Thermospheric Densities and Ionospheric Conditions During the Starlink Destruction Event

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Background - A (not so) friendly atmosphere

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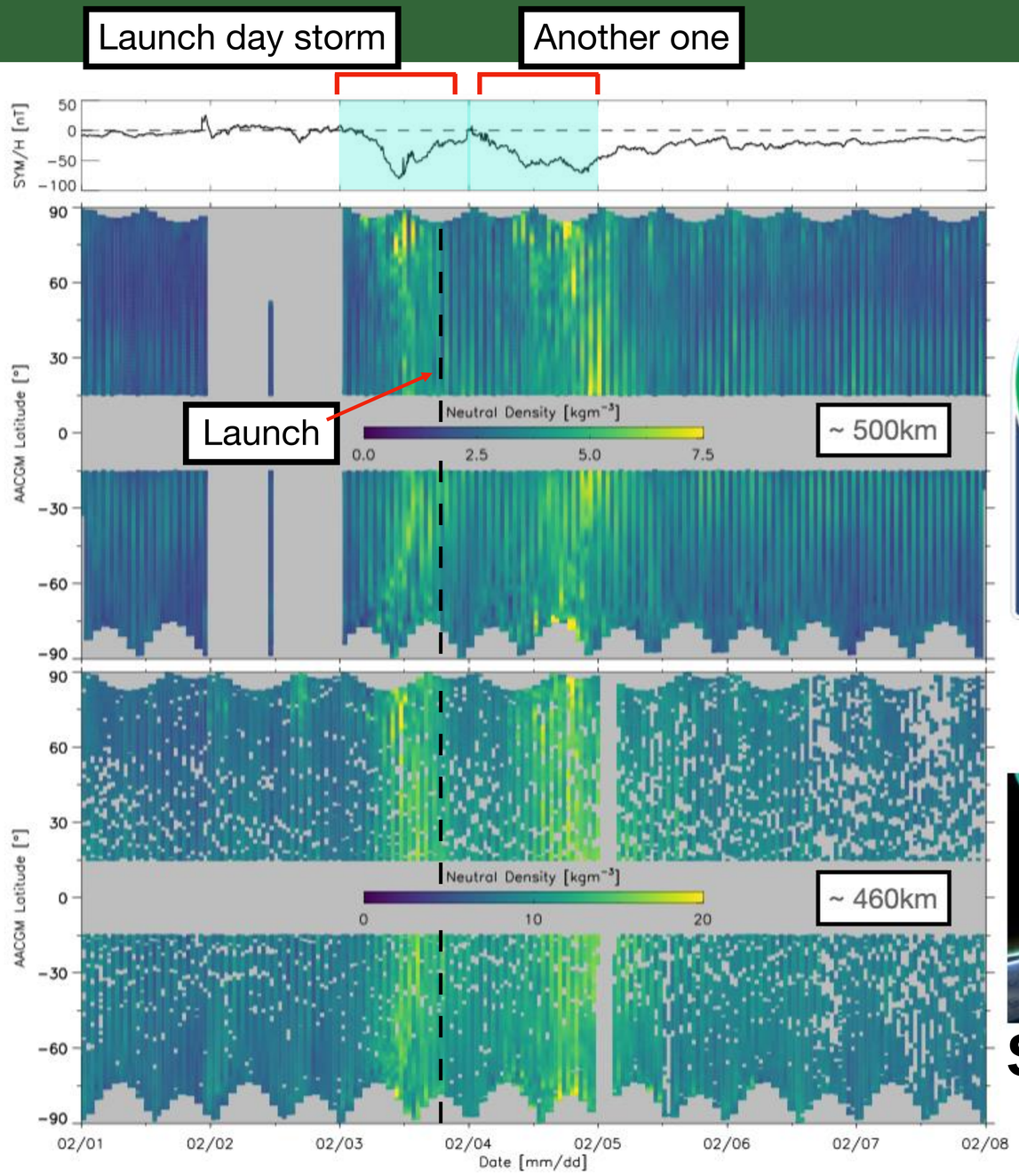
PUBLISHED WED, FEB 9 2022•10:53 AM EST | UPDATED WED, FEB 9 2022•6:42 PM EST

Starlink debris over Puerto Rico - 07/02/2022

Spacecraft neutral densities



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Starlink staging altitude:

~210km

Pros:

- Cheap launch
- Bad satellites de-orbit by themselves

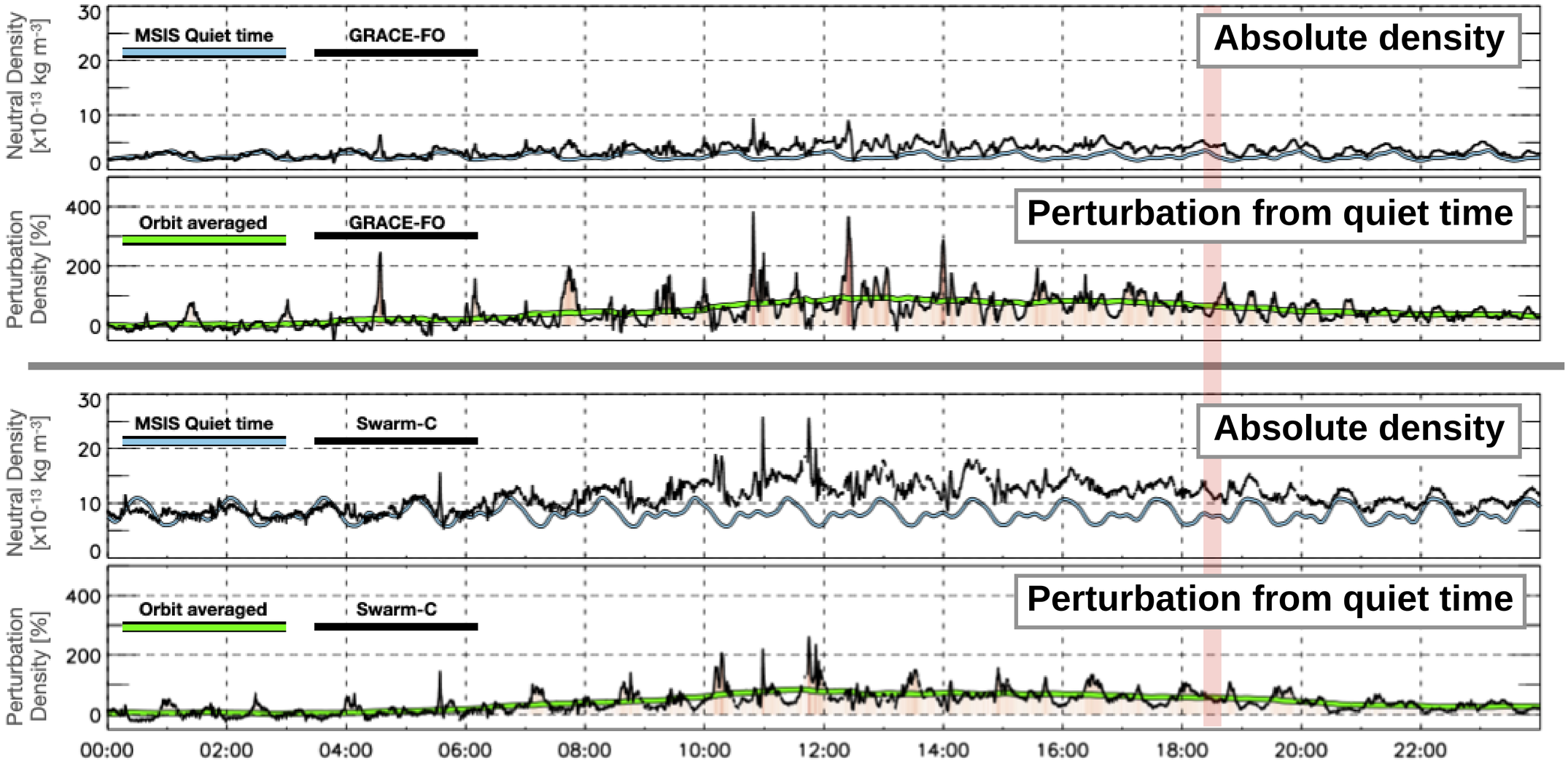
Cons:

- Any moderate geomagnetic activity is bad

Perturbations from quiet time

Subtracting **MSIS** quiet time model (ap=3)

