

# Briefing Space Weather - 2021/12/13

## Sun

### Responsible: José R. Cecatto

12/06 – Fast ( $\leq 500$  km/s) wind stream; 7 CME can have component toward the Earth; Partial halo, SB Pred. Arrival – Dec/ 11, 15:00Z;

12/07 – Fast ( $\leq 500$  km/s) wind stream; 1 CME can have component toward the Earth;

12/08 – Fast ( $< 450$  km/s) wind stream; 2 CME can have component toward the Earth;

12/09 – No fast wind stream; 5 CME can have component toward the Earth; (05) Partial halo, SB Pred. Arrival – Dec/09, 18:00Z – 23:00Z;

12/10 – No fast wind stream; 1 CME can have component toward the Earth; (05) SB Pred. Arrival – Dec/10, 09:00Z

12/11 – No fast wind stream; 1 CME can have component toward the Earth; (06) SB Pred. Arrival – Dec/11, 15:00Z

12/12 – No fast wind stream; No CME toward the Earth;

12/13 – No fast wind stream; 1 CME can have component toward the Earth;

Prev.: Fast wind expected on December 15-16; for while low (1% M, 1% X) probability of M / X flares next 2 days; also, occasionally some other CME can present a component toward the Earth.

## Radiation Belts

### Responsible: Ligia Alves Da Silva

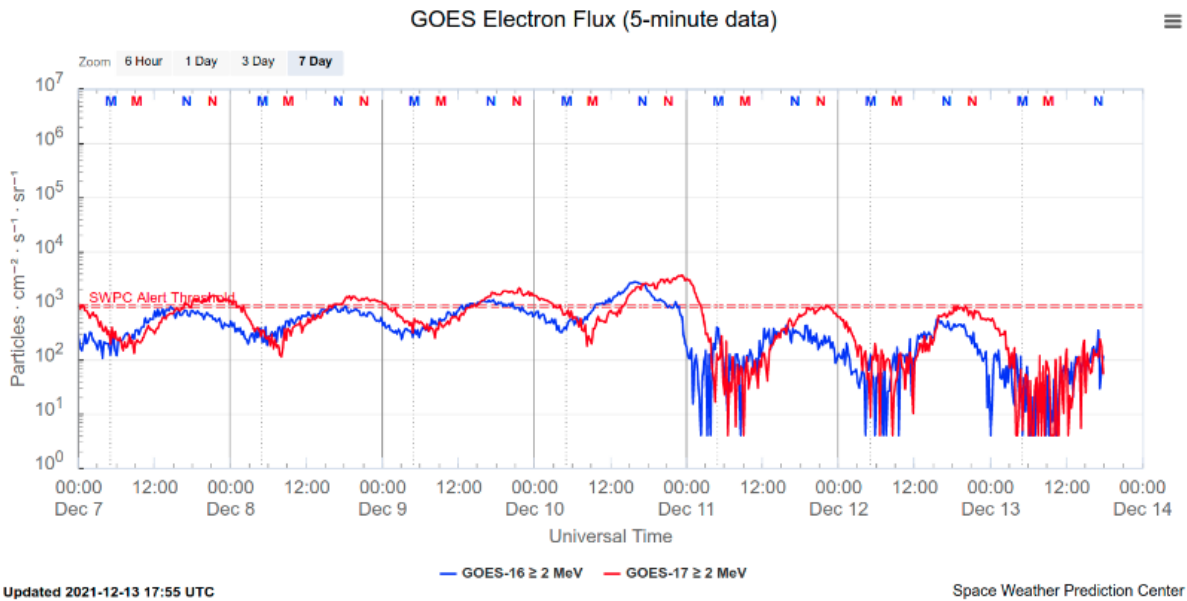


Figure 1: High-energy electron flux (> 2MeV) obtained from GOES-16 and GOES-17 satellite.  
 Source: <https://www.swpc.noaa.gov/products/goes-electron-flux>

