

# Briefing Space Weather - 2022/02/21

## Sun

### Responsible: José Cecatto

02/14 – Fast ( $\leq 500$  km/s) wind stream; 4 CME can have component toward the Earth;

02/15 – Fast ( $\leq 450$  km/s) wind stream; Huge farside CME assoc strong flare;

02/16 – No fast wind stream; 5 CME can have component toward the Earth;

02/17 – No fast wind stream; 2 CME can have component toward the Earth;

02/18 – No fast wind stream; 5 CME can have component toward the Earth;

02/19 – No fast wind stream; 2 CME can have component toward the Earth;

02/20 – Fast ( $\leq 550$  km/s) wind stream; 6 CME can have component toward the Earth; CIR arrival at begin of day;

02/21 – Fast ( $\leq 550$  km/s) wind stream; No CME toward the Earth;

Prev.: Fast wind expected up to February 22; for while low (10% M, 1% X) probability of M / X flares next 2 days; also, occasionally some other CMEs can present a component toward the Earth.

### Responsible: Douglas Silva

CME:

- One coronal mass ejections type IV halo (2022-02-15T22:12Z) and one type II halo

(2022-02-17T 21:24Z) were observed on the LASCO coronal images.

WSA-ENLIL (CME 2022-02-15T22:09Z)

- No or little impact to Earth.

WSA-ENLIL (CME )

- No or little impact to Earth.

Coronal holes (SPOCA):

- The SPOCA observed the coronal holes 34857 and 35082 between the 14th and 17th of February.

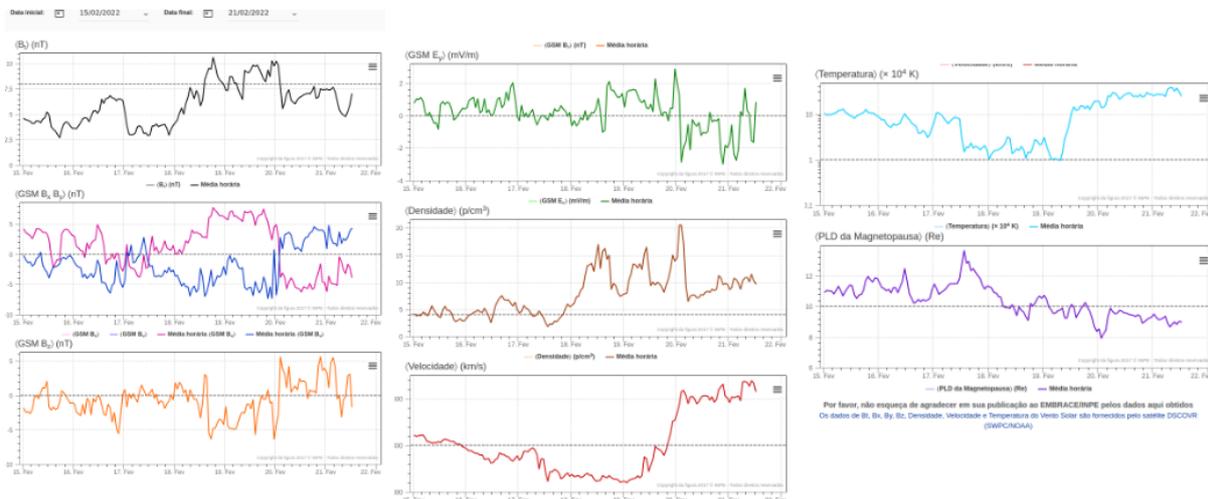
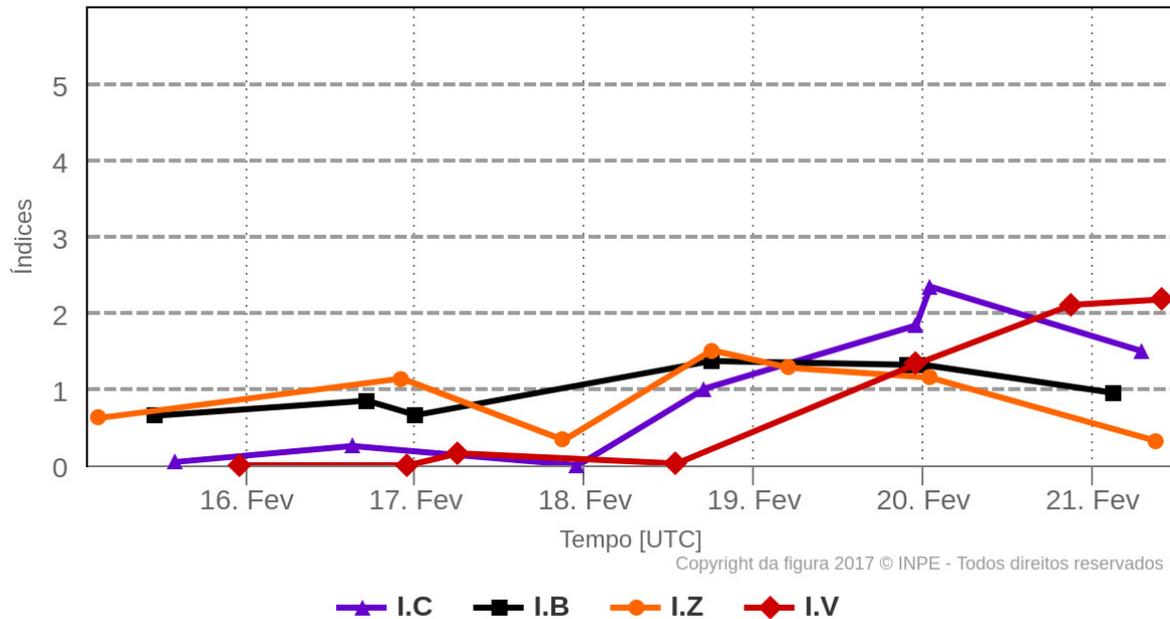
- Coronal hole 35094 was observed on the 17th of February.

# Interplanetary Medium

Responsible: Paulo Ricardo Jauer

## Resumo dos índices do meio interplanetário

Máximos diários - mais recentes entre 15 Fev, 2022 e 21 Fev, 2022



- The interplanetary region in the last week showed a moderate/high level of plasma perturbations due to the passage of the HSS and CIRs structures identified by the DSCOVR satellite in the interplanetary region.