Launch day - 2022/02/03



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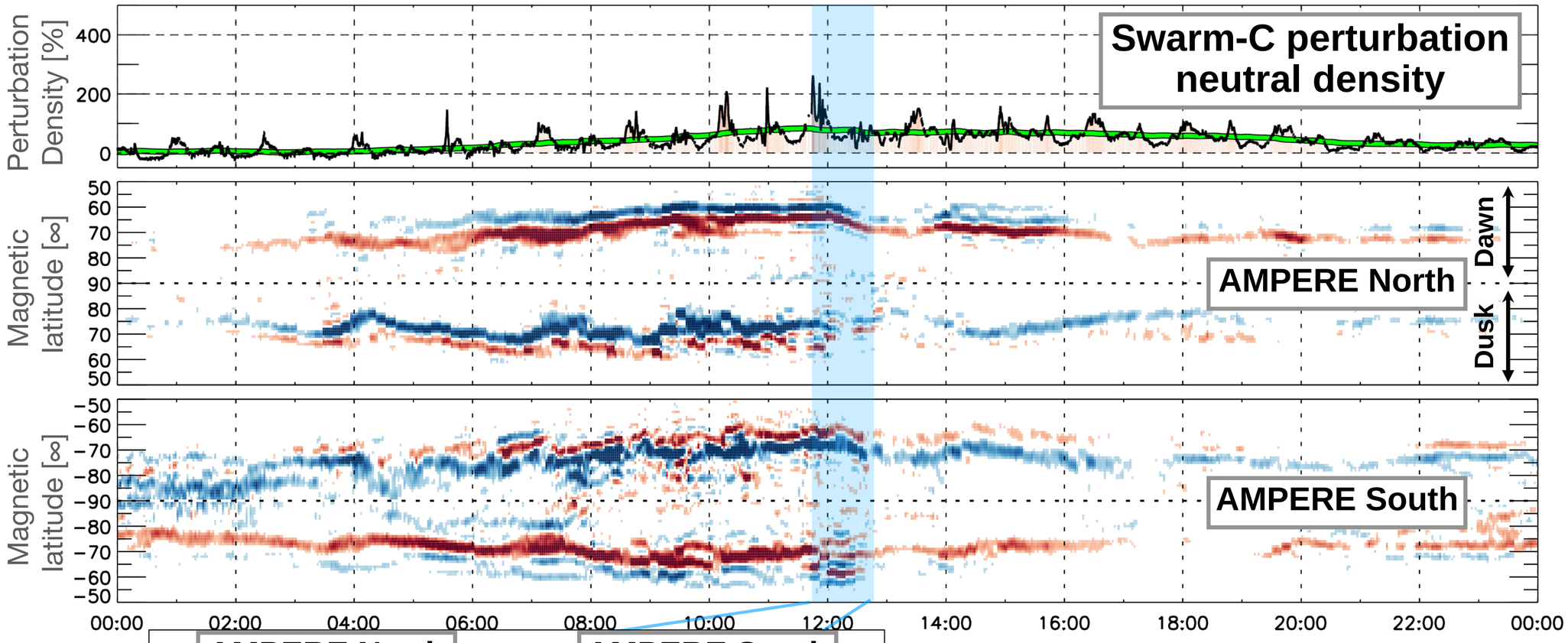
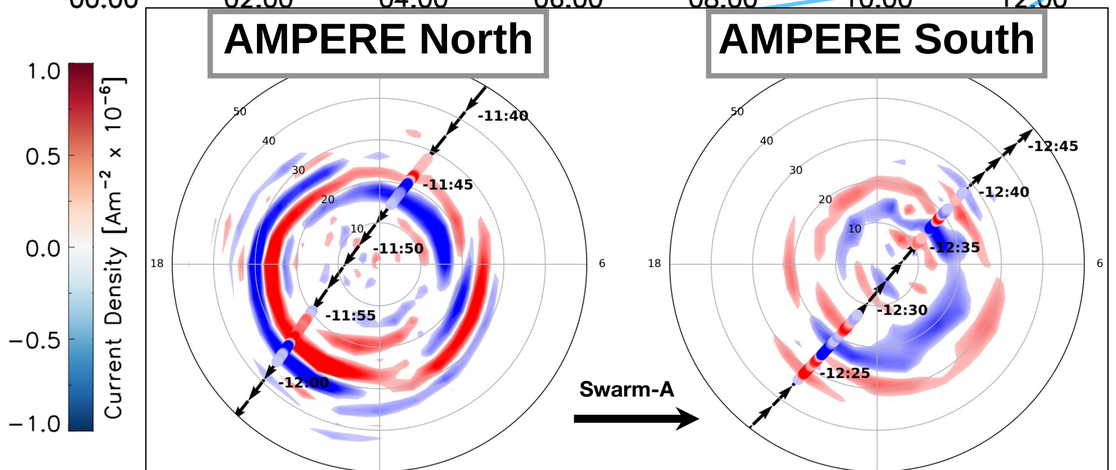
The role of the ionosphere