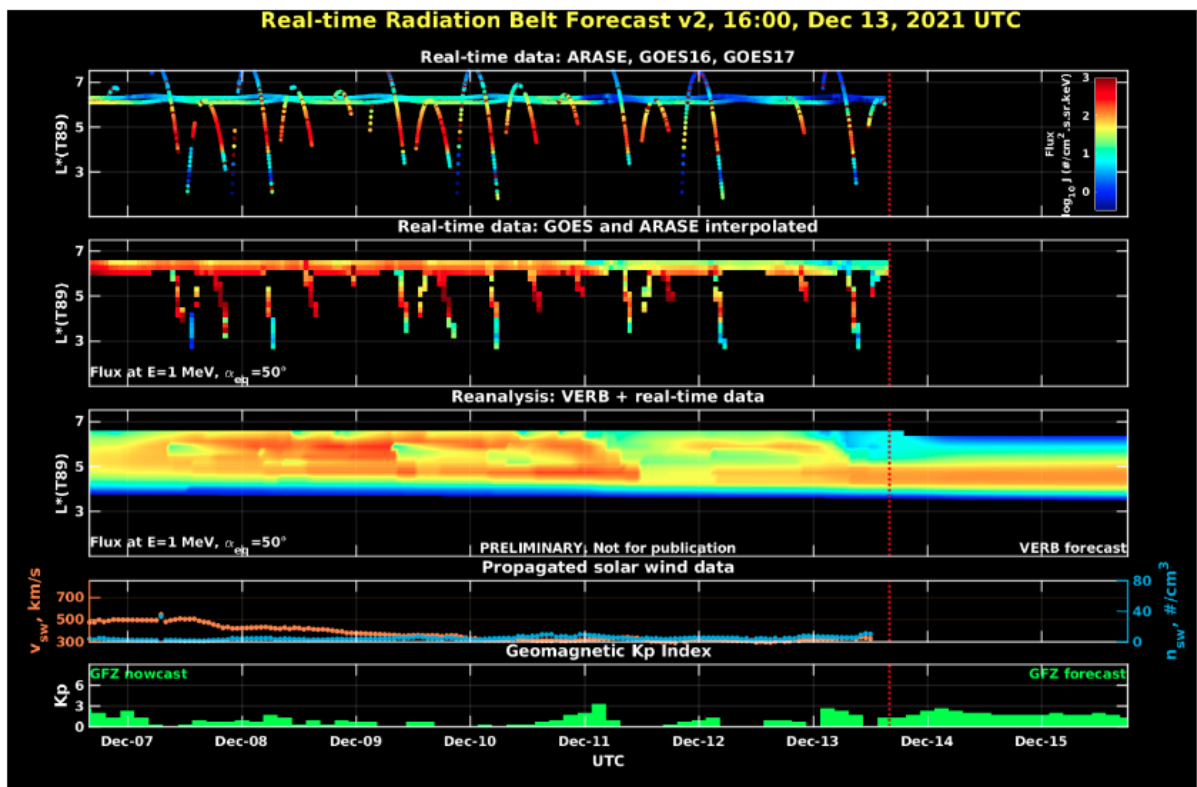


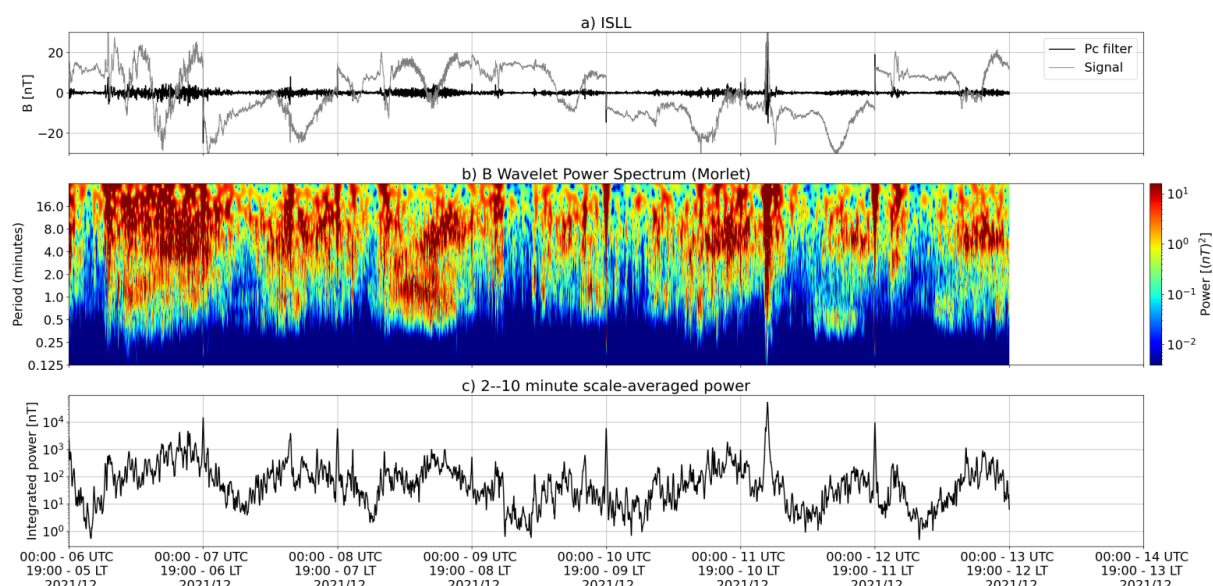
Figure 2: high-energy electron flux data (real-time and interpolated) obtained from ARASE, GOES-16, GOES-17 satellites. Reanalysis's data from VERB code and interpolated electron flux. Solar wind velocity and proton density data from ACE satellite.  
 Source: <https://rbm.epss.ucla.edu/realtime-forecast/>

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 to be close to 103 particles/(cm<sup>2</sup> s sr) on December, 7-10th. A decrease in electron flux was observed on December 11th, where the electron flux remained confined below 103 particles/(cm<sup>2</sup> s sr) until December 13th.

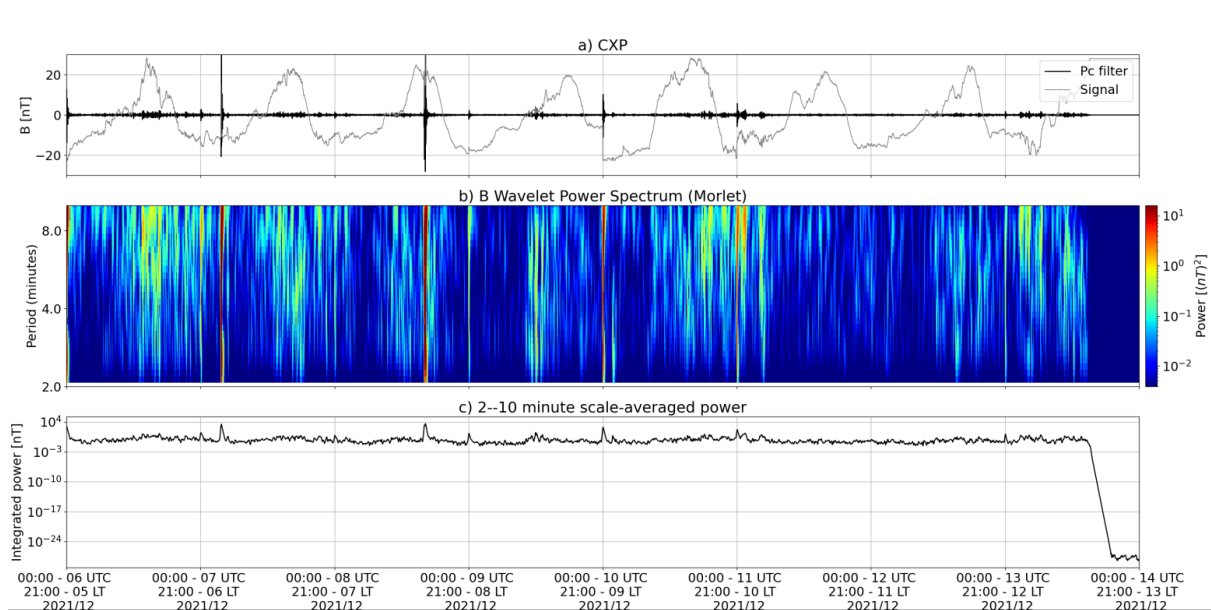
The GOES-16, GOES-17, and Arase satellite data are analyzed and interpolated to observe the high-energy electron flux variability (1 MeV) in the outer radiation belt (Figure 2). Additionally, the VERB code rebuilds this electron considering the Ultra Low Frequency (ULF) waves' radial diffusion. The electron flux decrease observed from December 11th reached L-shell > 3.5 concomitantly with the arrival of coronal mass ejection and the ULF wave activity.

