Sun – Solar activity (José Marchezi)

Summary

This week, the Sun began with a group of active regions exhibiting high magnetic complexity. Over the course of the week, the magnetic complexity of these regions increased. These active regions produced four M-class flares and one X-class flare. During this period, two coronal holes with significant area extending to low latitudes were also present. On the 18th, an X1.9-class solar flare launched a relatively fast CME, with speeds exceeding 1400 km/s, which may impact Earth on Monday night, potentially triggering an intense geomagnetic storm. The NASA M2M system's WSA–ENLIL+Cone model forecasts an arrival around 01 UT on January 20.

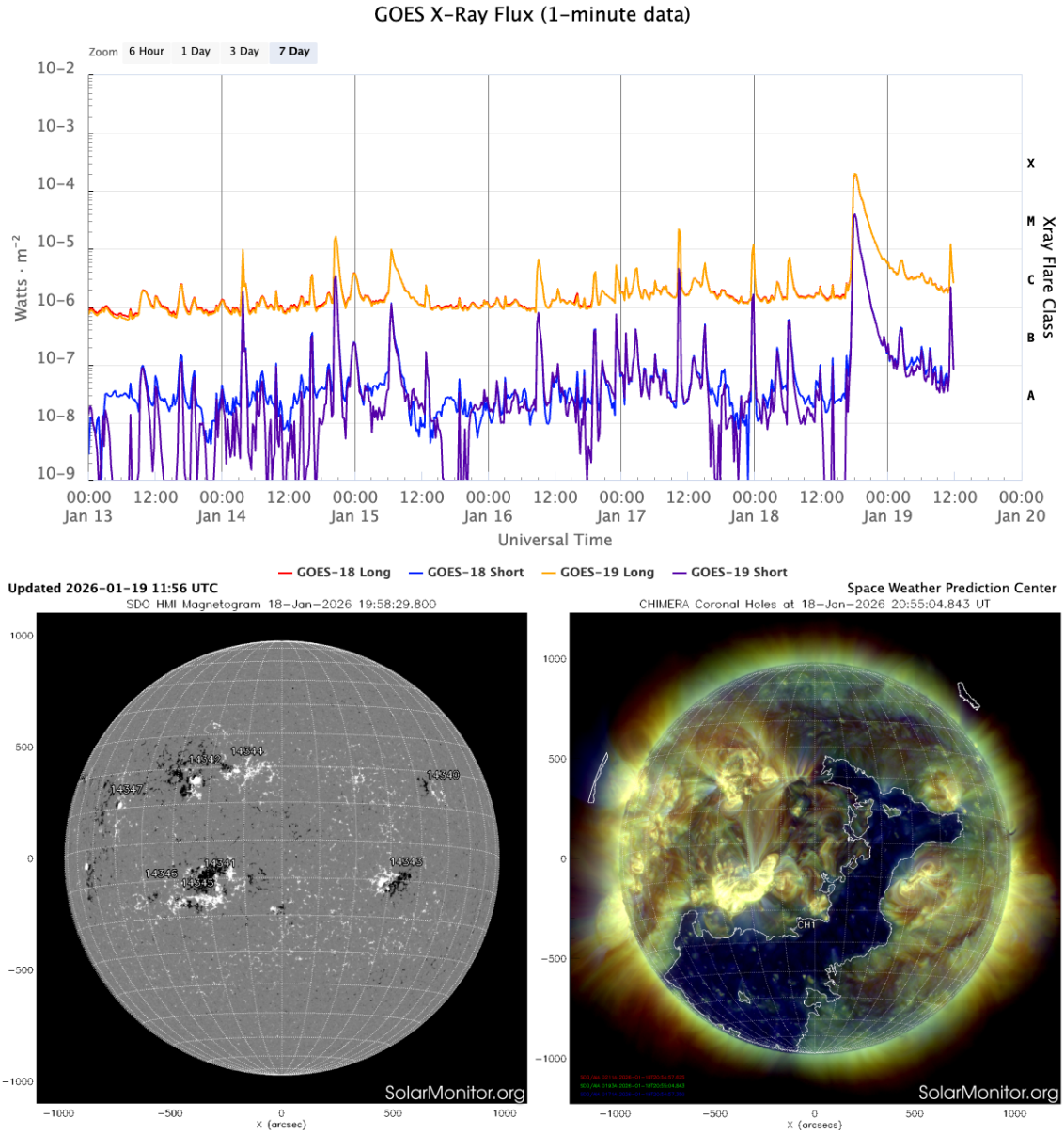

Figure 1 - X-ray flux measured by GOES (top panel) for the period from January 13 to 20, line-of-sight magnetic field (bottom left panel), and 193 Å images (bottom right panel) acquired on January 18, 2026, showing, respectively, the active regions and coronal holes present on the solar disk.

Interplanetary Medium – IM – Daniele da S. F. Medeiros and Paulo R. Jauer
Period: January 12th to January 19th.

Summary

Summary of IM conditions for the last week. The interplanetary medium region in the last week showed a moderate level of plasma disturbances due to the possible interaction with HSS identified by the DSCOVR satellite in the interplanetary medium. The Kp index obtained by NOAA/SWPC and the modeling.

- The magnitude of the interplanetary magnetic field component peaked on January 16th at 11:30 UT at +13.43 nT due to HSS.