- The modulus of the interplanetary magnetic field component remained below 11 nT. With peaks recorded on February 16, 17, and 18 at 5:30 pm, 6:30 pm, and 12:30 am respectively.
- The  $b_x b_y$  components remained below 10 nT, showing a clear sector switch on Feb/20 at 02:30.
- The component of the  $b_z$  south field showed changes in its orientation. On the 16/Feb at 21:30 the component showed the lowest value -5.5 nT, after on the 18/Feb there was a peak at 17:30 UT of -6.63 nT. Returning on Feb 20th to positive values of +5.58 nT at 02:30 UT.
- The solar wind density showed 3 disturbed intervals. On Feb 18 at 12:30 UT in the amount of 16.9 p/cm<sup>3</sup>, and another on Feb 19 at 10:30 on 16. p/cm<sup>3</sup>, and on Feb 20 at 02:30 on 20 p/ cm<sup>3</sup>.
- The solar wind speed was mostly above 400km/s until 15/Feb at 22:30 UT. Peak around ~536km/s on 21/Feb at 07:30 UT. The magnetopause position showed a compression on Feb 20 at 01:30 UT of 7.9 Re and an expansion on Feb 17 at 13:30 of 13.66 Re.

## Radiation Belts

Responsible: Ligia Alves Da Silva

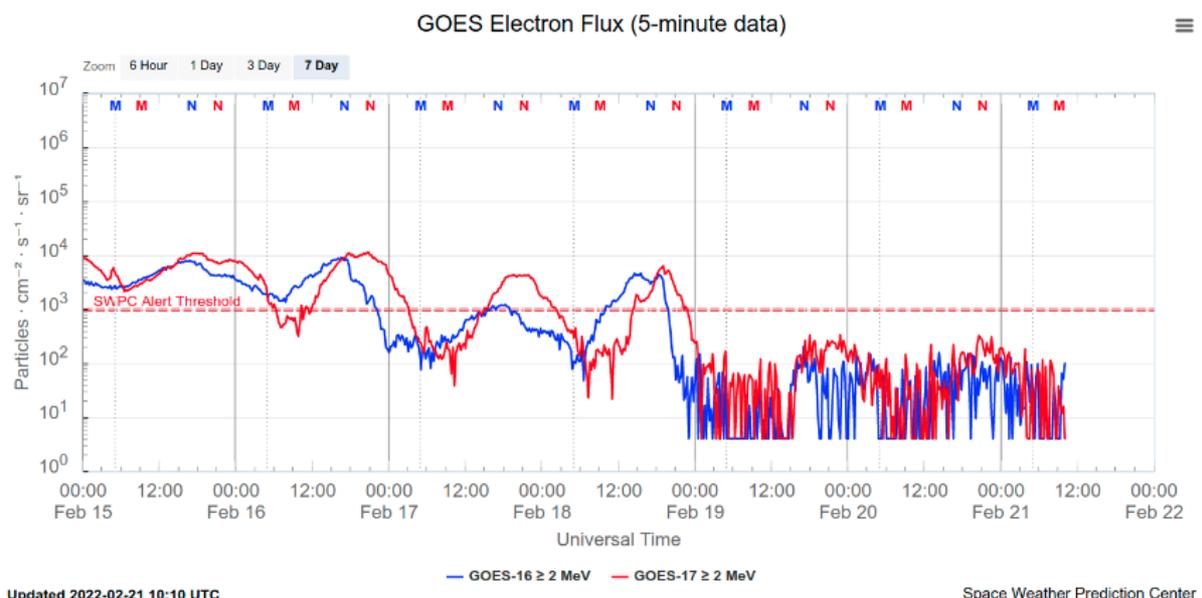


Figure 1: High-energy electron flux (> 2MeV) obtained from GOES-16 and GOES-17 satellite.

