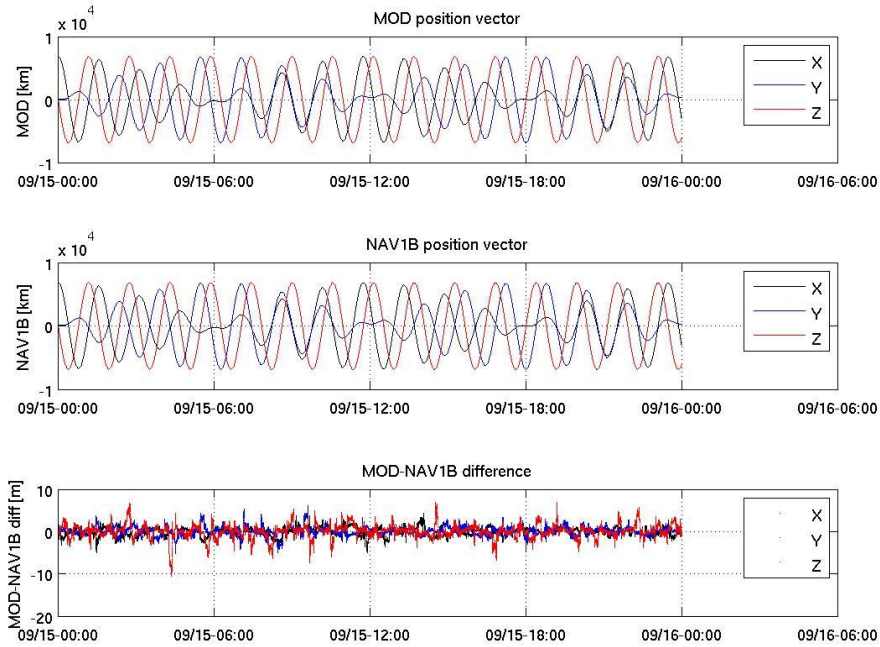

Figure 2: Difference MOD-GPSNAV, sc A, 18/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

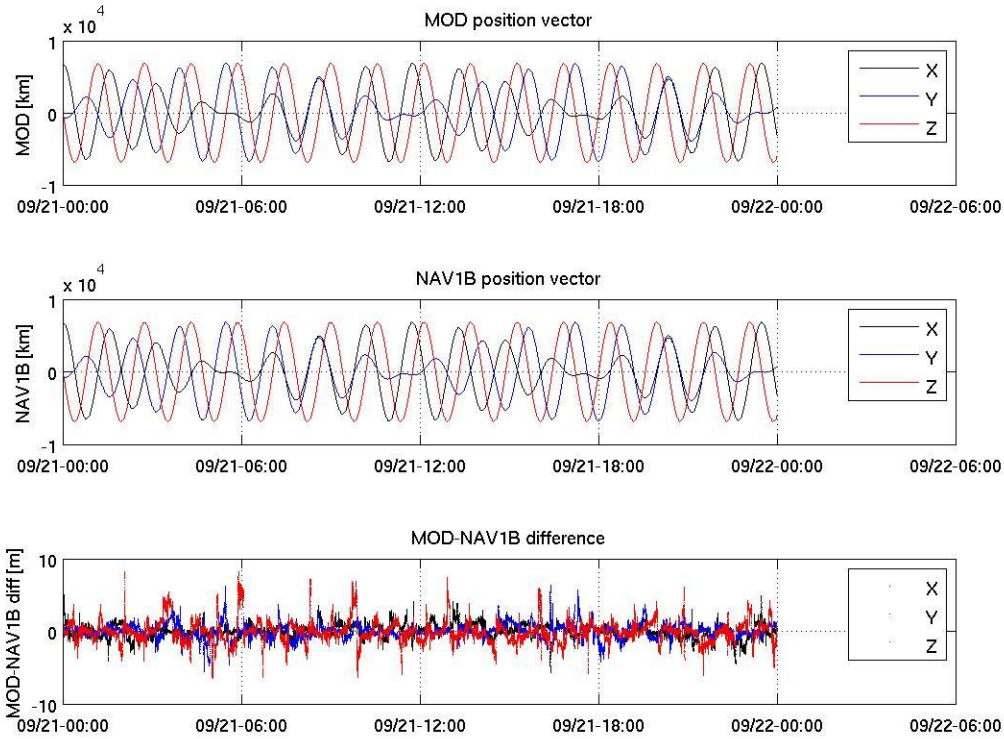

Figure 3: Difference MOD-GPSNAV, sc A, 21/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.1.2 Attitude observations

- **SW-IDEAS-30**
  Affected product:
  SW_OPER_STRAATT_1B_20140919T000000_20140919T235959_0301

  10 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
19SEP2014 23:35:33	14SEP2014 23:35:42	10	255

Table 3: Attitudes out-of-range, S/C A, 19/09/2014

The cause of such rejected attitudes is the simultaneous occurrence of BBOs on the three camera units 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, 15-21/09/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
15/09	0.09	-7.5, 12 (Z)	1.6	
16/09	0.09	-8.7,13.74 (Z)	1.5	
17/09	0.12	-13,2,8.2(Z)	1.6	
18/09	0.12	-6.9,6.3(Z)	1.3	
19/09	0.12	-9.47, 13.2(Z)	1.6	
20/09	0,11	-12.4,6.7(Z)	1.7	
21/09	0.08	-8, 27 (Z)	1.7	One single spike affects the Z component (see Figure 6)

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 (15/09, Figure 4), in the middle (18/09, Figure 5), and at end of the week (21/09, 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.

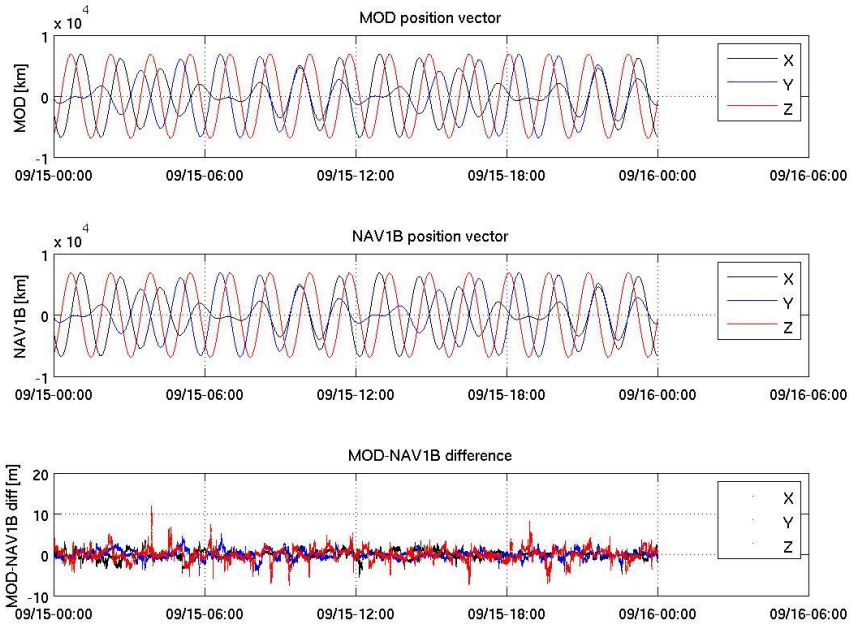

Figure 4: Difference MOD-GPSNAV, sc B, 15/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

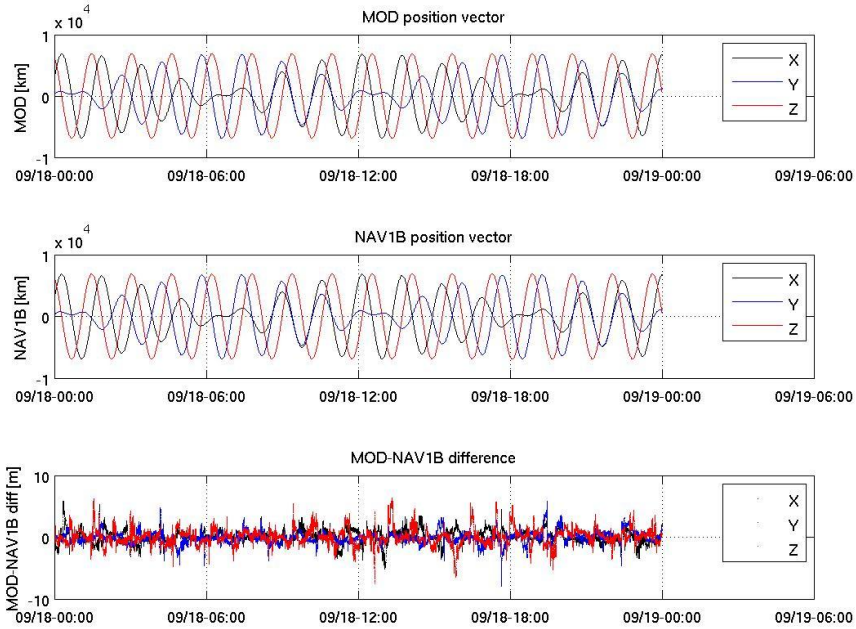

Figure 5: Difference MOD-GPSNAV, sc B, 18/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

