

Geomagnetic Field

Responsible: Karen Sarmiento/ Livia Alves

Summary

Starting on May 14, rapid variations in the magnetic field were observed on the nightside, indicating an intensification of currents in the magnetotail. On May 17, sudden increases in the Hp component of up to 50 nT were recorded, reaching a significant value of 159 nT (GOES-19) at 16 UT on the dayside. A sharp decrease in the Hp component was also observed, with a minimum value of 39.2 nT recorded by the magnetometer onboard the GOES-18 satellite at 03:45 UT. Auroral activity intensified in both hemispheres, with multiple substorm episodes. The AE index fluctuated between 500 and 1000 nT for short periods on May 14, 15, 16, 18, and 19, showing typical substorm signatures. On May 17, the AE index exceeded 1000 nT between 00 and 02 UT, indicating an intense substorm with a prolonged recovery phase. Several periods of instability were recorded, with the Kp index reaching a maximum value of 6 α , corresponding to a moderate geomagnetic storm (G2), and varying between active conditions (on May 16 and 19), moderate G2 storm (on May 17), and unsettled conditions (on May 19). The Dst index reached levels compatible with a moderate storm, with a minimum value of -58 nT at 06 UT on May 17. Data from the Embrace magnetometer network revealed: (1) a slight increase in the H component on May 14 (~6 UT), coinciding with a peak in solar wind density; (2) a sudden increase on May 15 (~3 UT); and (3) a gradual increase in the H component at all stations between 00 and 03 UT on May 17, associated with a sector boundary crossing in the interplanetary magnetic field (variations in the Bx and By components) and positive values of the Bz component. A sudden increase was also observed around 05 UT, with a storm signature. Although the storm did not fully develop, the two events appear to be related to the arrival of a high-speed stream (HSS) and a possible glancing blow from a coronal mass ejection (CME) ejected from the Sun on May 12. This interaction produced a storm signature, resulting in minimum magnetic field values (-174.41 nT) recorded at the Porto Velho station at 16:20 UT, located in the region influenced by the Equatorial Electrojet.

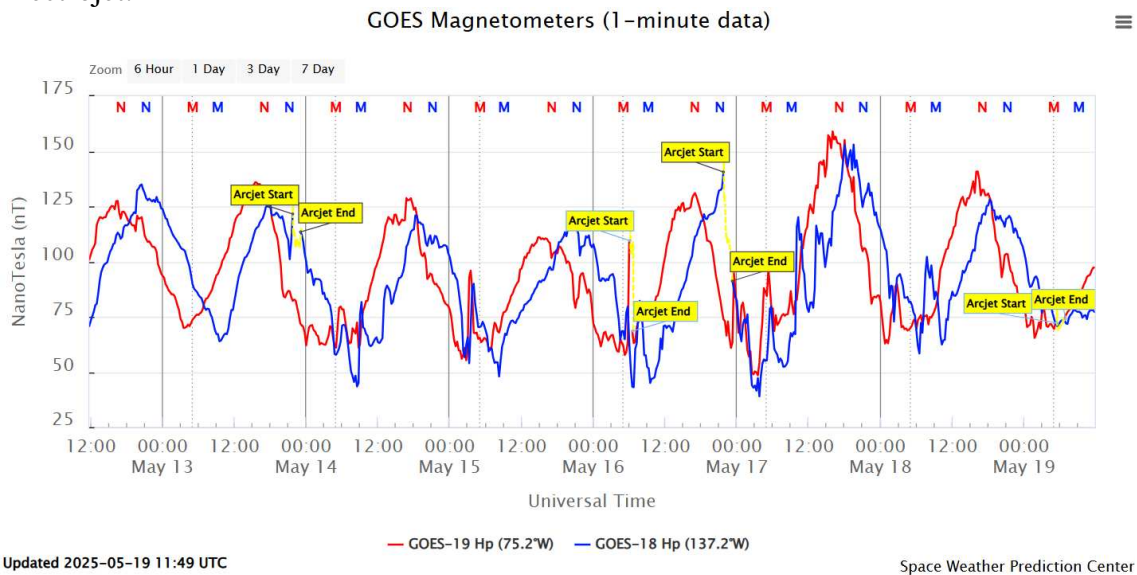


Figure 1- Magnetic field horizontal component at the GOES satellite orbit through.

