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Universidade Federal do Paraná

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IMPACT OF APRIL 23-24, 2023 GEOMAGNETIC STORM ON THE GNSS POSITIONING AT CACHOEIRA PAULISTA

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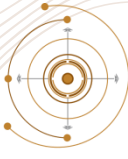
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OUTLINE

- Geomagnetic storm, Disturbance electric fields and TADs;
- Experimental data;
- Results and discussion;
- Conclusions;
- Acknowledgments

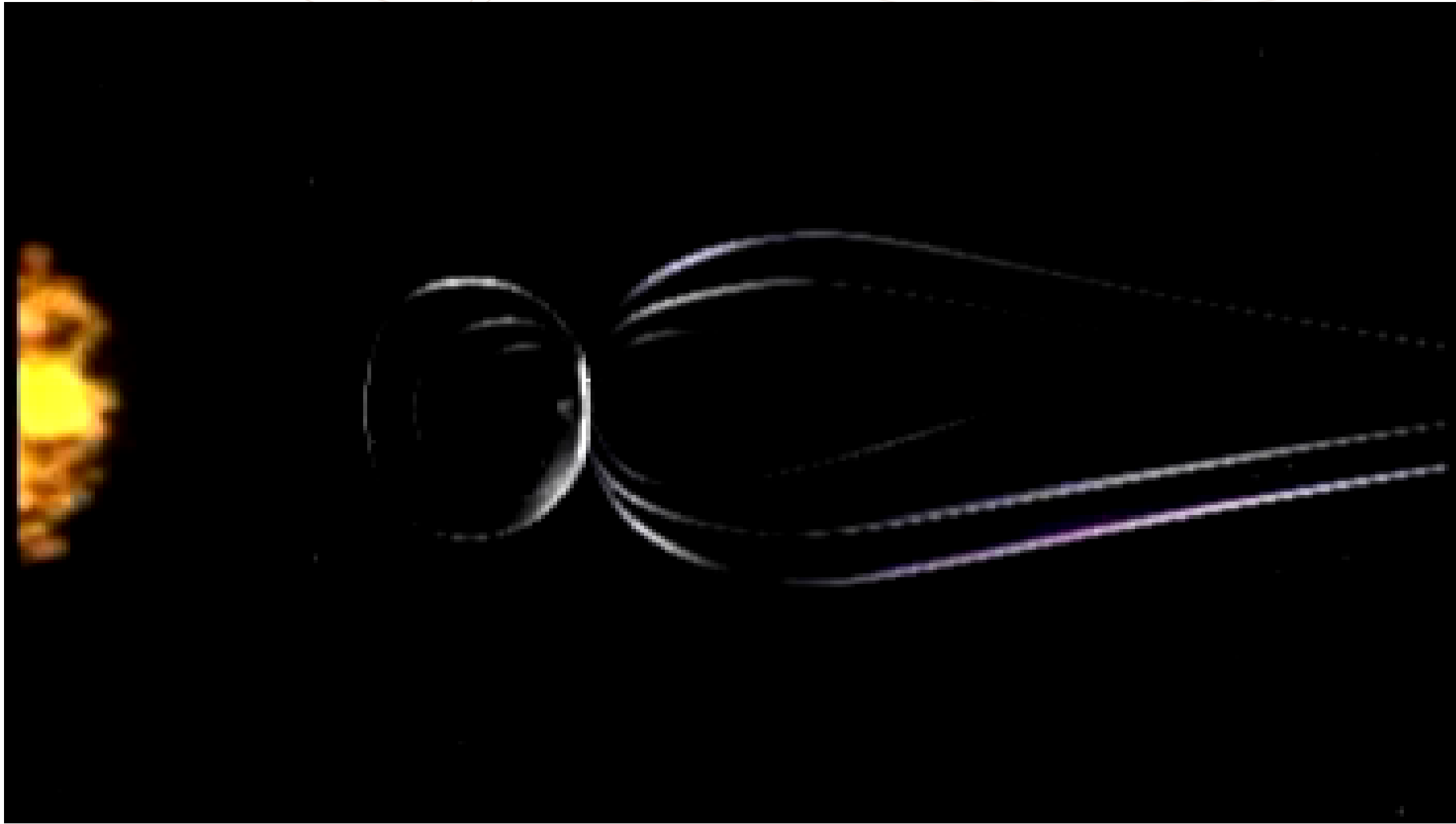


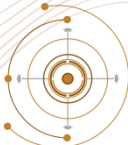
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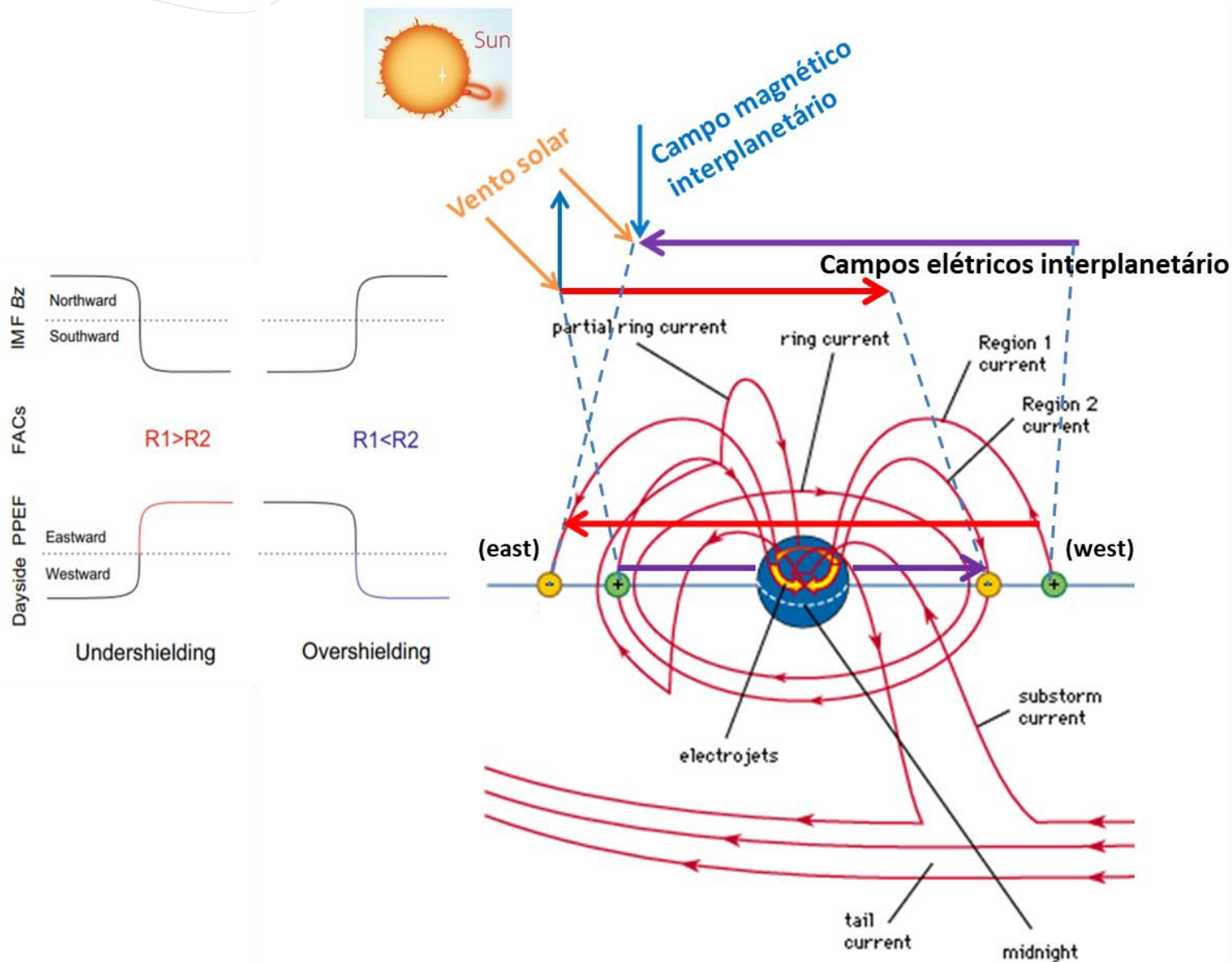
CORONAL MASS EJECTION (CME) AND GEOMAGNETIC STORM

