

Briefing Space Weather

2023/03/23

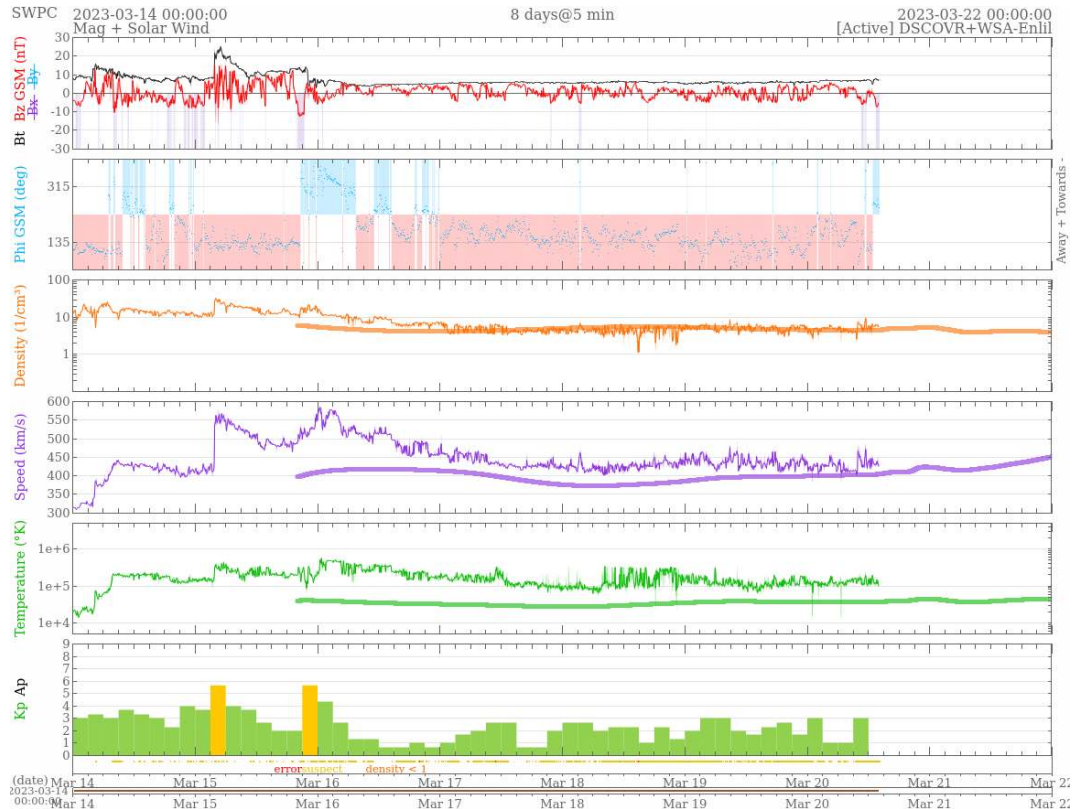
1 Sun

1.1 Responsible: José Cecatto

03/13 – No flare; No fast wind stream; 10 CME c.h.c. toward the Earth *,*;
03/14 – No flare; Fast wind stream (≤ 450 km/s); 5 CME c.h.c. toward the Earth;
03/15 – No flare; Fast wind stream (≤ 600 km/s); 3 CME c.h.c. toward the Earth;
03/16 – No flare; Fast wind stream (≤ 600 km/s); 3 CME c.h.c. toward the Earth;
03/17 – M1.0 flare; Fast wind stream (≤ 500 km/s); 11 CME c.h.c. toward the Earth *,*,**;
03/18 – No flare; Fast wind stream (≤ 450 km/s); 13 CME c.h.c. toward the Earth *;
03/19 – No flare; Fast wind stream (≤ 500 km/s); 5 CME c.h.c. toward the Earth *;
03/20 – M1.2 flare; Fast wind stream (≤ 500 km/s); 2 CME c.h.c. toward the Earth;
Prev.: No fast wind stream for the next 01-03 days; for the next 2 days (25% 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 Interplanetary Medium

2.1 Responsible: Paulo Jauer



- The interplanetary medium region in the last week showed a 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 module of the interplanetary magnetic field component showed 3 peaks 13, 21 and 12 nT on day 14, and two registered on March 15 at 04:30 and 21:30 UT during the analyzed period.
- The BxBy components presented variations in the analyzed period, keeping both oscillating within the interval $[+10, -10]$ nT, without any crossing sector boundary.
- The bz field component showed a minimum value on March 15 at 20:30 UT of -10. nT, due to the interaction of a CME structure. Bz also had negative values in other intervals, however with the magnitude oscillating around -5nT.
- The solar wind density showed peaks on days 14-15. It showed a value of 22 p/cm^3 on March 14th at 6:30 am and two peaks on March 15th at 4:30 am and 11:30 pm 28 and 17 p/cm^3 .
- The solar wind speed averaged above 400 km/s with peaks on March 14-15 at 08:30, 05:30 and 02:30 at 434, 558 and 571 km/s.
- The magnetopause position was oscillating below the equilibrium position between days 13 to 16 from 23:30 to 19:30 UT, whose maximum compression was recorded on March 15 at 04:30 UT and at 20:30 UT of 7.38 and 7.55 Re.

