

Penetrating electric study using ICON observations & MAGE simulations

*Qian Wu, Wenbin Wang, Dong Lin, Liying Qian (NCAR)
Yongliang Zhang (APL)*

*NSF NCAR/HAO
GIGI Workshop Boulder Co Sep 2024*

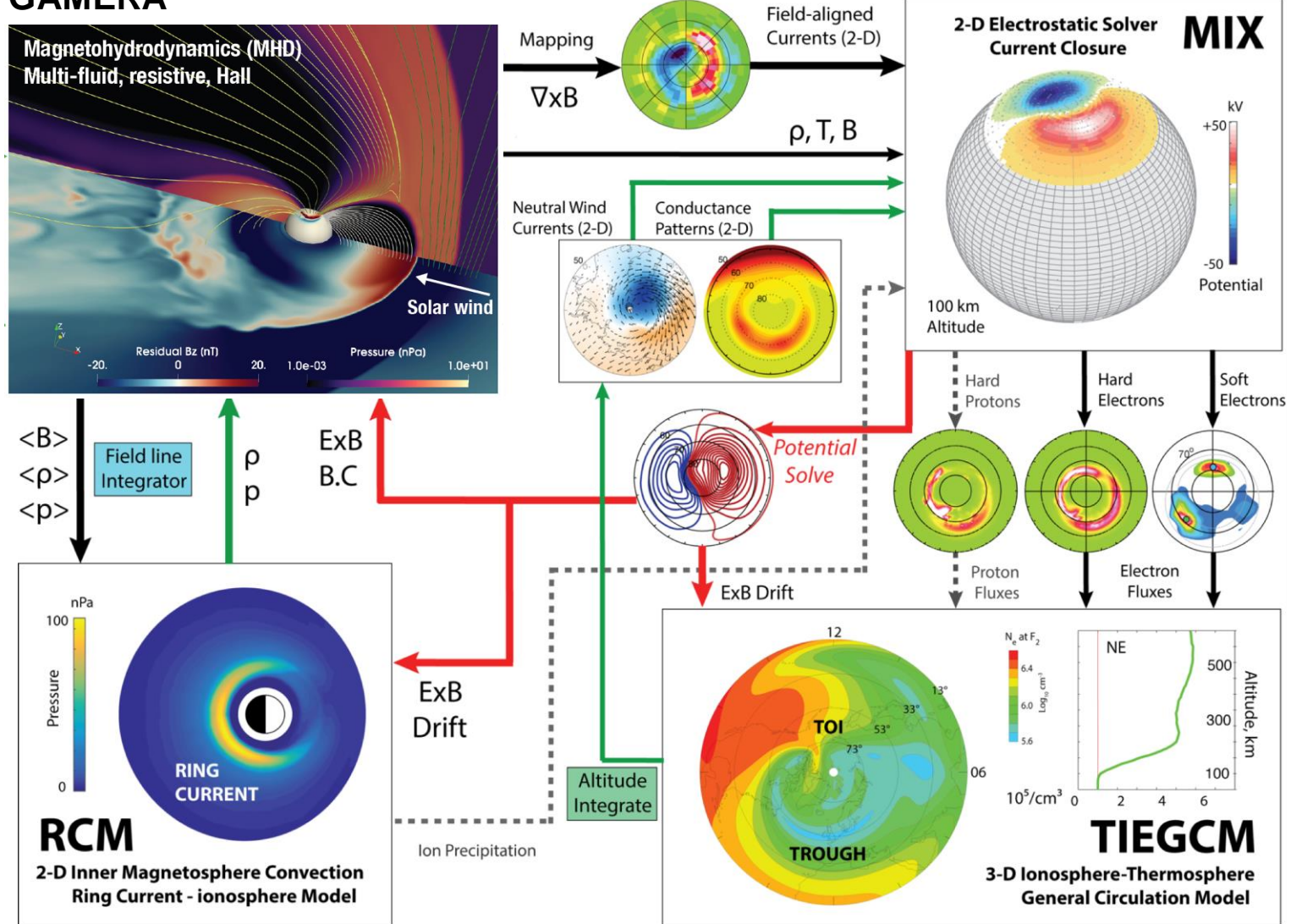


Overview

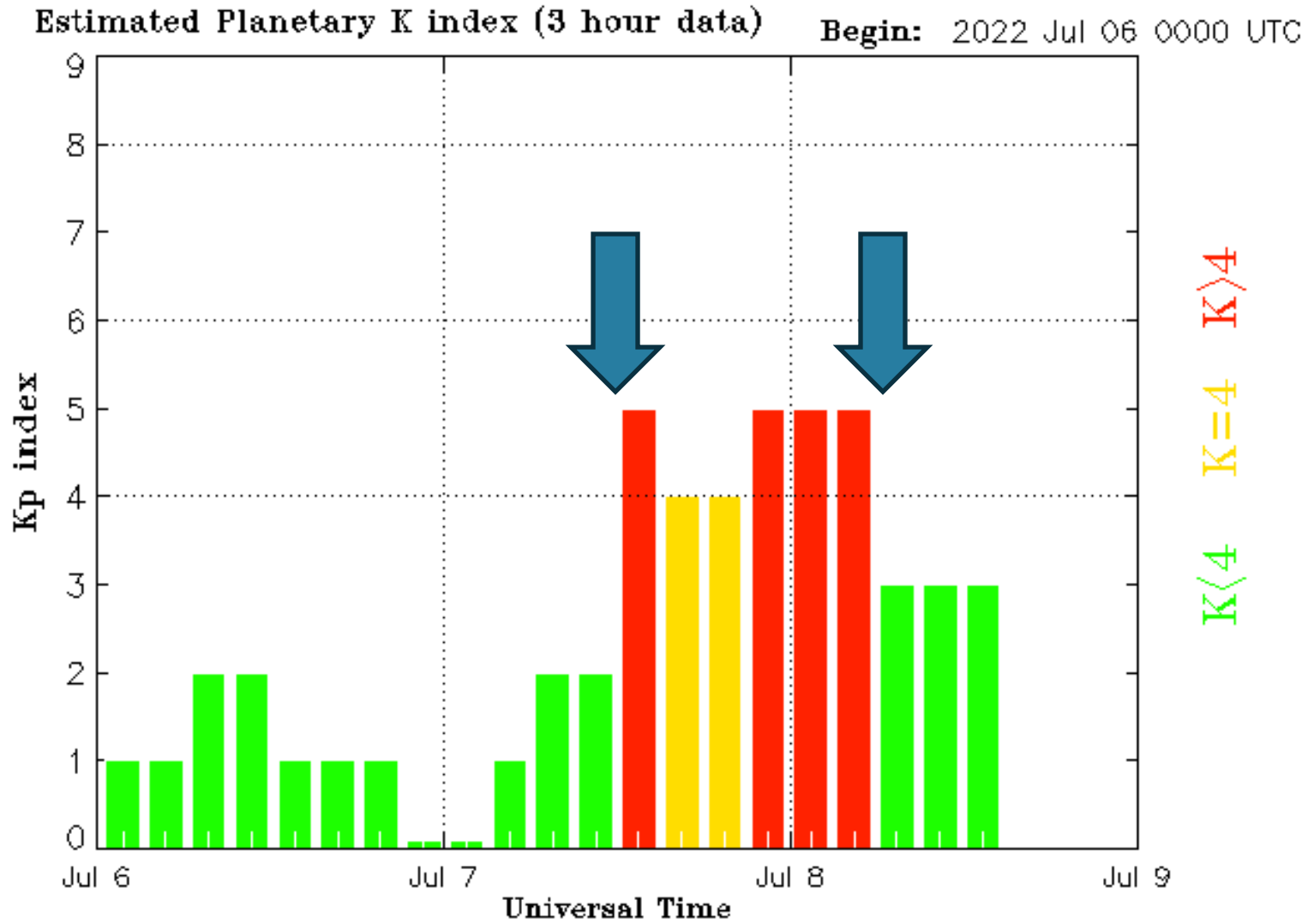
- ❖ Equatorial ionosphere can feel direct penetrating electric field and slow disturbed electric field.
- ❖ It will be a great interest to examine the penetrating electric field with/without disturbed electric field.
- ❖ The recently developed magnetospheric and ionospheric coupling model GTR (GAMERA-TIEGCM-RCM) is well suited for study penetrating electric field. GTR is part of the Multiscale Atmosphere-Geospace Environment (**MAGE**) modeling effort. We will simulate the penetrating electric field effect.