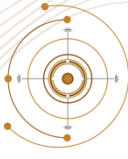
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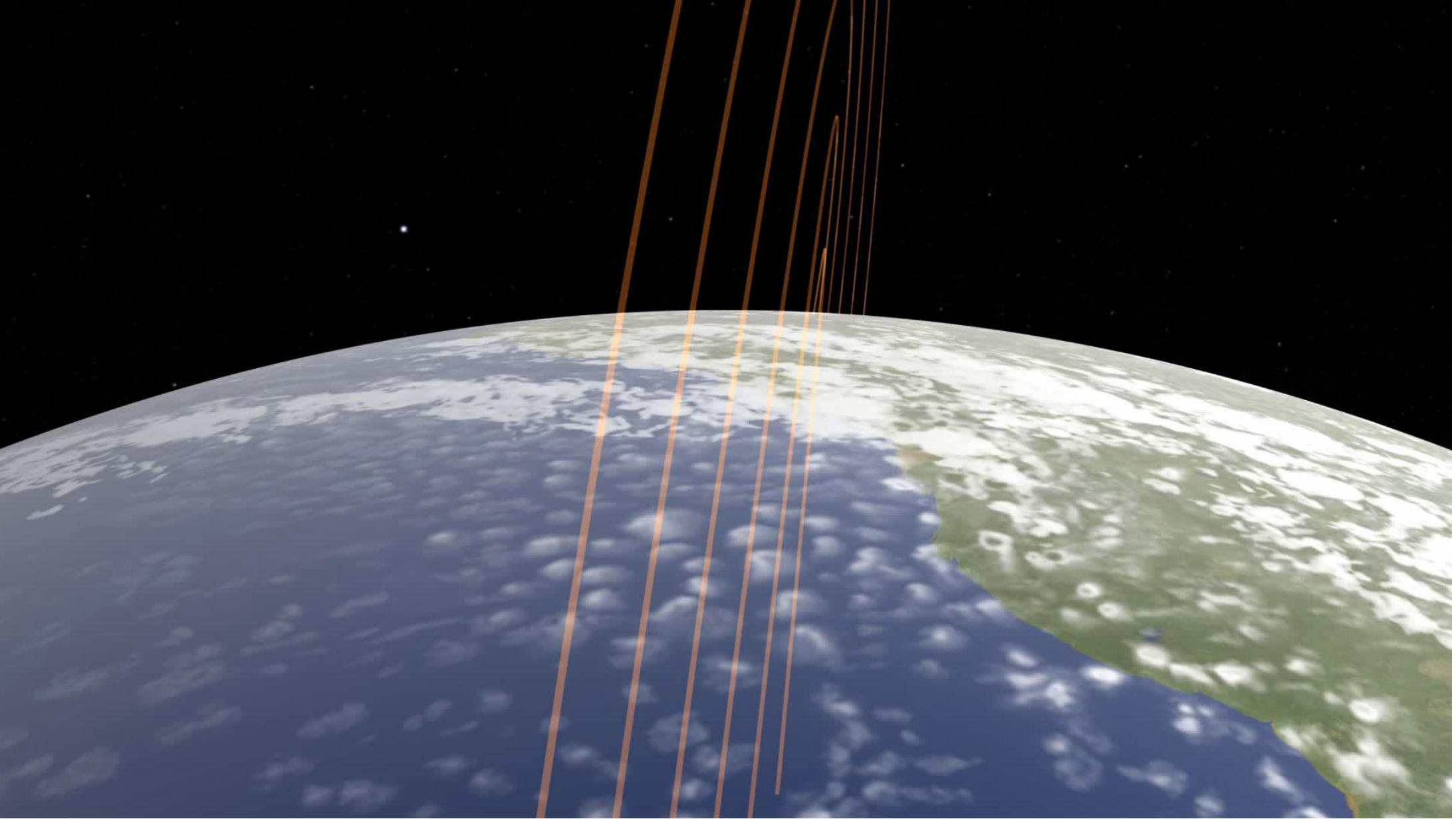