Launch day - 2022/02/03

Dusk - dawn keograms of AMPERE field-aligned currents

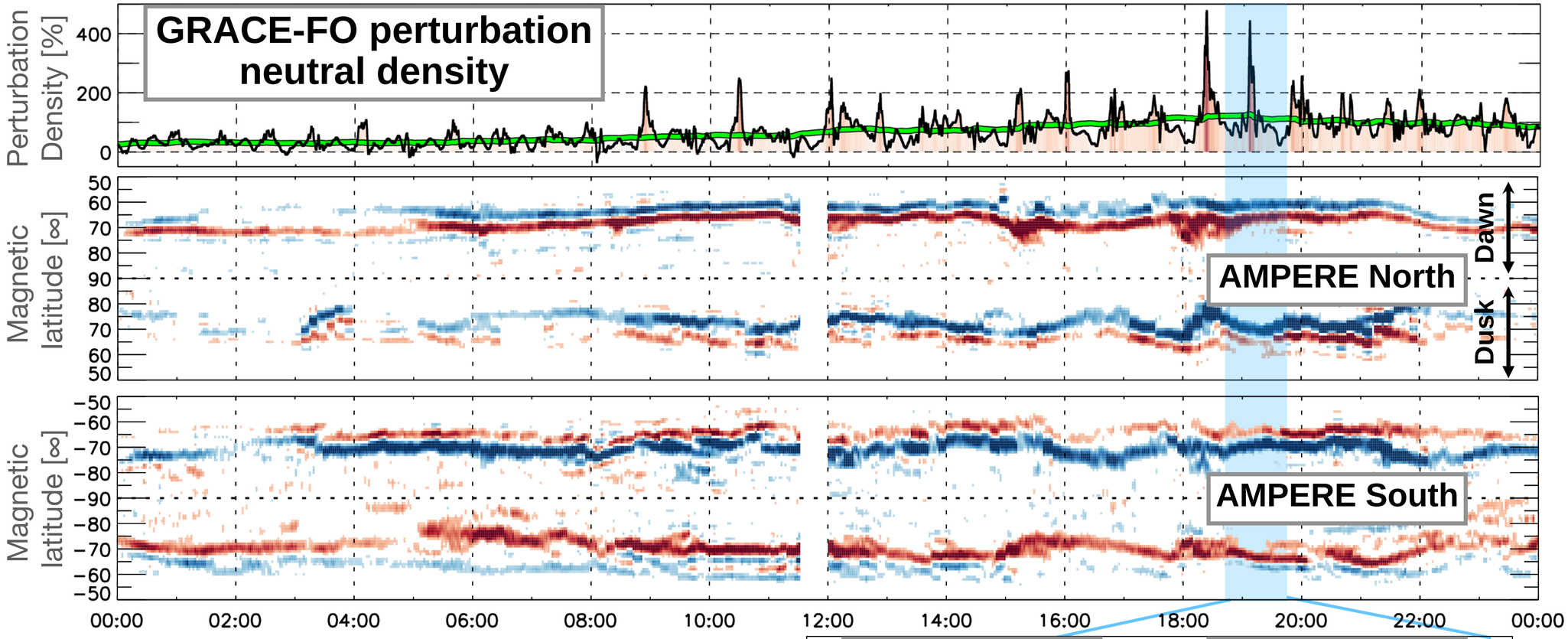




FACs reduce, neutral density remains sustained