- ❖ Additionally, we will use the observations from **ICON** to validate the simulation results. The ion drift and neutral winds are particularly important for understanding the equatorial dynamo.

MAGE (Multiscale Atmosphere-Geospace Environment)

GAMERA



July 7-8 2022 Storm Event

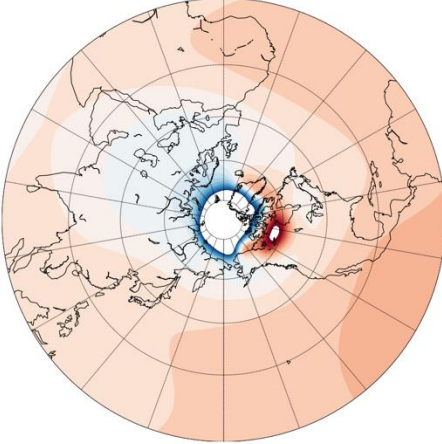


Updated 2022 Jul 8 15:30:08 UTC

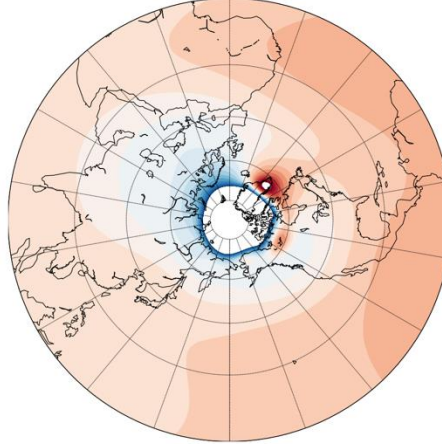
NOAA/SWPC Boulder, CO USA

Hemispheric Potential Map 12-13 UT July 7, 2022

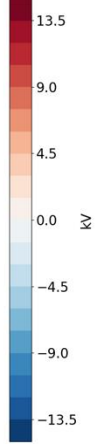
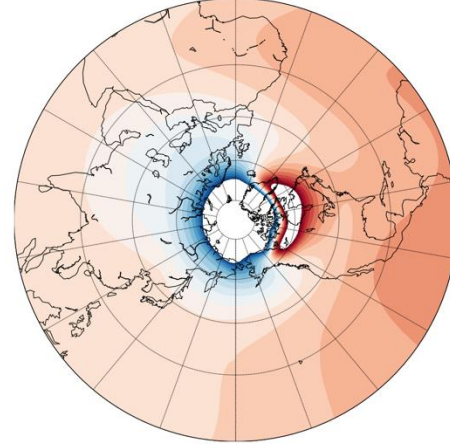
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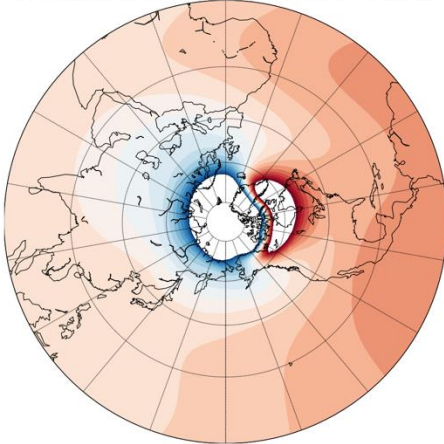
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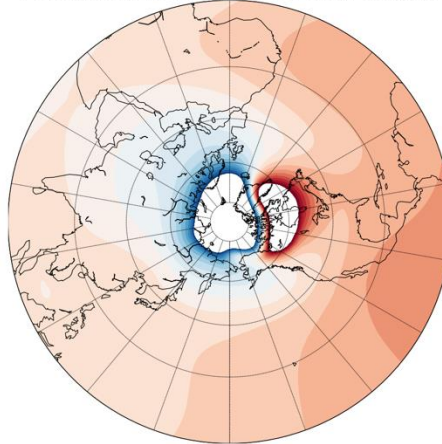
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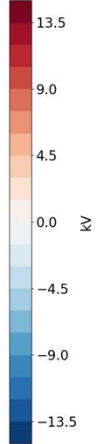
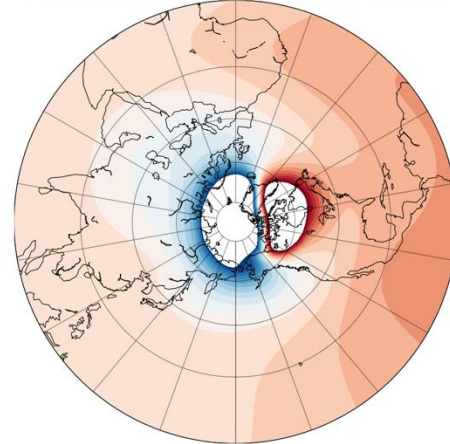
MAGE 2022 07-07 12:31 UT CPCP 101. kV