IT CAN PRODUCE PROMPT PENETRATION ELECTRIC FIELDS





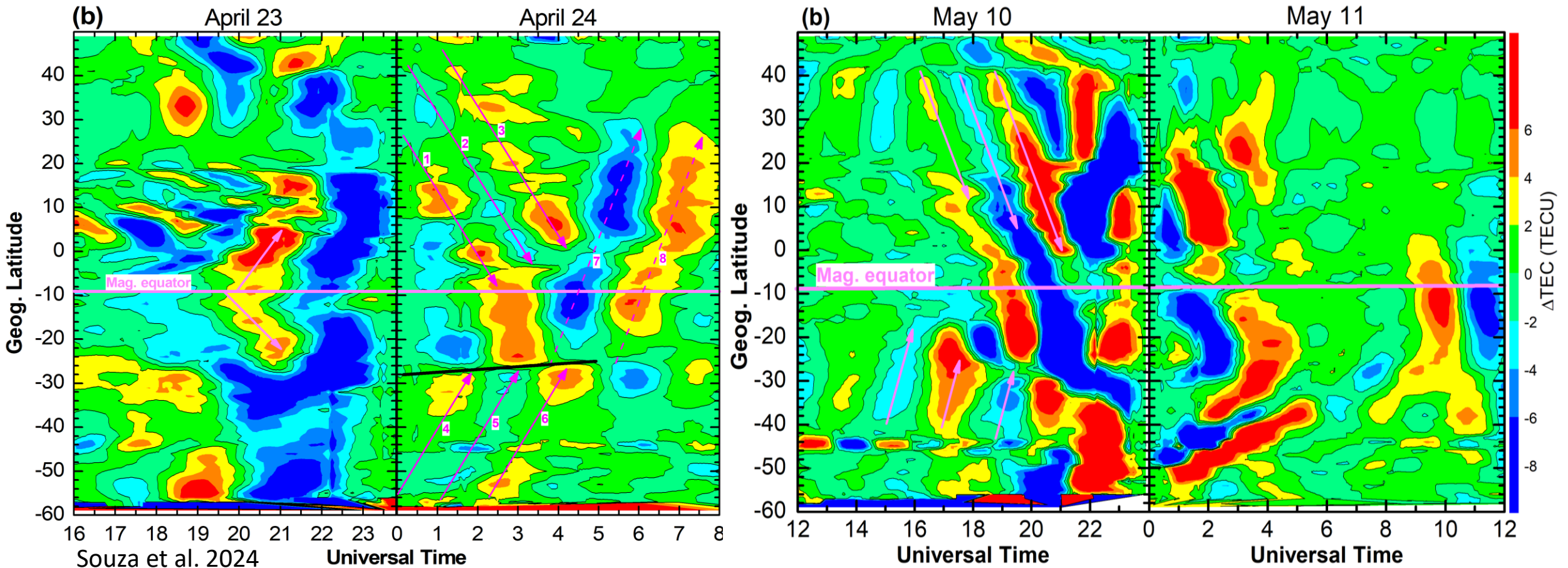
IT CAN PRODUCE SUPERFOUNTAIN EFFECT



KEOGRAMS OF Δ TEC ALONG GEOGRAPHIC MERIDIAN 67 W: TWO GEOMAGNETIC STORMS - 2023 AND 2024

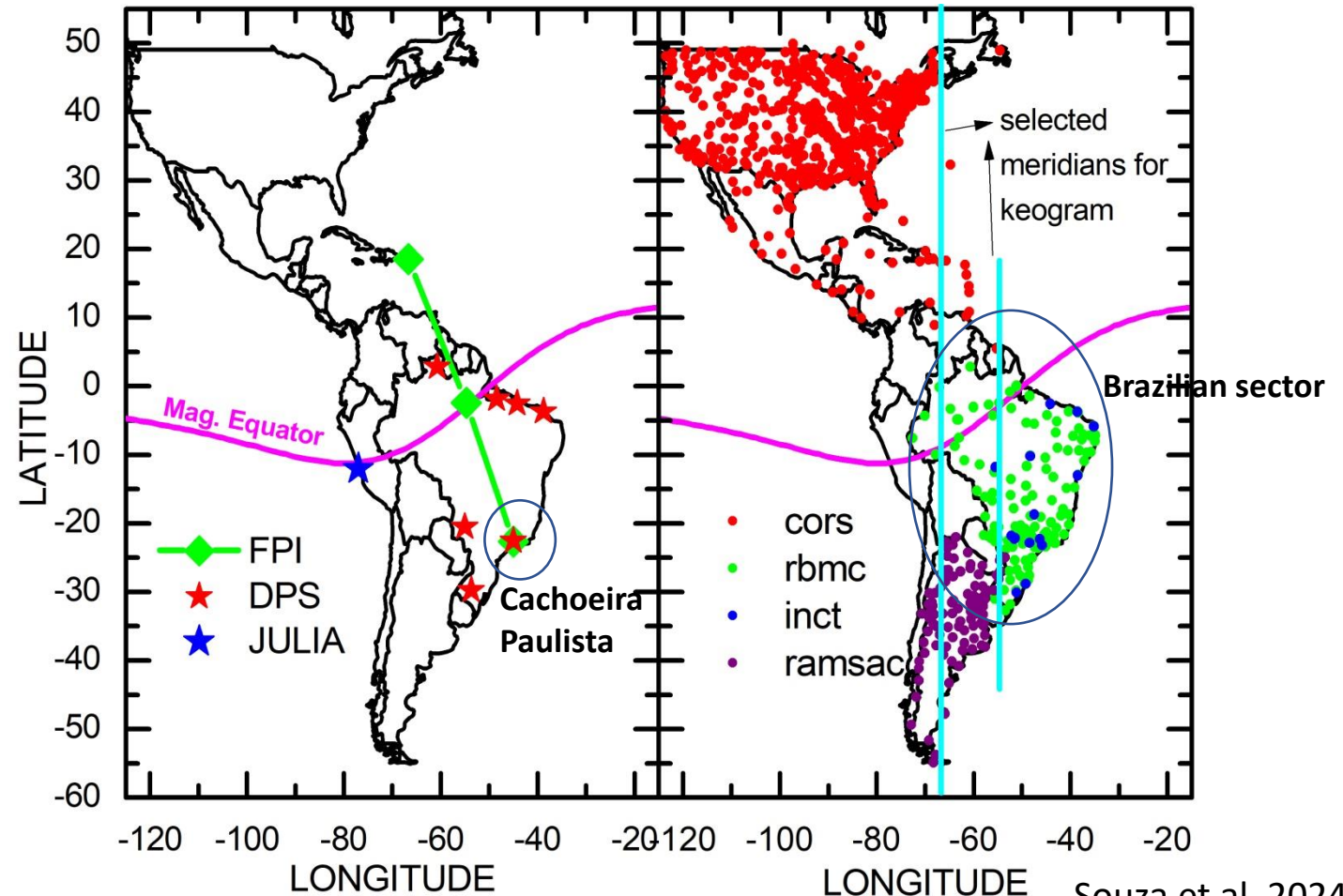
$$\Delta\text{TEC} = [\text{TEC}]_{-3.33\text{h}} - [\text{TEC}]_{-1\text{h}},$$

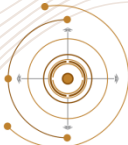
where $[\text{TEC}]_{-3.33\text{h}}$ and $[\text{TEC}]_{-1\text{h}}$ are running averages for 3.33 and 1 hour bins, respectively.