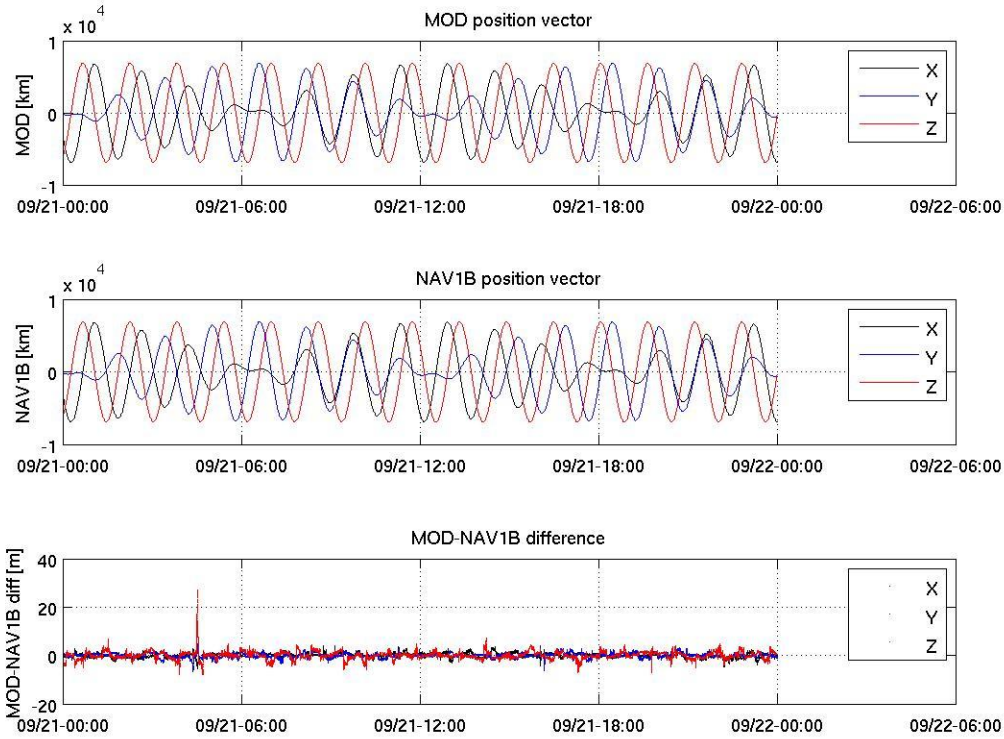

Figure 6: Difference MOD-GPSNAV, sc B, 21/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

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, 15-21/09/2014, Position difference				
Day	**Average Difference (m)**	**Maximum difference (m)**	**Standard Deviation (m)**	**Notes**
15/09	0.08	+/- 10 (Z)	1.6	

Swarm C, 15-21/09/2014, Position difference				
16/09	0.09	-6,9, 8.6 (Z)	1.2	
17/09	0.10	-12.3, 9.3 (Z)	1.5	
18/09	0.09	-9.4, 8.7 (Z)	1.6	
19/09	0.02	-10.5, 7.4 (Z)	1.5	
20/09	0.05	-9.3, 10.5 (Z)	1.5	
21/09	0.06	-9 (X), 10.8 (Z)	1.5	

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 (15/09, Figure 7), in the middle (18/09,

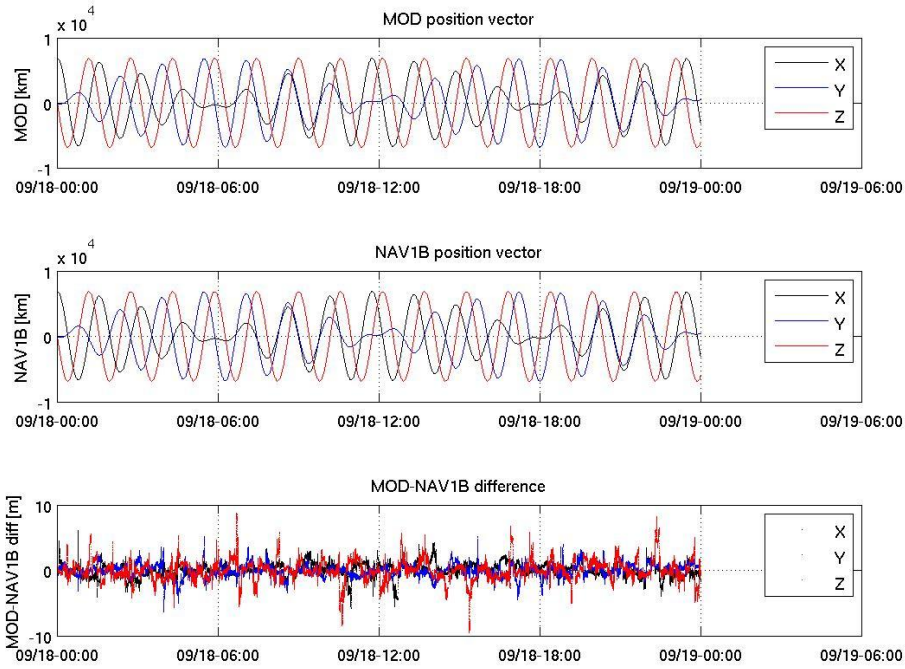

Figure 8) and at the end (21/09,

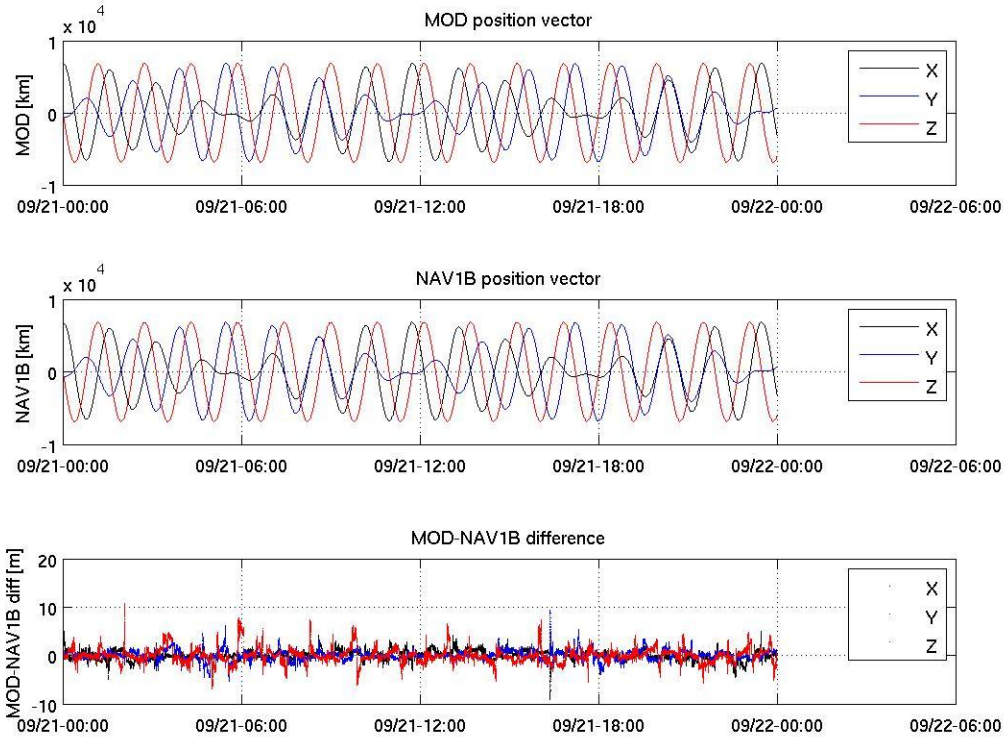

Figure 9). From top to bottom the plots show: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two. The values are given in Km.

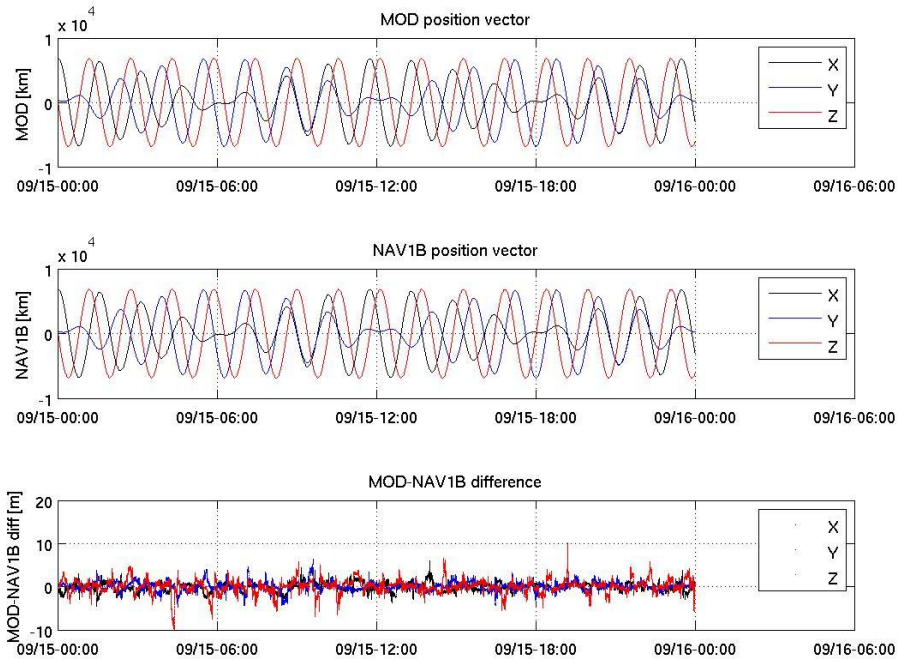

Figure 7: Difference MOD-GPSNAV, sc C, 15/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

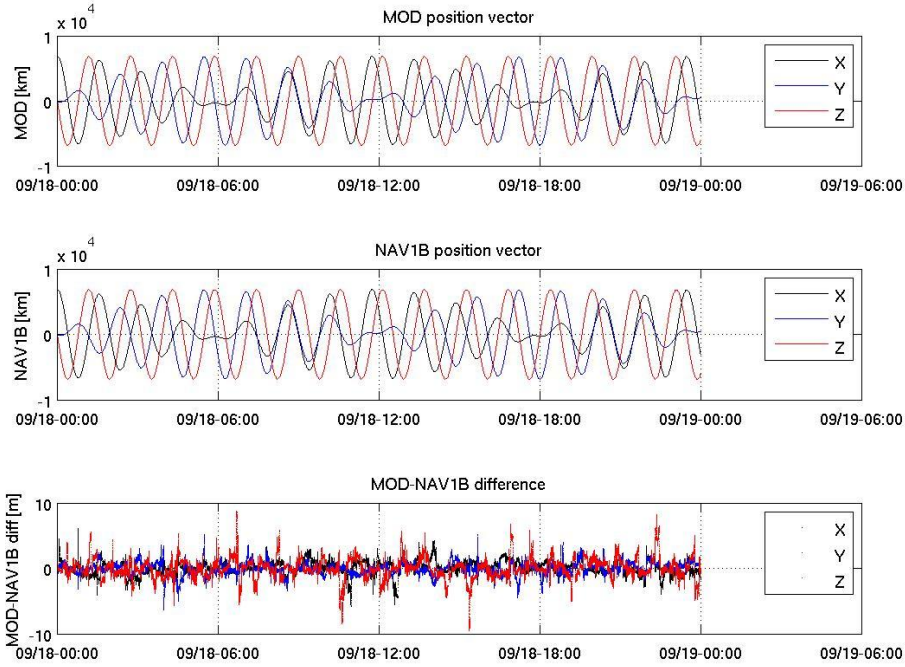

Figure 8: Difference MOD-GPSNAV, sc C, 18/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