- The BxBy components presented variations in the analyzed period, keeping both oscillating within the interval [-10.98, +8.38] nT. Showing seven rotations of the By component.

- The Bz component presents negative values for most of the week with a maximum negative -7.27 nT at 14:30 UT on January 16th. It presented positive value of +5.60 nT on January 16th at 10:30 UT.

- The solar wind density maximum peaked on January 13th at 21:30 UT, reaching 5.33 protons/cm^3.

- The solar wind speed fluctuated between 278 to 743 km/s, with a increase on January 16th starting at 01:30 UT due to HSS.

- The magnetopause position remained relaxed almost throughout the analyzed period, reaching maximum compression (9.76 RE) at 16:30 UT on January 16th.

- The measured interplanetary Kp index reached a peak above 5 (Kp > 5) on January 17th, corresponding to a G1-level geomagnetic storm (minor geomagnetic storm), while the modeled Kp index exhibited values below 4 (Kp < 4).

Figure 1 ilustrates a set of parameters observed in the solar wind by the DSCVR satellite. The measured solar wind parameters can be identified in the following order starting in column 1: Interplanetary magnetic field modulus (IMF), the Bx and By components, Bz component, convection electric field Ey. Column 2: Solar wind density, speed, temperature and the last graph represents the position of the subsolar magnetopause.

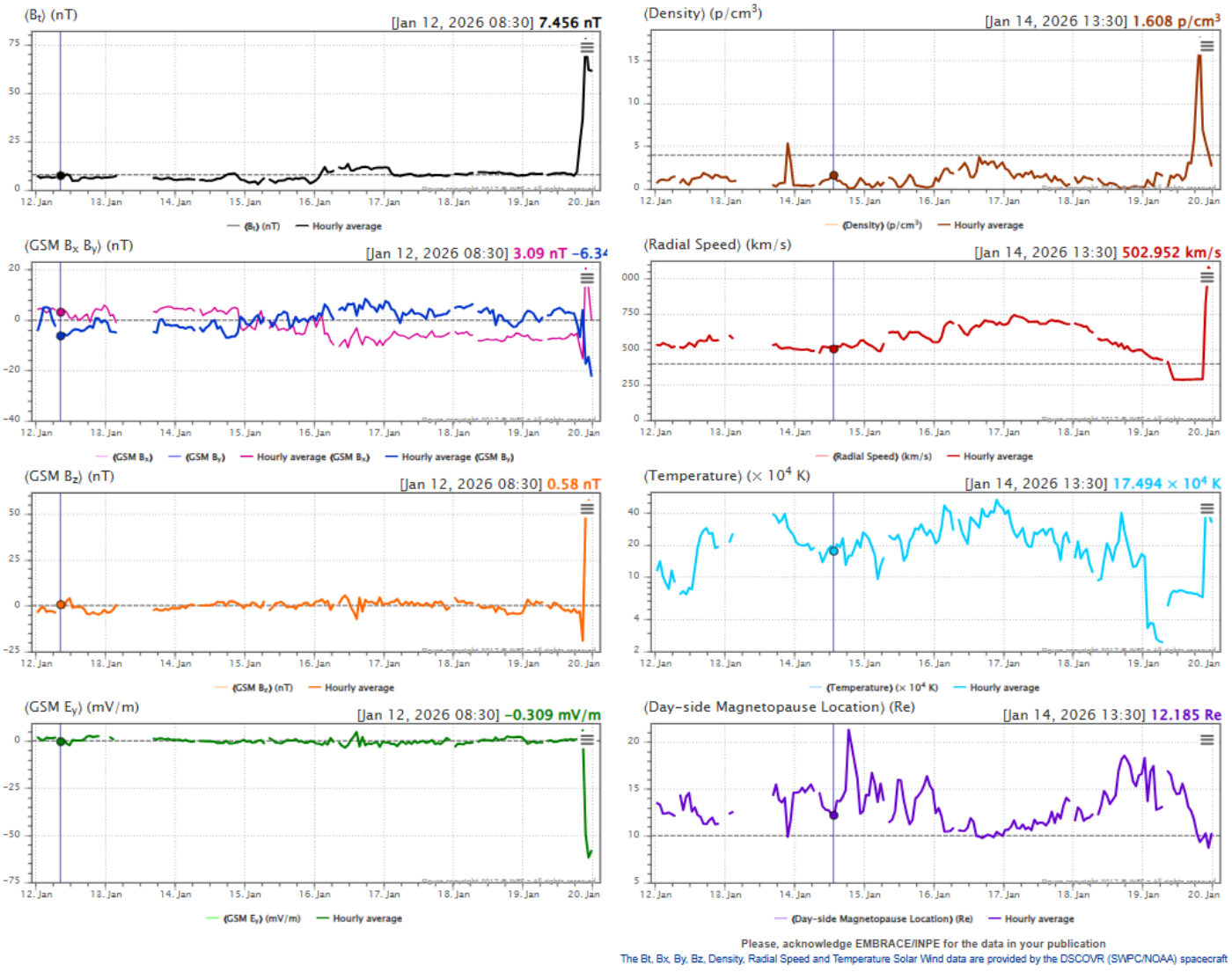

Figure 1: Illustrates a set of parameters observed in the solar wind by the DSCVR satellite.

