SWARM-ECHO MGF LV1B RELEASE NOTES

SWE-RN-MGF-001

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1 INTRODUCTION

This document provides the release notes for the Swarm-Echo (CASSIOPE/e-POP) MGF lv1b data set, released in January 2022. This is the first on-orbit calibrated, CDF-formatted release of the MGF dataset and is similar in structure to the Swarm-A/B/C lv1b magnetic data product.

2 APPLICABLE AND REFERENCE DOCUMENTATION

2.1 REFERENCE DOCUMENTS

[RD-1] Swarm-Echo MGF lv1b Data Product Description

[RD-2] Swarm-Echo MGF lv1b Data Calibration Validation Report

[RD-3] e-POP Data Handbook – https://epop.phys.ucalgary.ca/data-handbook

3 ABBREVIATIONS

Acronym	Description
CASSIOPE	Cascade, Smallsat and Ionospheric Polar Explorer
CDF	Common Data Format
e-POP	Enhanced Polar Outflow Probe
MGF	Magnetic Field Instrument on Swarm-Echo
NEC	North-East-Center

4 MGF lv1b MAGNETIC FIELD DATA

4.1 DATASET DESCRIPTION

This release note describes the updates to the Swarm-Echo MGF level 1b data product. This newly formatted and calibrated data set improves on the original MGF data set quality by introducing a 7-day rolling window on-orbit calibration, and incorporating the updated and improved attitude solution from the Swarm-E Mission Operation System.

The on-orbit calibration utilizes the full vector information by minimizing the vector residuals between the measured field and a model field, following the procedure outlined in Olsen et al. (2003) and Olsen et al. (2020). After careful filtering of the data for calibration purposes, four basic calibration parameters are determined from the procedure, each in three dimensions: sensitivity, orthogonality, Euler angle, and offset. Full details of the implementation can be found in [RD-1].

The format of the MGF data products have changed from a text-based implementation to ISTP-compliant CDF files that are similar in structure to the Swarm-A/B/C lv1b magnetic products. Included in the data files are the inboard and outboard measured fields in the Common Reference Frame, the outboard sensor data in the NEC frame, magnetic field error estimates, various data quality flags, the model magnetic field determined from the CHAOS 7.7 model, and the calibration parameters. Note that Swarm-E does not have an absolute scalar magnetometer. The full CDF product definition and differences from the Swarm-A/B/C CDF MAG products can be found in [RD-1].

The daily Swarm Echo MGF CDF products are available in both low-rate (LR, 1 Hz), and high-rate (HR, 160 Hz) CDF files.

4.2   DATASET RELEASE NOTES

The Swarm-E MGF data product is available on both the e-POP (epop-data.phys.ucalgary.ca) and Swarm (swarm-diss.eo.esa.int) dissemination data servers. File names are of the form

```
SW_OPER_MAGE_XR_1B_YYYYMMDDT000000_YYYYMMDDT235959_VVVV_MDR_MAG_XR.cdf
```

Where *X* indicates low or high rate data (L or R, respectively), *YYYY* is the year, *MM* is the month, *DD* is the day, and *VVVV* is the version number.

It is stressed here that users of the Swarm-E MGF data product should be keenly aware of the data quality flags: Flags_B and Flags_q in the CDF data product. These flags indicate to the user times when the magnetic measurements are degraded due to poor attitude solutions, fast attitude maneuvers, operation of the bus magnetotorquers, and interpolation of the data due to instrumental clipping. Care must be taken when utilizing the magnetic data for publication purposes.