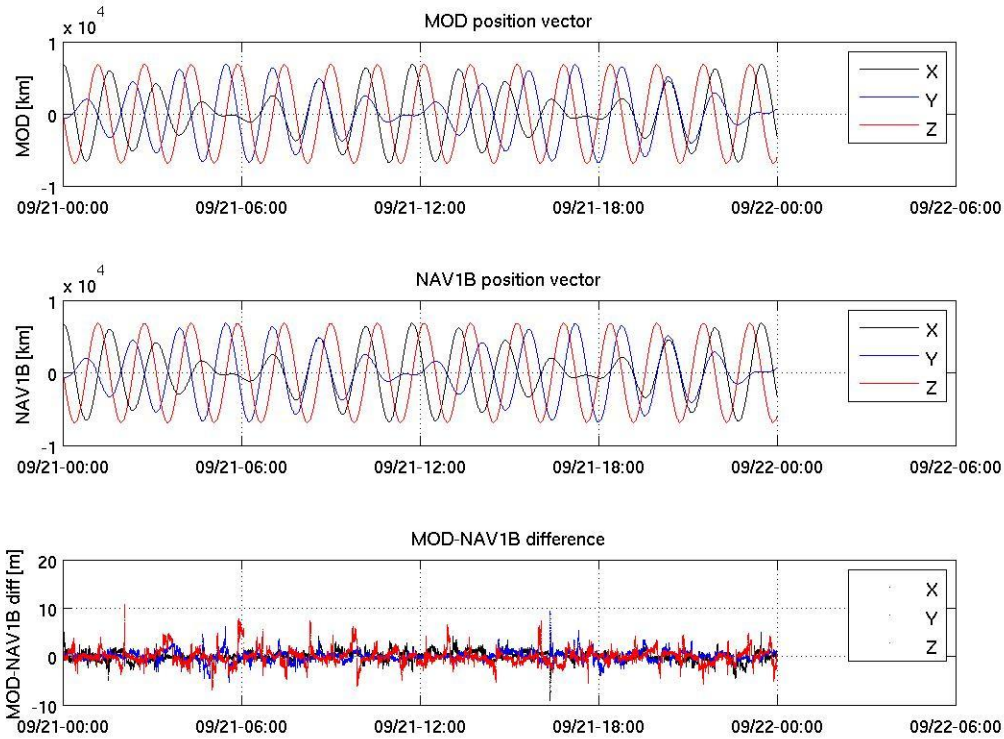

Figure 9: Difference MOD-GPSNAV, sc C, 21/09/2014. From top to bottom: the S/C position determined from the MOD calculation, the S/C position determined on-board, the difference between the two.

3.2.3.2 Attitude observations

Nothing to report.

3.3 Magnetic Products

The following events have to be reported:

Observation ID	Description	Affected parameter	Sect. of Obs. Description	Sect. of Obs. analysis
SW-IDEAS-27	OBS_ROUTINE: increase of noise in VFM-ASM diff	B_{VFM}, F, B_{NEC}	3.3.1.2, 3.3.2.2, 3.3.3.2	**Error! eference source not found.**

Table 6: list of events related to magnetic products to be reported in the monitoring for Week 38: 15/09/2014 - 21/09/2014.

The effects of rejected attitudes (**SW-IDEAS-30**) are observed in magnetic data as “zero” values in the vector field time series and few isolated spikes in the ASM-VFM differences.

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): weekly series of biases, scales, non-orthogonality factors and RMS.

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 (21/09/2014):

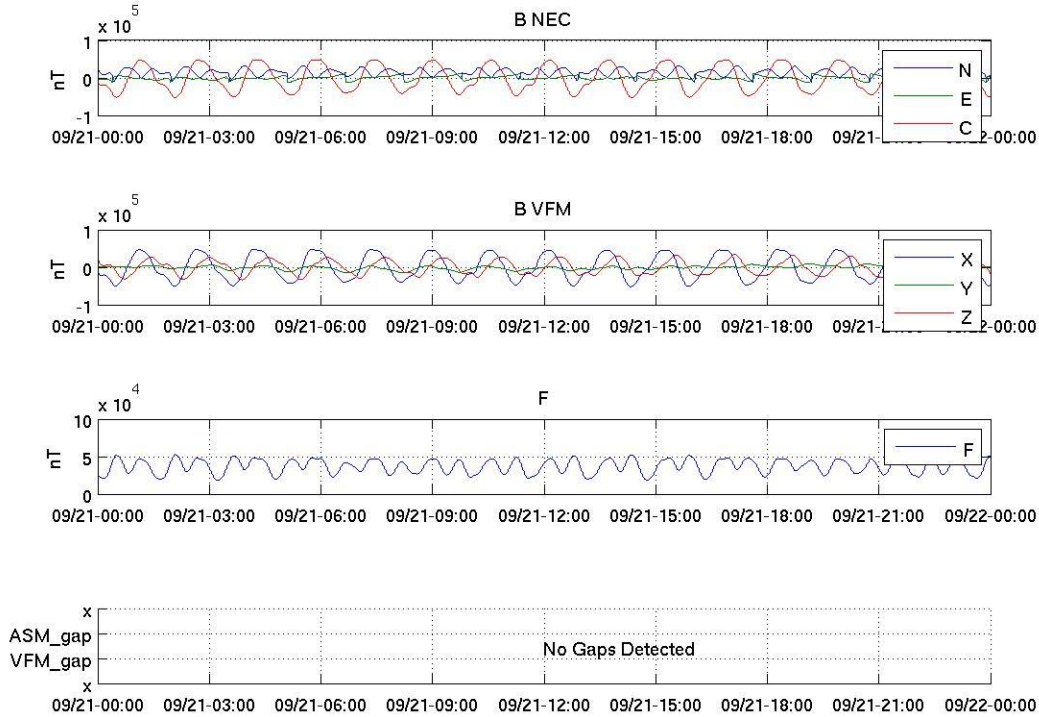

Figure 10: Time series of the geomagnetic field, for 21/09/2014, S/C A. From top to bottom: magnetic field components in NEC reference frame, magnetic field components

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:** during the 19/09/2014, all S/C observe a noise superimposed on the ASM-VFM time series. The effect seems related with the increased geomagnetic activity and not to an instrument/processing effect. Further analysis is given in Sect. 4.1.

The daily peak-to-peak difference around the week is, on average: [-3.6, 3.2] nT, with some isolated spike which reaches up to 5 nT.

Below some plot example of such differences follows, taken at the beginning of the week (15/9, Figure 11) middle of week (18/09, Figure 12), and across the new **SW-IDEAS-27** event occurrence (19/09, Figure 13). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

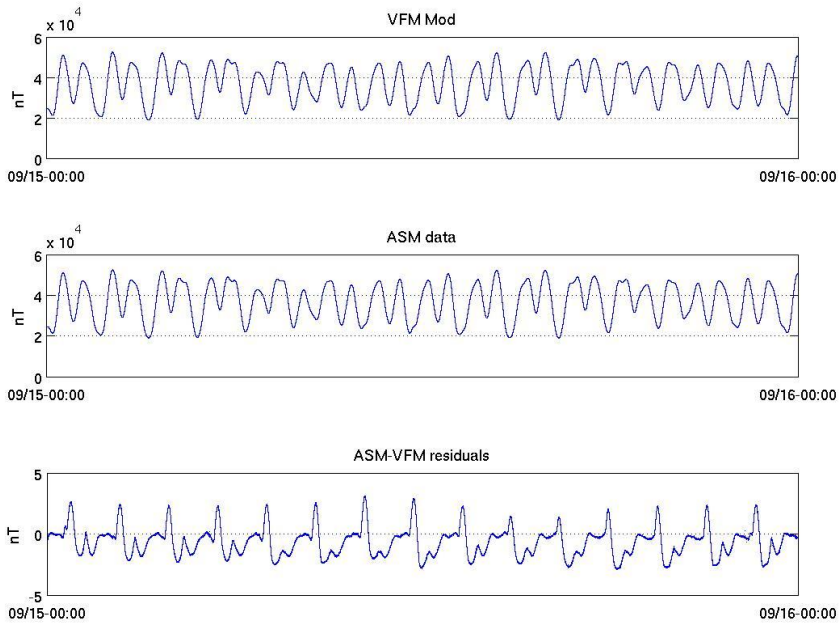

Figure 11: VFM module, ASM module and ASM-VFM residuals for S/C A, 15/09/2014.

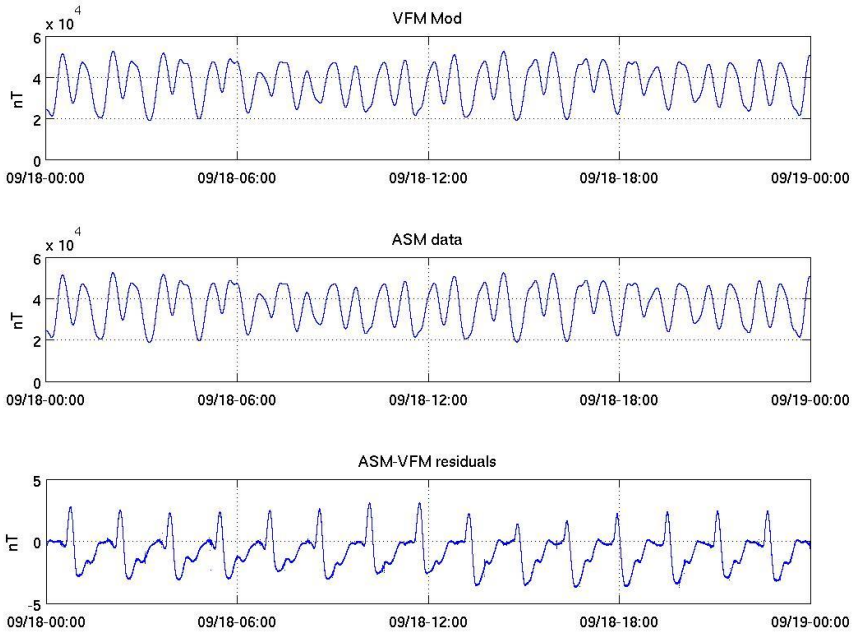

Figure 12: VFM module, ASM module and ASM-VFM residuals for S/C A, 18/09/2014.

