Briefing Space Weather

2022/10/11

1 Sun

1.1 Responsible: José Cecatto

10/03 – M2.6, M4.2, M1.7, M1.8 flares; Fast wind stream (=<600 km/s); 6 CME c.h.c. toward the Earth *;
10/04 – M1.6 flare; Fast wind stream (=<600 km/s); 1 CME c.h.c. toward the Earth;
10/05 – No flare (M/X); Fast wind stream (=<550 km/s); 3 CME c.h.c. toward the Earth;
10/06 – No flare (M/X); Fast wind stream (=<550 km/s); 5 CME c.h.c. toward the Earth ;
10/07 – M1.1 flare; Fast wind stream (=<600 km/s); 2 CME c.h.c. toward the Earth *;
10/08 – No flare (M/X); Fast wind stream (=<550 km/s); 4 CME c.h.c. toward the Earth;
10/09 – No flare (M/X); Fast wind stream (=<600 km/s); 7 CME c.h.c. toward the Earth *;
10/10 – M1.1, M2.4 flares; Fast wind stream (=<600 km/s); 3 CME c.h.c. toward the Earth;
Prev.: Fast wind stream expected up to October 11; for the next 2 days (45% M, 10% 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

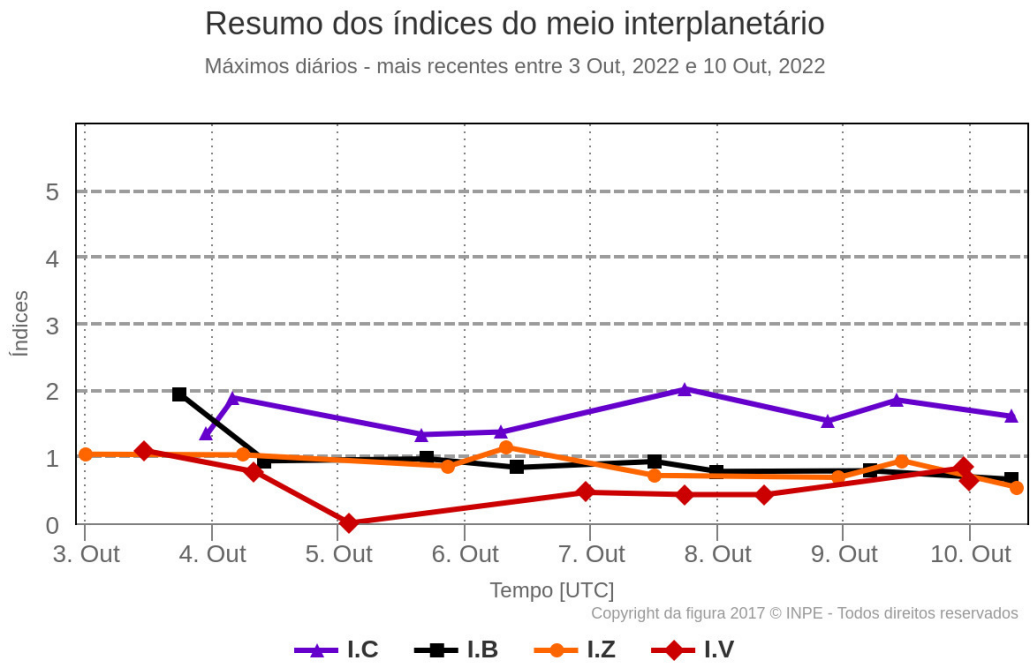
2.1 Responsible: Douglas Silva

WSA-ENLIL (Prediction for CMEs :2022-10-01T12:24Z and 2022-10-01T13:09Z)

- The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2022-10-03T22:43Z and 2022-10-04T12:43Z. WSA-ENLIL (Prediction for CME : 2022-10-03T00:36Z)
- The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2022-10-05T23:00Z and 2022-10-06T13:00Z. WSA-ENLIL (Prediction for CME 2022-10-04T14:24)
- The simulation indicates that Coronal Mass Ejection will reach the DSCOVR mission between 2022-10-06T23:00Z and 2022-10-07T13:00Z. WSA-ENLIL (Prediction for CME : 2022-10-07T08:23Z)
- The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2022-10-12T00:00Z and 2022-10-12T14:00Z.

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 component of the interplanetary magnetic field showed a peak of 14 nT on 03/Oct at 18:30 during the analyzed period.
- The BxBy components showed variations in the analyzed period, both remaining oscillating within the [+11, -11] nT interval, without the presence of sector switching.
- The component of the bz field presented a minimum value on Oct/03 at 18:30 UT of -9.33nT and a maximum value of 9.14 nT on Oct/03 at 14:30 UT. In the rest of the period the bz component oscillated in the interval [+5, -5] nT.
- The solar wind density peaked at 16.56 p/cm^3 on 07/Oct 18:30, however the density remained on average below 14 p/cm^3 in the rest of the period.
- The solar wind speed remained on average above 450 km/s with a peak on 09/Oct at 23:30 UT of 607 km/s.
- The position of the magnetopause was oscillating with a minimum value recorded on 07/Oct at 18:30 UT of 8.2 Re. On average, the magnetopause position was below the equilibrium position.

4 Radiation Belts

4.1 Responsible: Ligia Alves da Silva

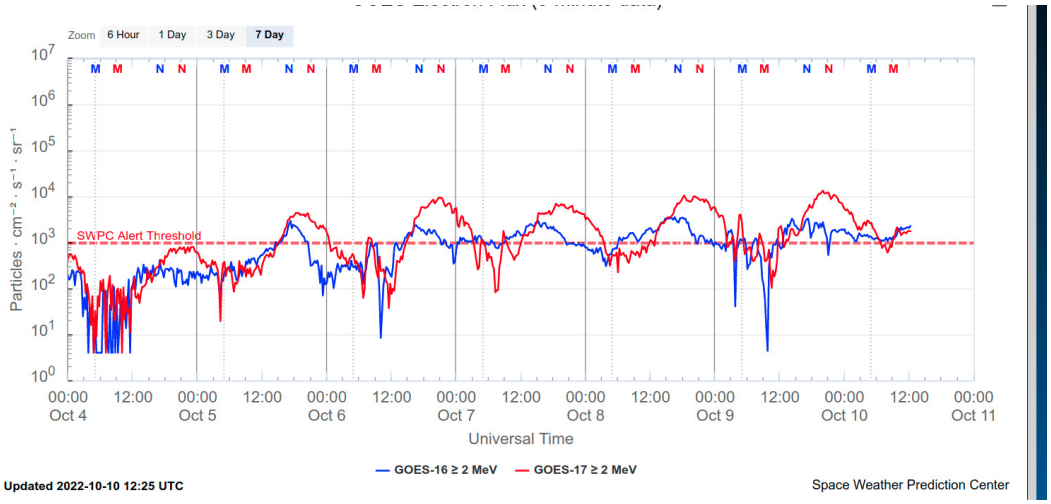


Figura 1: High-energy electron flux (> 2 MeV) obtained from GOES-16 and GOES-17 satellite. Source: `https://www.swpc.noaa.gov/products/goes-electron-flux`

