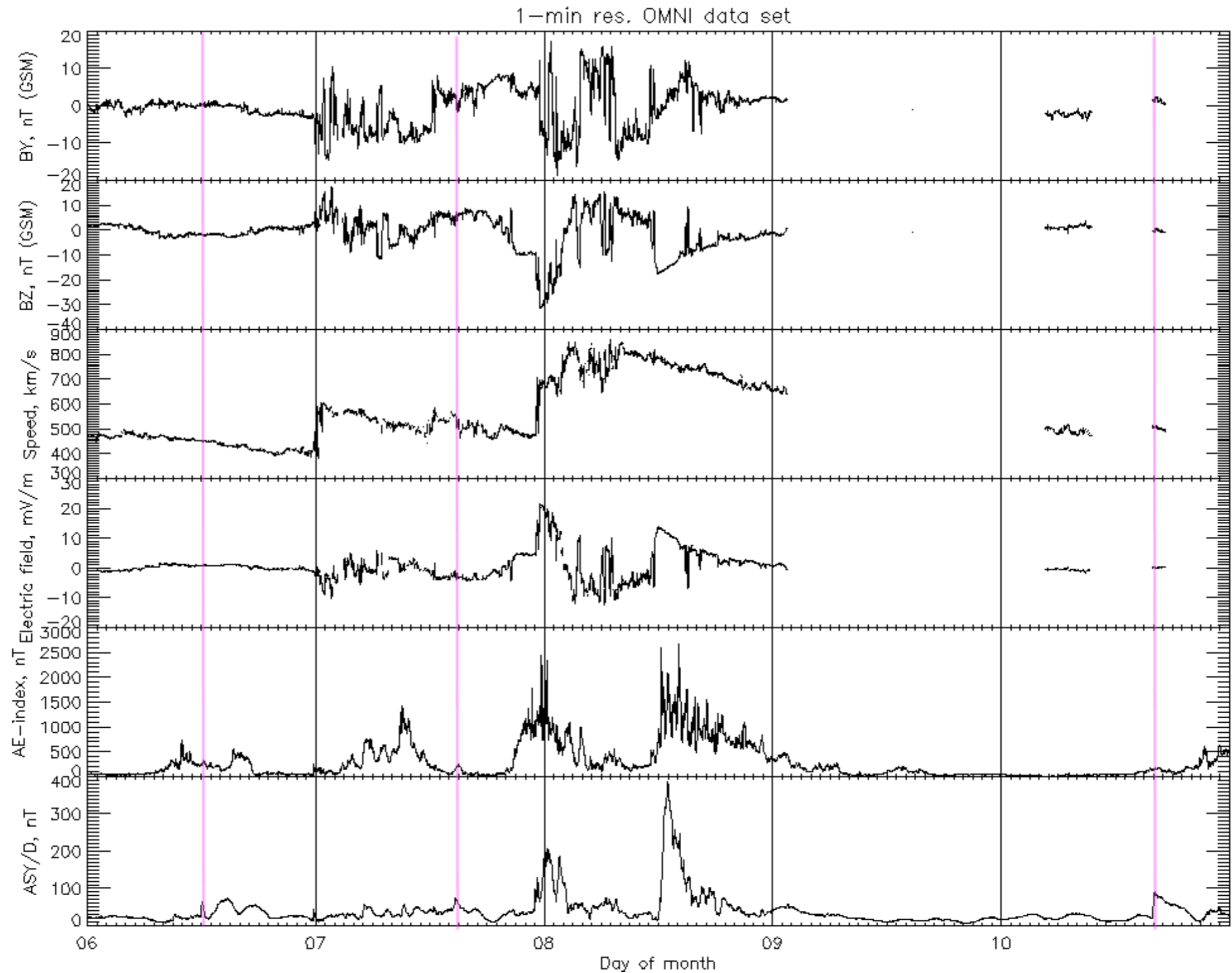
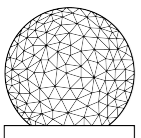
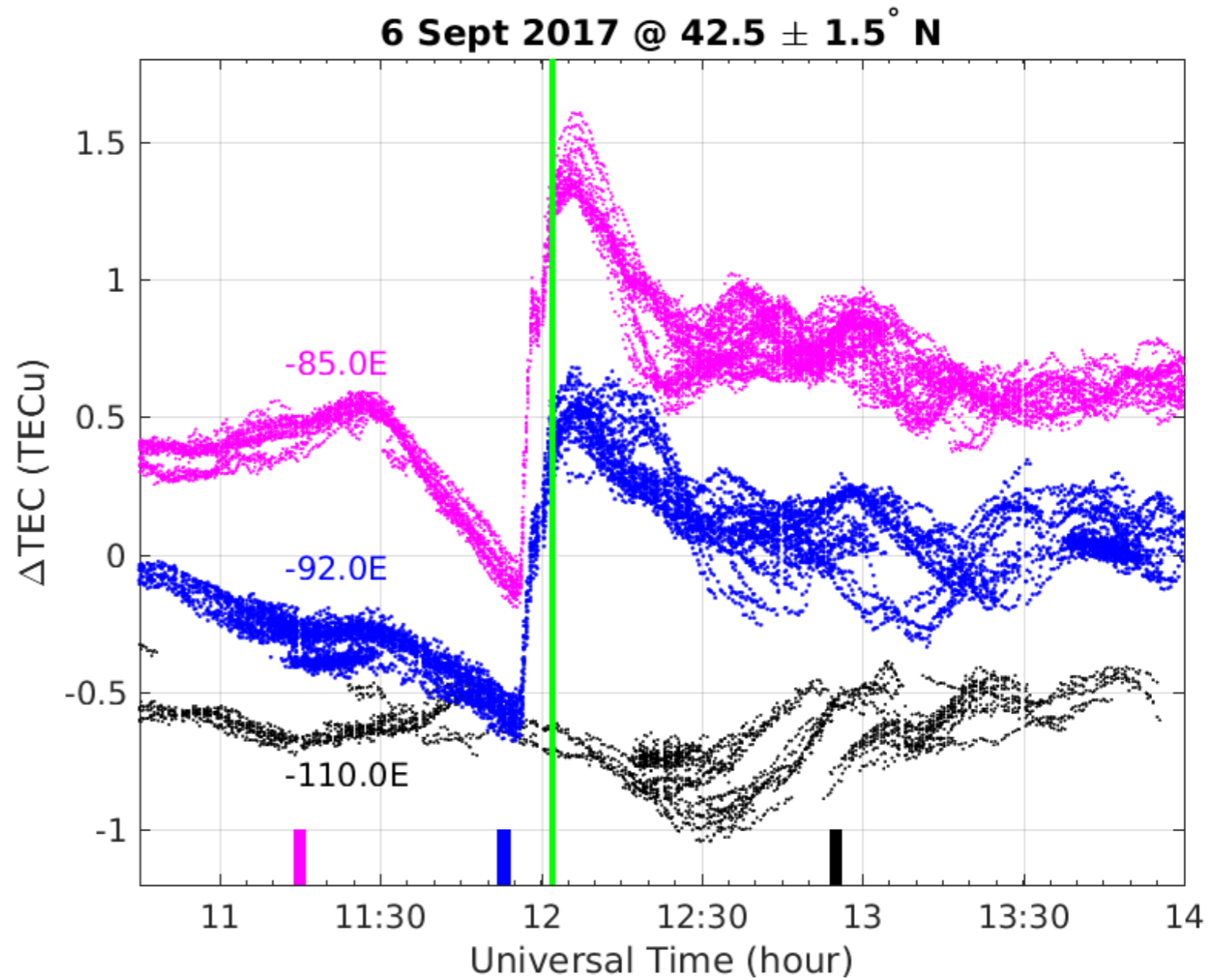
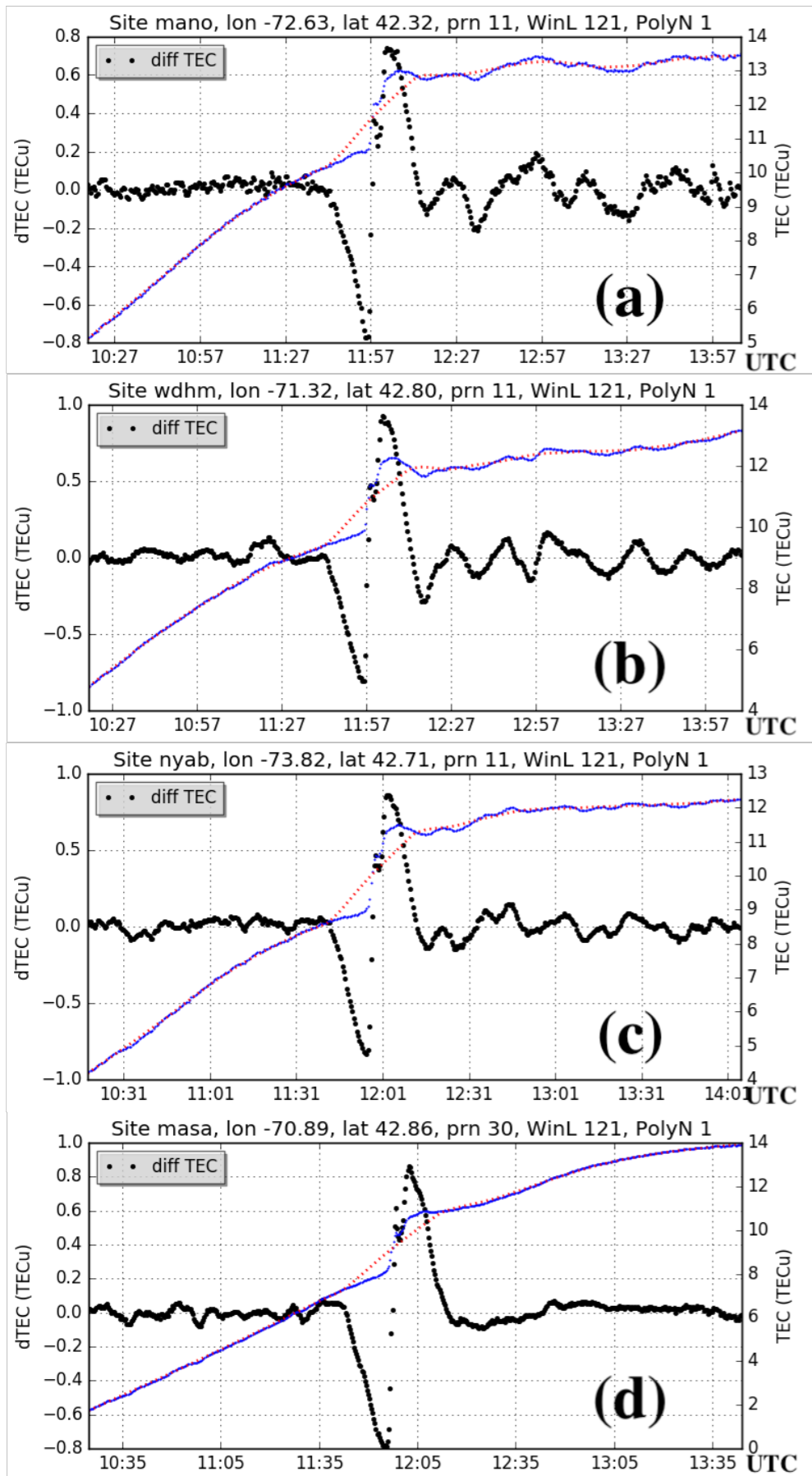