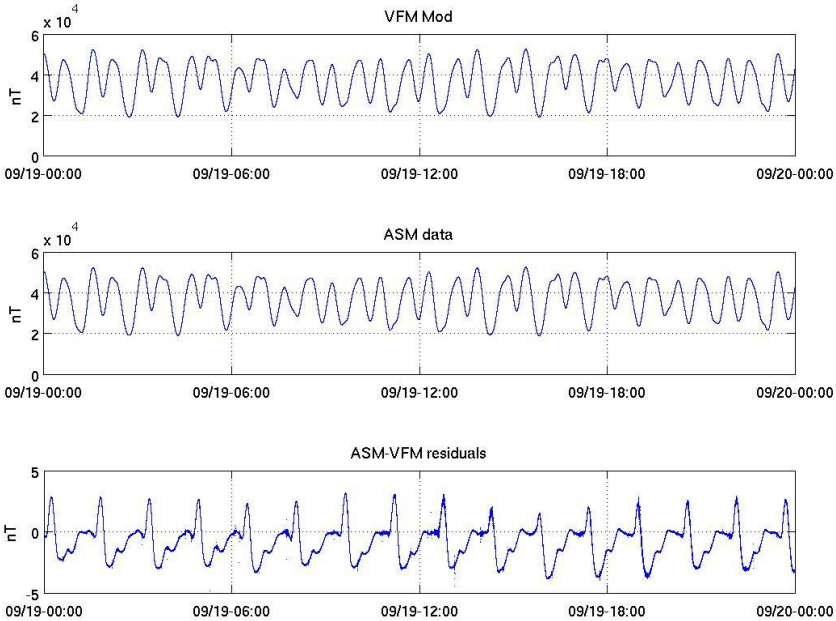

Figure 13: VFM module, ASM module and ASM-VFM residuals for S/C A, 19/09/2014.

3.3.1.3 TCF.VFM monitoring

In the following plots one can see the three groups of TCF VFM calibration parameters for Swarm A, for the reported period: Biases (Figure 14), Scales (Figure 15) and Non-orthogonalities (Figure 16). Each group is actually a three-component vector in the compact detector coil frame. The parameters are steady and constant during the week, decreasing trend continues in the X scale components (of about 0.001%).

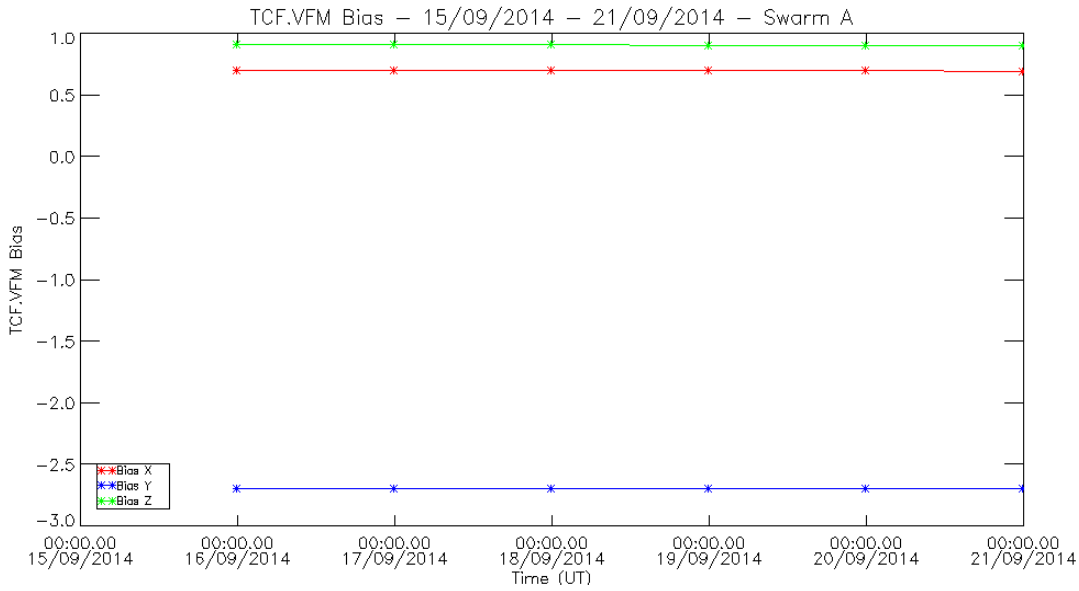

Figure 14: TCF.VFM Biases for S/C A, 15-21/09/2014.

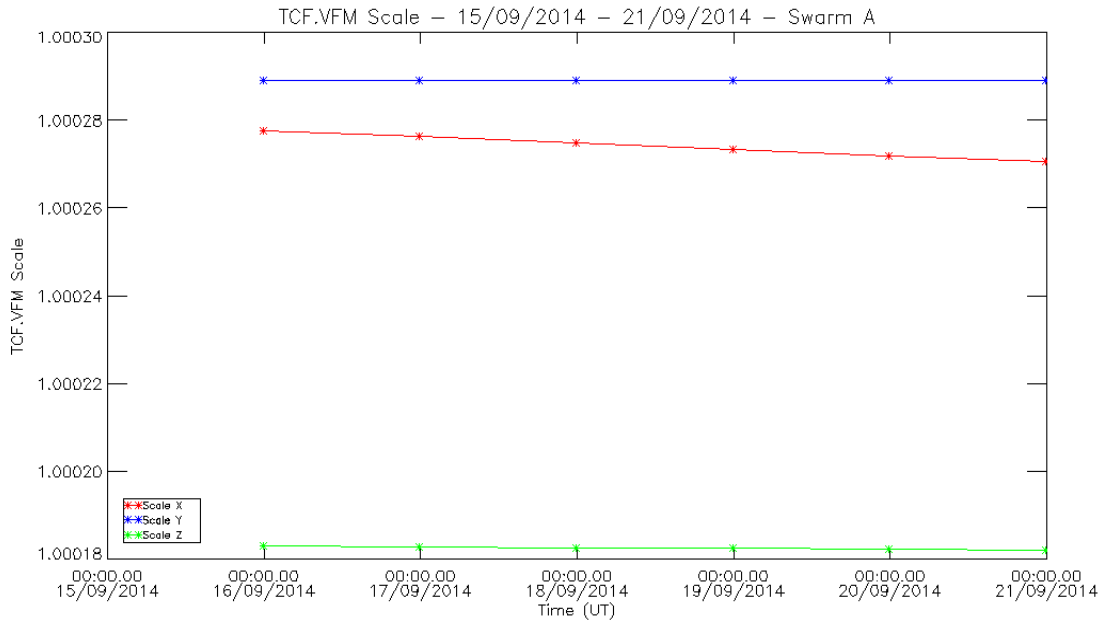

Figure 15: TCF.VFM Scales for S/C A, 15-21/09/2014.

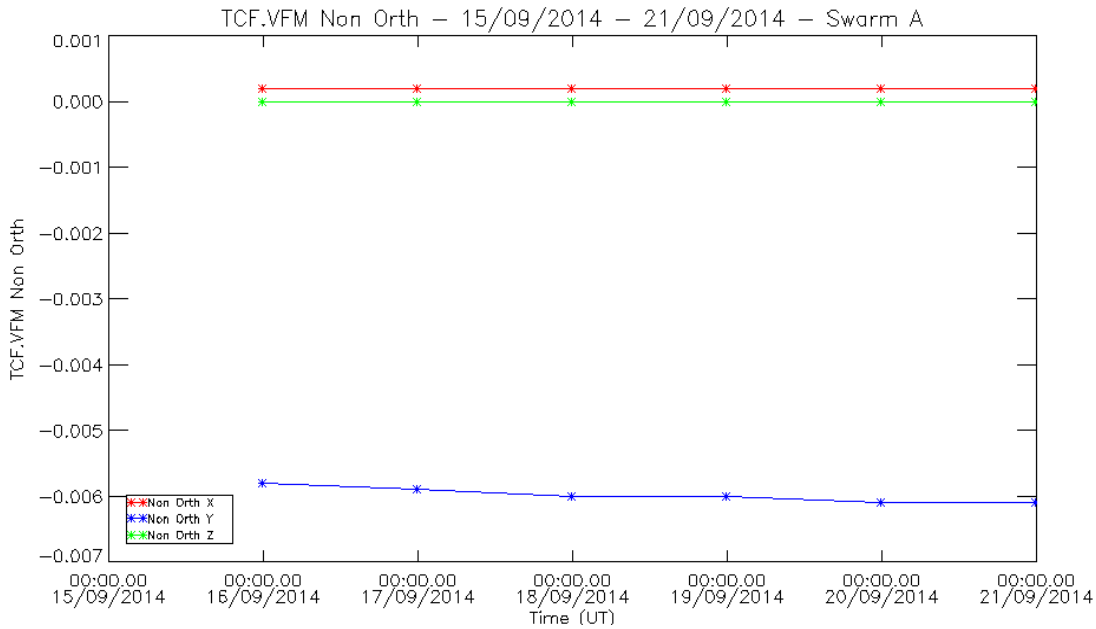

Figure 16: TCF.VFM Non-Orthogonalities for S/C A, 15-21/09/2014.

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 (21/09/2014) can be seen in Figure 17 below.