3 Radiation Belts

3.1 Responsible: Ligia Alves da Silva

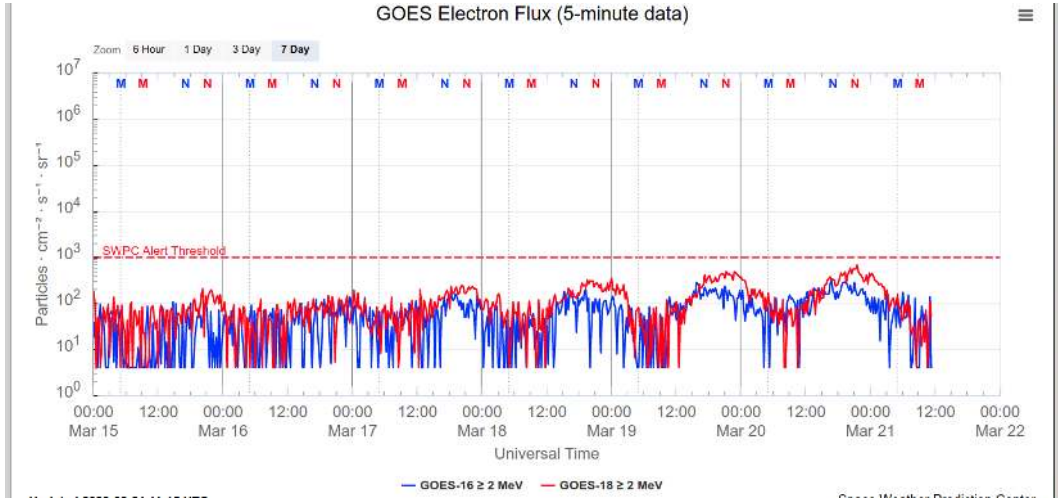


Figura 1: High-energy electron flux ($> 2 \text{ MeV}$) obtained from GOES-16 and GOES-18 satellite. Source: <https://www.swpc.noaa.gov/products/goes-electron-flux>.

High-energy electron flux ($> 2 \text{ MeV}$) in the outer boundary of the outer radiation belt obtained from geostationary satellite data GOES-16 and GOES-17 shows considerably low values, appearing below 10^3 particles/($\text{cm}^2 \text{sr}$) throughout the analyzed period. This concentrates close to 10^2 particles/($\text{cm}^2 \text{sr}$) between March 15th-17th and above 10^2 particles/($\text{cm}^2 \text{sr}$) from 15:30 UT on March 17th.