Ionospheric Disturbances During 6-10 September Solar Events

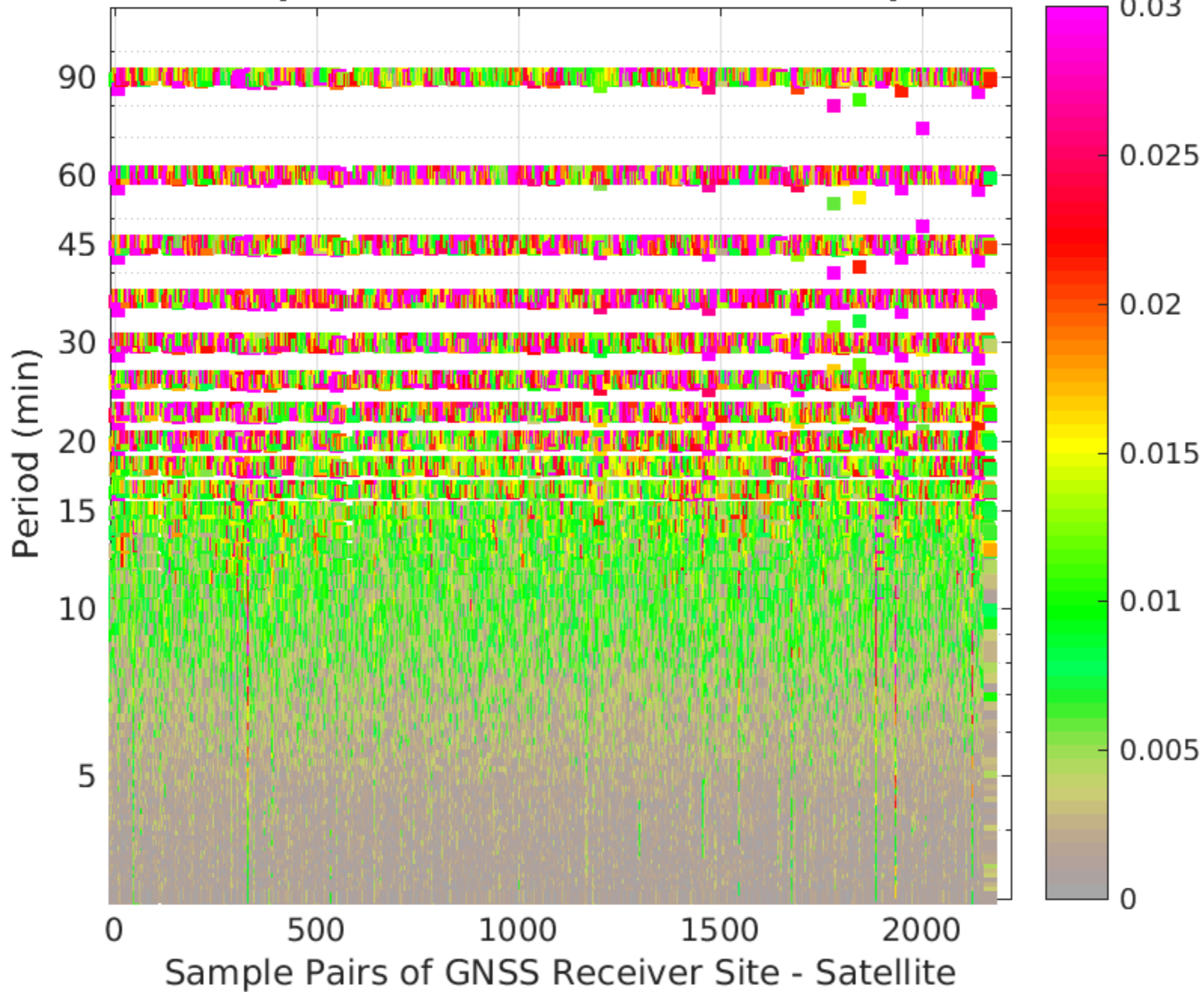
Shunrong Zhang, Anthea Coster, Phil Erickson
MIT Haystack Observatory

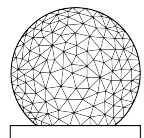
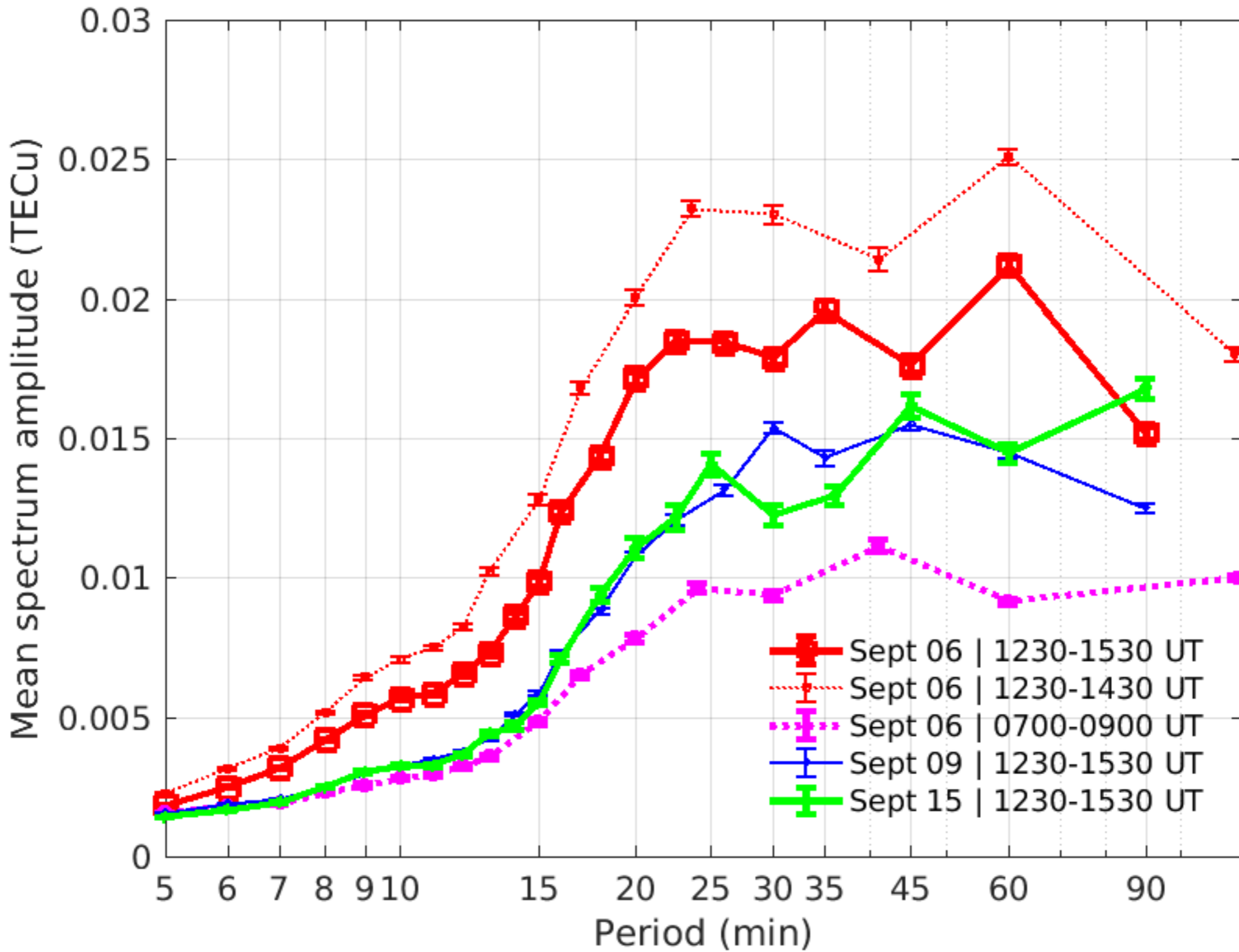
Solar Geophysical Conditions: 6-10 Sept 2017



