

Global Mean Total Electron Content Behavior in Periods of High Geomagnetic Activity

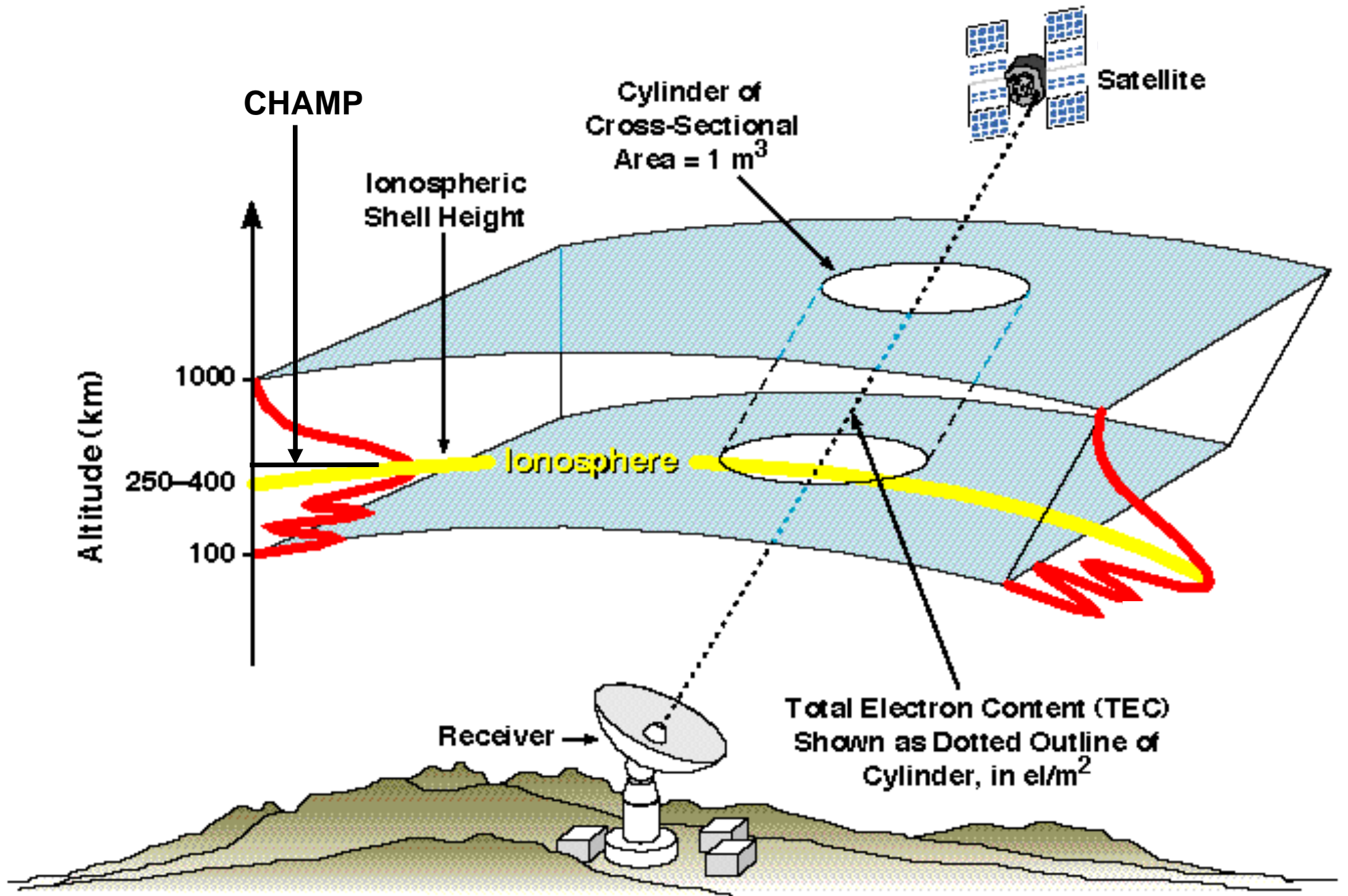
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Mentors:

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Introduction

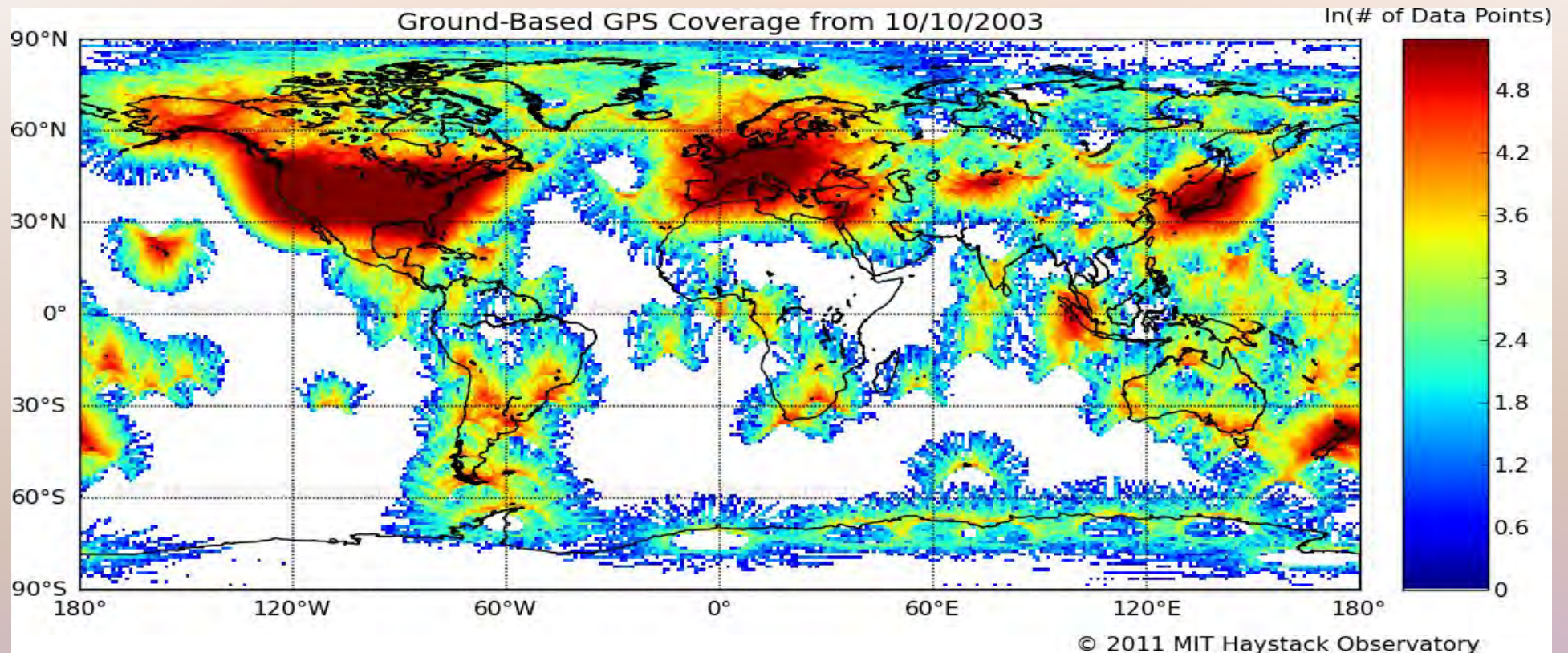
- We are interested in global total electron content (TEC) behaviors, not local effects.
- We have observed global behaviors by looking at satellite and ground-based averages.
- We have analyzed data from three years of differing solar activity: 2003, 2004, and 2005.