MAGE 2022 07-07 12:41 UT CPCP 100. kV

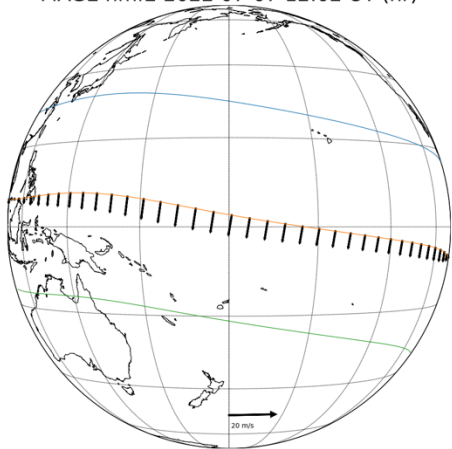


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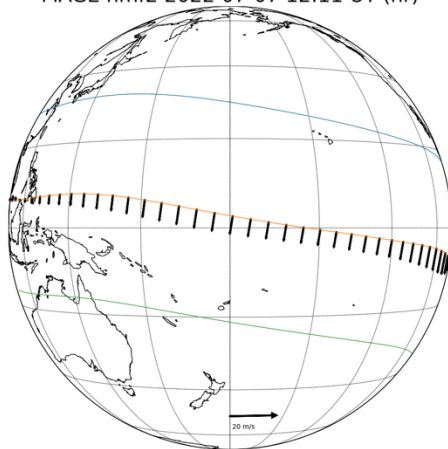


Equatorial Vertical Ion Drift

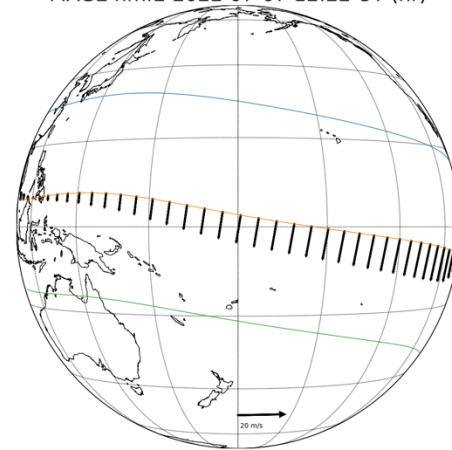
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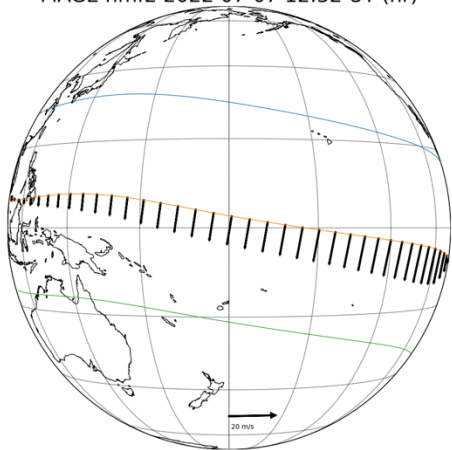
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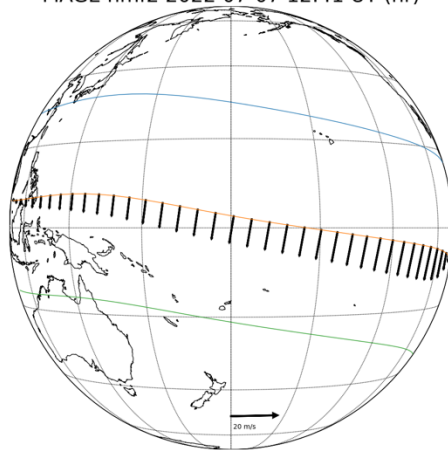
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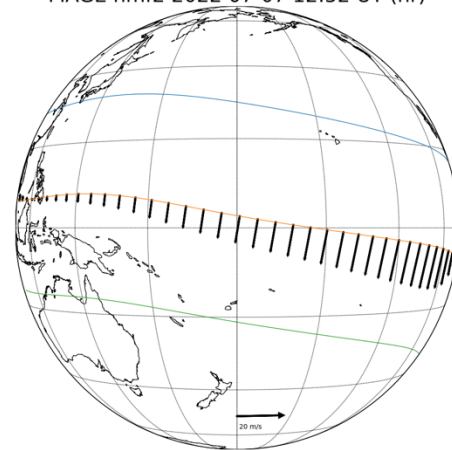
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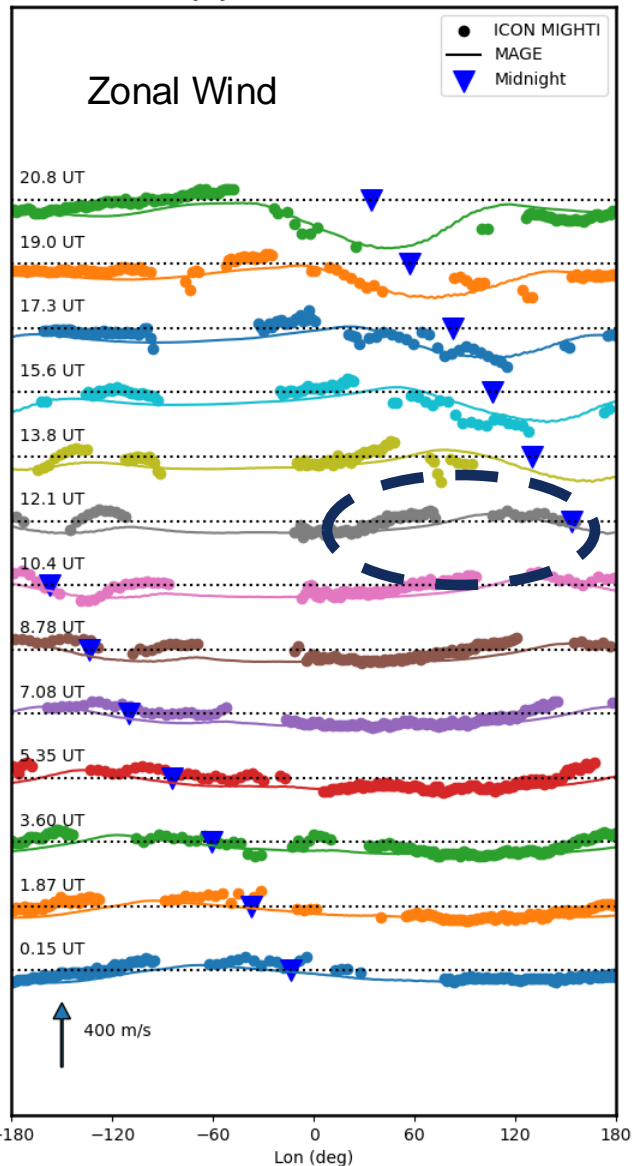


