Vertical Behavior of TADs/TIDs using SAMI3 driven by GITM

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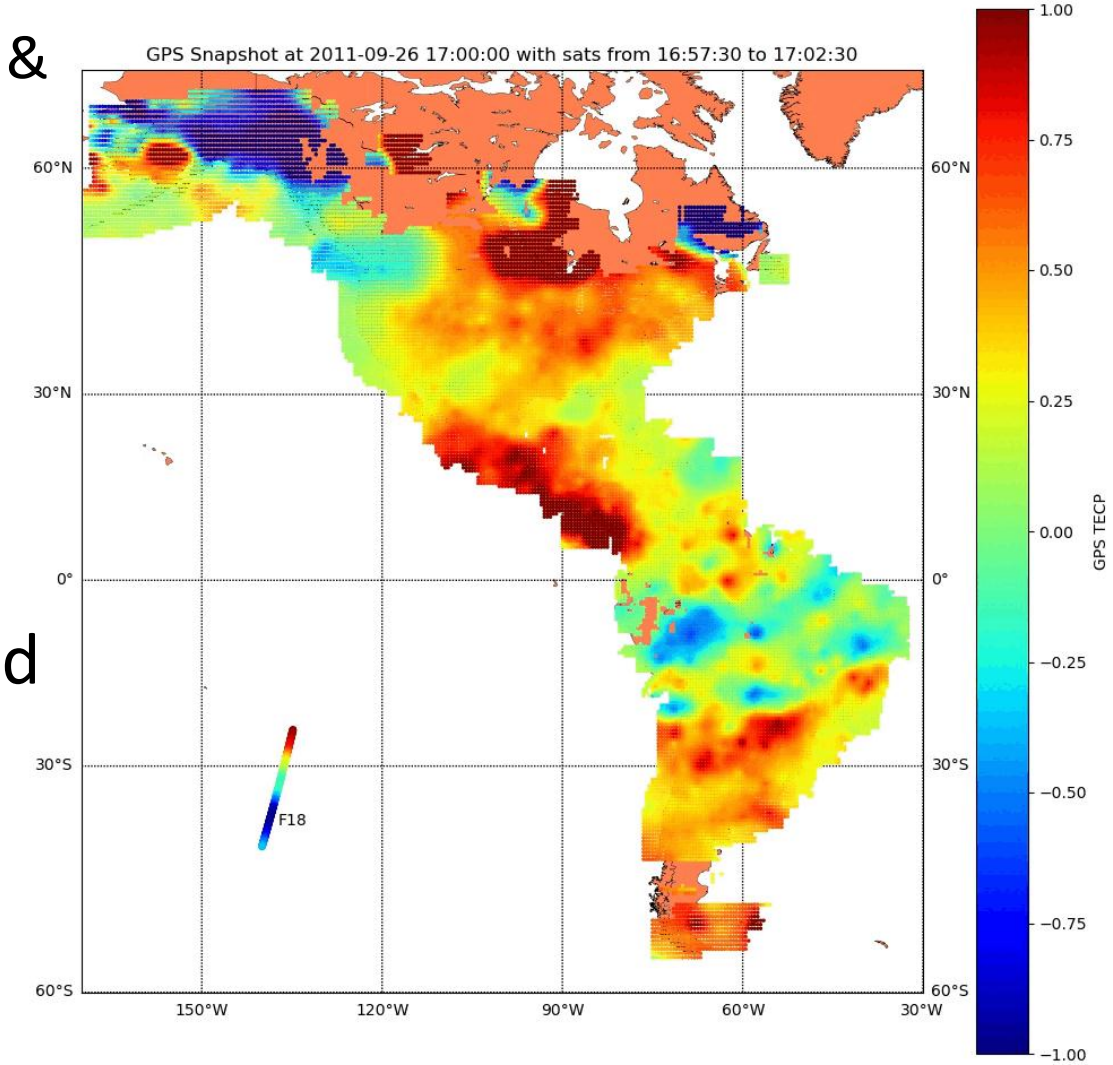
Outline

