

Applying midnight temperature maximum wind data to ESF prediction

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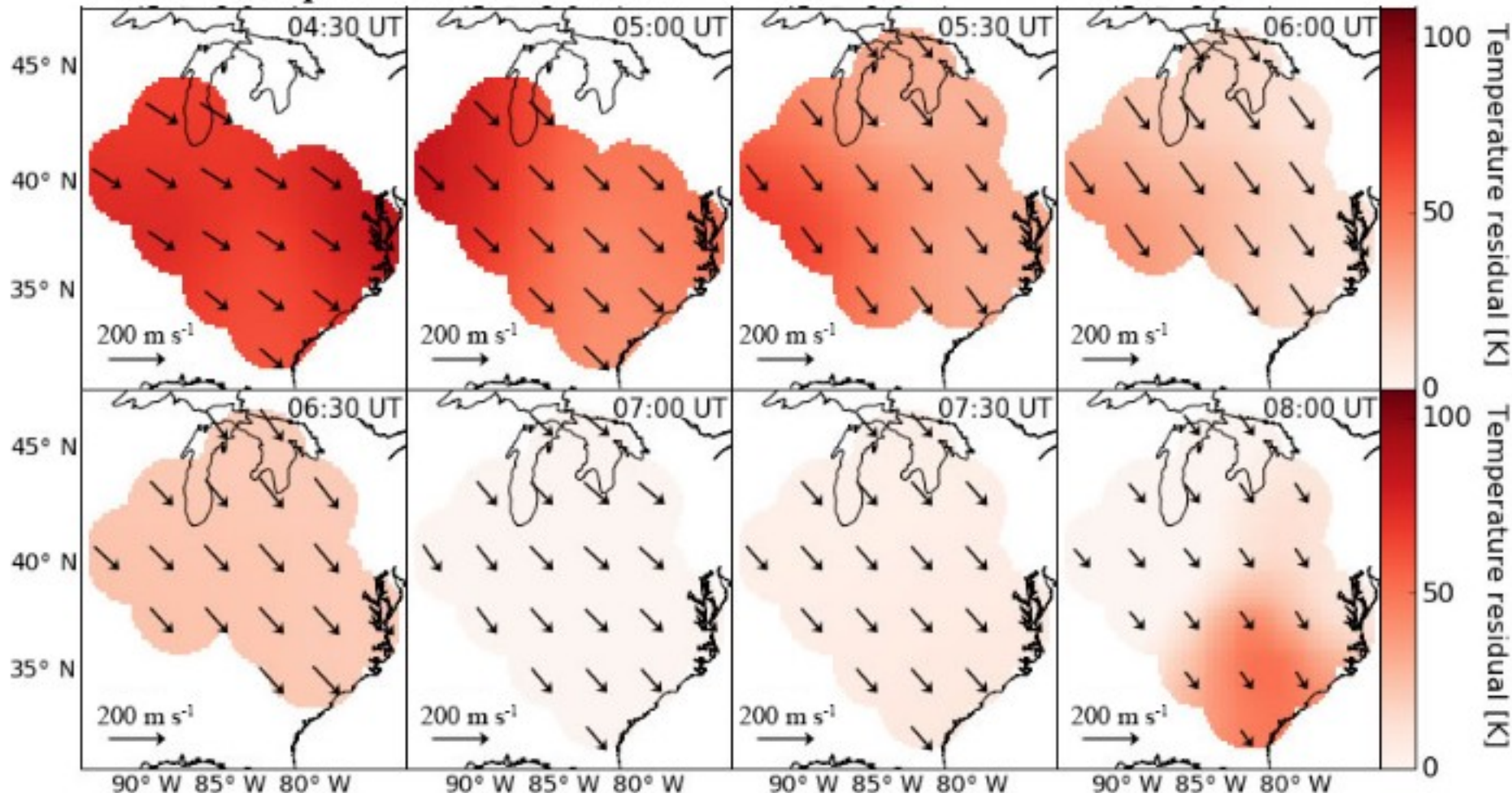
Winds from the NATION dataset