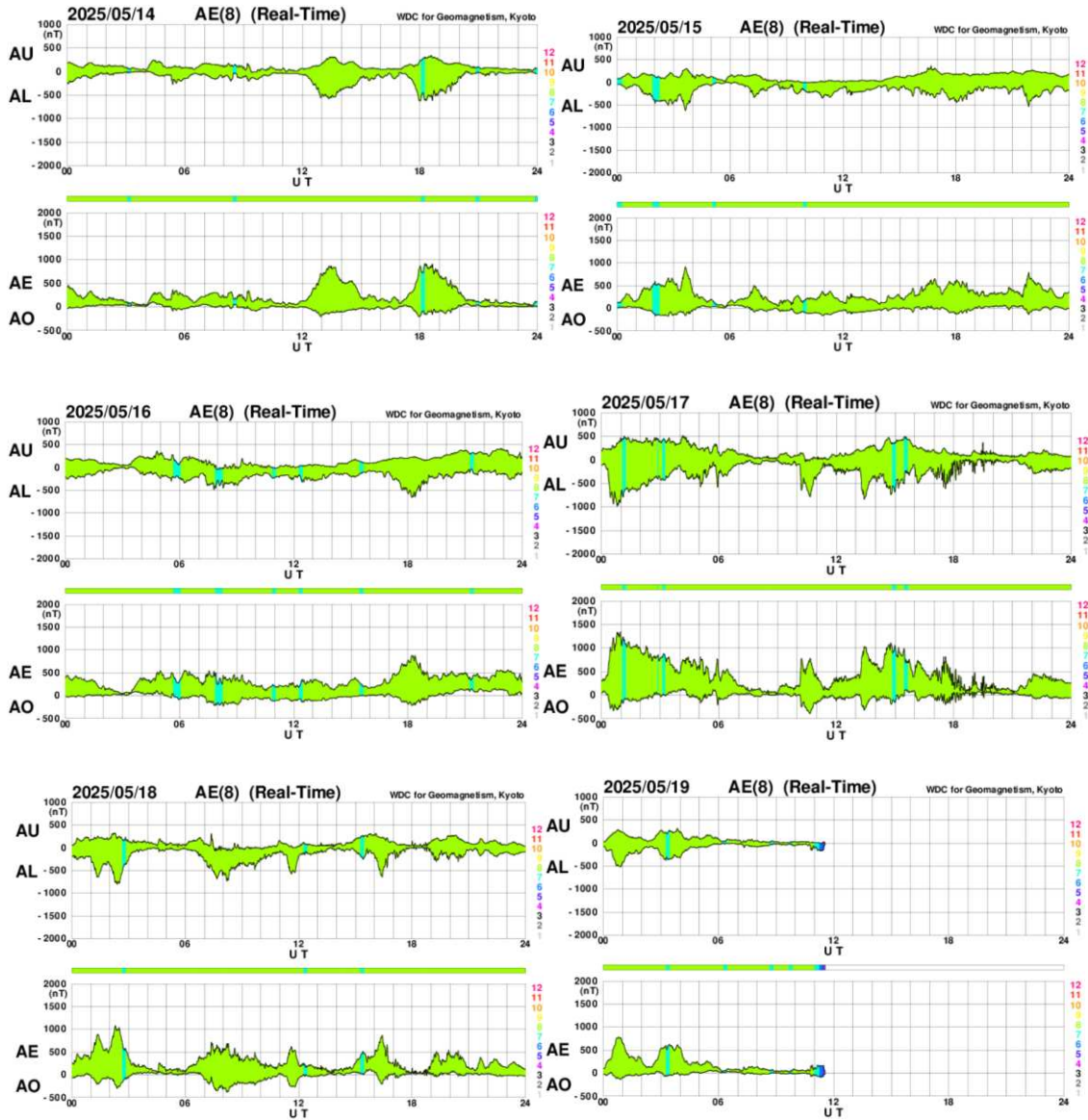


Figure 2- AE index.