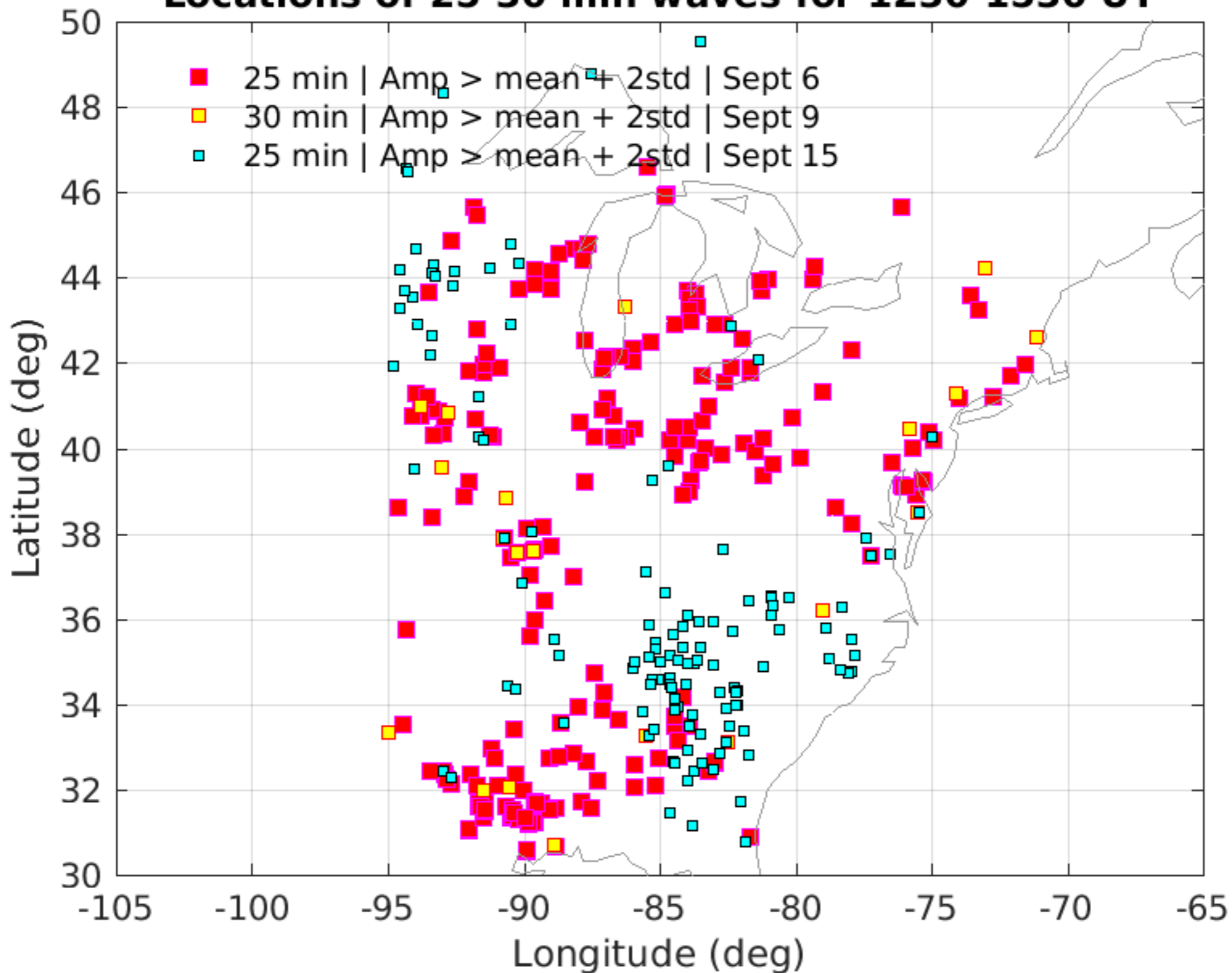


FFT Amplitude for 1230-1530 UT on Sept 06

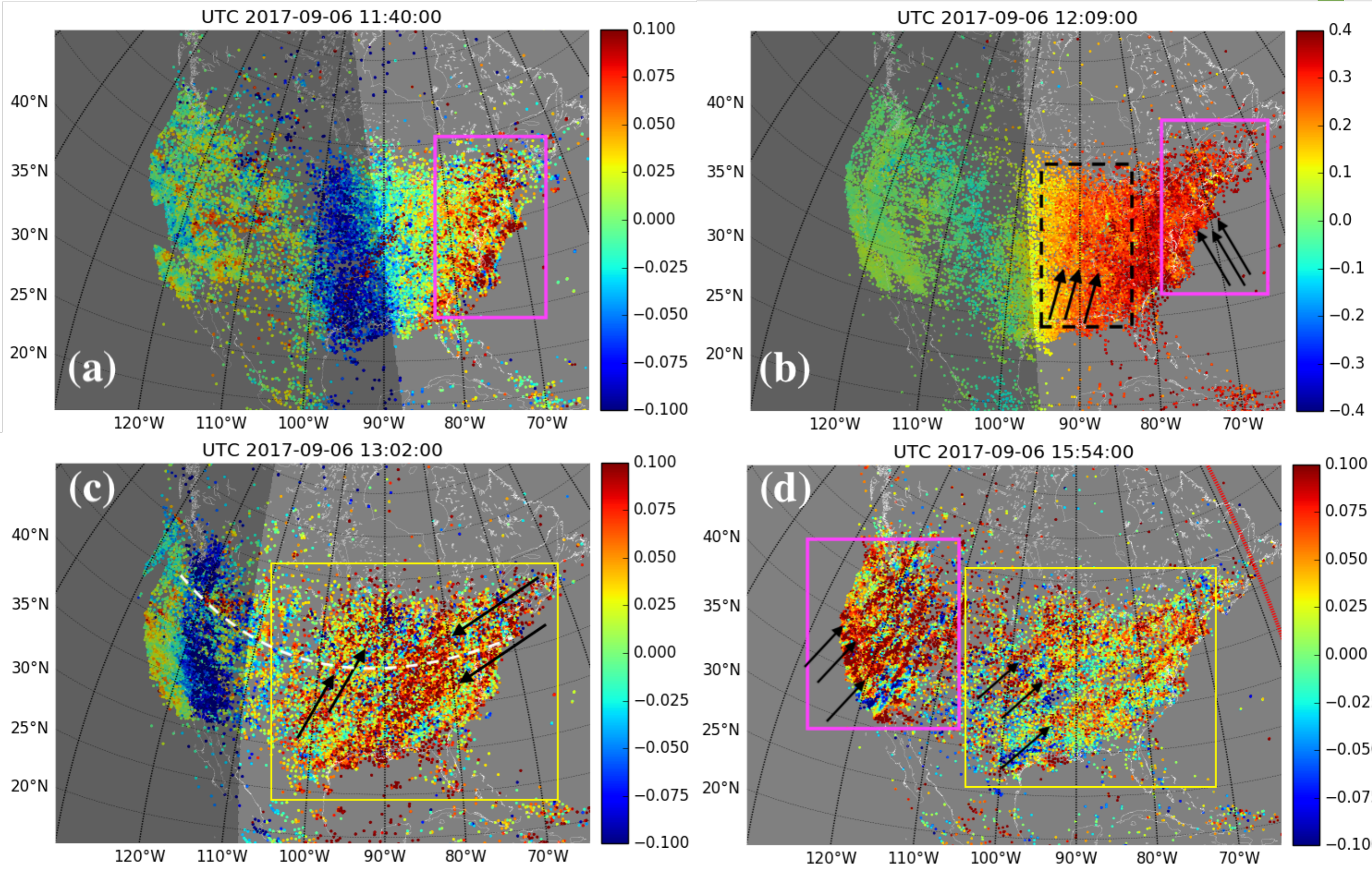




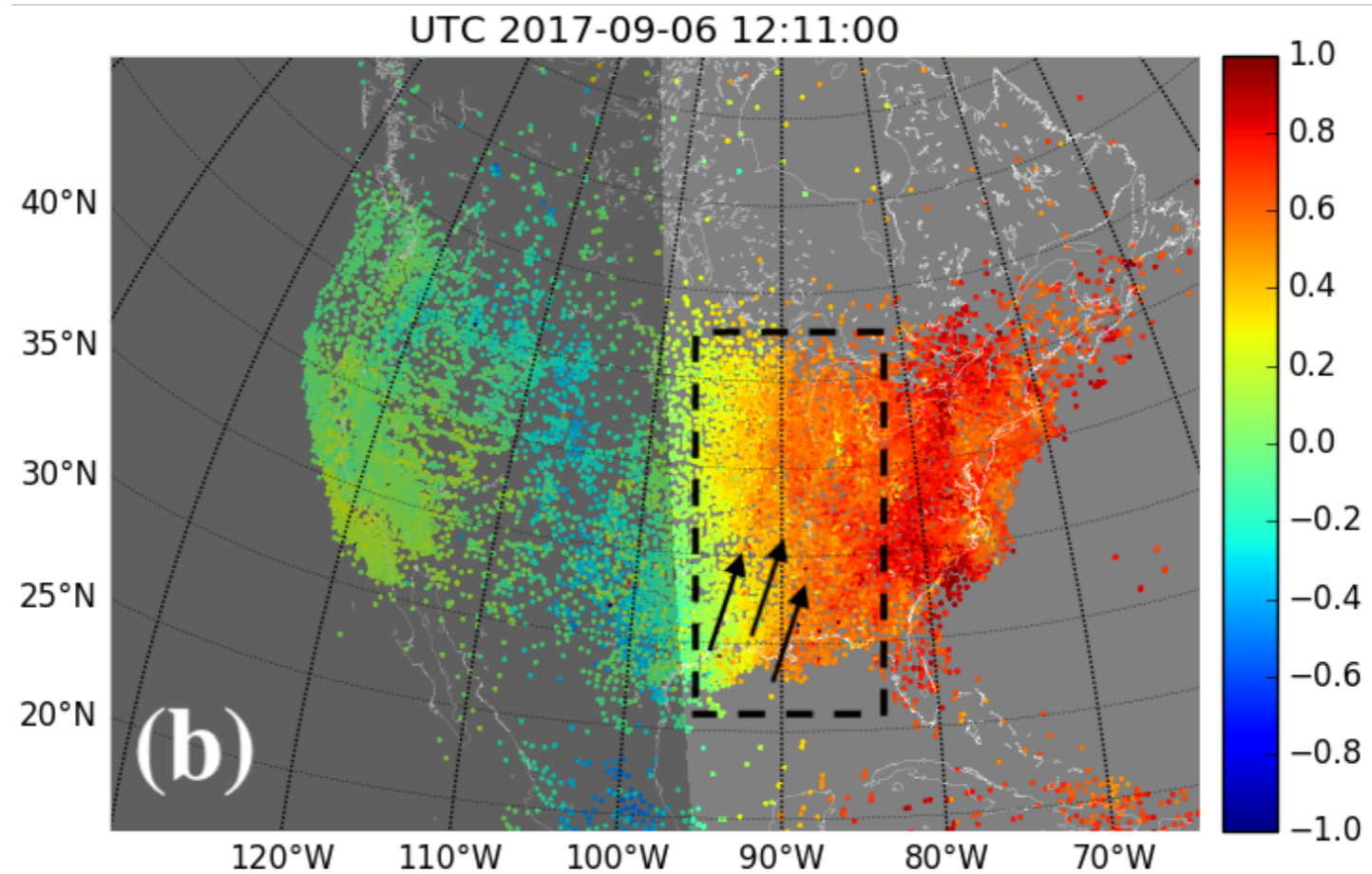
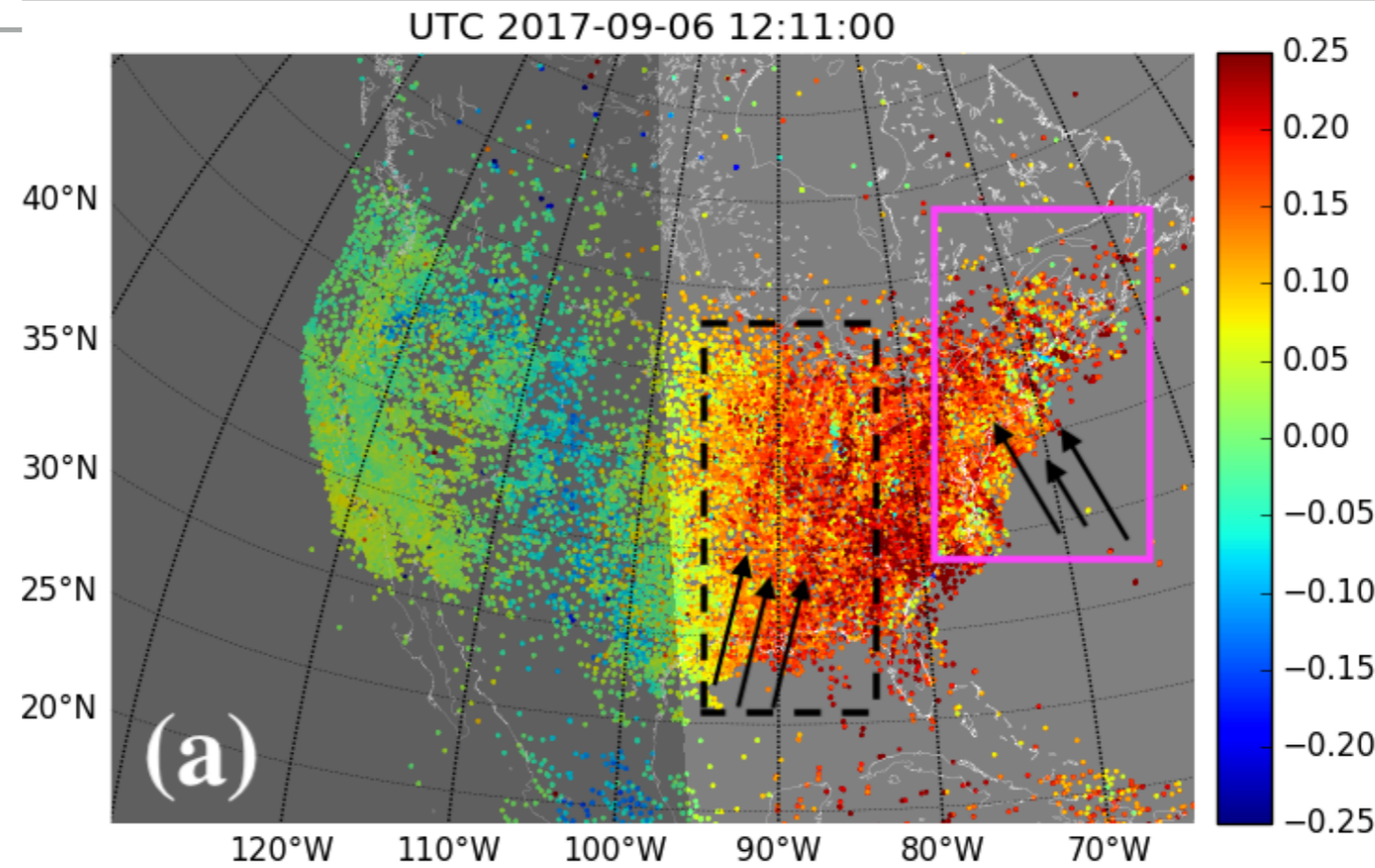
Locations of 25-30 min waves for 1230-1530 UT



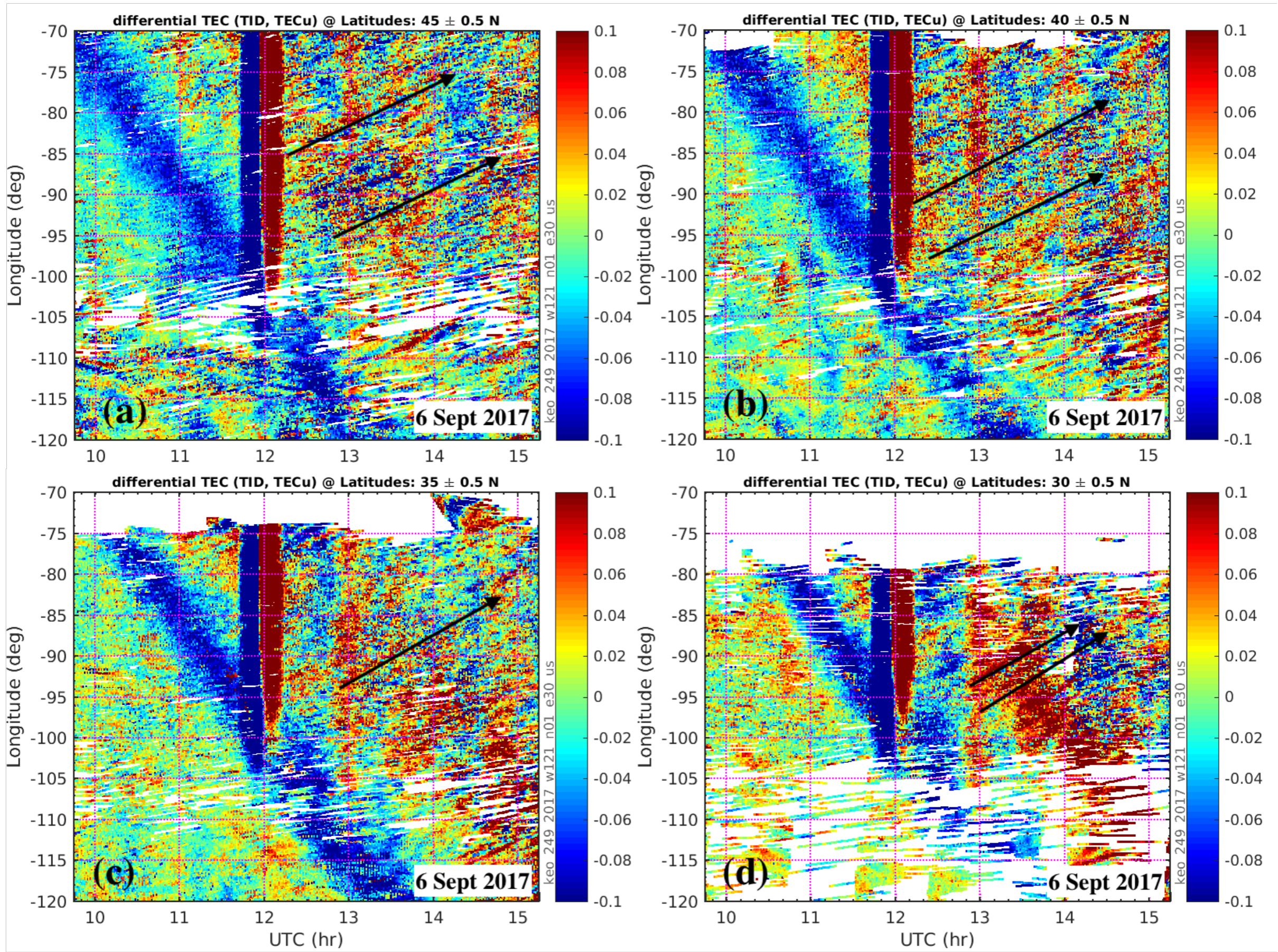
Flare Peaked at 12:02 UT; 12:07 Saw TID Wave Fronts



