Impact of uncertainty in high-latitude electrodynamics on the low-mid latitude ionosphere

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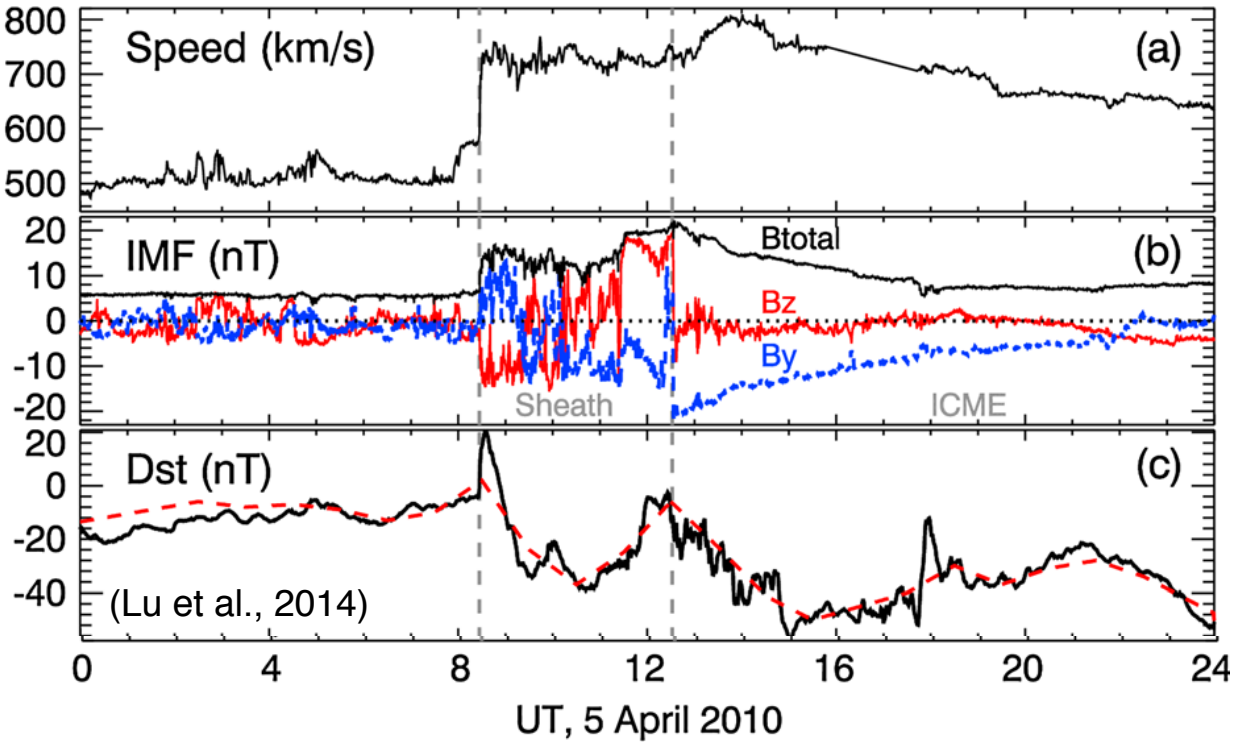
Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM) Simulations

- We perform an ensemble (10 members) of simulations of the April 2010 geomagnetic storm in TIE-GCM