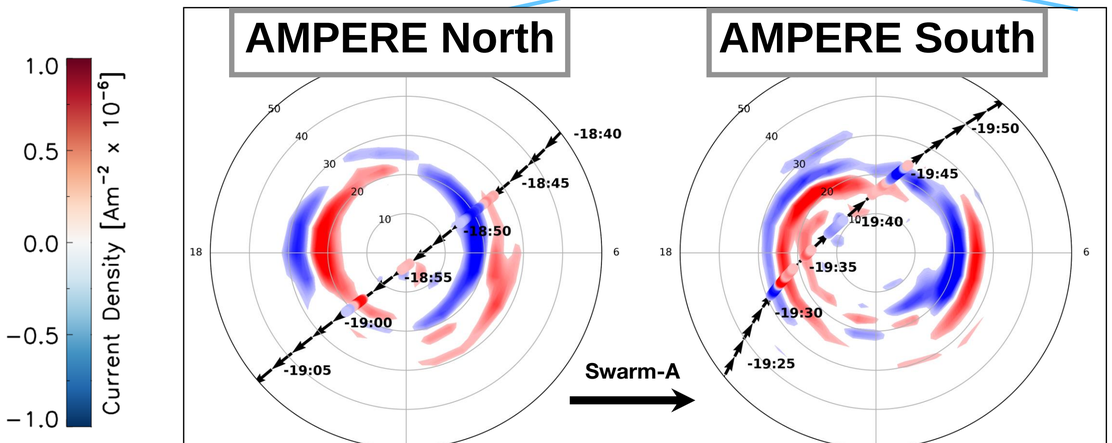
The role of the ionosphere

Day after launch - 2022/02/04



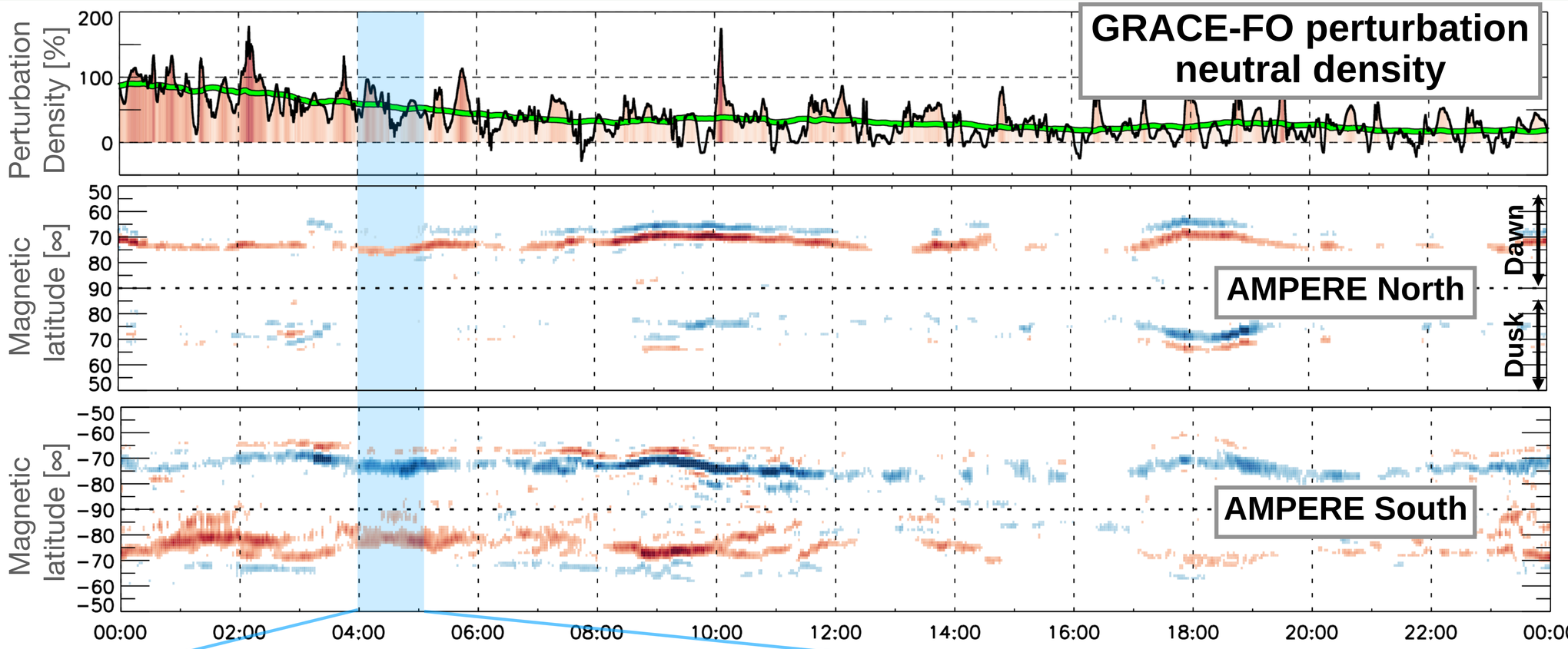
2nd storm hits and increases the density again