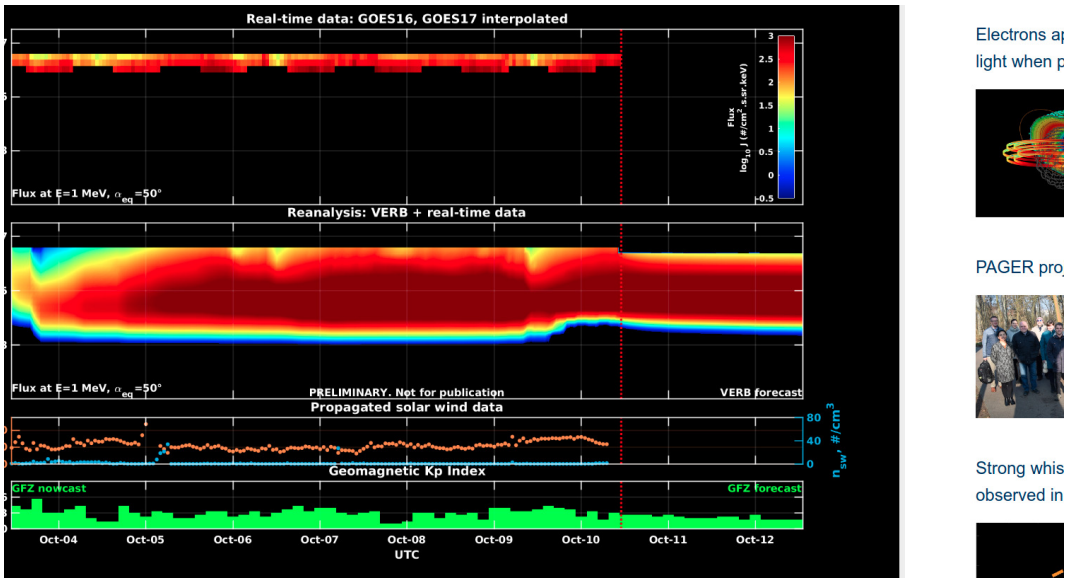


Figura 2: High-energy electron flux data (real-time and interpolated) obtained from GOES-16 and GOES-17 satellites. Reanalysis's data from VERB code and interpolated electron flux. Solar wind velocity and proton density data from ACE satellite. Source: `https://rbm.epss.ucla.edu/realtime-forecast/`

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) shows a rapid dropout at the beginning of October 4th, followed by an electron flux increase from 12:00 UT on the same day. It is observed that the electron flux exceeds 10^3 particles/$(cm^2 ssr)$ from 15:15 UT on October 5th, preferentially remaining between 10^3 and 10^4 particles/$(cm^2 ssr)$ until the end of the analyzed period. On October 6th and 9th, the dropouts reach 10^1 particles/$(cm^2 ssr)$, quickly returning to their respective previous levels.

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 dropouts observed on October 4th and 9th

reached innermost L-shells, while the dropout observed on October 6th reached $L - shell > 6.0$. The electron flux variabilities coincide with the arrival of solar wind structures and ULF wave activity.

