Briefing Space Weather

2022/10/18

1 Sun

1.1 Responsible: José Cecatto

10/10 – M1.0, M2.4 flares; Fast wind stream (=< 600 km/s); 9 CME c.h.c. toward the Earth *;
10/11 – M3.9, M1.5 flares; Fast wind stream (=< 500 km/s); 4 CME c.h.c. toward the Earth;
10/12 – M1.5 flare; No fast wind stream; 2 CME c.h.c. toward the Earth;
10/13 - No flare (M/X); No fast wind stream; 3 CME c.h.c. toward the Earth ;
10/14 – M1.3 flare; Fast wind stream (=< 500 km/s); 5 CME c.h.c. toward the Earth *;
10/15 – No flare (M/X); Fast wind stream (=< 600 km/s); 3 CME c.h.c. toward the Earth;
10/16 – No flare (M/X); Fast wind stream (=< 600 km/s); 3 CME c.h.c. toward the Earth *;
10/17 – No flare (M/X); Fast wind stream (=< 600 km/s); 1 CME c.h.c. toward the Earth;
Prev.: Fast wind stream expected up to October 18; for the next 2 days (05% M, 01% X) probability of M / X flares;
also, occasionally other CME can present component toward the Earth.
c.h.c. – can have a component; * partial halo; ** halo

2 Sun

2.1 Responsible: Douglas Silva

- WSA-ENLIL (Prediction for CMEs :022-10-11T11:36Z and 2022-10-11T09:23Z)
  - The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2022-10-14T16:00Z and 2022-10-15T05:00Z.
- WSA-ENLIL (Prediction for CME : 2022-10-13T07:48Z)
  - The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2022-10-16T03:00Z e 2022-10-16T17:00Z.

Coronal holes (SPOCA):

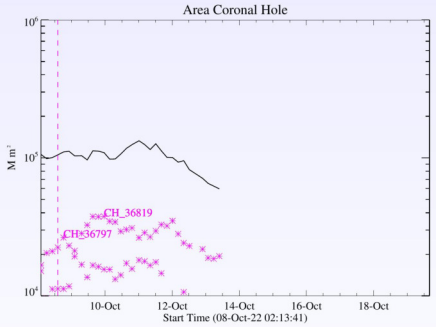


Figura: The solid line in black shows the products of the sum of areas for each detection interval performed by SPOCA between October 08 and 14, 2022.

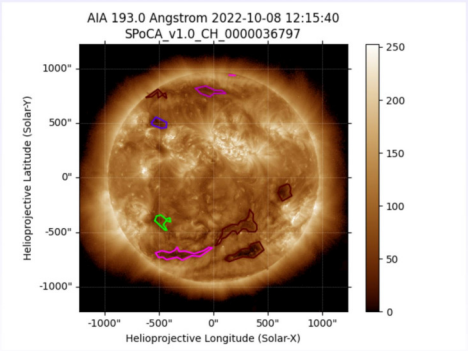


Figura: Above the 193 Å image of the Sun are highlighted coronal holes observed by SPOCA around 12:15 UT on October 08, 2022 (pink dot line).

Coronal holes (SPOCA):

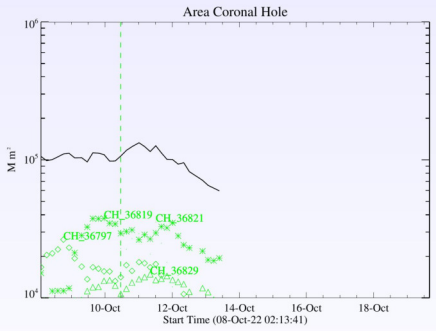


Figura: The solid line in black shows the products of the sum of areas for each detection interval performed by SPOCA between October 08 and 14, 2022.

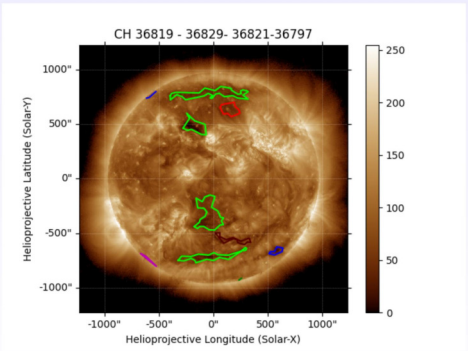


Figura: Above the 193 Å image of the Sun are highlighted coronal holes observed by SPOCA around 12:25 UT on October 10, 2022 (green dot line).

Coronal holes (SPOCA):

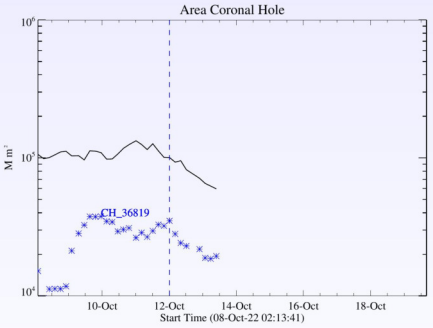


Figura: The solid line in black shows the products of the sum of areas for each detection interval performed by SPOCA between October 08 and 14, 2022.

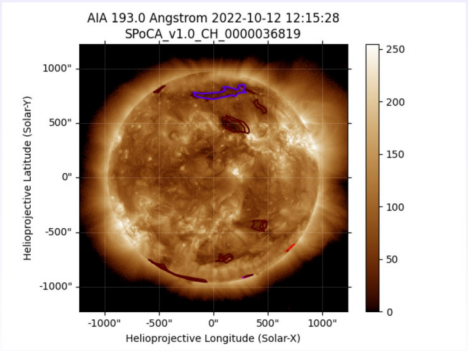
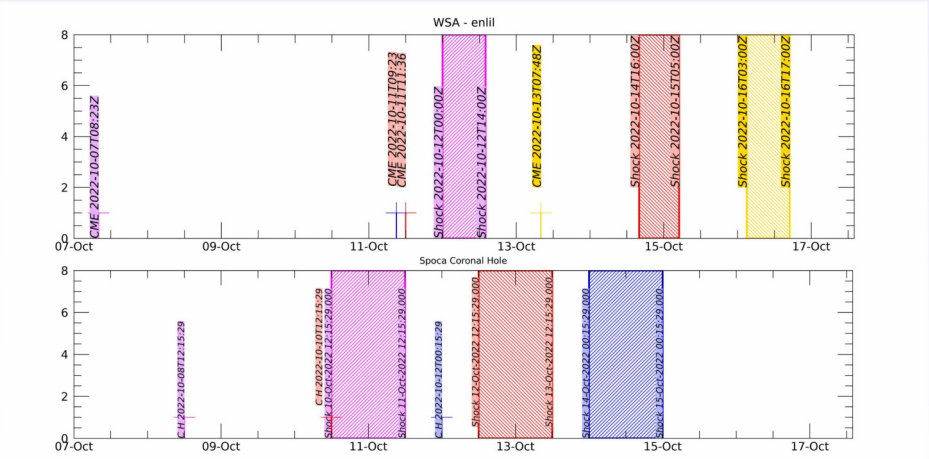