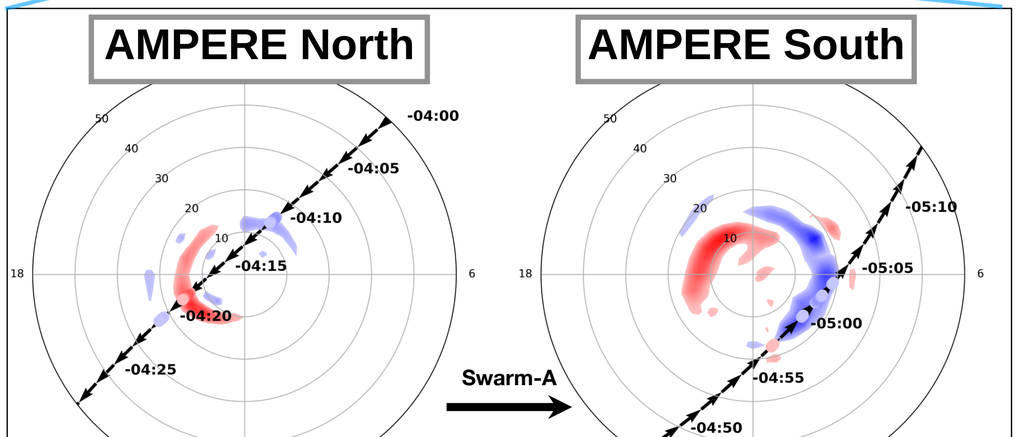
FACs are more symmetric between hemispheres

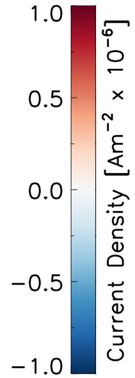


The role of the ionosphere

Two days after launch - 2022/02/05







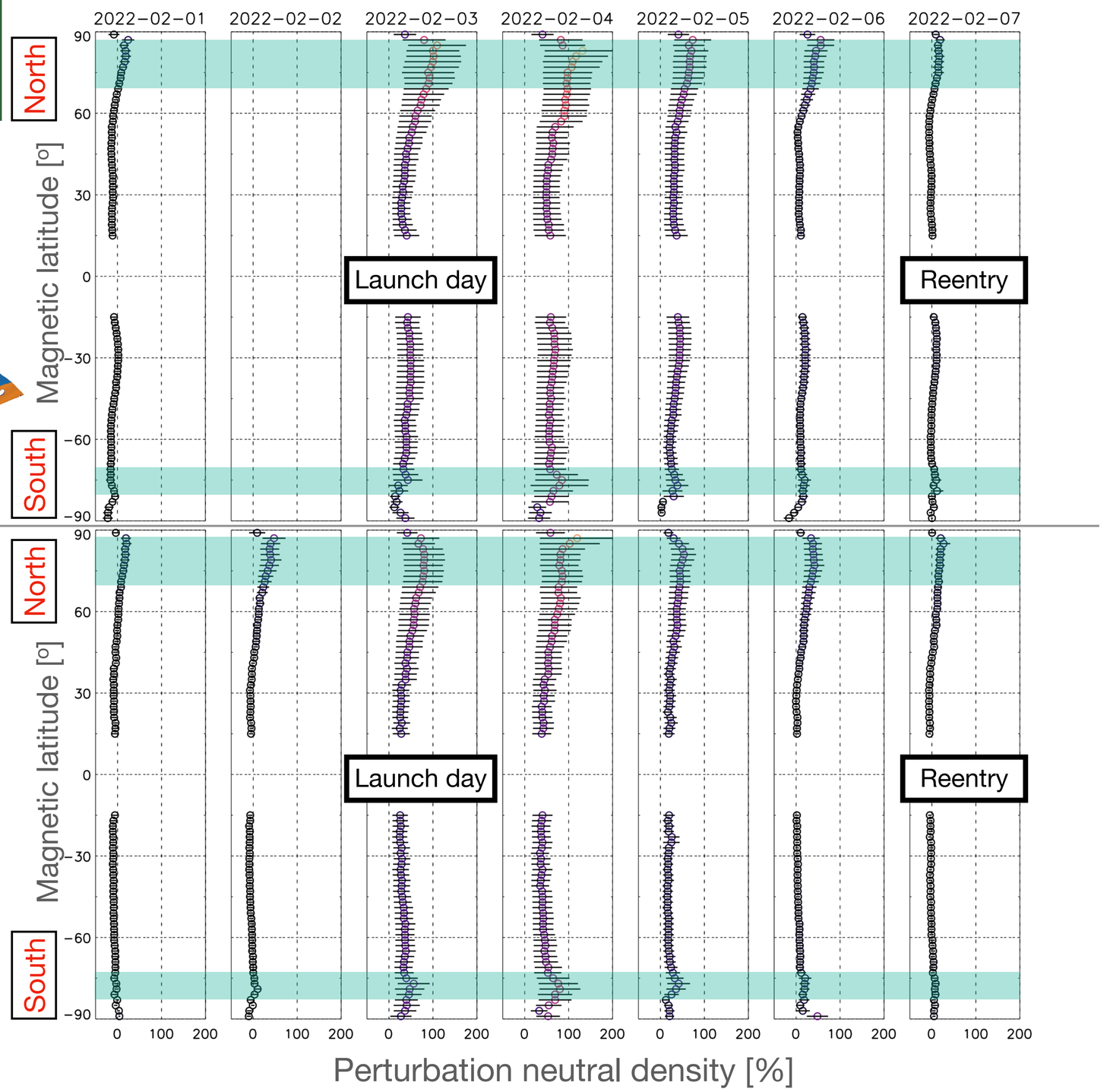
Density takes a day to recover after M-I forcing stops