Overview

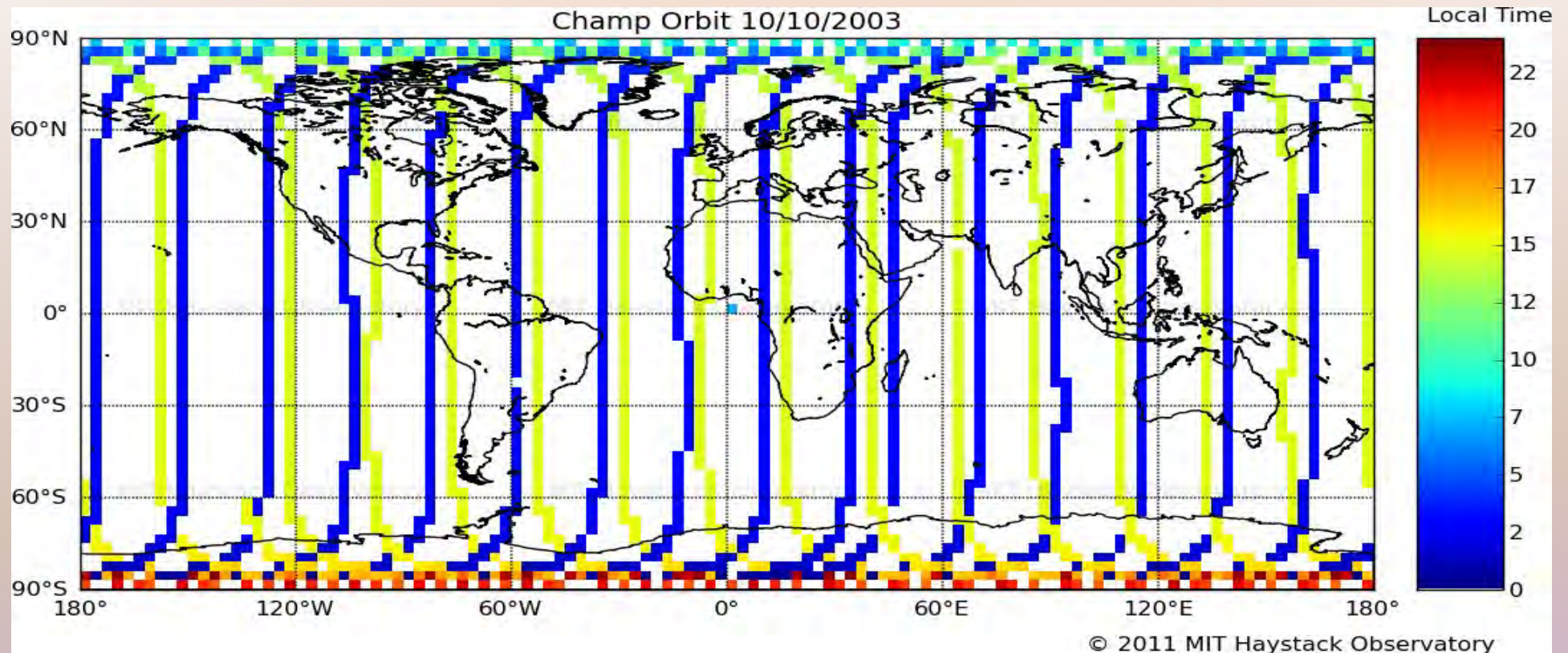
- Three data sources: ground-based, CHAMP, Jason-1.
- 24-hour northern hemisphere TEC averages (means).
- Relate TEC to solar EUV flux, the Dst index of geomagnetic activity, and solar wind parameters.
- Observe changes in proportional TEC below CHAMP during storm times.

Ground-Based Data Coverage



- Poor coverage in southern hemisphere.
- TEC measurements from the ground-20,000 km.
- No data over the oceans.

