Ionospheric Behavior During the First Few Hours of Intense Geomagnetic Storms

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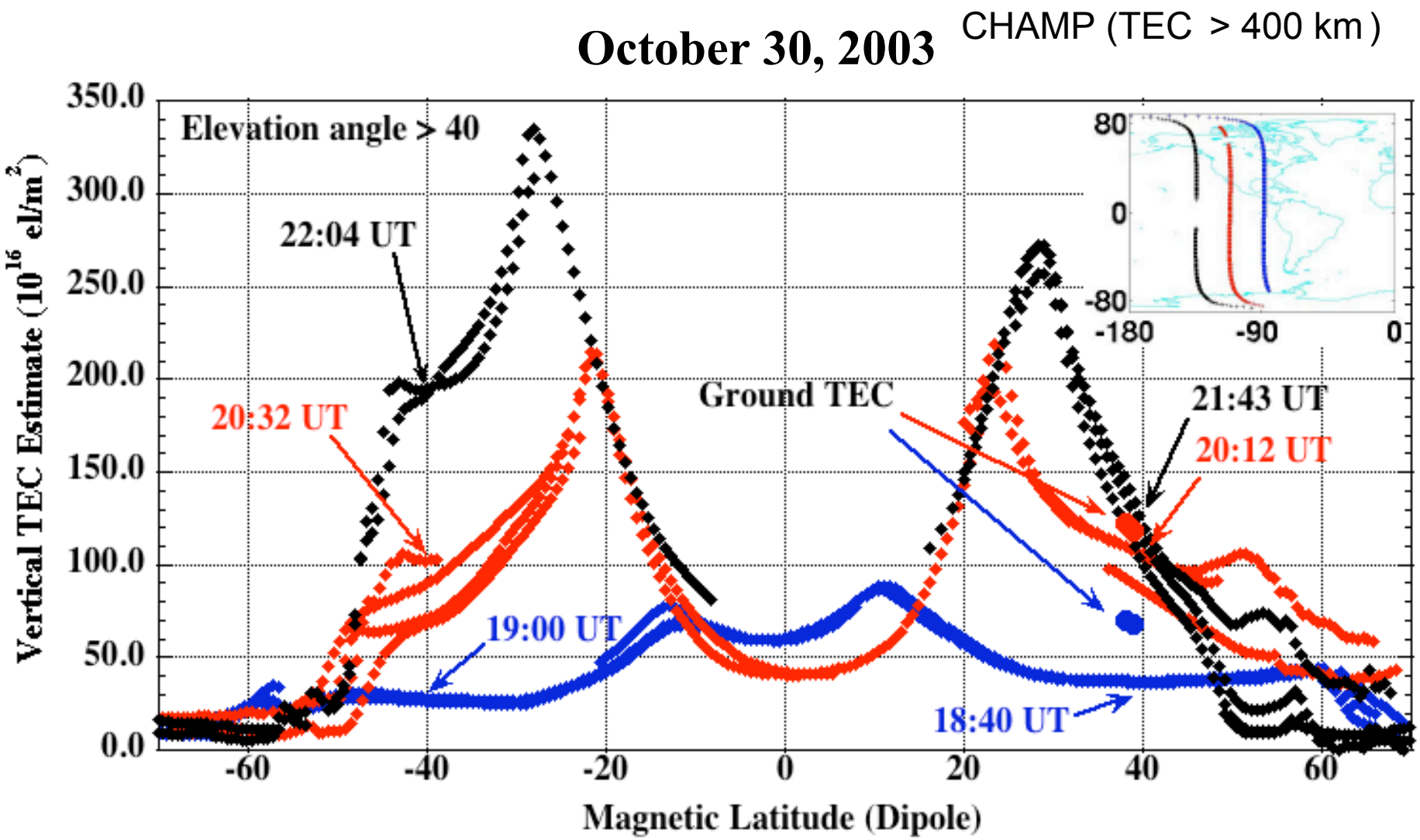
Objectives

- Penetration electric fields have a large impact on the global structure of ionospheric plasma
- Convection electric fields cause both large-scale and mesoscale structuring
- Many questions remain regarding:
  - The prevalence of these phenomena and their relationship to solar wind conditions initiating the storm
  - The global structure, for example, as a function of local time and latitude
  - The physical causes of the ionospheric response