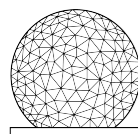
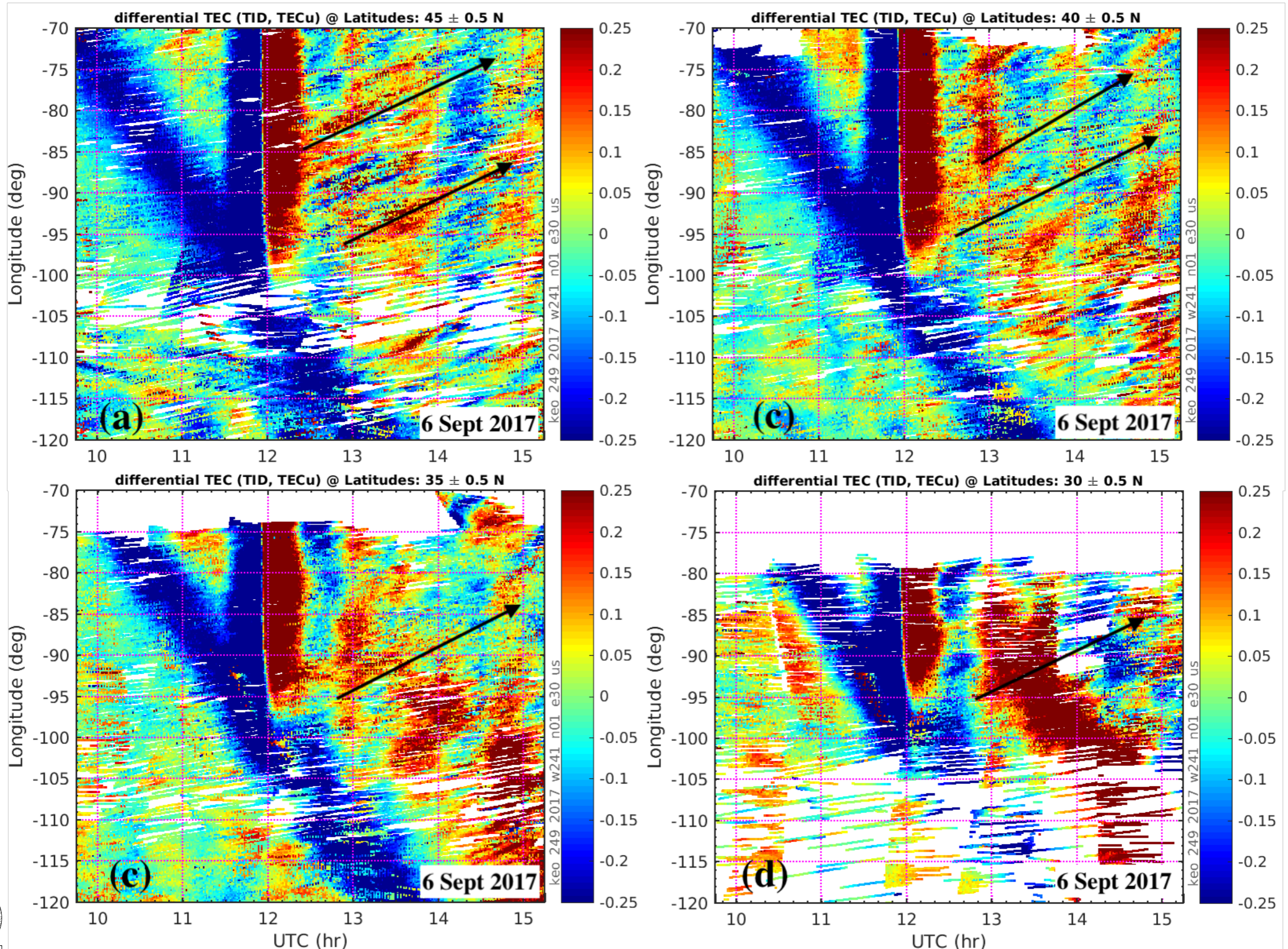
30-Min and 60-Min De-Trending Windows



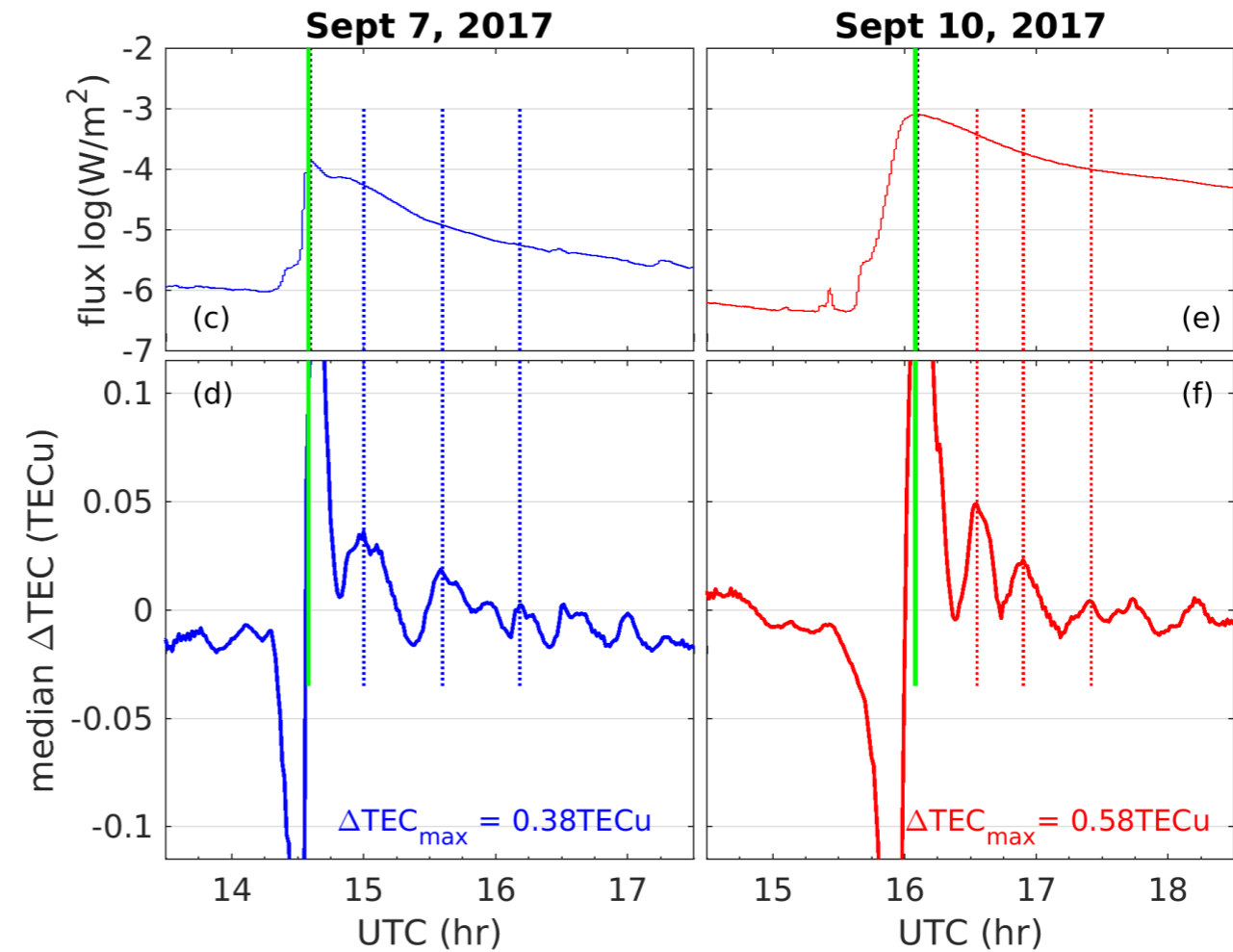
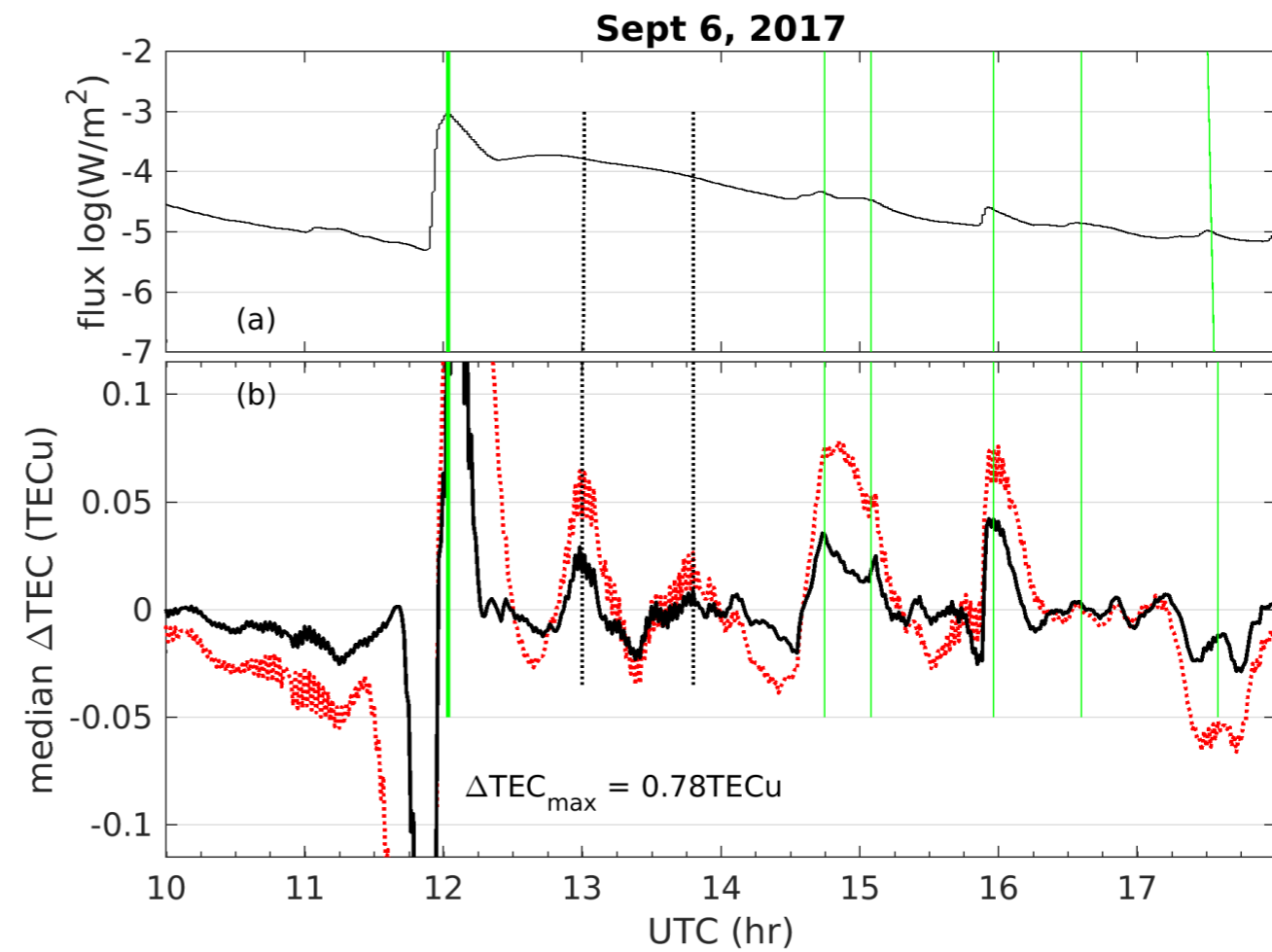
Propagation Speed