Bonus: Mean latitude profiles

Mean perturbation density latitude profiles

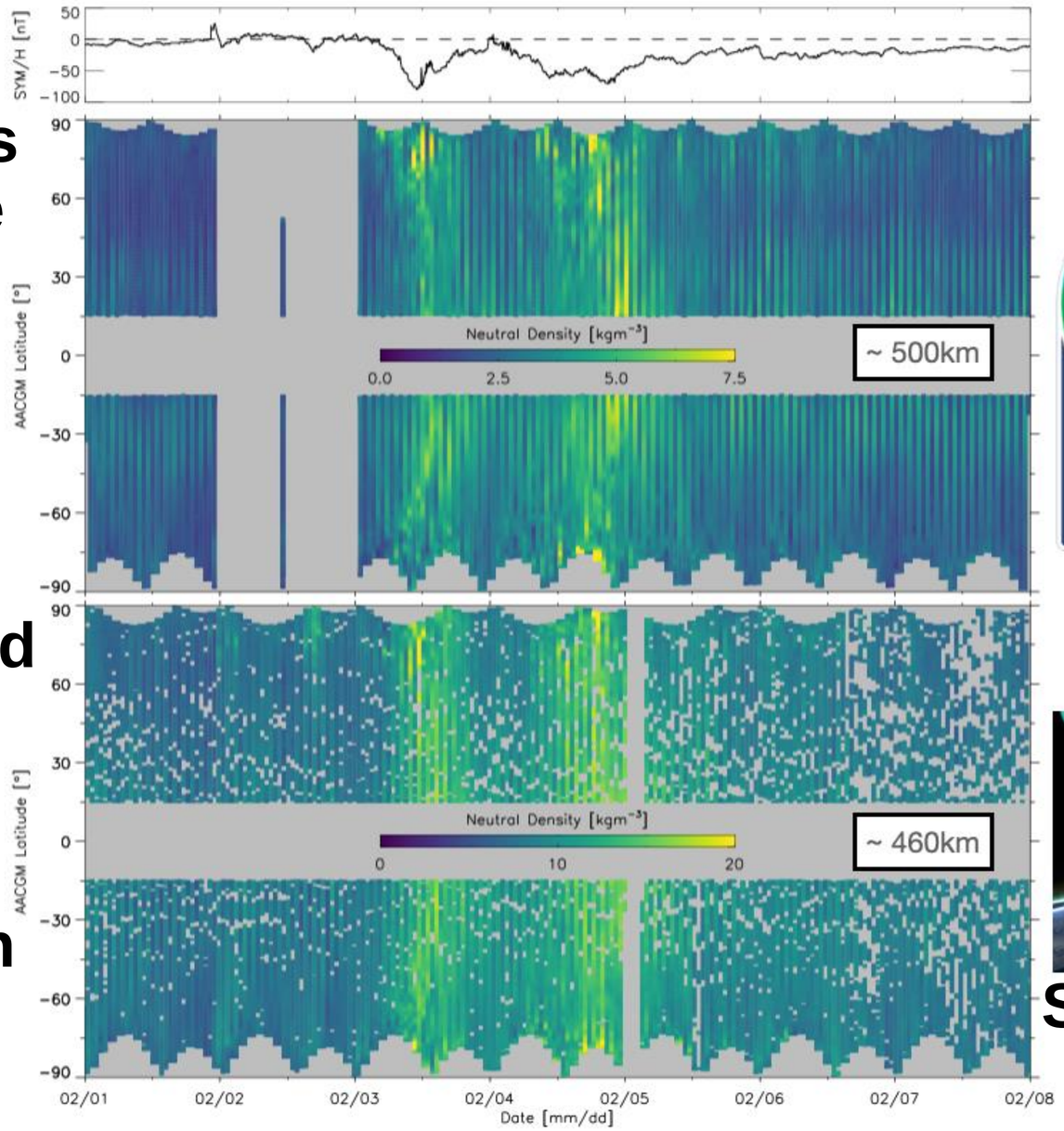
Enhancements consistently higher in the northern cusp - due to FAC asymmetries?