- Main goal of project, role of modeling
- SAMI3 & GITM Coupling
- Results from simulated storm
- Conclusions & future work

Main goal of project, role of modeling

- Study LSTIDS during storm time
  - GNSS has poor coverage over oceans & outside Americas
  - DMSP can help fill gaps
- DMSP observes a phase shift from what is seen in detrended TEC data from GNSS
- Use modeling to link observations from GNSS to DMSP and understand how TIDs behave altitudinally



SAMI3 vs GITM

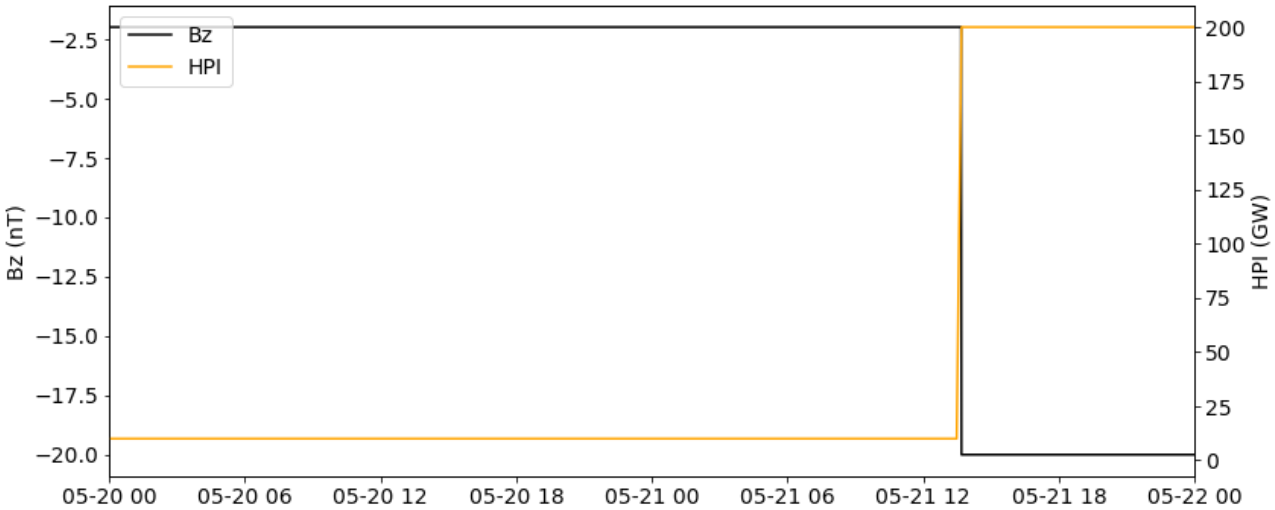
SAMI3	GITM
Physics-based ionosphere model	Ionosphere & thermosphere model
Magnetic coordinate system	Geographic coordinate system, stretched in altitude
Does not model neutrals – relies on external sources (usually MSIS)	Does not assume hydrostatic equilibrium
90km – 6Re	100-600km
Will not generate TIDs on its own	Does not reach DMSP altitudes

