remote sensing

MDPI

Communication

Quick report of the ML=3.3 on 1 January 2023 Guidonia (Rome, Italy) earthquake: evidence of a seismic acceleration

Dedalo Marchetti[1], Kaiguang Zhu[1,*], Laura Marchetti[2], Yiqun Zhang[1], Wenqi Chen [1], Yuqi Cheng [1], Mengxuan Fan[1], Siyu Wang[1], Ting Wang [1], Jiami Wen [1], Donghua Zhang [1], Hanshuo Zhang [1]

1 College of Instrumentation and Electrical Engineering, Jilin University, Changchun 130061, China

2 Noviconsult SAS, 15060, Basaluzzo (Alessandria), Italy

* Correspondence: zhukaiguang@jlu.edu.cn;

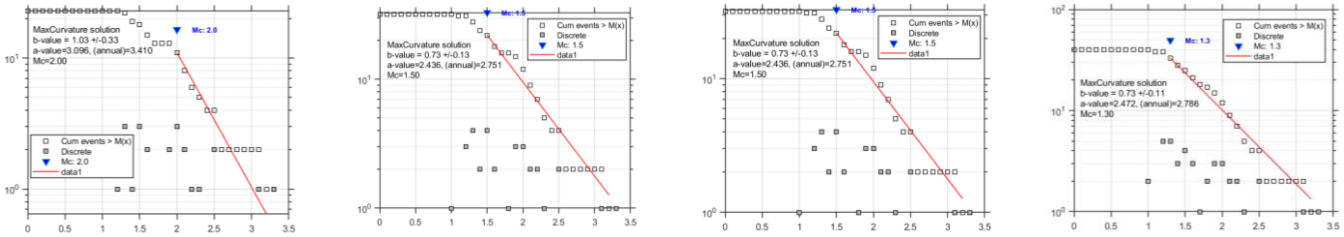
Supplementary Materials

1 Dobrovolsky's area of M=3.3

2 Dobrovolsky's area of M=3.5

3 Dobrovolsky's area of M=3.7

4 Dobrovolsky's area of M=3.9



5 Dobrovolsky's area of M=4.1

6 Dobrovolsky's area of M=4.3

7 Dobrovolsky's area of M=4.5

8 Dobrovolsky's area of M=4.7

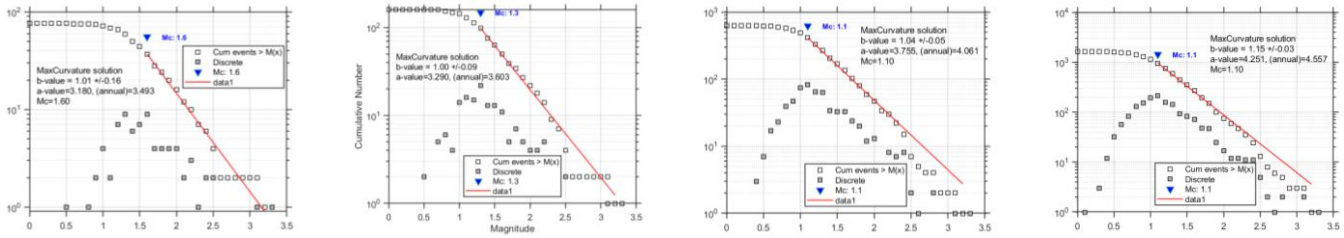


Figure S1. Gutenberg-Richeter distributions of the earthquake occurred in Dorovolsky's areas from magnitude 3.3. to 4.7 all centred on 1 January 2023 ML=3.3 Guidonia earthquake (41.982° N, 12.750° E). By the method of maximum curvature, the a and b values are computed for each graph by Z-Map software [1]

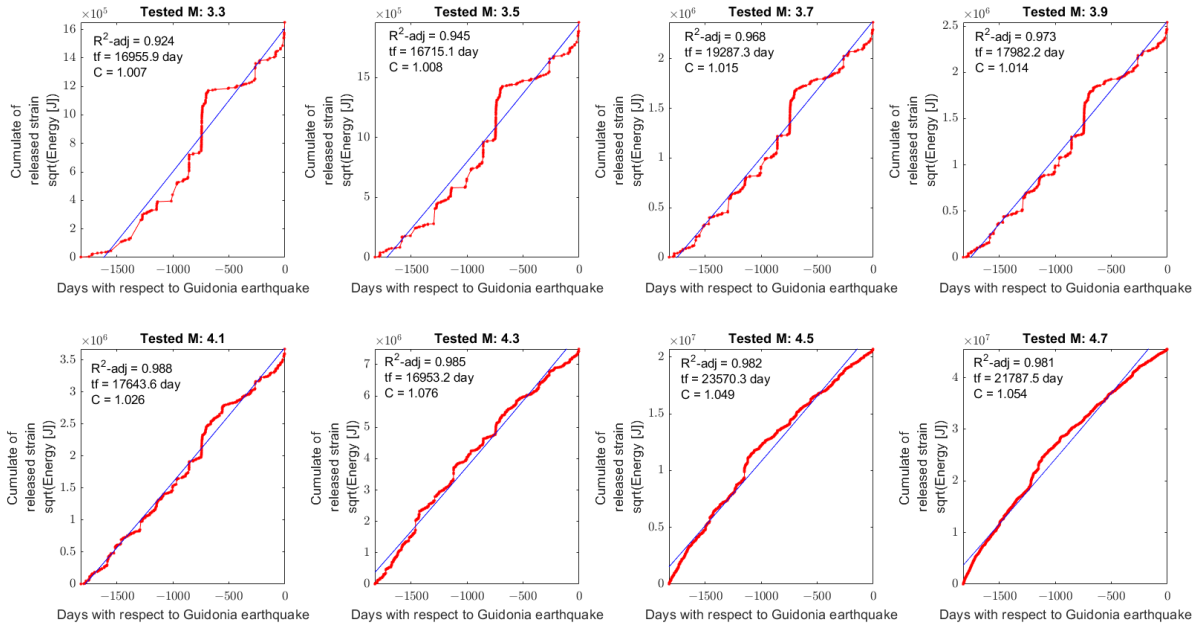


Figure S2. Benioff cumulative stress curves in the 5 years before the ML=3.3 1 January 2023 Guidonia earthquake tested in the Dobrovolsky areas of earthquakes with magnitude from 3.3 to 4.7. For each plot the blue curve represents the time-to-failure power law fit, whose R^2-adg. and tf are reported. The acceleration coefficient C is also reported.

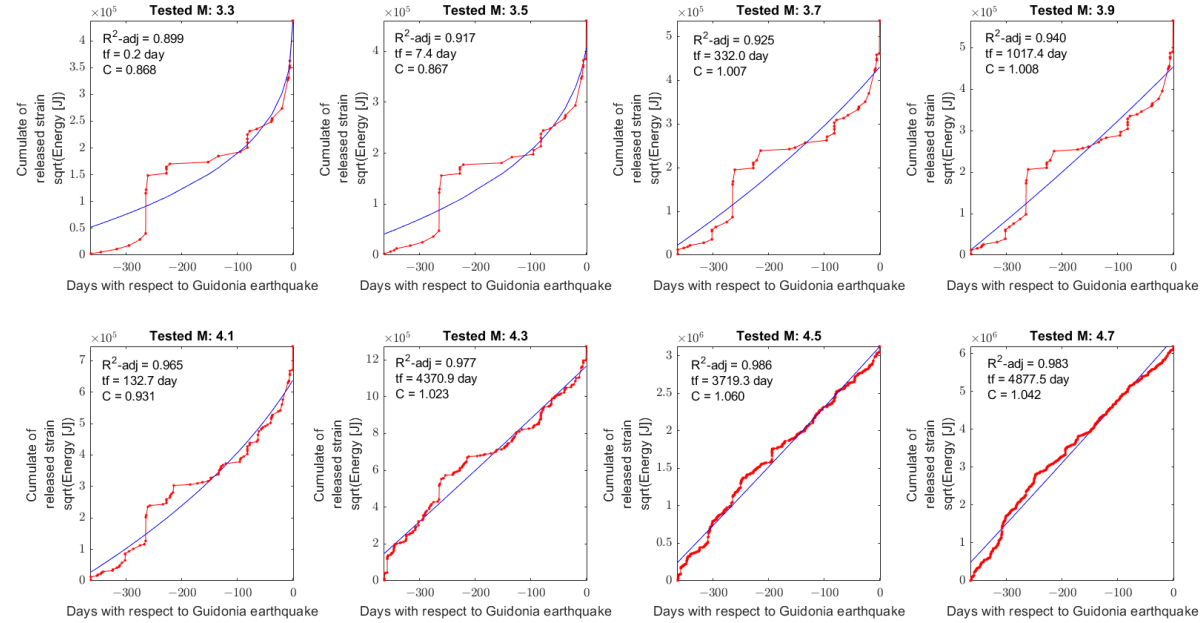


Figure S3. The same as Figure S2, but calculated in one year before the ML=3.3 1 January 2023 Guidonia earthquake.

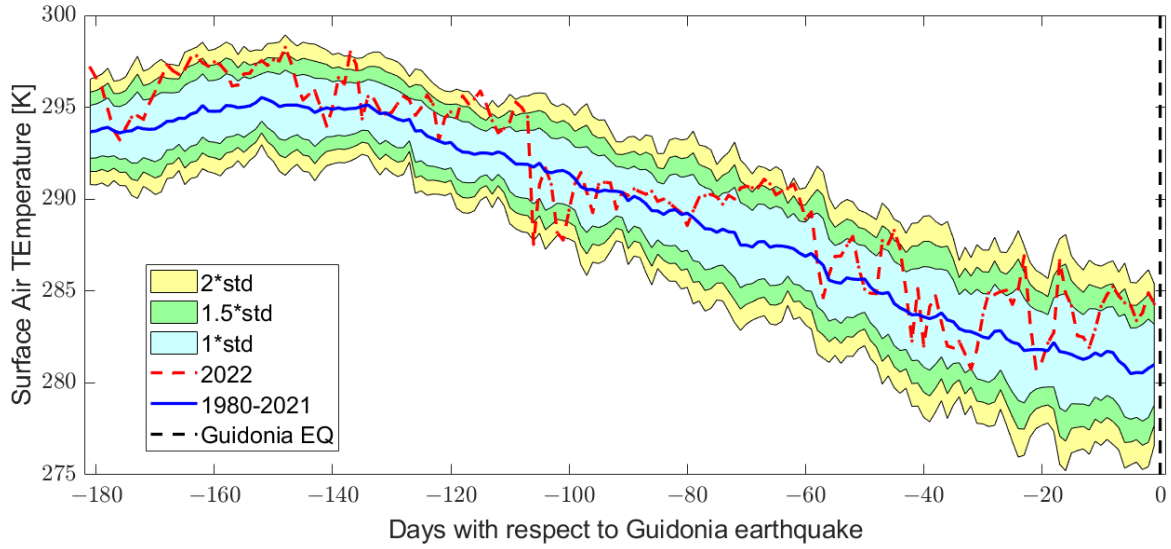


Figure S4. Surface air temperature time series from 4 July 2022) until 31 December 2022, i.e., six months before the ML=3.3 1 January 2023 Guidonia earthquake.