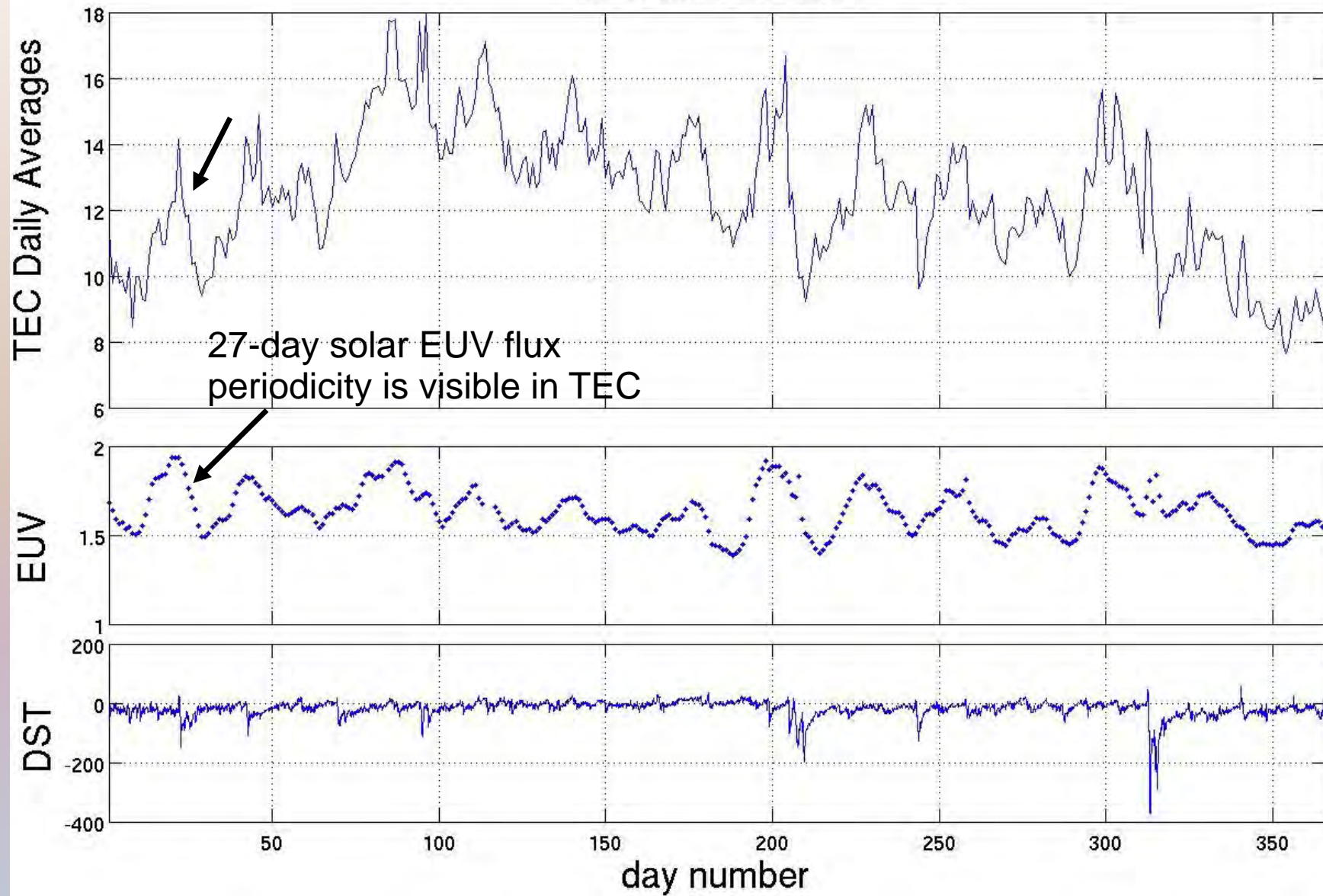
CHAMP Data Coverage



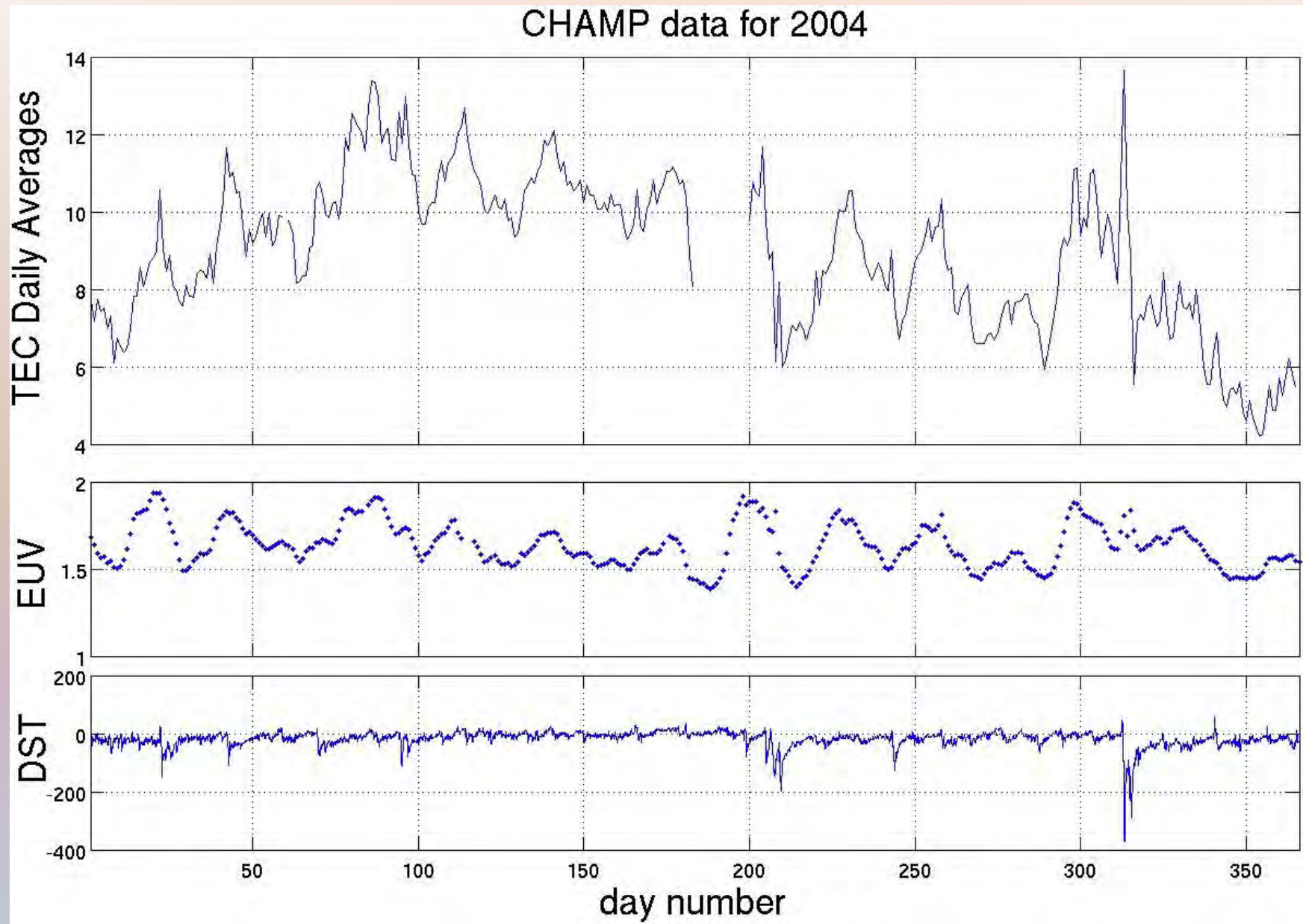
- Evenly spaced global coverage.
- TEC measurements from its orbital altitude (~400km) to 20,000 km.
- Significantly affected by receiver bias.

2004 Full Year: Ground-Based

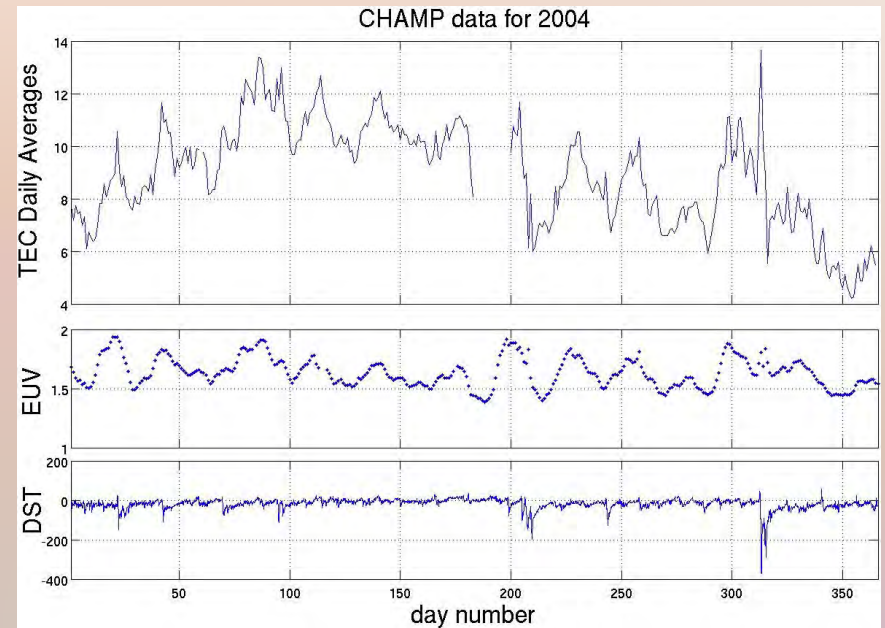
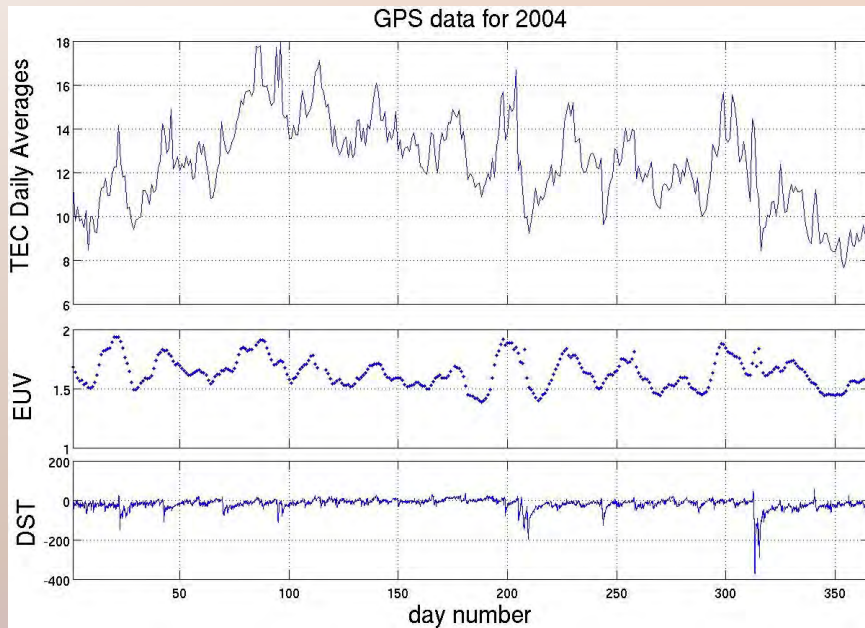
GPS data for 2004