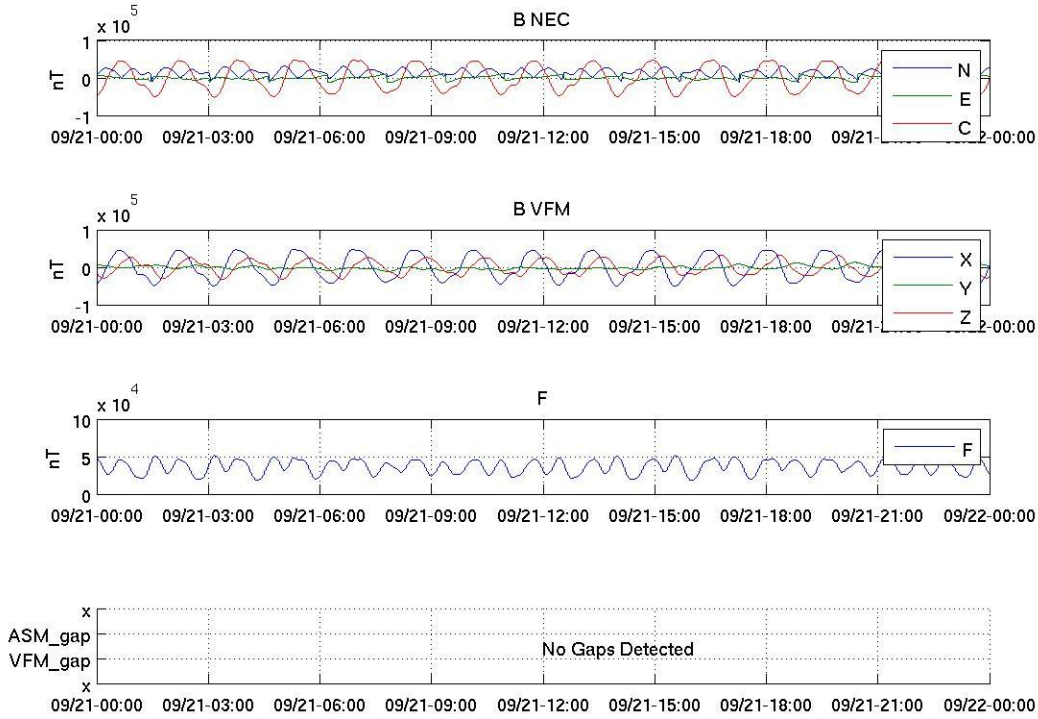

Figure 17: Time series of the geomagnetic field for 21/09/2014, S/C B. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.2.2 VFM-ASM anomaly

- **SW-IDEAS-27:** See Sect. 3.3.1.2

The daily peak-to-peak difference around the week is, on average: [-1.5, 1.8] nT, with some small isolated spike which reaches up to 2.5 nT.

Below some plot example follows of such differences taken at the beginning of the week (15/09, Figure 18), middle of the week (18/09, Figure 19) and across the **SW-IDEAS-27** event (19/09, Figure 20). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

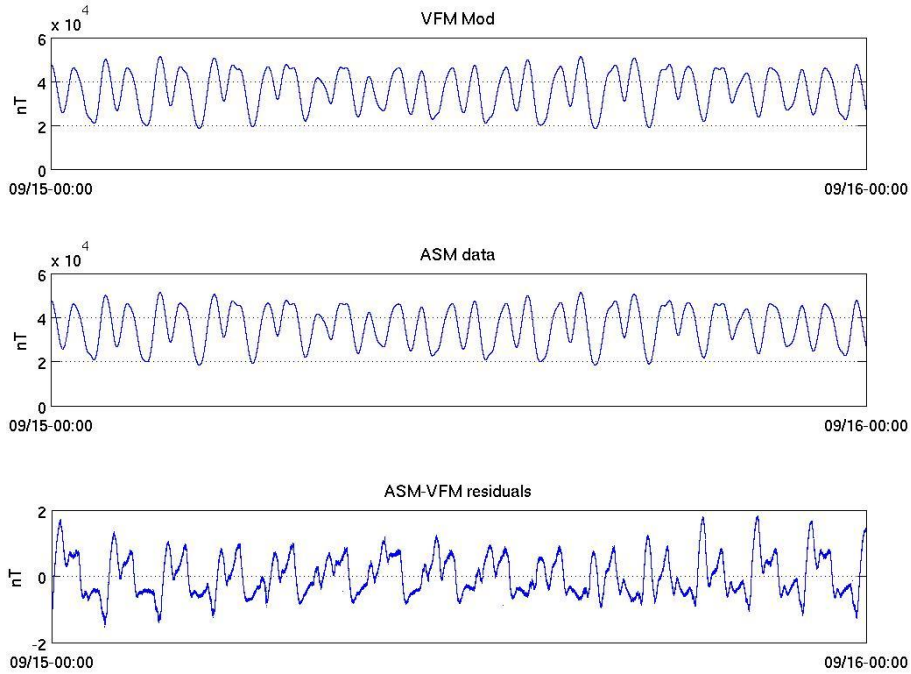

Figure 18: VFM module, ASM module and ASM-VFM residuals for S/C B, 15/09/2014

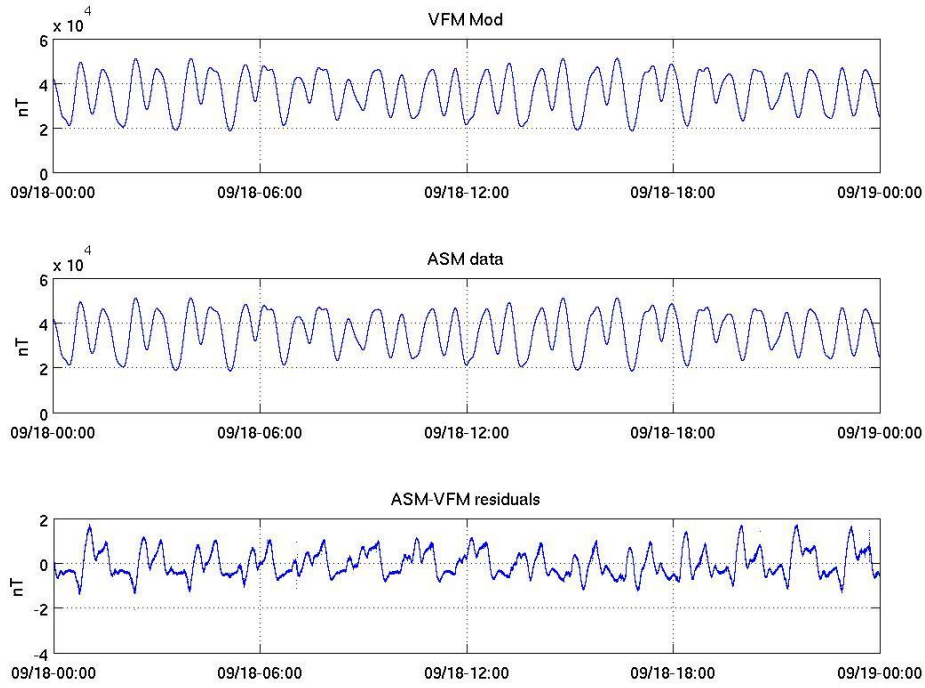

Figure 19: VFM module, ASM module and ASM-VFM residuals for S/C B, 18/09/2014.

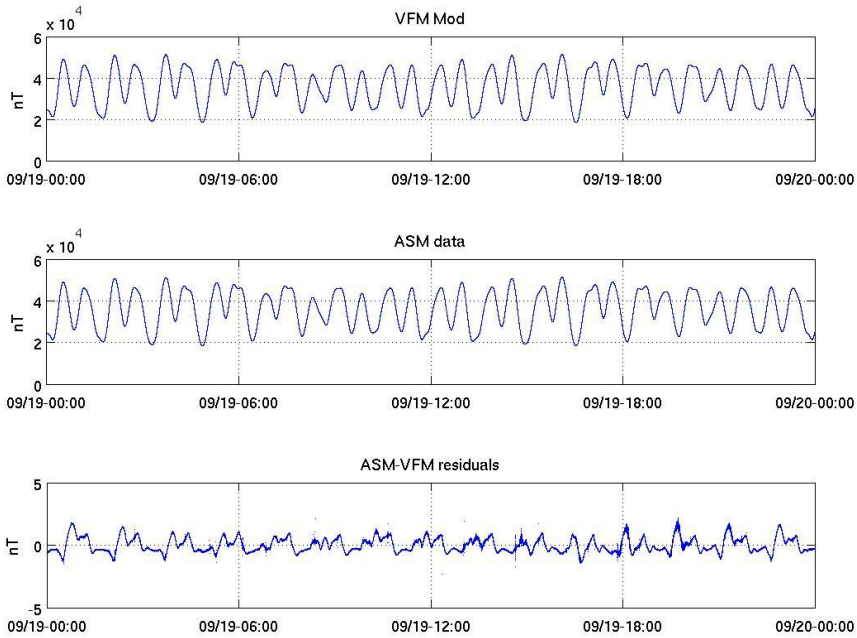

Figure 20: VFM module, ASM module and ASM-VFM residuals for S/C B, 19/09/2014.

3.3.2.3 TCF.VFM monitoring

In the following plots one can see the three groups of TCF VFM calibration parameters for Swarm B, for the reported period: Biases (Figure 21), Scales (Figure 22) and Non-orthogonalities (Figure 23). Each group is actually a three-component vector in the compact detector coil frame. The parameters are steady and constant during the period, except for a slow decrease of the Scale X component (less than 0.001% throughout the week).

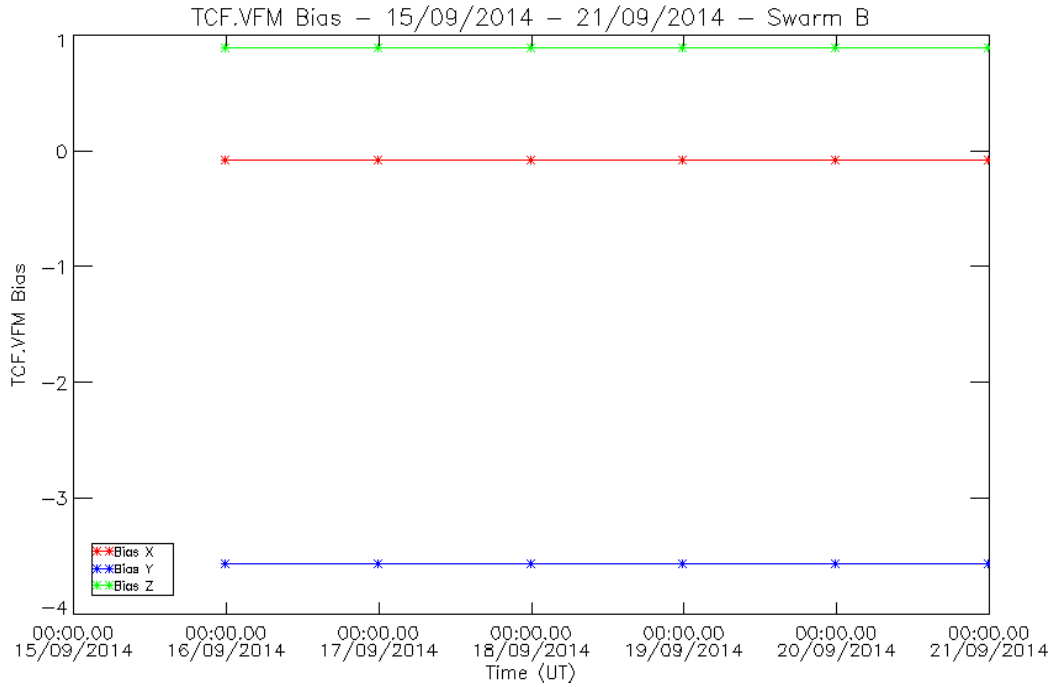

Figure 21: TCF.VFM Biases for S/C B, 15-21/09/2014.