## ULF waves in the Magnetosphere

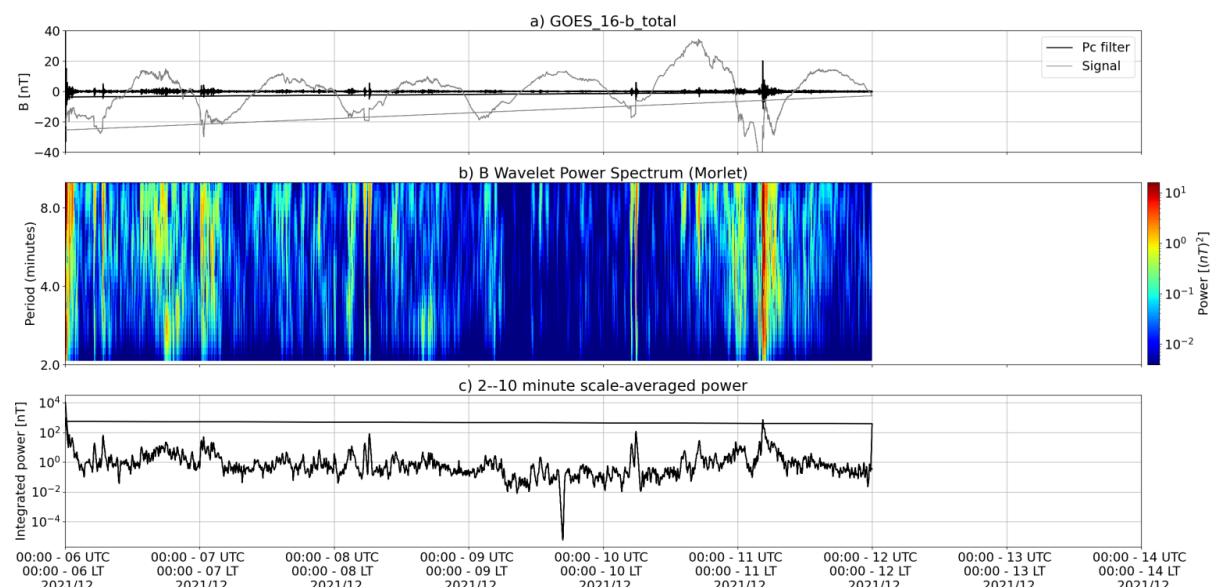
Responsible: José Paulo Marchezi



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 CXP 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 week starts with continuous high ULF wave activity on December 6th, from high latitudes (ISLL Station) to low latitudes (CXP). At the end of December 10th there is a new increase in activity continuously, mainly at high latitudes. On December 11th

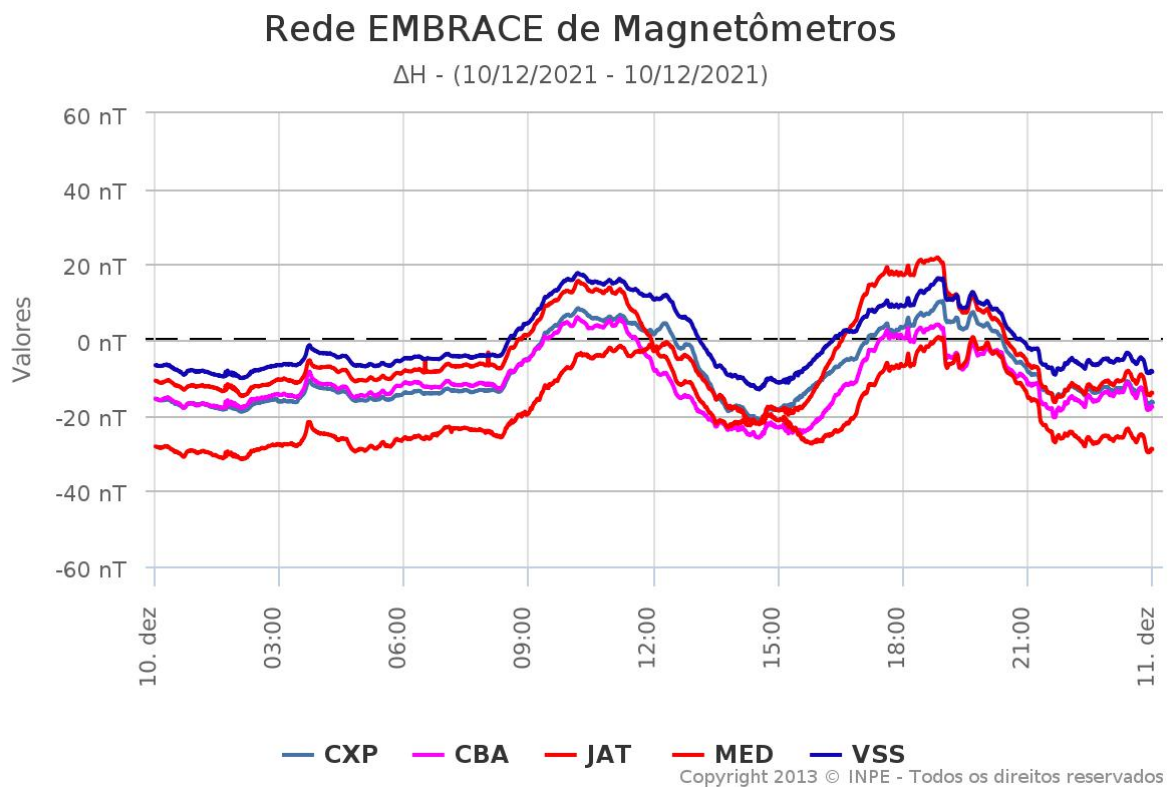
there is an abrupt spike, possibly related to a CME interacting with the magnetosphere.