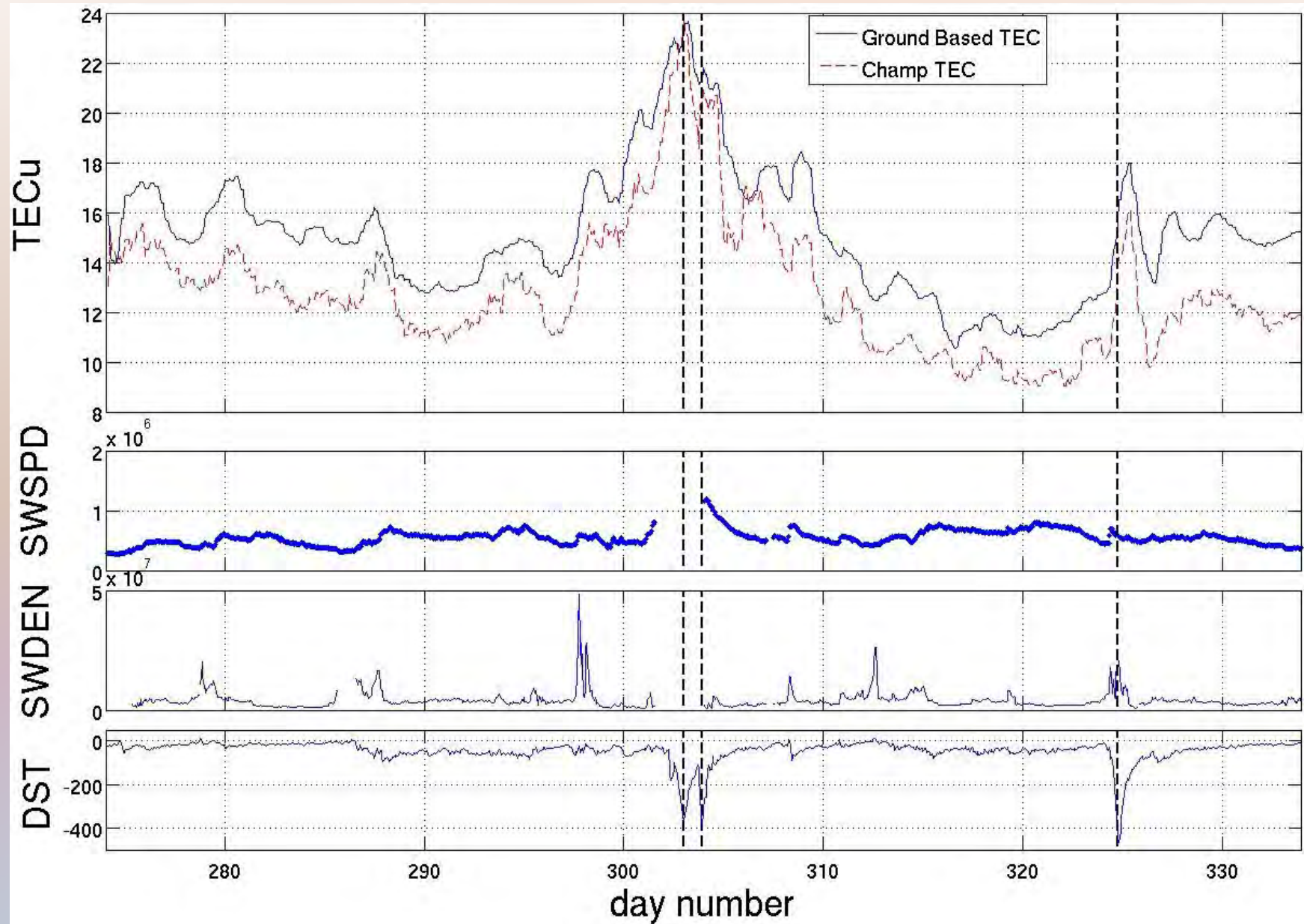
2004 Full Year: CHAMP



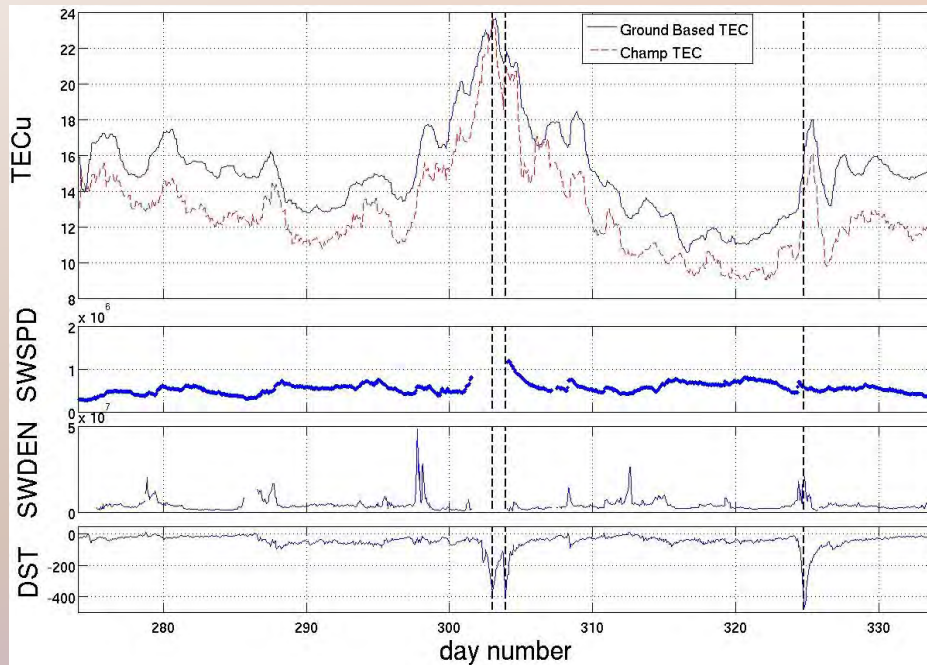
24-Hour Northern Hemisphere TEC Means



2003 Storm Period: October-November



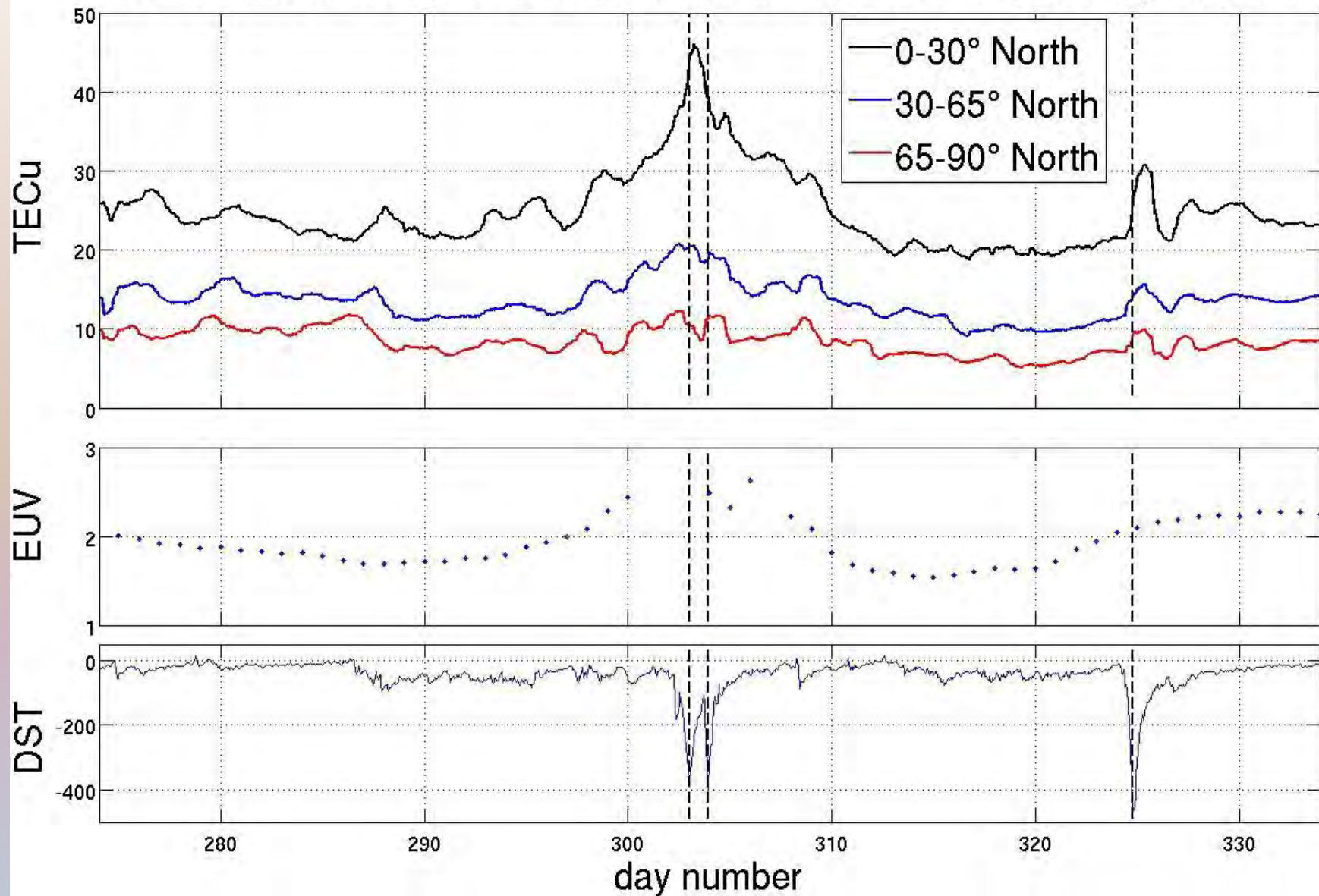
October-November, 2003



- Two significant DST disturbances.
- Large enhancement in TEC, solar wind speed, EUV.
- Spikes in solar wind density.