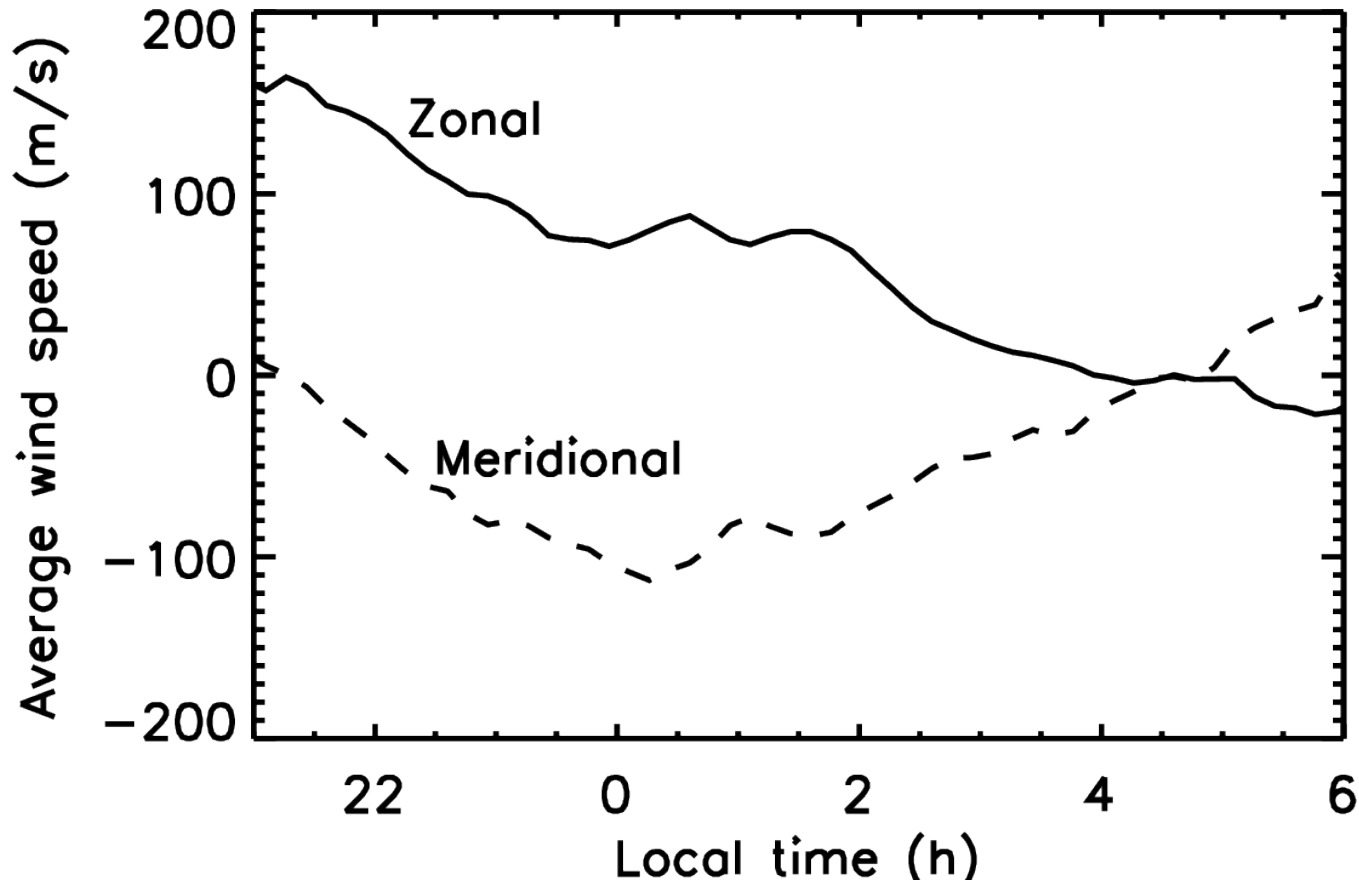
NRL PPD

North American Thermosphere Ionosphere Observing Network:

R. L. A. Mesquita et al.: Mid-latitude MTM (Ann Geophys 2018)



NATION winds show MTM



MTM meridional winds are equatorward; later poleward

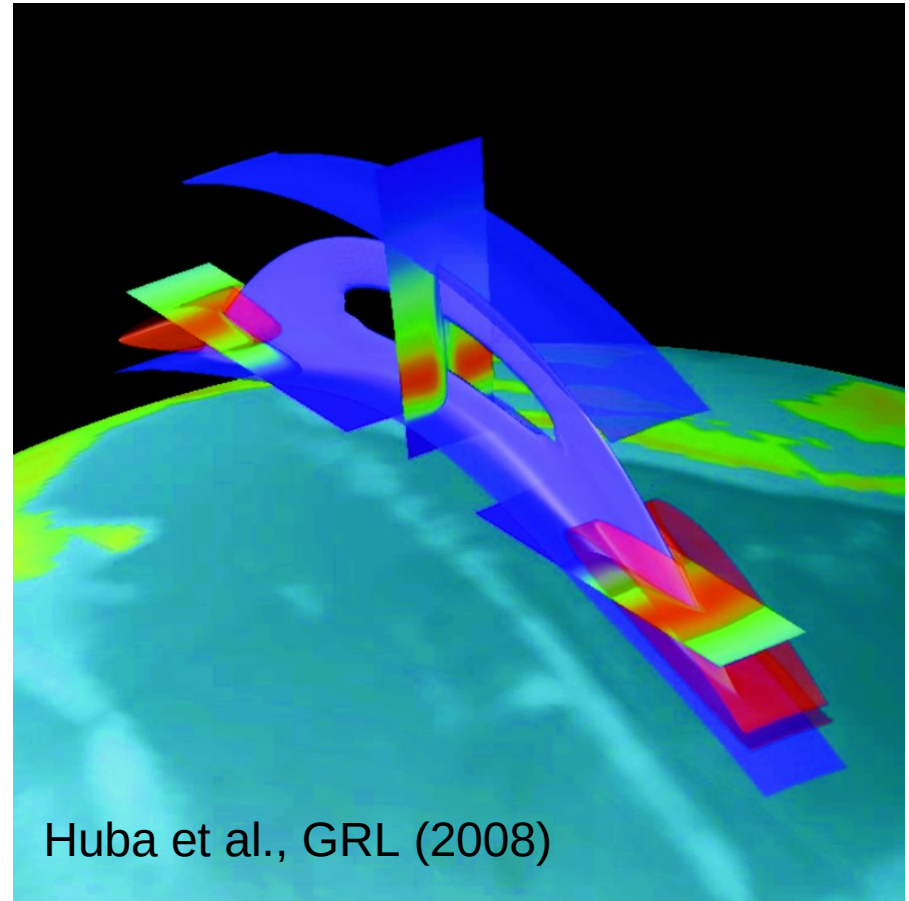
SAMI3/ESF

SAMI3/ESF is SAMI3
constrained to a narrow
wedge of the ionosphere

- O^+ H^+ He^+ N^+ O_2^+ N_2^+ NO^+
- inertial dynamics along B
- \mathbf{ExB} drifts across B