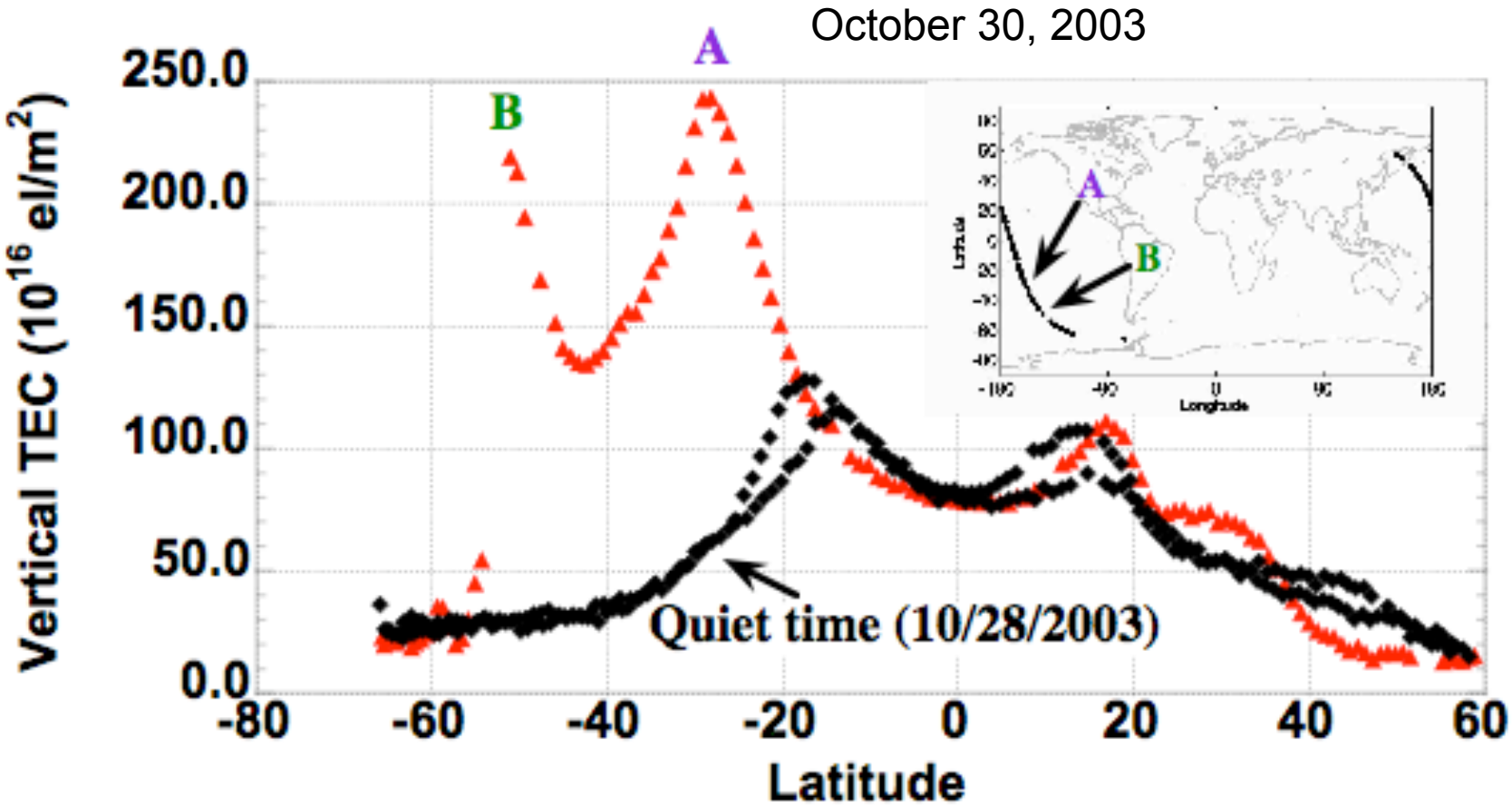
Solar wind-ionosphere coupling

  - Empirical relationships as an aid to coupled models of geospace

TEC Modification



JASON TEC (1336 km altitude)