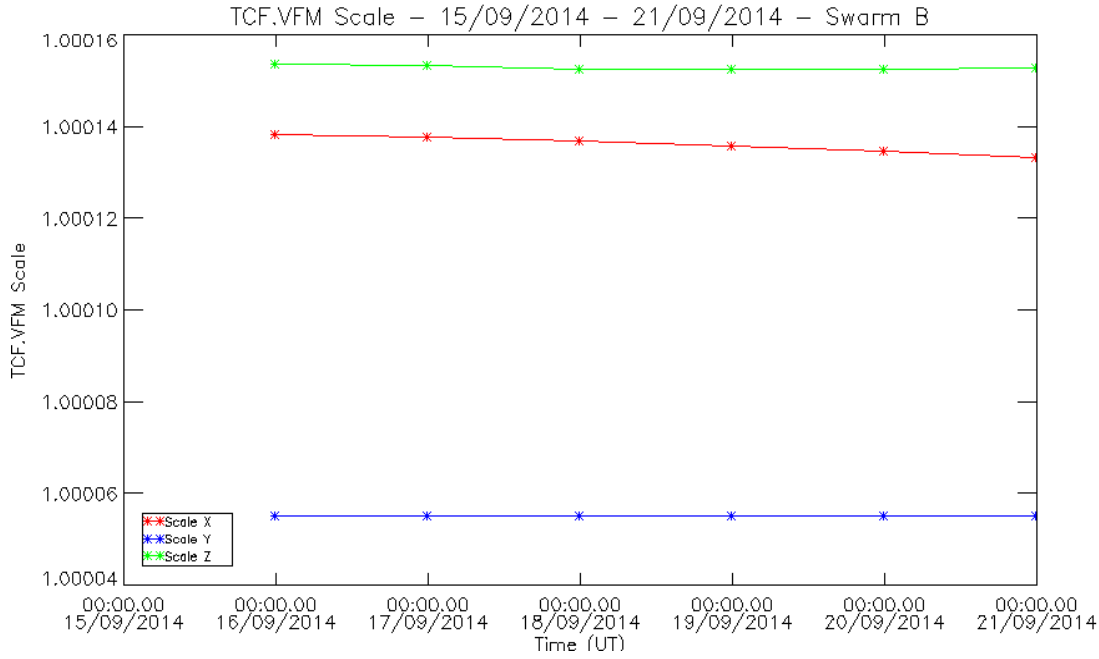

Figure 22: TCF.VFM Scales for S/C B, 15-21/09/2014.

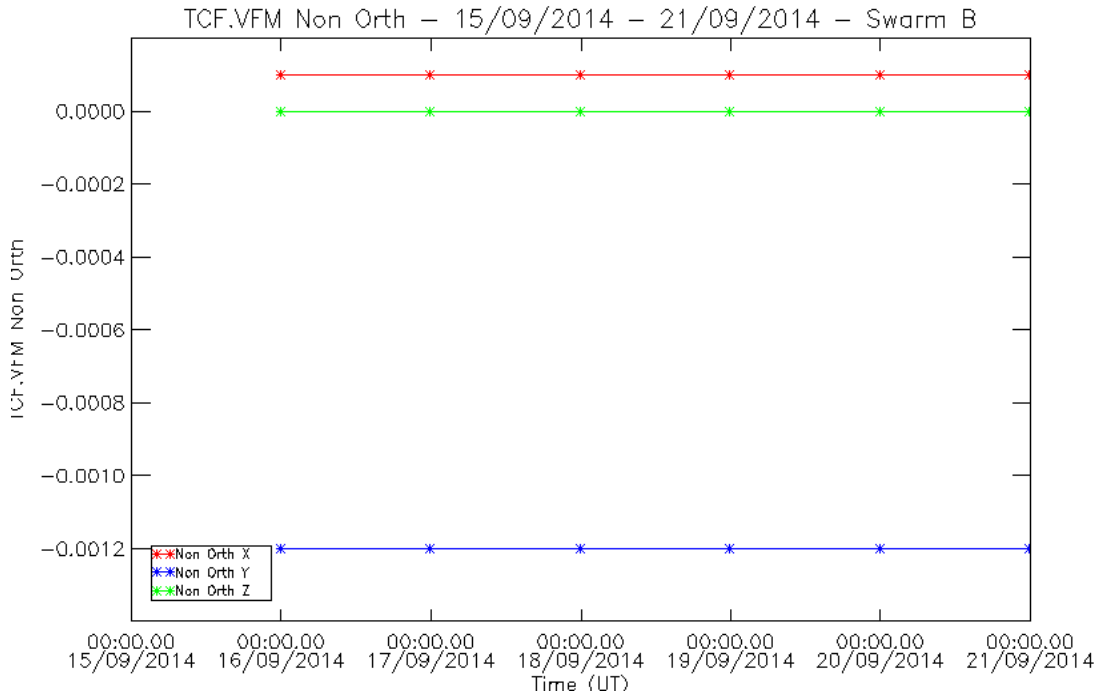

Figure 23: TCF.VFM Non-Orthogonalities for S/C B, 15-21/09/2014.

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 (21/09/2014) can be seen in Figure 24 below.

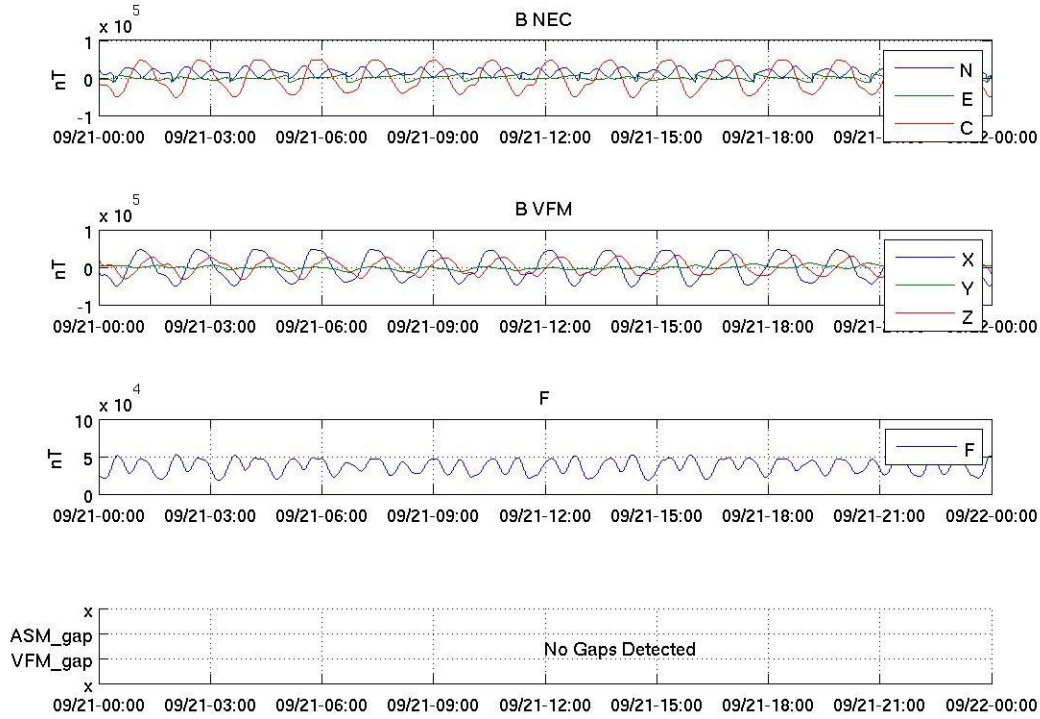

Figure 24: Time series of magnetic field intensity, F, for 21/09/2014, S/C C. From top to bottom: magnetic field components in NEC reference frame, magnetic field components in the VFM reference frame, magnetic field intensity (F) from ASM, and location of gaps (if any).

3.3.3.2 VFM-ASM anomaly

- **SW-IDEAS-27:** see Sect. 3.3.1.2.

The daily peak-to-peak difference around the week is, on average: [-2, 1.8] nT.

Below some plot example follows of such differences taken at the beginning of the week (15/09, Figure 25), at the middle of the week (18/09, Figure 26), and across the new **SW-IDEAS-27** event occurrence (19/09, Figure 27). From top to bottom the plots show: The VFM module, the ASM module, the difference ASM-VFM.