Figure 2 illustrates a set of parameters observed in the solar wind by the DSCOVR satellite. The measured solar wind parameters can be identified in the following order, starting with the panels below: solar wind speed, Bz component of the interplanetary magnetic field (IMF), solar wind density, and the last graph represents the Kp index obtained by NOAA/SWPC and the modeling.

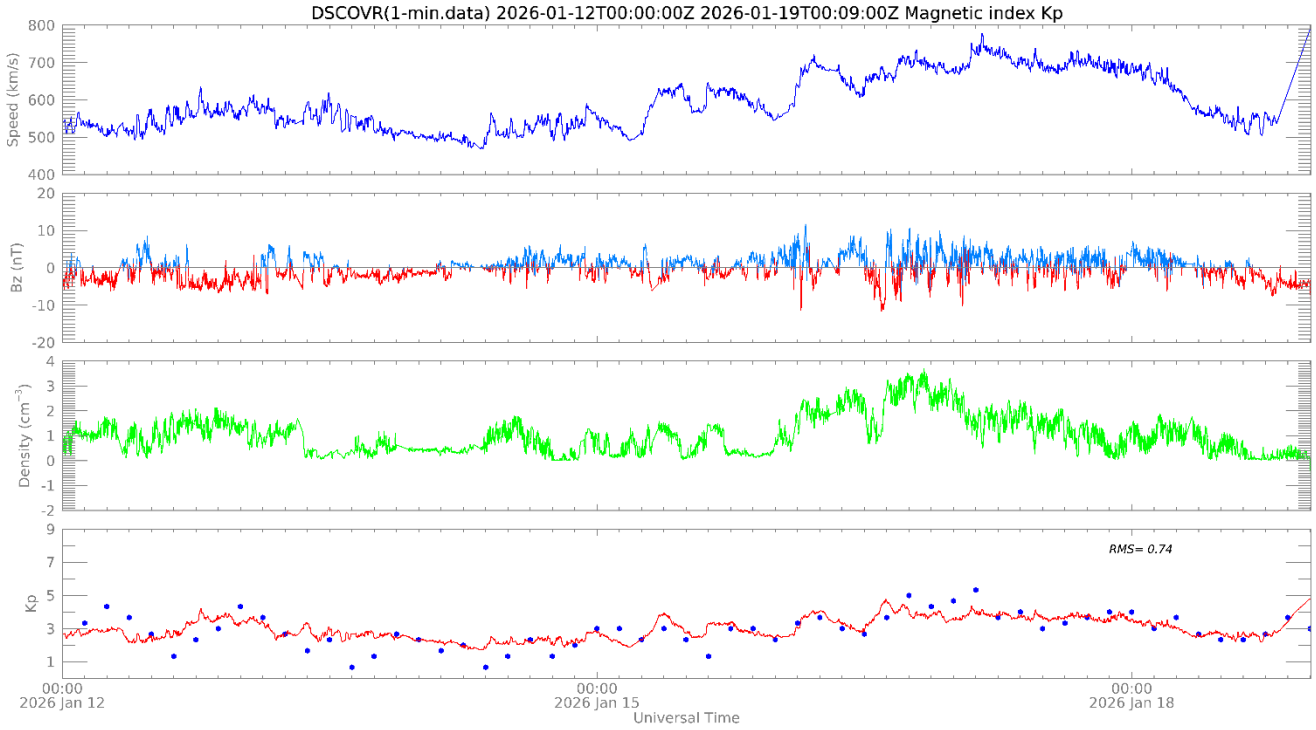

Figure 2: Illustrates a set of parameters observed in the solar wind by the DSCVR satellite and the Kp index by NOAA/SWPC, blue dot, and the modeling, red line.

EARTH'S RADIATION BELT

Responsible: Ligia Da Silva

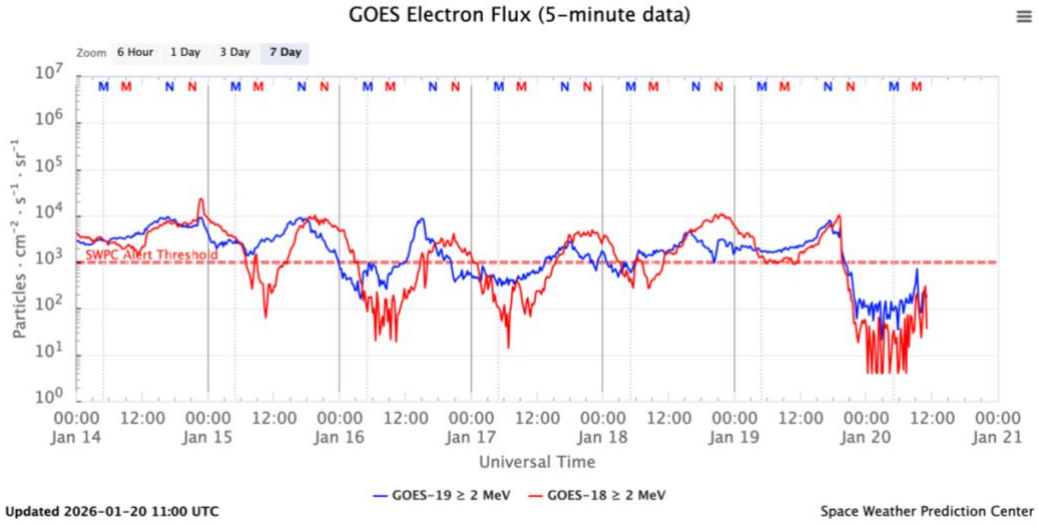

Figure 1: High-energy electron flux (> 2MeV) obtained from GOES-18 and GOES-19 satellite. Source: https://www.swpc.noaa.gov/products/goes-electron-flux