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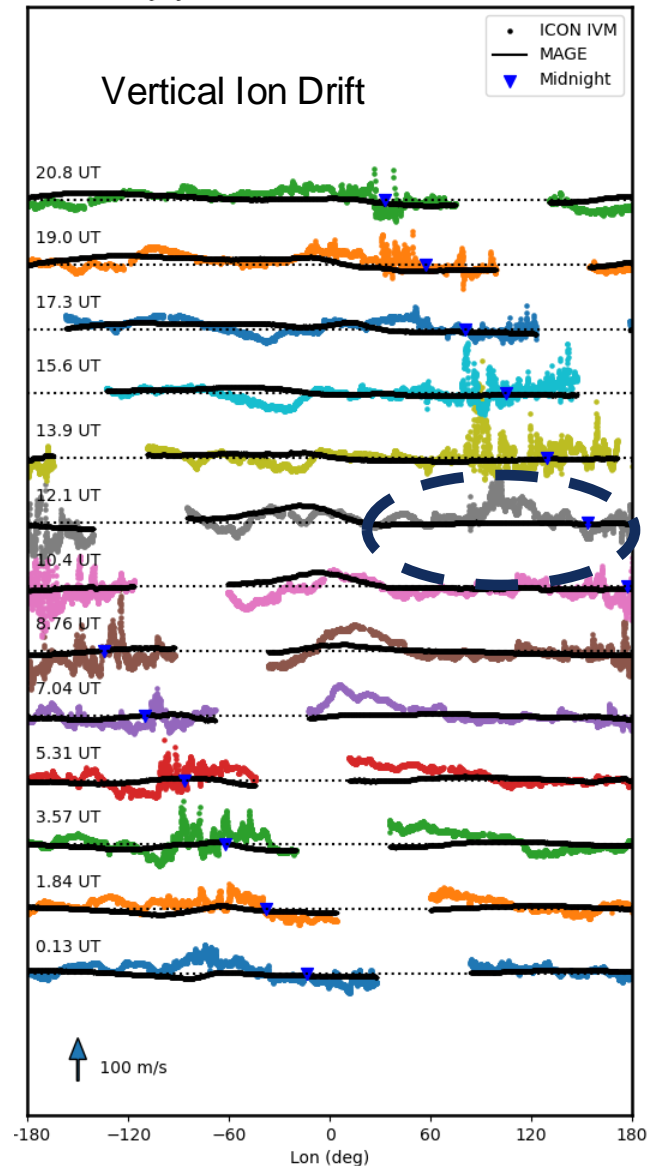