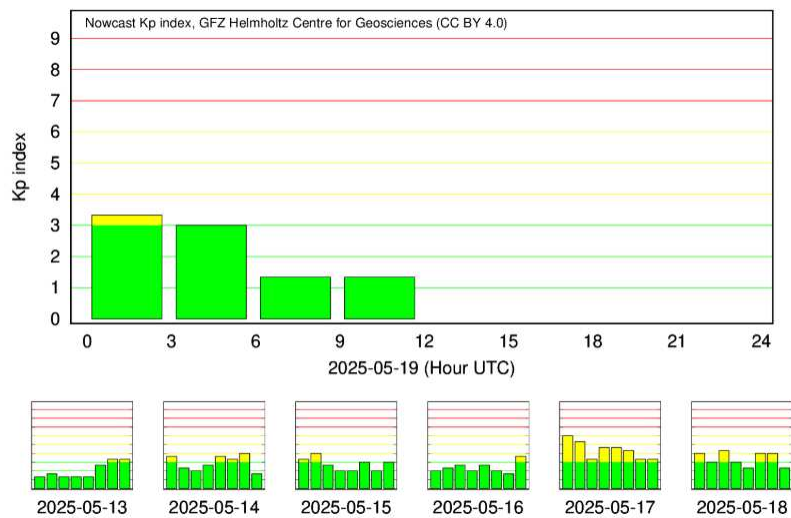


Figure 3- Kp index in logarithmic scale.