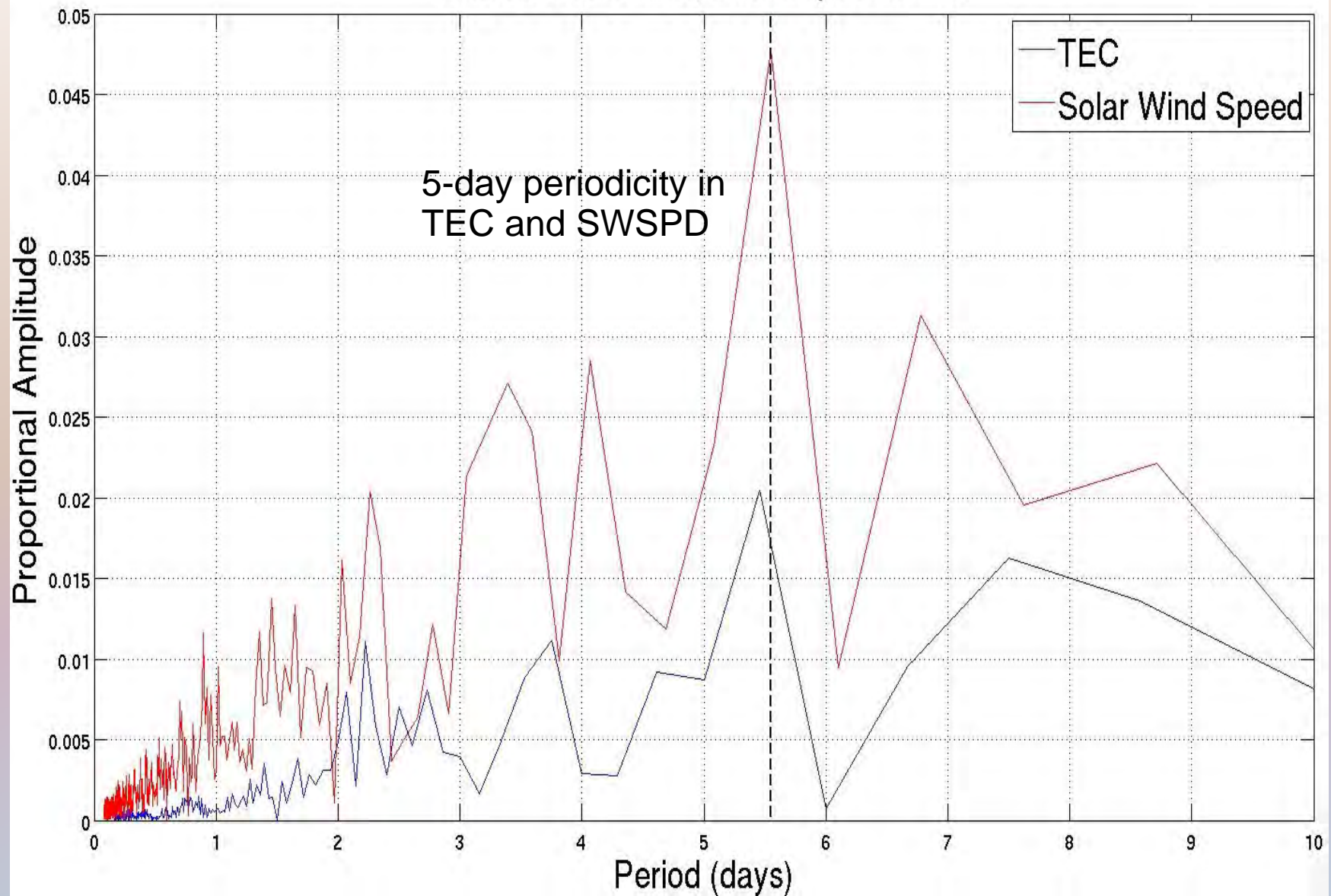
Latitudinal Effects

October-November, 2003: Ground Based TEC Measurements by Latitude

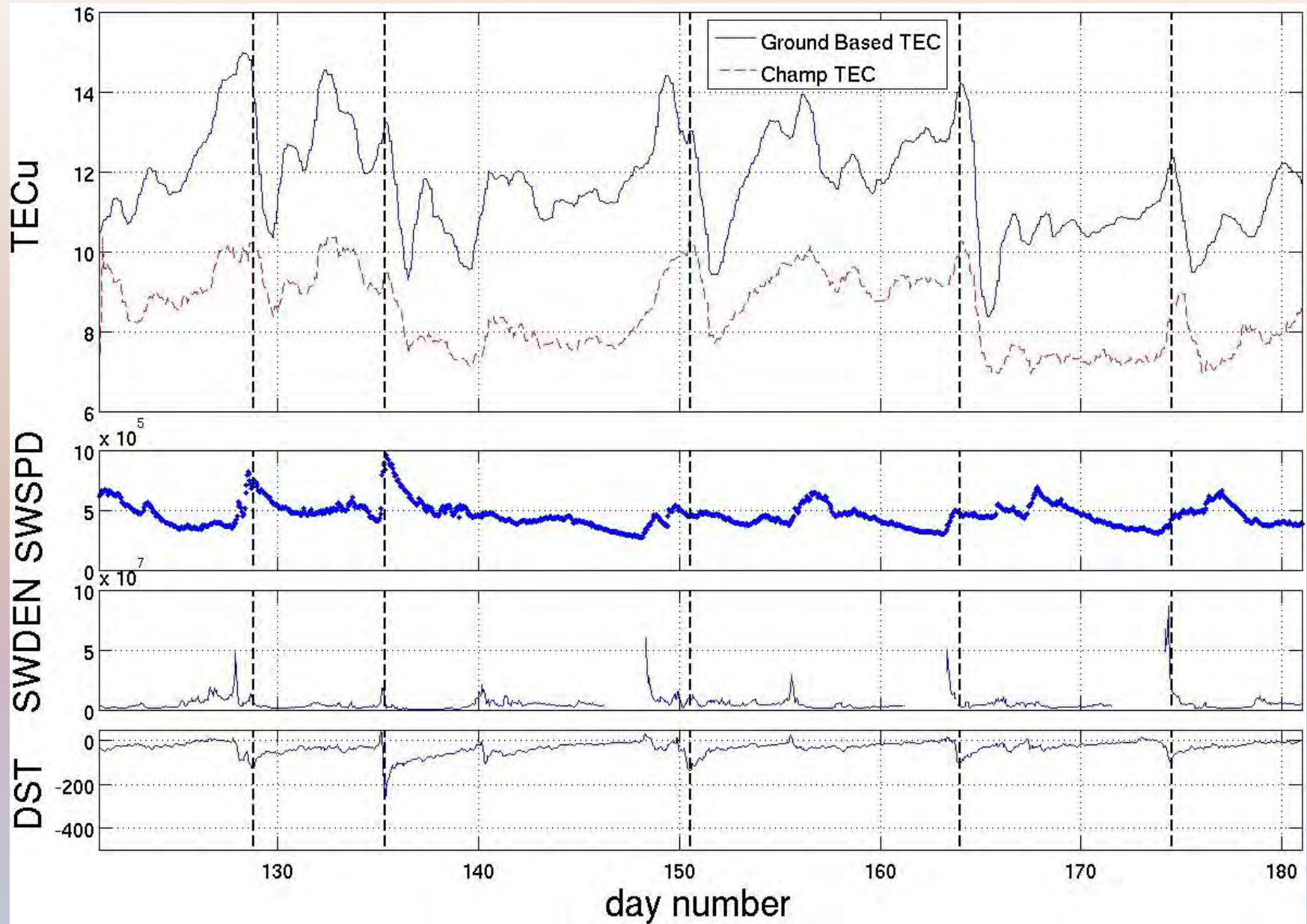


TEC Periodicity