5 ULF waves

5.1 Responsible: Graziela B. D. Silva

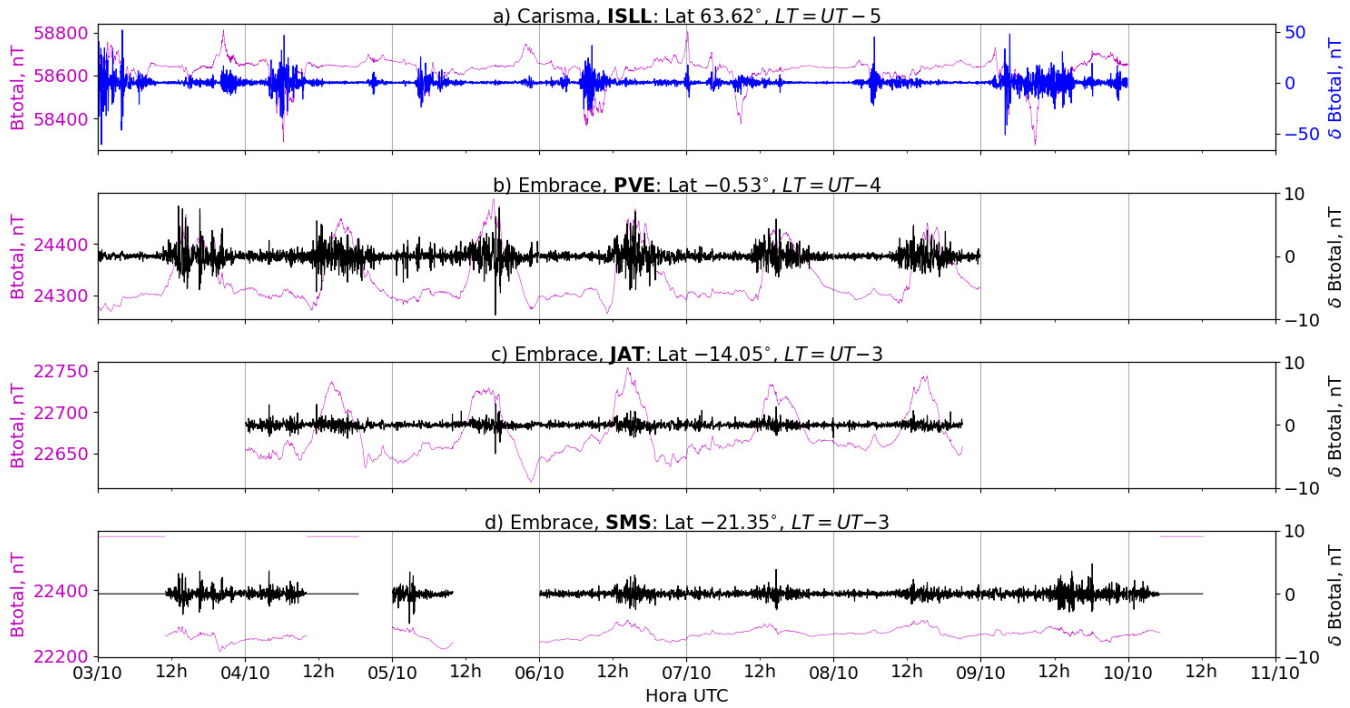


Figura 3: a) Timeseries of the geomagnetic field total component measured at ISLL station (Island Lake) of the CARISMA magnetometer network in magenta, along with the associated perturbation in the Pc5 band shown in blue. b-d) timeseries of the geomagnetic field total component measured at stations PVE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

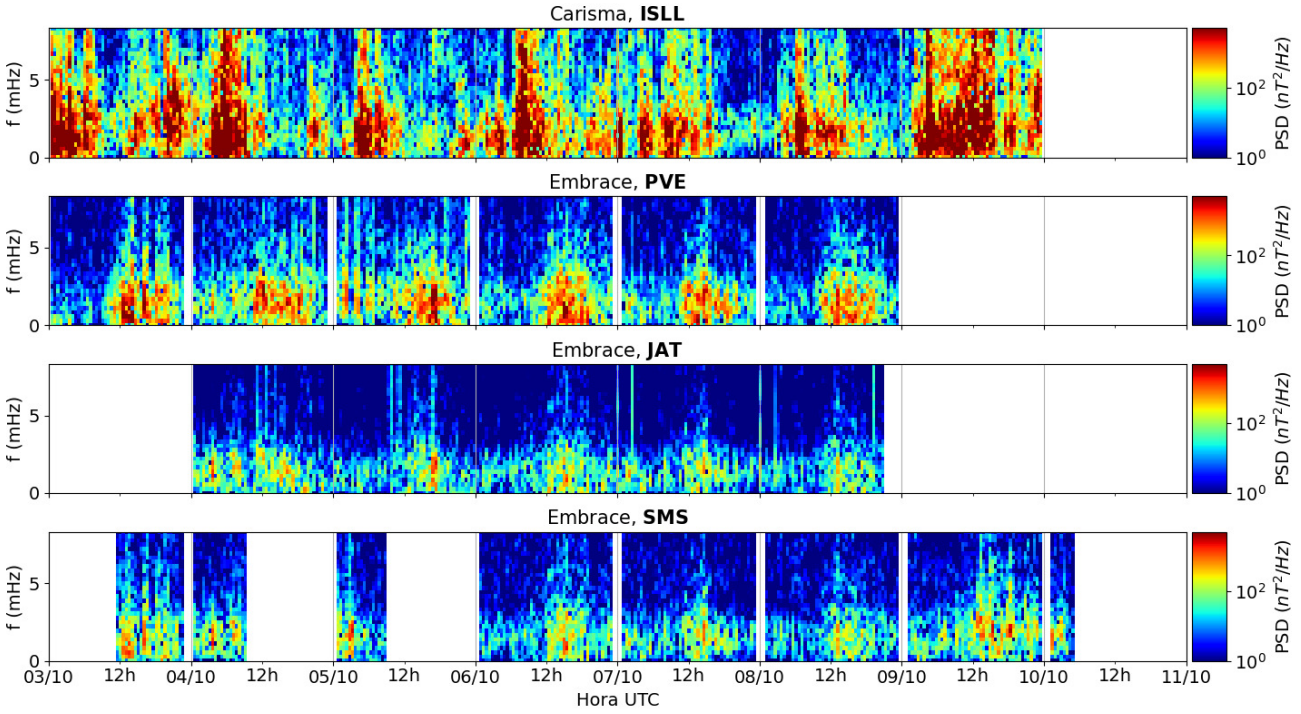


Figura 4: a-d) Time evolution of the power spectral density obtained from the filtered timeseries of the geomagnetic field total component (δ Btotal) for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, JAT, SMS).