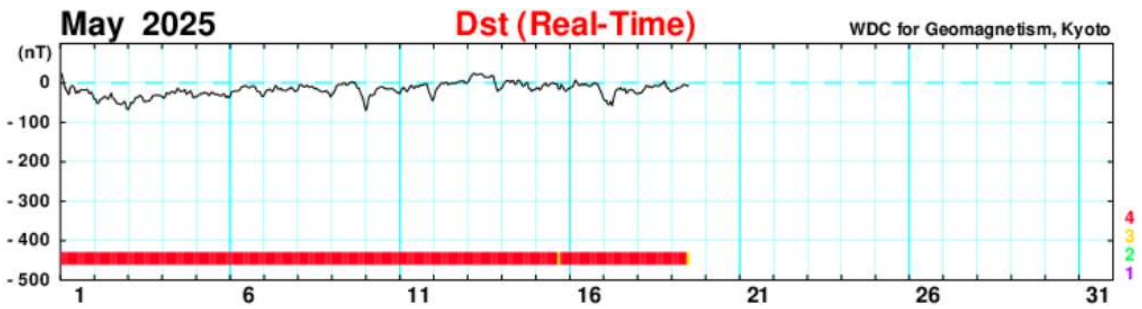


Figure 4- Dst Index

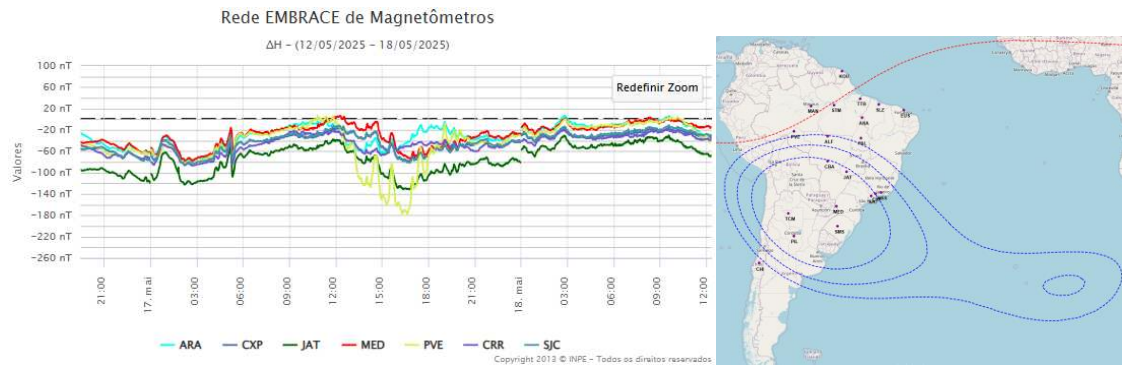
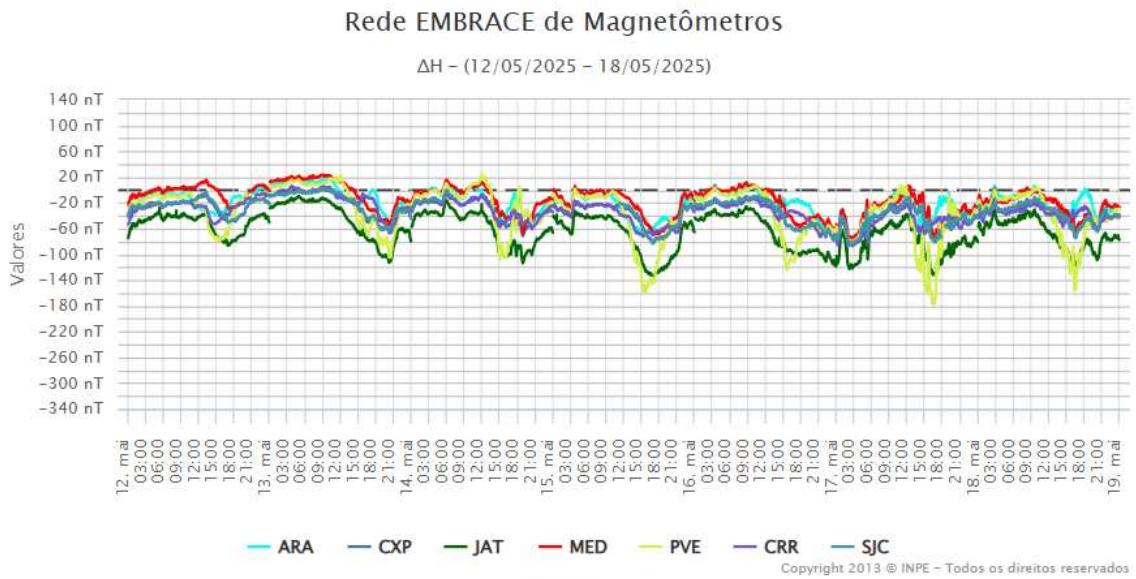


Figure 5- Daily variation of the geomagnetic field from $H(nT)$ measured at Embrace MagNet.

EARTH'S RADIATION BELT

Responsible: Ligia Da Silva

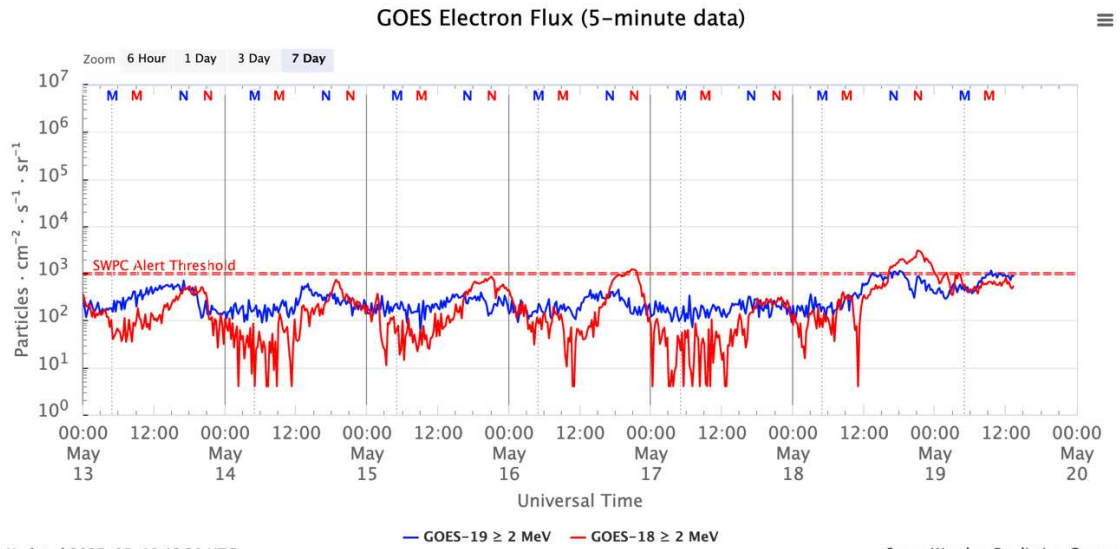


Figure 1: High-energy electron flux (> 2MeV) obtained from GOES-16 and GOES-18 satellite. Source: <https://www.swpc.noaa.gov/products/goes-electron-flux>