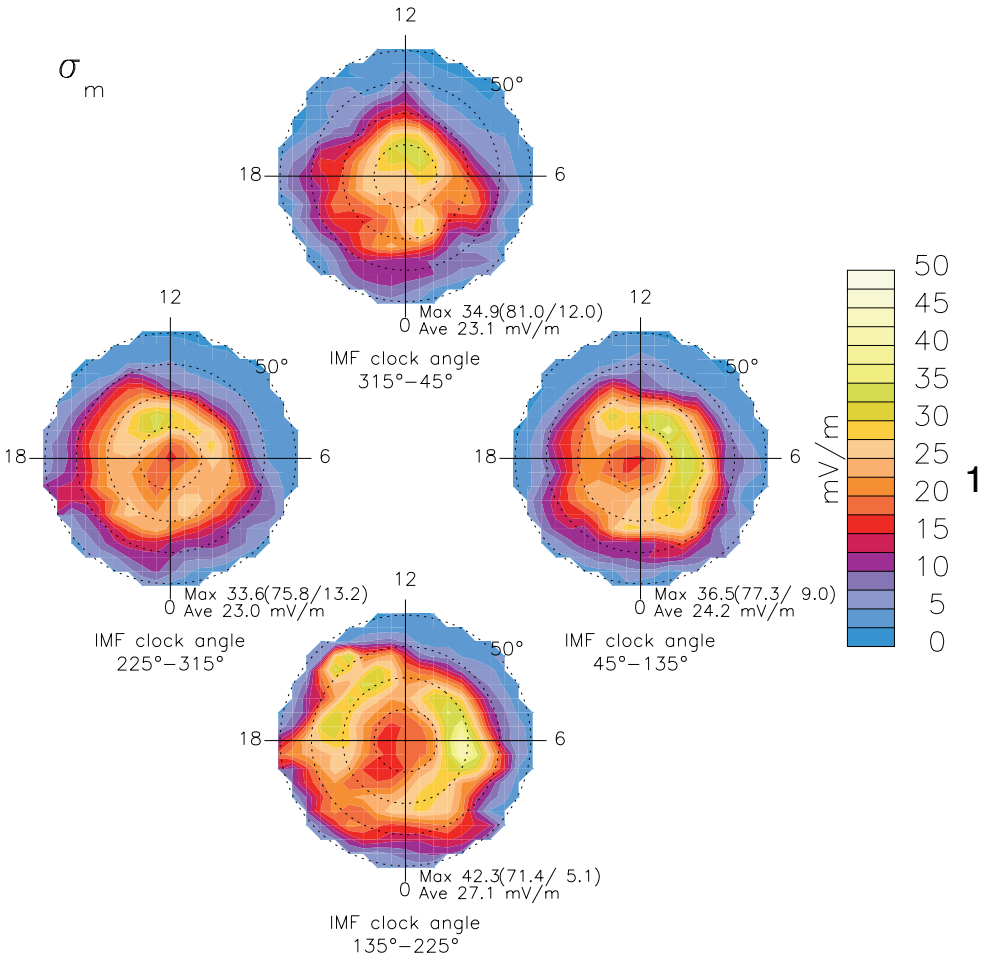
- Ensemble is generated by perturbing the AMIE high latitude potential in order to determine how uncertainty in the high latitude electric field is transferred to the low-mid latitude ionosphere

  - Additional simulations (not shown) perturbed aurora energy flux, and used high/low mean energy