5   RESULTS

The MGF data product can be visualized via quicklook plots (Figure 5-1), summary plots (Figure 5-2), and residual plots (Figure 5-3). See [RD-2] for complete details regarding the visualization plots. The data can also be imported into the Swarm VirES platform.
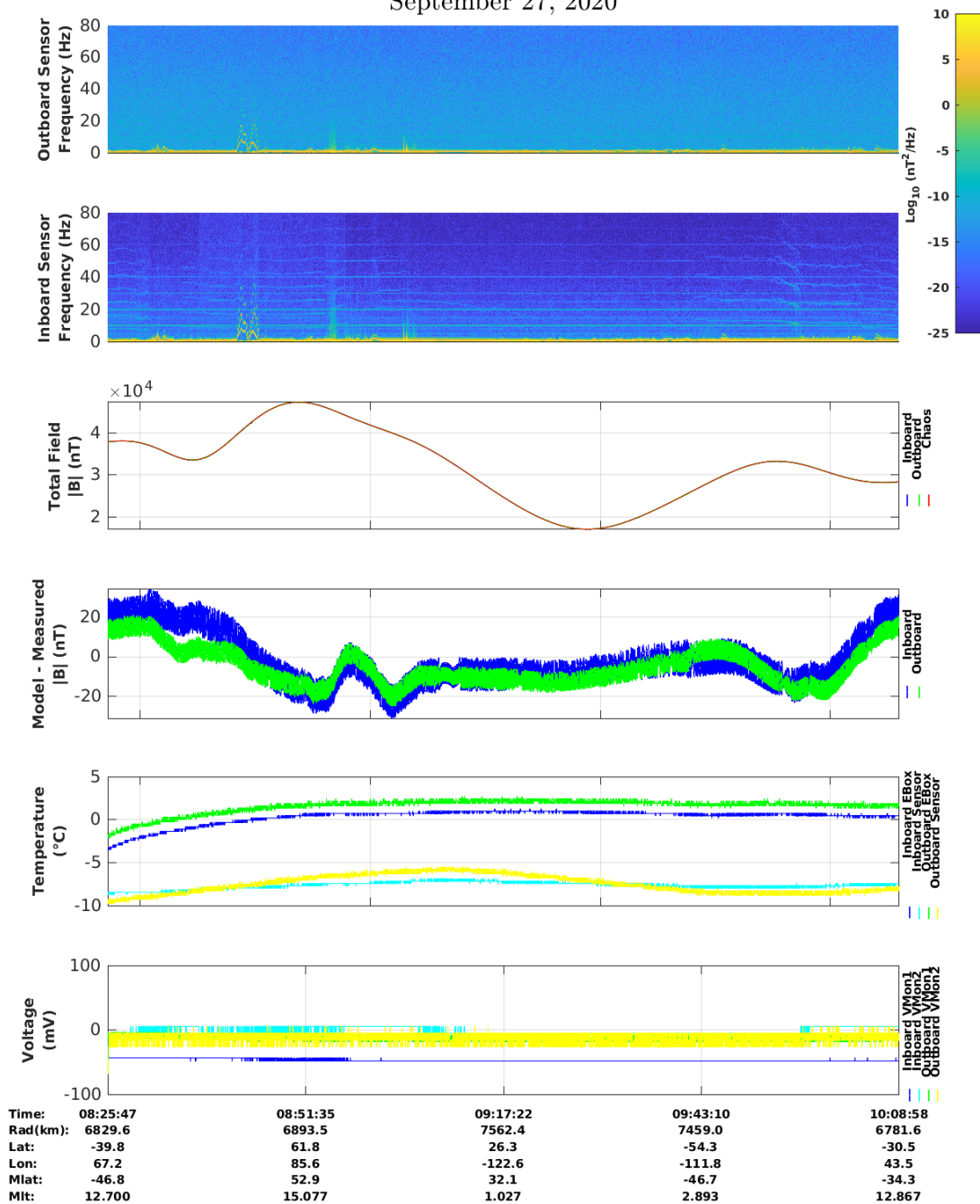
Overall quality of the Swarm-E MGF data has improved vastly from the first iteration of the data set. The average RMS deviation from the CHAOS model for the selected calibration data is on the order of 7 nT.