4 ULF waves

4.1 Responsible: Graziela B. D. Silva

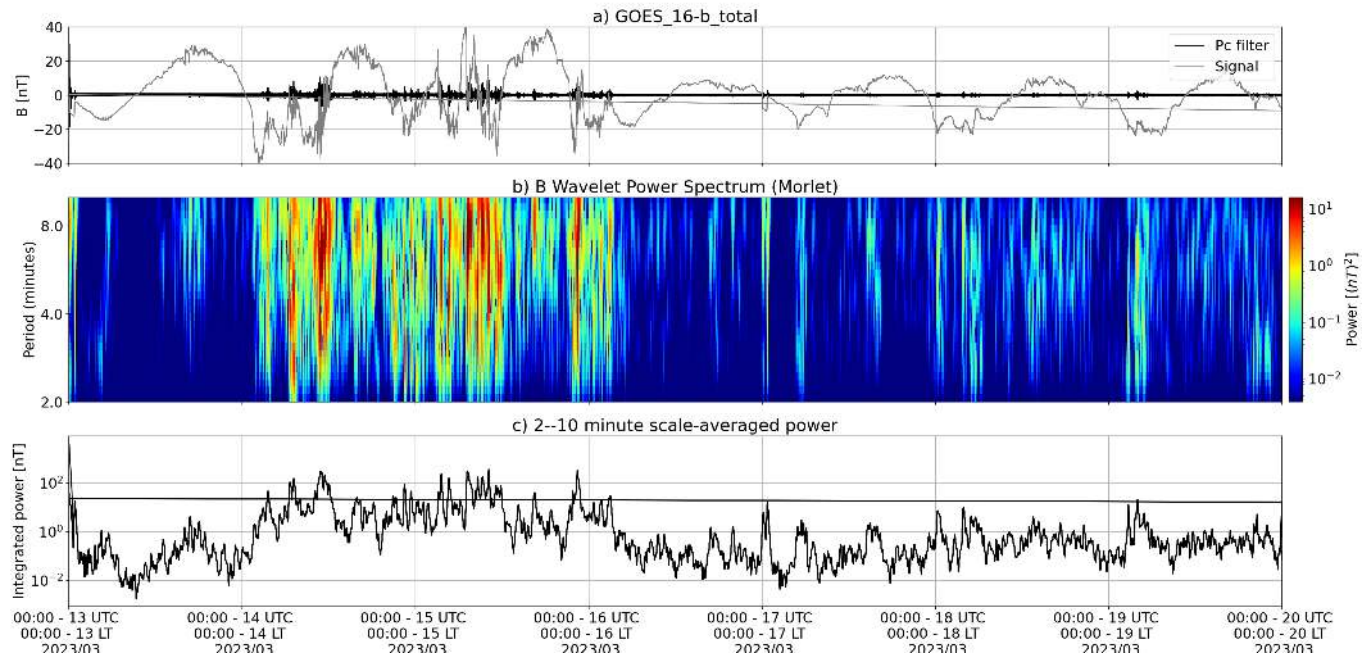


Figura 2: a) Timeseries of the geomagnetic field total component measured by GOES 16, together with the Pc5 fluctuation in black. b) Wavelet power spectrum of the filtered timeseries. c) Average ULF power in the period range from 2 to 10 minutes.

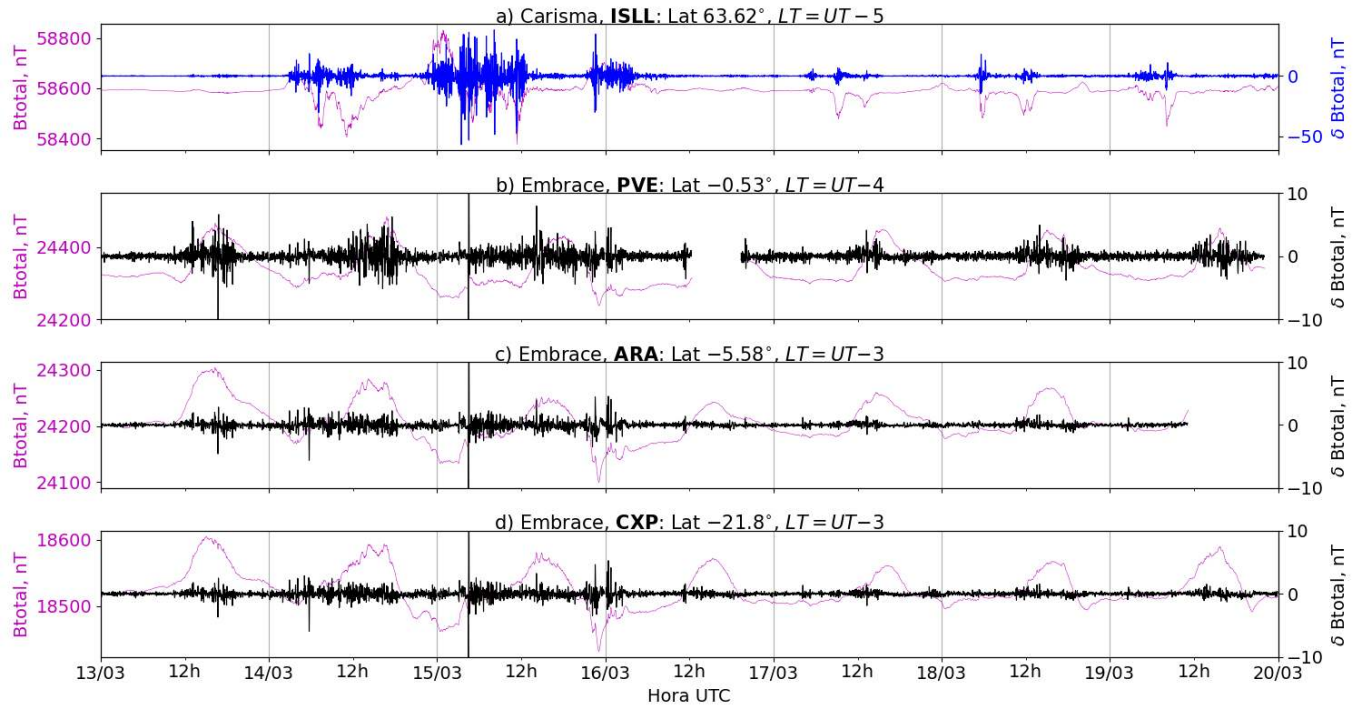


Figura 3: a) Timeseries of the geomagnetic field H component measured at ISLL station (Island Lake) of the CARISMA magnetometer network in magenta, along with the associated perturbation in the Pc5 band shown in blue. b-d) timeseries of the geomagnetic field total component measured at stations PVE (Porto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