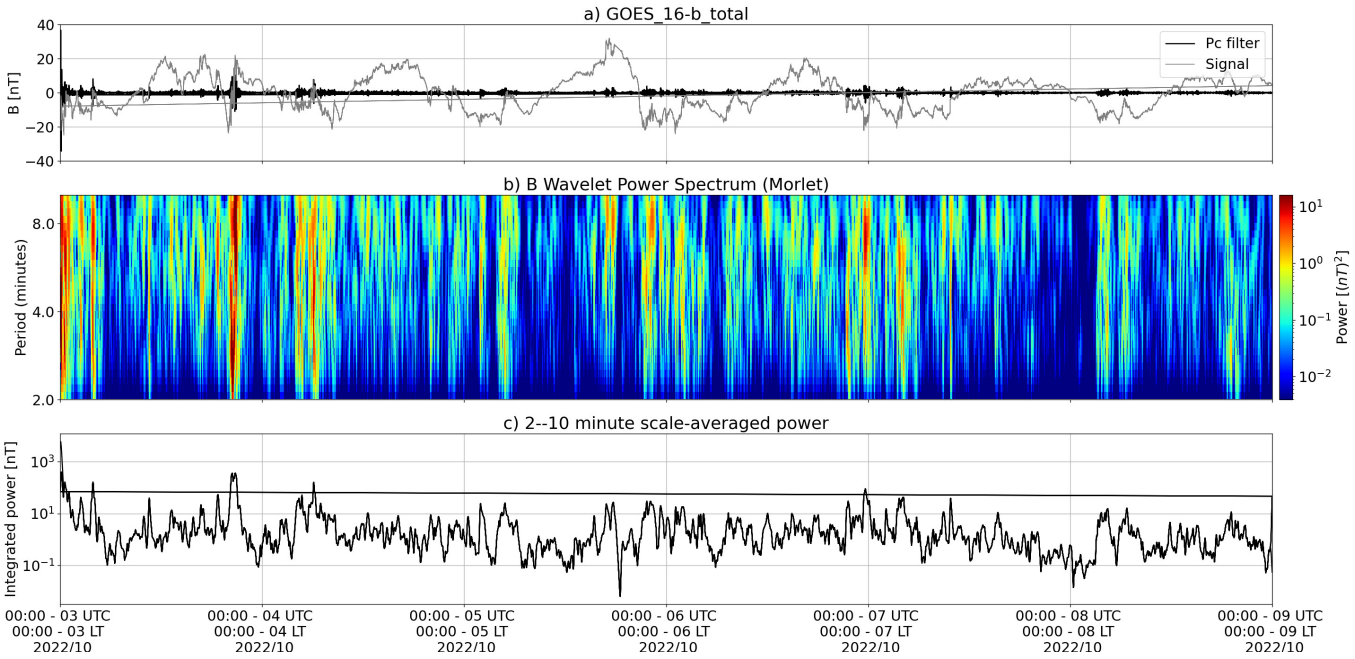


Figura 5: a) Timeseries of the geomagnetic field total component measured by GOES 16, together with the Pc5 fluctuation in black. b) Wavelet power spectrum of the filtered timeseries. c) Average ULF power in the period range from 2 to 10 minutes.

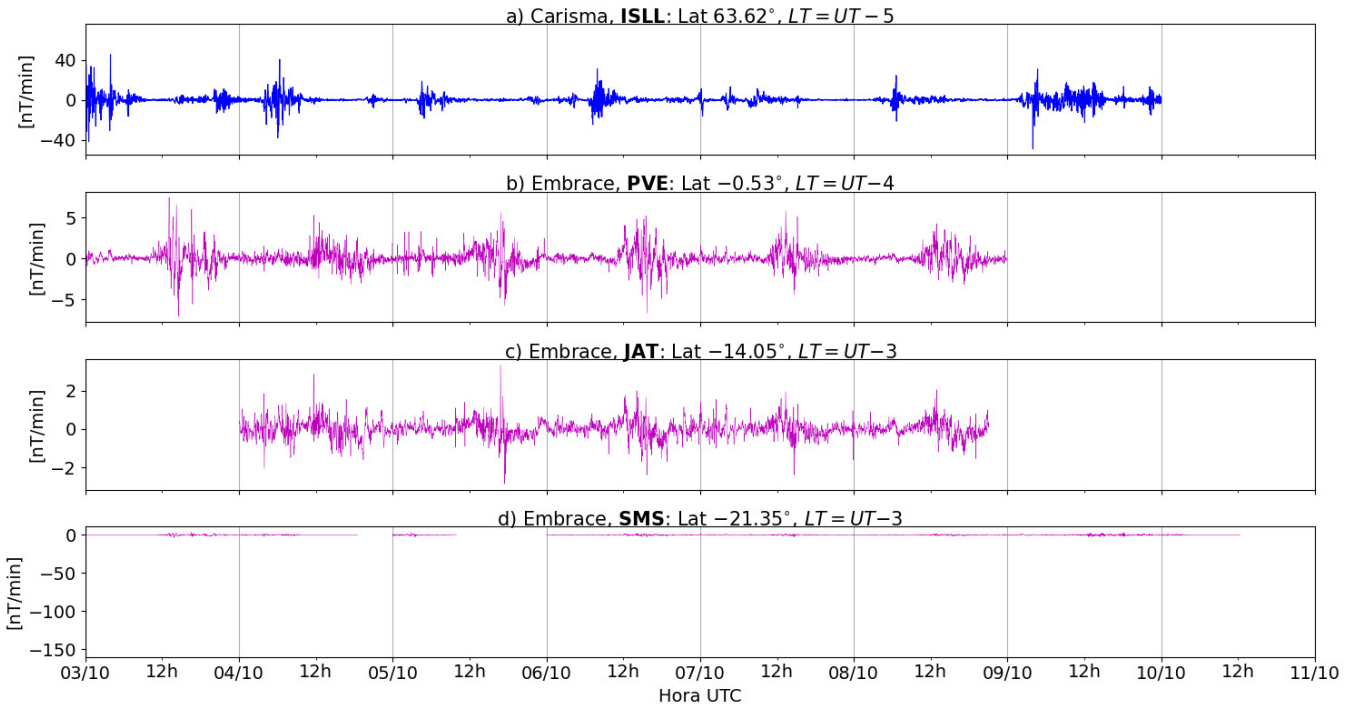
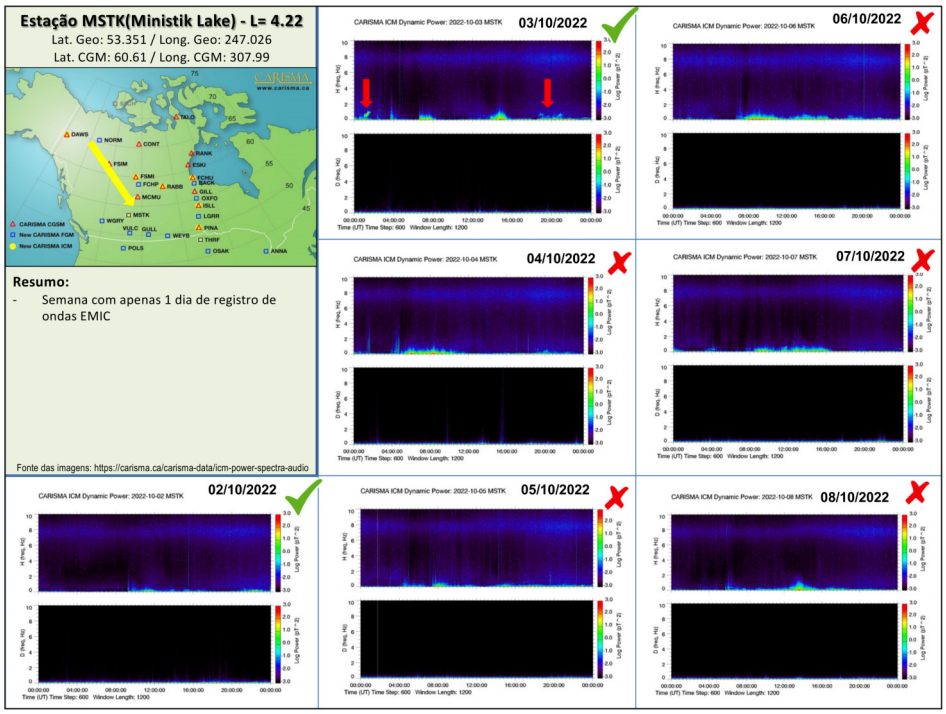


Figura 6: a-d) The rate of change of the geomagnetic field total component (dB/dt) obtained for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, JAT, SMS).