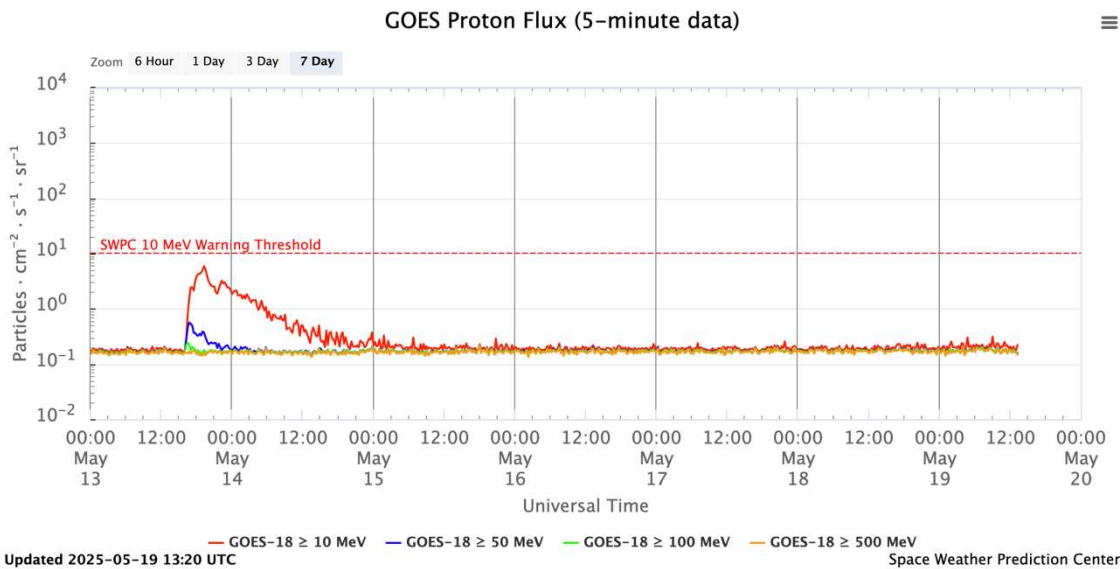


Figure 2: Proton flux (≥ 10MeV, ≥ 50MeV, ≥ 100MeV) obtained from GOES-18 satellite. Source: <https://www.swpc.noaa.gov/products/goes-proton-flux>



Summary

The high-energy electron flux (>2 MeV) in the outer boundary of the outer radiation belt obtained from geostationary satellite data GOES-19 (Figure 1 - blue line) is practically stable below the minimum threshold of 10^3 particles/($\text{cm}^2 \text{ s sr}$) almost throughout the analyzed period, reaching 10^3 particles/($\text{cm}^2 \text{ s sr}$) on May 18 and 19. The GOES-18 satellite (Figure 1 – red line) shows the electron flux also below the minimum threshold of 10^3 particles/($\text{cm}^2 \text{ s sr}$) almost throughout the analyzed period, with dropouts on May 14, 15, 16 and 17. These dropouts were followed by enhancements, the most significant being observed after the dropout on May 17. These variations in the electron flux are generally associated with the arrival of solar wind structures, such as coronal mass ejections and high-speed streams.

The proton flux $\geq 10\text{MeV}$, $\geq 50\text{MeV}$ and $\geq 100\text{MeV}$ outer boundary of the outer radiation belt obtained from the geostationary satellite GOES-18 (Figure 2) increased from 16:15 UT on May 13. A rapid decay of a few hours is observed to the energy levels of $\geq 50\text{MeV}$ and $\geq 100\text{MeV}$, and a slower decay, lasting just over 24 hours, to the level of $\geq 10\text{MeV}$.