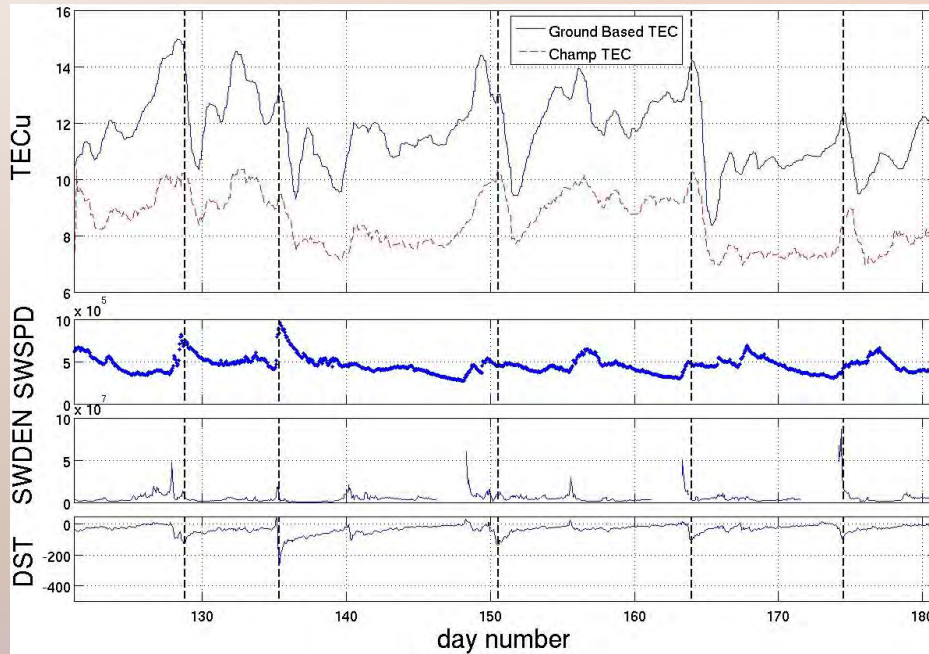
October-November, 2003: Spectral Plot



2005 Storm Period: May-June

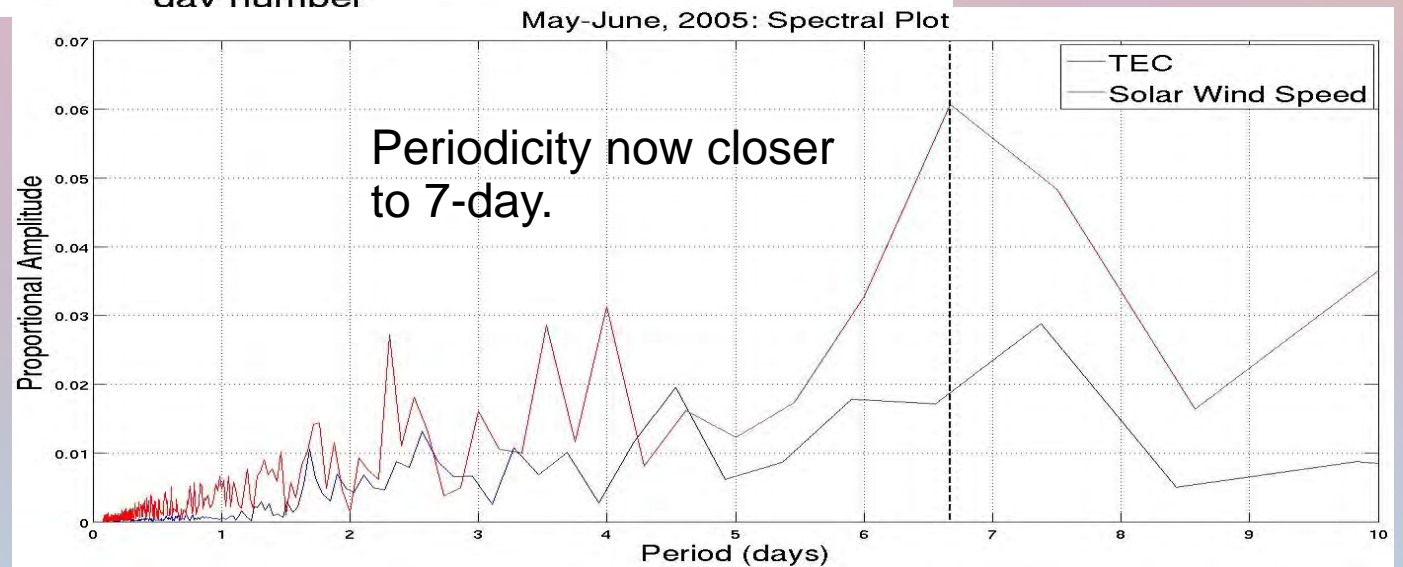
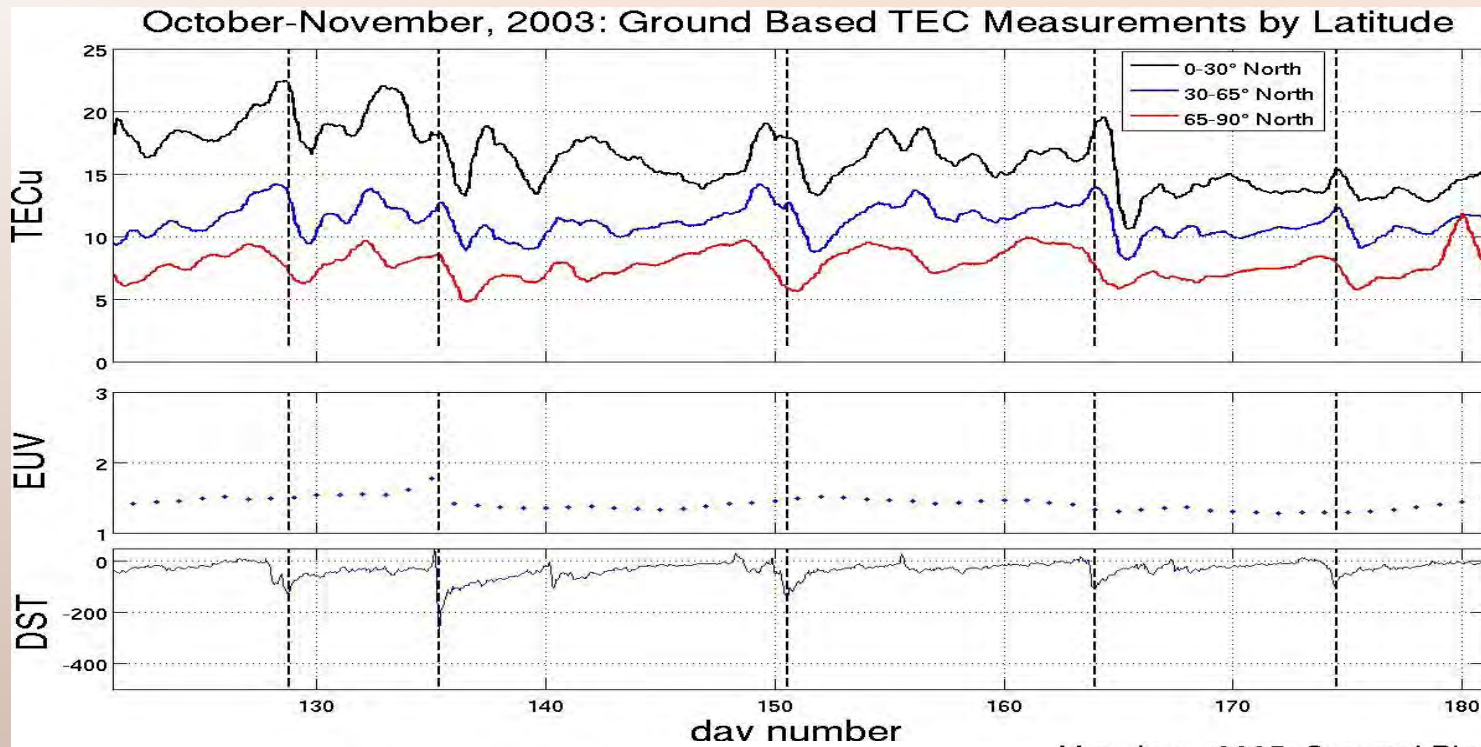