ICON Zonal Wind and Vertical Ion Drift July 7, 2022

ICON MIGHTI and MAGE Model Comparison
July 7, 2022 Zonal Wind

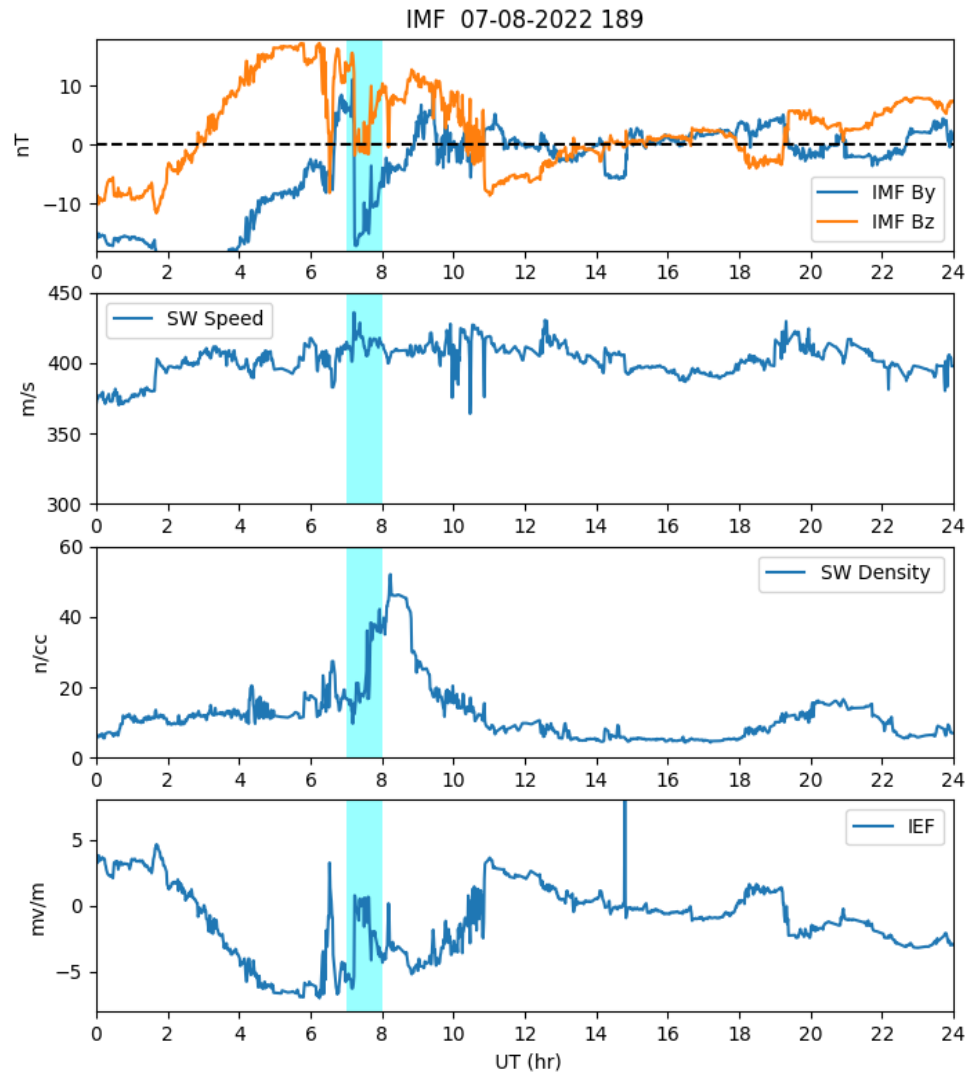


ICON IVM and MAGE Model Comparison
July 7, 2022 EXB Meridional Ion Drift



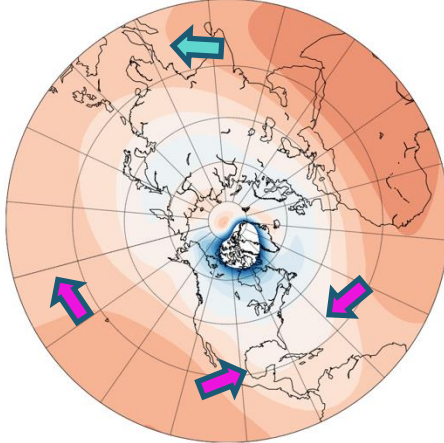
12-13 UT
➡

July 8 2022 IMF Conditions

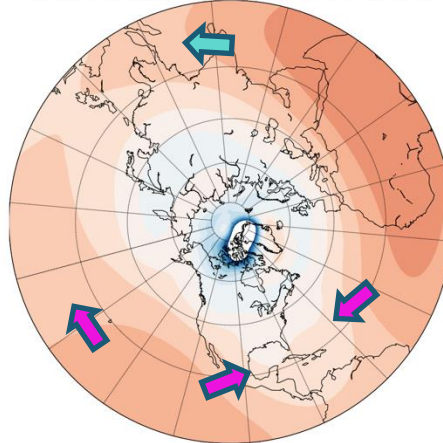


Hemispheric Potential Pattern 7-8 UT July 8 2022

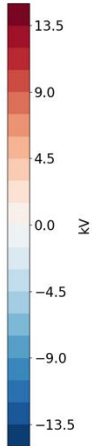
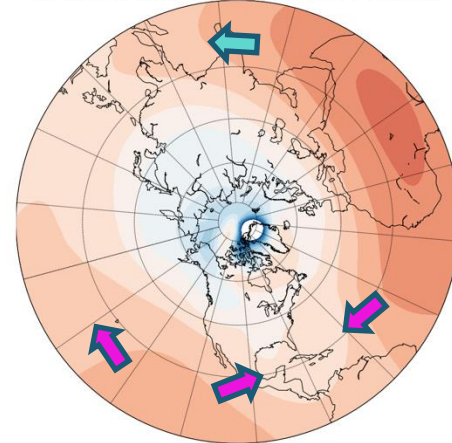
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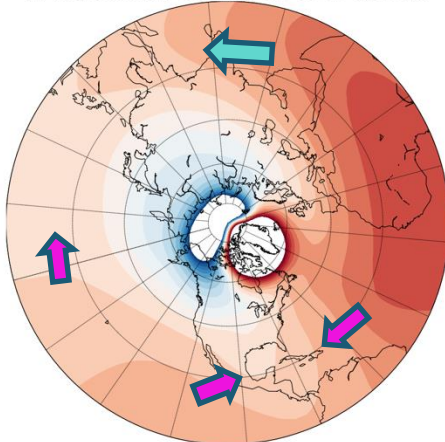
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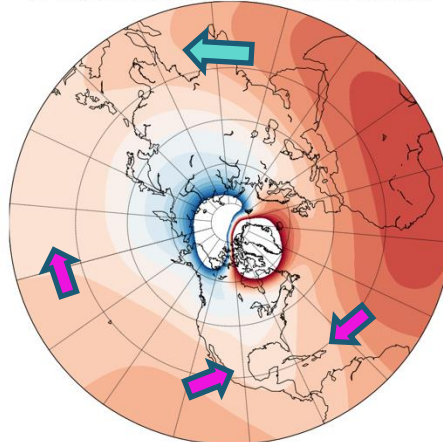
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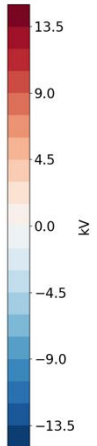
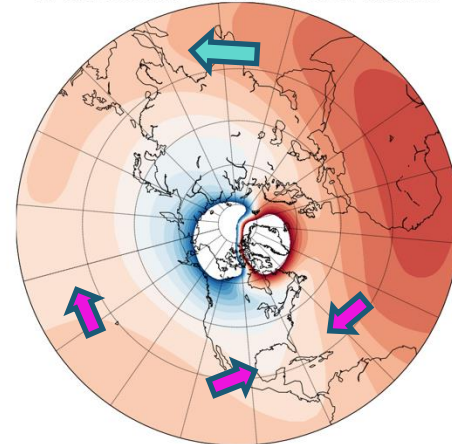
MAGE 2022 07-08 7:31 UT CPCP 93.5 kV