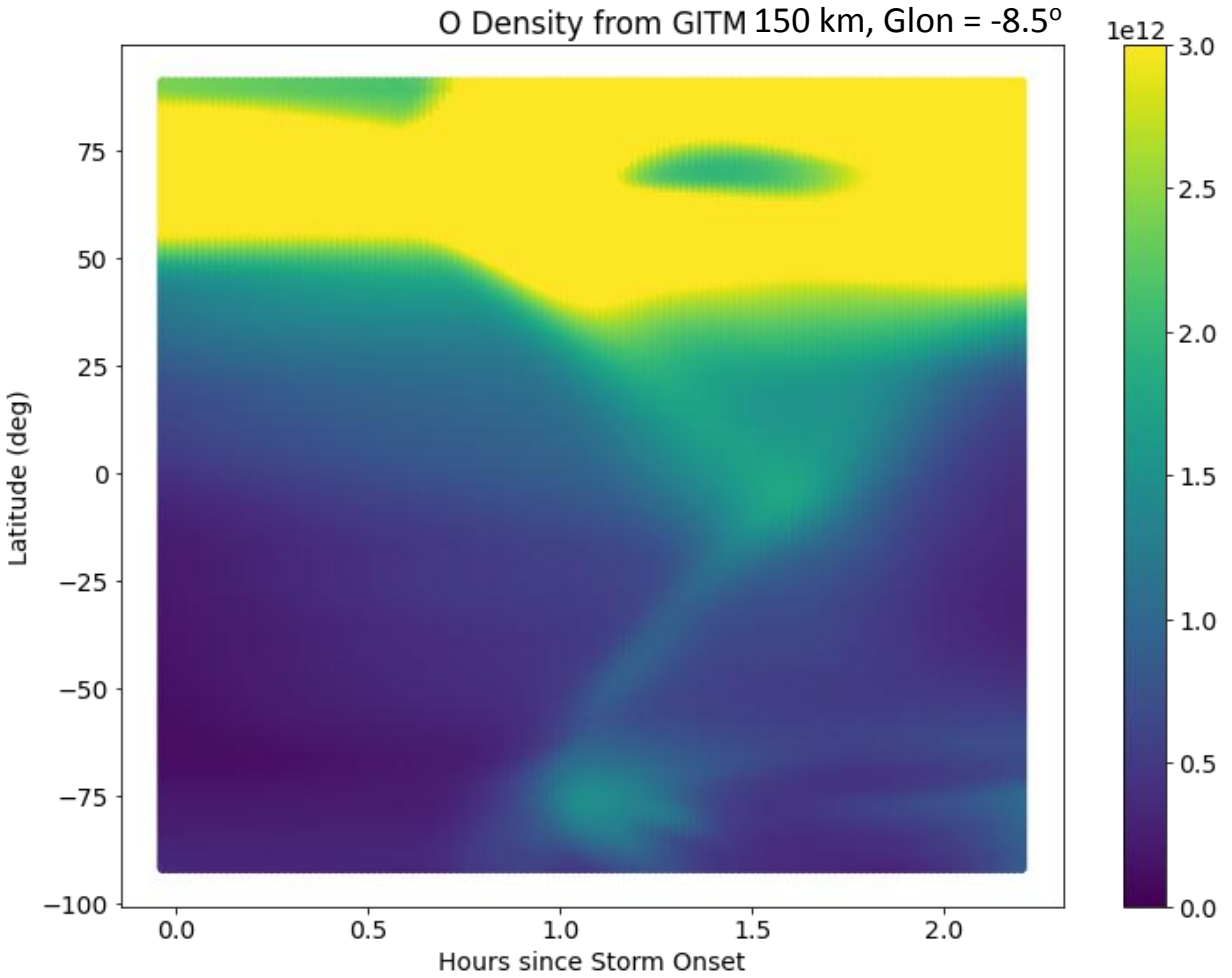
SAMI3 & GITM Coupling

- GITM grid: 4^{o}x1^{o} longitude x latitude, 50 altitudes, output every 5 minutes
- SAMI grid: 80 magnetic longitudes, 72 altitudes (field lines), 256 grid cells along each field line, output every 5 minutes
- Both run for 24+ hours before storm onset
- Select outputs from GITM are read by SAMI3 every 5 minutes
  - Neutral species, temperature, zonal & meridional winds