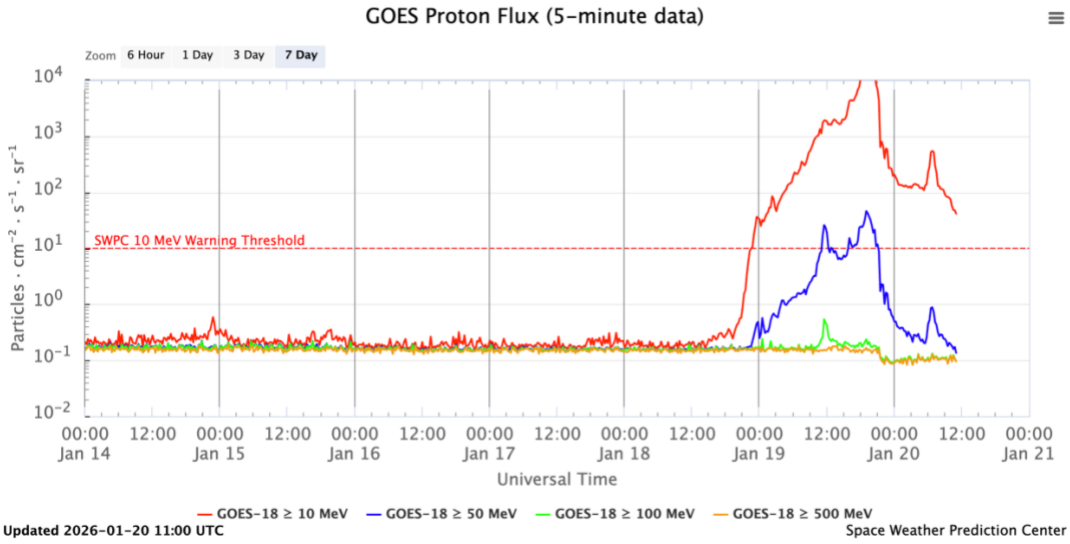

Figure 2: Proton flux (≥ 10 MeV, ≥ 50 MeV, ≥ 100 MeV, ≥ 500 MeV) obtained from GOES-18 satellite. Source: https://www.swpc.noaa.gov/products/goes-proton-flux

Summary

The high-energy electron flux (>2 MeV) in the outer boundary of the outer radiation belt obtained from the GOES-18 and GOES-19 geostationary satellites (Figure 1) is around the alert threshold (103 particles/(cm2 s sr)). Four dropouts were observed on January 15, 16, 17, and 20, respectively, associated with the arrival of solar wind structures. The dropout on January 20 is considered a fast dropout, in which the high-energy electron flux decreases by more than three orders of magnitude in approximately 3 hours. This flux decrease of trapped electrons causes electron precipitation over auroral regions and also over the South Atlantic Magnetic Anomaly (SAMA), potentially directly impacting the atmospheric composition of these regions.

Proton fluxes ≥ 10 MeV, ≥ 50 MeV e ≥ 100 MeV at the outer boundary of the outer radiation belt, obtained from the GOES-18 geostationary satellite (Figure 2), increased from 15:00 and 22:00 UT on January 18th, and 10:00 UT on January 19th, respectively. Proton fluxes ≥ 10 MeV and ≥ 50 MeV exceeded the alert threshold (10^1 particles/(cm^2 s sr)). However, it is worth noting that the proton flux ≥ 10 MeV reached values above 10^4 particles/(cm^2 s sr)). The increase of this species at different energy levels is damaging to circuits on board satellites, especially in auroral regions and over the South Atlantic Magnetic Anomaly (SAMA) region.

Geomagnetic field

Responsible: Karen Sarmiento /Lívia Alves/Sony Su Chen

Summary

Between 14 and 15 January, geomagnetic activity remained quiet, with the Kp index ranging between 1- and 3o, remaining below the geomagnetic storm threshold. However, on 15 January, a slight intensification of auroral currents was observed, with the AE index reaching values of up to 1000 nT. The Dst index remained stable, with values above 0 nT, and no geomagnetic storm was characterized.

Between 16 and 18 January, a G1-level geomagnetic storm was observed. The Kp index reached a maximum value of 5o on 16 January, characterizing the storm at the G1 level. During this period, the AE index remained elevated, with peaks exceeding 1500 nT, indicating an intensification of auroral currents. The Dst index reached a minimum value of -18 nT on 16 January, while the dHsa index reached -77 nT. Geomagnetic activity conditions gradually stabilized until the beginning of 19 January.

