Briefing Space Weather - 2022/03/14

Sun

Responsible: José Cecatto

03/07 – Fast (=< 500 km/s) wind stream; 2 CME can have component toward the Earth;
03/08 – Fast (=< 500 km/s) wind stream; 4 CME can have component toward the Earth;
03/09 – No fast wind stream (~ 400 km/s); 4 CME can have component toward the Earth;
03/10 – No fast wind stream; 4 CME can have component toward the Earth; 1 halo CME assoc. C2 flare;
03/11 – No fast wind stream (~ 400 km/s); 3 CME can have component toward the Earth;
03/12 – No fast wind stream (~ 400 km/s); 6 CME can have component toward the Earth;
03/13 – Fast (=< 550 km/s) wind stream; 4 CME can have component toward the Earth; CME arrival & G2 geom strom
03/14 – Fast (=< 500 km/s) wind stream with a decay trend; 2 CME can have component toward the Eartharth; Prev.: Fast wind expected to March 15-16; for while low (25% M, 5% X) probability of M / X flares next 2 days; also, occasionally some other CMEs can present a component toward the Earth.

Responsible: Douglas Silva

WSA-ENLIL (Prediction for CME 2022-03-07T00:12Z)
● The simulation indicates that the CME on Earth arrival forecast will occur on the following
date:2022-03-10T13:38Z (+- 7 hours) .
WSA-ENLIL (CME 2022-03-08T04:24Z)
● The simulation indicates a potential influence of the flank of the coronal mass ejection on Earth
on the following date: 2022-03-11T20:00Z (+- 7 hours).
WSA-ENLIL (CMEs 2022-03-10T00:12Z, 2022-03-10T02:00Z)

● The simulation indicates that the flanks of the Coronal Mass Ejection will reach Earth at about
2022-03-13T11:43Z (+- 7 hours).
WSA-ENLIL (CME 2022-03-10T19:23Z)
● The simulation indicates that the CME on Earth arrival forecast will occur on the following
date:2022-03-13T11:35Z.

Coronal holes (SPOCA):

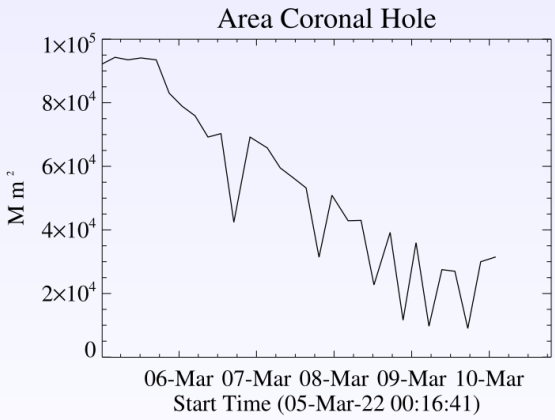
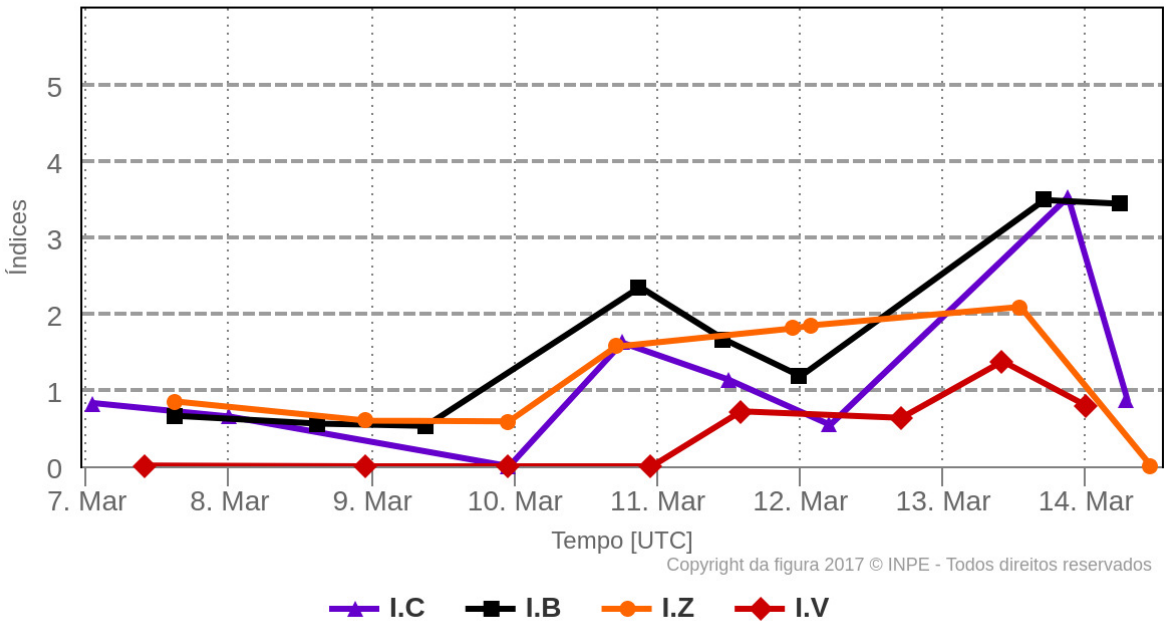
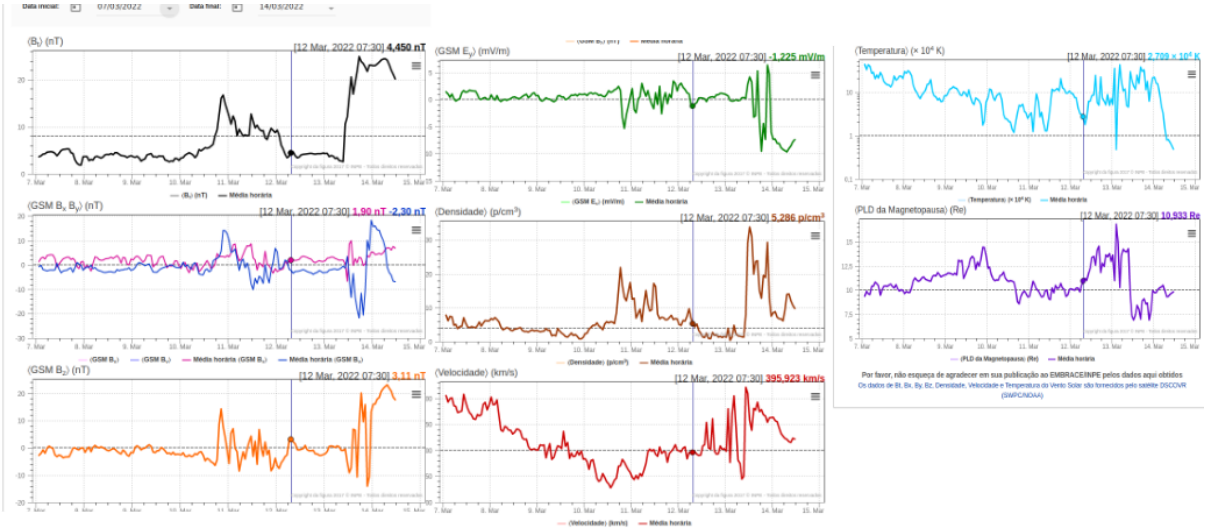


Figura: Derivative of the totality of areas for each detection interval performed by SPOCA
between March 5th and 10th, 2022

Interplanetary Medium

Responsible: Paulo Ricardo Jauer





- The interplanetary region in the last week showed a moderate of plasma perturbations due to the passage of the CME and HSS structures identified by the DSCOVR satellite in the interplanetary region.
- The modulus of the interplanetary magnetic field component showed 2 peaks: 10/Mar at 21:30 from ~ 16nT, 13/Mar at 09:30 ~ 24nT.