# Geomagnetism

## Responsible: Livia Ribeiro Alves

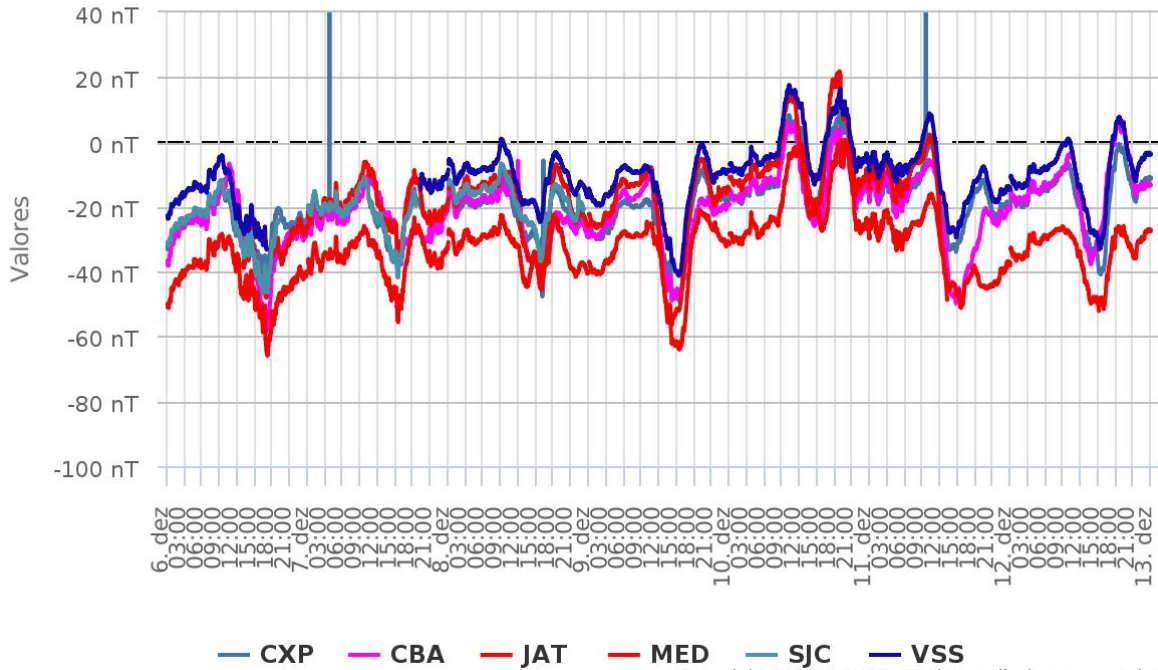
Geomagnetic Report - December 06-12.

- Data from the Embrace magnetometer network show geomagnetic instabilities throughout the period, with some highlighted events:  
06/12, 09/12, H component drop at all stations, down to -70 nT 10/12, increase in SQ currents at all stations, followed by an atypical signature in the geomagnetic field

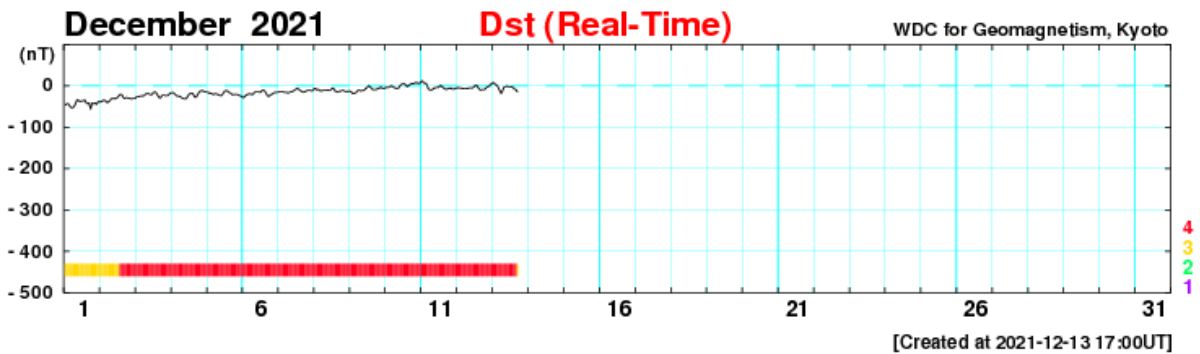


# Rede EMBRACE de Magnetômetros

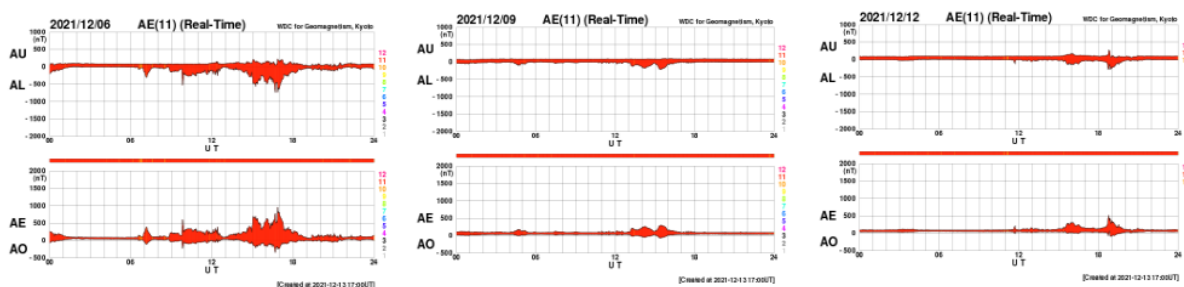
$\Delta H$  - (06/12/2021 - 12/12/2021)