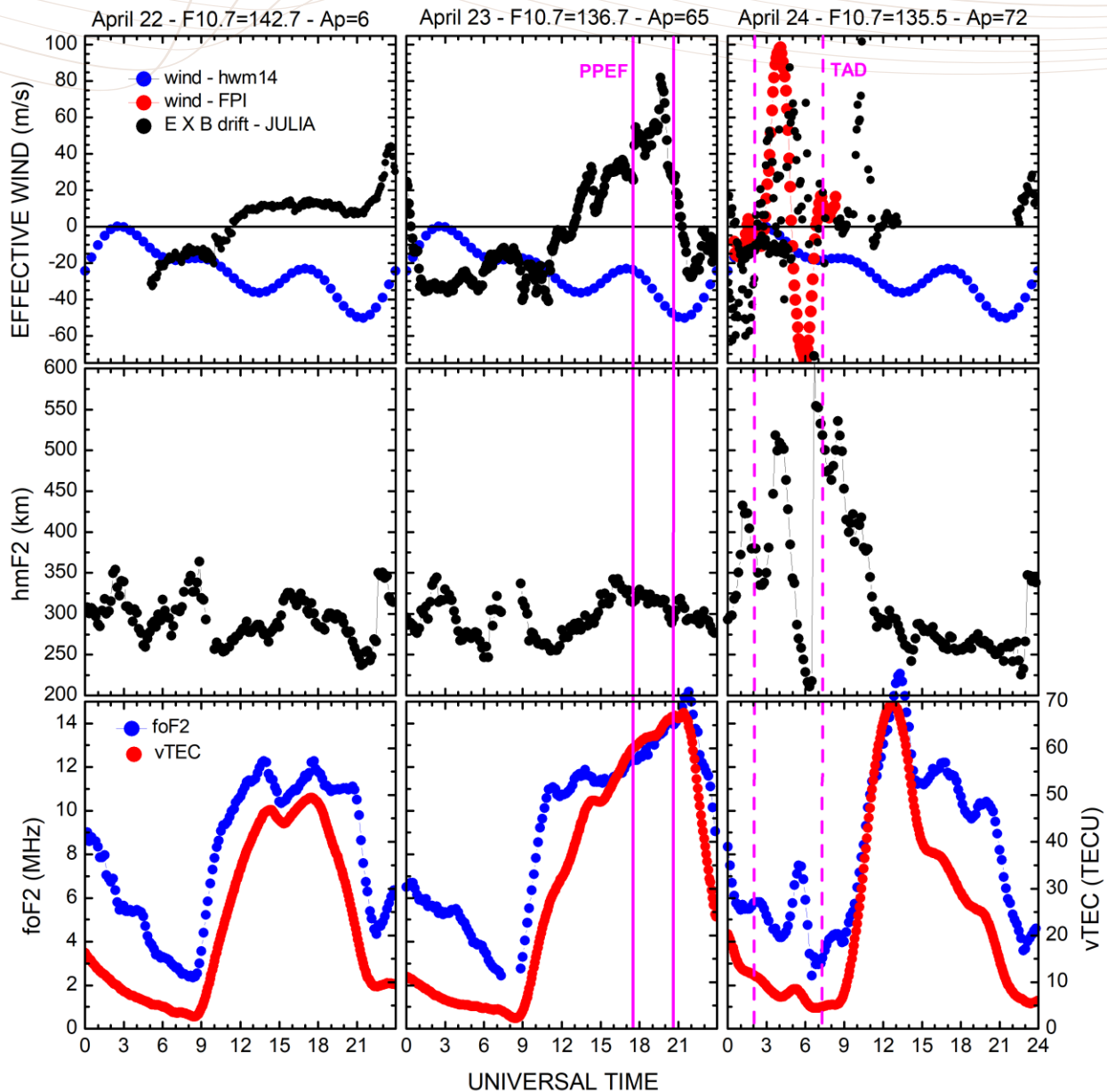
Maps with the positions of the Fabry-Pérot Interferometers, the JULIA radar and the Digisondes (DPSs) (on the left). Positions of the GNSS receivers of the CORS/USA, RBMC/Brazil, INCT/Brazil, and RAMSAC/Argentine networks are shown on right side. The vertical cyan bars indicate the selected meridians for applying the keogram technique

- An IONEX file was produced for the Brazilian region (BR IONEX) replacing the vTEC from IGS IONEX files by the values calculated by the UTD code.