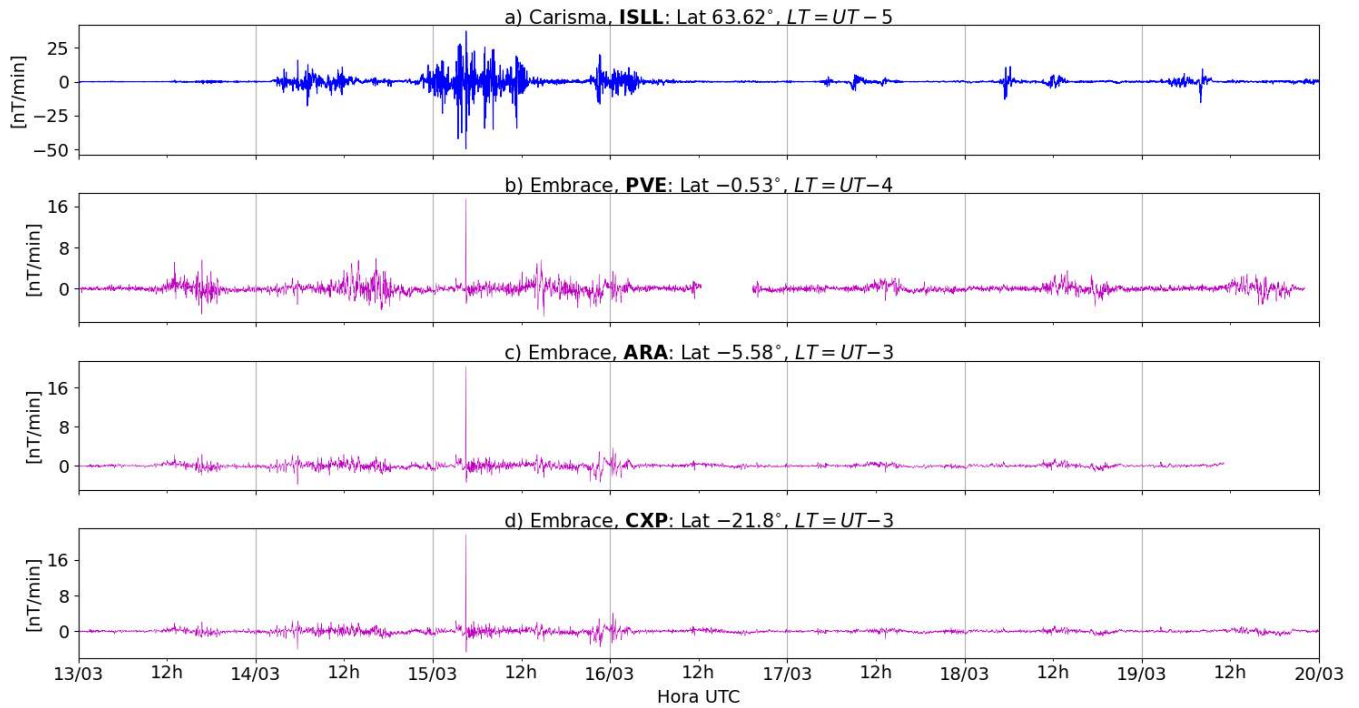


Figura 4: a-d) The rate of change of the geomagnetic field H component (dB_H/dt) obtained for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, ARA, CXP).

- The GOES 16 satellite in geosynchronous orbit ($L \sim 6.6$) registered significant activity of Pc5 ULF waves during March 14-16 resulting from the passing of ICMEs.
- As observed on the ground, the ISLL station at high latitude registered high intensity levels of ULF wave activity over 14-15 and beginning of 16th.
- In the same way, the PVE station from Embrace MagNet, located under the dip equator, registered significant levels of ULF wave activity over these days, however, with strong diurnal influence by the equatorial electrojet.
- Also, the ARA and CXP stations at low latitudes of Brazil did register significant activity of the waves throughout 14-16.
- The dB/dt rates showed peaks > 16 nT/min simultaneously observed (in the H component of the geomagnetic field) by the Embrace stations at ~ 5 UT on 15th. In ISLL station (Carisma network), long-term dB/dt activity was recorded especially on 15th for values up to 50 nT/min in modulus.