Source: <https://www.swpc.noaa.gov/products/goes-electron-flux>

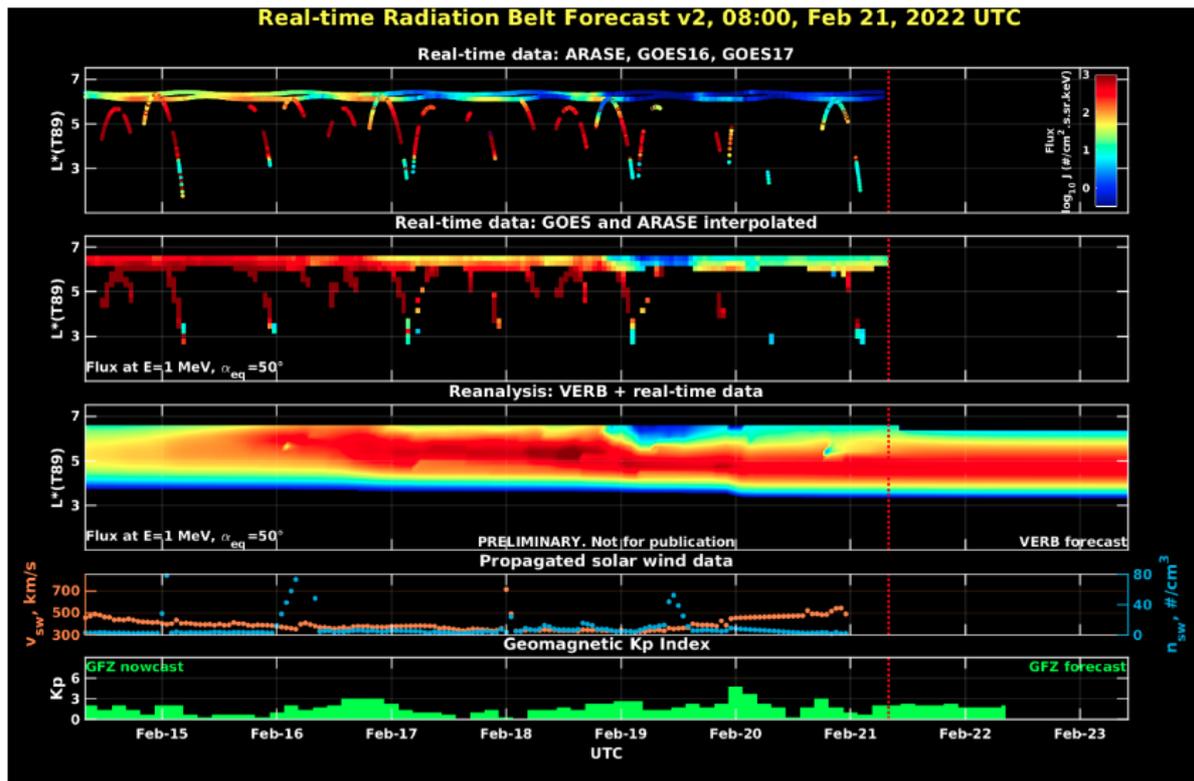
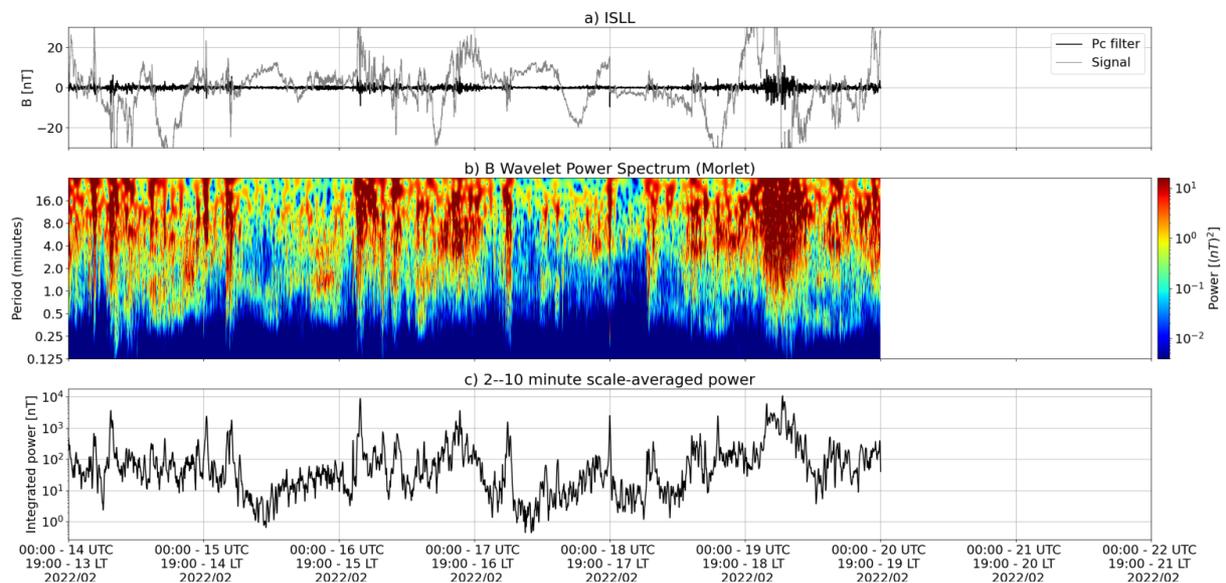


Figure 2: high-energy electron flux data (real-time and interpolated) obtained from ARASE, GOES-16, GOES-17 satellites. Reanalysis's data from VERB code and interpolated electron flux. Solar wind velocity and proton density data from ACE satellite.  
 Source: <https://rbm.epss.ucla.edu/realtime-forecast/>

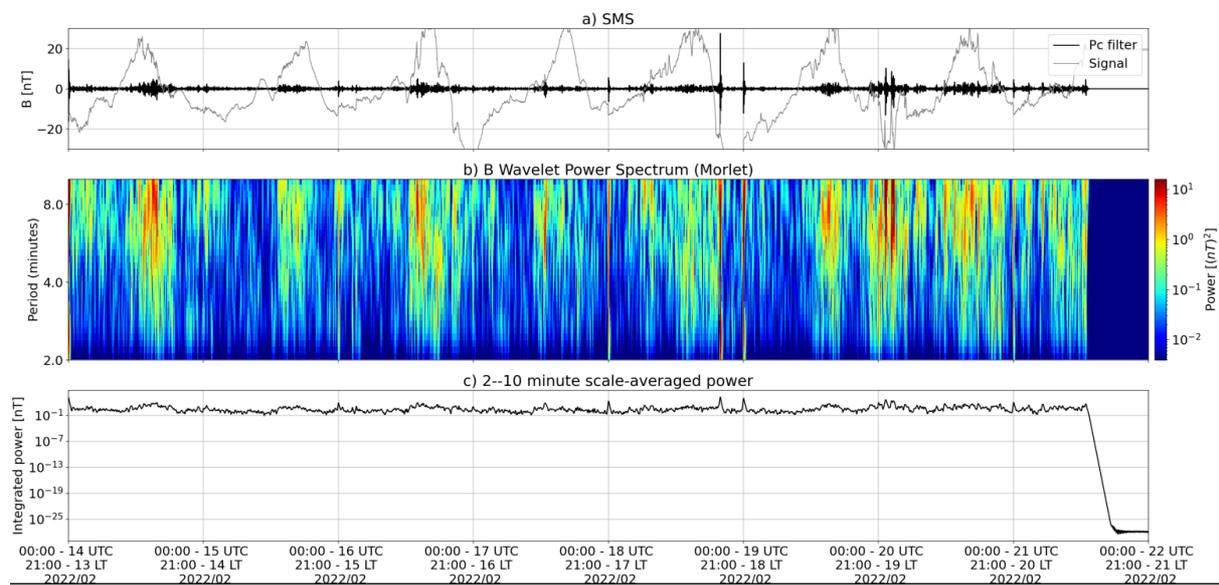
High-energy electron flux (>2 MeV) in the outer boundary of the outer radiation belt obtained from geostationary satellite data GOES-16 and GOES-17 (Figure 1) oscillates between 103 e 102 particles/(cm2 s sr) between February, 15th-19th. At the beginning of February 19th, a dropout of approximately three orders of magnitude is observed. After that, a slight electron flux increase is observed, which remained above 102 particles/(cm2 s sr) for a few hours. The dropout observed at the outer boundary is associated with the arrival of a high-speed solar wind stream. 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 dropout observed reached L-shell > 5.0 and is associated with the arrival of a high-speed solar wind stream. These observed variabilities occurred concomitantly with ULF wave activity.