MAGE 2022 07-08 7:42 UT CPCP 124. kV



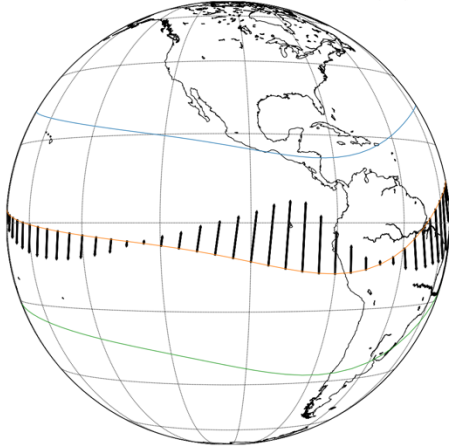
MAGE 2022 07-08 7:52 UT CPCP 116. kV



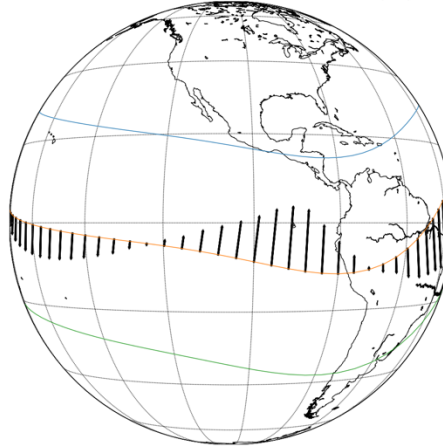
Pressure bulge reduced dawn/dusk potential difference

Equatorial Vertical Ion Drift

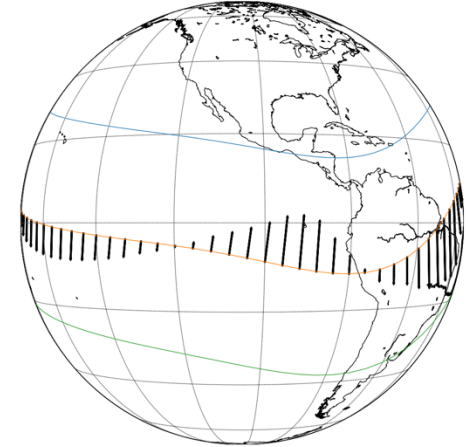
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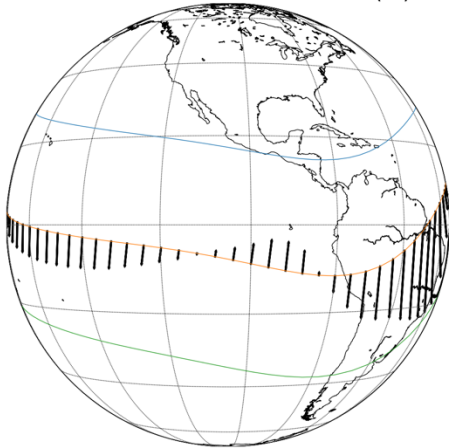
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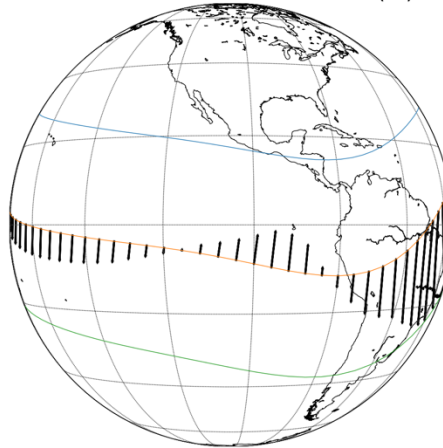
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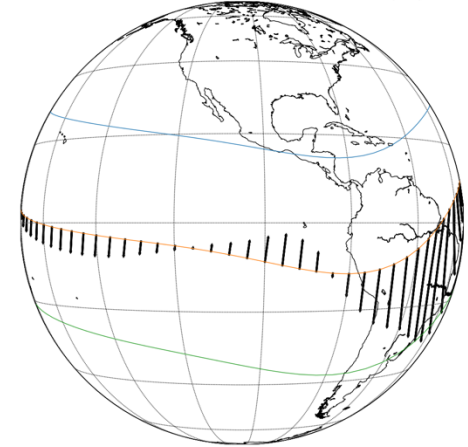
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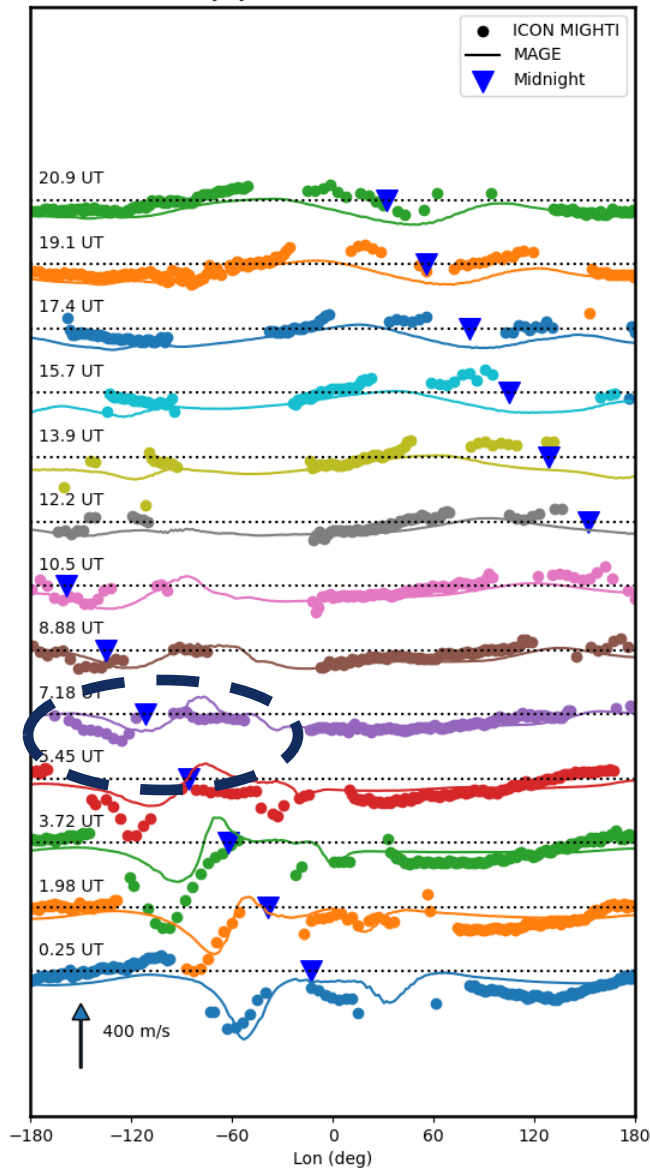