5 Geomagnetic activity

5.1 Responsible: Livia Alves

The following figures show that in the week of March 13-20 the auroral activity was at high levels ($AE > 1000$ on 15th), and there was the development of a moderate storm with the main phase observed over 15th.

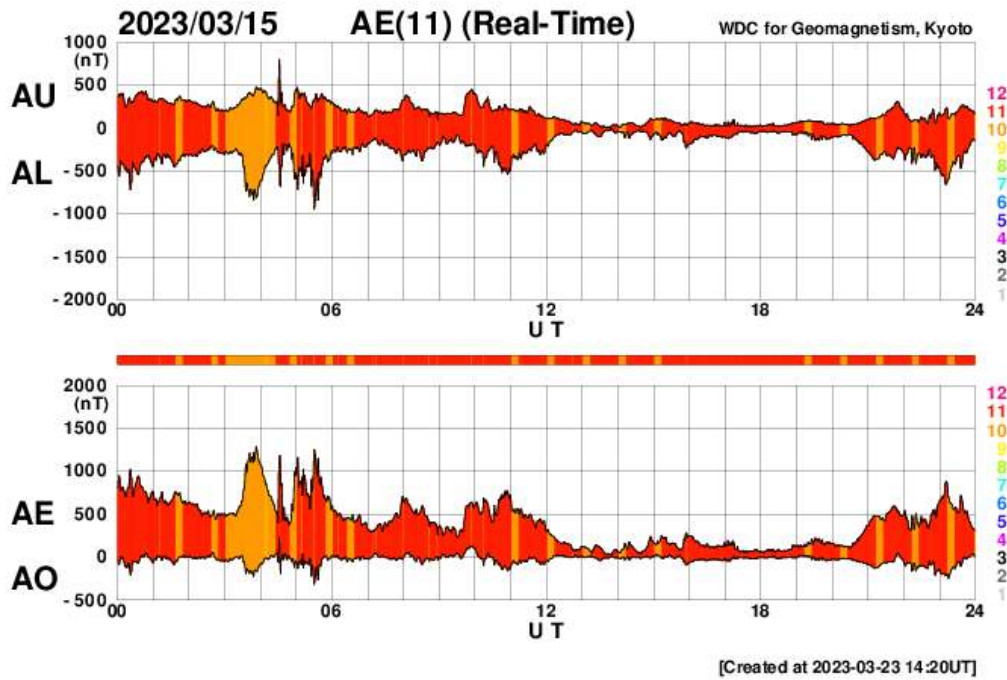


Figura 5: Geomagnetic index AE.