At approximately 19:15 UT on 19 January, the interplanetary coronal mass ejection (ICME), originating from the X1.9-class solar flare that occurred on 18 January, arrived at Earth. This event triggered a severe geomagnetic storm (G4). The Kp index reached peaks of 8+ and 9- between 18 and 24 UT, characterizing G4-level conditions. The Dst index reached -119 nT, while the AE index exceeded 4000 nT between 19 and 20 UT. The storm continued throughout 20 January, remaining at the G4 level during the main phase, when the Dst index reached -218 nT. In South America, the dHsa index recorded a minimum value of -282 nT.

On 21 January, the geomagnetic storm entered its recovery phase. Geomagnetic storm levels gradually declined from G4 to G2, as indicated by the Kp and Ksa indices. Nevertheless, geomagnetic instabilities persisted, with AE index values exceeding 1000 nT, and the magnetic field continued to exhibit disturbances in the auroral region.

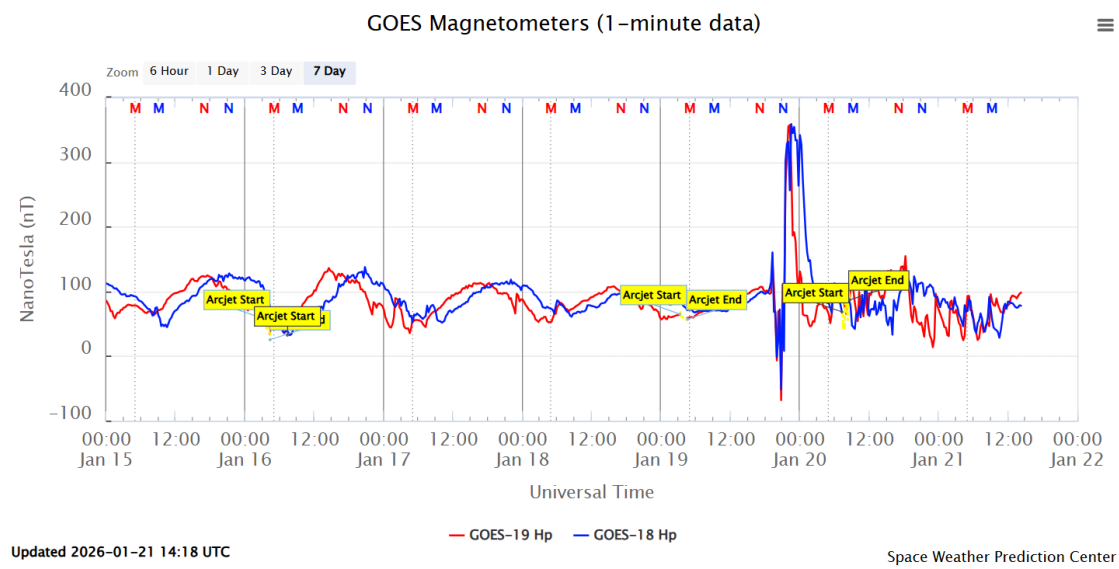

Figure 1 - Magnetic field measurement at the GOES satellite position.