- The GOES 16 satellite in geosynchronous orbit (L $\sim$ 6.6) registered significant activity of Pc5 ULF waves throughout the reported week (October 3-10).
- As observed on the ground, the four stations both from high and low latitudes also registered an intense level of ULF wave activity throughout the reported week, despite the data gaps.
- On a daily basis, it can be noted a strong effect of the equatorial electrojet on the wave activity observed at the PVE station after around 12 UT.
- The rate of change in the geomagnetic field (dB/dt) was below 40 nT/min at the ISLL station (Carisma network) and below 5 nT/min in the magnetic data from the three Embrace stations.

6 EMIC waves

6.1 Responsible: Claudia Medeiros



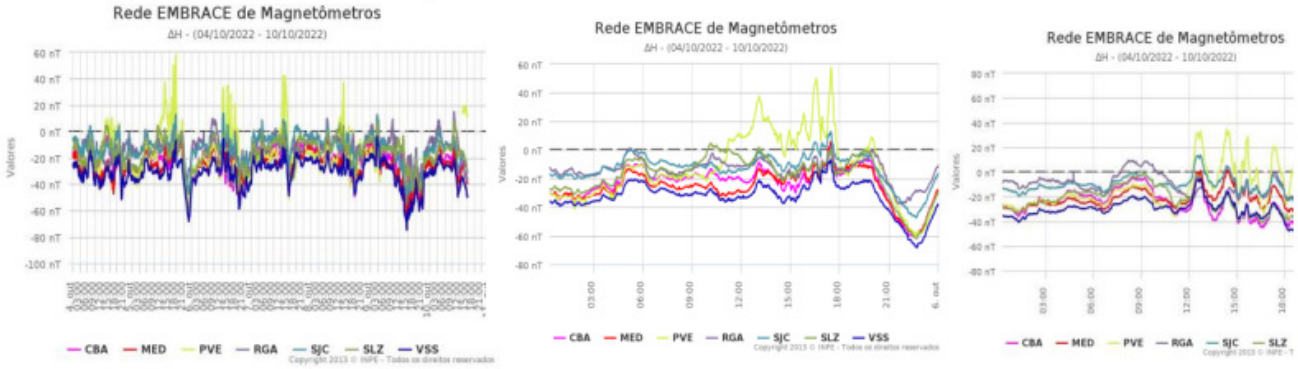
7 Geomagnetic activity

7.1 Responsible: Lívia Alves

In the week of October 3-10, the following events related to geomagnetic activity stand out:

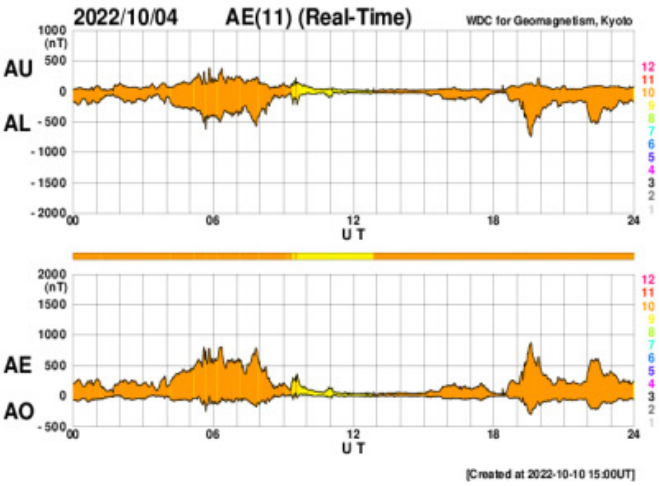
- The data from the Embrace magnetometer network registered instabilities in Oct 05, 06, and 09.
- The magnetometers of the Embrace network recorded a significant drop in the H component on these days.
- The geomagnetic field was active, the AE index was at 500 nT for several hours on Oct. 04, 06 and 09. 3. The Dst index reached -50 nT. The highest Kp of the week was 4+.
- The geomagnetic field measured at the GOES orbit shows instabilities during the reported period.