High latitude perturbations still apparent two days after 2nd storm



Summary

- **Thermospheric neutral densities and magnetosphere-ionosphere field-aligned currents are examined for the Starlink destruction event**
- **When M-I forcing stops, the thermosphere remains perturbed for days afterwards**
- **Significant hemispheric asymmetries exist between both densities and FACs**



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Summary

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The 2022 Starlink Geomagnetic Storms: Global Thermospheric Response to a High-Latitude Ionospheric Driver

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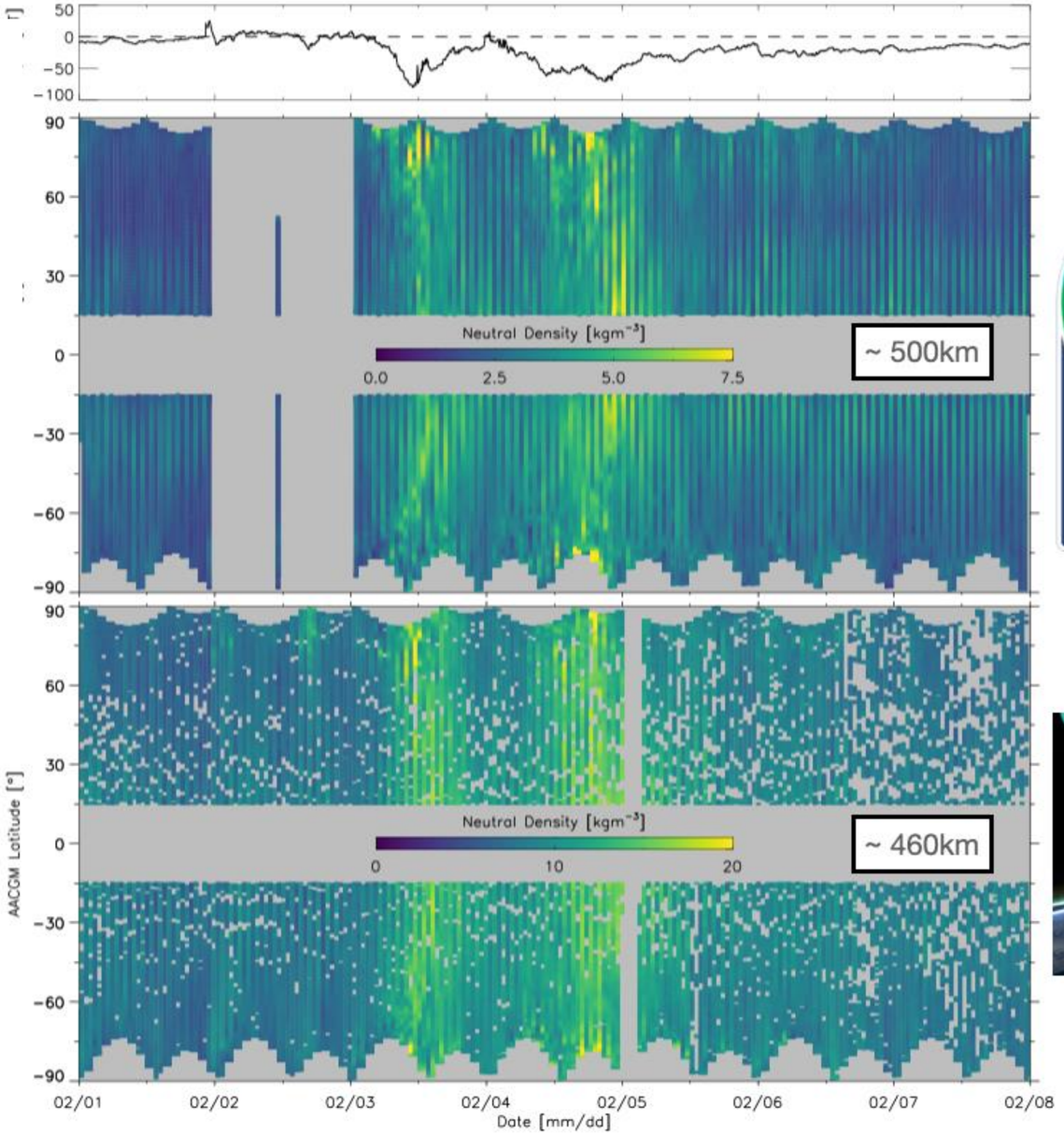
First published: 01 February 2024 | https://doi.org/10.1029/2023SW003748



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