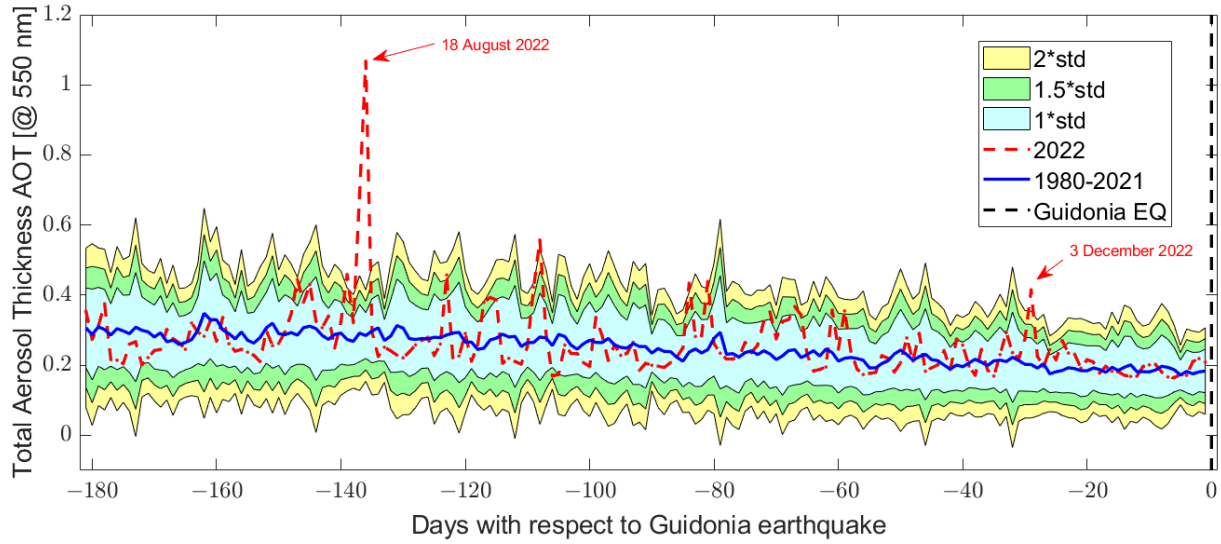


Figure S5. Aerosol time series from 4 July 2022 until 31 December 2022, i.e., six months before the ML=3.3 1 January 2023 Guidonia earthquake.

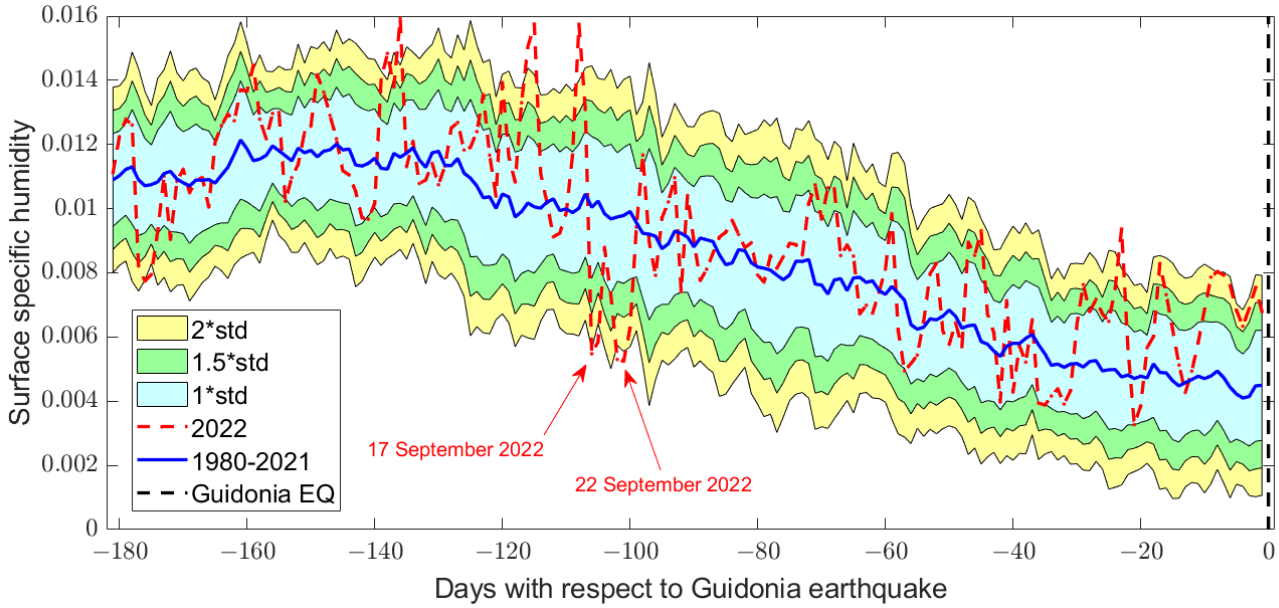


Figure S6. Surface specific humidity time series from 4 July 2022 until 31 December 2022, i.e., six months before the ML=3.3 Guidonia 1 January 2023 earthquake.

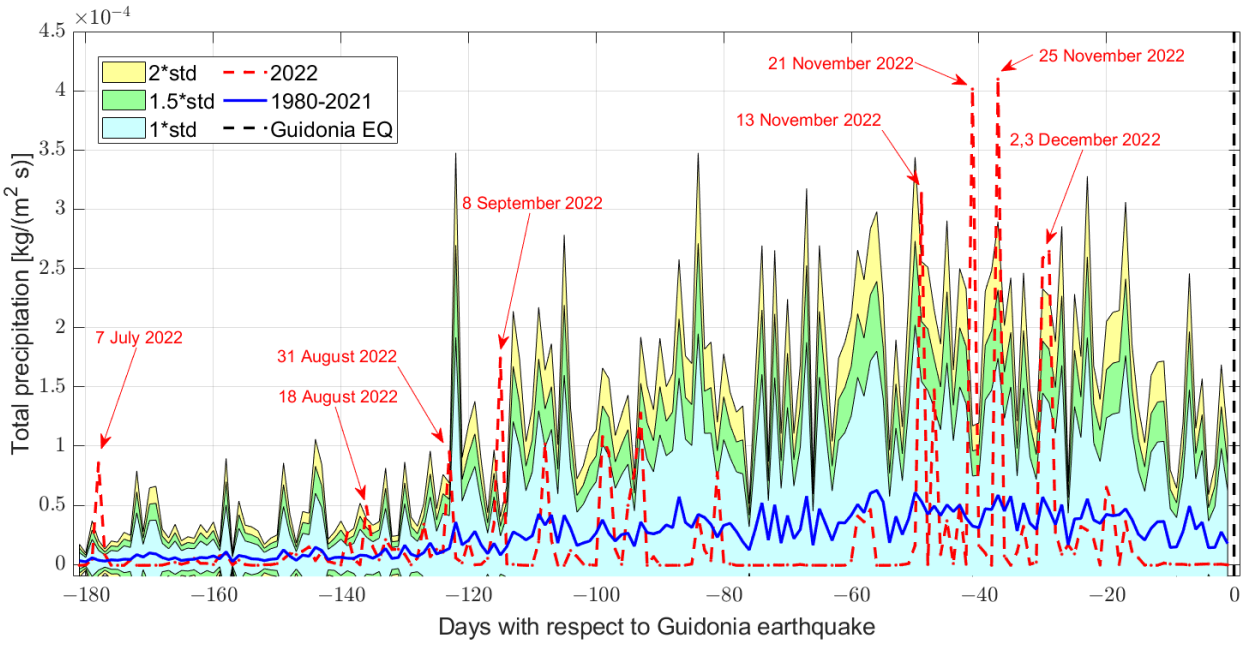


Figure S7. Total precipitation time series from 4 July 2022 until 31 December 2022, i.e., six months before the ML=3.3 Guidonia 1 January 2023 earthquake.

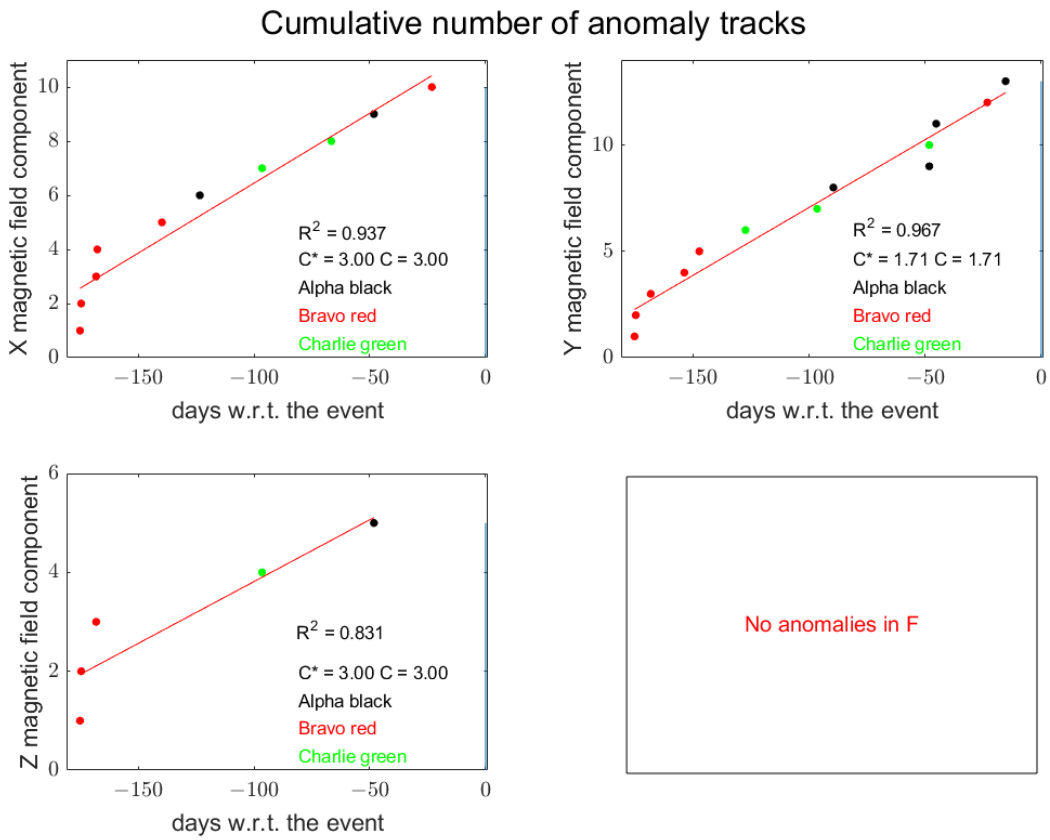


Figure S8. The cumulate number of Swarm Alpha, Bravo and Charlie geomagnetic field anomalies extracted by MASS algorithm with a window length of 1° latitude and threshold kt = 2.5 inside a circular area of 470km of diameter.

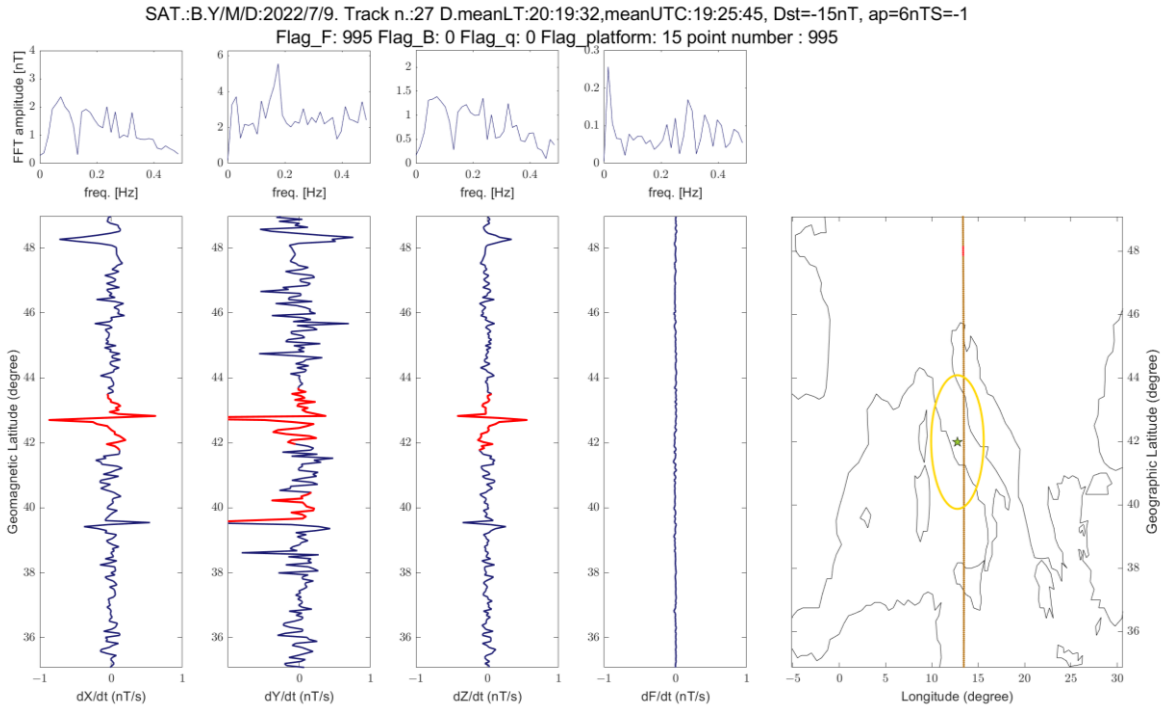


Figure S9. Swarm Bravo magnetic field analysis on 9 July 2022, track 27.