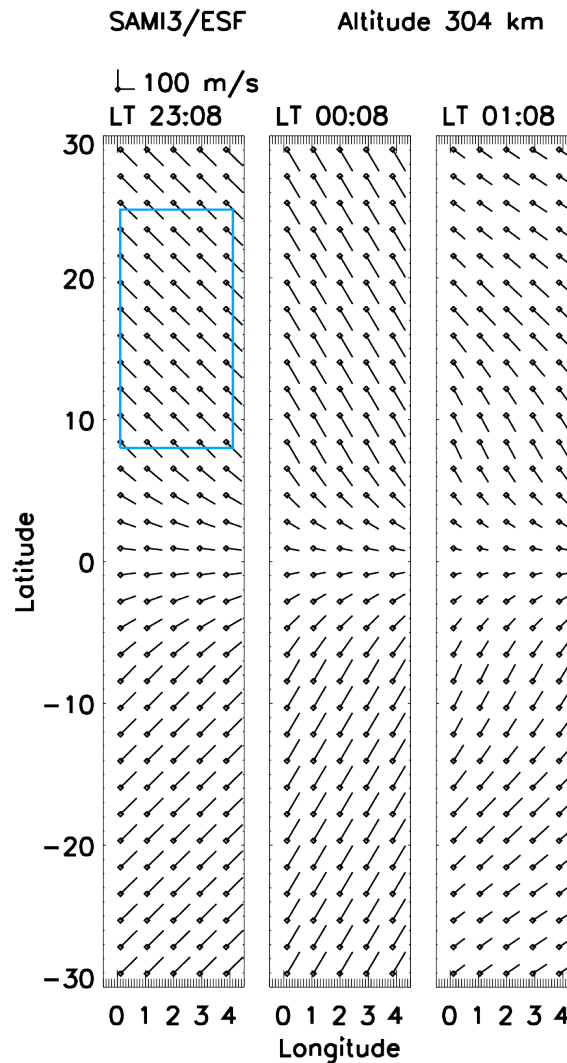
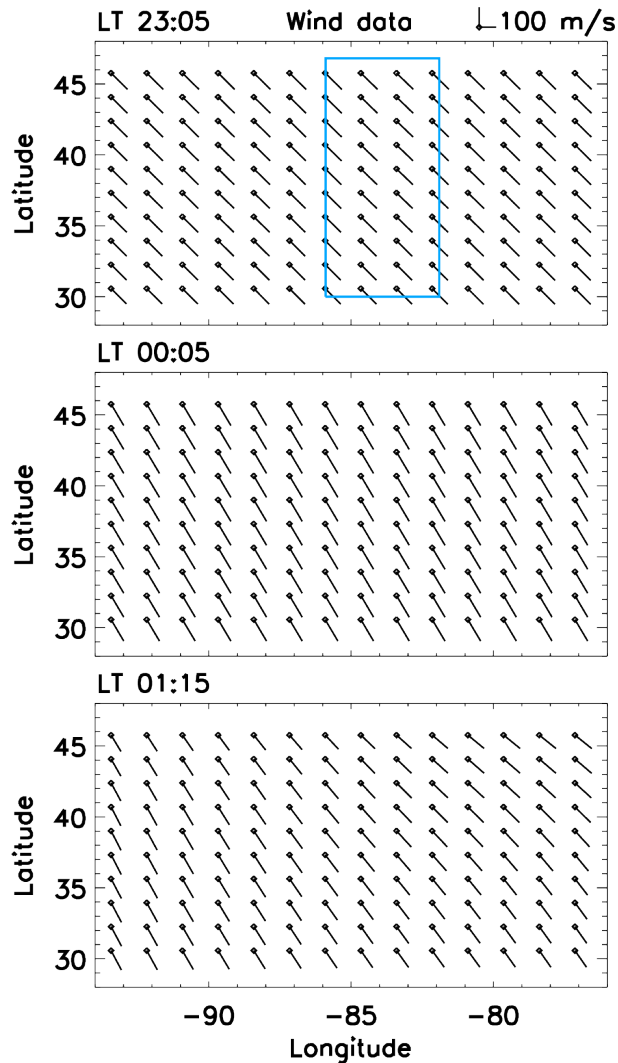
For these simulations

- Day 80
- $F10.7/A = 130$
- Begin at 23h LT



Motivation: MTM winds and post-midnight ESF

NATION winds in SAMI3/ESF



The measured wind pattern is placed in the northern half of the SAMI3 grid.