- The bxby components do not show a clear sector change, with maximum variation in the by component of [-21.7,18.23], on March 13 at 5:30 pm and 11:30 pm respectively.
- The component of the south bz field presented 3 significant peaks on March 10th at 20:30 ~ 14 nT, and another on March 13th at 21:30 from -14, nT, and finally returns to positive values on the 14th. /March at 08:30 on 21.82 nT, indicating a CME/MC type interplanetary structure.
- The solar wind density showed two significant peaks on 10/March at 18:30 UT of ~ 21 p/cm³ and another on 13/March at 12:30 of 33 p/cm³.
- The solar wind speed was mostly oscillating above 400km/s during the analyzed period, with a peak around ~521 km/s on March 13 at 10:30 UT. The speed reached a minimum value on March 10th of 327 km/s at 13:30 UT.
- The magnetopause position was on average above the typical position. Maximum compression was observed on March 13 at 12:30 at 6.8 Re

Radiation Belts

Responsible: Ligia Alves Da Silva

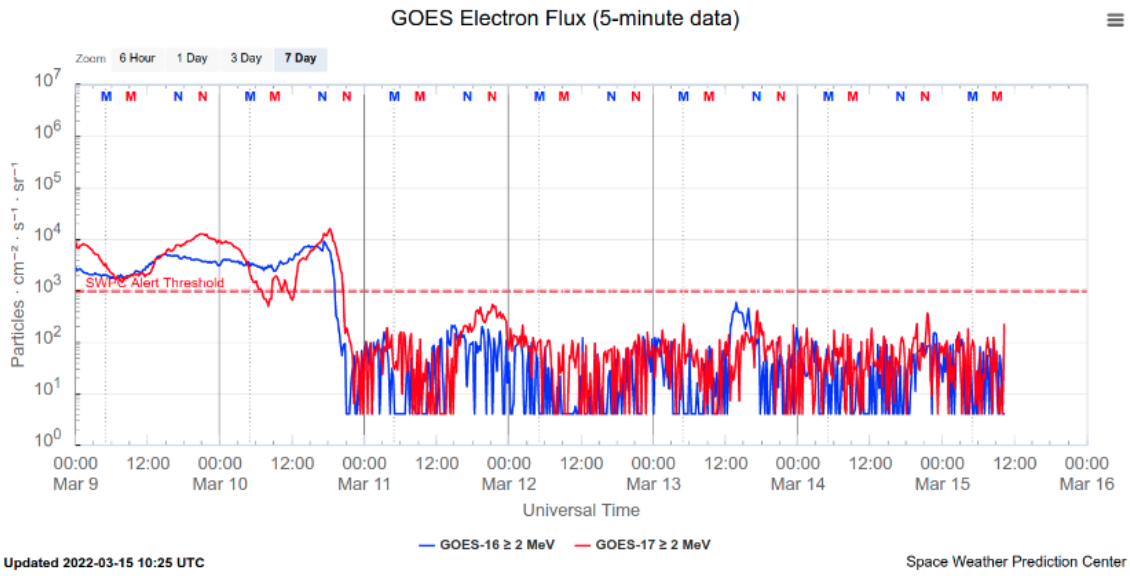


Figure 1: High-energy electron flux (> 2MeV) obtained from GOES-16 and GOES-17 satellite. Source: https://www.swpc.noaa.gov/products/goes-electron-flux