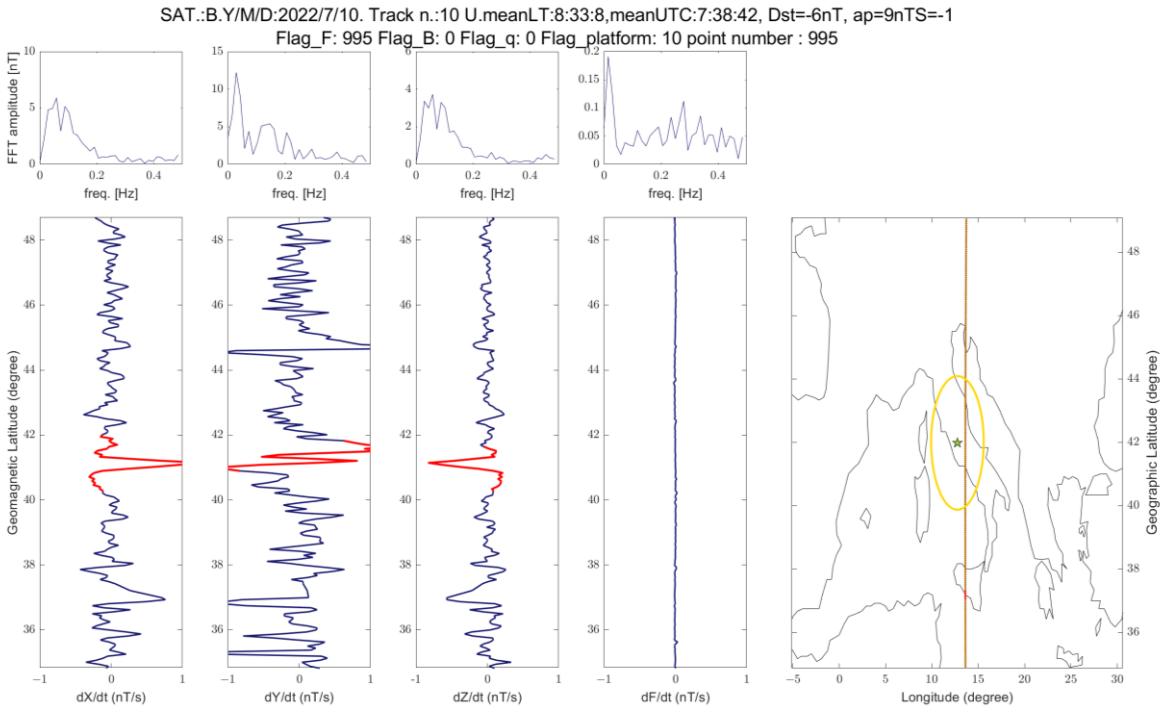


Figure S10. Swarm Bravo magnetic field analysis on 10 July 2022, track 10.

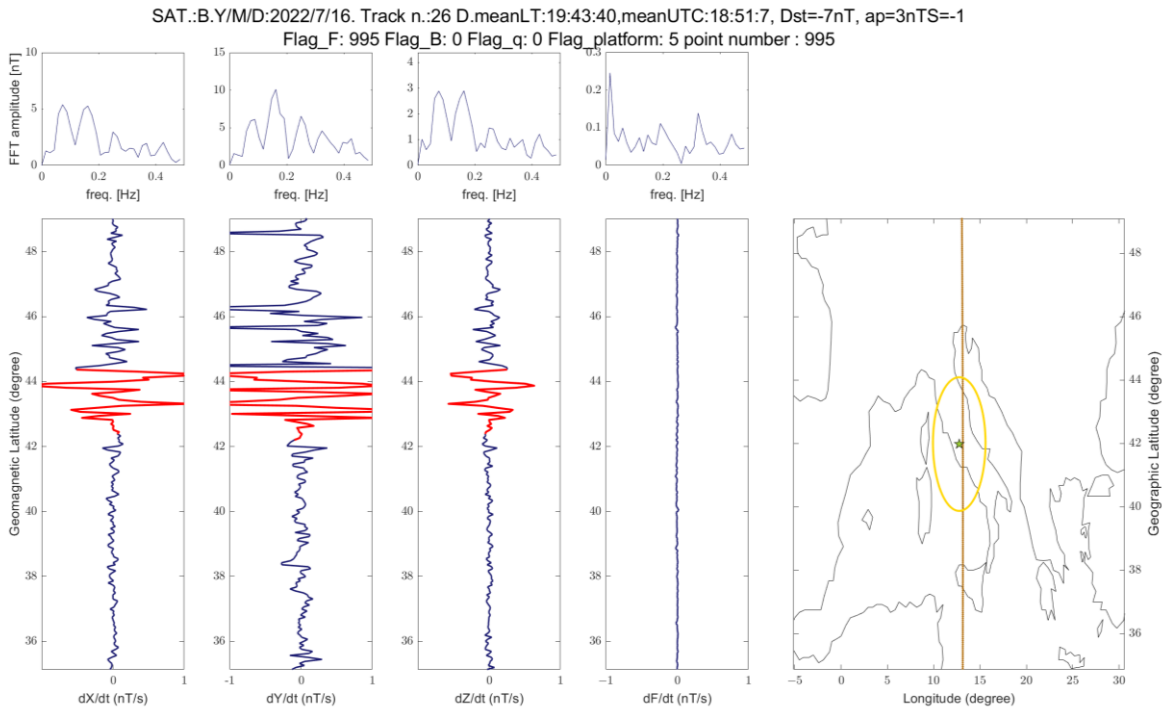


Figure S11. Swarm Bravo magnetic field analysis on 16 July 2022, track 26.

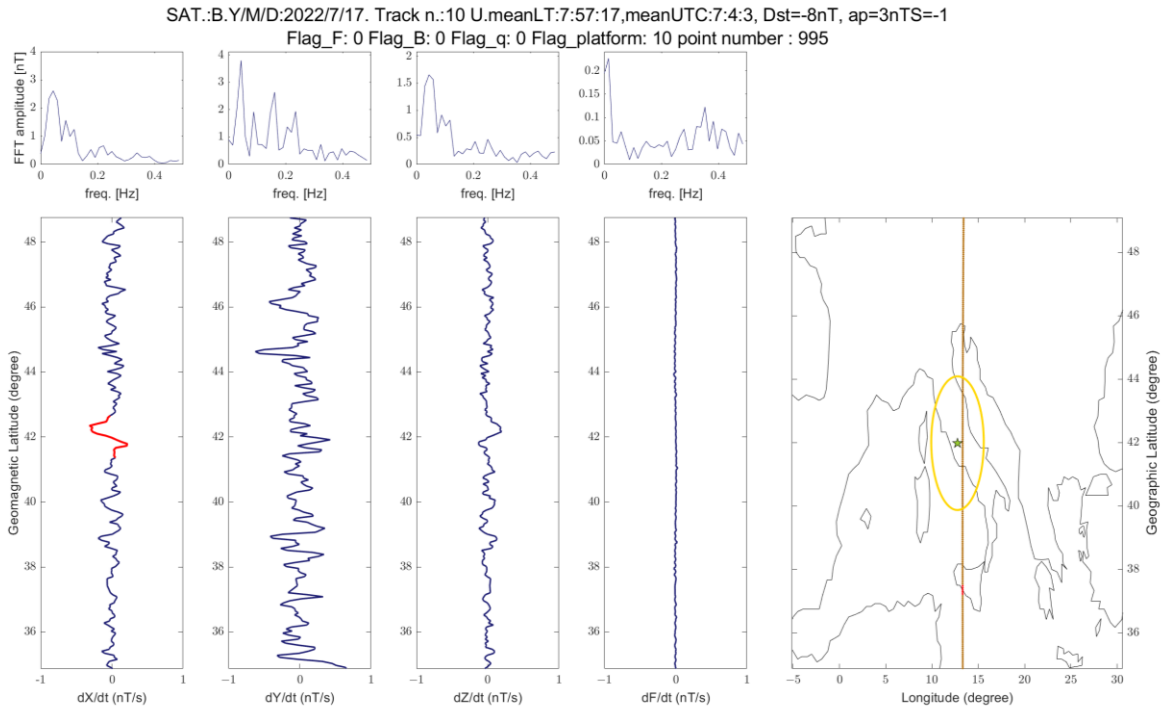


Figure S12. Swarm Bravo magnetic field analysis on 17 July 2022, track 10.

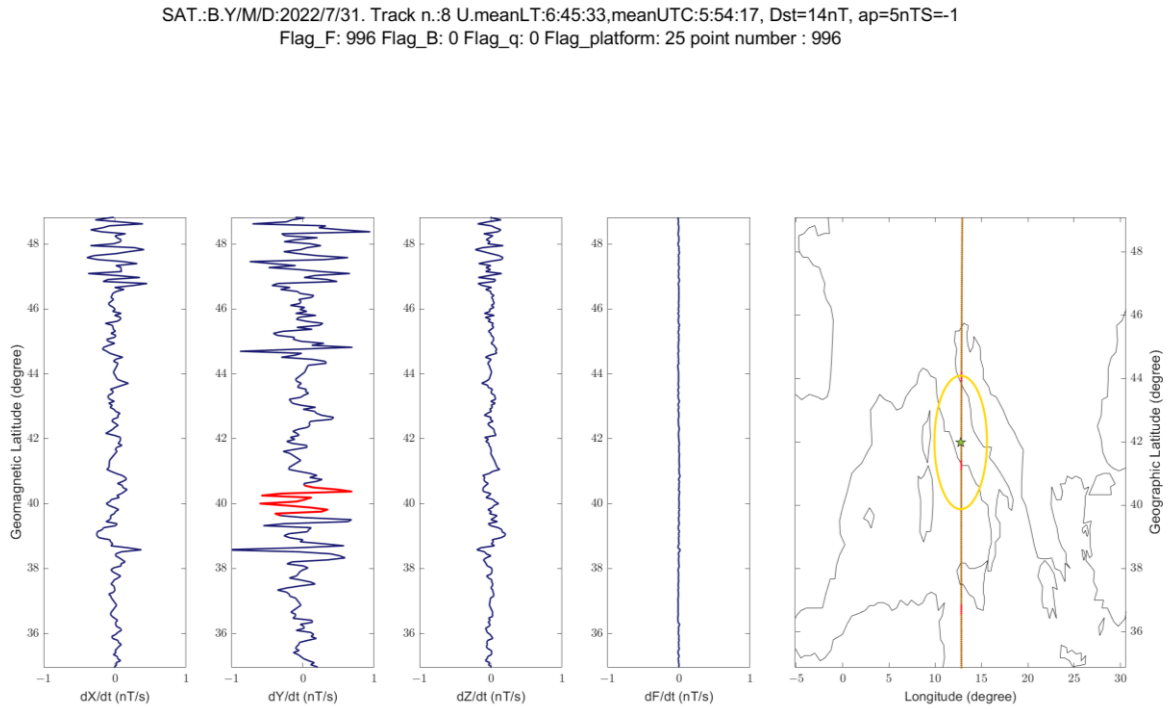


Figure S13. Swarm Bravo magnetic field analysis on 31 July 2022, track 8. Spectra are not available due to not a sufficient number of samples acquired with good flags. In the map, the part of the orbit with bad flags is highlighted in red.