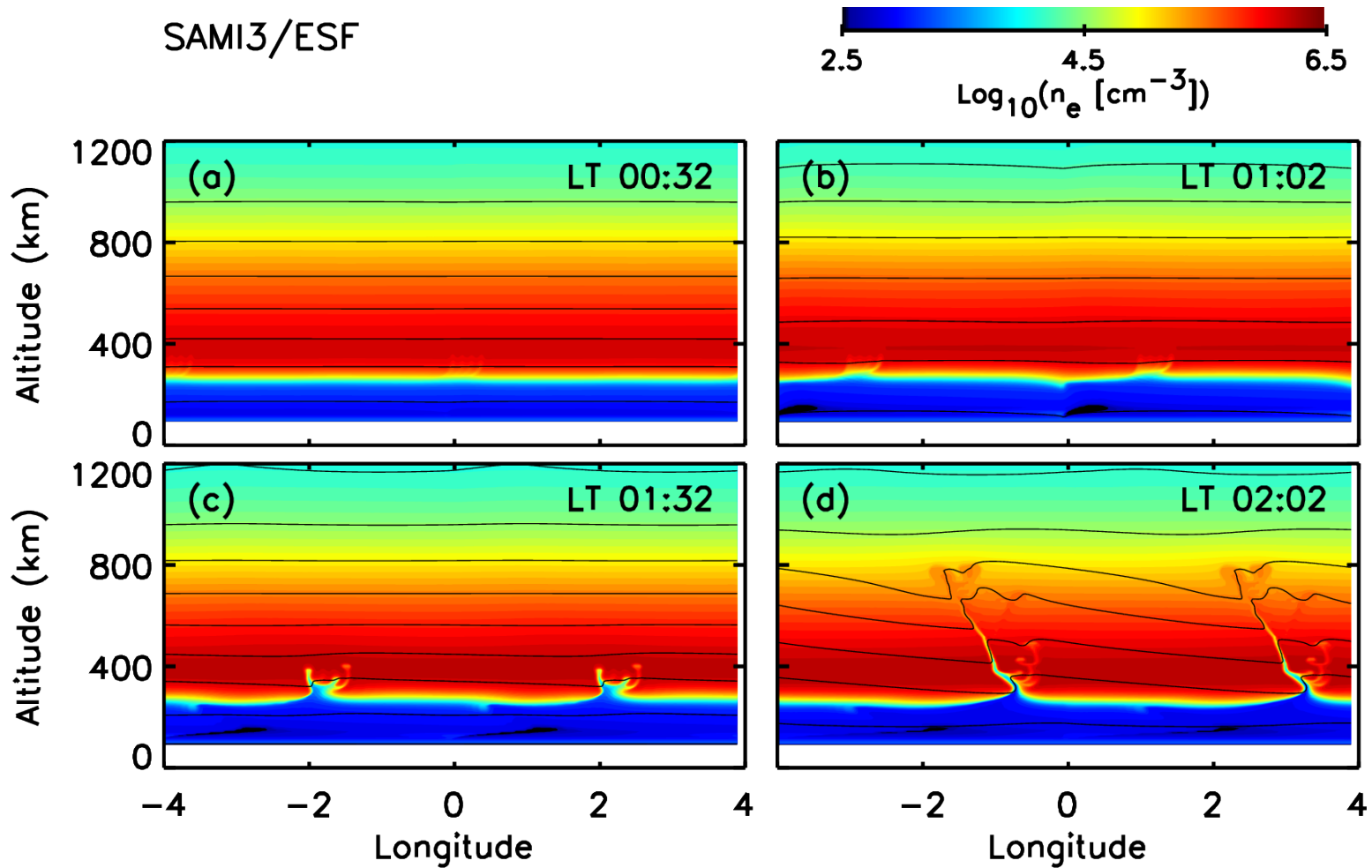
What about the southern half?

We set

$$U_{\text{merid},S} = -U_{\text{merid},N}$$

(speed is indicated by direction of line away from the dot)