May-June, 2005

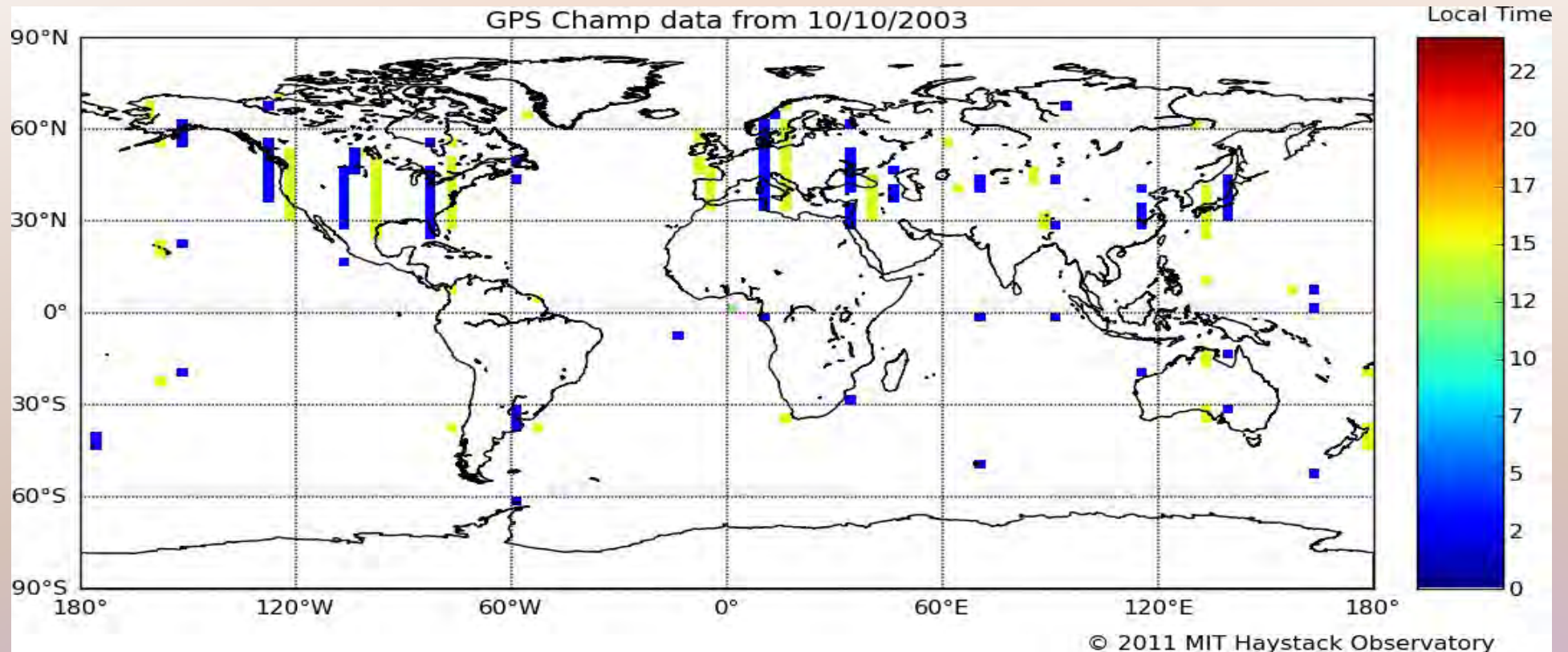


- Smaller DST disturbances.
- Periodic effects seem larger than storm effects.
- DST disturbances related to TEC depletions.