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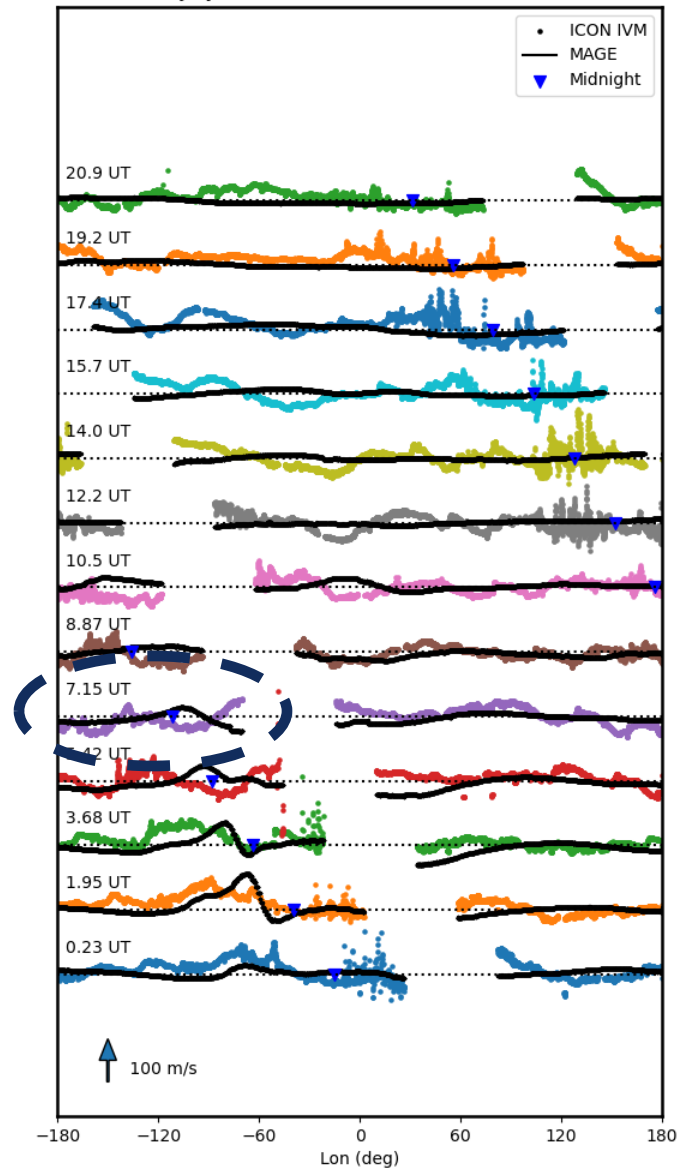
ICON Zonal Wind and Vertical Ion Drift July 8, 2022