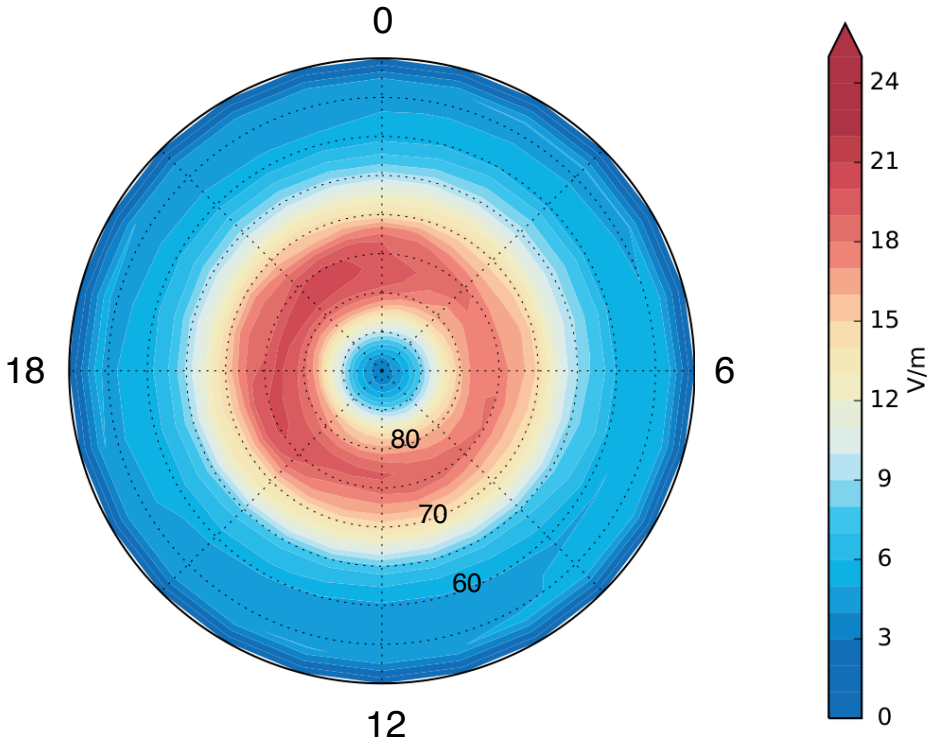


AMIE Electric Field Variability

DE-2 σ_E

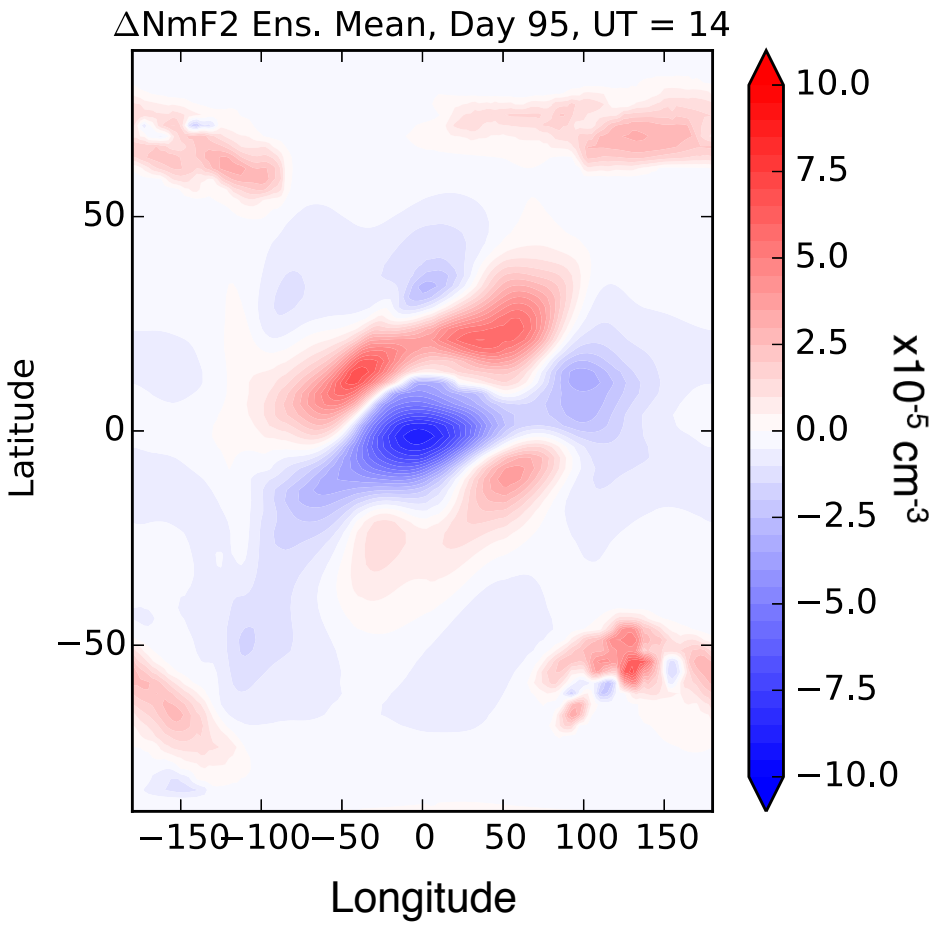