Briefing semana de 04 à 10/10 de 2022

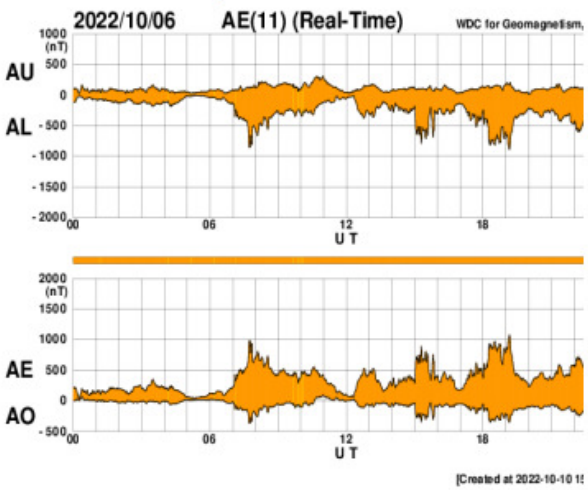


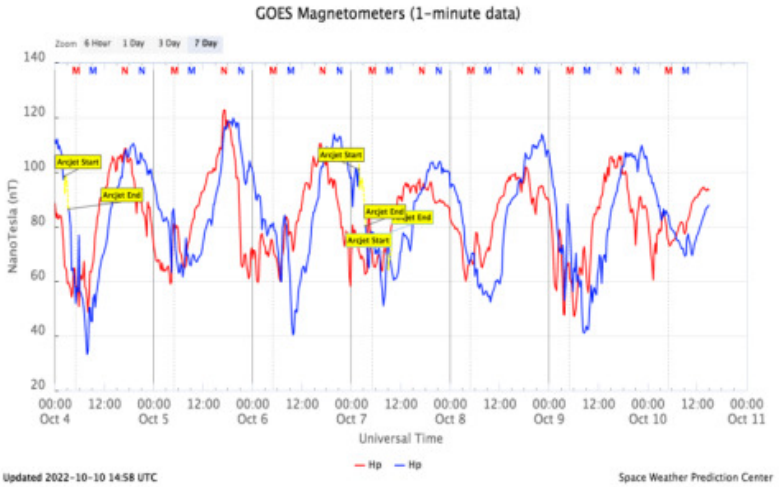
05/out

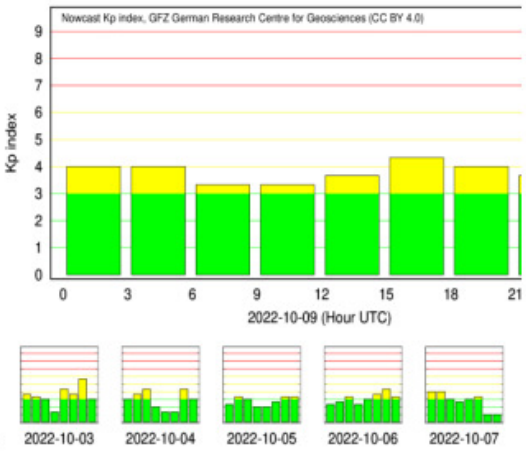
04/out

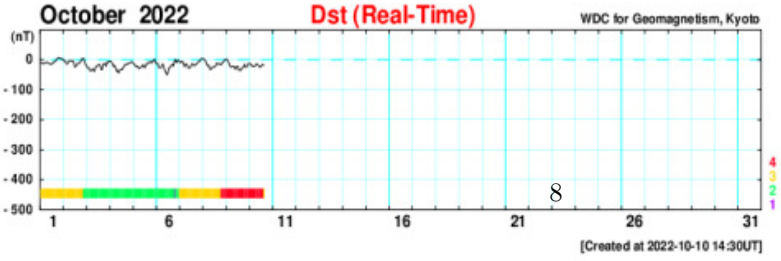


06/out







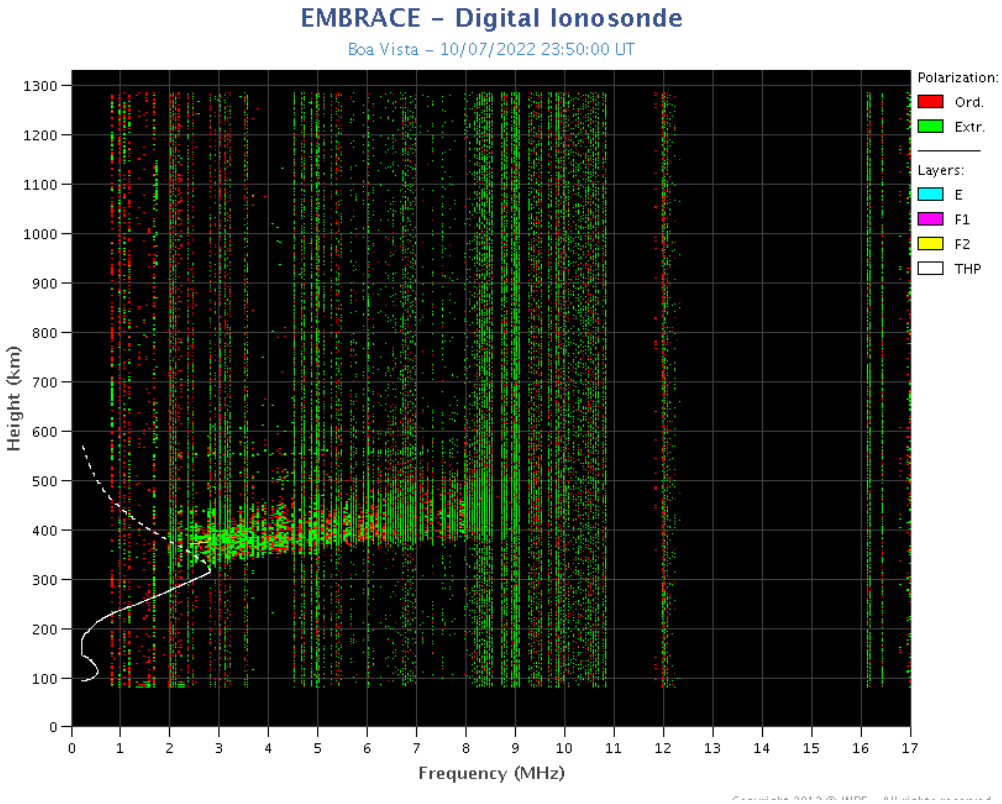


8 Ionosphere

8.1 Responsible: Laysa Resende

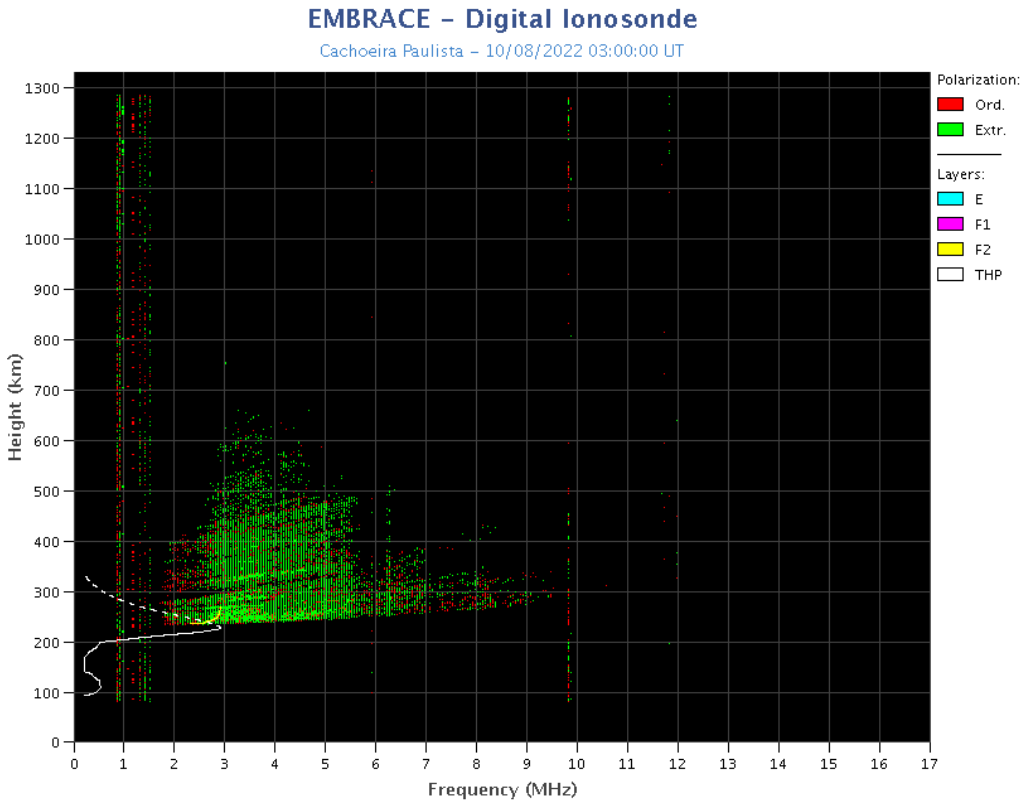
Boa Vista:

- The spread occurred on October 07,08 and 09.
- The Es layers reached scale 2 during the week.



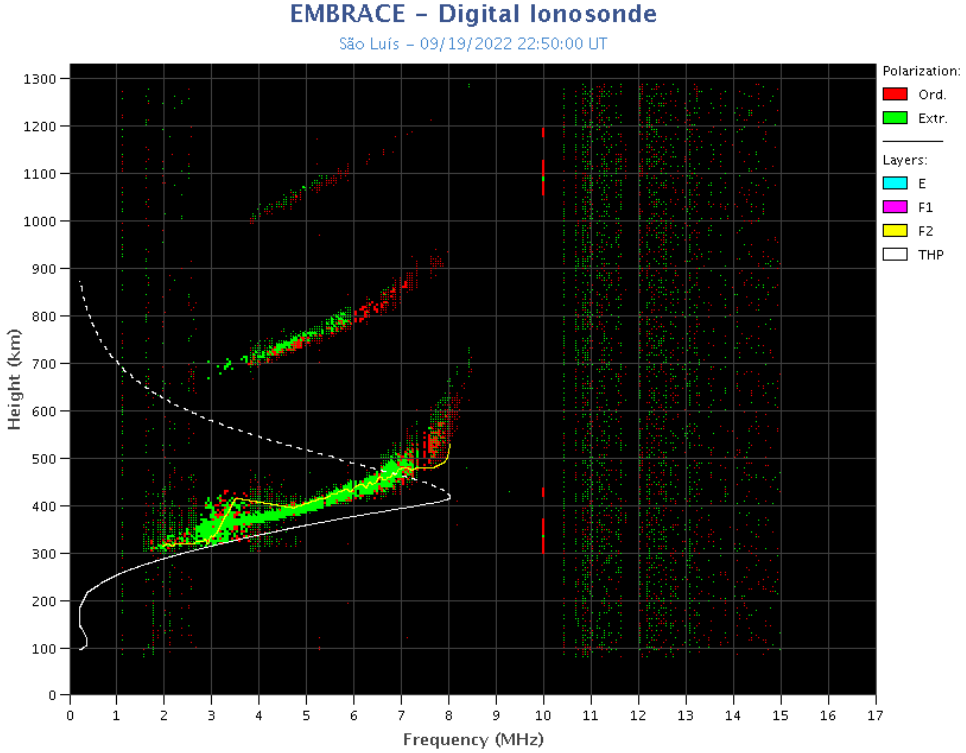
Cachoeira Paulista:

- The spread occurred on October 09.
- The Es layers reached scale 2 during the week.



São Luís:

- There were spread F during this week.
- The Es layers reached scale 3 on October 03.



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 ~ 360 m. Strong and severe scintillation activity was recorded at SLMA, STCB and UFBA recorded for most of the week 10/02-10 (exempting day 3) as shown in Figure 1. A lack of scintillation may be seen during the night of October 3 and early hours of October 4. This may be a consequence of a suppression process acting over a plasma bubble formation mechanism. After sunset on October 7th, all stations manifested, the most intense and lasting event of S4 scintillation of the week reported in this summary (Figure 2).

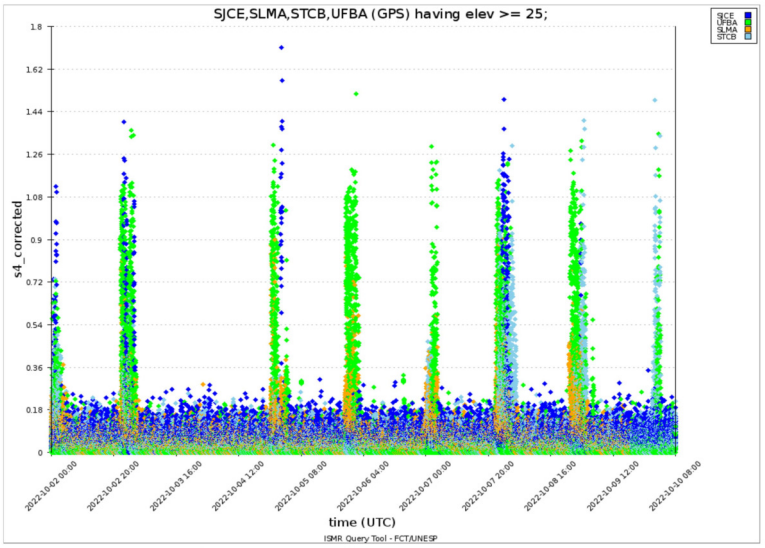


Figure 1: S4 index values for the GPS constellation measured at SLMA, UFBA, STCB e SJCE during the week 10/02--10.