## ULF waves in the Magnetosphere

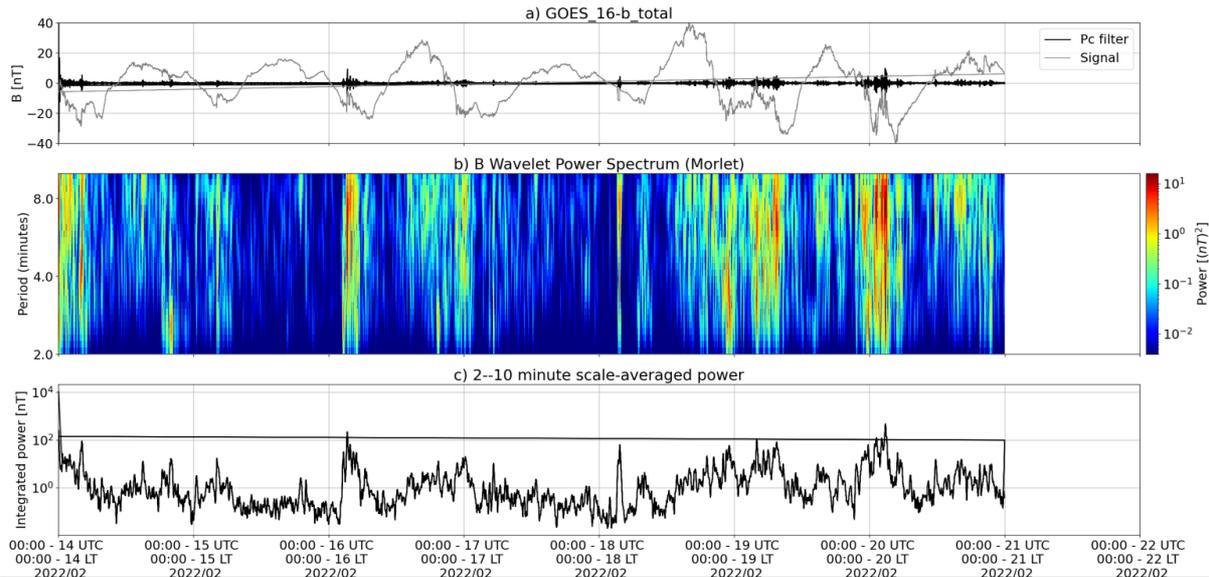
# Responsible: José Paulo Marchezi



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 SMS 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).

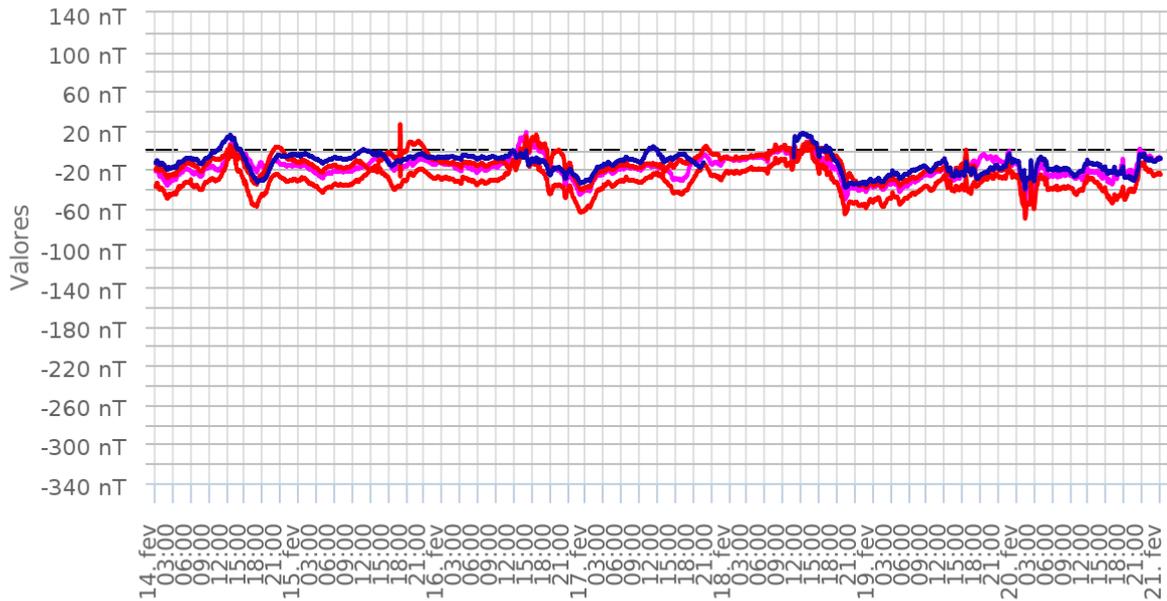
The ULF indas activity shows an increase in power from the 16th of February, where there are small shocks, which are mainly visible at high latitudes and by the GOES satellite, as impulsive pulsations with short duration. On the 19th, there is a greater power of waves in the Pc5 band that last for a long period, which may be associated with the interaction of a CME followed by a fast beam of the solar wind with the earth's amagnetosphere. 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**