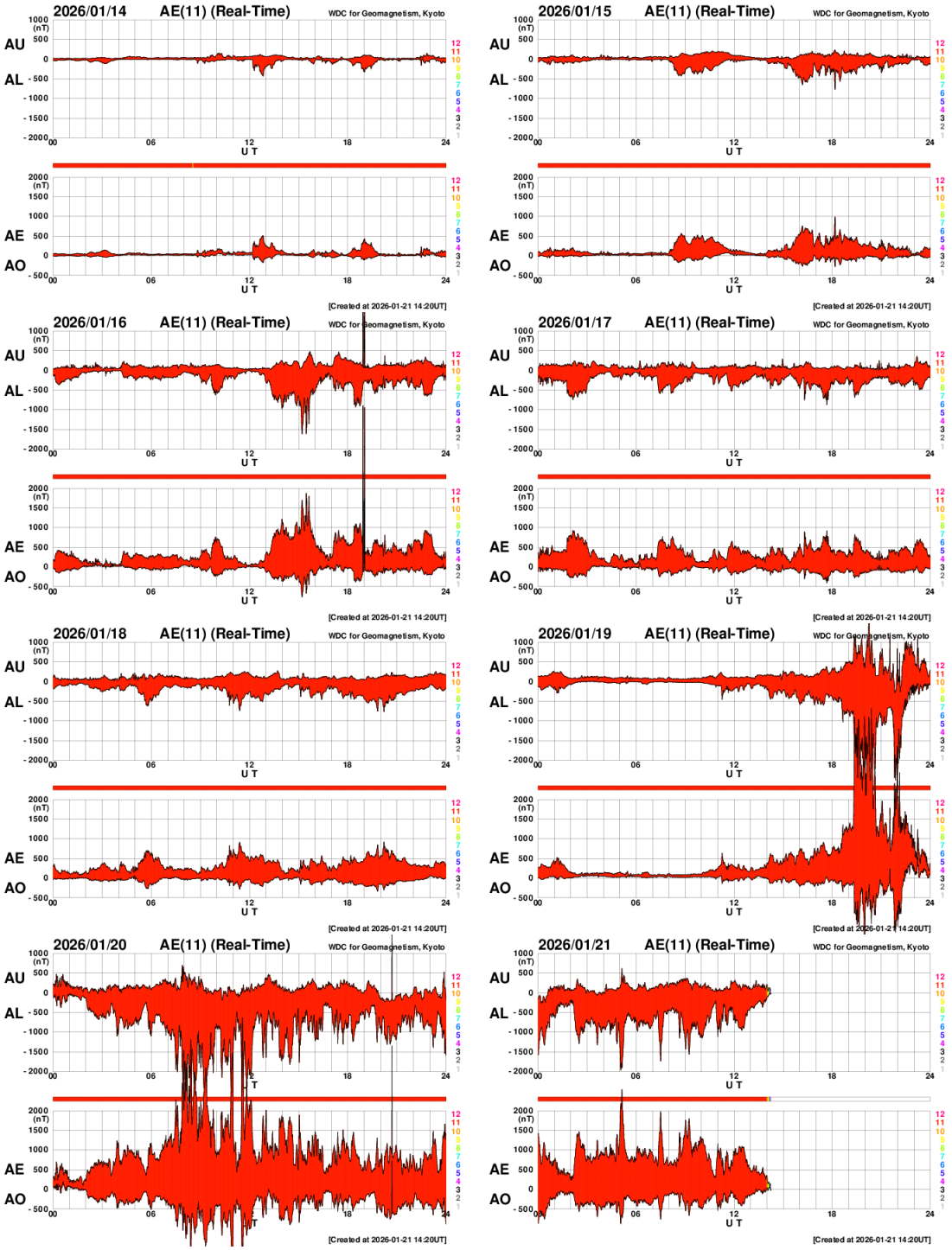

Figure 2 – AE index for the days of the week.

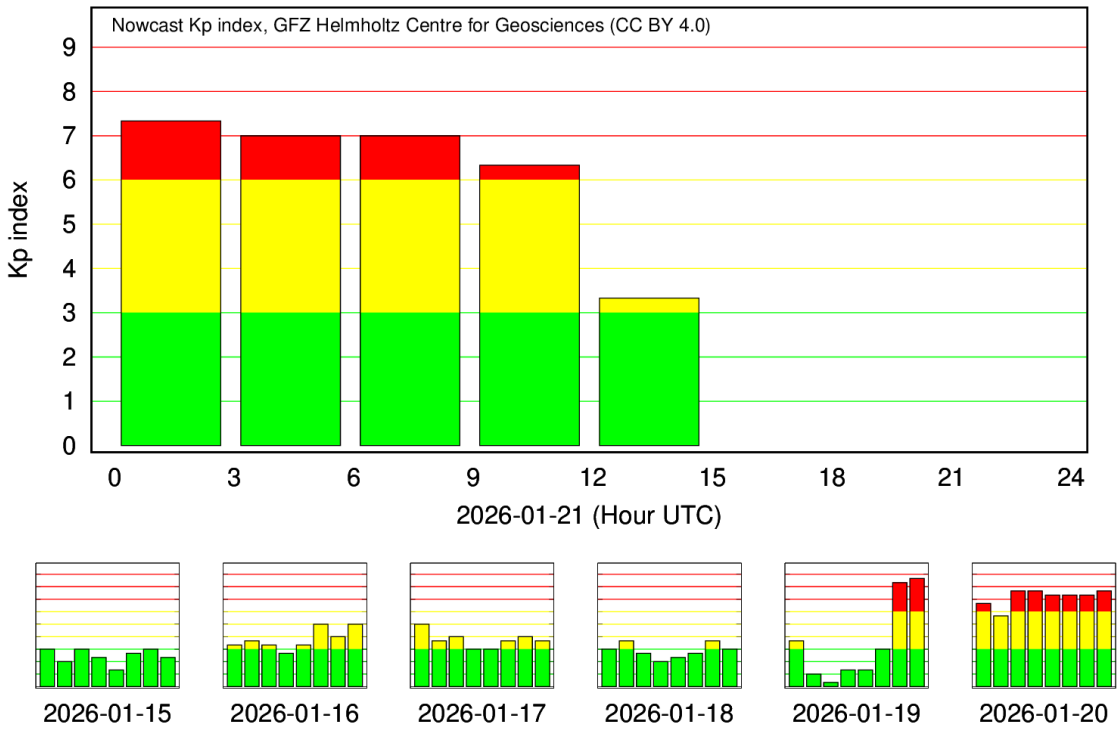

Figure 3 – Kp index on a logarithmic scale.

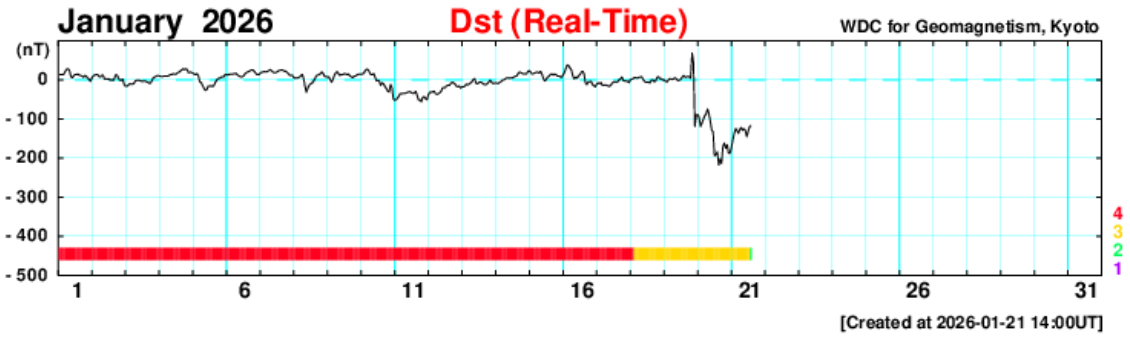

Figure 4 – Dst index.