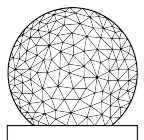
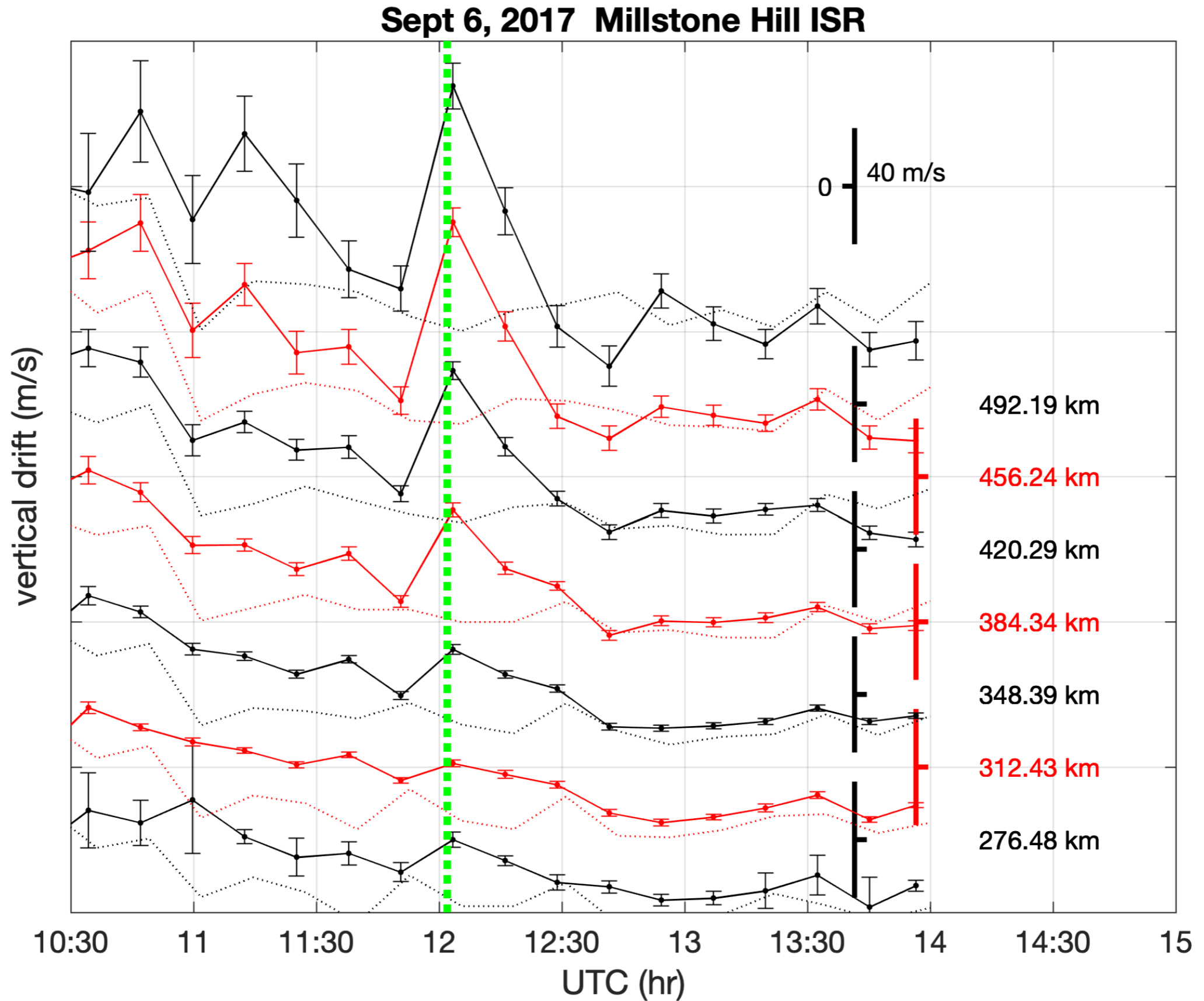


Propagation Speed - 60 Min Window



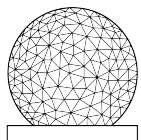
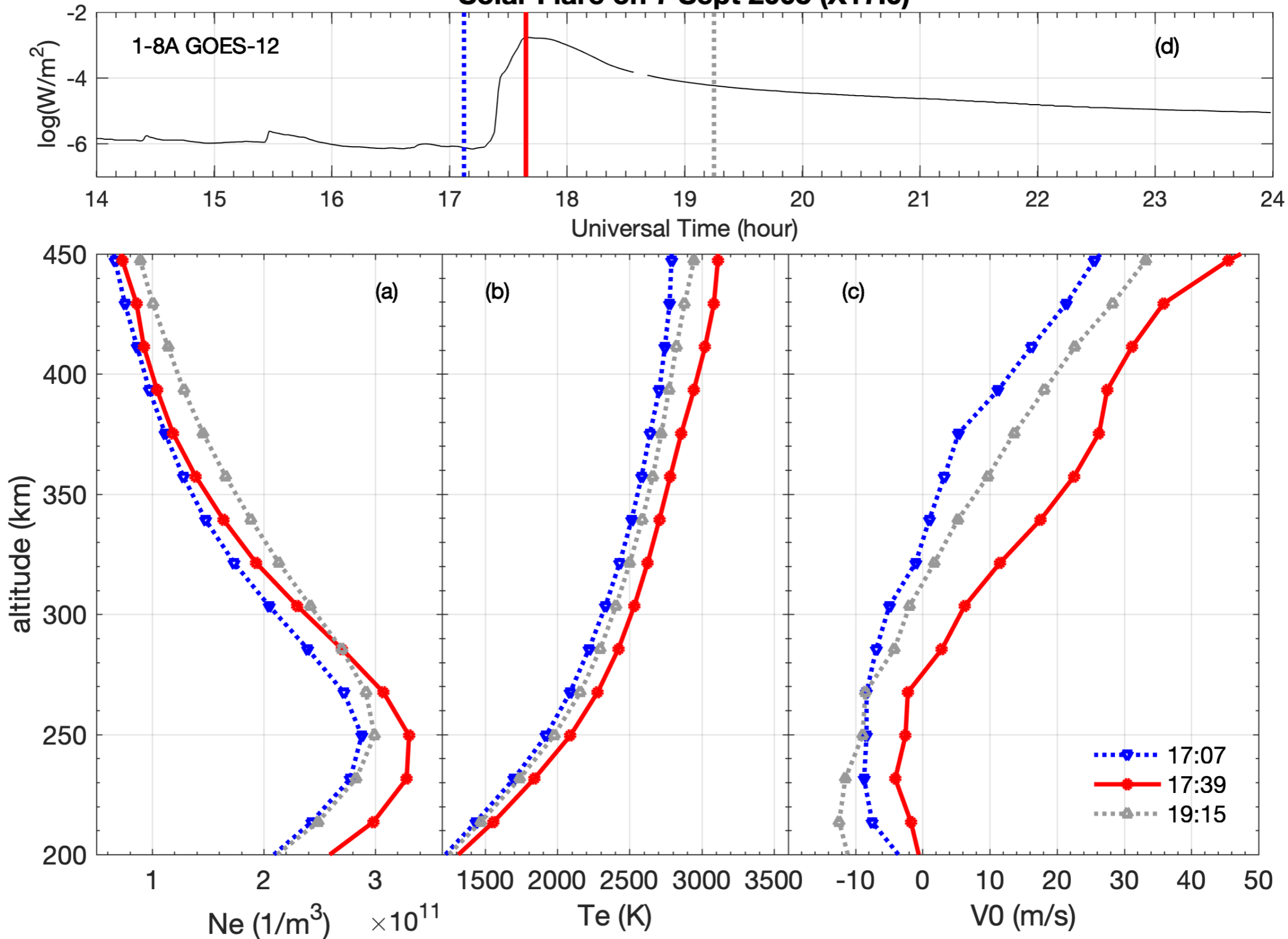
CONUS Median dTEC



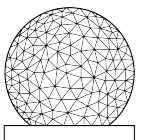
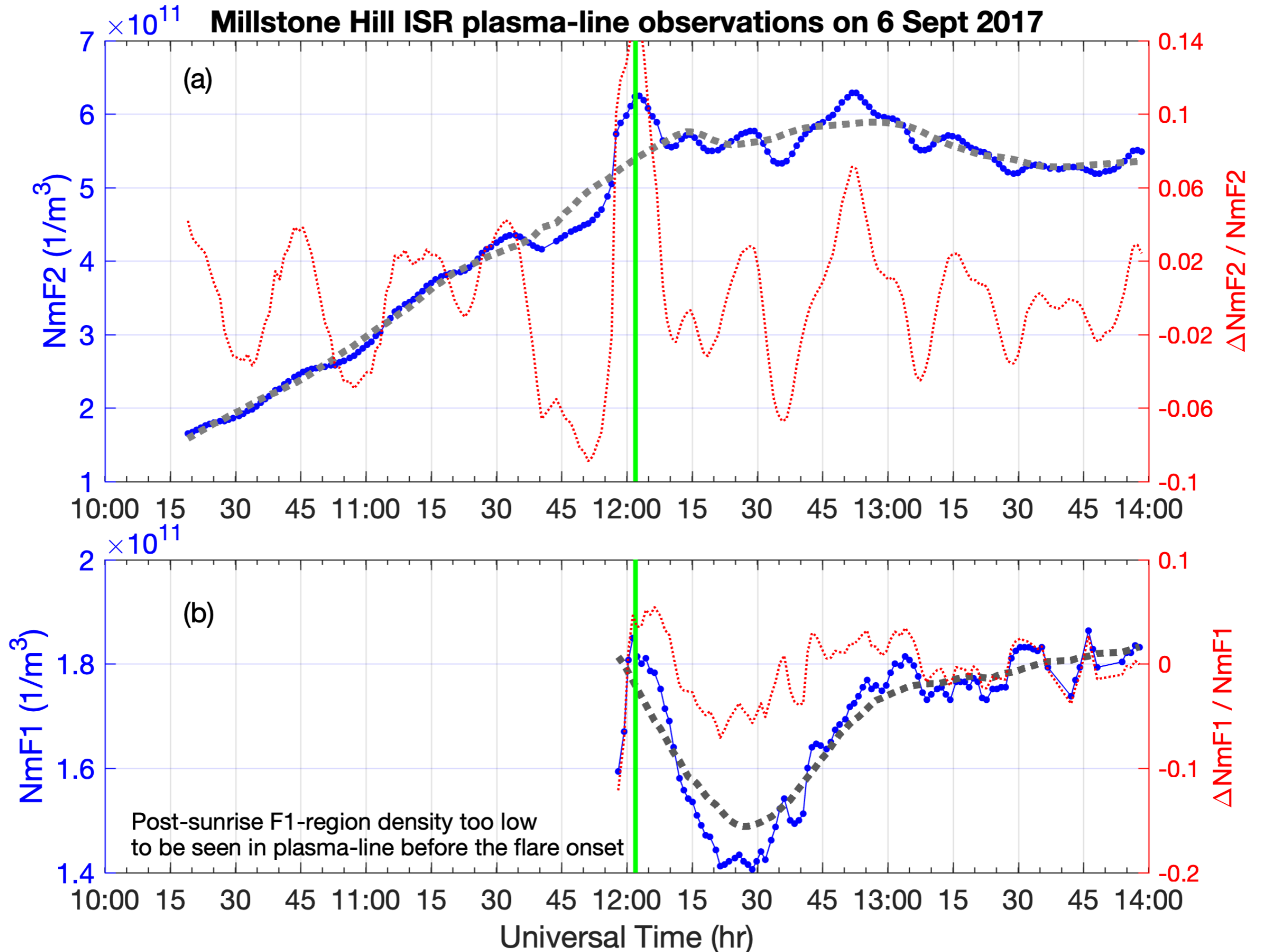


Another Event: X17.0 on 7 Sept 2005

Solar Flare on 7 Sept 2005 (X17.0)