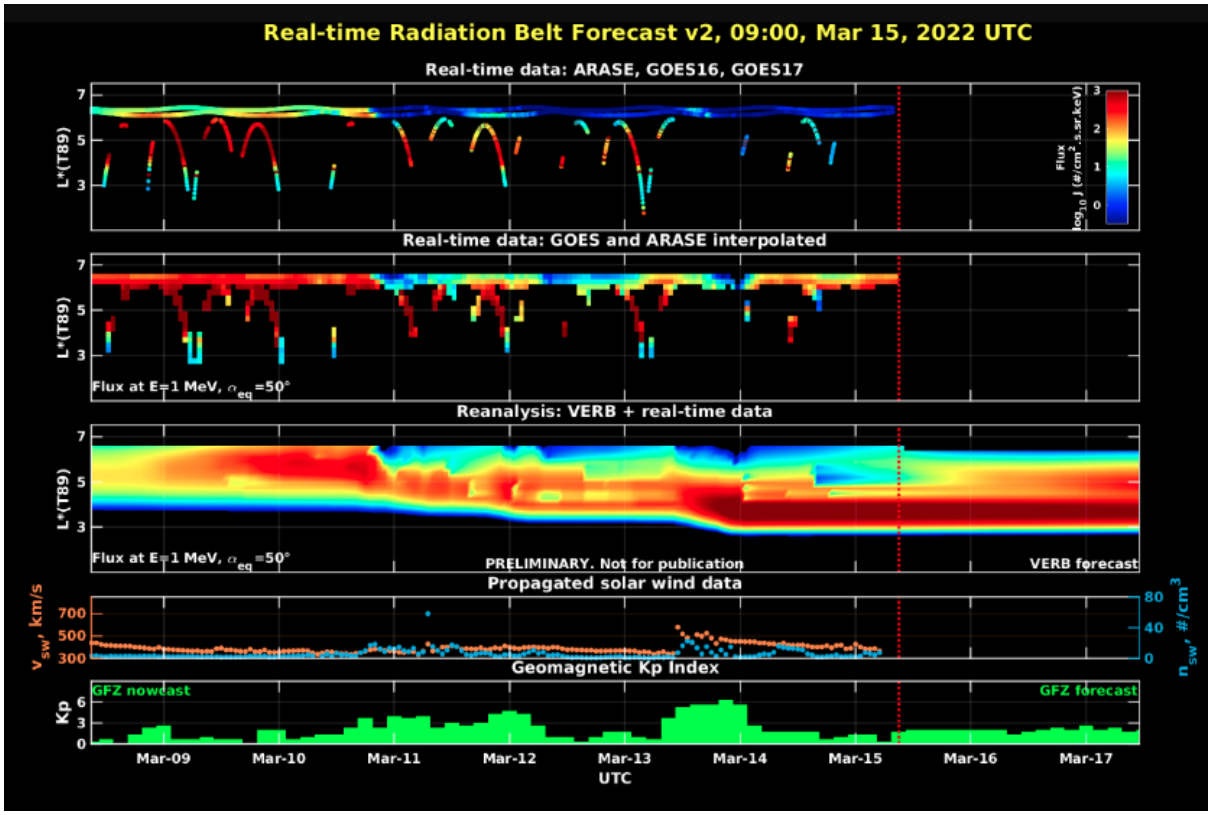


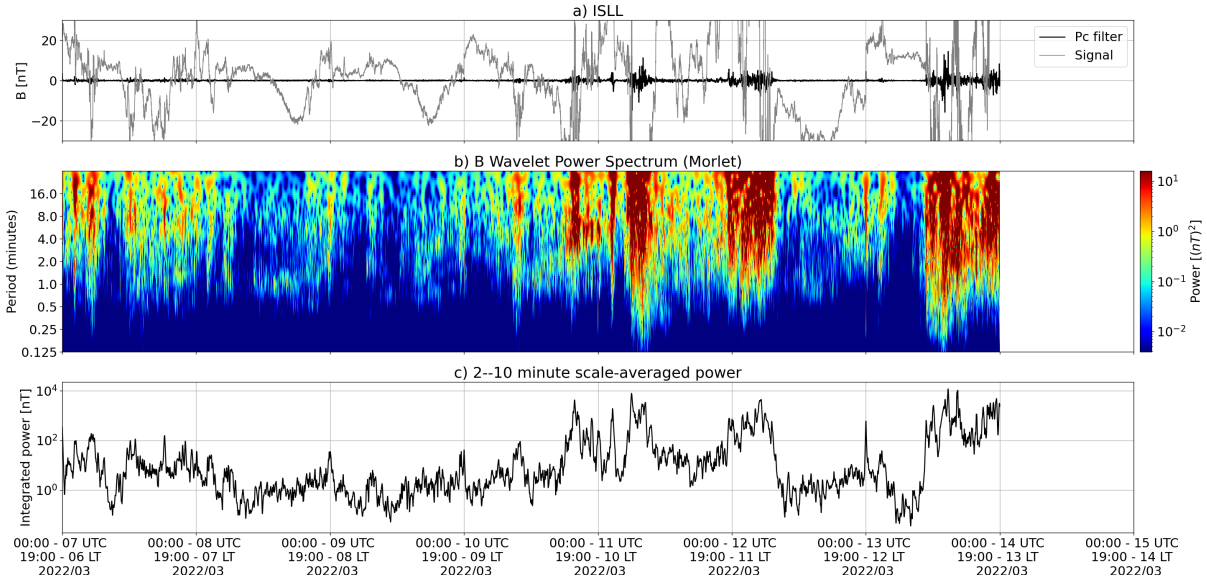
Figure 2: high-energy electron flux data (real-time and interpolated) obtained from ARASE, GOES-16, GOES-17 satellites. Reanalysis's data from VERB code and interpolated electron flux. Solar wind velocity and proton density data from ACE satellite.
Source: https://rbm.epss.ucla.edu/realtime-forecast/

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 confined between 103 and 104 particles/(cm2 s sr) between March, 9th-10th, with a dropout of approximately 3 orders of magnitude in the last hours of March 10th. The electron flux is confined below 103 particles/(cm2 s sr) after this dropout until today.

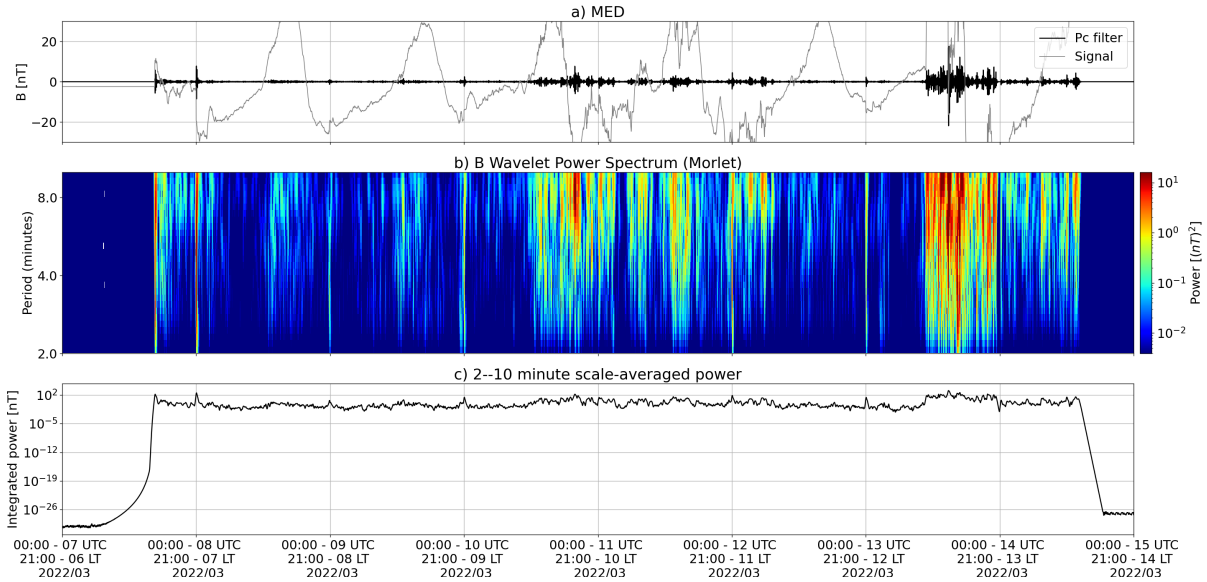
The GOES-16, GOES-17, and Arase satellite data are analyzed and interpolated to observe the high-energy electron flux variability (1 MeV) in the outer radiation belt (Figure 2). Additionally, the VERB code rebuilds this electron considering the Ultra Low Frequency (ULF) waves' radial diffusion. The electron flux decrease observed in the last hours of March 10th reached L-shell > 3.8. This electron flux decrease observed occurred concomitantly with ULF wave activity and the arrival of a coronal mass ejection.