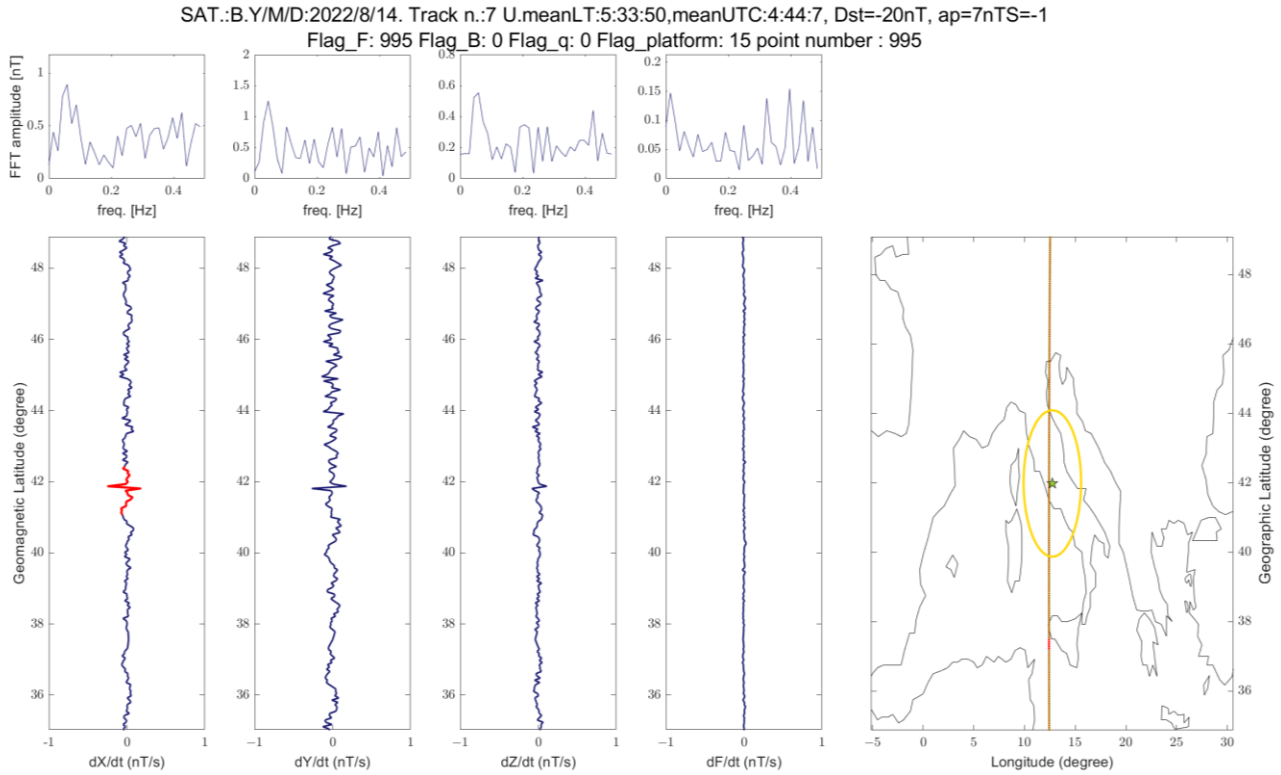


Figure S14. Swarm Bravo magnetic field analysis on 14 August 2022, track 7.

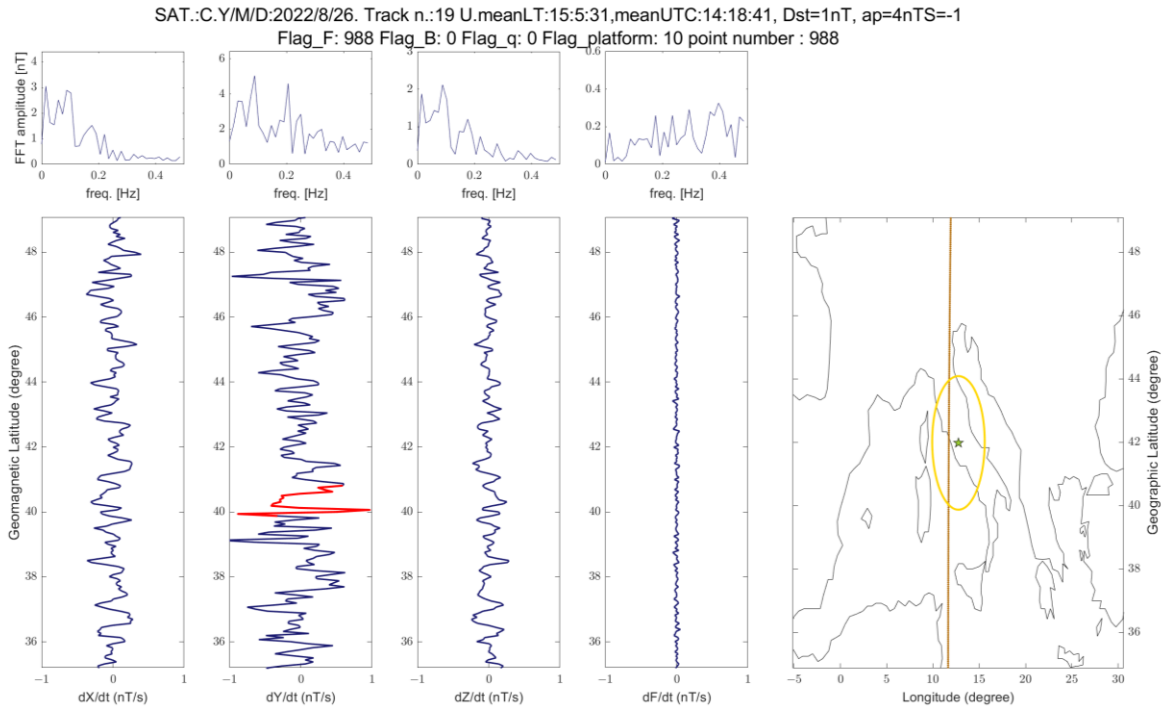


Figure S15. Swarm Charlie magnetic field analysis on 26 August 2022, track 19.

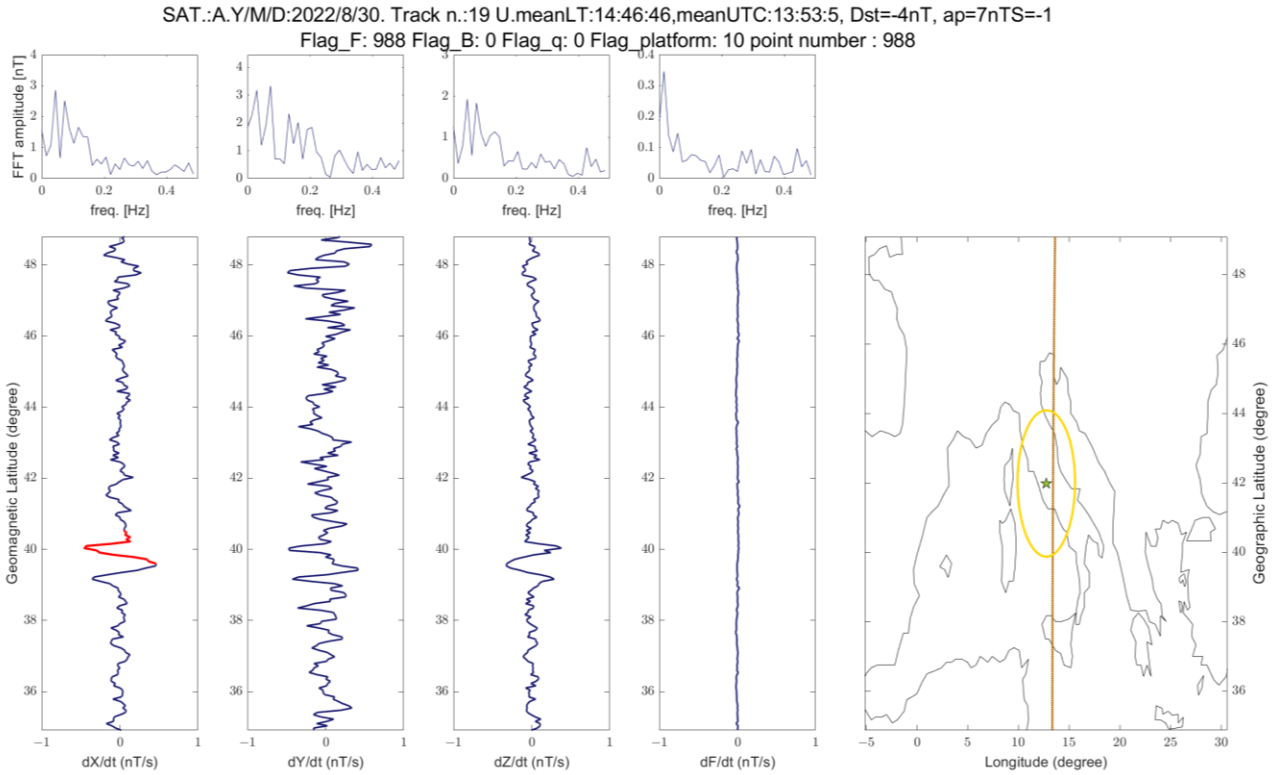


Figure S16. Swarm Alpha magnetic field analysis on 30 August 2022, track 19.

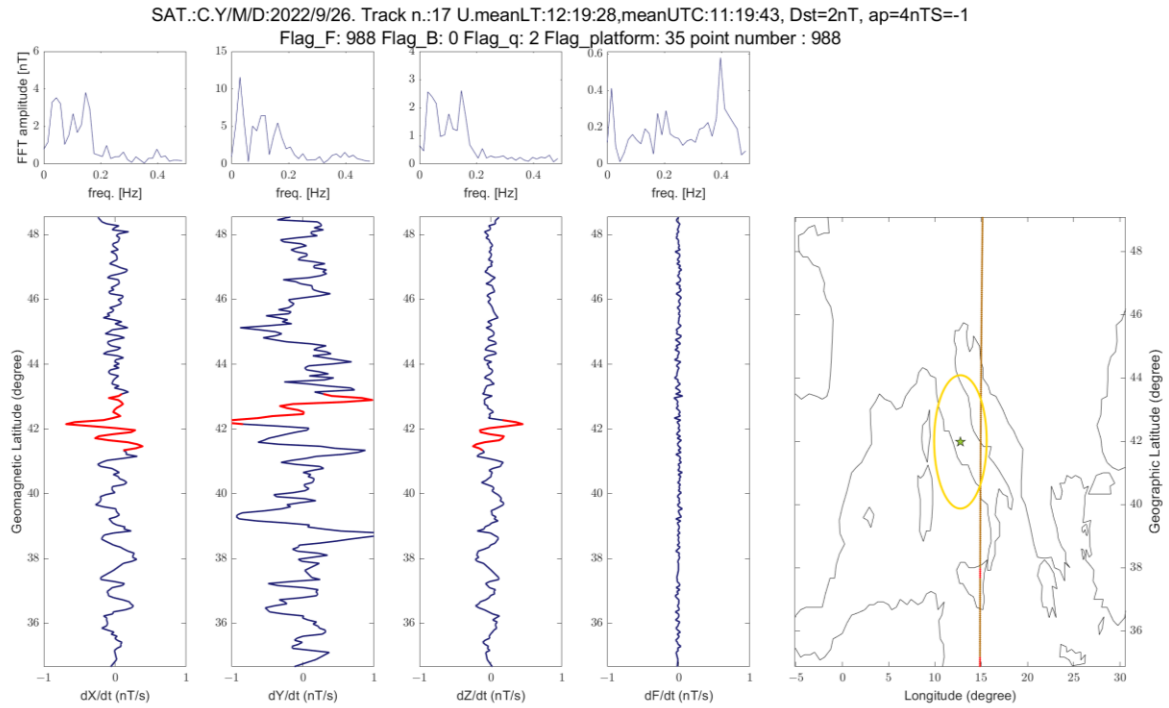


Figure S17. Swarm Alpha magnetic field analysis on 26 September 2022, track 17.