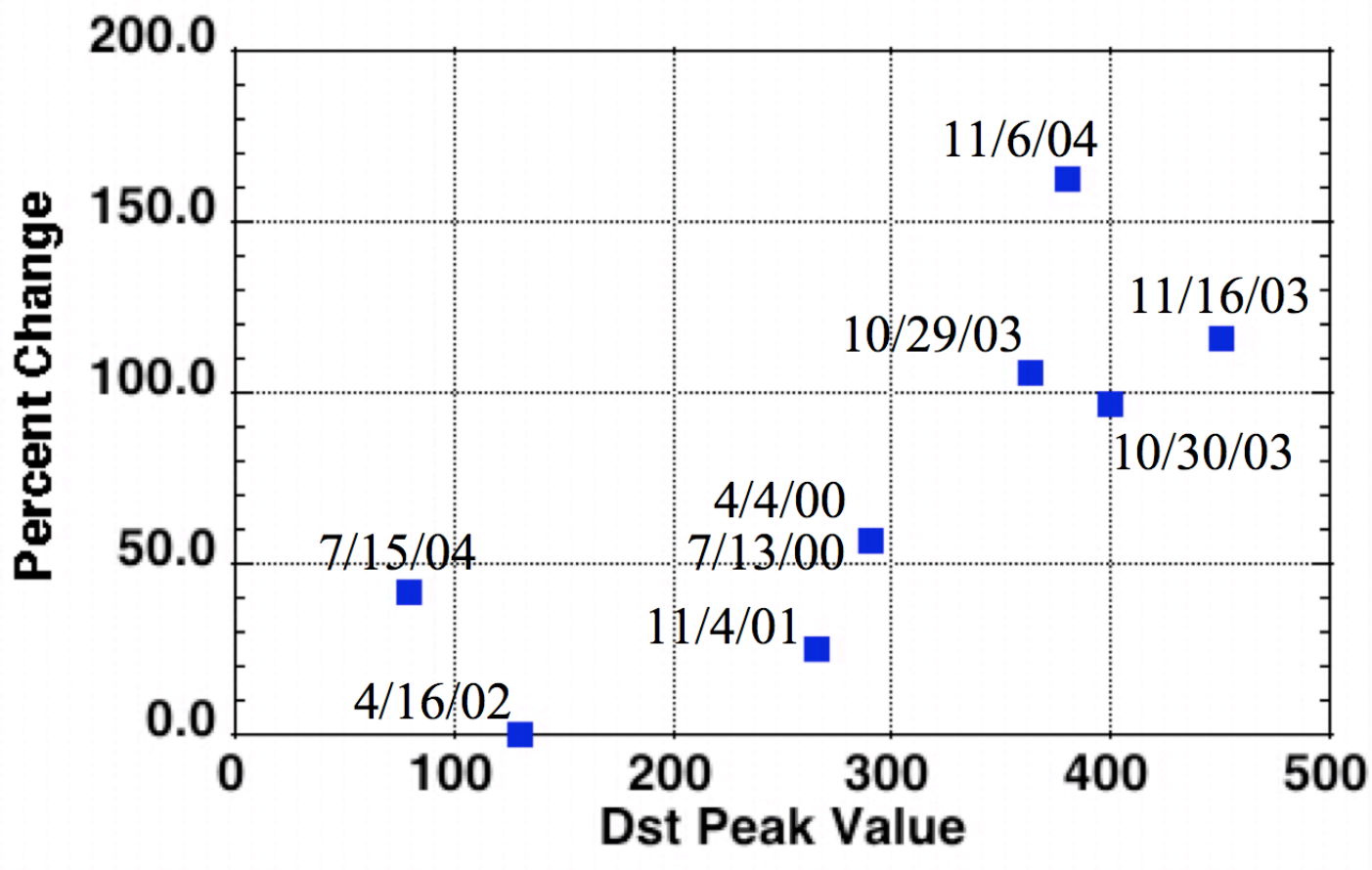


UT 2212 (~4 hours into the storm)
Equatorial LT: 1048

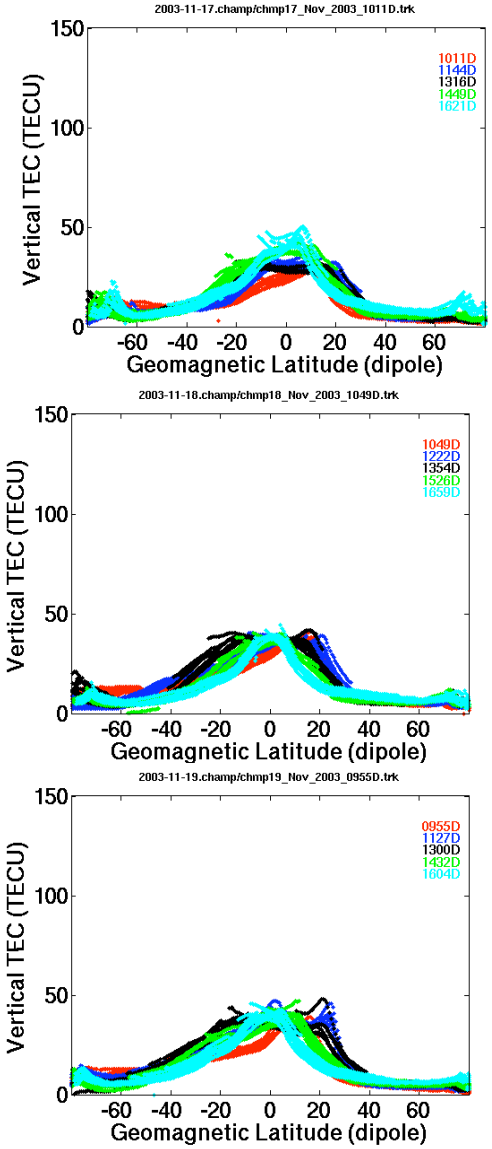
Multiple Storms

Mean TEC versus time:

Within ±40 degrees latitude 1200-1600 LT

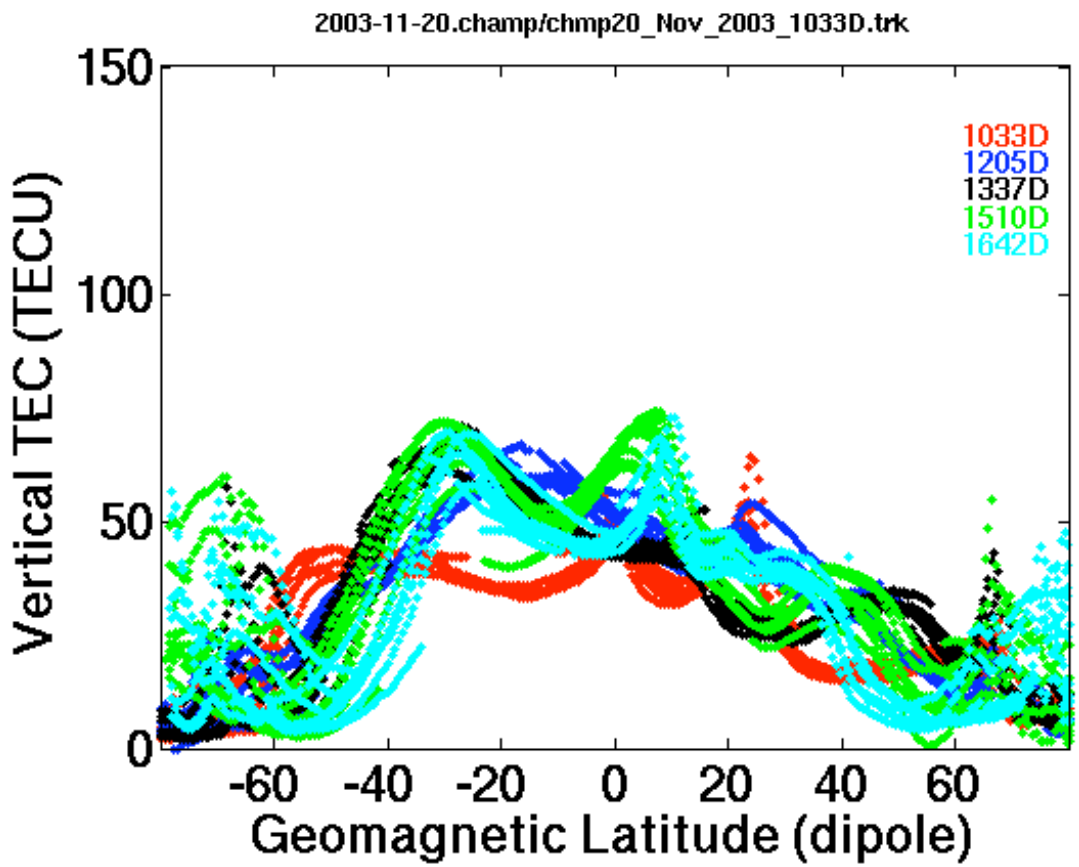


CHAMP (>400 km) November 20, 2003

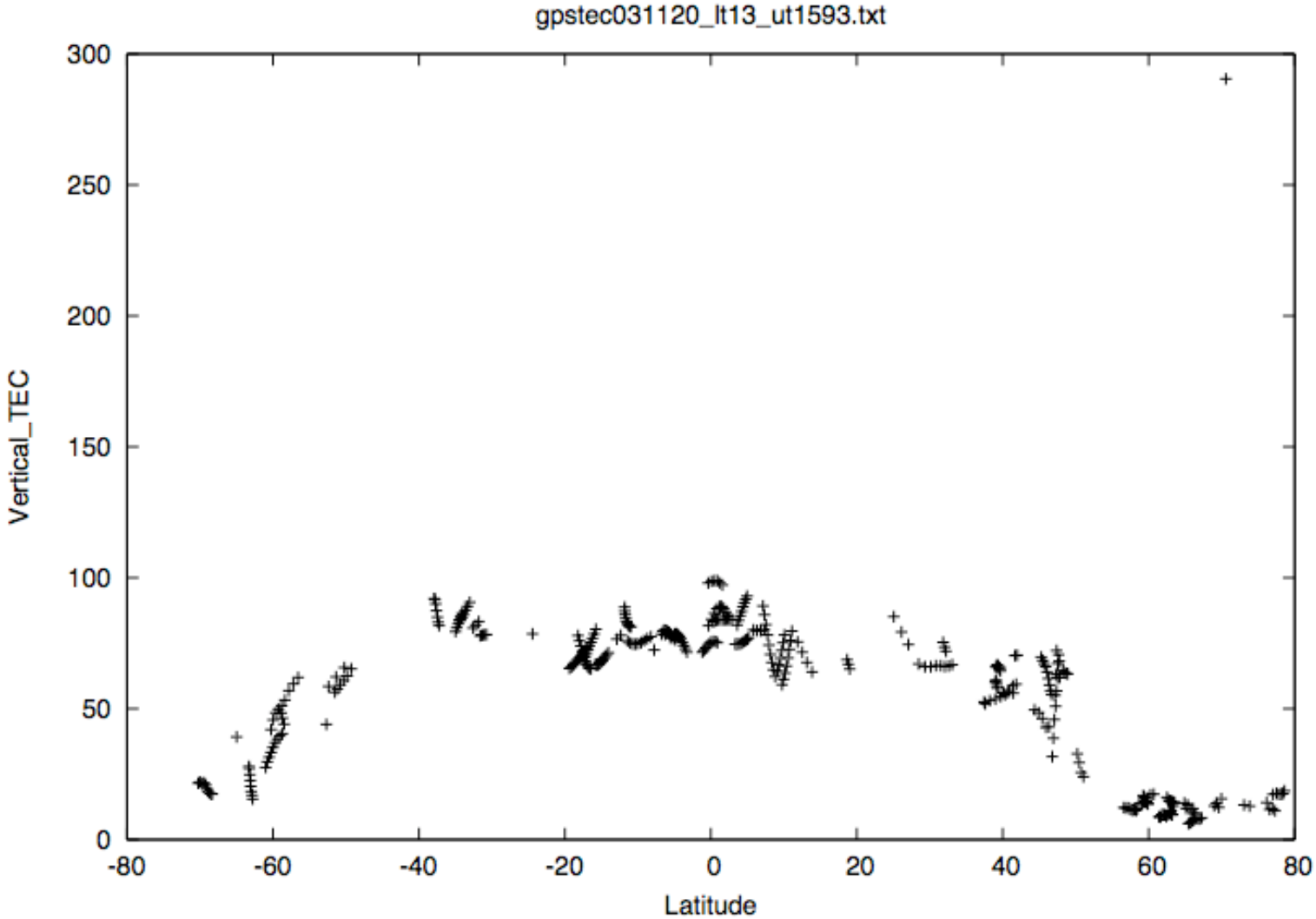


Event Time: 13:20 UT

Local Time: 11:00



November 20, 1PM LT, Ground



See also Yizengaw et al., GRL *in press*

Role of Modeling