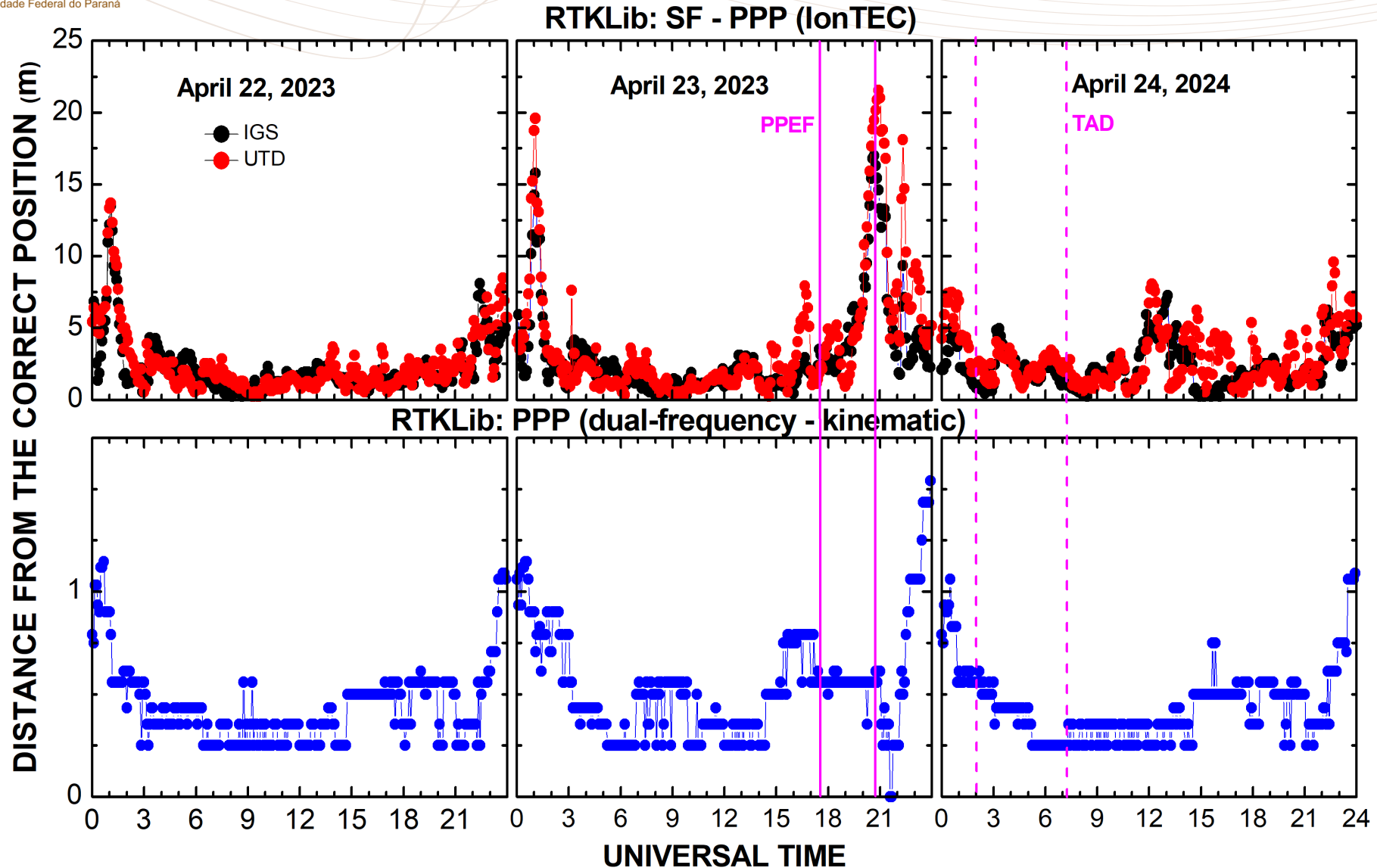




EXPERIMENTAL DATA



Diurnal variations of effective wind, $E \times B$ vertical drift, $hmF2$, $foF2$ and $vTEC$ over CP for April 22-24, 2023



Diurnal variations of CP position deviation during April 22 to 24, 2023. Black dots are the deviation calculated using IGS IONEX maps and red one using BR IONEX obtained with UTD code. Bottom panels show PPP for dual-frequency.

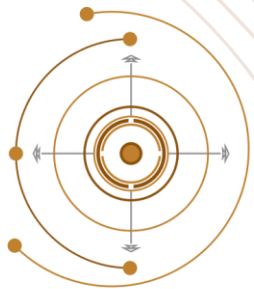
CONCLUSIONS

The main conclusions of this work are:

- 1) The most significant impact on positioning errors in the CP sector occurred shortly after the eastward storm's electric field to reach the highest level. Such an impact may be associated with the dynamics of the southern crest of the equatorial ionization anomaly;
- 2) There was no impact on the positioning attributed to TADs.

REFERENCE

Souza, J. R., Dandenault, P., Santos, A. M., Riccobono, J., Migliozzi, M. A., Kapali, S., et al. (2024). Impacts of storm electric fields and traveling atmospheric disturbances over the Americas during 23–24 April 2023 geomagnetic storm: Experimental analysis. *Journal of Geophysical Research: Space Physics*, 129, e2024JA032698. <https://doi.org/10.1029/2024JA032698>



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REALIZAÇÃO



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