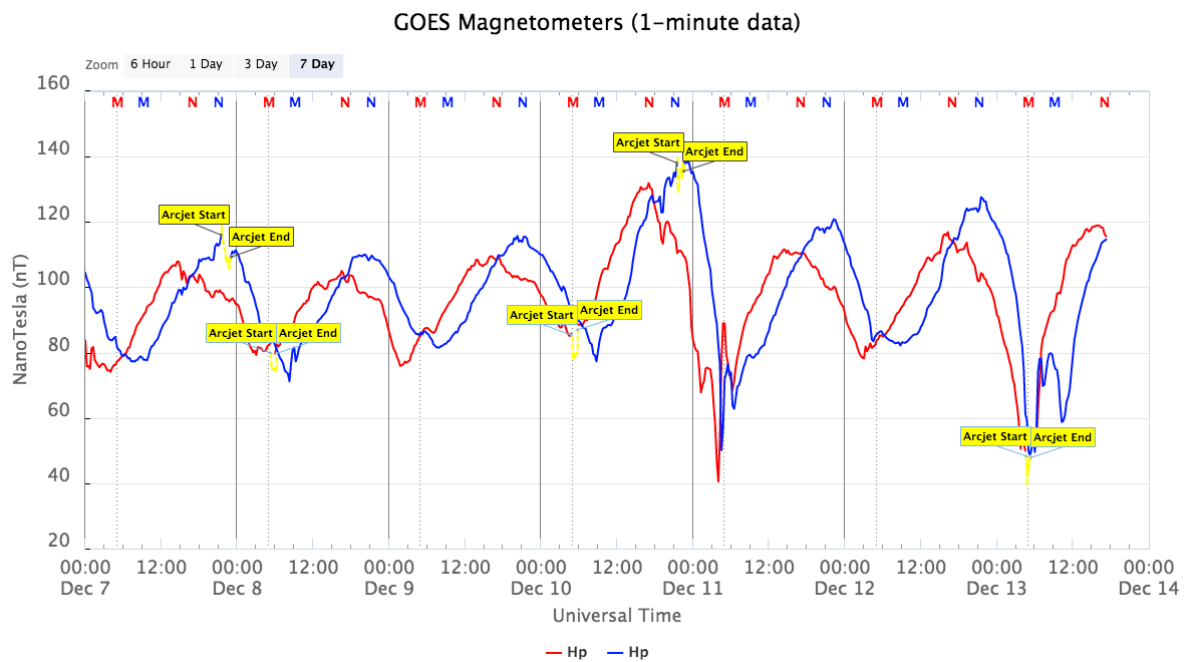
- Geomagnetic activity was predominantly quiet during the week, with the Dst index showing its minimum value of -20 nT on 12/13. The highest Kp of the week was 3+ recorded on 12/11



- The auroral activity was intensified on 06/12.



- Magnetic field measured in the GOES satellite orbit shows disturbances on 10 and 11/12.