Fast Decay Time: 10–20 Min



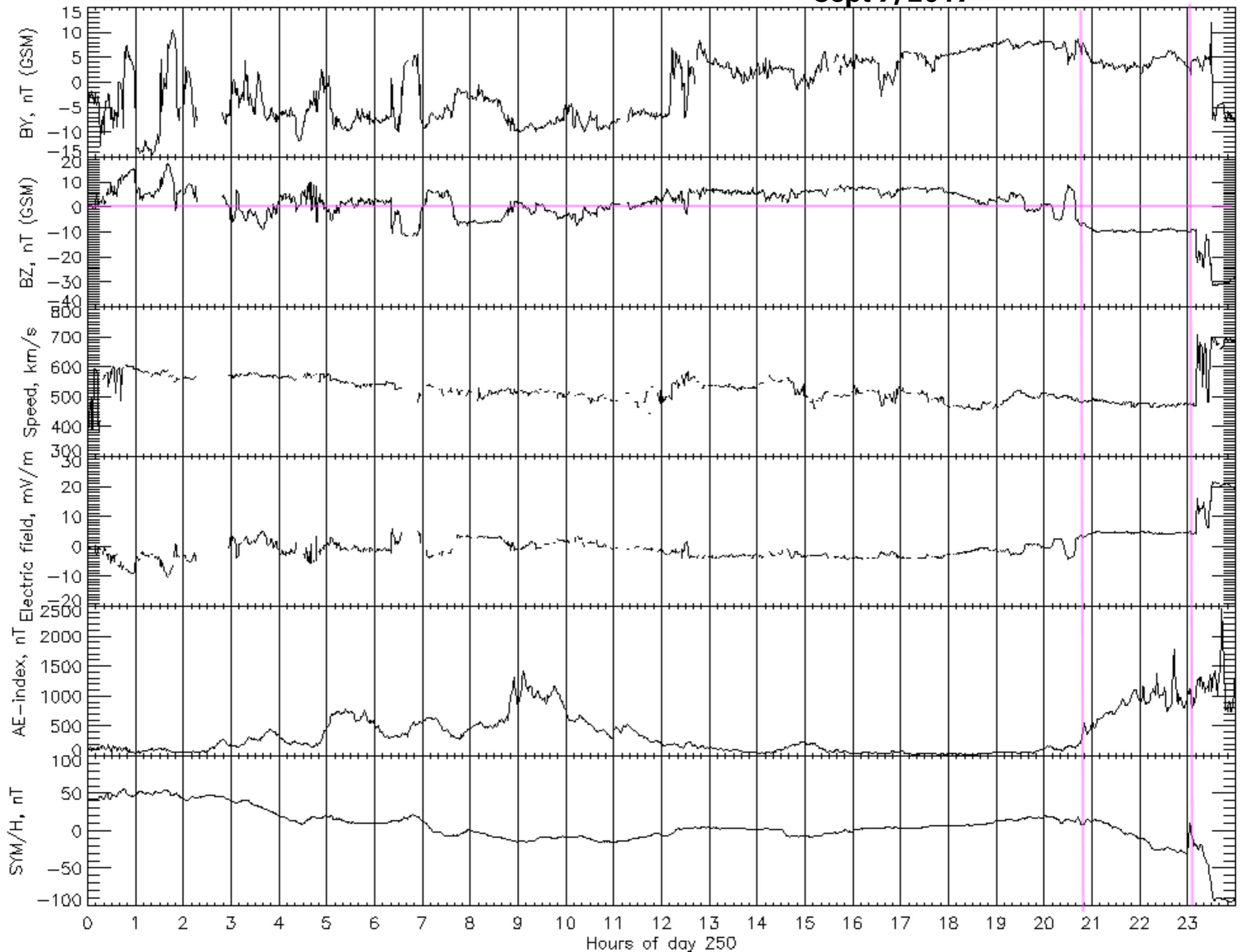
- ▶ Post-flare TIDs emanating near sunrise terminator propagated predominantly eastward with 150 m/s zonal phase speed and ~30 min period
- ▶ Synchronized differential TEC oscillations occurred over the continental US with 40-60 min period and decreasing amplitude over time
- ▶ Rapid and significant ionospheric up-welling developed in the topside immediately after onset of X-class flare

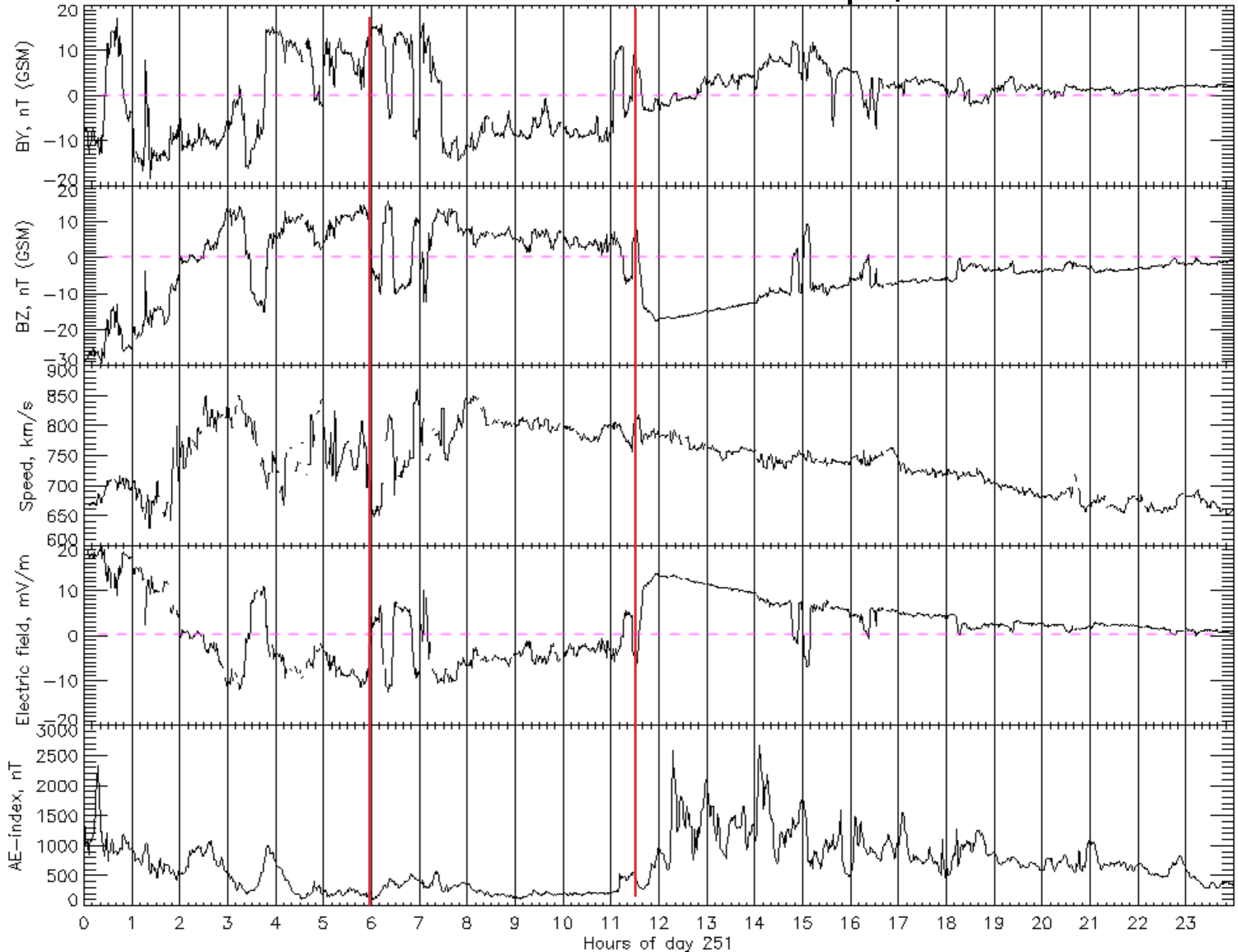
The overall picture: very dynamic ionospheric disturbances near the solar terminator.

Ionospheric heating is substantial; conductive changes are large. Joule heating.

We hypothesize that sudden solar flare energy inputs trigger certain (but not yet completely quantified) ionospheric inherent resonances leading to observed 30-60 min synchronized TEC oscillations which are damped quickly in amplitude.

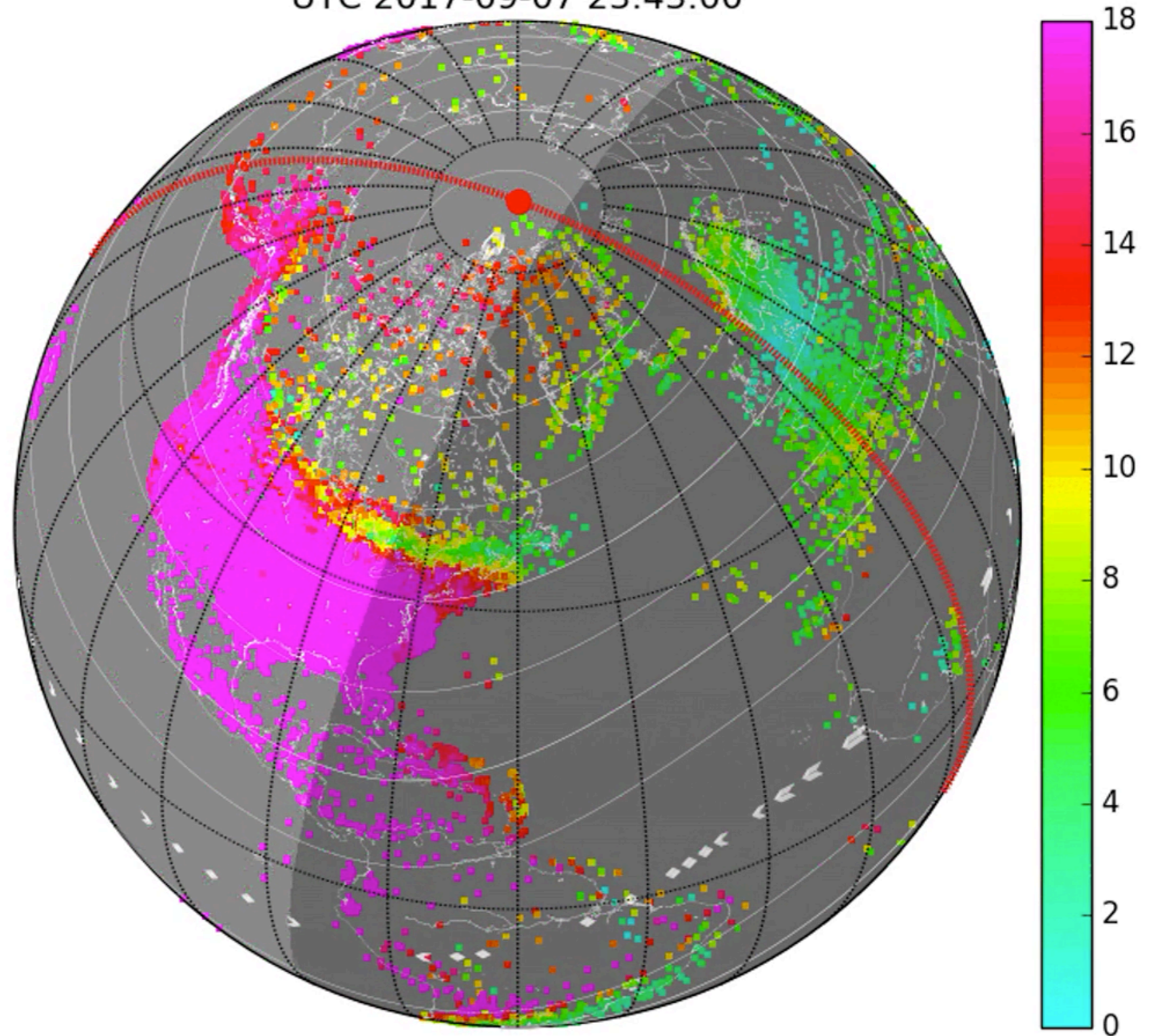
TIDs are presumably excited by the flare near the solar terminator and are therefore related to joint flare and sunrise effects. These TIDs could interact with pre-existing solar terminator induced TIDs.