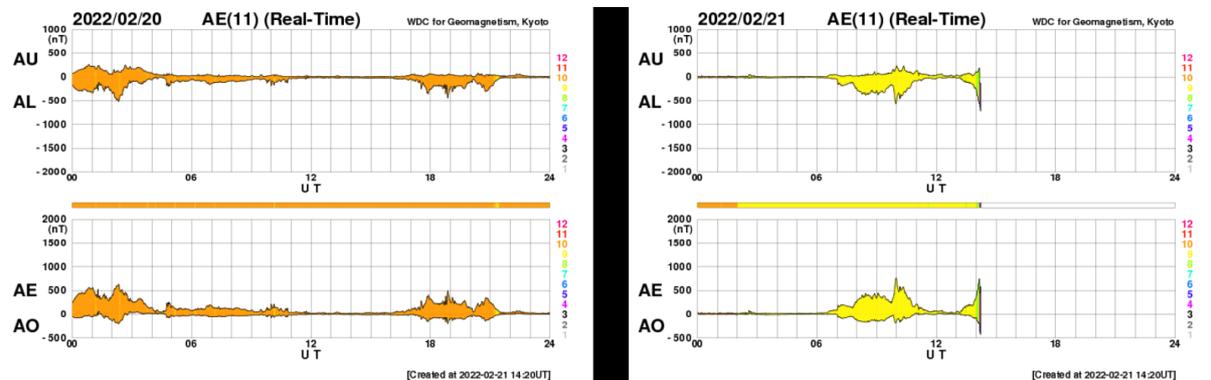
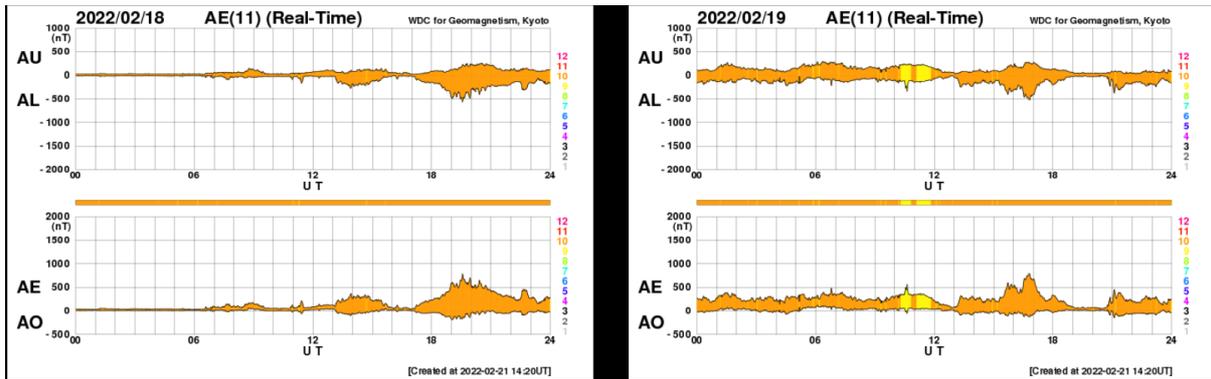
# Rede EMBRACE de Magnetômetros

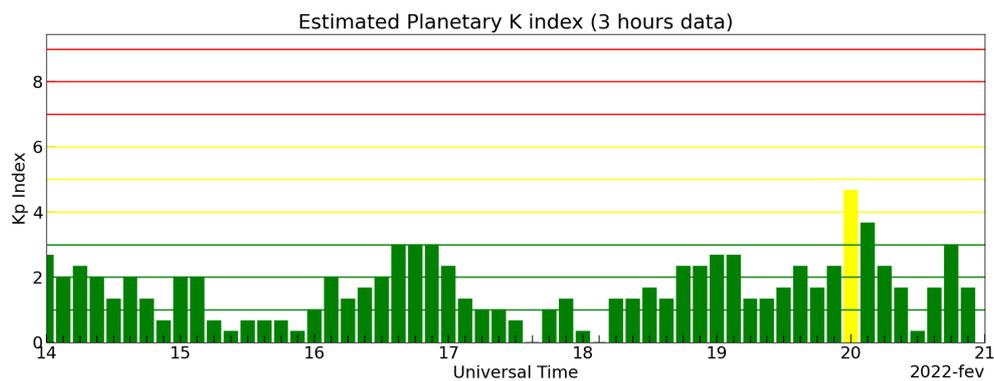
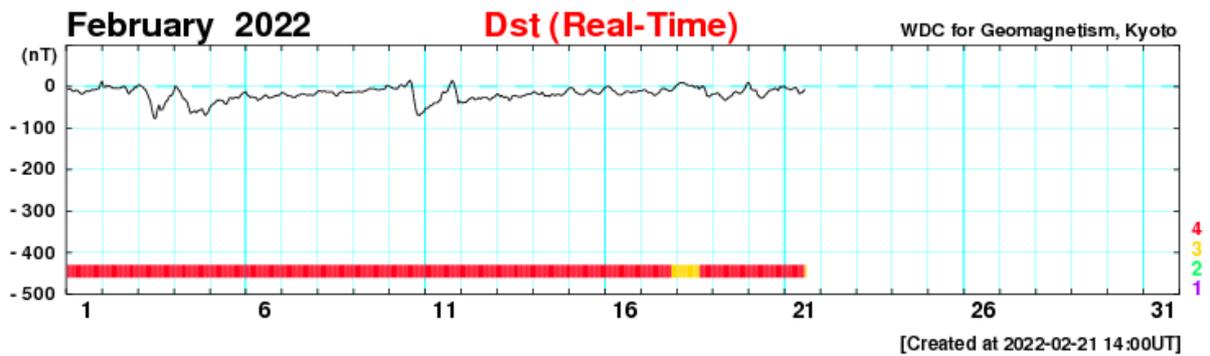
$\Delta H$  - (14/02/2022 - 20/02/2022)



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In the week of February 14th to 21st, the following events related to geomagnetic activity stand out:

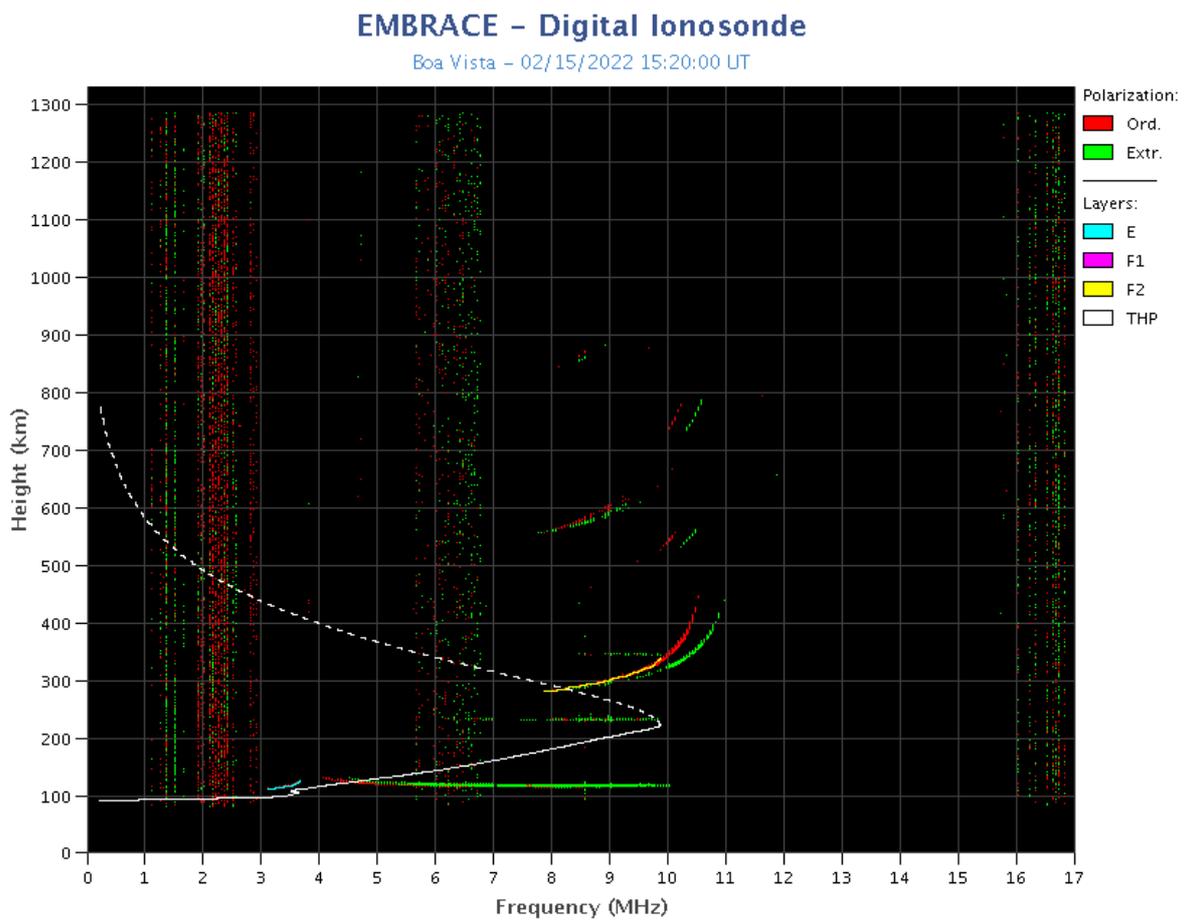
- The data from the Embrace magnetometer network showed instabilities throughout the period, with some highlighted events:
  - day 17, fall in component H in all stations, from up to -63 nT
  - day 18, increase in comp. From up to + 16.9 nT following a drop in all stations, from up to -63 nT
  - days 19.20 recovery phase from the geomagnetic storm
- The geomagnetic activity recorded a G1-level storm on 02/10 and 02/11, with the Dst index reaching its minimum value of -32 nT on 02/19.
- The highest Kp of the week was 4+ recorded on 20/02
- The auroral activity was intensified on the 19th and 20th.
- Magnetic field measured in the orbit of the GOES satellite showed disturbances in the period from 02/19 to 02/21.

## Ionosphere

# Responsible: Laysa Resende

## Boa Vista:

- There were spread F during all days in this week.
- The Es layers reached scale 4 on day 15.

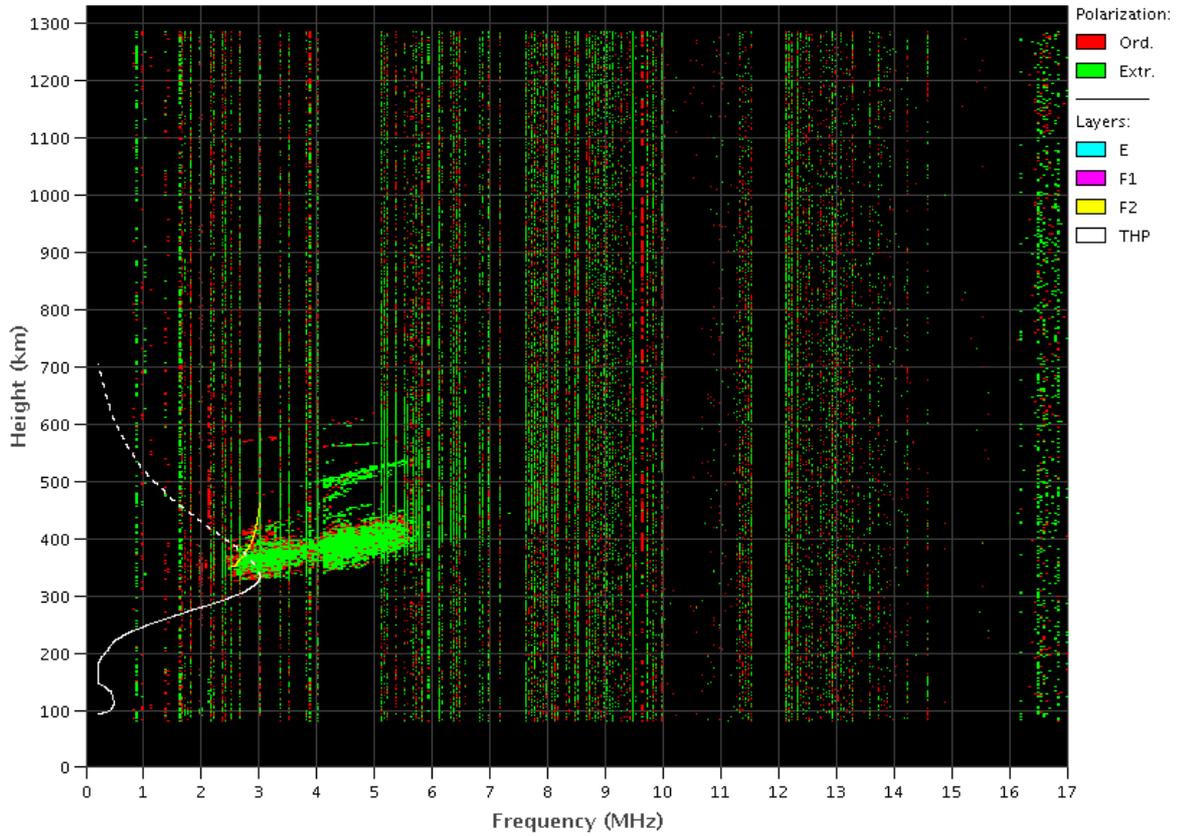


## Cachoeira Paulista:

- There were not spread F on days 14, and 15.
- The Es layers reached scales 2 and 3 during the week.