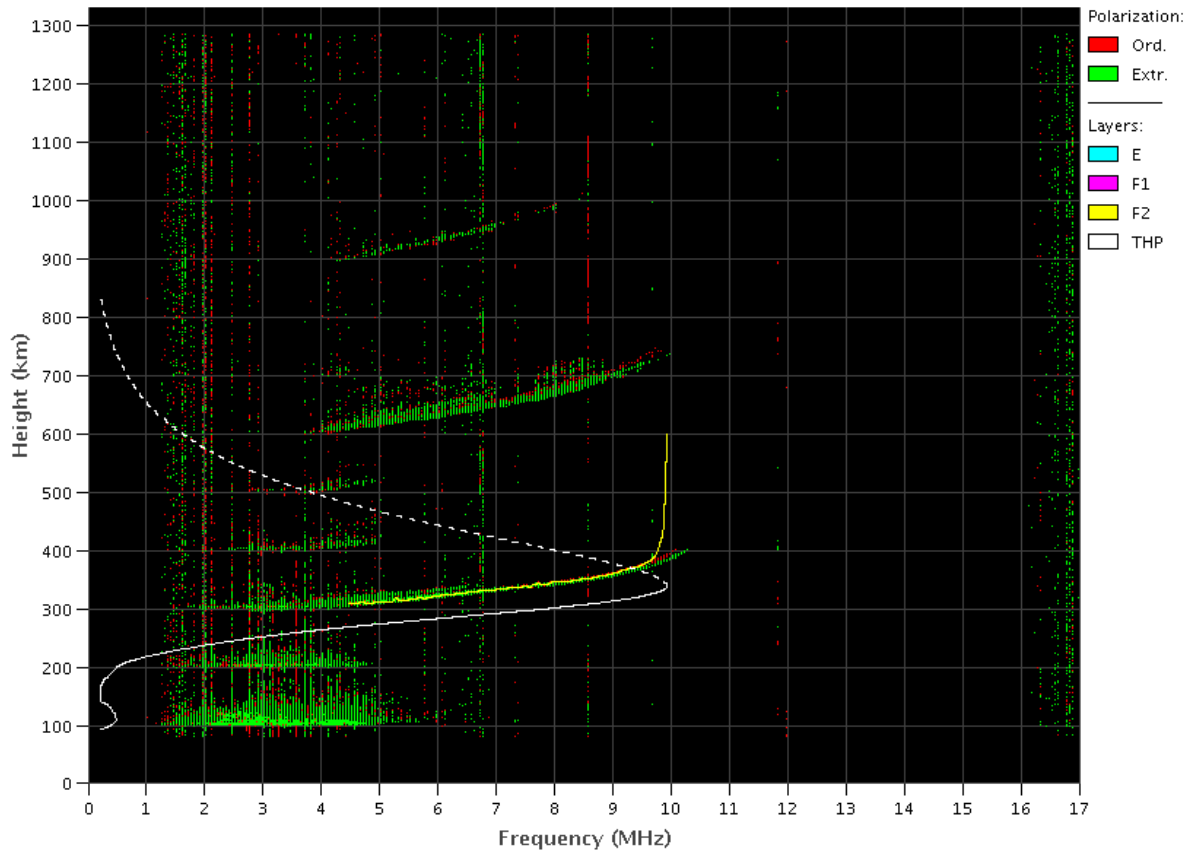
# Ionosphere

**Responsible: Laysa Resende**

**Boa Vista:**

- There were spread F during all days in this week.
- The Es layers reached scale 4 on day 08.

Boa Vista - 12/08/2021 22:40:00 UT

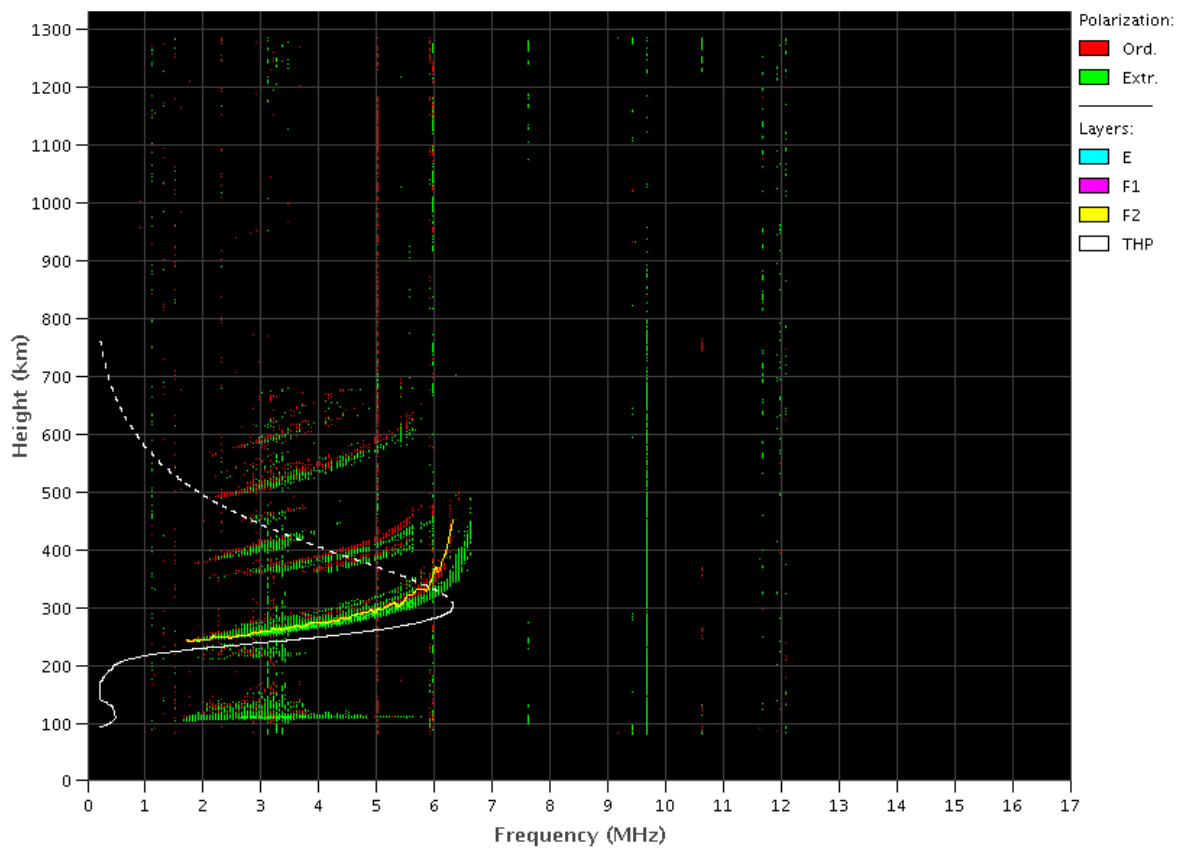


### Cachoeira Paulista:

- There were not spread F anyday.
- The Es layers reached scale 3 on days 07, and 12.