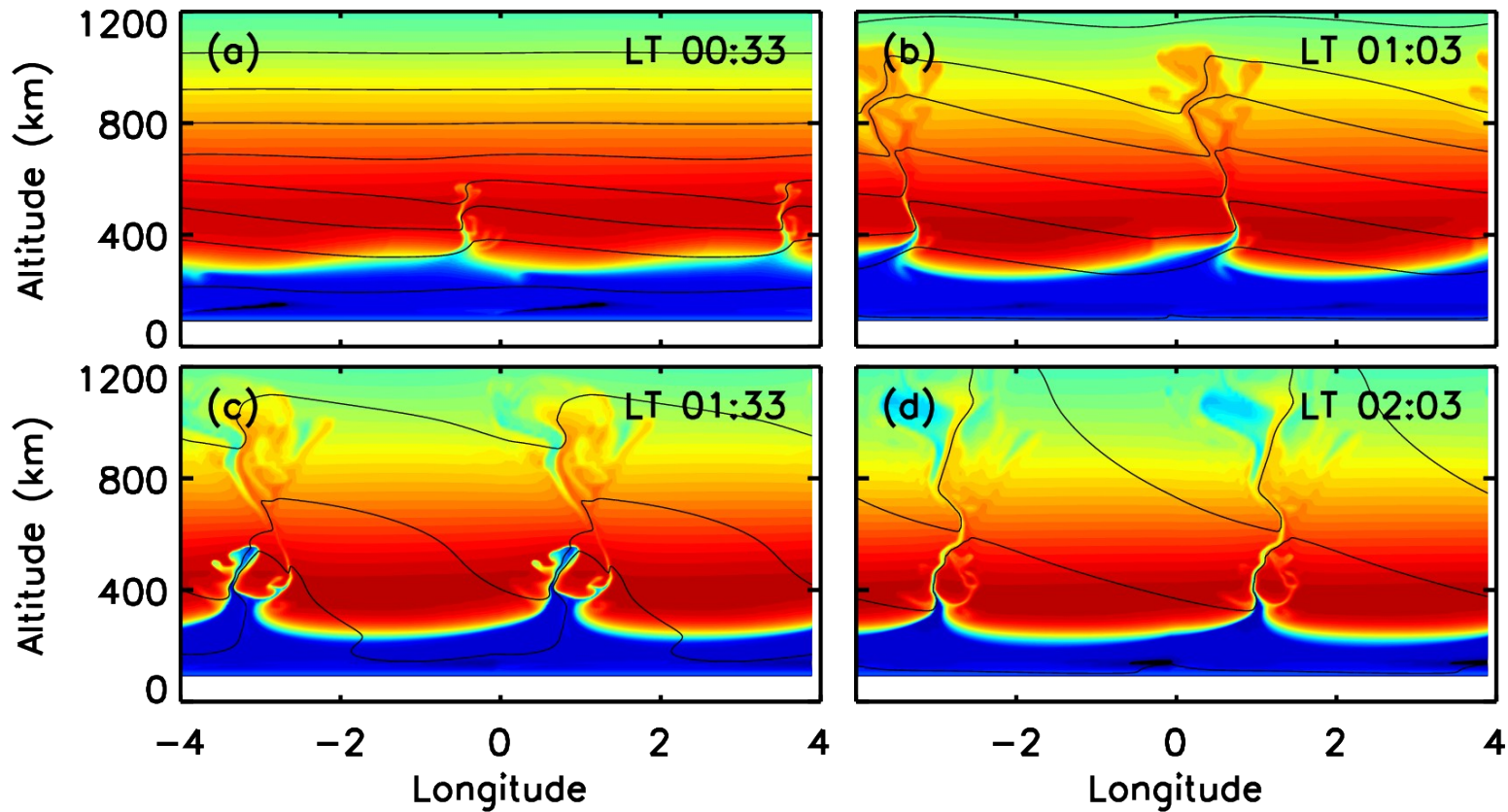
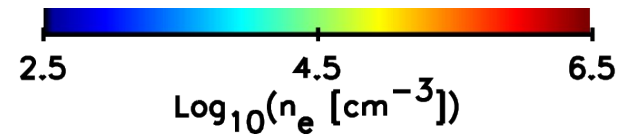
SAMI3/ESF result



ESF grows 3 hours after the initial seed is imposed at 23h LT

SAMI3/ESF result

Winds occur 1 hour earlier



ESF grows much faster if MTM occurs 1 hour earlier

Discussion



Strongest growth associated with strongest converging meridional winds; such winds can occur during the MTM

A converging meridional wind is destabilizing (Huba & Krall, GRL, 2013)