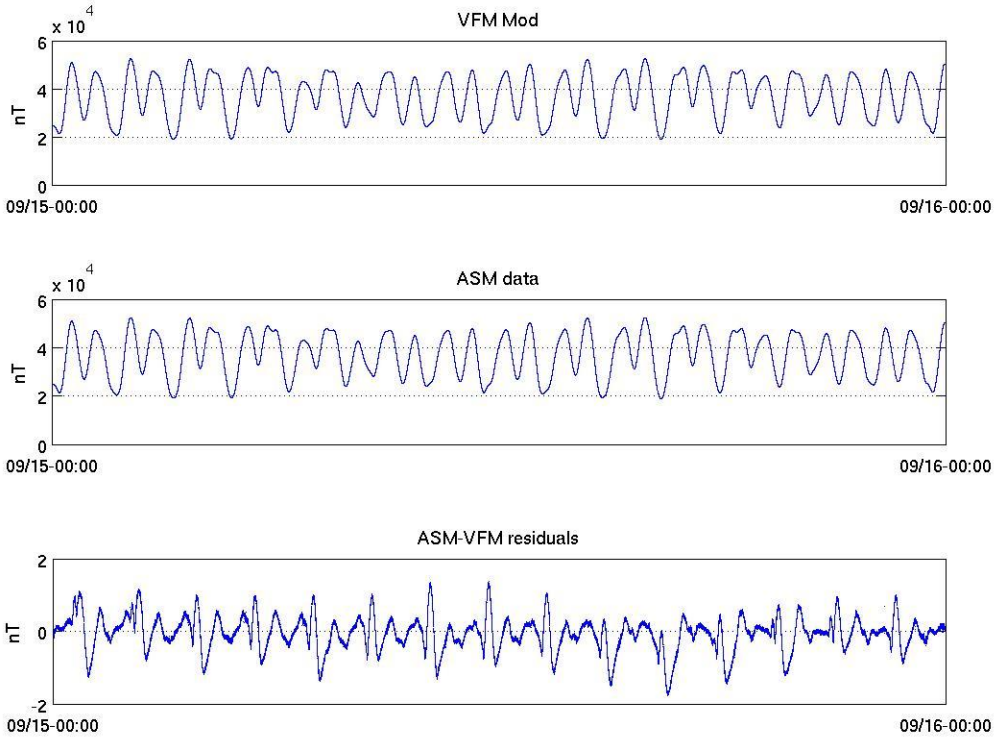

Figure 25: VFM module, ASM module and ASM-VFM residuals for S/C C, 15/09/2014.

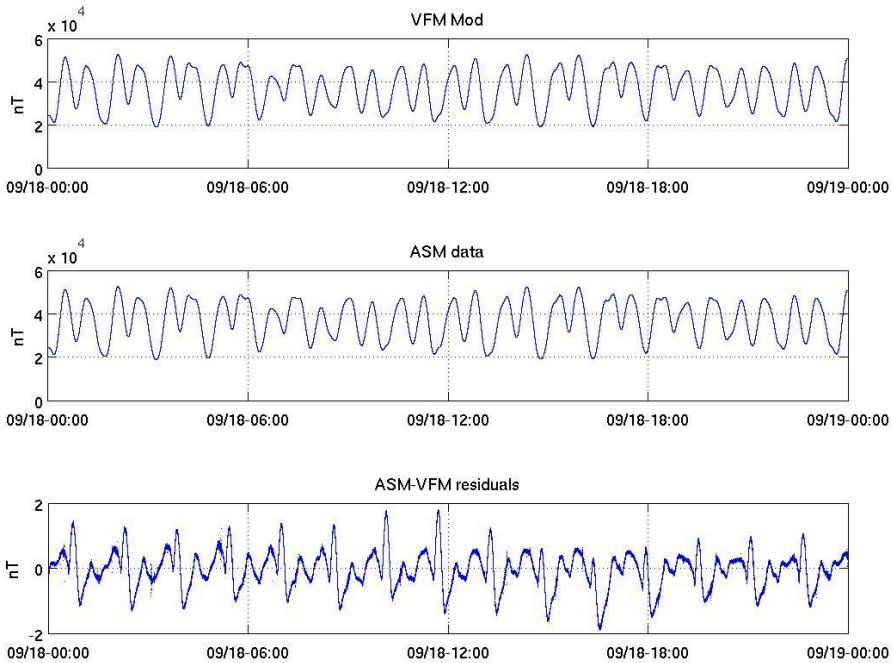

Figure 26: VFM module, ASM module and ASM-VFM residuals for S/C C, 18/09/2014.

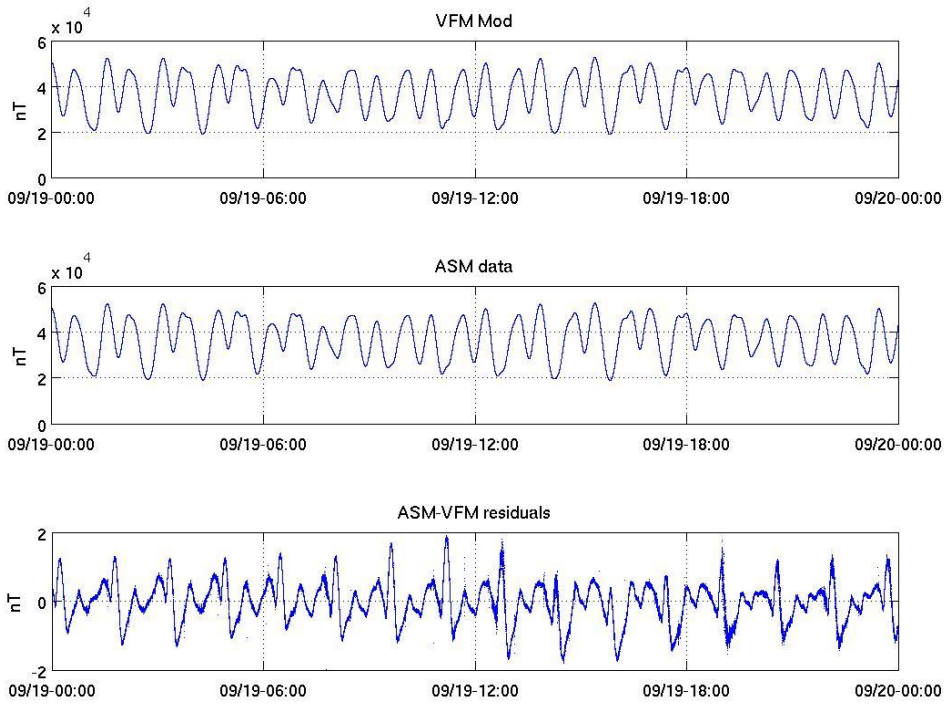

Figure 27: VFM module, ASM module and ASM-VFM residuals for S/C C, 19/09/2014.

3.3.3.3 TCF.VFM monitoring

In the following plots one can see the three groups of TCF VFM calibration parameters for Swarm C, during the reporting period: Biases (Figure 28), Scales (Figure 29) and Non-orthogonalities (Figure 30). Each group is actually a three-component vector in the compact detector coil frame. The parameters are steady and constant during the week, with an exception in the X scale component, which shows a slow decrease (less than 0.001%).

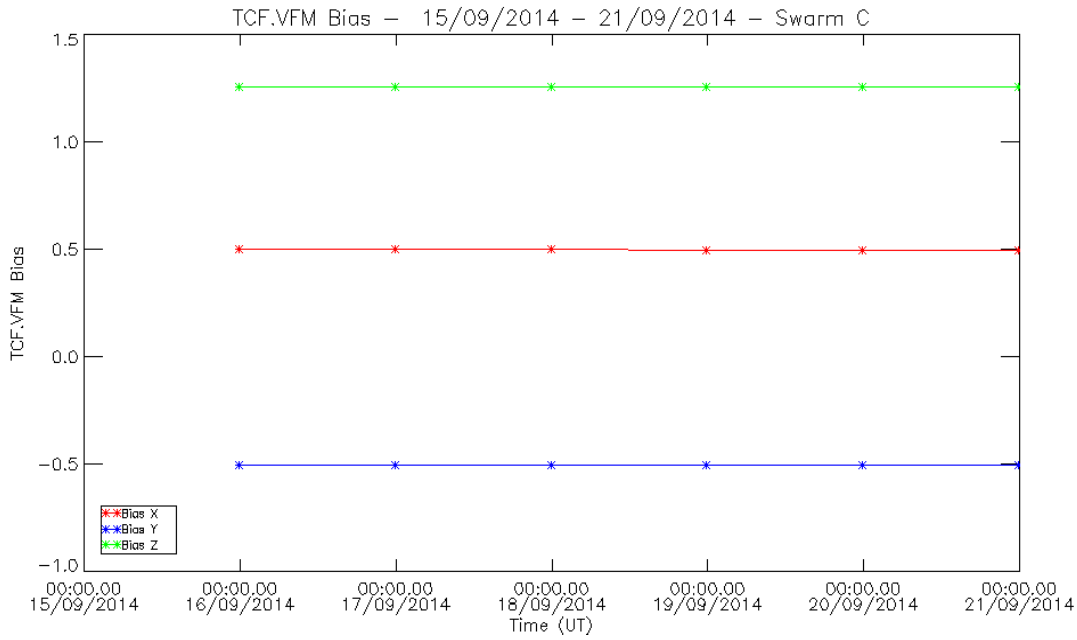

Figure 28: TCF.VFM Biases for S/C C, 15-21/09/2014.

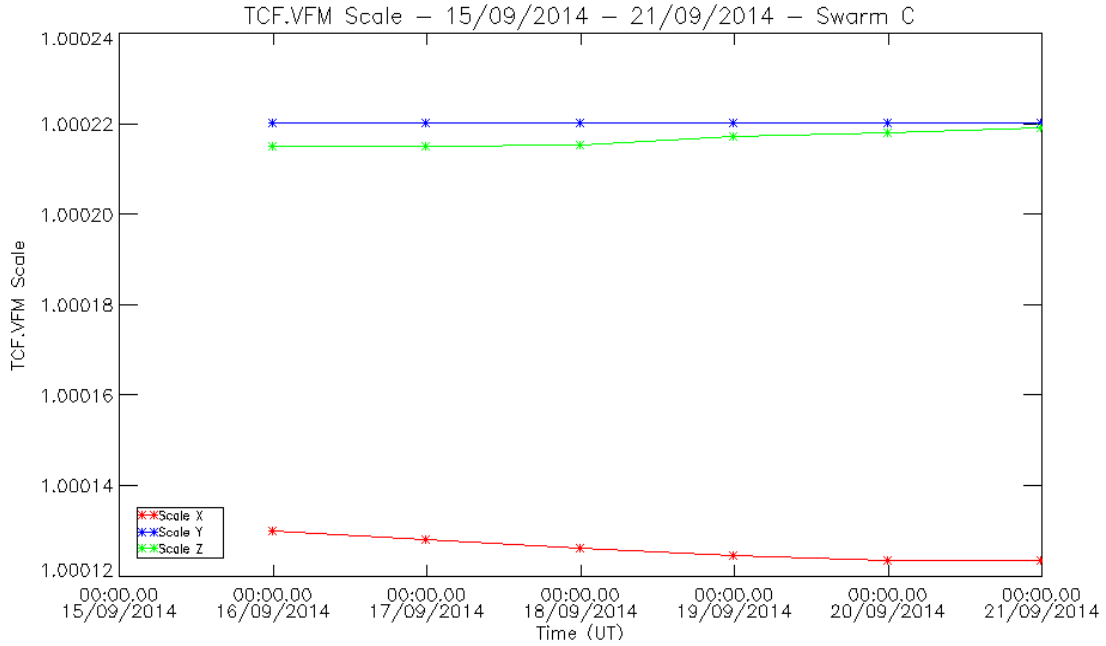

Figure 29: TCF.VFM Scales for S/C C, 15-21/09/2014.