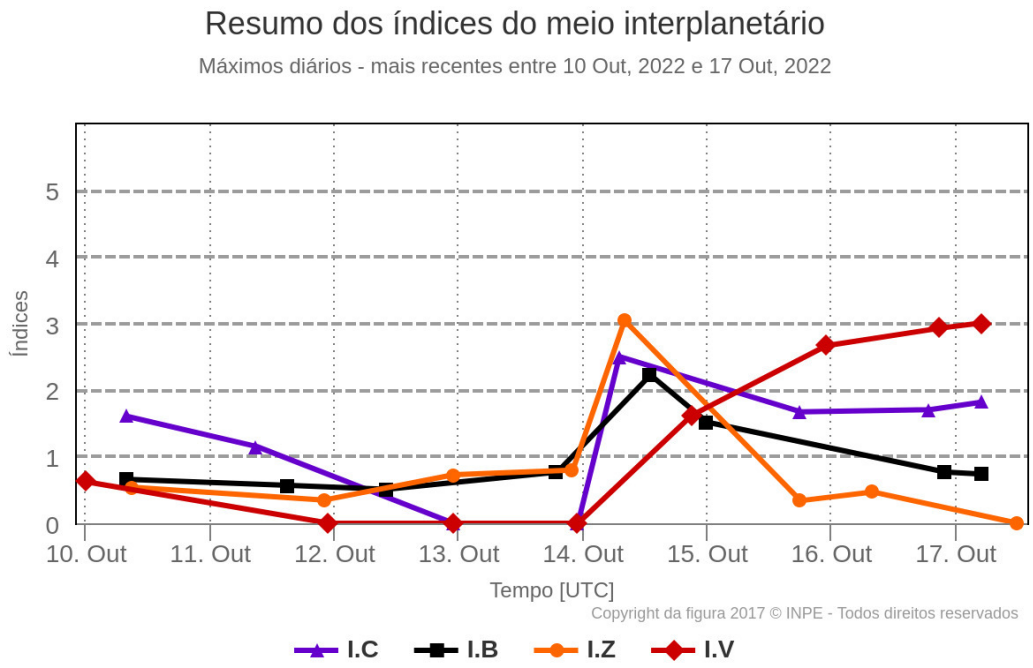
Figura: Above the 193 Å image of the Sun are highlighted coronal holes observed by SPOCA around 12:15 UT on October 12, 2022 (blue dot line).

WSA - ENLIL and SPOCA



3 Interplanetary Medium

3.1 Responsible: Paulo Jauer



- The interplanetary medium region in the last week showed a low/moderate level of plasma perturbations due to the possible interaction of CME and HSS-like structures identified by the DSCOVR satellite in the interplanetary medium.
- The modulus of the interplanetary magnetic field component peaked at 15.7 nT on Oct/14 at 12:30 UT during the analyzed period.
- The BxBy components showed variations in the analyzed period, with the presence of sector boundary crossings on Oct/12 at 22:30.
- The By component presented a maximum negative value of -13.9 nT on Oct/14 at 01:30 UT. The Bx Component presented a maximum value on Oct/14 at 09:30 UT of -9.4 nT.
- The component of the bz field presented a minimum value on Oct 14 at 8:30 UT of -10.9nT and a maximum value of 10.9 nT on Oct 14 at 10:30 UT characteristic of an interplanetary structure of the CME type.
- The solar wind density peaked at 23.9 p/cm^3 on 14/Oct 7:30, however the density remained on average below 15 p/cm^3 in the rest of the period.
- The solar wind speed had a minimum peak on the 13/Oct at 14:30 UT of 293 km/s and a maximum value on the 16/Oct at 22:30 of 580 km/s.
- The position of the magnetopause was oscillating with a minimum value recorded on Oct 14 at 07:30 UT of 7.7 Re. On average, the position of the magnetopause was below the equilibrium position.

4 Radiation Belts

4.1 Responsible: Ligia Alves da Silva

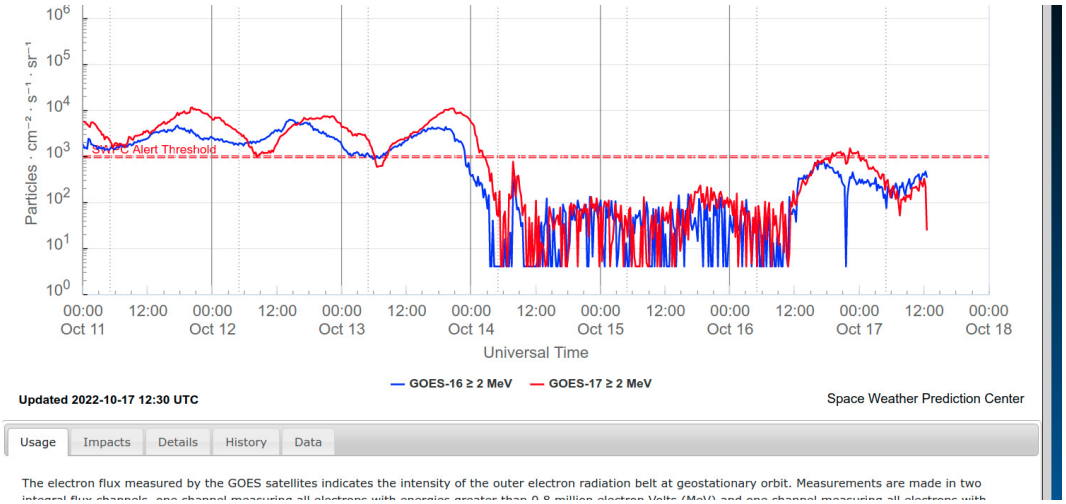


Figura 1: High-energy electron flux (> 2MeV) obtained from GOES-16 and GOES-17 satellite. Source: `https://www.swpc.noaa.gov/products/goes-electron-flux`