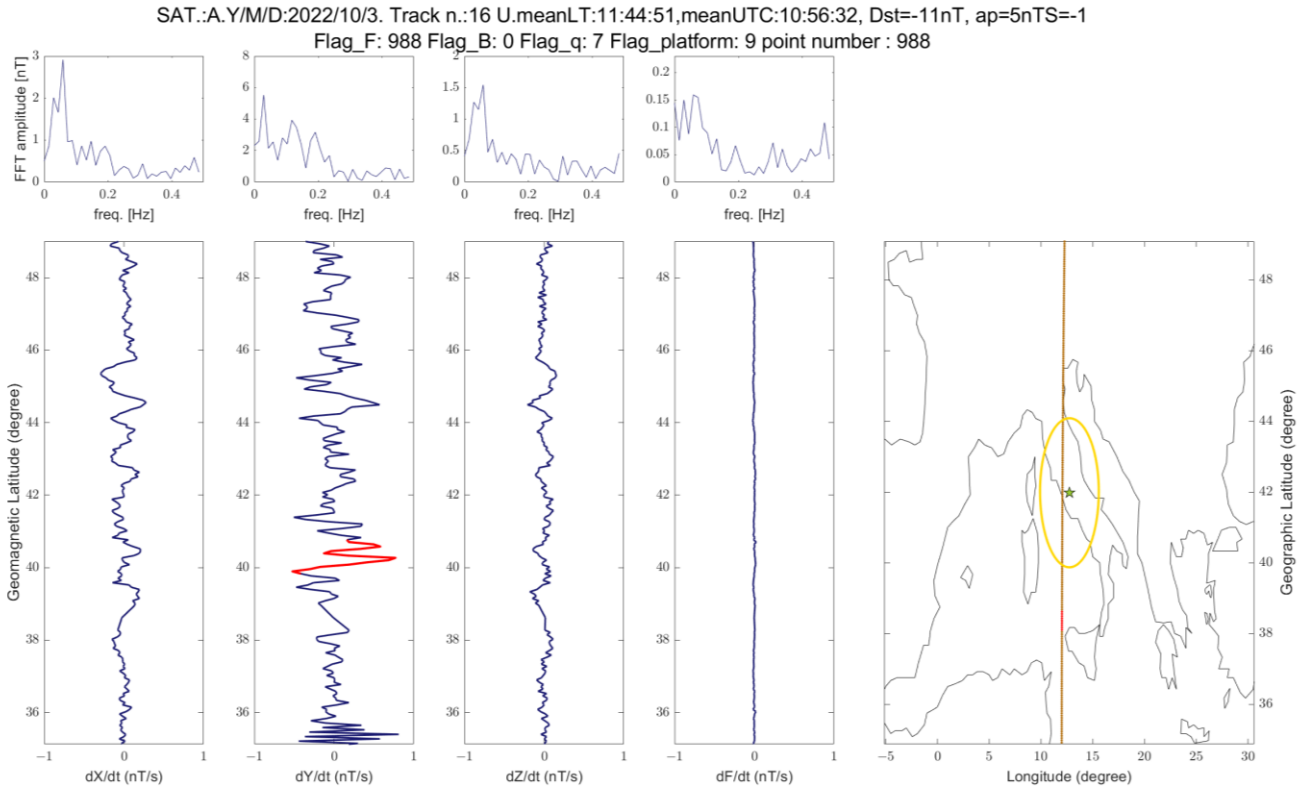


Figure S18. Swarm Alpha magnetic field analysis on 3 October 2022, track 16.

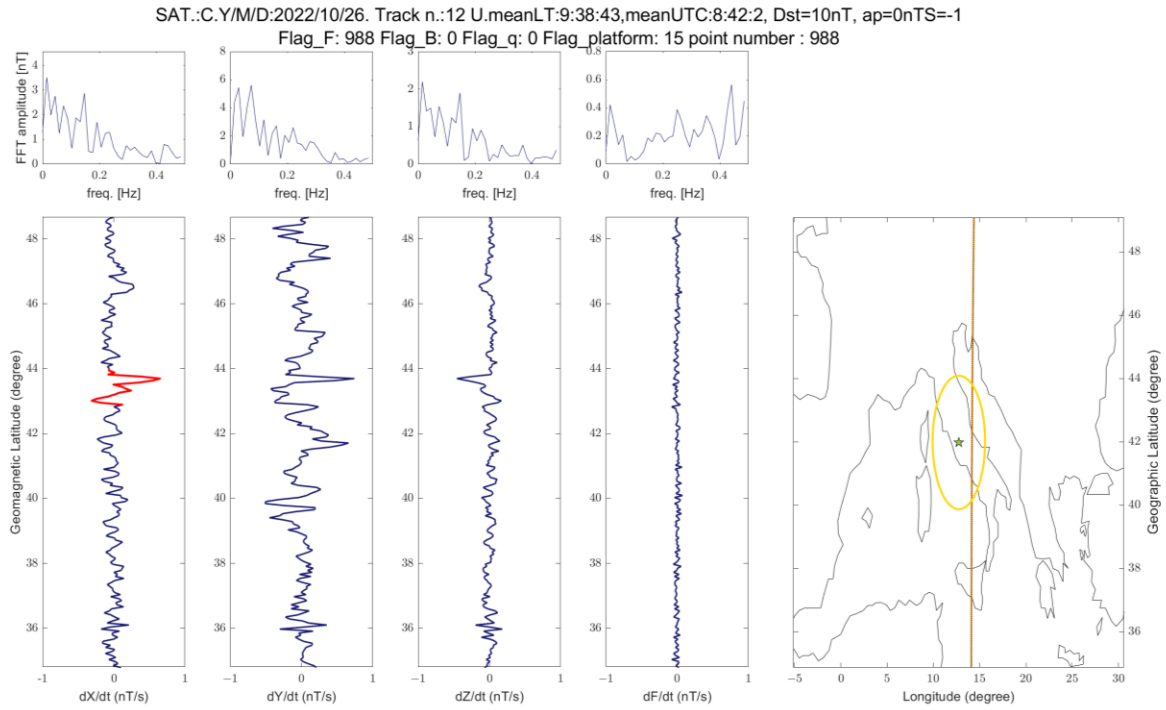


Figure S19. Swarm Charlie magnetic field analysis on 26 October 2022, track 12.

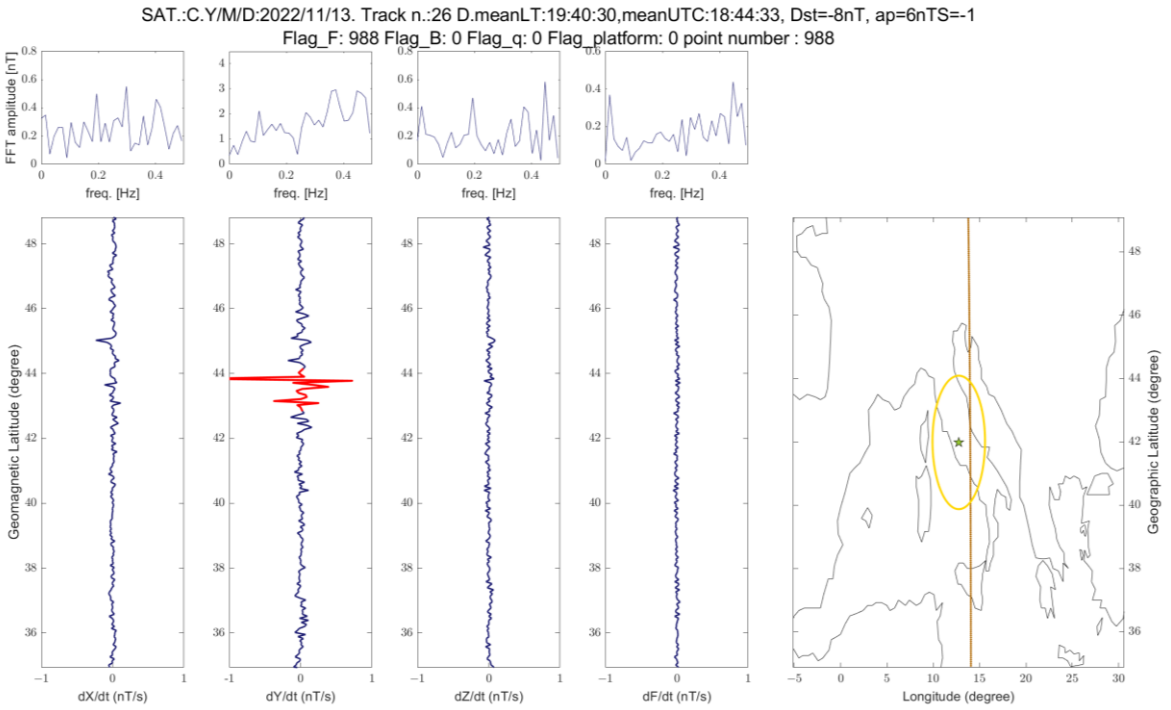


Figure S20. Swarm Charlie magnetic field analysis on 13 November 2022, track 26.

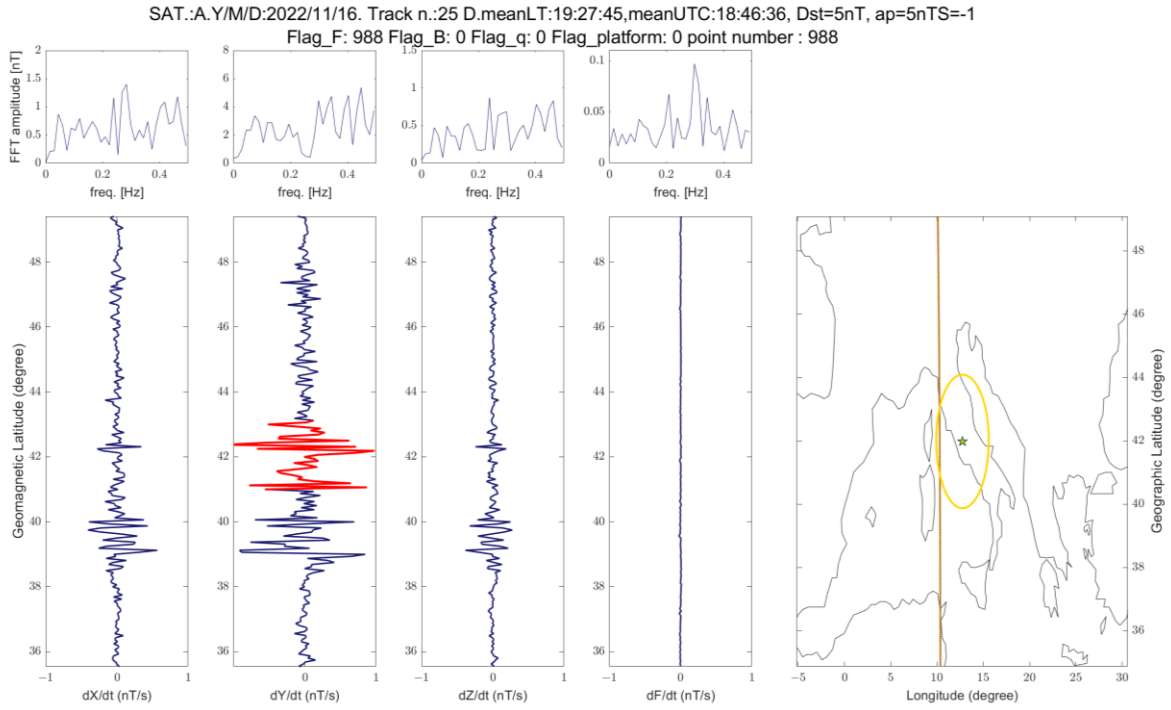


Figure S21. Swarm Alpha magnetic field analysis on 16 November 2022, track 25.