Latitudinal Effects and TEC Periodicity

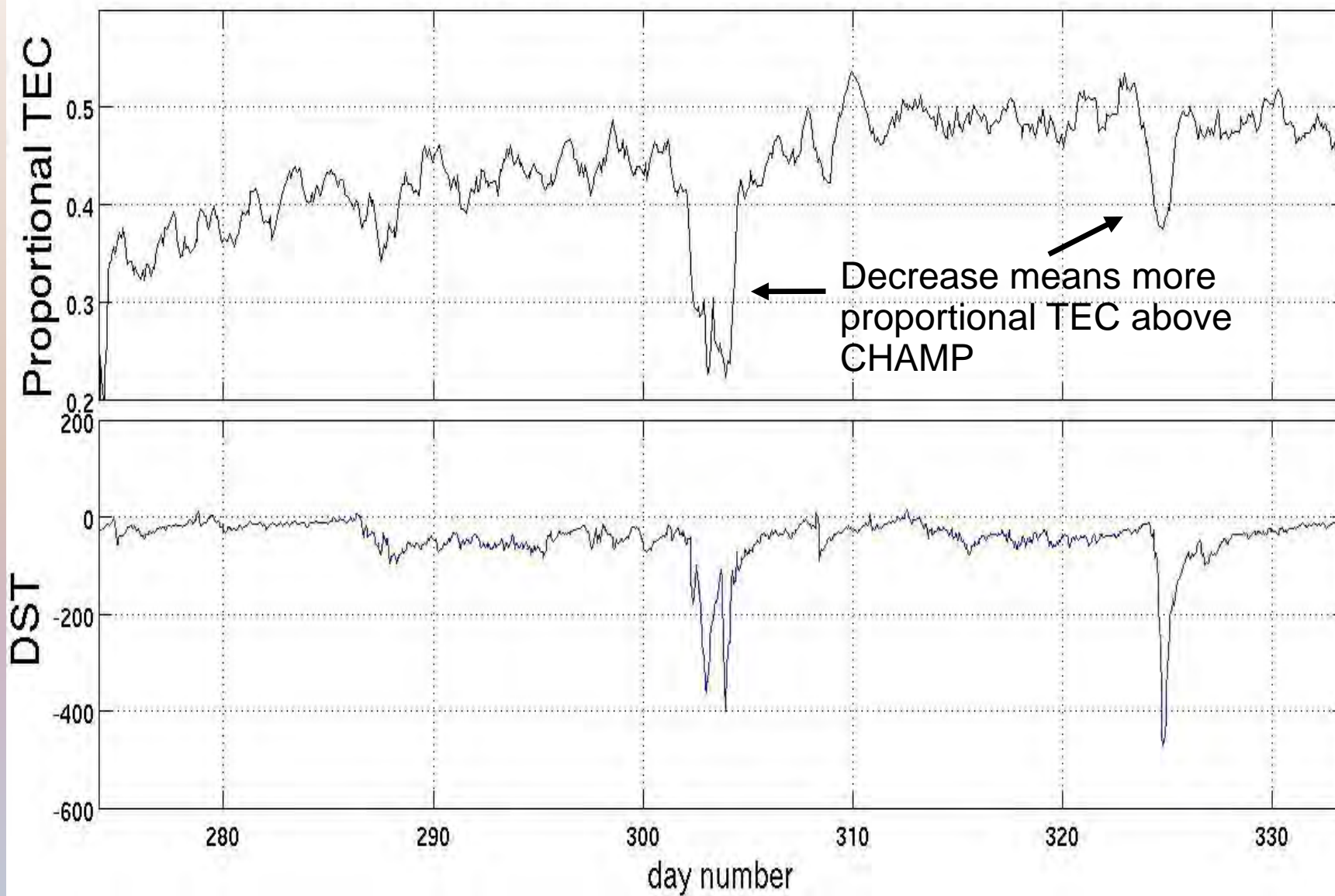


Proportional TEC Below CHAMP

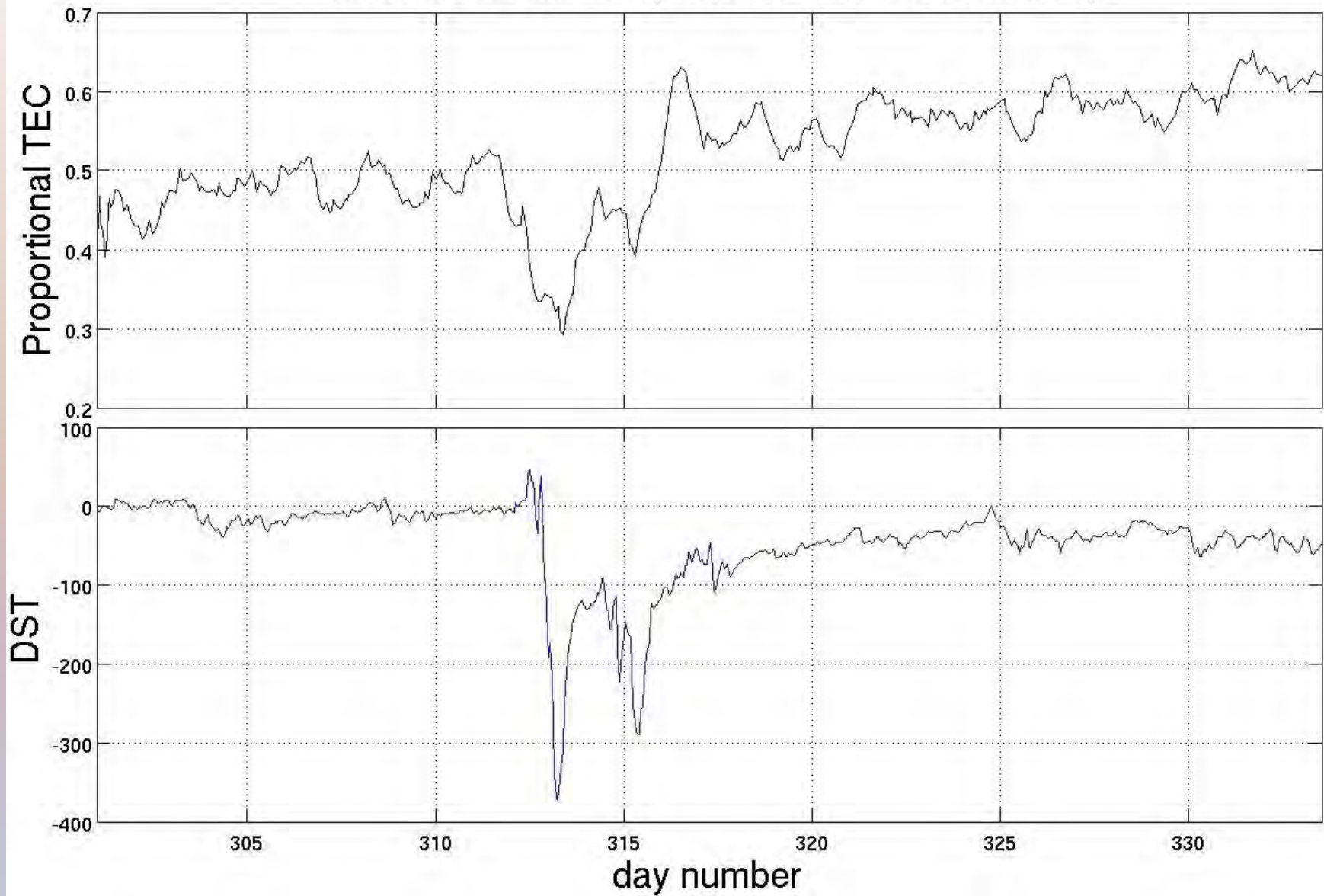


- Only included simultaneous CHAMP and ground-based measurements.
- Subtracted CHAMP measurement from ground based, divided by ground-based.

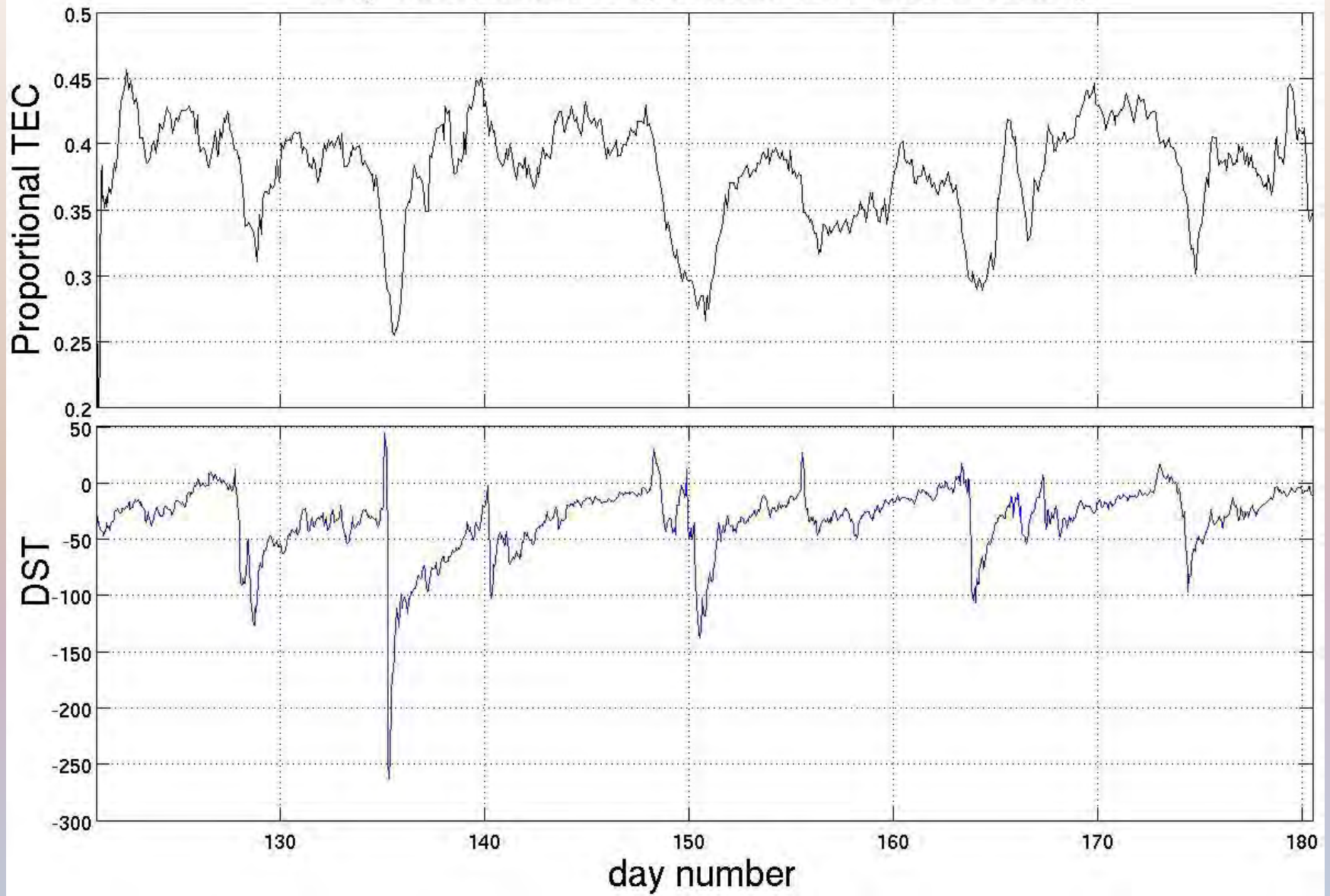
October-November, 2003: Proportional TEC Below CHAMP



November, 2004: Proportional TEC Below Champ



May-June, 2005: Proportional TEC Below Champ



Summary

- DST disturbances correspond to global TEC effects. These effects are more significant at low latitudes and high altitudes.
- Storm effects are more noticeable during the solar maximum. During times of lower solar activity, storm effects are overcome by quasiperiodic TEC variations.
- Many global TEC structures are still unaccounted for.

Acknowledgments

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- Shunrong Zhang
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