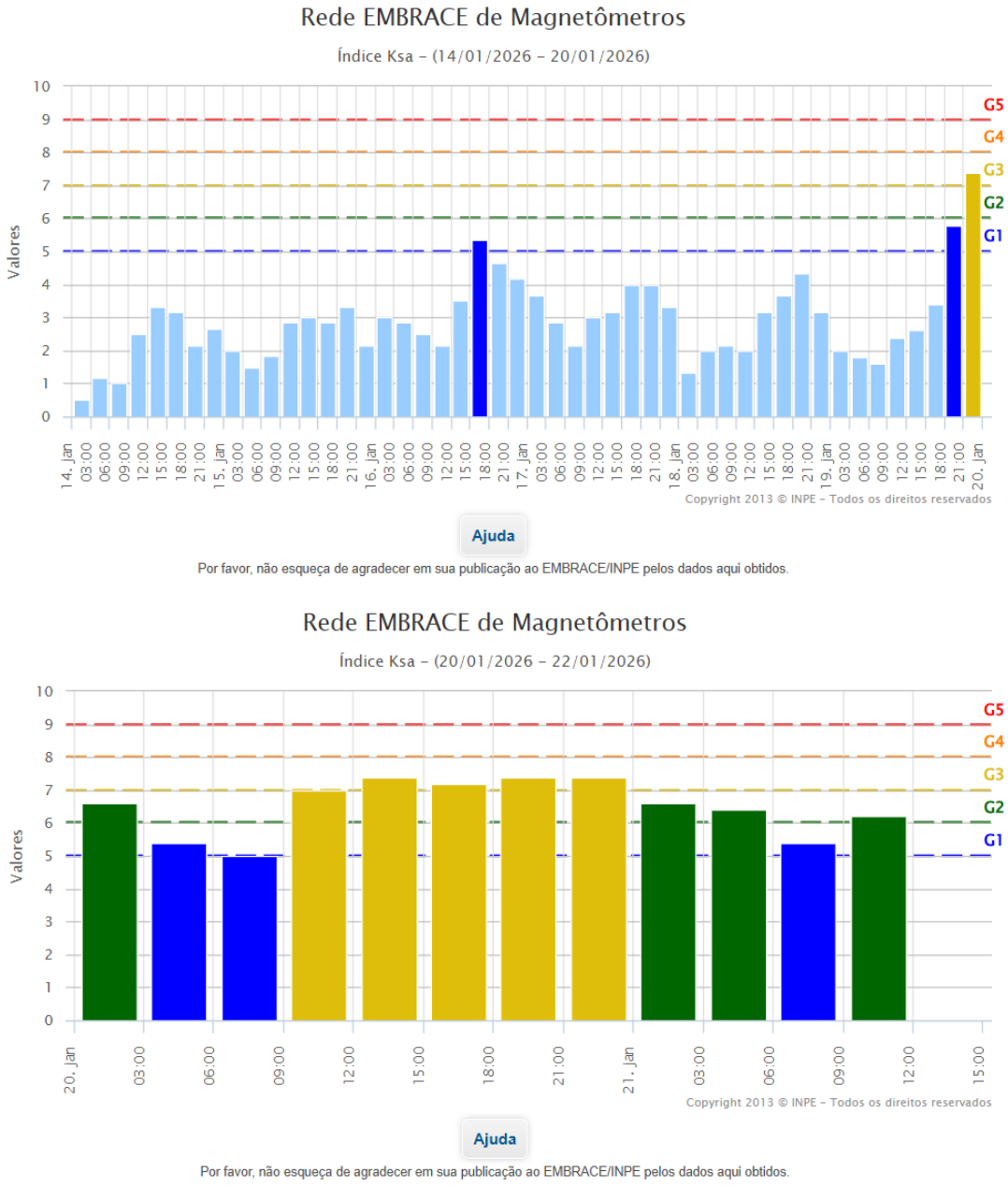

Figure 5 – Geomagnetic index in South America – Ksa Index.