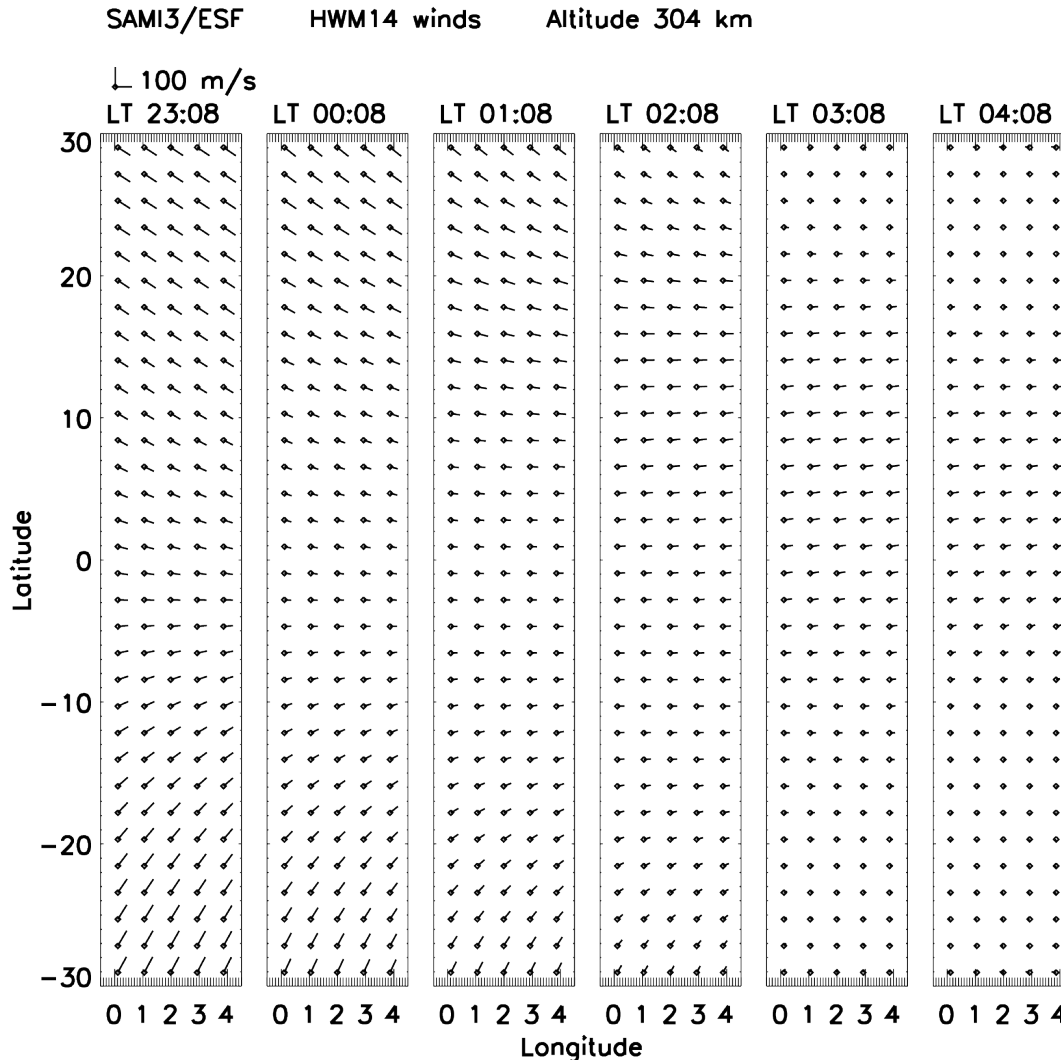
To predict ESF, wind predictions needed in both hemispheres

To predict ESF, wind predictions needed for $|\text{latitude}| < 30^\circ$

Background conditions for the “wedge” code provided by a global model; global wind prediction is also needed

The NATION network is provides an amazing regional wind dataset; something similar is needed to nowcast ESF

Extra: HWM14 winds for day 80



HWM14 for day 80 (equinox) shows a wind pattern similar to MTM winds, but weaker.

HWM14 winds are typical winds for a given day.

MTM occurs about 25% of the time.

HWM14 (Drob et al., 2015)