ULF waves in the Magnetosphere

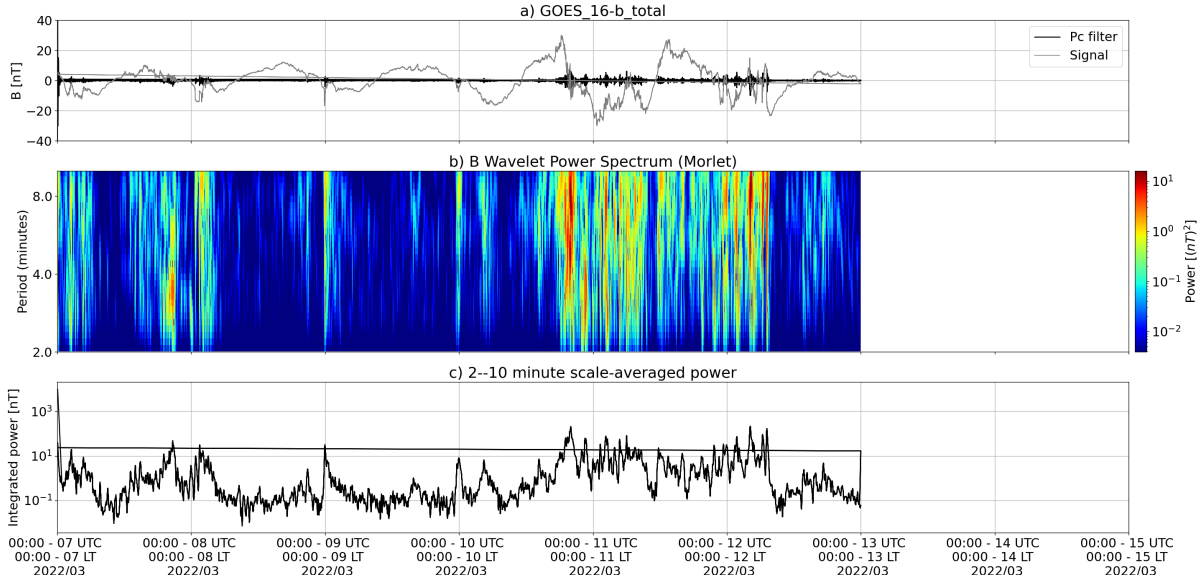
Responsible: José Paulo Marchezi



a) signal of the total magnetic field measured in the ISLL Station of the CARISMA network in gray, together with the fluctuation in the range of Pc5 in black. b) Wavelet power spectrum of the filtered signal. c) Average spectral power in the ranges from 2 to 10 minutes (ULF waves).



a) signal of the total magnetic field measured in the MED Station of the EMBRACE network in gray, together with the fluctuation in the range of Pc5 in black. b) Wavelet power spectrum of the filtered signal. c) Average spectral power in the ranges from 2 to 10 minutes (ULF waves).

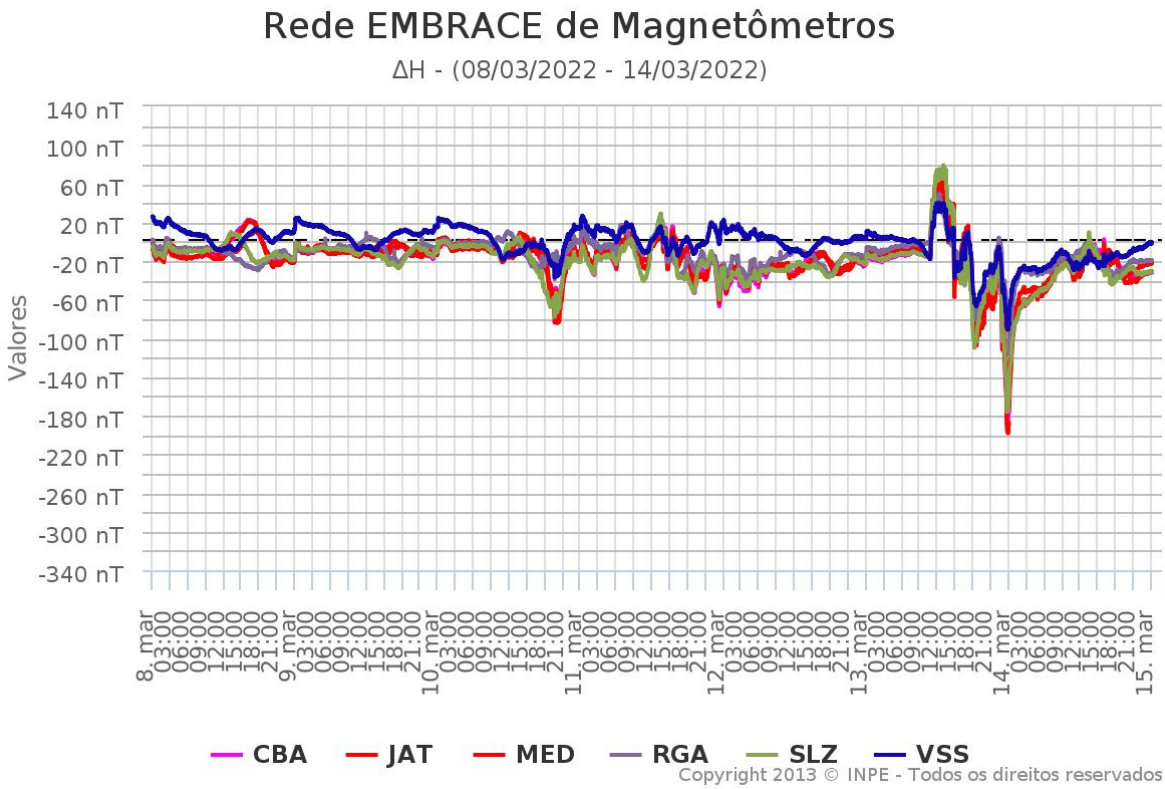


a) signal of the total magnetic field measured by the GOES 16 satellite, together with the fluctuation in the range of Pc5 in black. b) Wavelet power spectrum of the filtered signal. c) Average spectral power in the ranges from 2 to 10 minutes (ULF waves).

The ULF wave activity shows an increase in power from the 11th of March, where there are small shocks, which are mainly visible at high latitudes and by the GOES satellite, as impulsive pulsations with short duration. From the 13th onwards, there is a greater power of waves in the Pc5 range that last for a long period, which may be associated with the interaction of a CME with the Earth's magnetosphere. These waves are the result of a disturbance in the equatorial currents, seen by the GOES satellite and in low-latitude magnetometers in the EMBRACE network, and also a result of the intensification of the auroral currents, detected by magnetometers at high latitudes (ISLL-CHARISMA).