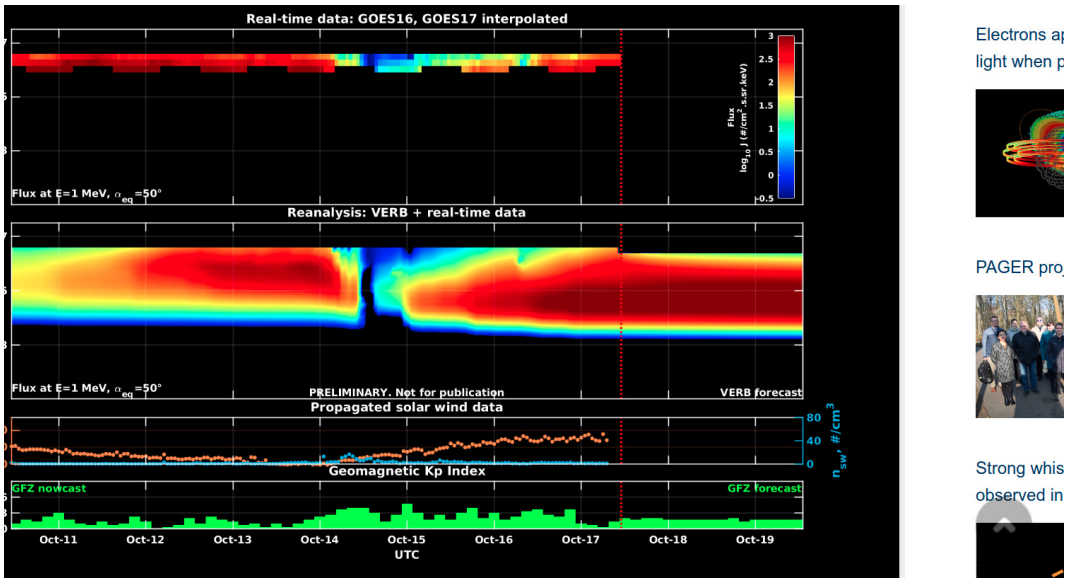


Figura 2: High-energy electron flux data (real-time and interpolated) obtained from GOES-16 and GOES-17 satellites. Reanalysis's data from VERB code and interpolated electron flux. Solar wind velocity and proton density data from ACE satellite. Source: `https://rbm.epss.ucla.edu/realtime-forecast/`

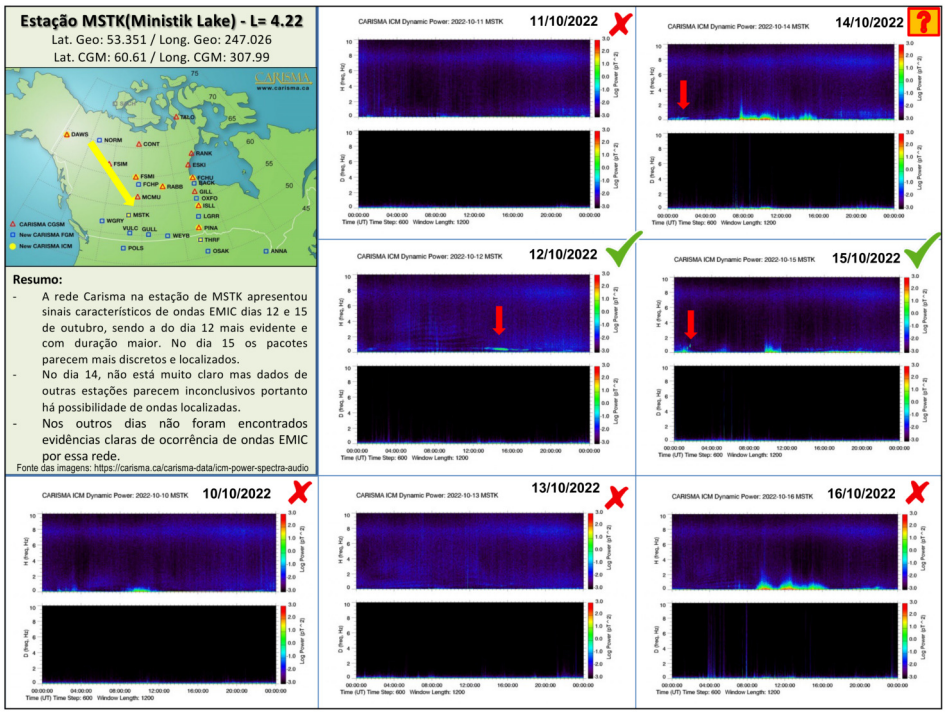
High-energy electron flux (> 2 MeV) in the outer boundary of the outer radiation belt obtained from geostationary satellite data GOES-16 and GOES-17 (Figure 1) is between 10^3 particles/$(cm^2 ssr)$ during the first three days analyzed. A strong and rapid dropout was observed on October 14th, in which the electron flux was confined below 10^2 particles/$(cm^2 ssr)$ until 06:45 UT of the same day. This slight increase persists for a few hours, and a second dropout is observed, persisting below 10^2 particles/$(cm^2 ssr)$ until 11:30 UT on October 16th.

The GOES-16 and GOES-17 satellite data are interpolated and assimilated into the VERB code (Figure 2), which reconstructs this electron flux considering the Ultra Low Frequency (ULF) waves' radial diffusion. The simulation (VERB code) shows that the first dropout reaches L-shell ¿ 5.5, and the

second one reaches all L-shells in the outer belt. The electron flux variabilities coincide with the arrival of solar wind structures and ULF wave activity.

5 Ondas EMIC

5.1 Responsável: Claudia Medeiros



6 ULF waves

6.1 Responsible: Graziela B. D. Silva

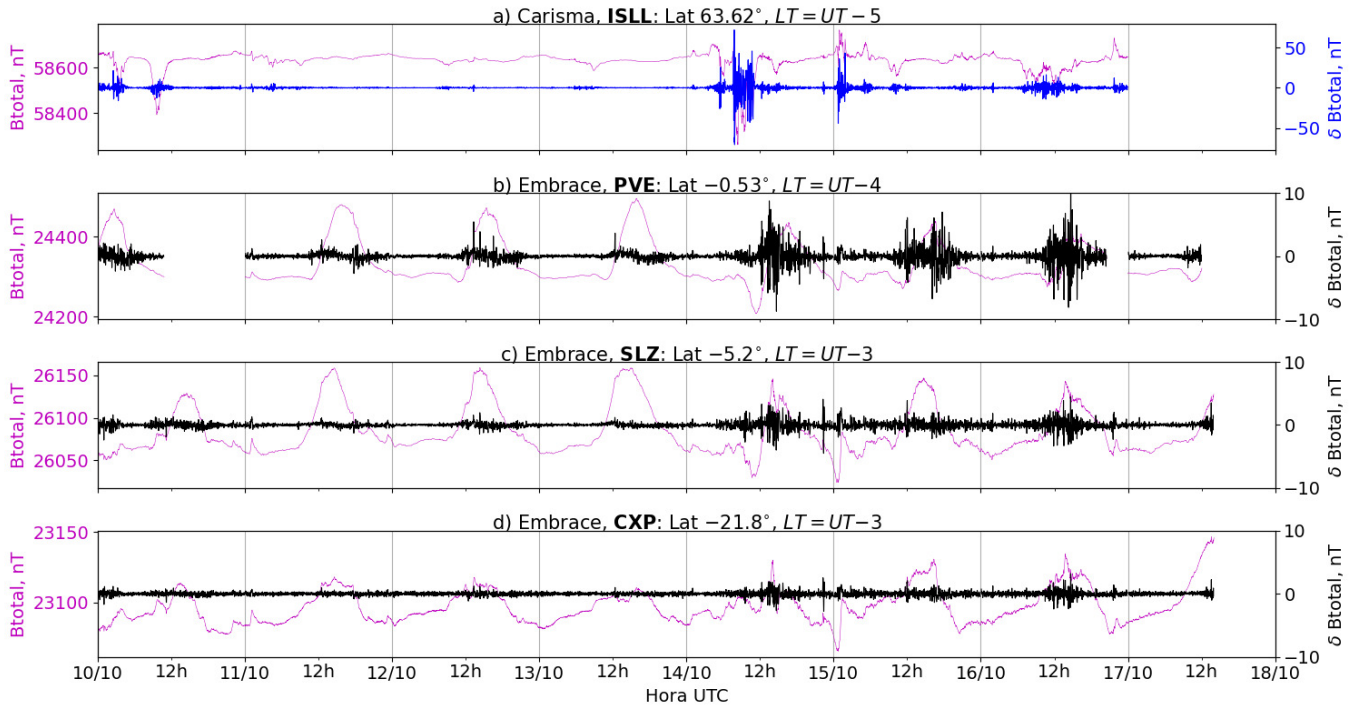


Figura 3: a) Timeseries of the geomagnetic field total component measured at ISLL station (Island Lake) of the CARISMA magnetometer network in magenta, along with the associated perturbation in the Pc5 band shown in blue. b-d) timeseries of the geomagnetic field total component measured at stations PVE (Porto Velho), SLZ (São Luís), and CXP (Cachoeira Paulista) of the EMBRACE network in magenta, along with the Pc5 perturbation in blue.