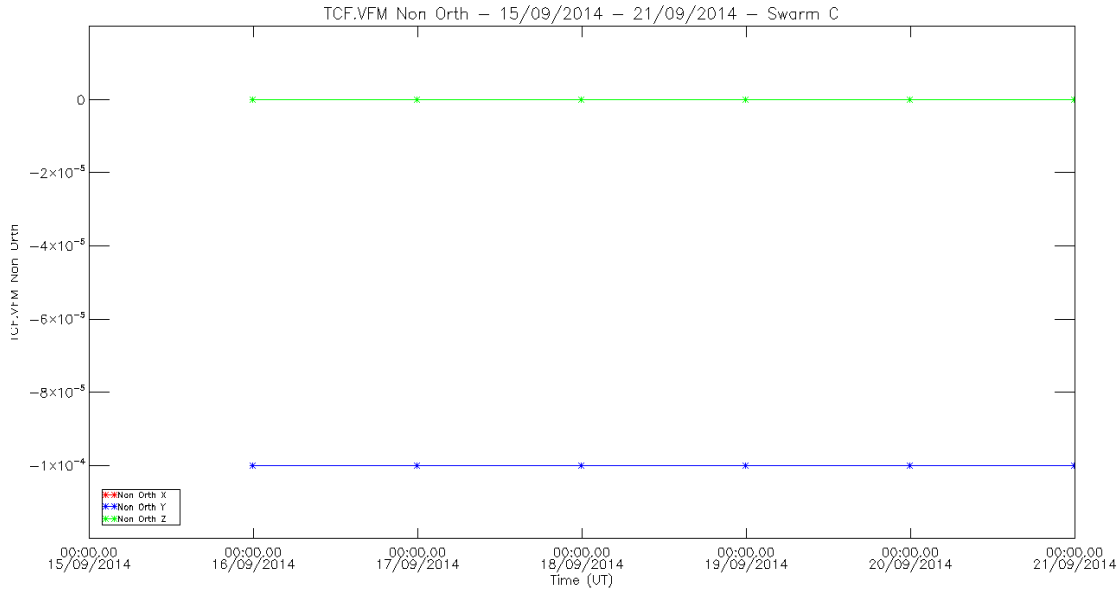

Figure 30: TCF.VFM Non-Orthogonalities for S/C C, 15-21/09/2014.

3.3.4 Summary of TCF behaviour for the three S/C

An important parameter which characterizes the quality of the TCF calculation is the weighted Root Mean Square (RMS) value of the residuals after the estimation. Figure 31 summarizes the RMS behaviour for all S/C during the week 15-21/09/2014 (Red curve = S/C A, blue curve = S/C B, green curve = S/C C).

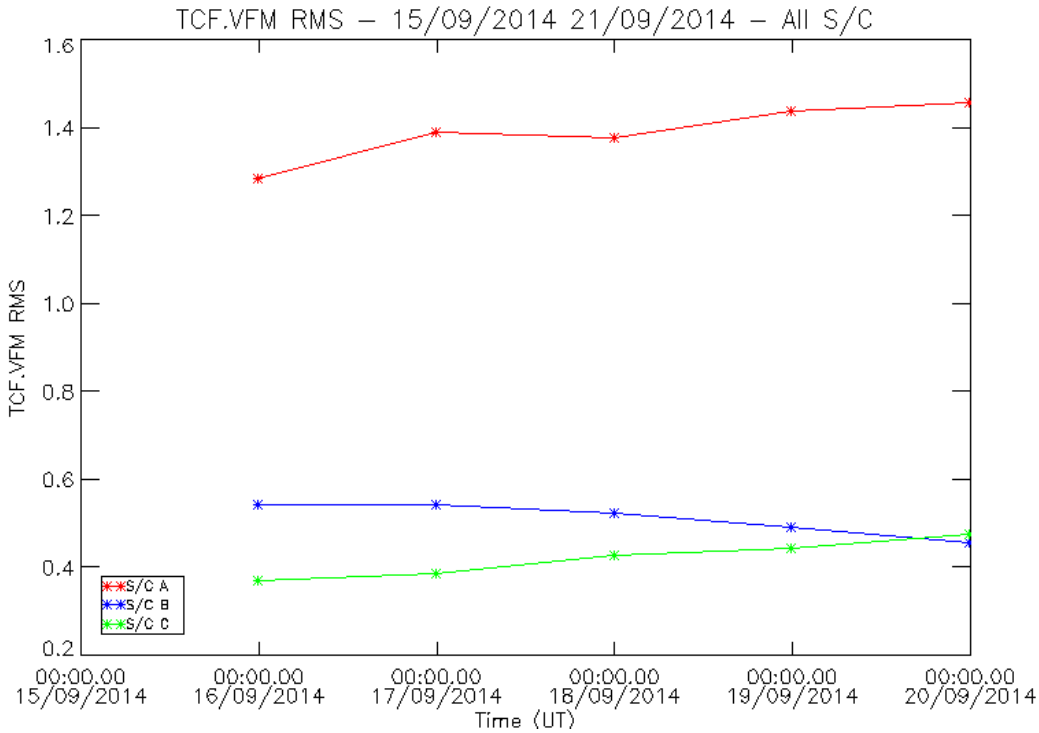

Figure 31: weighted RMS of the residuals after the TCF estimation, all S/C, 15-21/09/2014.

4. ON-DEMAND ANALYSIS

4.1 Increase of noise in VFM-ASM diff (SW-IDEAS-27)

Below the Kp index related to the 19/09/2014 and the Dst index related to September 2014 (Figure 32 and Figure 33). In the second half of day 19/9, the Kp index reaches a maximum value of 5, while Dst shows a negative dip of about 50-60 nT, which indicates the occurrence of a small geomagnetic storm.

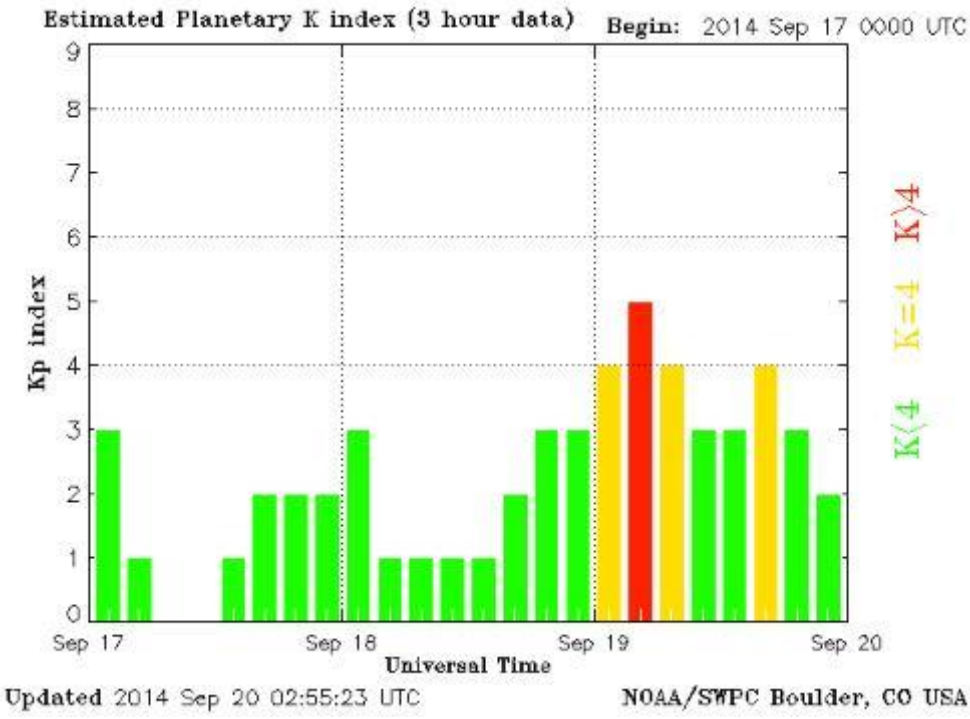

Figure 32 Kp index behaviour from NOAA, for 19/09/2014.

Figure 33 DST Index behaviour from World Data Center for Geomagnetism, Kyoto, for September 2014.

As we observed in Sects. 3.3.1.2, 3.3.2.2, and 3.3.3.2, the ASM-VFM difference is affected by an increase of the noise in the frequency band 0.04 – 0.1 Hz (see Figure 34 below, example for S/C A), starting around noon and continuing up to the end of the day (around 23 UT). This is a further confirmation of the effect of the geomagnetic perturbations on the Swarm magnetic measurements, as already detailed in [RD.9].

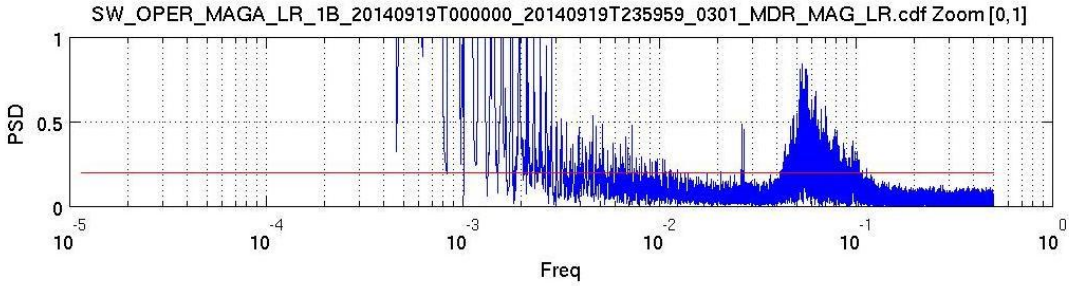

Figure 34: PSD zoom between 0 and 1 $nT^2/\sqrt{Hz}$ for the ASM-VFM difference, S/C A, 19/09/2014.

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