Geomagnetism

Responsible: Livia Ribeiro Alves


Rede EMBRACE de Magnetômetros
ΔH - (08/03/2022 - 14/03/2022)
Valores
140 nT
100 nT
60 nT
20 nT
-20 nT
-60 nT
-100 nT
-140 nT
-180 nT
-220 nT
-260 nT
-300 nT
-340 nT
8. mar
9. mar
10. mar
11. mar
12. mar
13. mar
14. mar
15. mar
CBA
JAT
MED
RGA
SLZ
VSS
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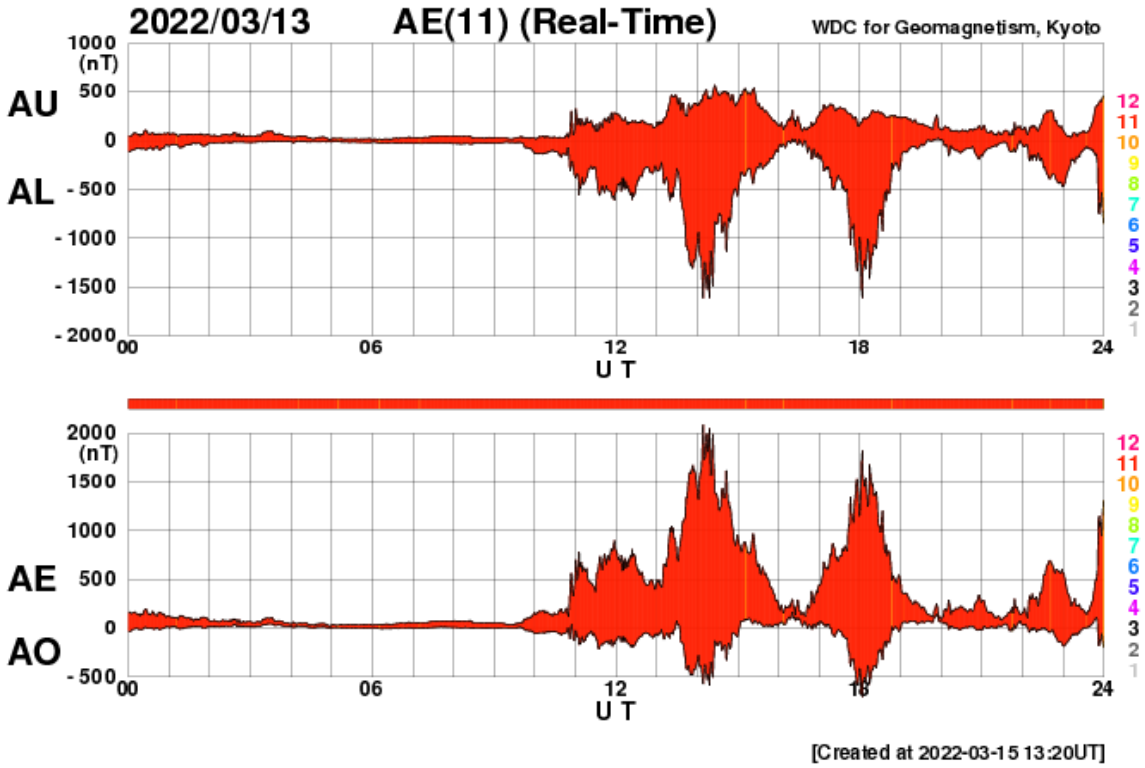
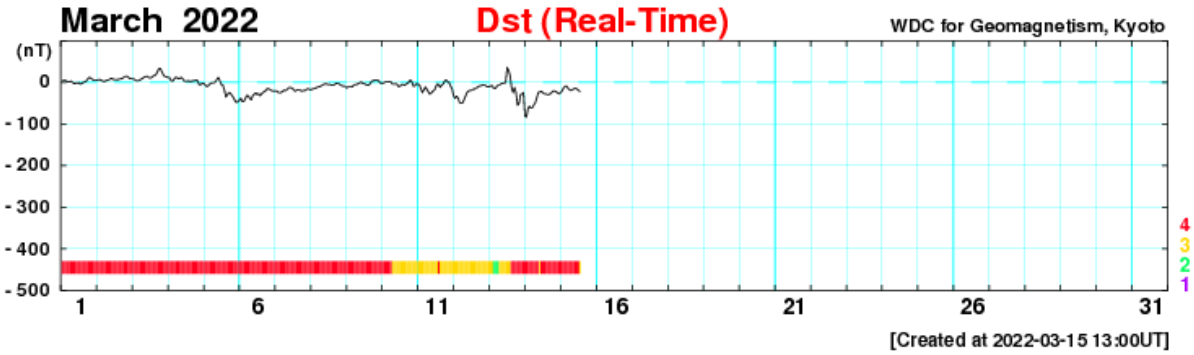
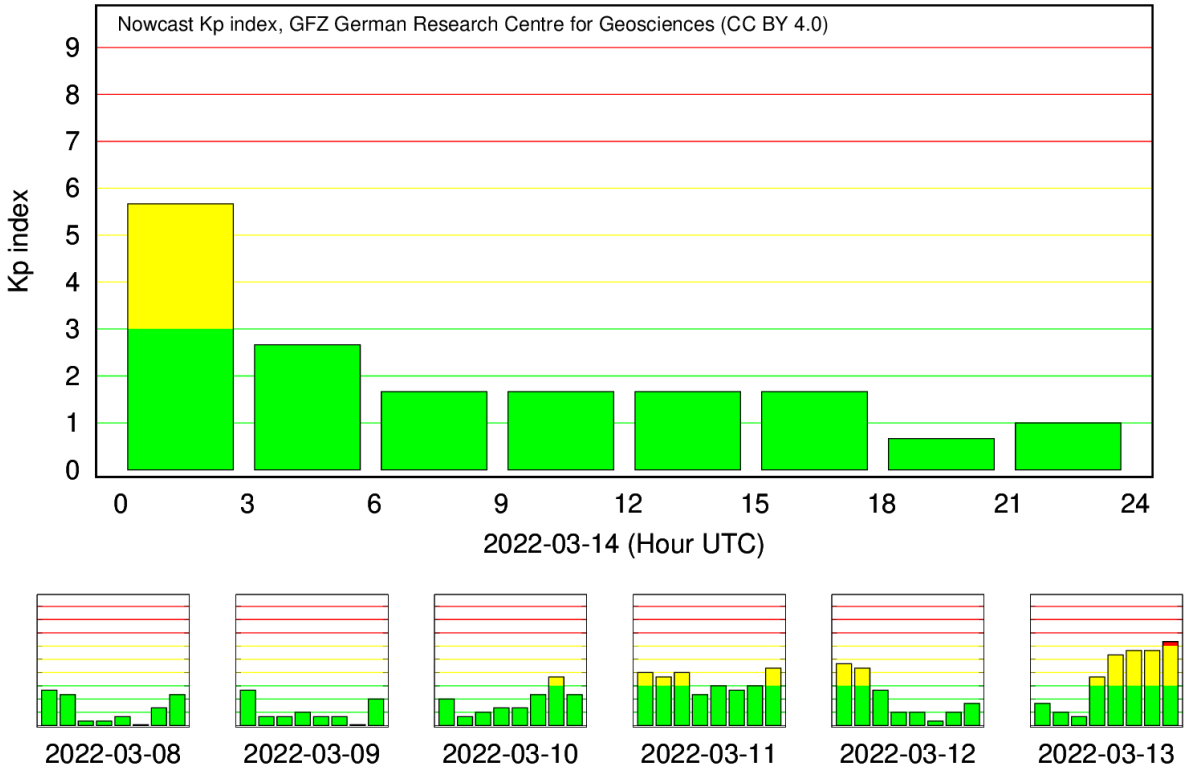

2022/03/13
AE(11) (Real-Time)
WDC for Geomagnetism, Kyoto
AU
AL
AE
AO
(nT)
U T
[Created at 2022-03-15 13:20UT]





In the week of March 7th to 14th, the following events related to geomagnetic activity stand out:

- Data from the Embrace magnetometer network showed instabilities throughout the period, with some events highlighted:
  - day 10, drop in H component in all seasons, up to -60 nT
  - day 14, drop in the H component in all seasons, up to -173 nT
- Geomagnetic activity recorded storm level G2 on 03/13 and 03/14, with the Dst index reaching its minimum value of -83 nT on 03/05. Highest Kp of the week was 5+ recorded on 05/03

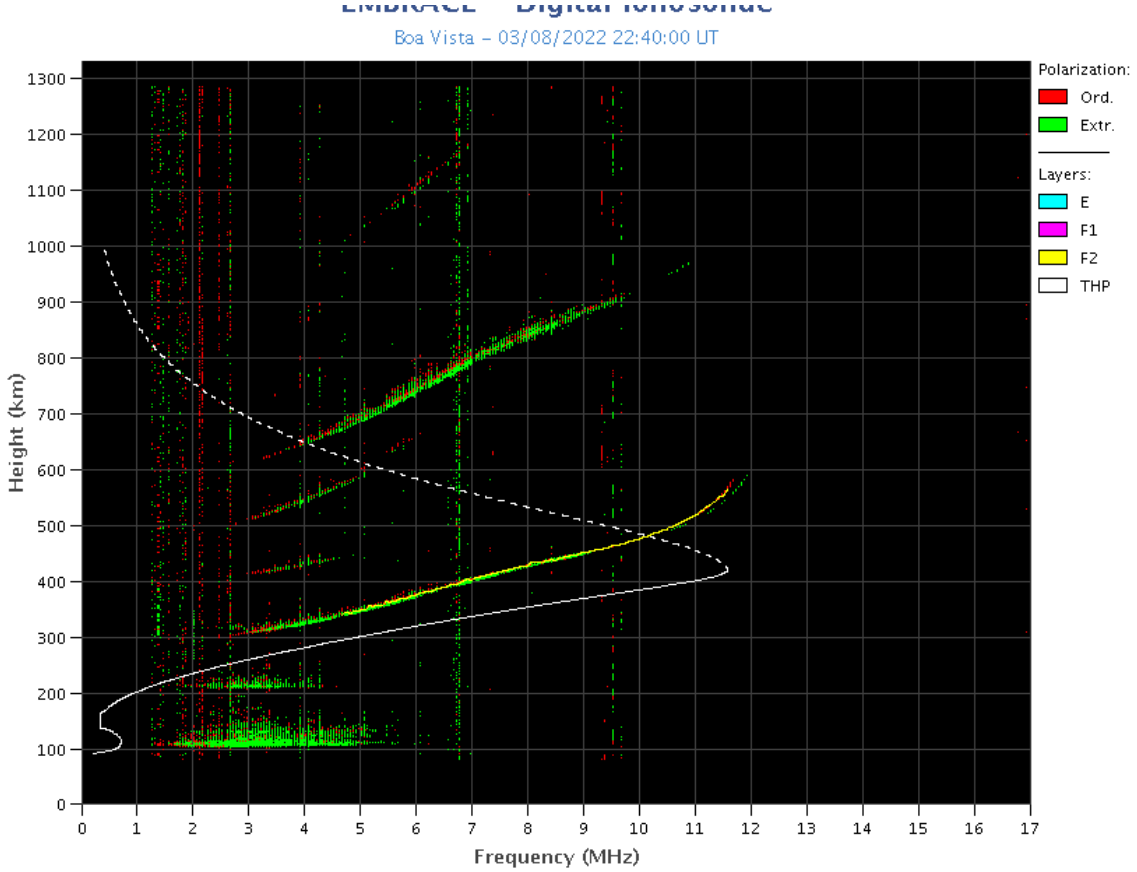
- Auroral activity was intensified on the 13th and 14th.
- Magnetic field measured in the orbit of the GOES satellite showed disturbances on the 11th, 13th and 14th of March.

Ionosphere

Responsible: Laysa Resende

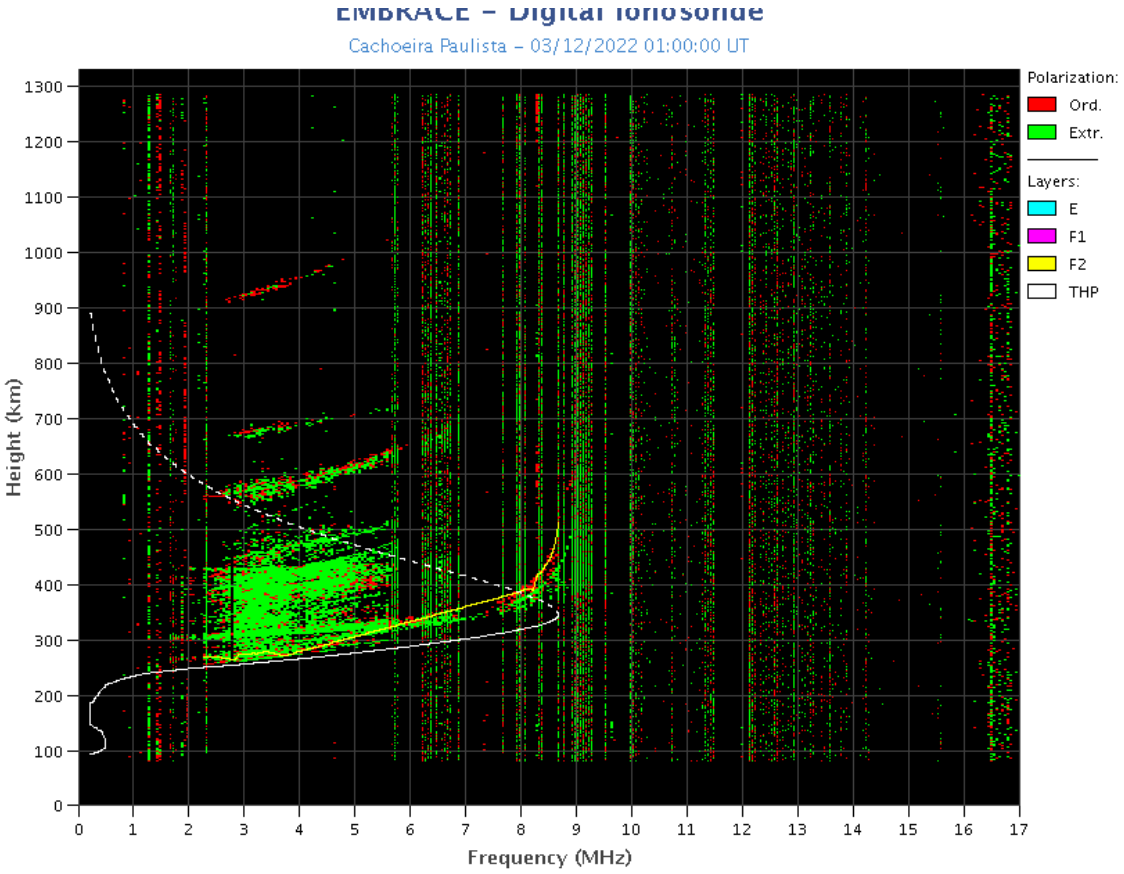
Boa Vista:

- There were spread F during all days on the week.
- The Es layers reached scale 3 on days 08, 12, and 13.