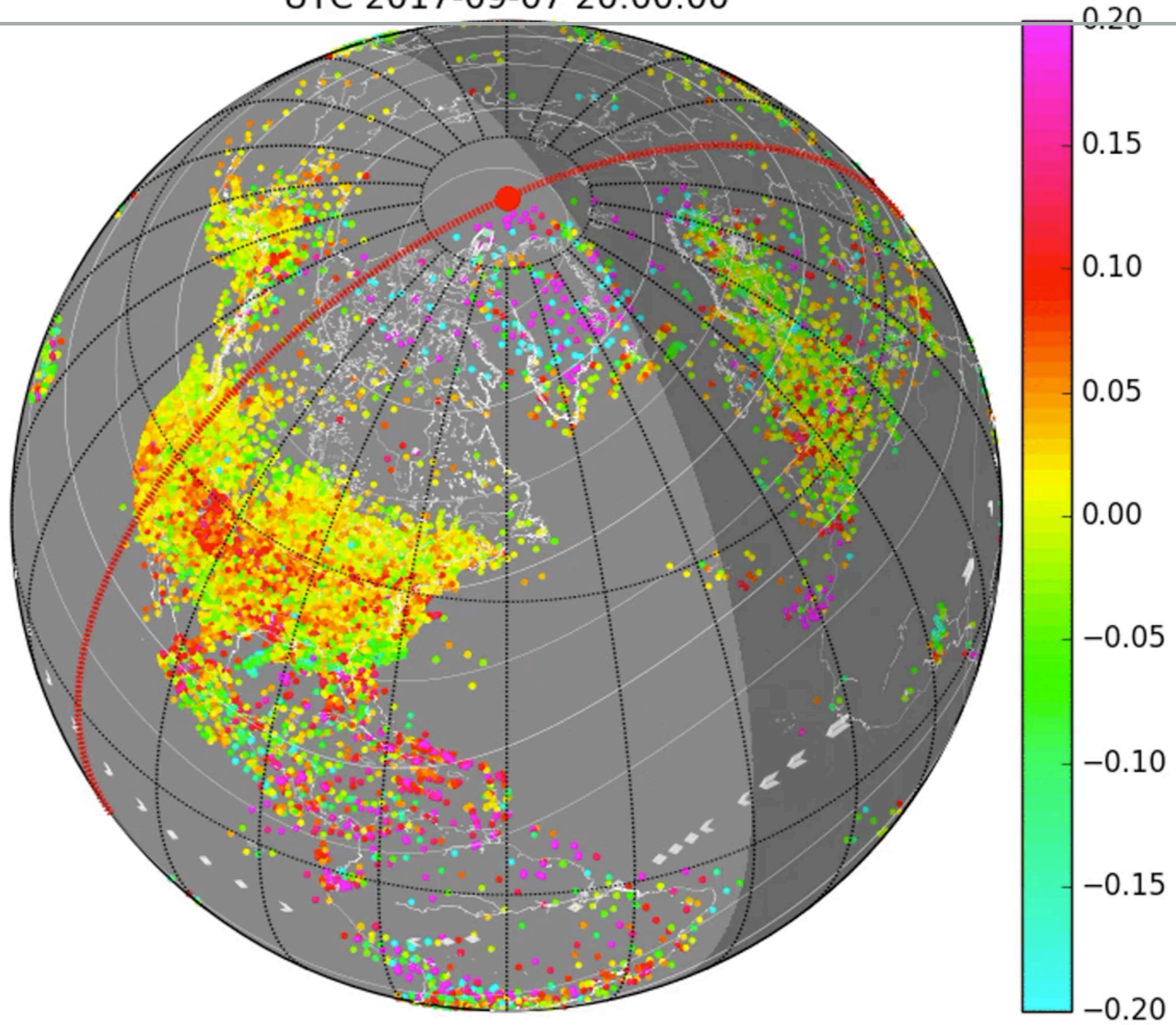


TEC (22-02UT; 13UT-; 21 UT)