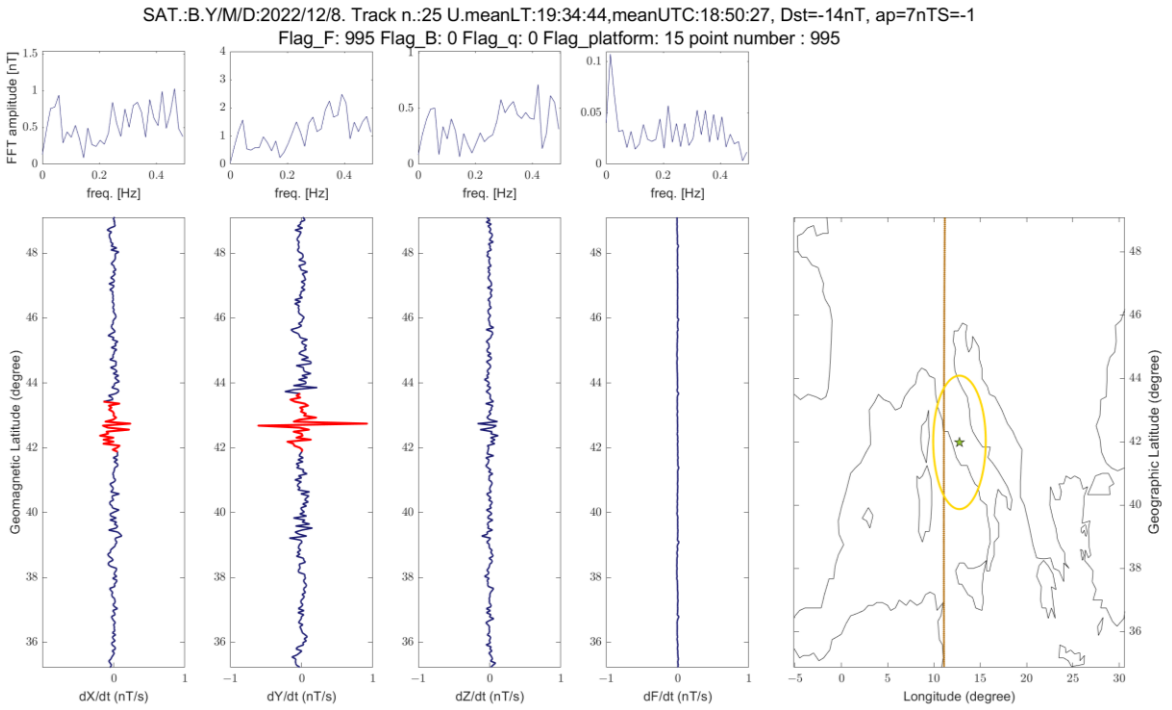


Figure S22. Swarm Bravo magnetic field analysis on 8 December 2022, track 25.

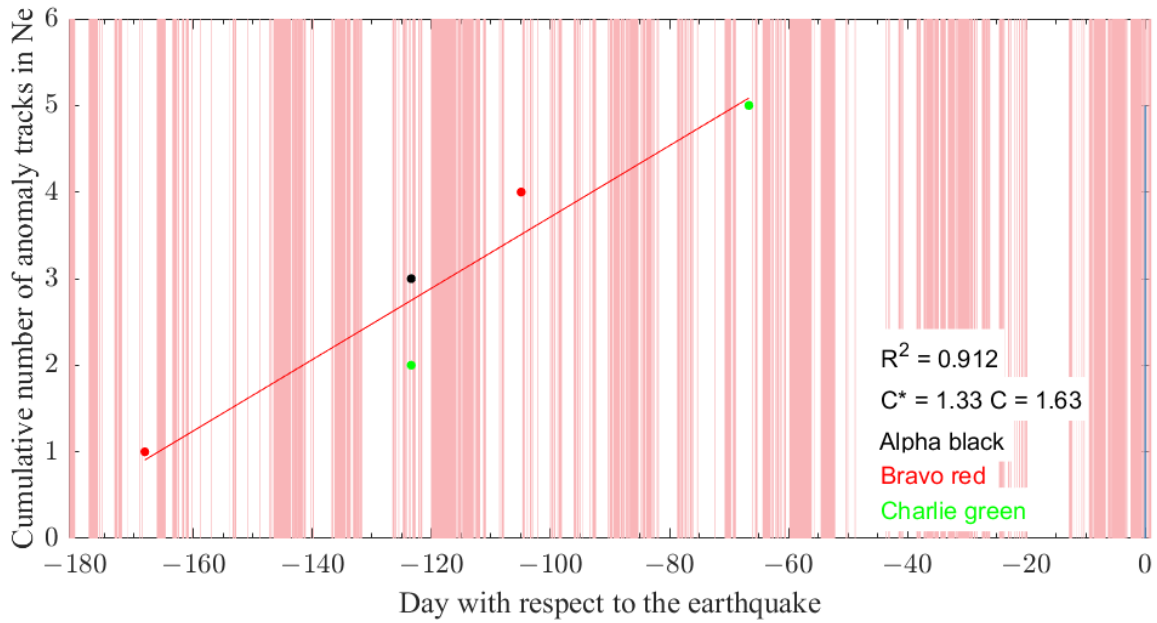


Figure S23. The cumulate number of Swarm Alpha, Bravo and Charlie electron density (Ne) anomalies extracted by NeLOG algorithm with a threshold kt = 2.0 inside a circular area of 470km of diameter. Single track are shown in the following figures.

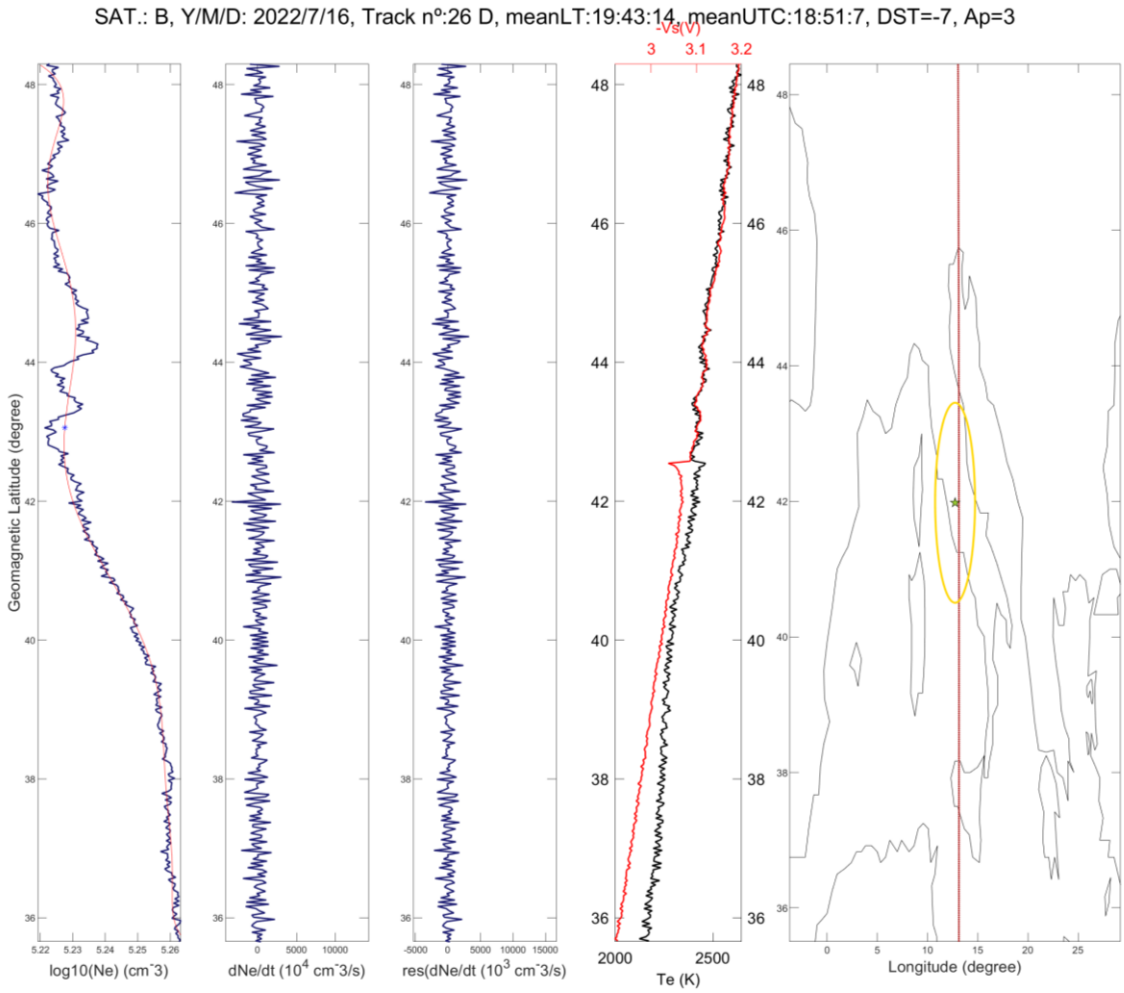


Figure S24. Swarm electron density analysis on 16 July 2022, track 26. The Electron Temperature (black line) and Spacecraft potential (red line) are also shown.