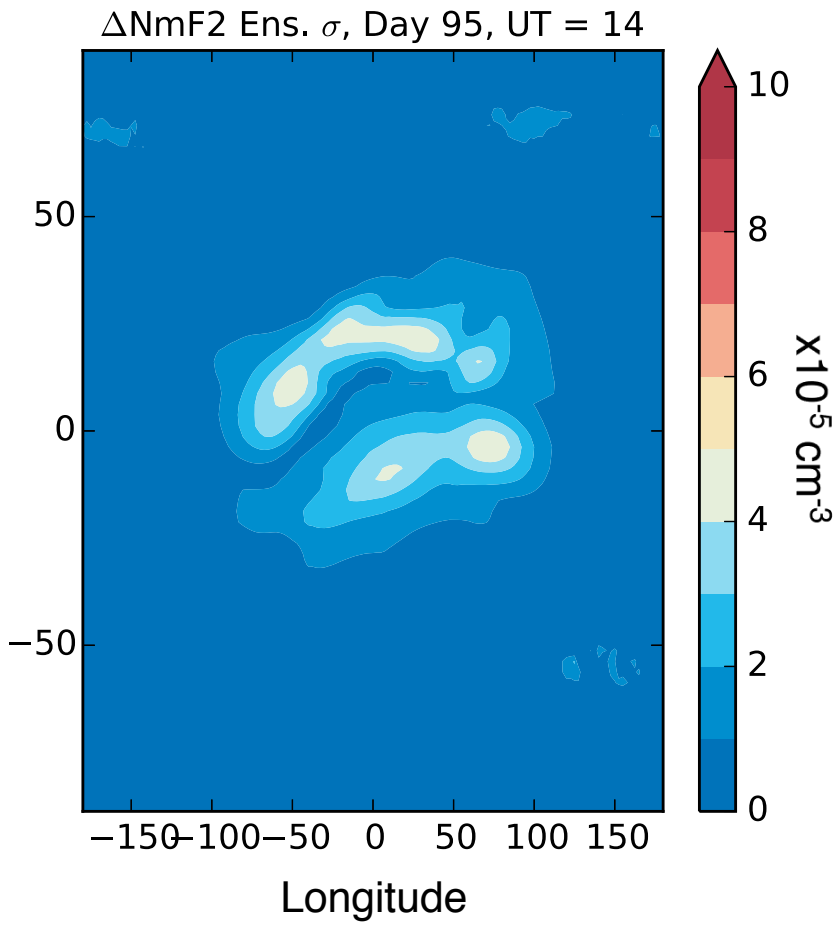
AMIE Ensemble σ_E



(Matsuo et al., 2003)