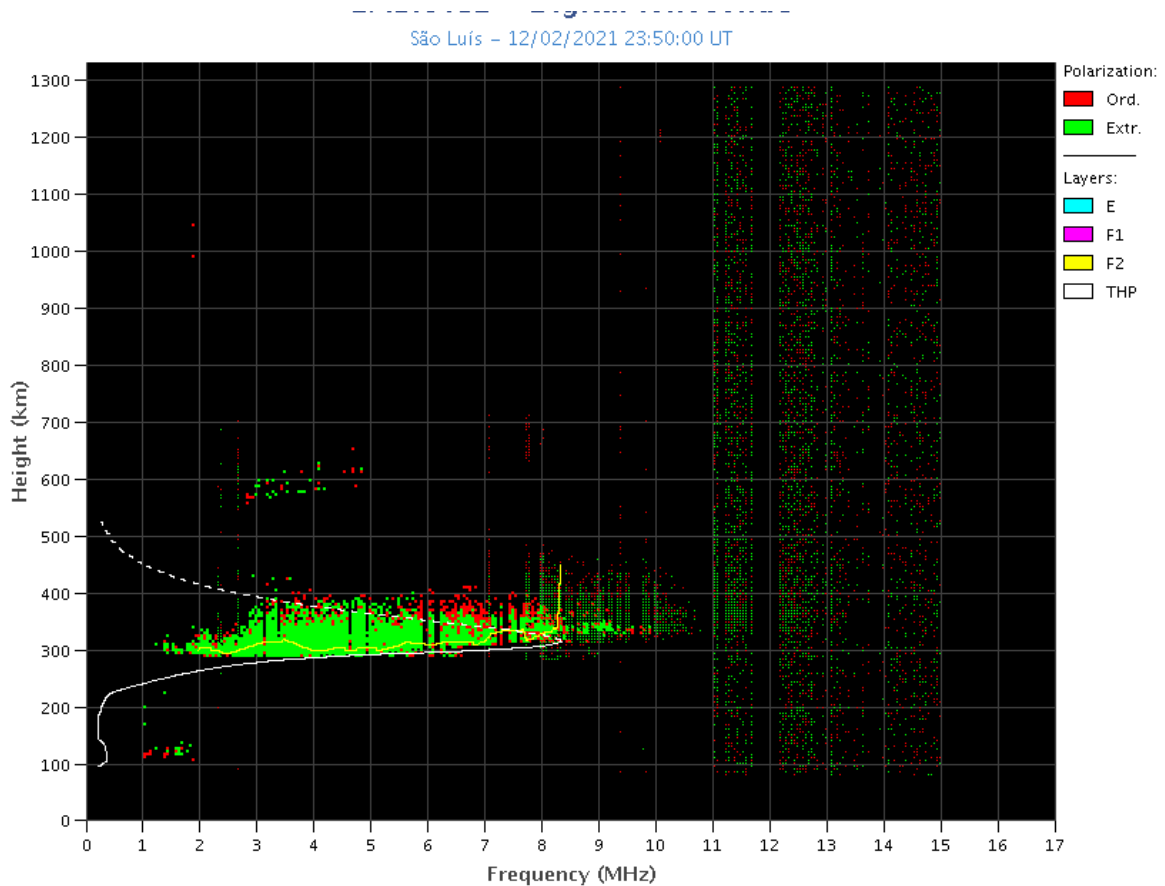


Cachoeira Paulista - 12/12/2021 01:50:00 UT



### São Luís:

- There were spread F during all days in this week.
- The Es layers reached scale 4 on day 09.



## Scintillation S4

**Responsible: Siomel Savio Odriozola**

In this report on the S4 scintillation index, data from the SLMA stations in São Luís / MA, STSN in Sinop /MT, UFBA, in Bahía / BA and SJCE in São José dos Campos / SP were presented. The S4 index tracks the presence of irregularities in the ionosphere having a spatial scale  $\sim 360$  m.

The S4 index values for the SLMA and STSN stations were lower throughout the week compared to the November weeks. However, weak scintillation values appeared every day of the week at these stations. The UFBA and SJCE stations, further away from the geomagnetic equator, had strong scintillation events for three different days (Figure 1). In the case of the SJCE station, beginning around 21 hours LT (00 UT) on 12/12, values from S4 up to 0.8 were recorded (Figure 2). These values originated in a small part of the satellites from GPS constellation (Figure 2)

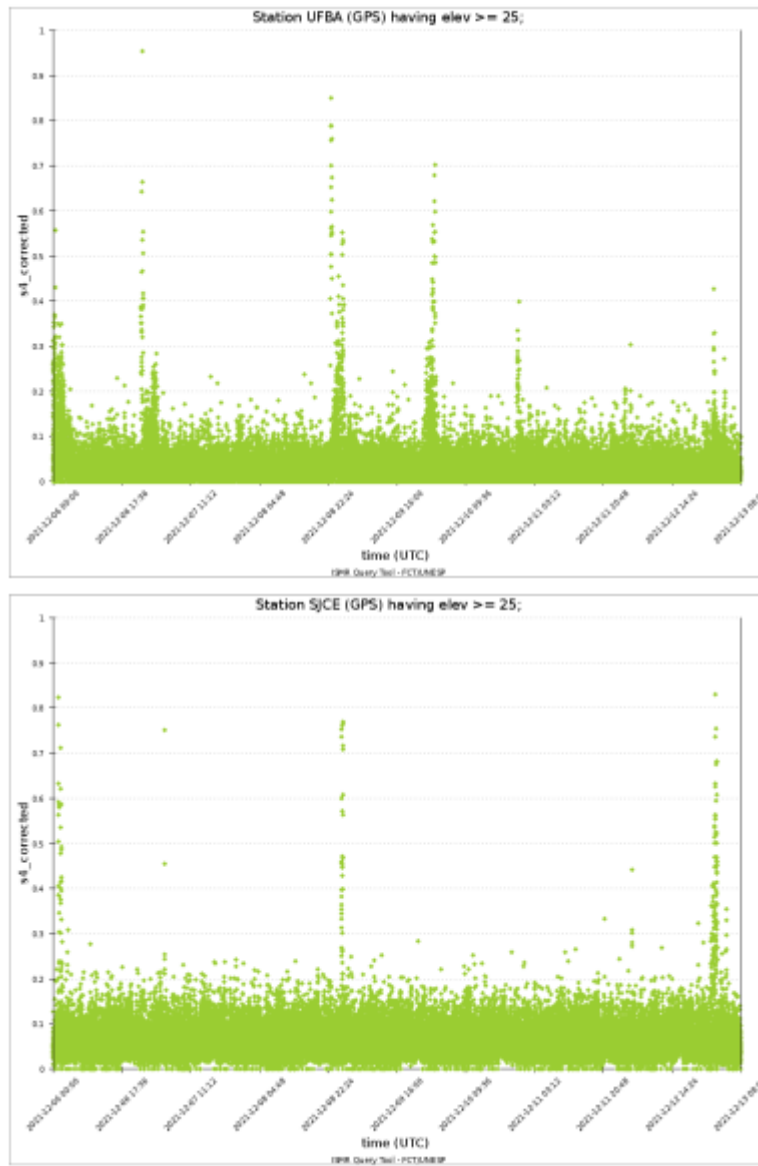


Figure 1: Values of the S4 index for the GPS constellation for UFBA station (upper panel) and SJCE (lower panel) measured during the week 06/12—12/12/