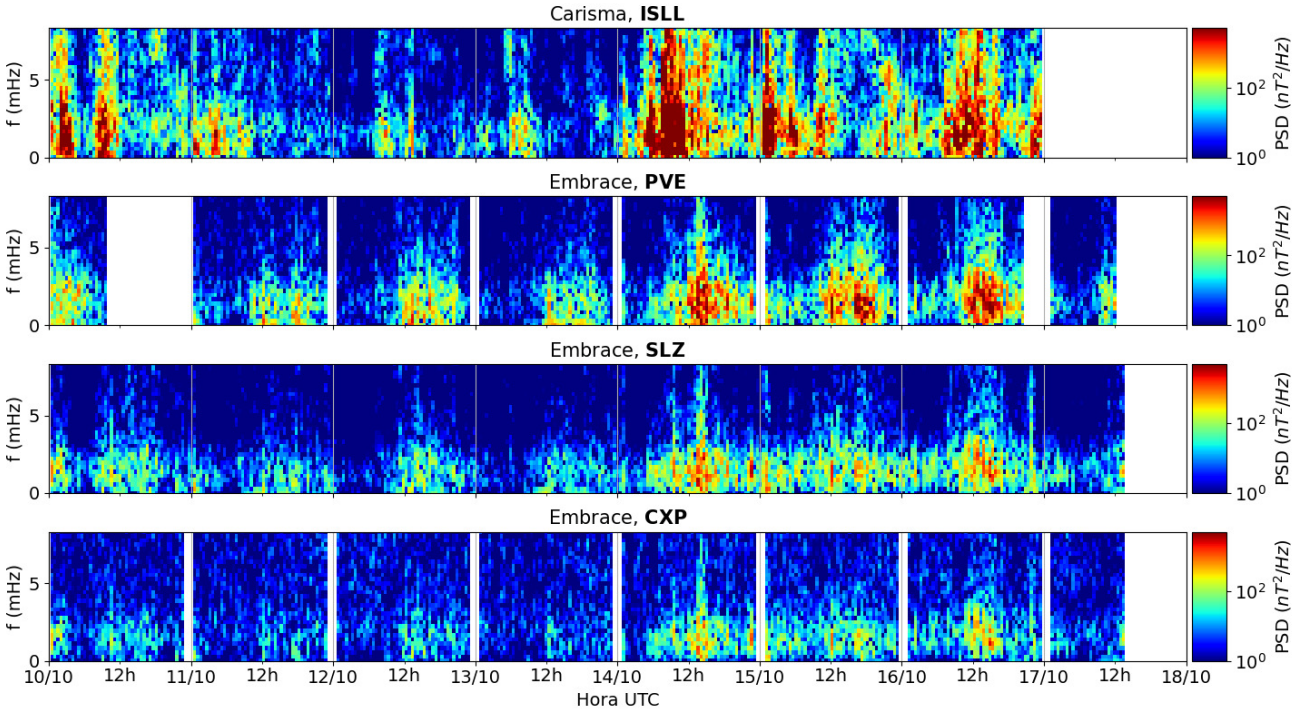


Figura 4: a-d) Time evolution of the power spectral density obtained from the filtered timeseries of the geomagnetic field total component (δ Btotal) for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, SLZ, CXP).

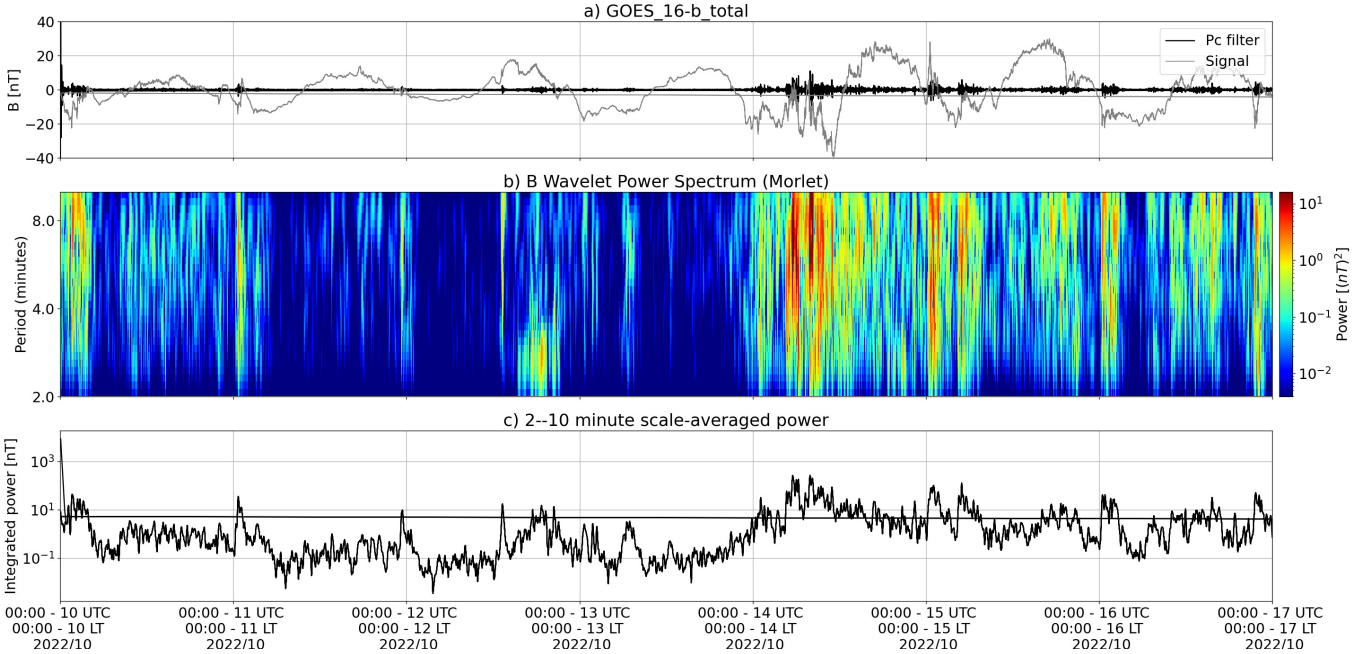


Figura 5: a) Timeseries of the geomagnetic field total component measured by GOES 16, together with the Pc5 fluctuation in black. b) Wavelet power spectrum of the filtered timeseries. c) Average ULF power in the period range from 2 to 10 minutes.