Figure 5-1: Sample Swarm-E MGF Quicklook Plot
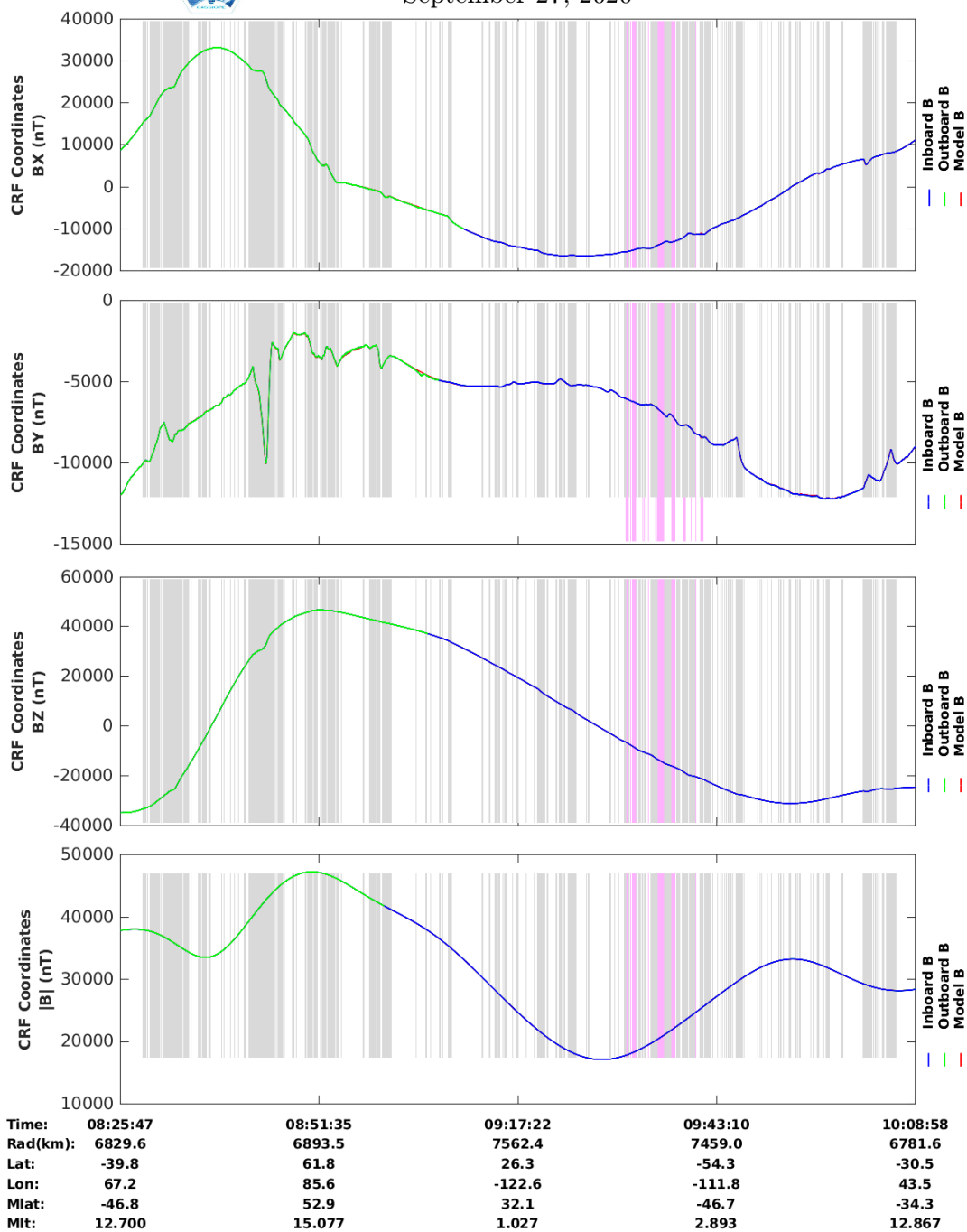
Figure 5-2: Sample Swarm-E MGF Summary Plot
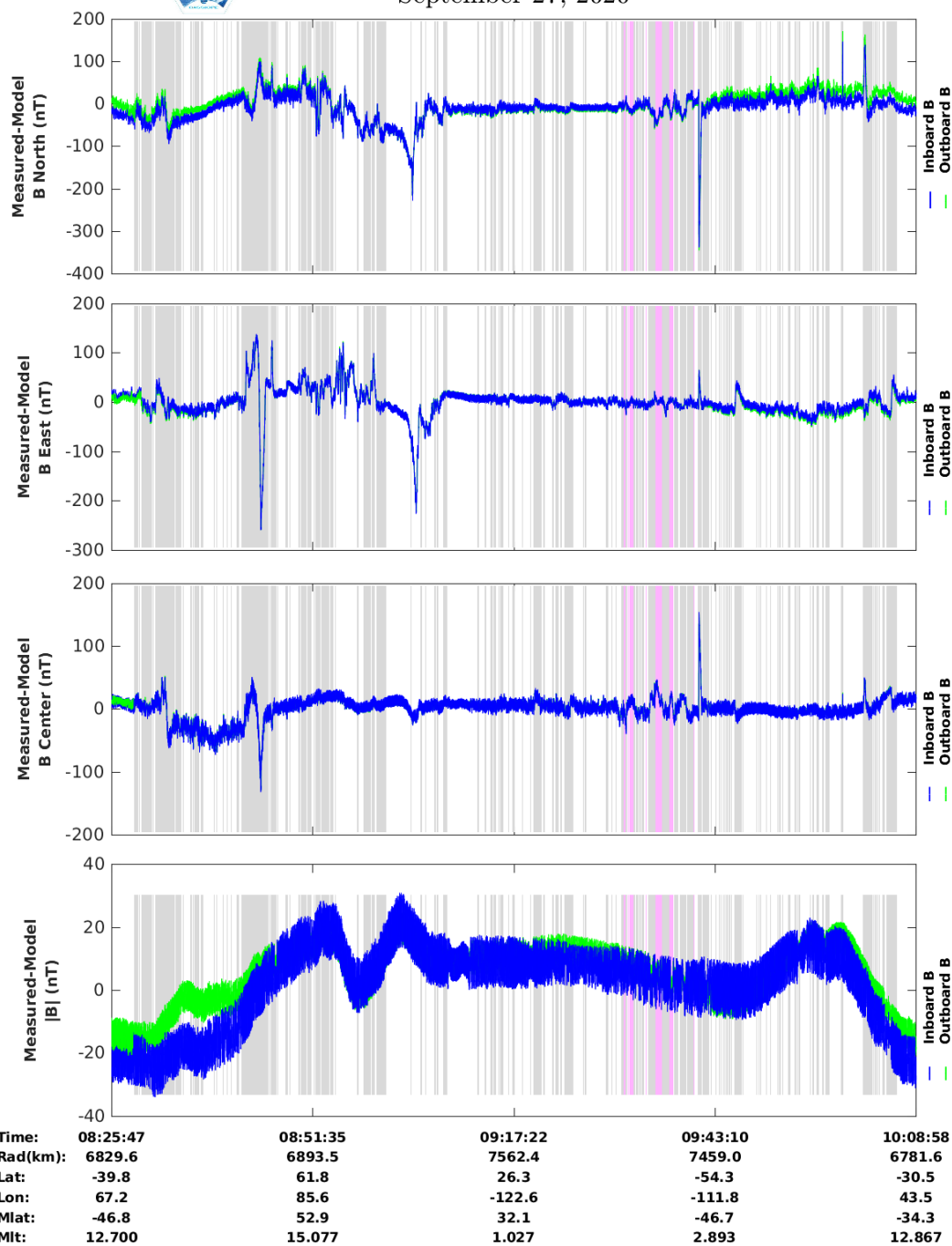
Figure 5-3: Sample Swarm-E MGF Residual Plot

6 REFERENCES

Olsen, N., Clausen, L. T., Sabaka, T. J., Brauer, P., Merayo, J. M., Jørgensen, J. L., et al. (2003). Calibration of the Ørsted vector magnetometer. Earth, Planets and Space, 55(1), 11–18.

Olsen, N., Albini, G., Bouffard, J., Parrinello, T., & Tøffner-Clausen, L. (2020). Magnetic observations from CryoSat-2: calibration and processing of satellite platform magnetometer data. Earth, Planets and Space, 72, 1–18.