## EMBRACE – Digital Ionosonde

Cachoeira Paulista – 02/20/2022 02:10:00 UT

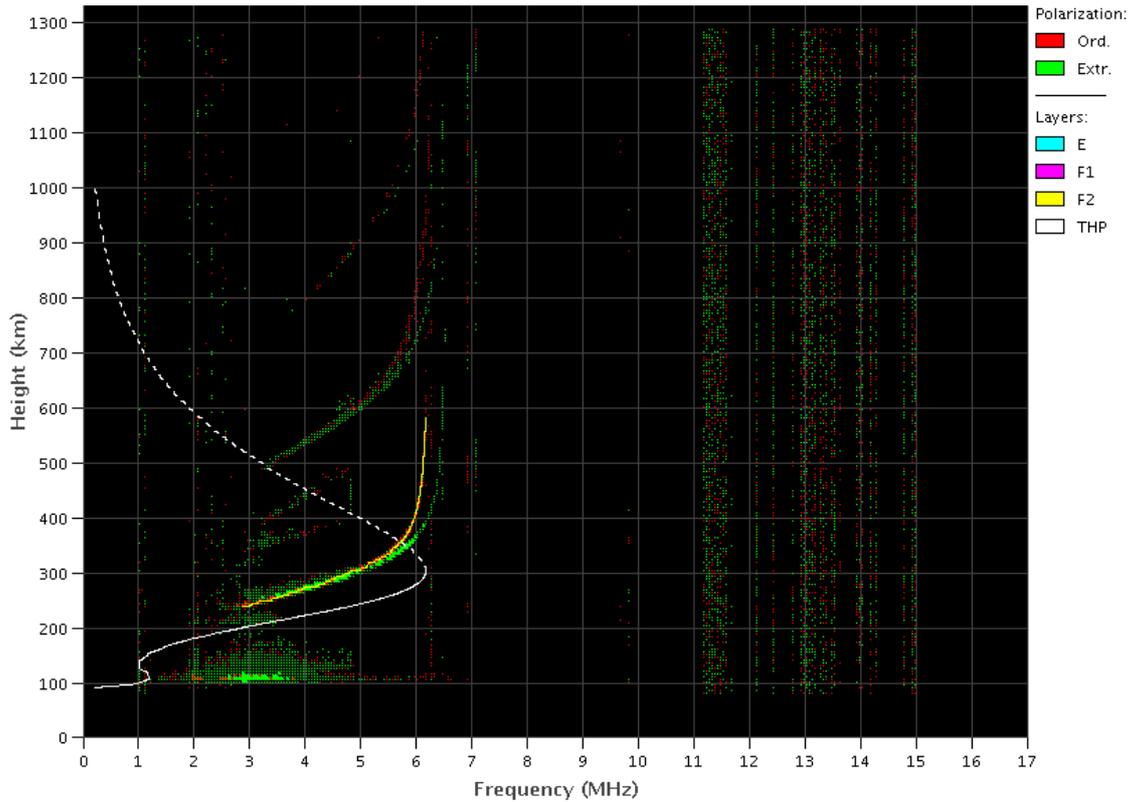


### São Luís:

- There were spread F during all days in this week.
- The Es layers reached scale 4 on day 18.

## EMBRACE – Digital Ionosonde

São Luís – 02/18/2022 09:10:00 UT



## Scintillation S4

### Responsible: Siomel Savio Odriozola

In this report on the S4 scintillation index, data from SLMA in São Luís/MA, PALM in Palmas/RN, UFBA, in Bahia/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  $\sim 360$  m.

Moderate values of the S4 index ( $> 0.6$ ) were measured throughout the week at the SLMA and PALM stations (Figure 1). Days 19-20 and 15-16 were the most relevant, regarding the severity of scintillation, at UFBA and SJCE stations respectively.

Figure 2 shows the satellites that contributed to the highest S4 values at PALM and UFBA stations during 02/19-20/2022.