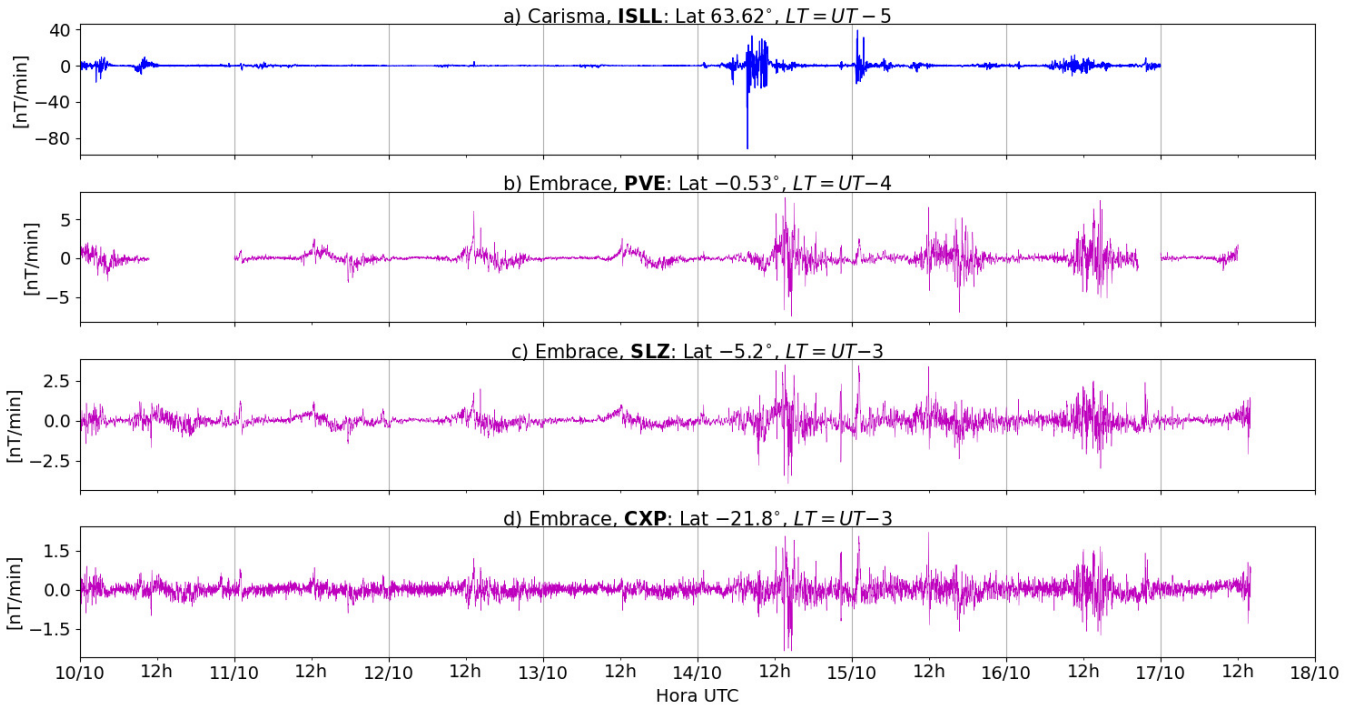


Figura 6: a-d) The rate of change of the geomagnetic field total component (dB/dt) obtained for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, SLZ, CXP).

- The GOES 16 satellite in geosynchronous orbit (L $\sim$ 6.6) registered significant activity of Pc5 ULF waves in the first hours of October 10 and at the end of Oct. 12. Later on , the ULF wave activity became intense and continuous between Oct. 14 and 16, in response to the geomagnetic storm of Oct. 14.
- As observed on the ground, the ISLL station at high latitude registered moderate levels of ULF wave activity between Oct. 10 and 13, and an intense wave activity that started from Oct. 14.
- The PVE and SLZ stations at very low latitudes of Brazil measured moderate to intense levels of ULF wave activity throughout the reported week. Also, it can be noted as of $\sim$ 12 UT on a daily basis, and for both stations, the strong modulation by the equatorial electrojet on the wave activity.
- The rate of change in the geomagnetic field (dB/dt) estimated for the ISLL station (Carisma network) reached a maximum of $\sim$ 40 nT/min over the week, while the three Embrace stations had dB/dt rates ranging up $\sim$ 5 nT/min.

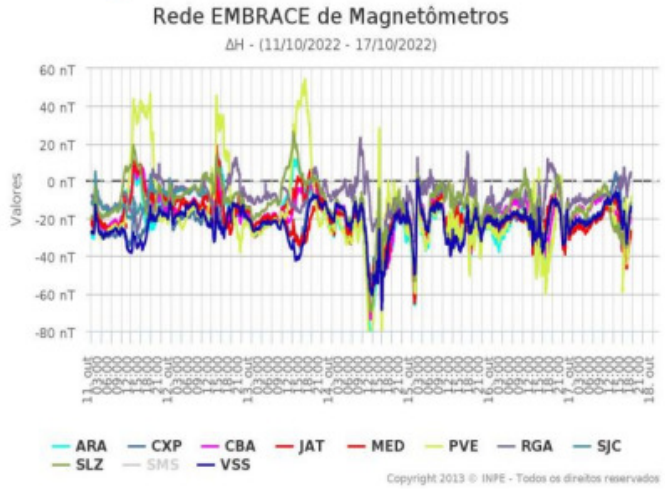
7 Geomagnetic activity

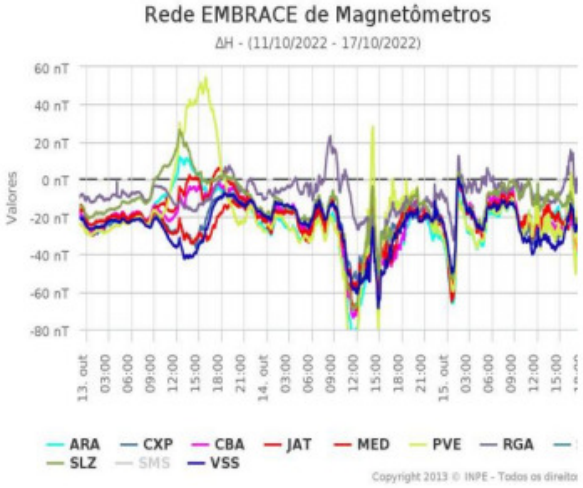
7.1 Responsible: Lívia Alves

In the week of October 10-17, the following events related to geomagnetic activity stand out:

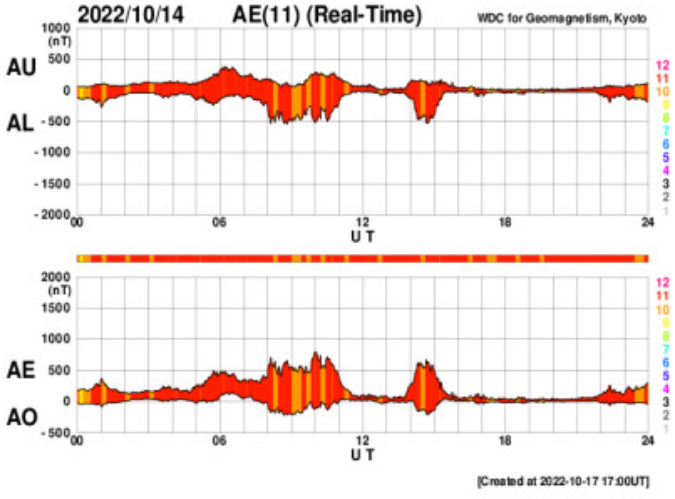
- The data from the Embrace magnetometer network registered instabilities in Oct 13-15, associated with the geomagnetic storm of Oct. 14.
- The magnetometers of the Embrace network recorded a significant drop in the H component on these days.
- The geomagnetic field was active, the AE index was at 500 nT for several hours on Oct. 14, 16 and 17. The Dst index reached -50 nT. The highest Kp of the week was 4+. The geomagnetic field measured at the GOES orbit shows instabilities after Oct. 14.