ICON MIGHTI and MAGE Model Comparison
July 8, 2022 Zonal Wind

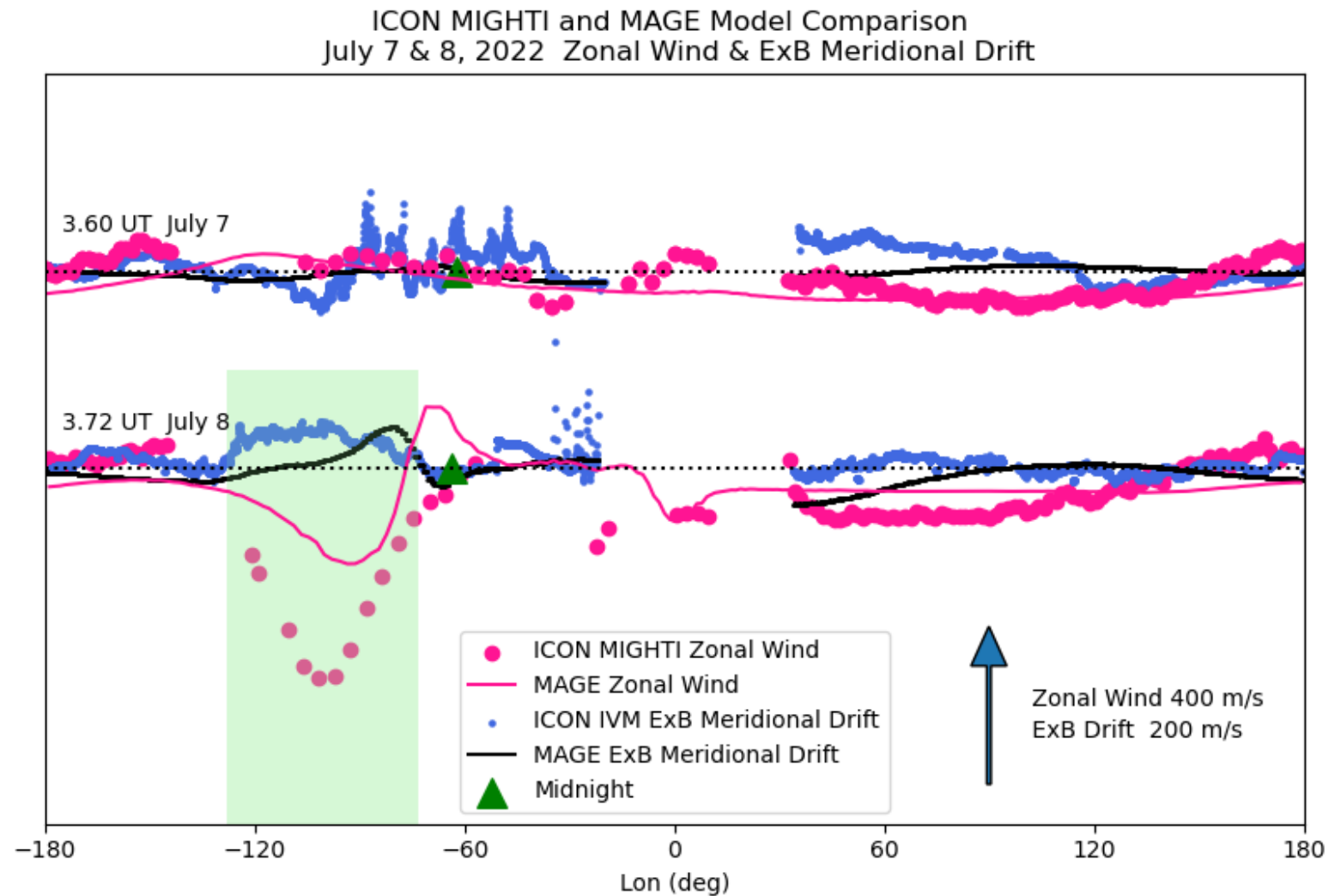


7-8 UT

ICON IVM and MAGE Model Comparison
July 8, 2022 EXB Meridional Ion Drift



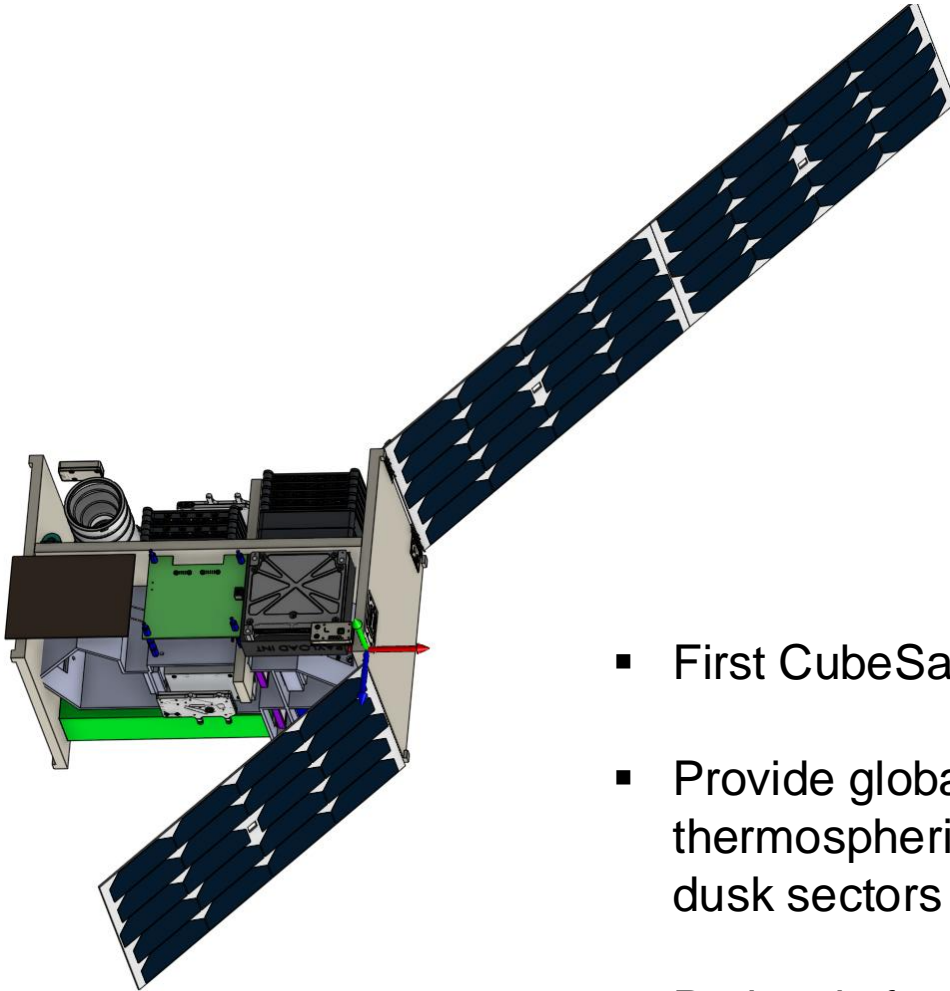
Quiet and Disturbed Electric Field ICON Observation vs MAGE Simulation



Summary

- ❖ The July 7-8, 2022 geomagnetic storm event provides an opportunity to examine the penetrating and disturbed electric fields.
- ❖ Electric field without disturbance is more uniform on day and nightside
- ❖ Disturbed electric field introduces structures on the nightside.
- ❖ Penetrating electric field reduces the nightside disturbed electric field.
- ❖ MAGE simulation of the disturbed electric field and zonal winds have a good agreement with ICON observations.

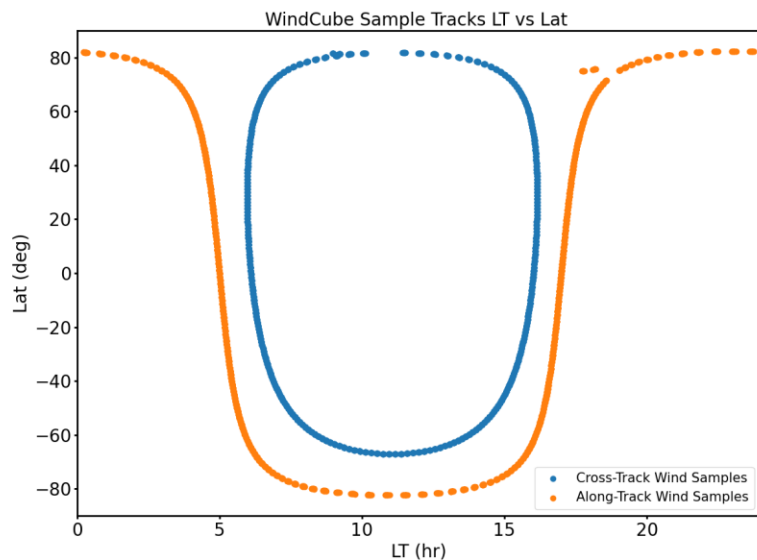
WindCube



- First CubeSat FPI (12 U)
- Provide global coverage of thermospheric winds in the dawn and dusk sectors
- Project is funded by NASA

WindCube Coverage

LT vs Lat



Plan to have a sun synch dawn/dusk orbit

Lon vs Lat