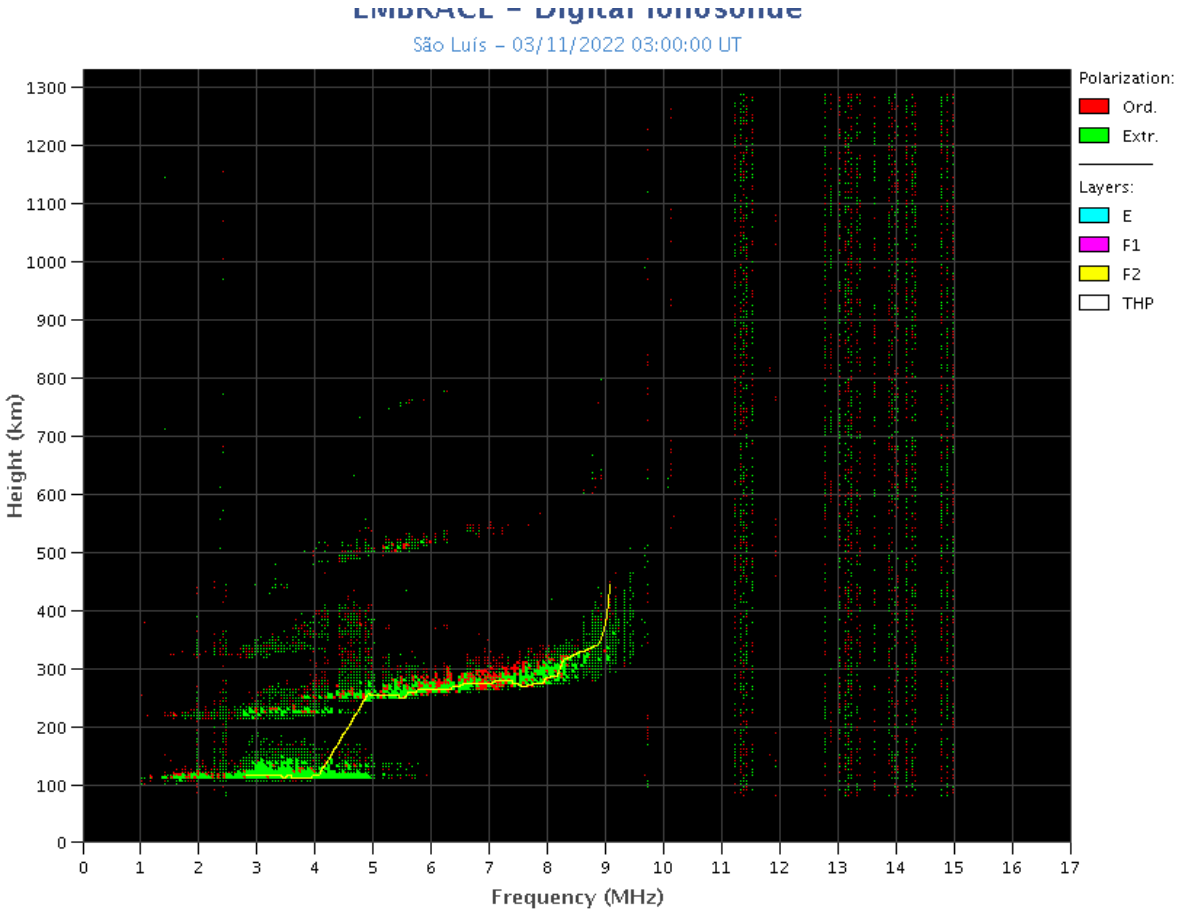
Cachoeira Paulista:

- There were spread F during all days on the week.
- The Es layers reached scale 2 during all days on the week.



São Luís:

- There were spread F during all days in this week.
- The Es layers reached scale 3 on days 11, and 12.



Scintillation S4

Responsible: Siomel Savio Odriozola

In this report on the S4 scintillation index, data from SLMA in São Luíz/MA, STSN in Sinop/MT, UFBA, in Bahía/BA e 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.

Except March 8-9, strong S4 index values (> 0.6) were measured throughout the week at the SLMA station. At the STSN station, S4 values above 0.8 were recorded every day (Figure 1). Something similar was found at the UFBA station. The SJCE station detected strong S4 values after sunset on the 10th, 11th and 03/14th. Details of the temporal evolution of the S4 index for the last hours of the 11th to the early hours of the 03/12 are shown in Figure 2.