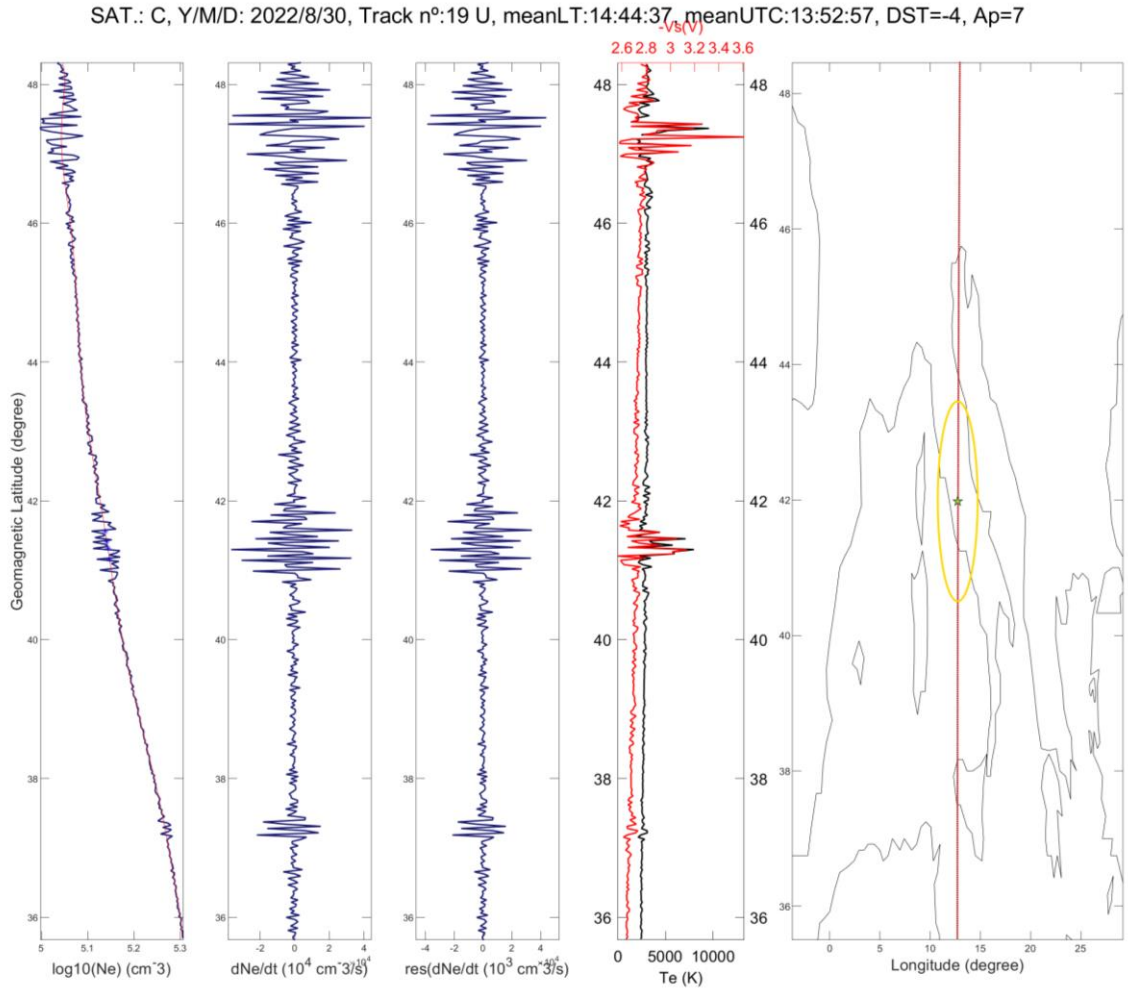


Figure S25. Swarm Charlie electron density analysis on 30 August 2022, track 19.

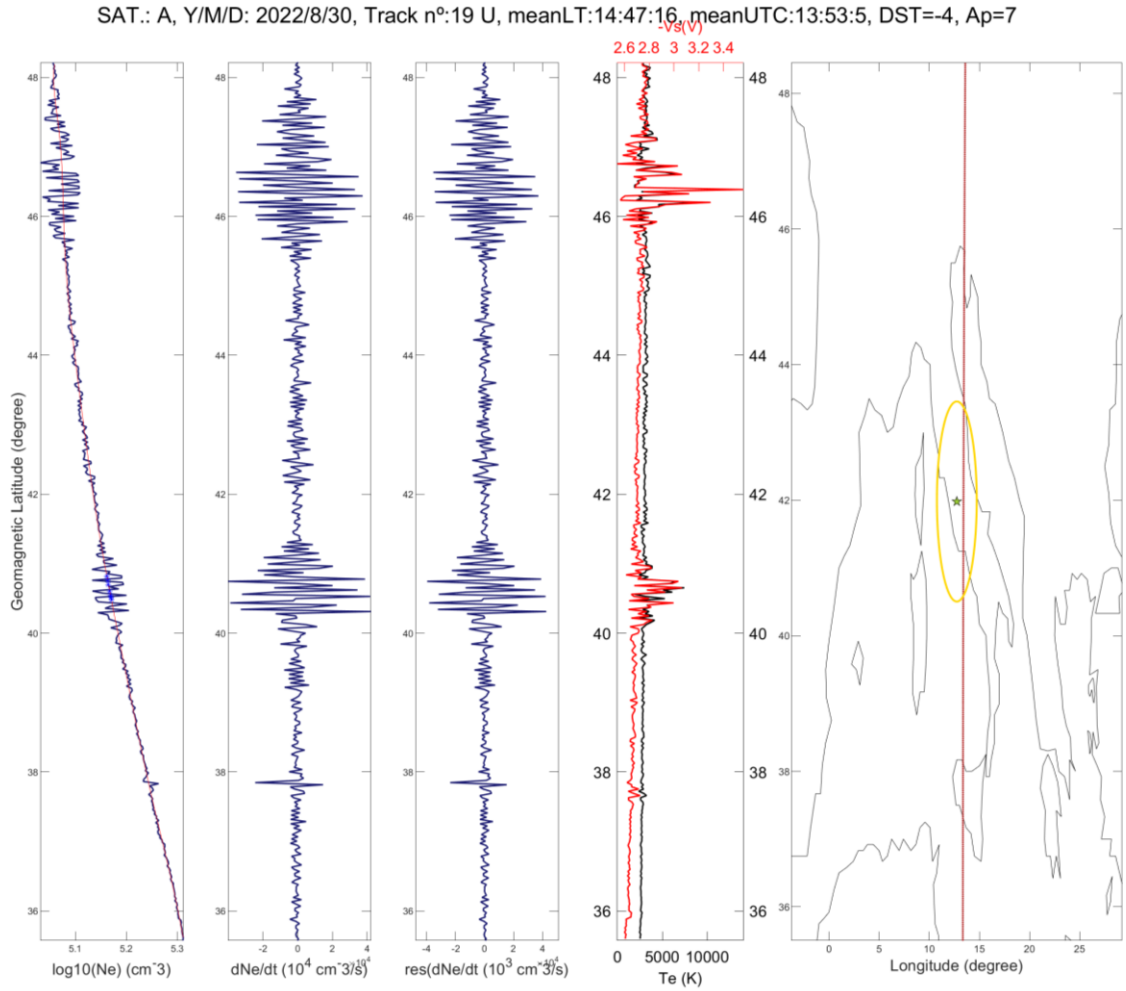


Figure S26. Swarm Alpha electron density analysis on 30 August 2022, track 19.

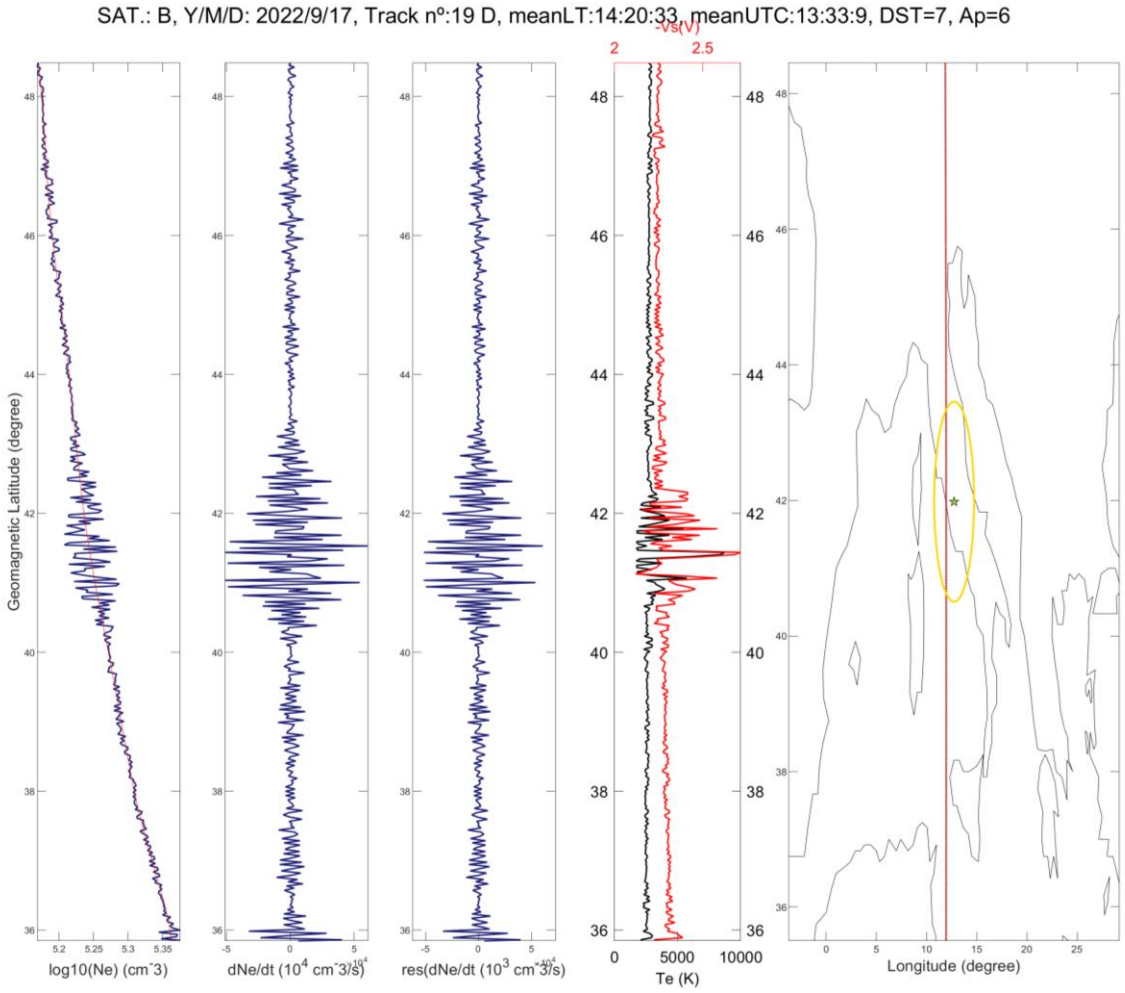


Figure S27. Swarm Bravo electron density analysis on 17 September 2022, track 19.

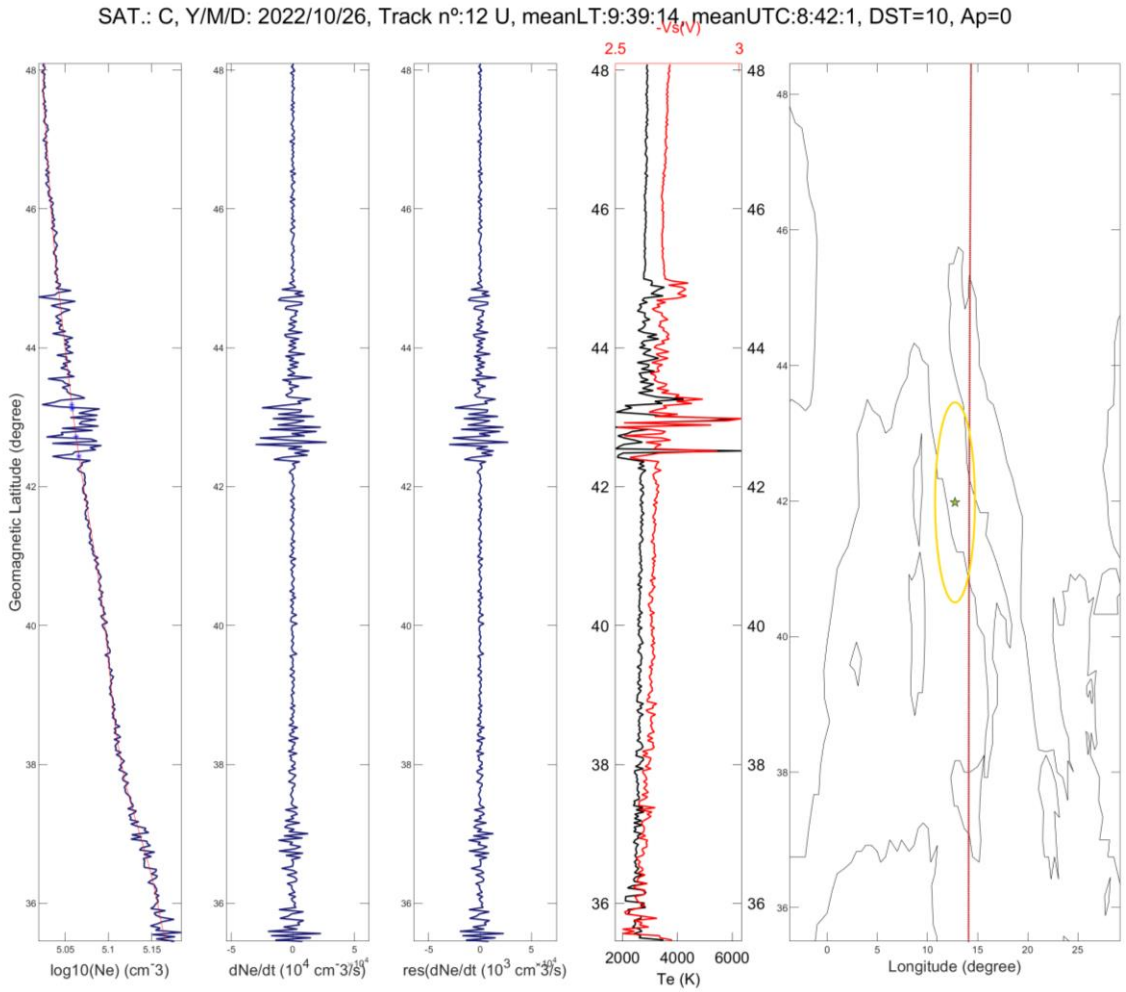


Figure S28. Swarm Charlie electron density analysis on 26 October 2022, track 12.