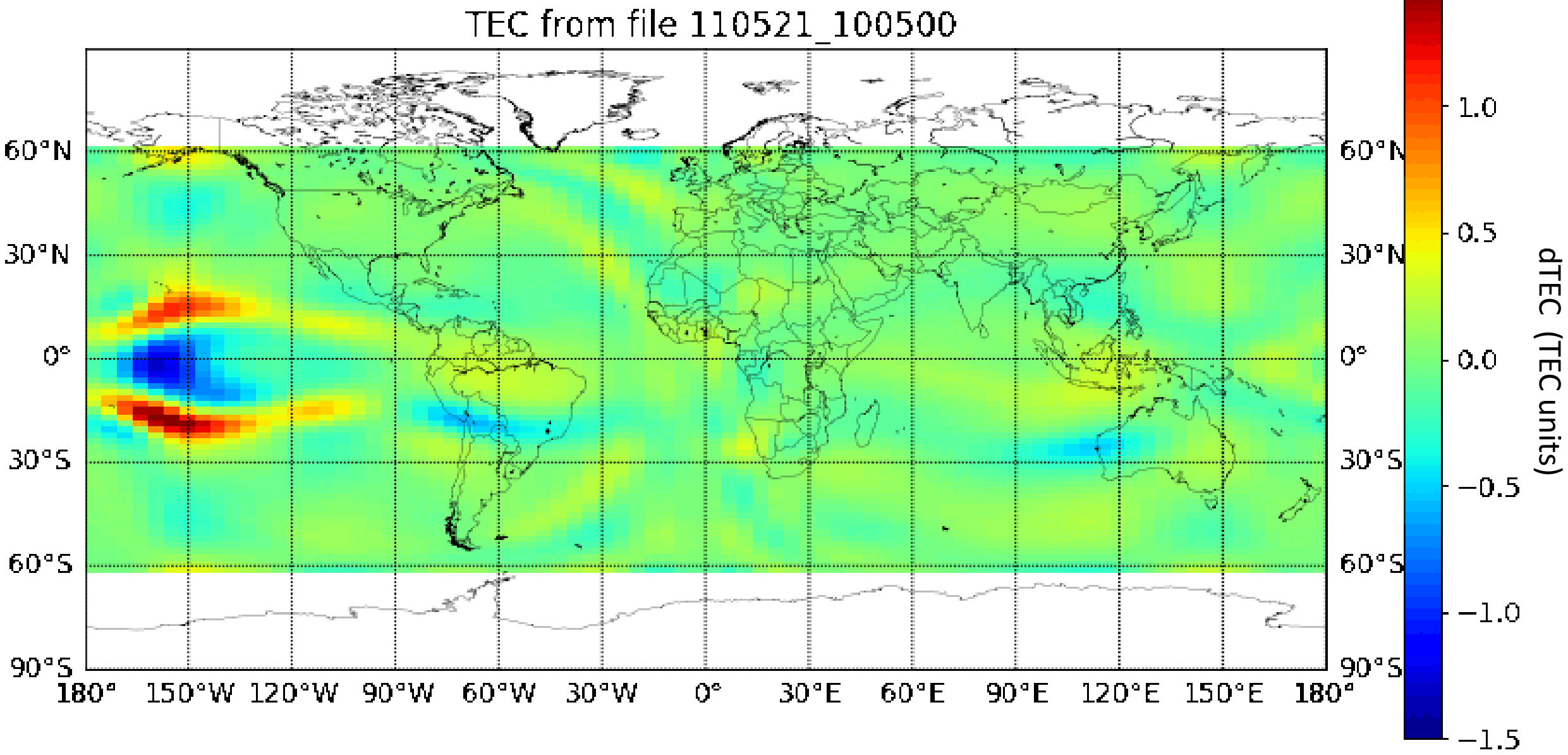
Results from Simulated Storm

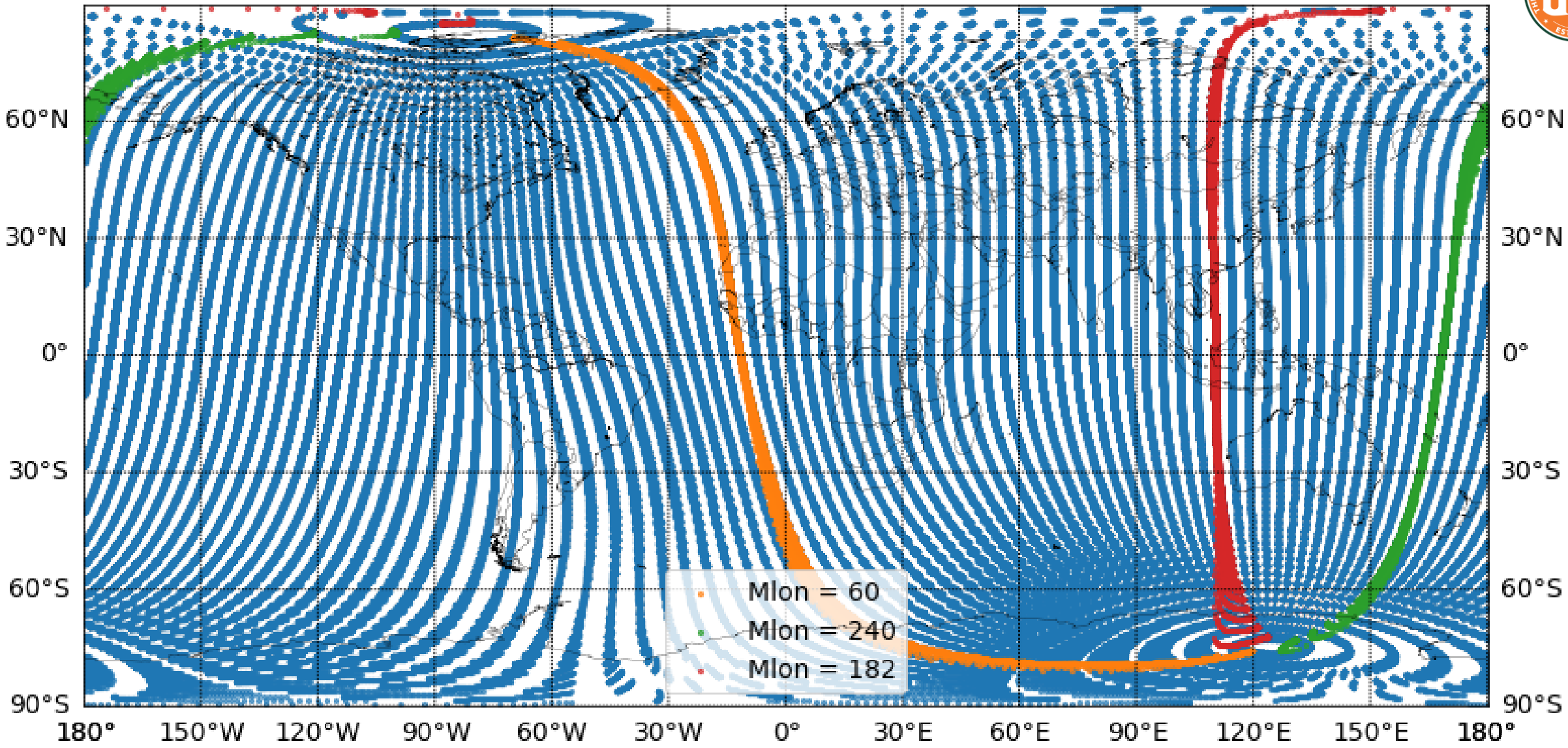
- 05/21/2011
  - Modeled for 36 hours to reach steady state
  - “Storm” onset at 13:40
- Activity increased as a step function
  - Bz -2.5nT -> -20nT
  - HPI 10 GW -> 200 GW