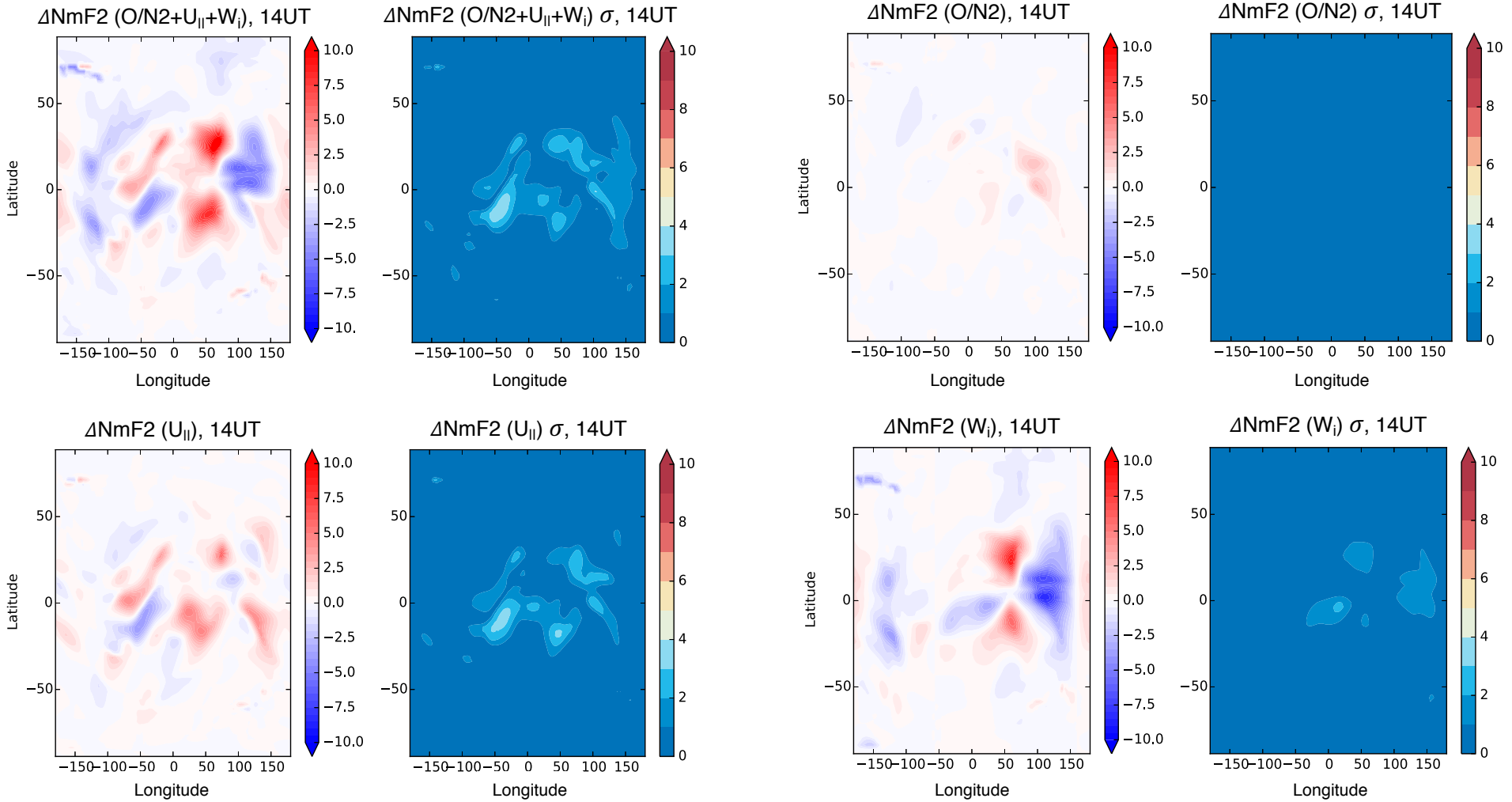
Low-Mid Latitude Ionosphere Variability





Multiple Linear Regression

$$\Delta NmF2(t) = a \bullet \Delta O/N_2(t) + b \bullet \Delta U_{||}(t) + c \bullet \Delta w_i\ (t\text{-}1)$$



Summary

TIEGCM/AMIE simulations were performed to understand the impact of high latitude forcing uncertainty on the low-mid latitude ionosphere.

Ensemble of AMIE simulations reveals that high latitude forcing uncertainty is transmitted to the low-mid latitude ionosphere during a geomagnetic storm.

Multiple linear regression may provide insight into the source of the ionosphere uncertainty. Analysis of the results is ongoing.

Perturbing the aurora energy flux leads to significantly less ionosphere variability compared to perturbing the potential.

F-region ionosphere variability is greater for constant low aurora mean energy compared to constant high aurora mean energy.

Results will be compared with complementary WACCM-X simulations that examine forcing uncertainty from the lower atmosphere for fixed high latitude forcing.