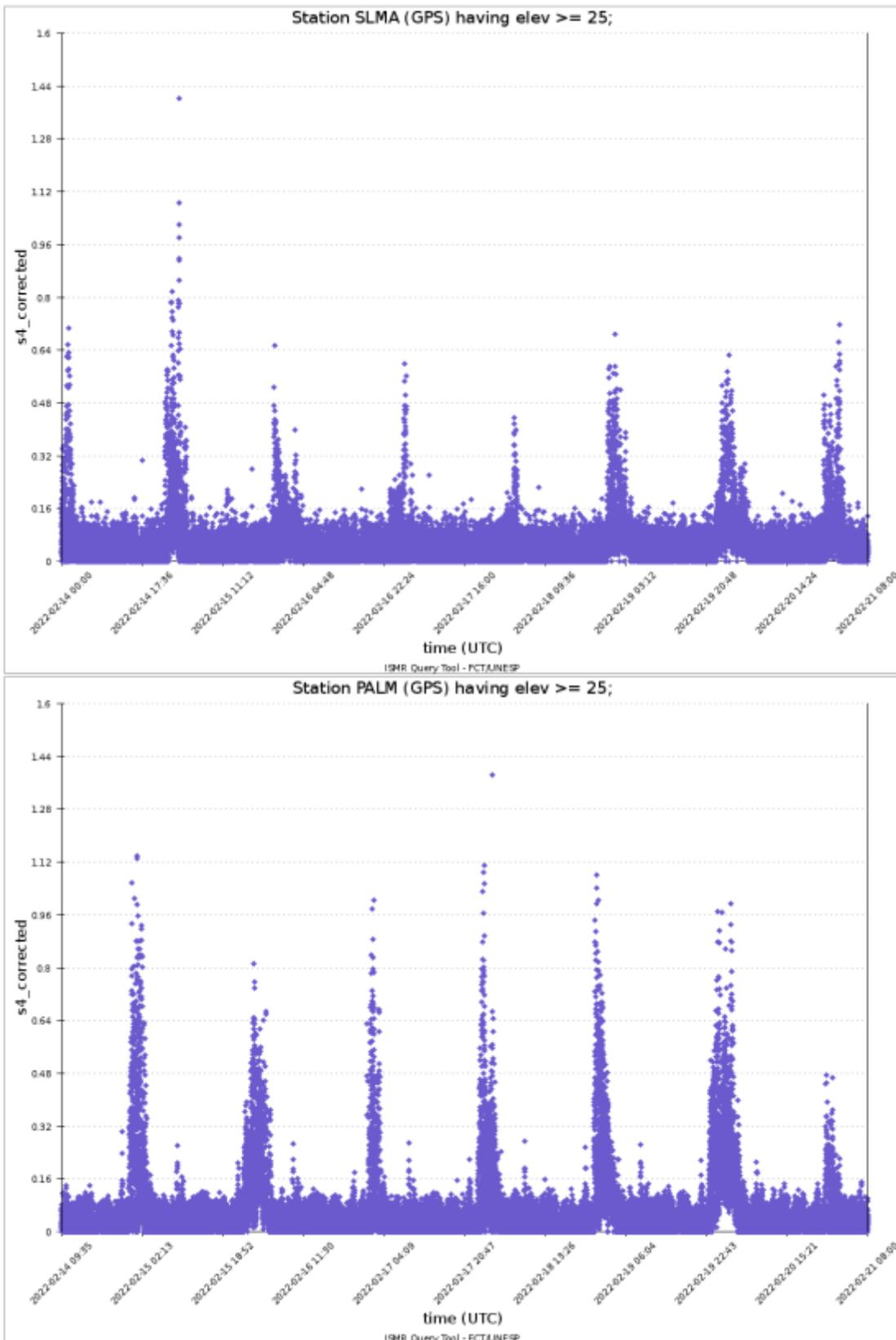


Figure 1: S4 index values for the GPS constellation for the station SLMA (upper panel) and PALM (lower panel) during the week 02/14—02/21/2022.

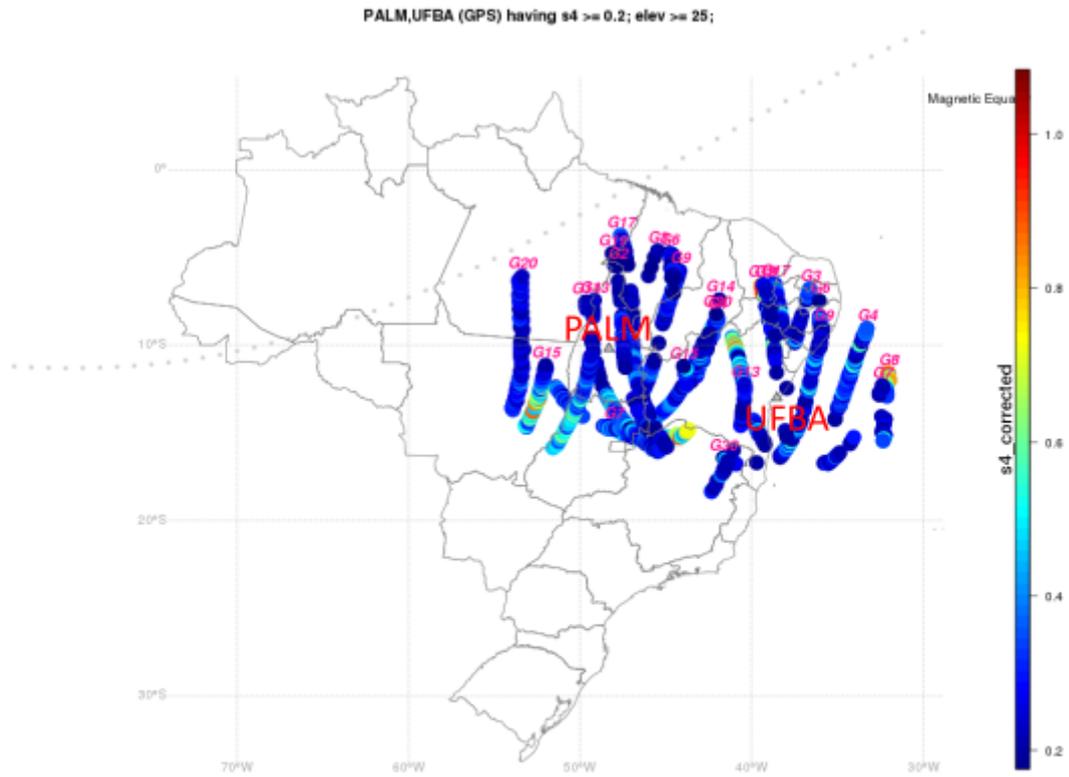


Figure 2: Map of S4 values > 0.2 for the GPS satellites with elevation > 25° in the receiver's field of view of PALM and UFBA stations between 2200 UT on 02/14 until 0700 UT on 02/20/2022.

## All-Sky Imager

Responsible: Prosper Nyassor

Observatory	Feb 13	Feb 14	Feb 15	Feb 16	Feb 17	Feb 18	Feb 19
Observatório	Feb 13	Feb 14	Feb 15	Feb 16	Feb 17	Feb 18	Feb 19
CA	X	X	X	X	✓●	✓●	✓●
BJL	X	X	X	X	✓●	✓◐	✓●
CP	X	X	X	X	✓●	✓●	✓●
SMS	X	X	X	X	X	X	X
CA	São João do Cariri						
BJL	Bom Jesus da Lapa						
CP	Cachoeira Paulista						
SMS	São Martinho da Serra						
✓	Observation						
X	No Observation						
○	Clear sky						
◐	Partly Cloudy						
●	Cloudy						

- Between February 13 and February 16, 2022, there were no plasma bubbles observations over Brazil region due to the cycle of the moon.
- At the São João do Cariri observatory, between February 17 and February 19, there were observations but the sky was cloudy and as a result there were observations but plasma bubbles were observed.
- At the Bom de Jesus da Lapa observatory, on February 17 and 19, the sky was cloudy and as a result, no plasma bubbles were observed. On February, 18 on the other, the sky was partly cloudy, however, no plasma bubbles were observed
- Similar to São João do Cariri observatory, between February 17 and February 19, there were observations but the sky was cloudy and as a result, there were observations but plasma bubbles were observed.
- Finally, in São Martinho da Serra, there were no observation throughout the entire week.

## TEC Map

- Between February 13 and February 19, 2022, TEC maps showed plasma bubbles signature throughout the week. In addition, equatorial ionization anomalies were observed.