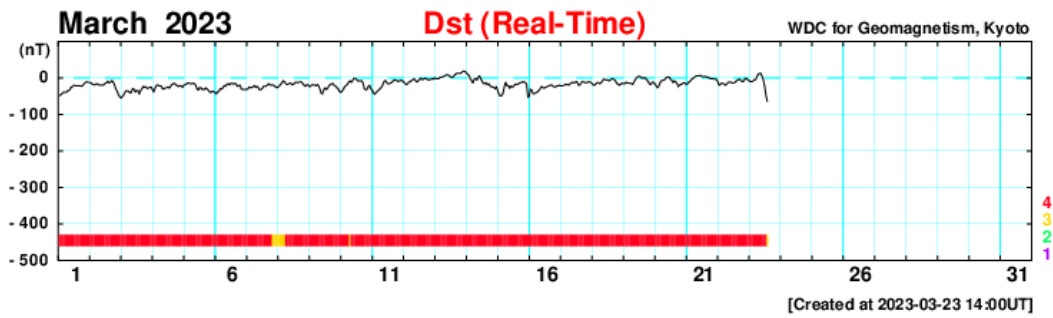


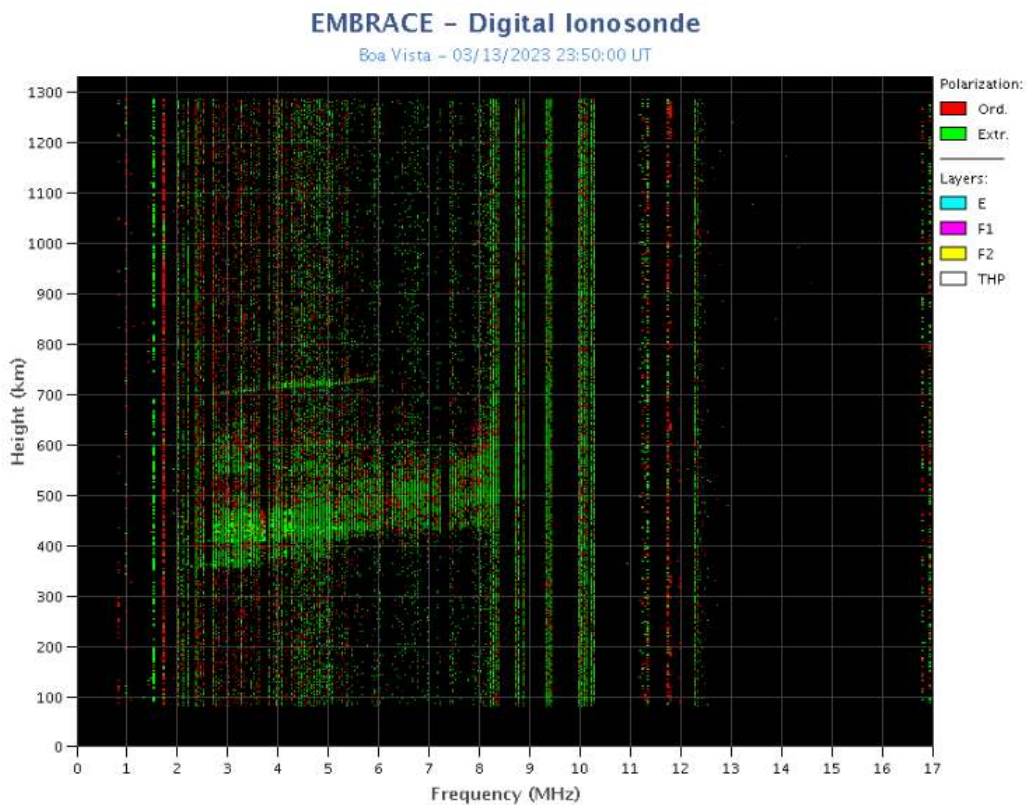
Figura 6: Geomagnetic index Dst.

6 Ionosphere

6.1 Responsible: Laysa Resende

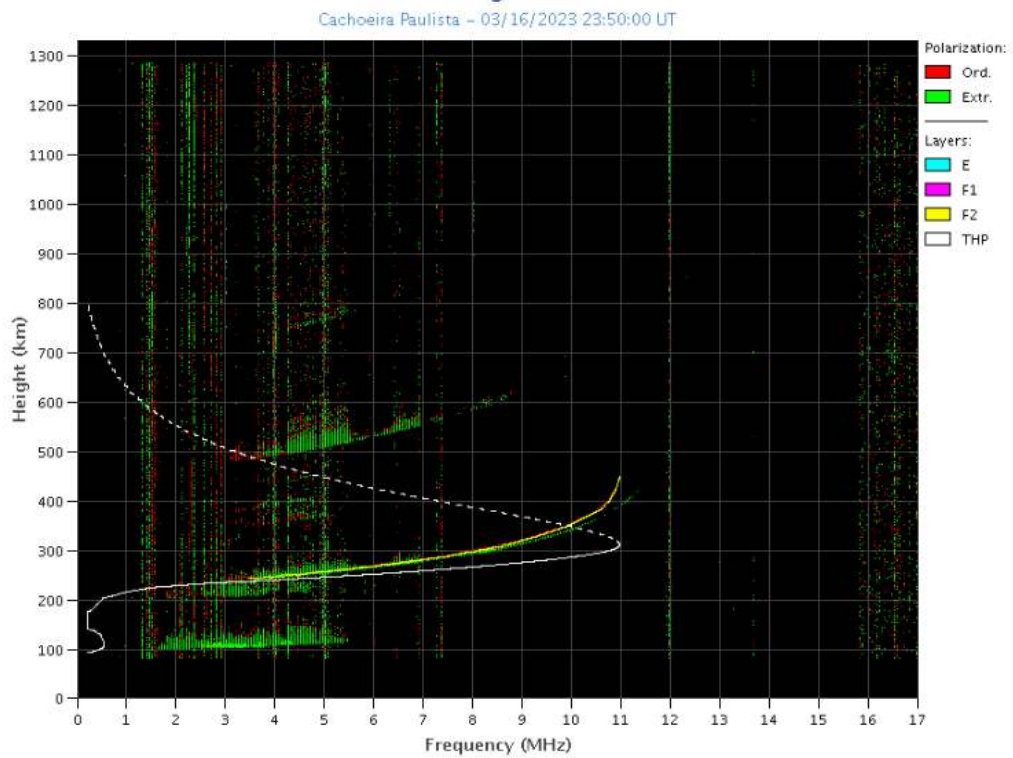
Boa Vista:

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



Cachoeira Paulista:

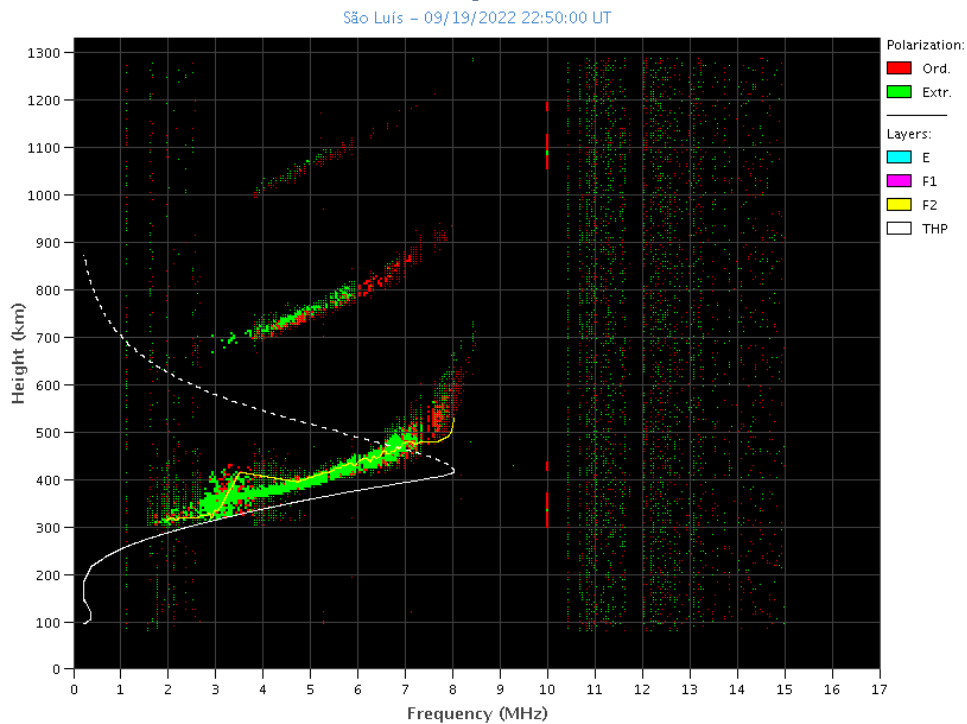
- There were spread F during all days in this week.
- The Es layers reached scales 2 and 3 during the week.



São Luís:

- There were spread F during all days in this week.
- The Es layers reached scales 2 and 3 during the week.

EMBRACE - Digital Ionosonde



7 Scintillation

7.1 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. The S4 index registered values of scintillation ranging from strong to severe during a whole week in all the stations (Figure 1). The period after sunset on 03/14th to the early hours of the 03/15th was particularly intense at the UFBA and SJCE station. Something similar was recorded on 03/19th-20th for the SLMA and STCB stations. Figure 2 shows the maps with the spatial arrangement of signal interception from some satellites in the GPS constellation, which presented S4 values > 0.2 and elevation $> 25^\circ$, with a layer at 400 km height over the field of view of the stations used in this report. These maps correspond to the aforementioned dates. The maximum values of S4 appear in the region where the southern crest of the equatorial ionization anomaly intercepts the plasma bubble that possibly is causing this degradation in the signal emitted by the satellites of the GPS constellation.