- Factors contributing to TEC increases
  - Electric fields (dayside uplift)
  - Composition changes
  - Winds
- Magnitude of prompt penetration electric field
  - Shielding
- Relationship to solar wind drivers

Composition-related increase

Early during Nov 20, 2003 superstorm

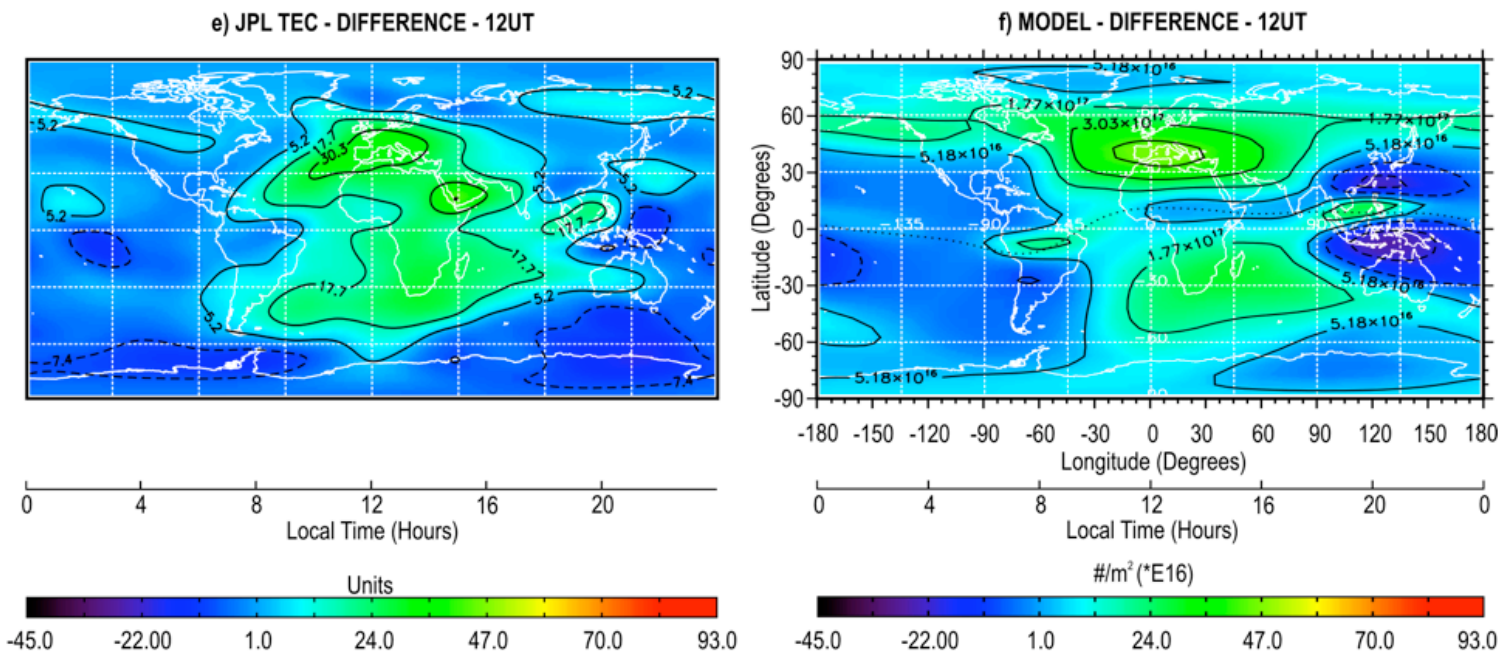


Figure 1: Measured total electron content for (a) QUIET, (c) STORM, (e) Difference (STORM - QUIET); Panels (b), (d), and (f) show corresponding model results.

Crowley et al., JGR *in press*

Summary

- Looking forward to fruitful collaborations with the team