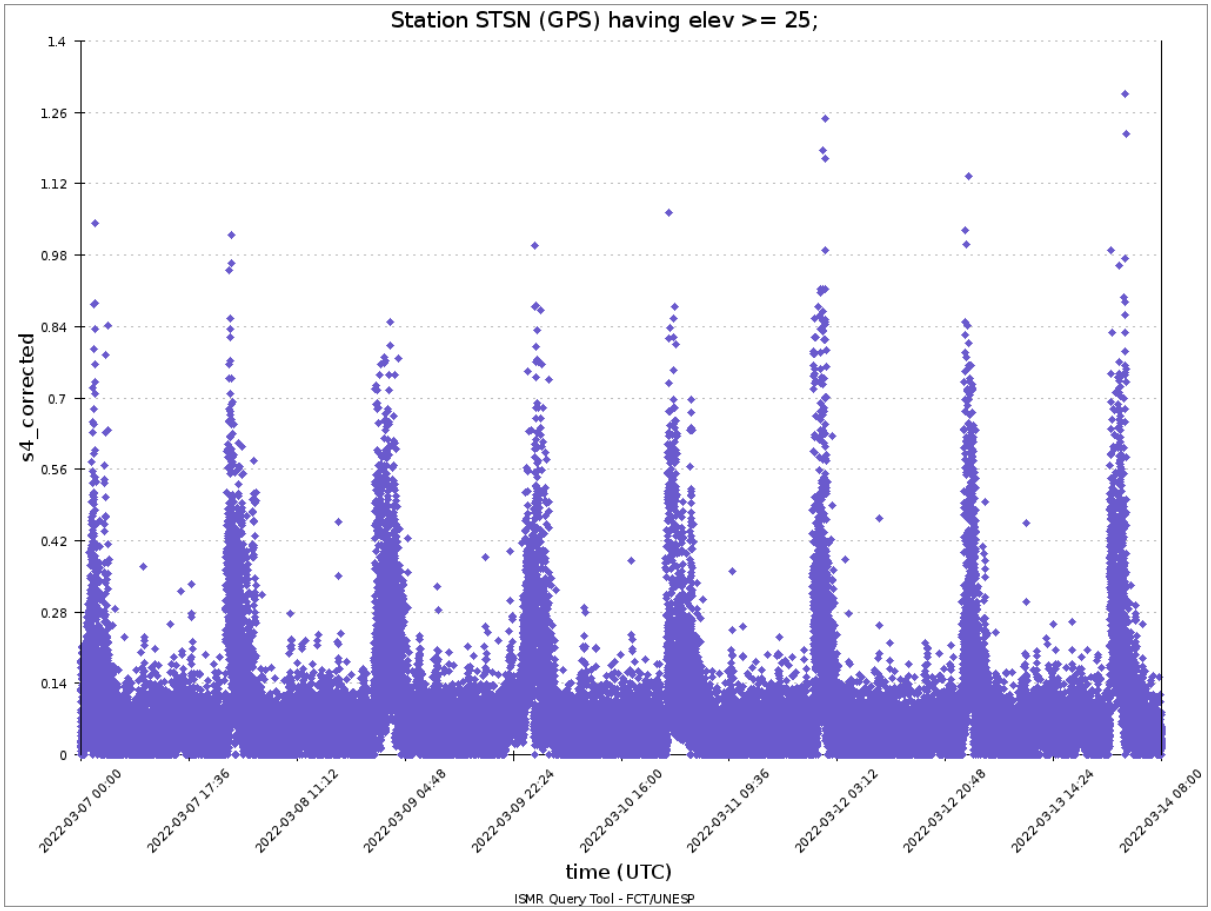


Figure 1: S4 index values for the GPS constellation for the station STSN during the week 03/07—
03/14/2022.

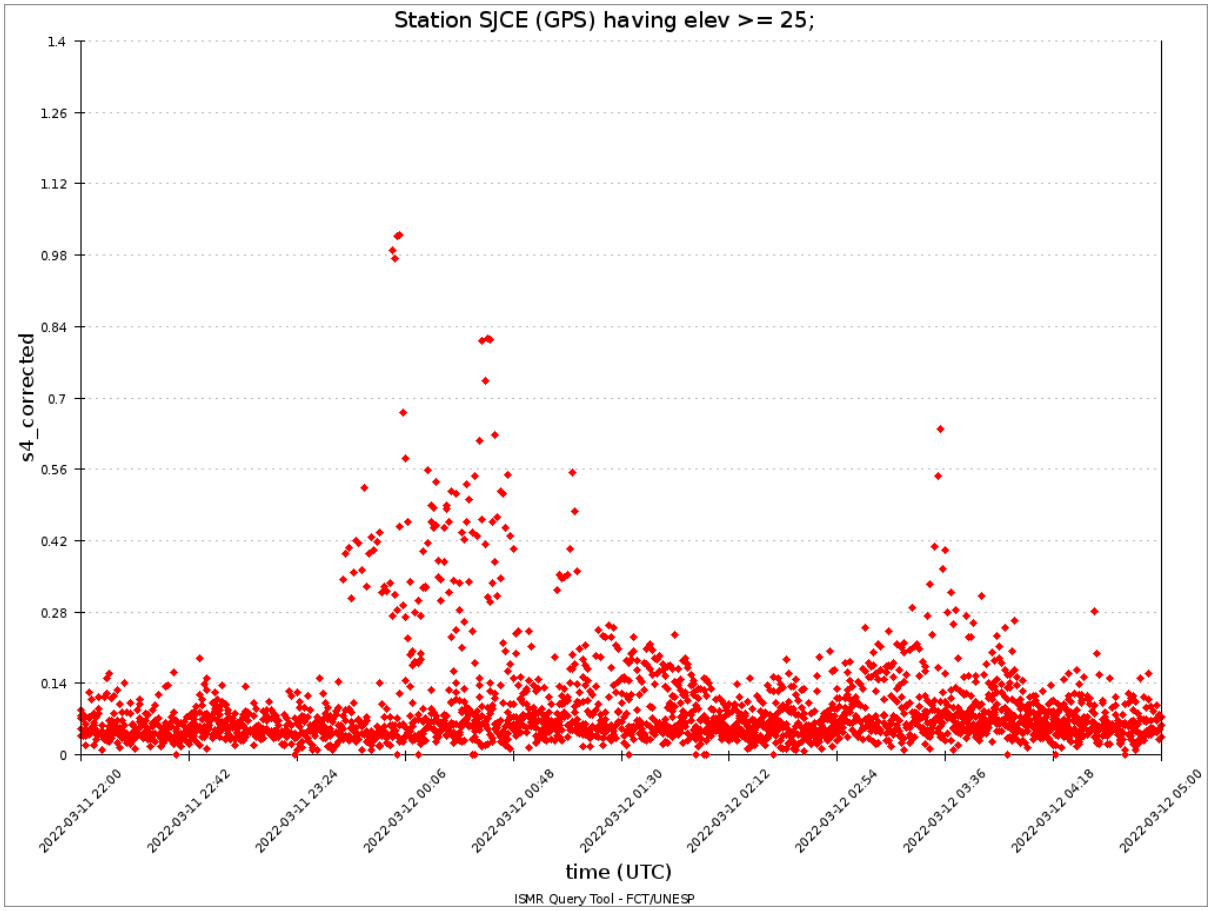


Figure 1: S4 index values for the GPS constellation at SJCE station between 22:00 (UT) on 03/11—until 05:00 (UT) on 03/12.

All-Sky Imager

Responsible: Cosme Alexandre

All-Sky Imager EPBs Observation || Mar 07 - Mar 13, 2022 – Observações das EPBs por meio do imageador All-Sky || 07 mar - 13 mar, 2022

Observatory Observatório	Mar 07 Mar 07	Mar 08 Mar 08	Mar 09 Mar 09	Mar 10 Mar 10	Mar 11 Mar 11	Mar 12 Mar 12	Mar 13 Mar 13
CA	✓○	✓◗	✓◗	✓◗	✓◗	✓●	✓●
BJL	✓◗	✓◗	✓◗	✓◗	✓◗	✓◗	✓◗
CP	✓◗	✓◗	✓◗	✓◗	✓●	✓●	✓◗
SMS	✓●	✓●	✓●	✓●	✓◗	✓●	✓●

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

- At the São João do Cariri observatory, between March 7th and 11th, there were observations with clear sky or partially cloudy sky but it was possible to observe plasma bubbles. However, on the 12th and 13th of March, it was not possible to observe the occurrence of plasma bubbles because of the cloudy sky.
- At the Bom de Jesus da Lapa observatory between March 7th and 13th, the sky was partially cloudy and plasma bubbles were observed throughout the period.
- At the Cachoeira Paulista observatory, between the 7th and 10th and also on March 13th, the sky was partially cloudy and bubbles of plasma were observed during these days. However, on March 11 and 12, the sky was partially cloudy and it was not possible to observe the atomic oxygen emission at 630 nm.
- Finally, at the observatory of São Martinho da Serra, it was not possible to measure the atomic oxygen Airglow at 630 nm because the sky was cloudy during the entire period.

TEC Map

- Between March 7th and 13th, 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.