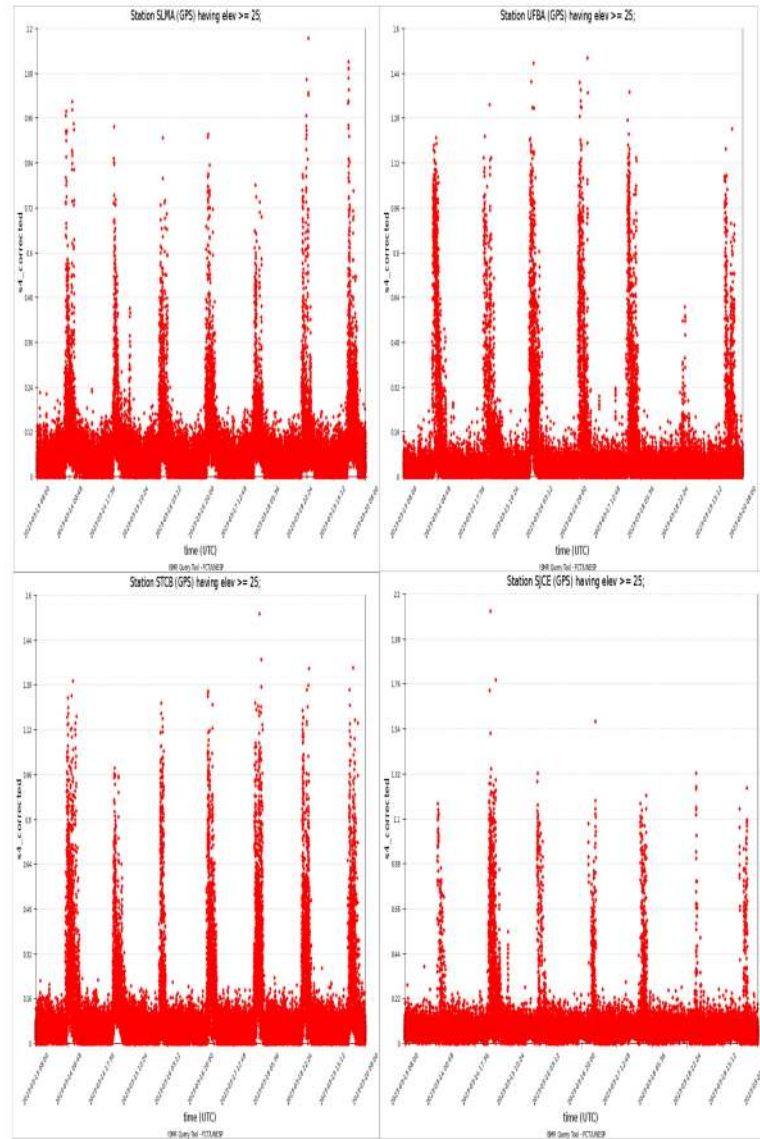


Figure 1: S4 index values for the GPS constellation measured at SLMA (upper left panel), UFBA (upper right panel), STCB (lower left panel) and SJCE (lower right panel) during the week 03/13–20.

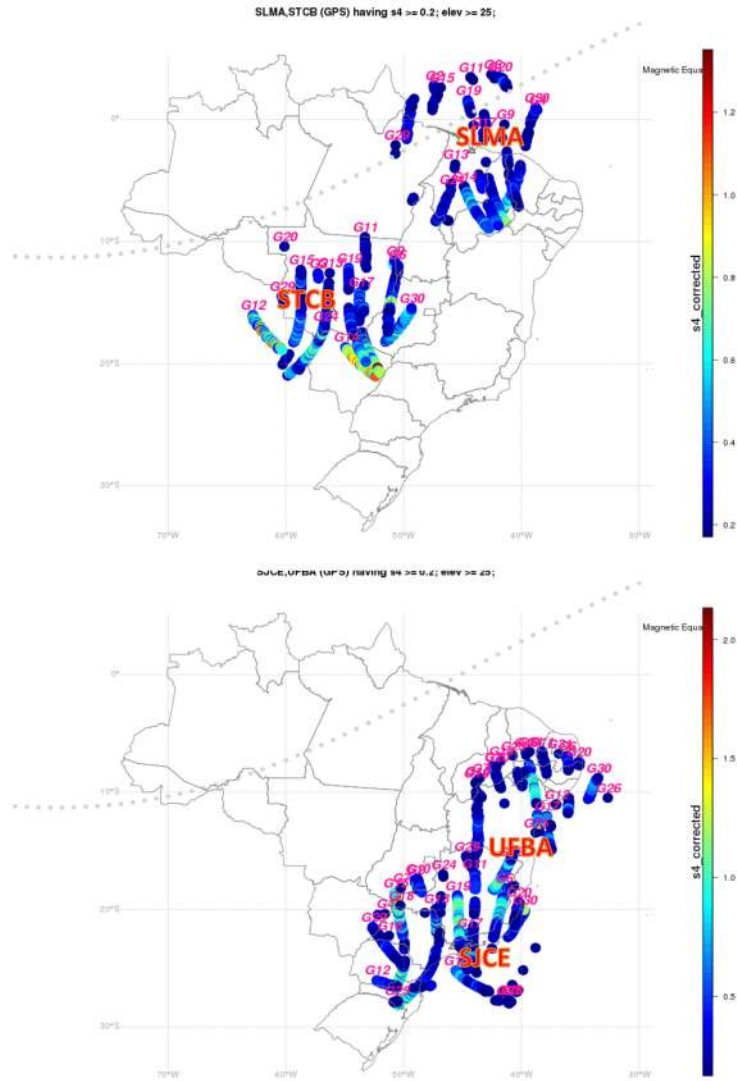


Figure 2: Map of S4 index values for the GPS constellation measured from the point of view of GNSS receiver at SLMA and STCB from 03/19 at 2100 UT to 03/20 at 0500 (upper panel) and UFBA, SJCE (lower panel) from 03/14 at 2200 UT to 03/15 at 0600 (lower panel).