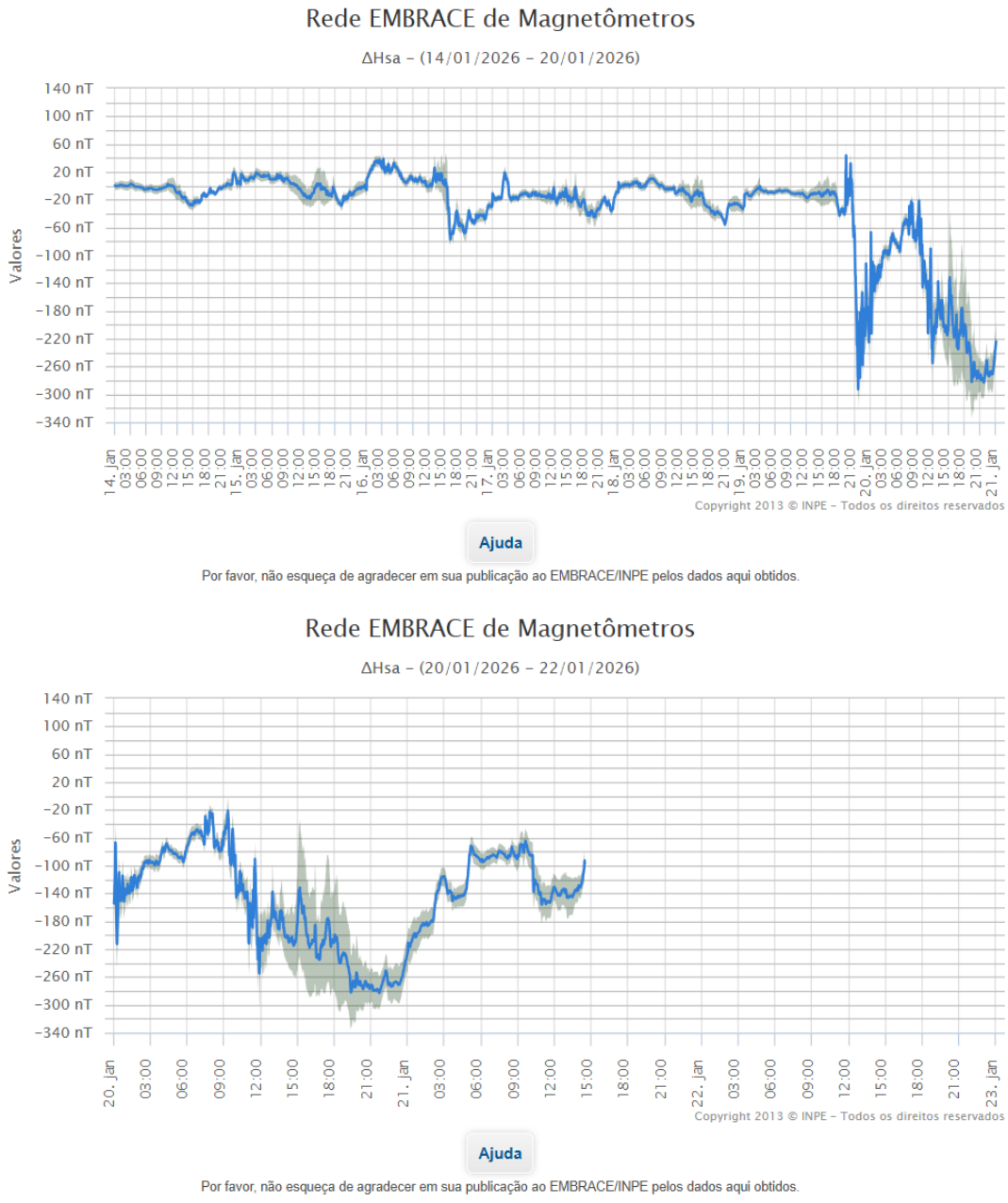

Figure 6 – Geomagnetic index in South America – ΔH index at magnetic stations of the EMBRACE Program.

Ionosfera – Digisonde (Laysa Resende)

Summary

This week, spread F was detected at nearly all latitudes, including Boa Vista, São Luís, and Juazeirinho. However, at Cachoeira Paulista, spread F traces were observed only after January 13. The spread F signatures in Boa Vista (Figure 1) and São Luís are atypical compared to their usual behavior. During this week, the Es layers were very weak, and the MUF variations did not reach the threshold required for a moderate index.

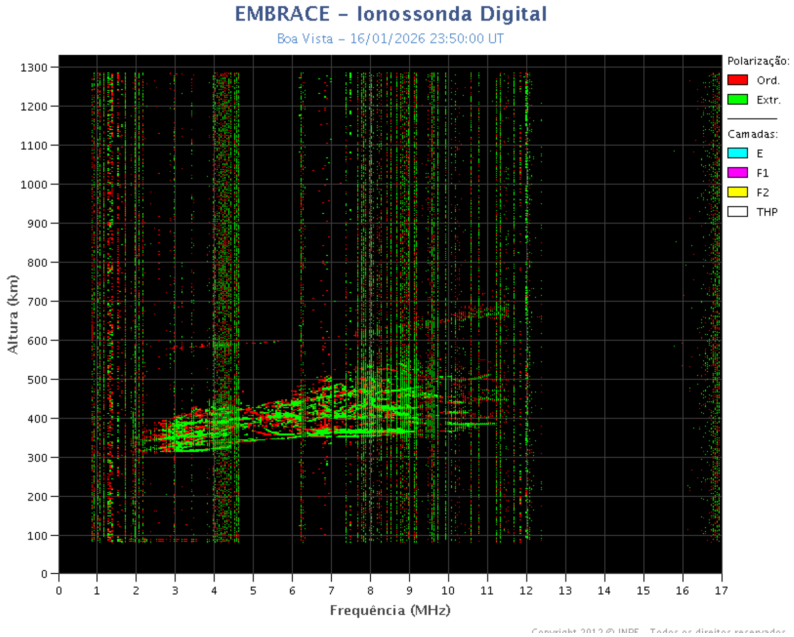

Figure 1 – Ionogram over Boa Vista, showing the atypical spread F absence.