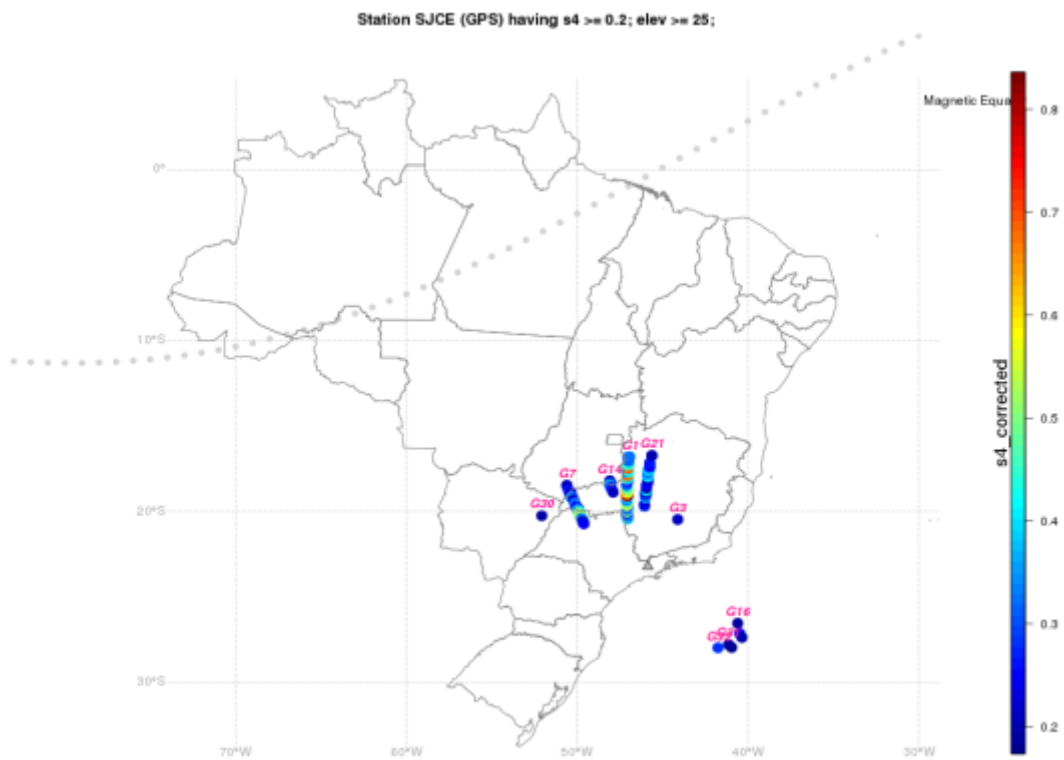
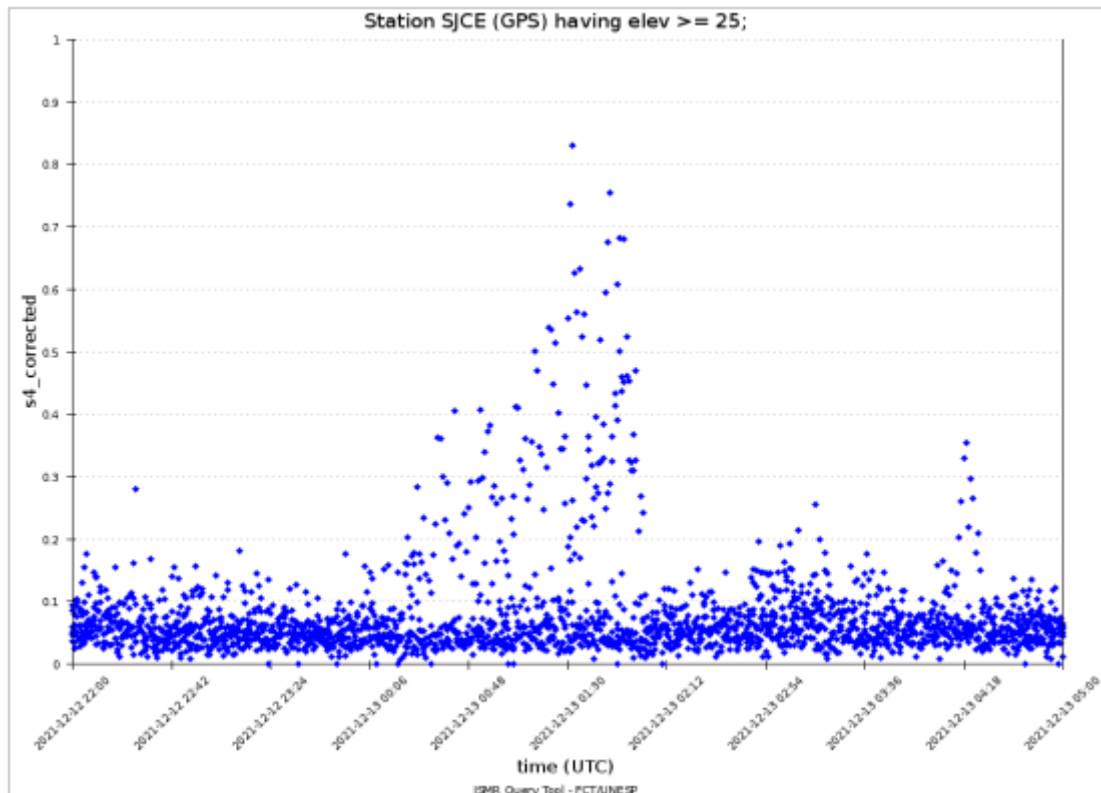


Figure 2: Values of the S4 index (GPS constellation) for the SJCE station (top panel) between 2200 UT on 12/12 and 0500 UT on 13/12. In the lower panel the map of S4 values > 0.2 for the GPS satellites with elevation > 25o in the receiver's field of view

at the same time interval  
represented in the upper panel.