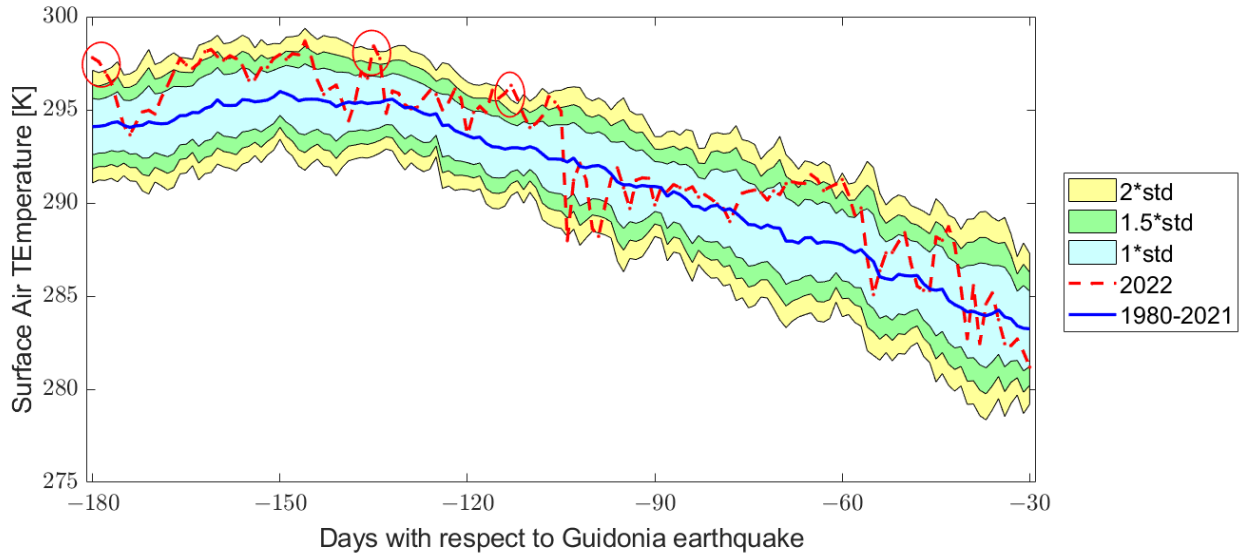


Figure S29. Surface air temperature time series from 3 July 2022 (six months before the ML=3.3 1 January 2023 Guidonia earthquake) until 30 November 2022.

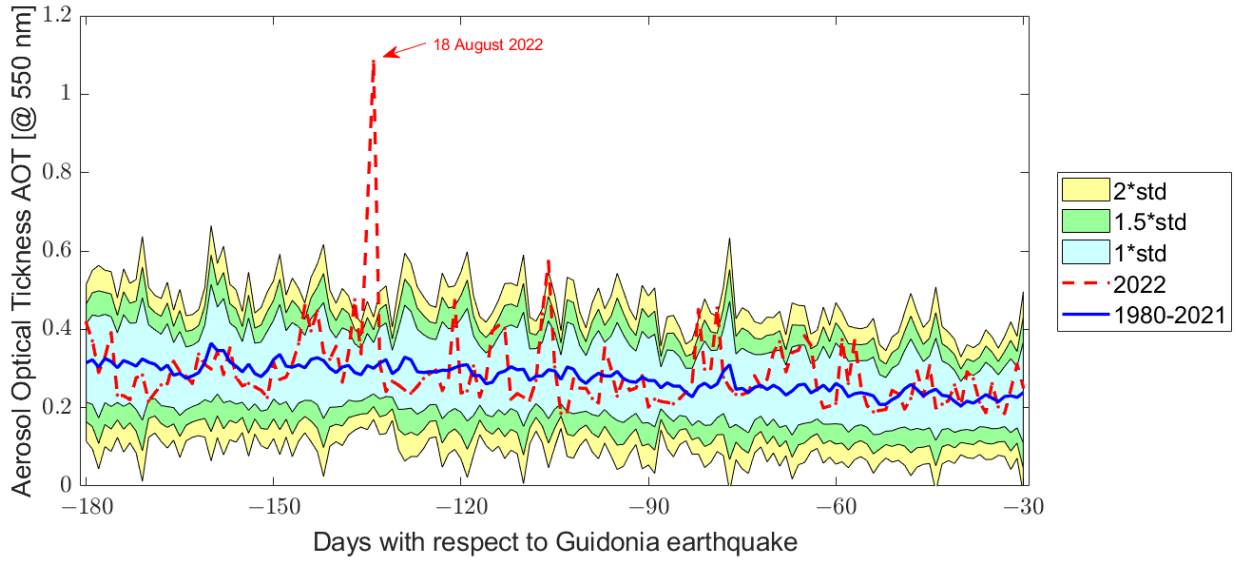


Figure S30. Aerosol time series from 4 July 2022 (six months before the ML=3.3 1 January 2023 Guidonia earthquake) until 30 November 2022.

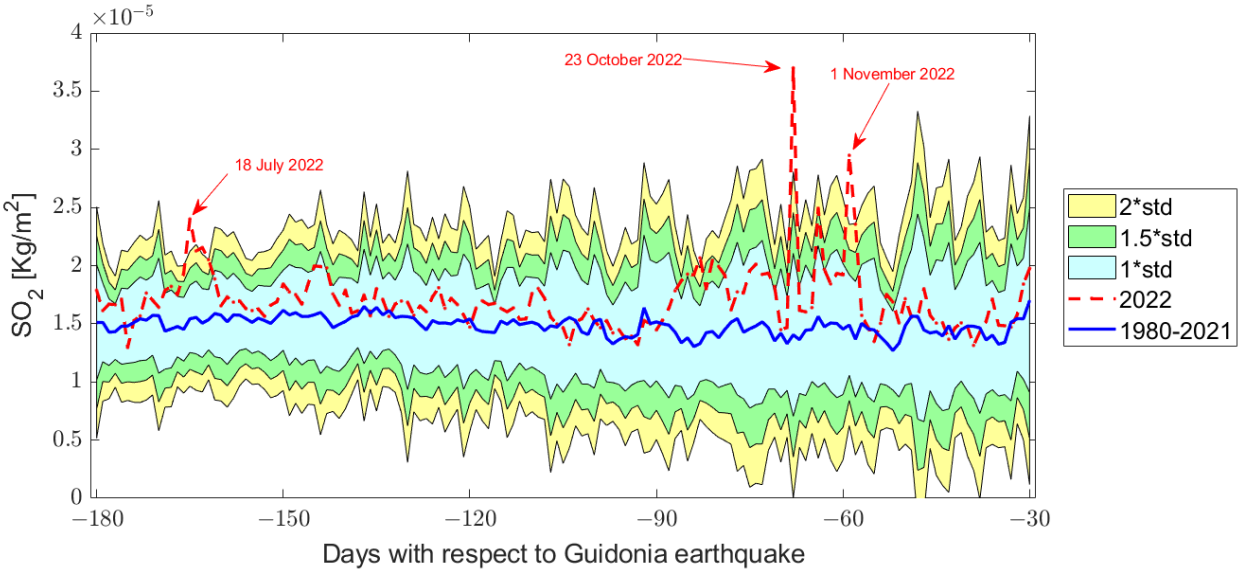


Figure S31. SO_2 time series from 4 July 2022 (six months before the ML=3.3 1 January 2023 Guidonia earthquake) until 30 November 2022. The years of 1989 and 1993 have been excluded automatically as particularly anomalous.

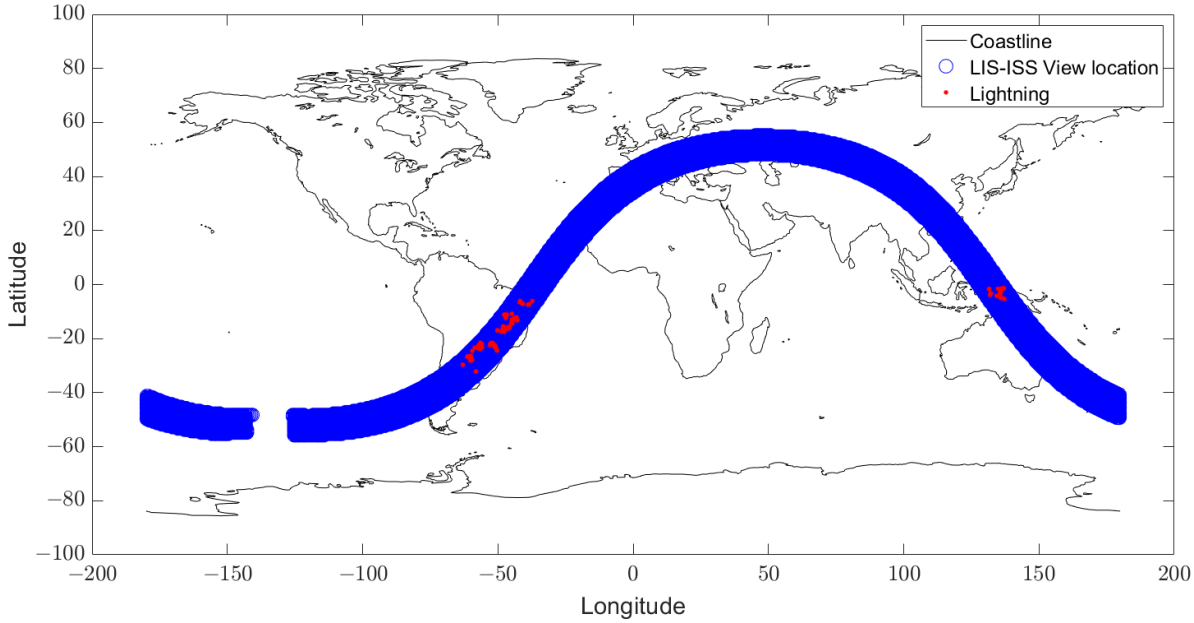


Figure S32. Lightning activity recorded by Lightning Image Sensors (LIS) mounted on International Space Station (ISS) on 13 November 2023 between 19:29:59 UT and 21:02:59 UT.

Reference

1 Wiemer, S. A Software Package to Analyze Seismicity: ZMAP. Seismological Research Letters 2001, 72, 373–382, doi:10.1785/gssrl.72.3.373.