Briefing semana de 11 à 17/10 de 2022

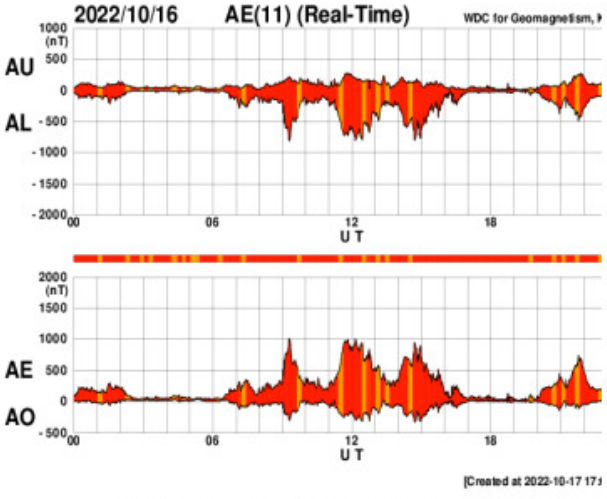


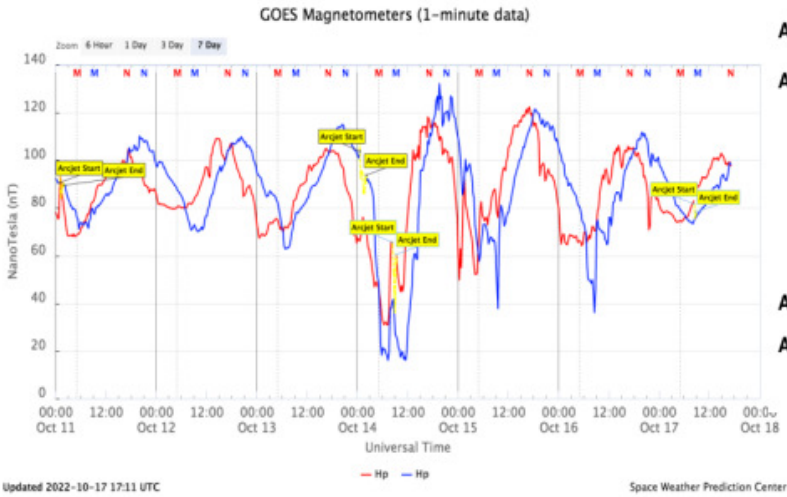


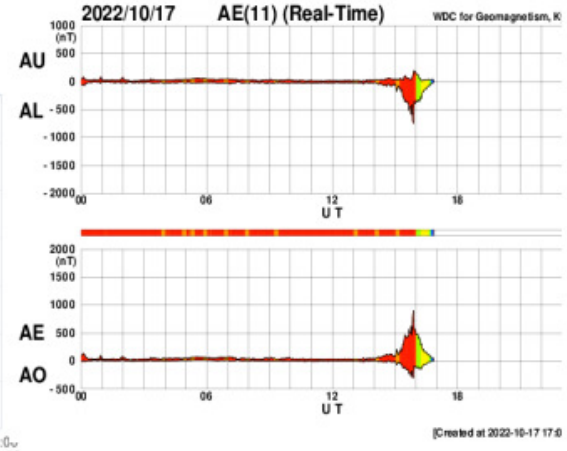
14/out

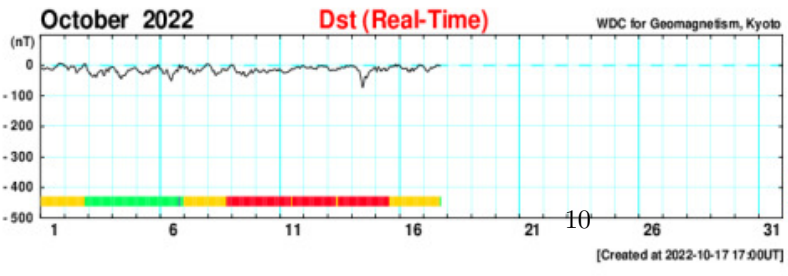


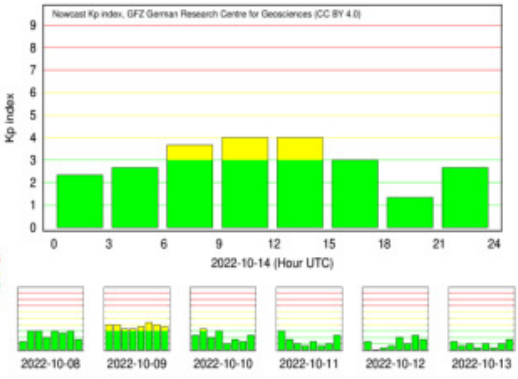
16/out









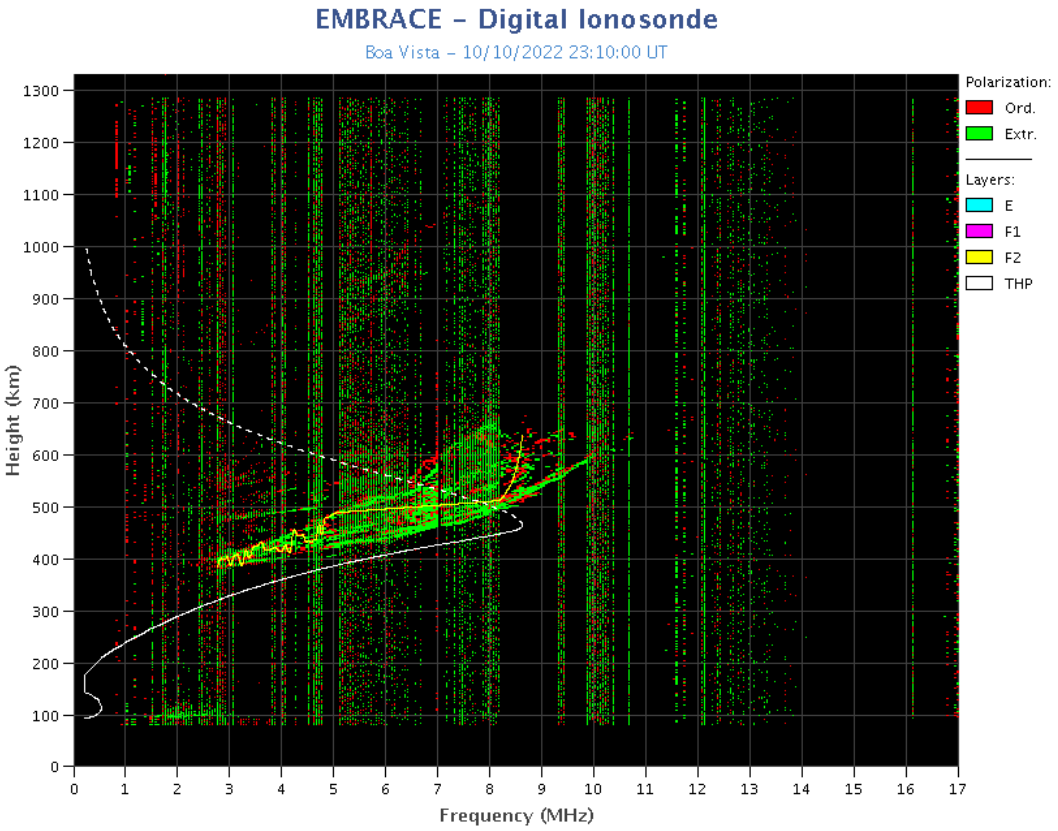


8 Ionosphere

8.1 Responsible: Laysa Resende

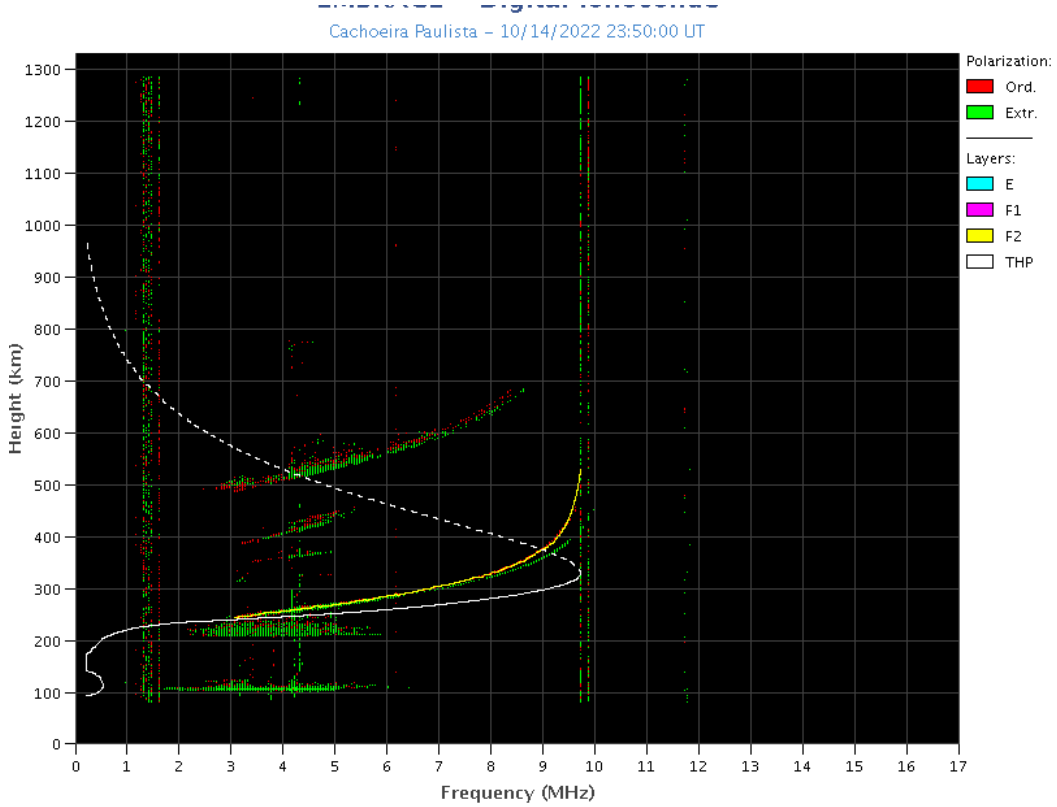
Boa Vista:

- There were spread F during this week.
- The Es layers reached scale 2 during the week.



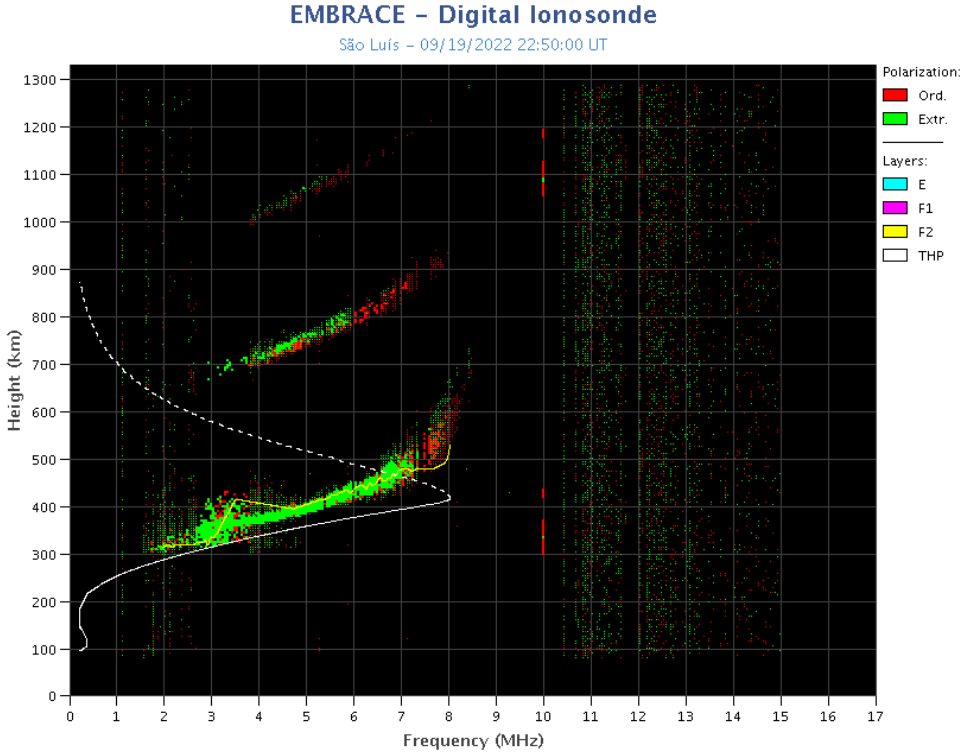
Cachoeira Paulista:

- The spread occurred on October 15.
- The Es layers reached scale 3 on October 14.