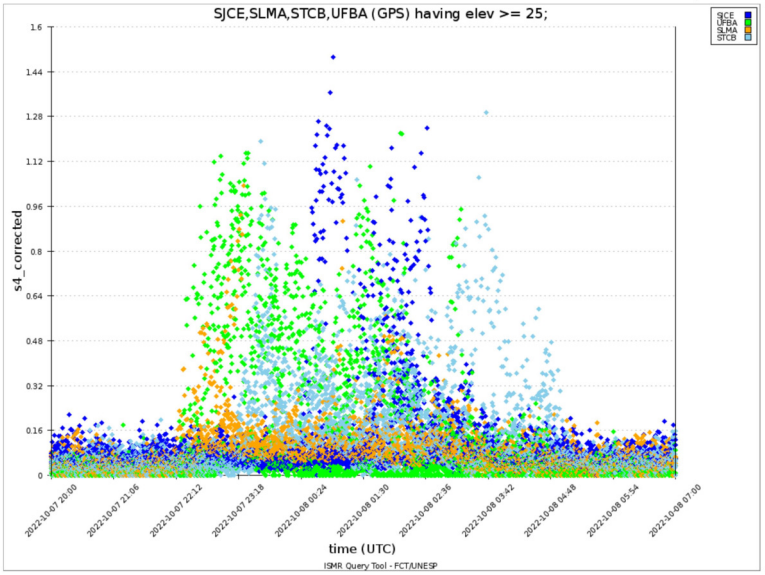


Figure 2: S4 index values for the GPS constellation measured at the SLMA, UFBA, STCB e SJCE station between 20UT of the 07th to 07UT of the following day.

10 All-Sky Imager

10.1 Responsible: LUME

All-Sky Imager EPBs Observation
Observações das EPBs por meio do imageador All-Sky
October 02 - October 08, 2022 || 02 de outubro - 08 de outubro, 2022

Observatory Observatório	October 02 outubro 02	October 03 outubro 03	October 04 outubro 04	October 05 outubro 05	October 06 outubro 06	October 07 outubro 07	October 08 outubro 08
CA	✓❍❍	✓☁❍	✓⛅❍	✓☁❍	✓☁❍	✓☁❍	✗
BJL	✗	✗	✗	✗	✗	✗	✗
CP	✓☁❍	✓☁❍	✓☁❍	✓⛅❍	✓☁❍	✗	✗
SMS	✓❍❍	✓❍❍	✓❍❍	✓☁❍	✓☁❍	✗	✗

Definition of Symbols	
CA	São João do Cariri
BJL	Bom Jesus da Lapa
CP	Cachoeira Paulista
SMS	São Martinho da Serra
✓	Observation - Observação
✗	No Observation - Sem Observação
❍	Clear sky - Céu limpo
⛅	Partly Cloudy - Parcialmente Nublado
☁	Cloudy - Nublado
🌧	Cloudy with Rain - Nublado com Chuva
✺	Blur image - Imagem Desfocada

- At the Sao Joao do Cariri observatory, plasma bubble was observed on October 02 and 04.
- At the Bom de Jesus da Lapa observatory there was no observation due to technical problems.
- At the Cachoeira Paulista observatory no geophysical phenomena such as plasma bubbles and traveling ionospheric disturbances were observed during the period.
- Finally, at the observatory of Sao Martinho da Serra observatory no geophysical phenomena such as plasma bubbles and traveling ionospheric disturbances were observed during the period.

TEC

- Between October 2nd and October 8th, 2022, TEC maps showed plasma bubbles. In addition, during this period, the equatorial anomaly is observed during the day and part of the night in the magnetic southern hemisphere.

11 ROTI

11.1 Responsible: Carolina de Sousa Carmo

In the week 2230 (October 2 to 8, 2022) there were ionospheric irregularities (plasma bubble), on all analyzed days, as shown in Table 1. However, on the night of the 3rd to the 4th of October, there was no presence of a plasma bubble. 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)). This figure shows the plasma bubble suppression in the night of the day 3 to day 4, in all stations.

Sunday	2022/10/02	00-05:00; 22:00-24:00
Monday	2022/10/03	00:00-04:00
Tuesday	2022/10/04	22:00-24:00
Wednesday	2022/10/05	00:00-04:00; 22:00-24:00
Thursday	2022/10/06	00:00-03:00; 23:00-24:00
Friday	2022/10/07	00:00-05:00; 21:30-24:00
Saturday	2022/10/08	00:00-05:00; 22:00-24:00

Tabela 1: Weekly Summary (Oct 2-8, 2022).

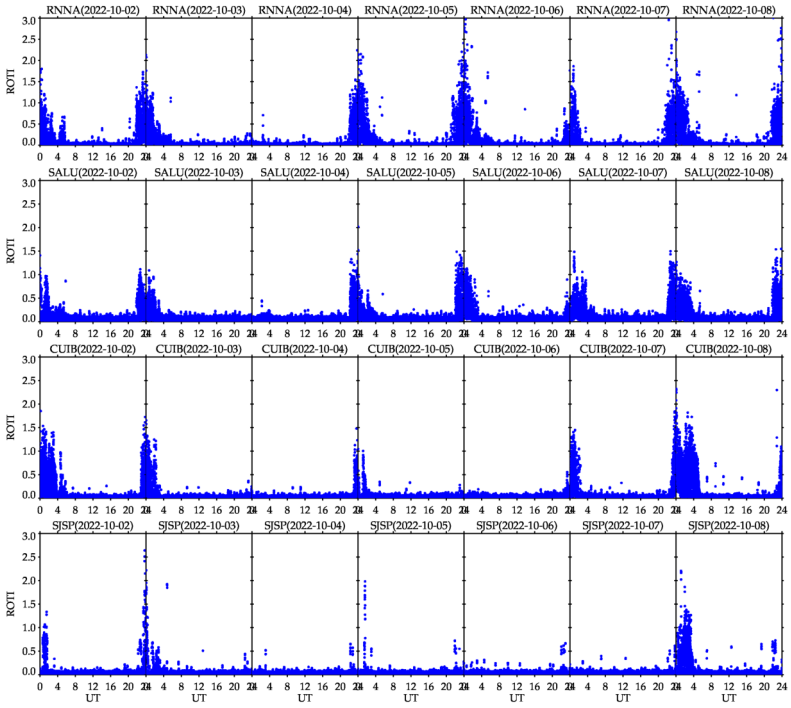


Figura 8: ROTI time series for four stations in the Brazilian sector (Natal (RNNA), São Luis (SALU), Cuiabá (CUIB) and São José dos Campos (SJSP)), from October 2 to October 8, 2015.