TIDs in SAMI3 deltaTEC

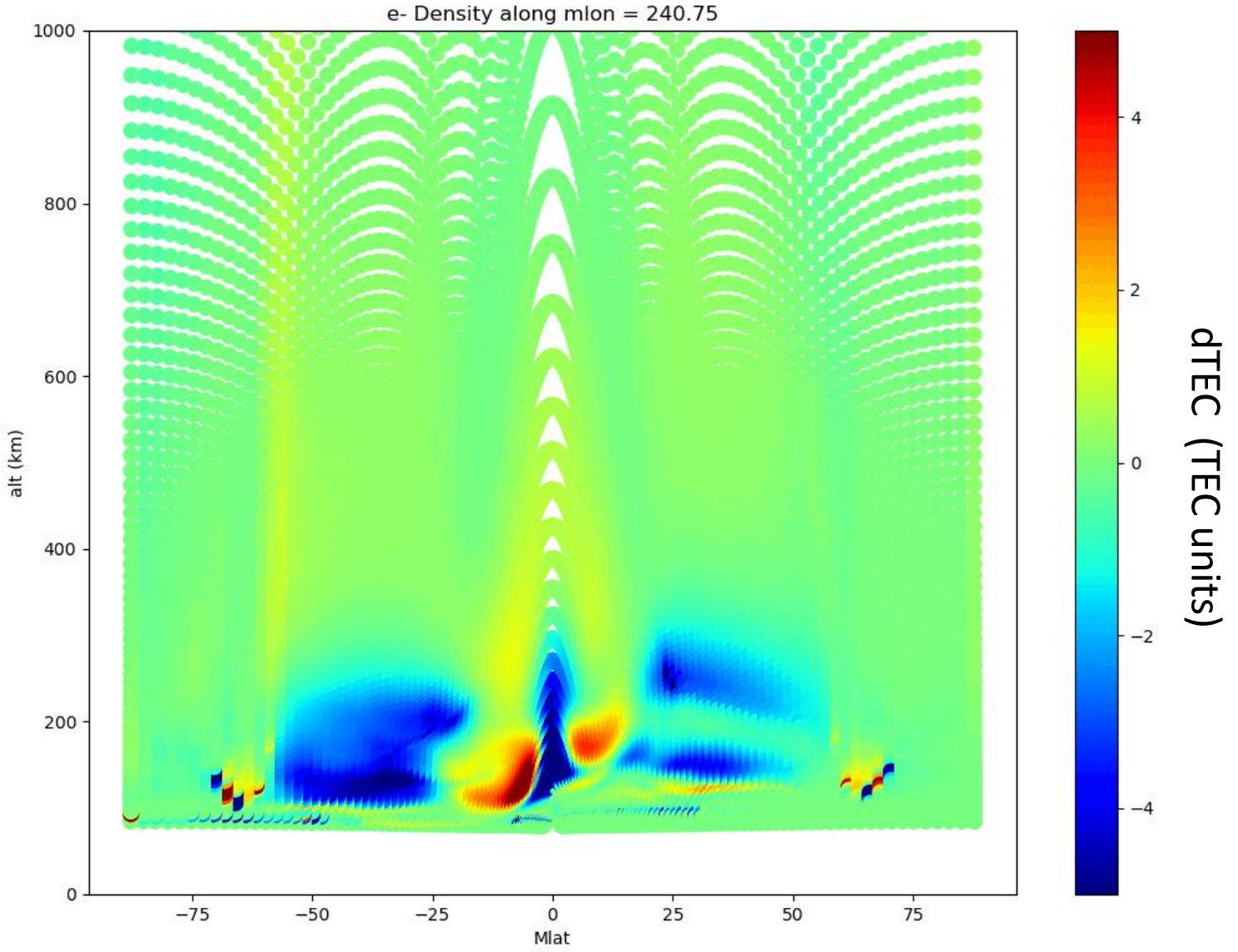




Next two slides will use the three magnetic longitudes shown

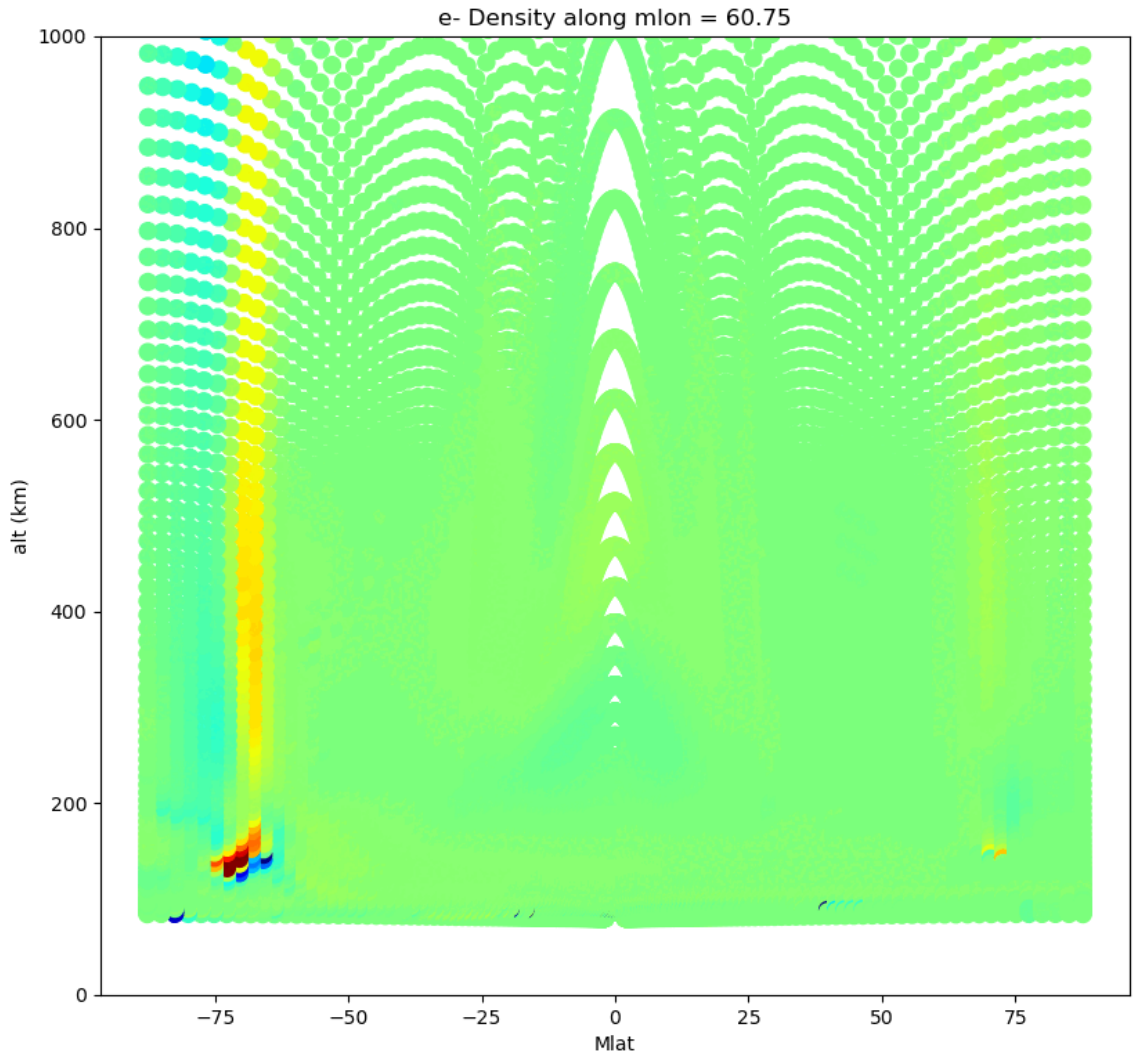
Results from Simulated Storm

- TIDs seeded at high latitudes and propagate towards magnetic equator
- Seen at topside ionosphere but with phase shift
- Velocity comparable to typical observations, wavelength shorter
- Can TIDs reaching the equator be a seeding mechanism for plasma bubbles?
- Movie starts at 11:30 UT (near terminator)