São Luís:

- There were spread F during this week.
- The Es layers reached scale during this week.



9 Scintilation

9.1 Responsible: Siomel Savio Odriozola

In this report on the S4 scintillation index, data from SLMA in São Luiz/MA, UFBA in Salvador/BA, STCB in Cuiabá/MT and SJCE in São José dos Campos/SP are presented. The S4 index tracks the presence of irregularities in the ionosphere having a spatial scale $\sim$ 360 m. The S4 index recorded severe scintillation values throughout the week at the SLMA, UFBA and STCB stations. At the SJCE station, this behavior was measured between days 10 to 15/10 (Figure 1). Post sunset time on the 11th manifested, in all analyzed stations, the most intense and lasting event of scintillation of the week reported in this summary (Figure 2).

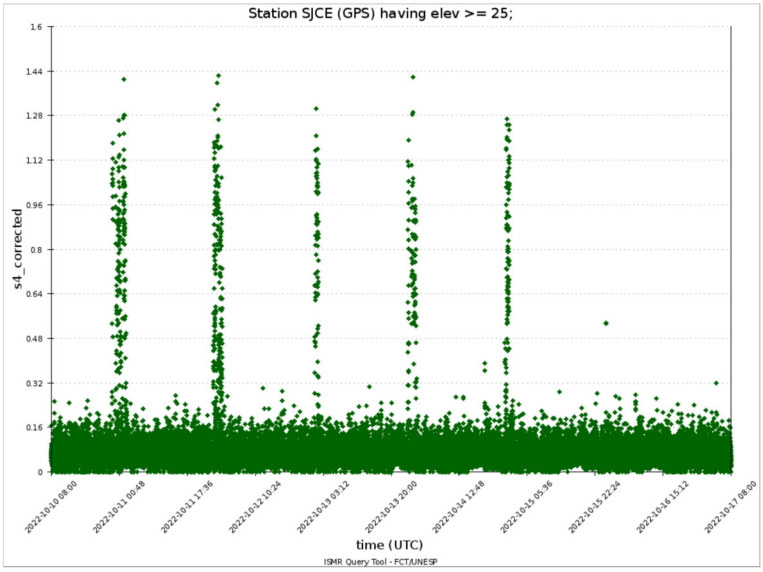


Figura 1: Valores do índice S4 para a constelação GPS medidos nas estações SJCE durante a semana 10/10—16/10.

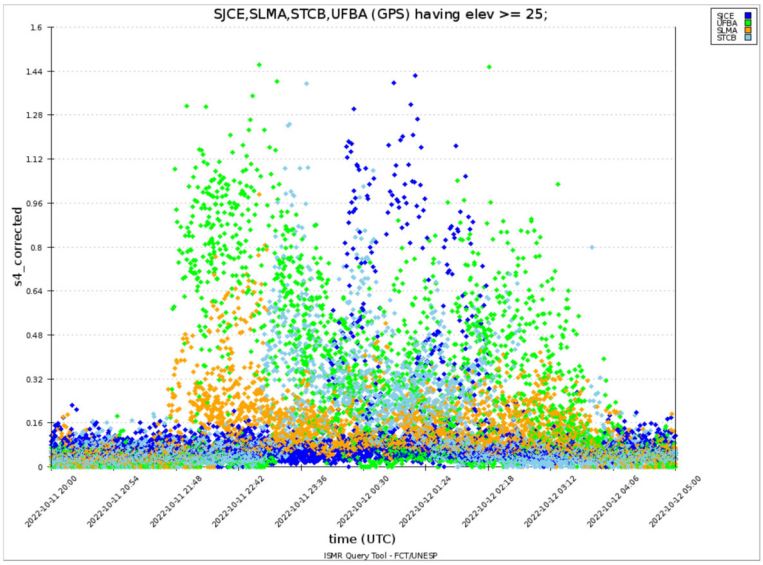


Figura 2: Valores do índice S4 para a constelação GPS medidos na estação SLMA, UFBA, STCB e SJCE entre as 20UT do dia 11 até as 05UT do dia seguinte.

10 ROTI

10.1 Responsible: Carolina de Sousa do Carmo

In the week 2231 (October 9 to 15, 2022) there were ionospheric irregularities (plasma bubble), on all analyzed days, as shown in Table 1. In addition, Figure 1 shows the ROTI time series for four stations in the Brazilian sector (Natal (RNNA), São Luis (SALU), Cuiabá (CUIB) and São José dos Campos (SJSP)).

Sunday	2022/10/09	00:00-04:00; 22:00-24:00
Monday	2022/10/10	00:00-04:00; 21:00-24:00
Tuesday	2022/10/11	00:00-04:00; 21:00-24:00
Wednesday	2022/10/12	00:00-04:00; 21:00-24:00
Thursday	2022/10/13	00:00-04:00; 21:00-24:00
Friday	2022/10/14	00:00-04:00; 22:00-24:00
Saturday	2022/10/15	00:00-02:00; 22:00-24:00

Tabela 1: Weekly Summary (Oct 9-15, 2022).

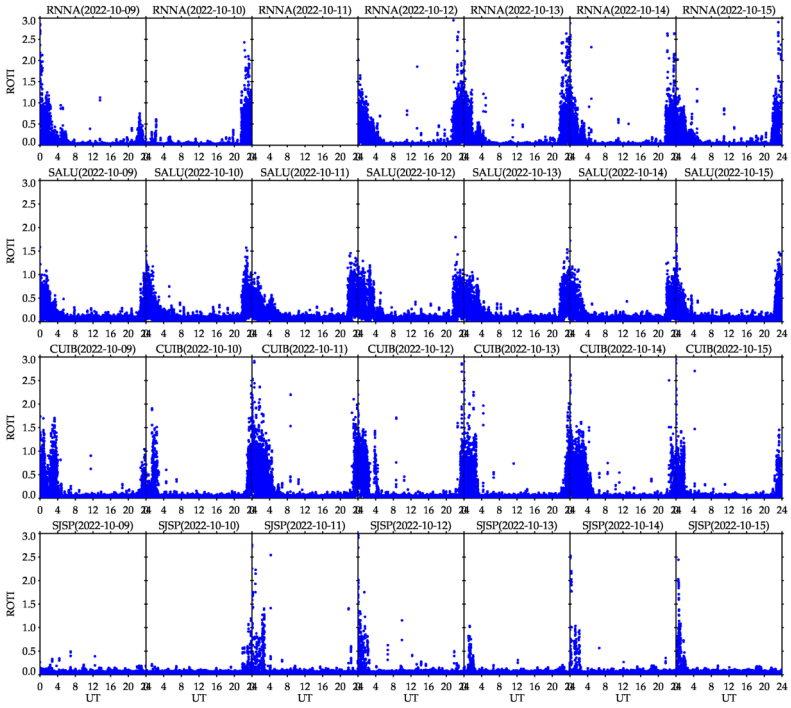


Figura 8: ROTI time series for four stations in the Brazilian sector (Natal (RNNA), São Luis (SALU), Cuiabá (CUIB) and São José dos Campos (SJSP)), from October 9 to October 15, 2015.