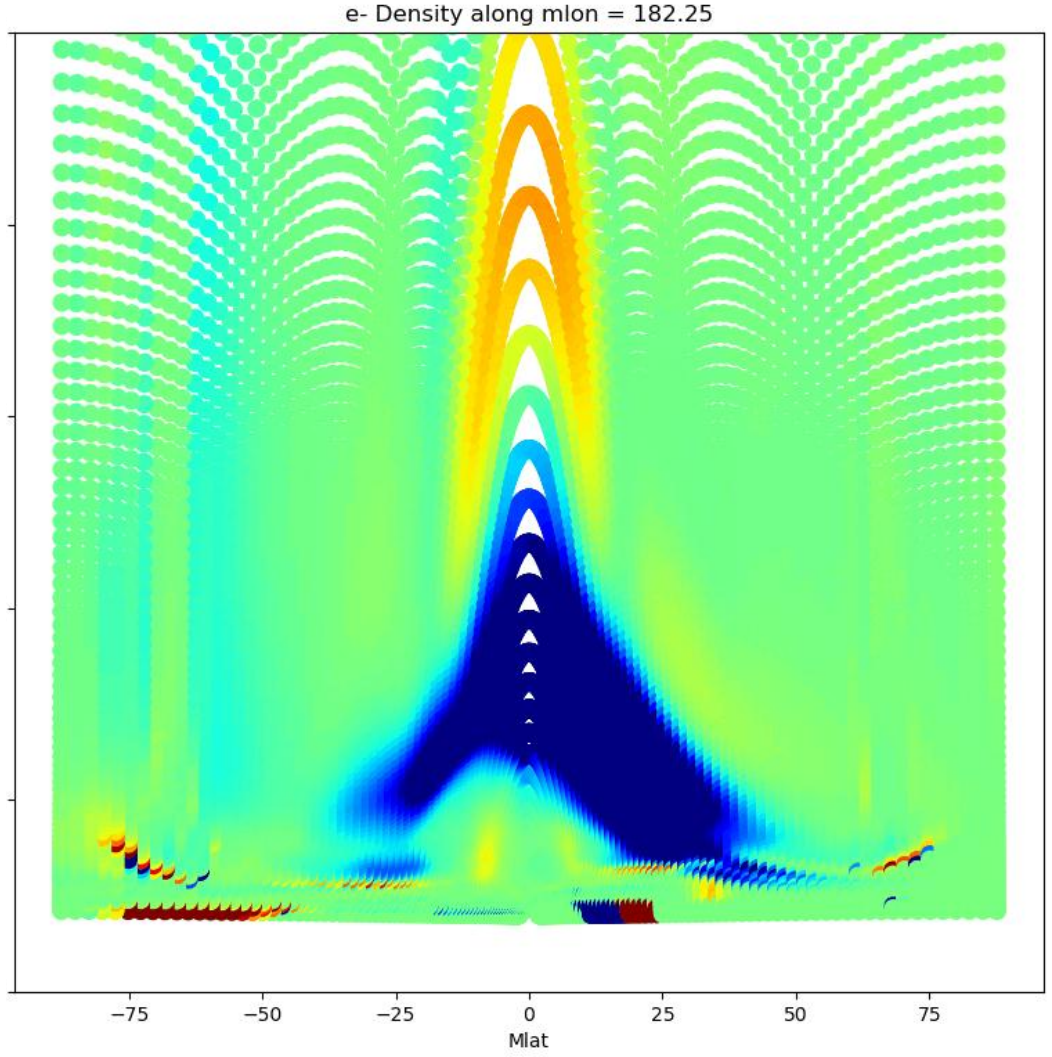


Results from Simulated Storm

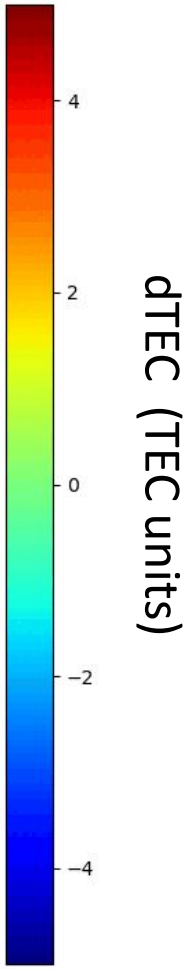
- Longitudinal/local time dependence



Movie starts near noon local time



Movie starts near midnight local time



Conclusions & Future Work

- Neutral wind perturbations in GITM drive TID propagation in SAMI3
- TIDs do reach topside ionosphere

- "Fly" a DMSP satellite through SAMI3 outputs
  - Other satellites to coordinate observations (GRACE, CHAMP, GOCE, etc.)
  - Map DMSP ion density to TEC
- Do LSTIDs seed plasma bubbles?
- Work with fully coupled SAMI3 & GITM
- Investigate the effects of different high latitude drivers