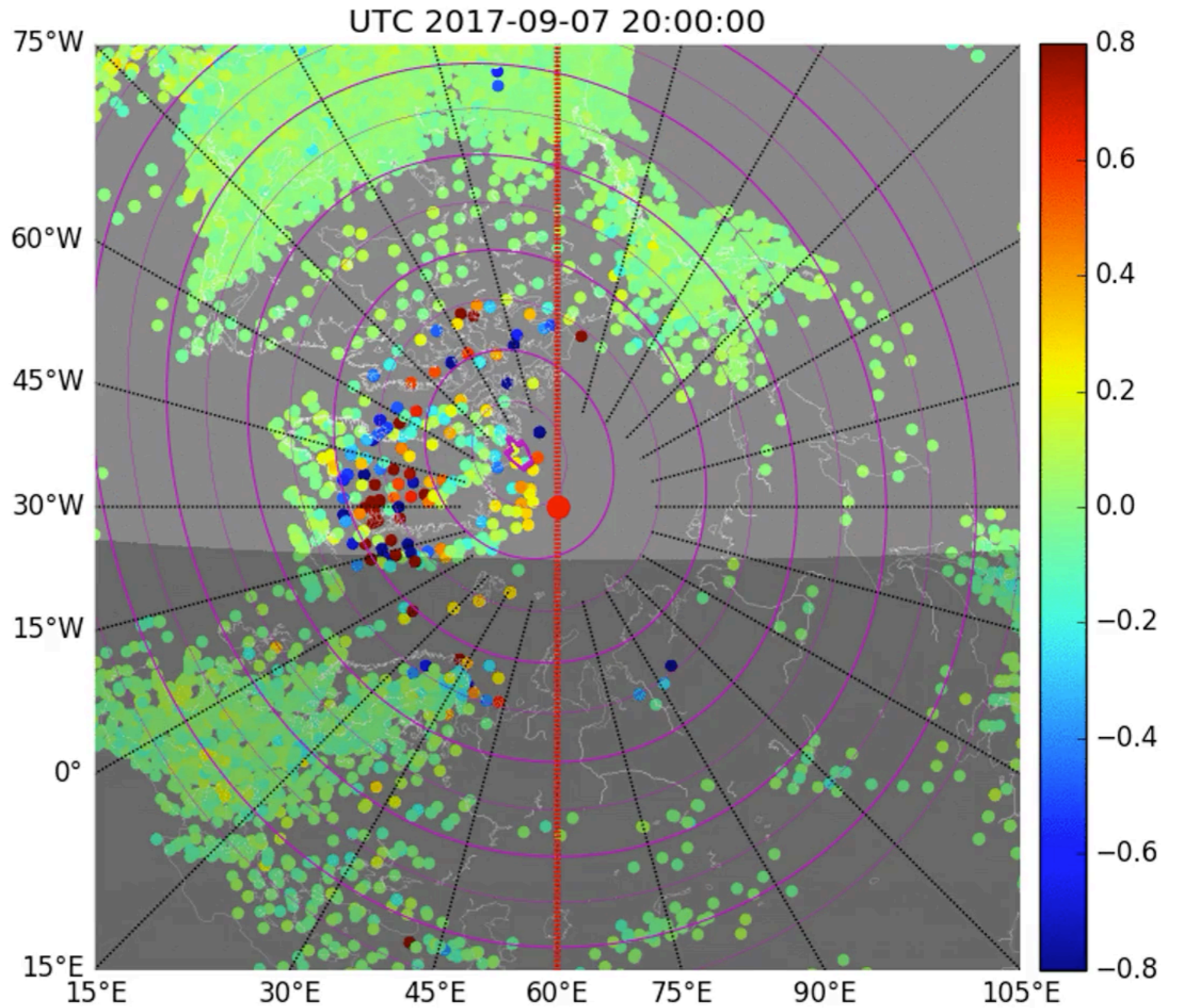
UTC 2017-09-07 23:43:00

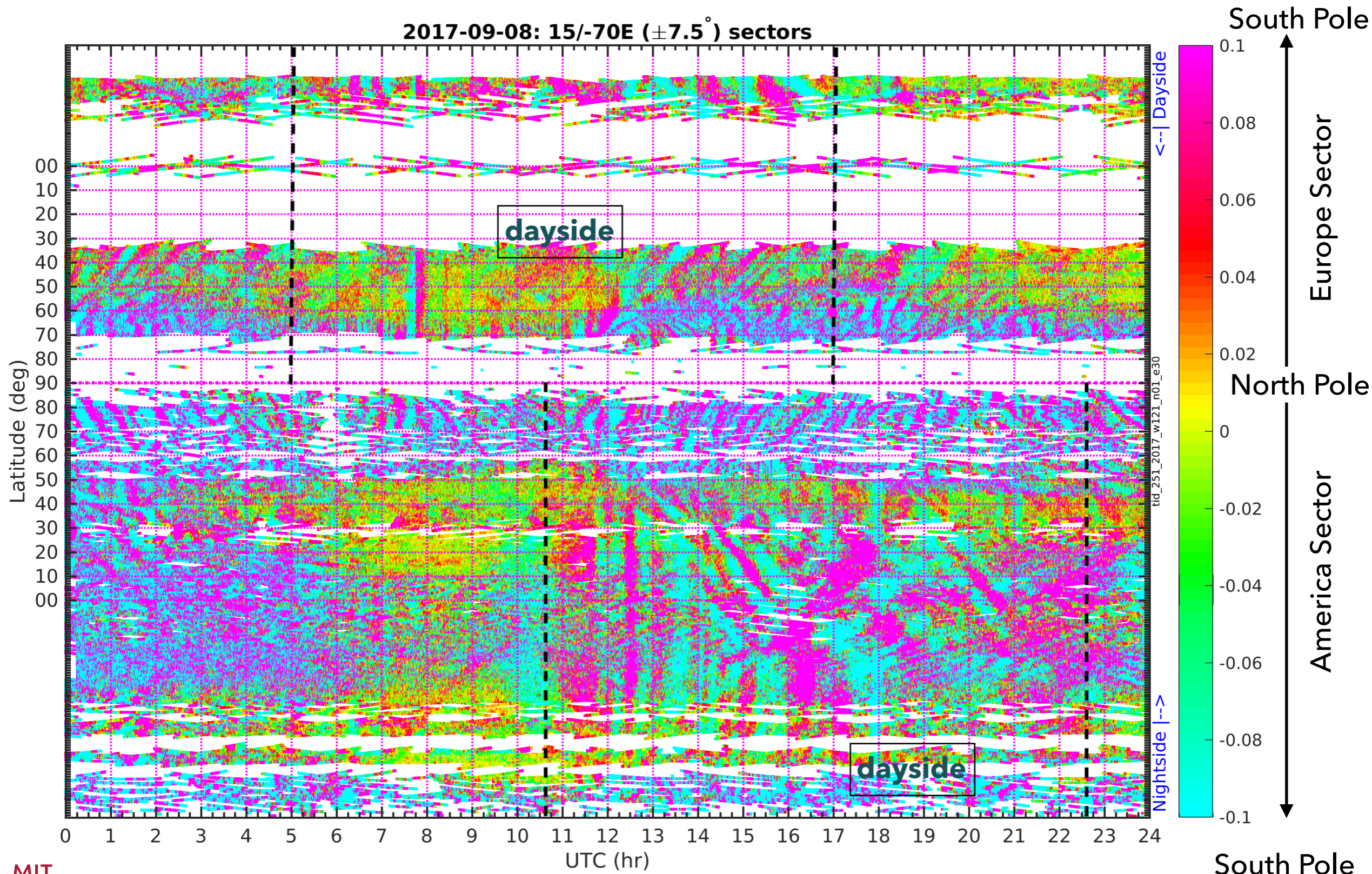


UTC 2017-09-07 20:00:00

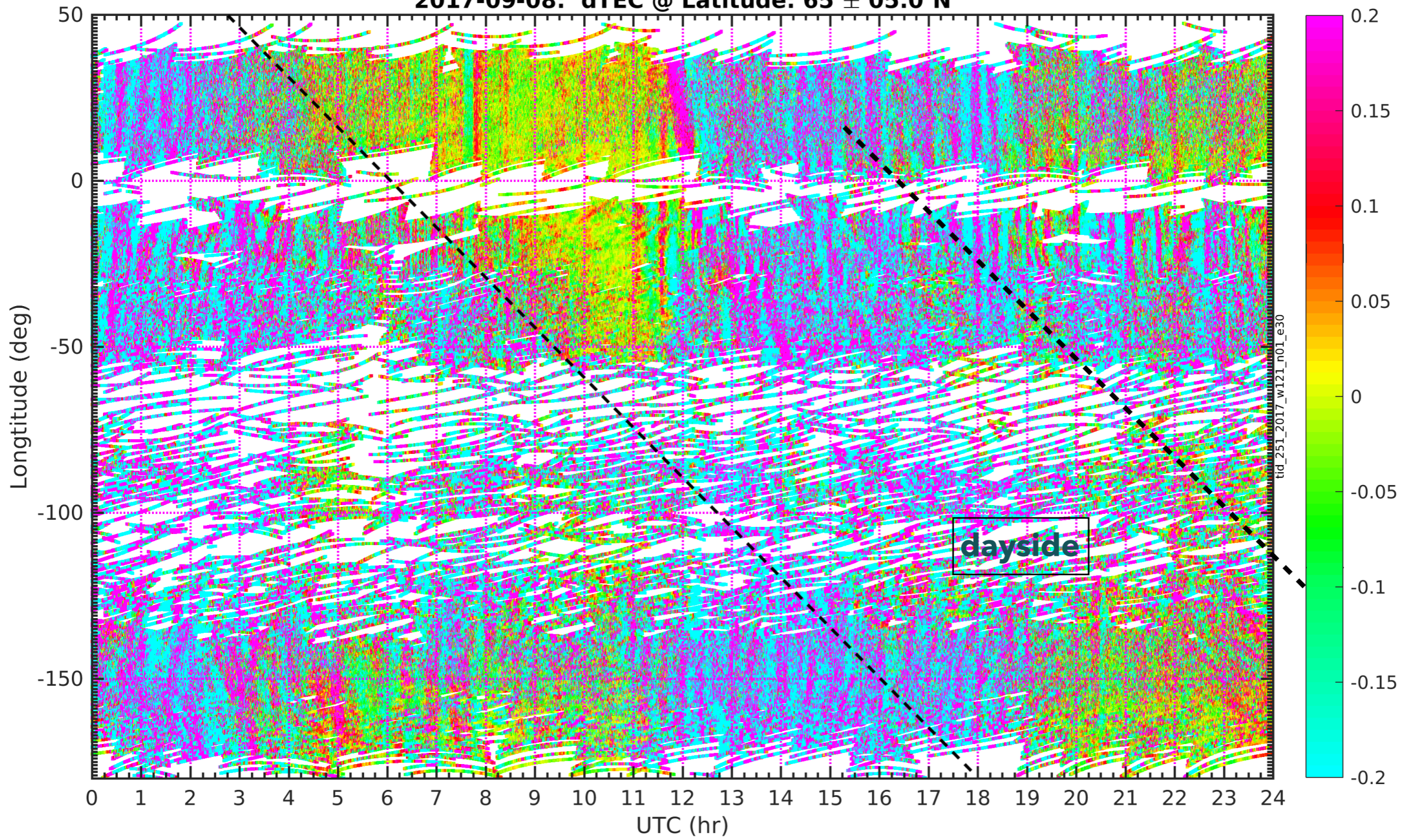


- ▶ **07:2110UT: Dusk, Greenland, Equatorward**
- ▶ **08: 1440UT: Noon, Poleward and Equatorward**
- ▶ **1645-18UT: Dayside EU, EW**

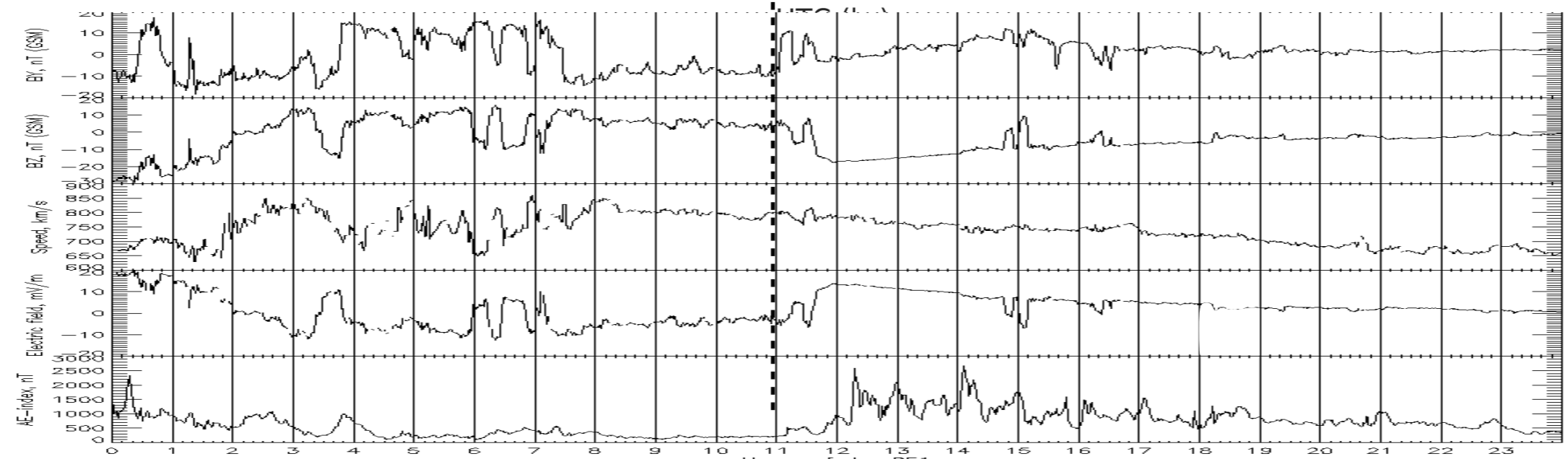
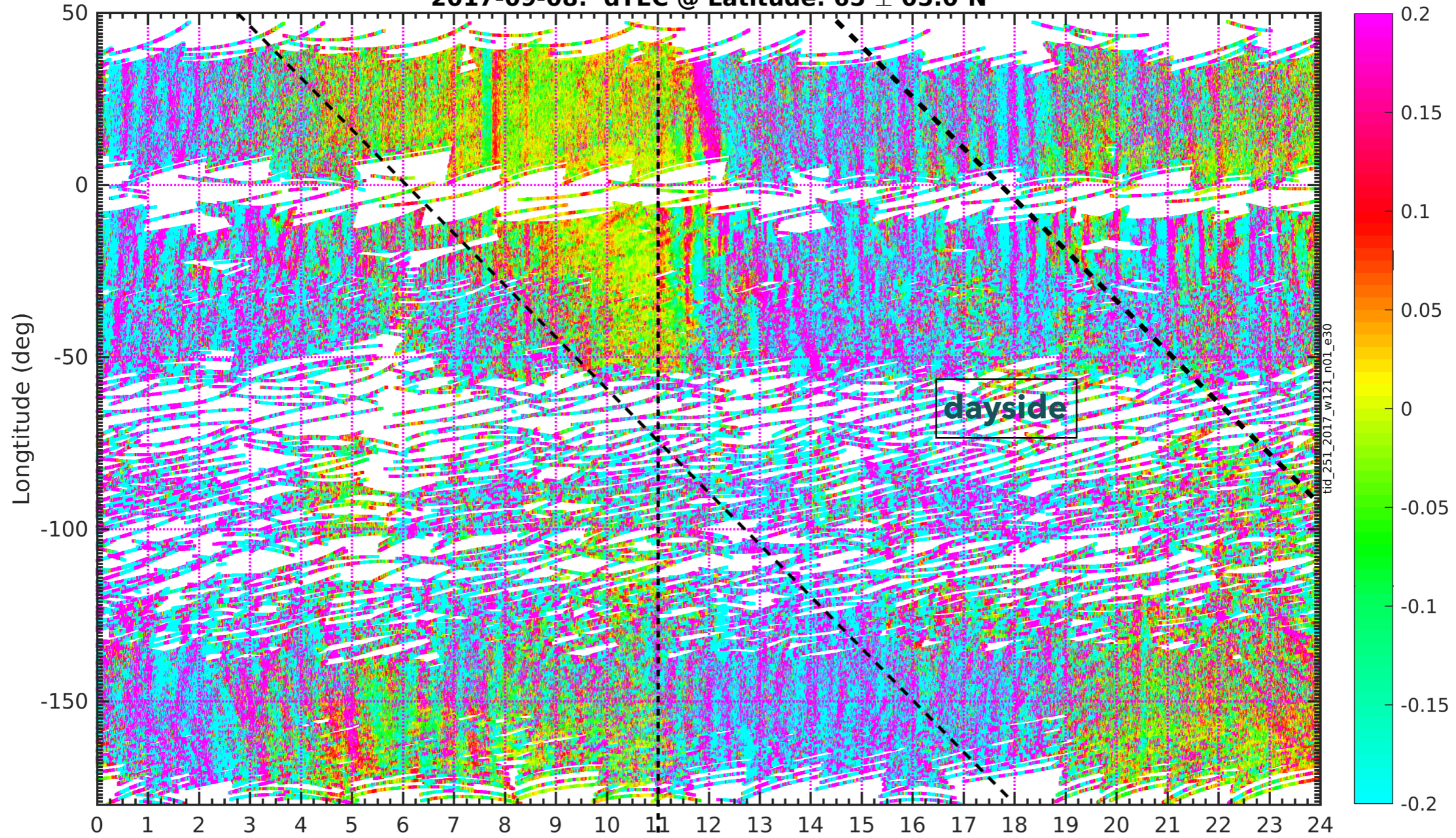




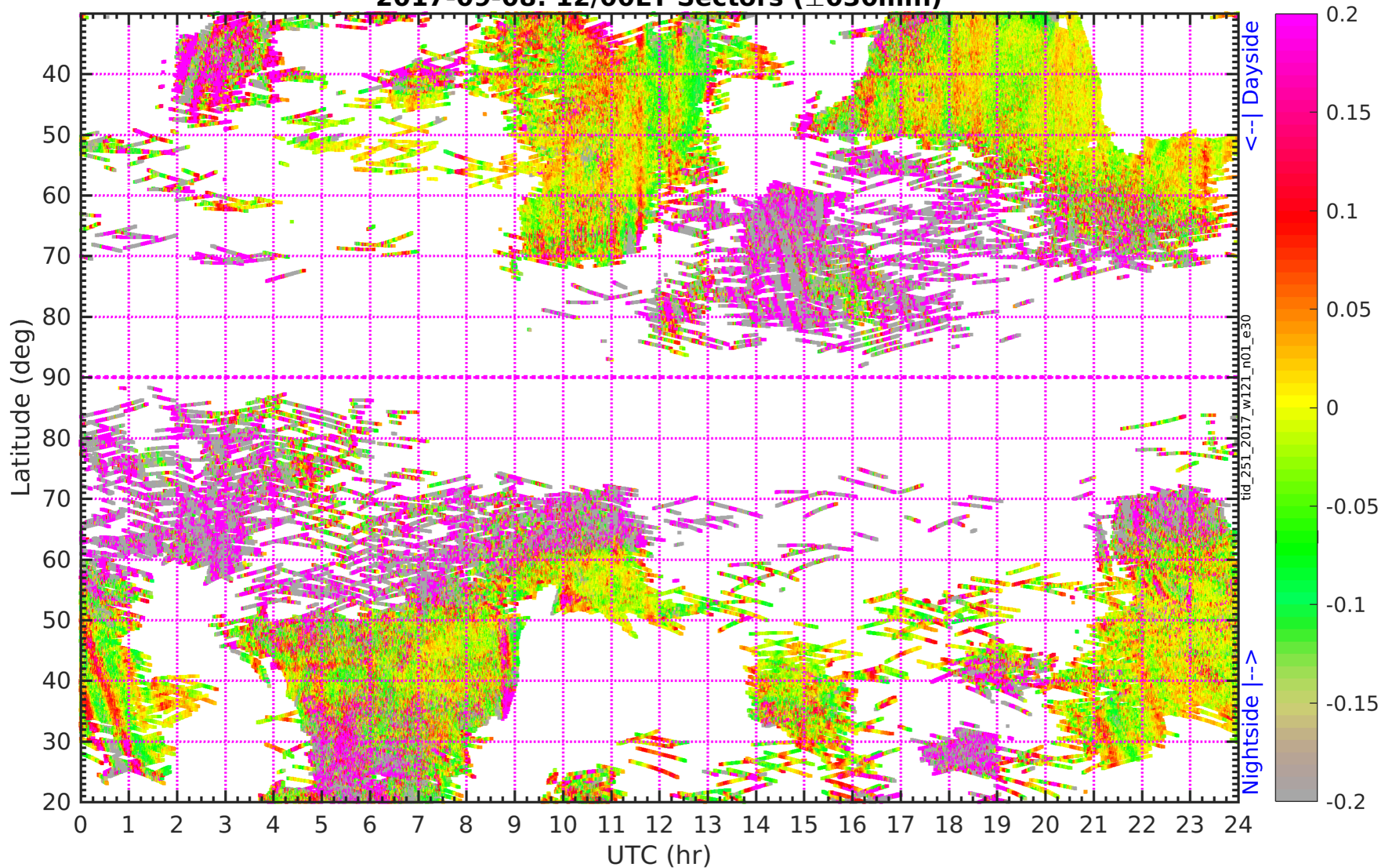
2017-09-08: dTEC @ Latitude: $65 \pm 05.0^\circ$ N



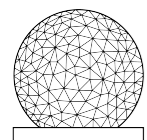
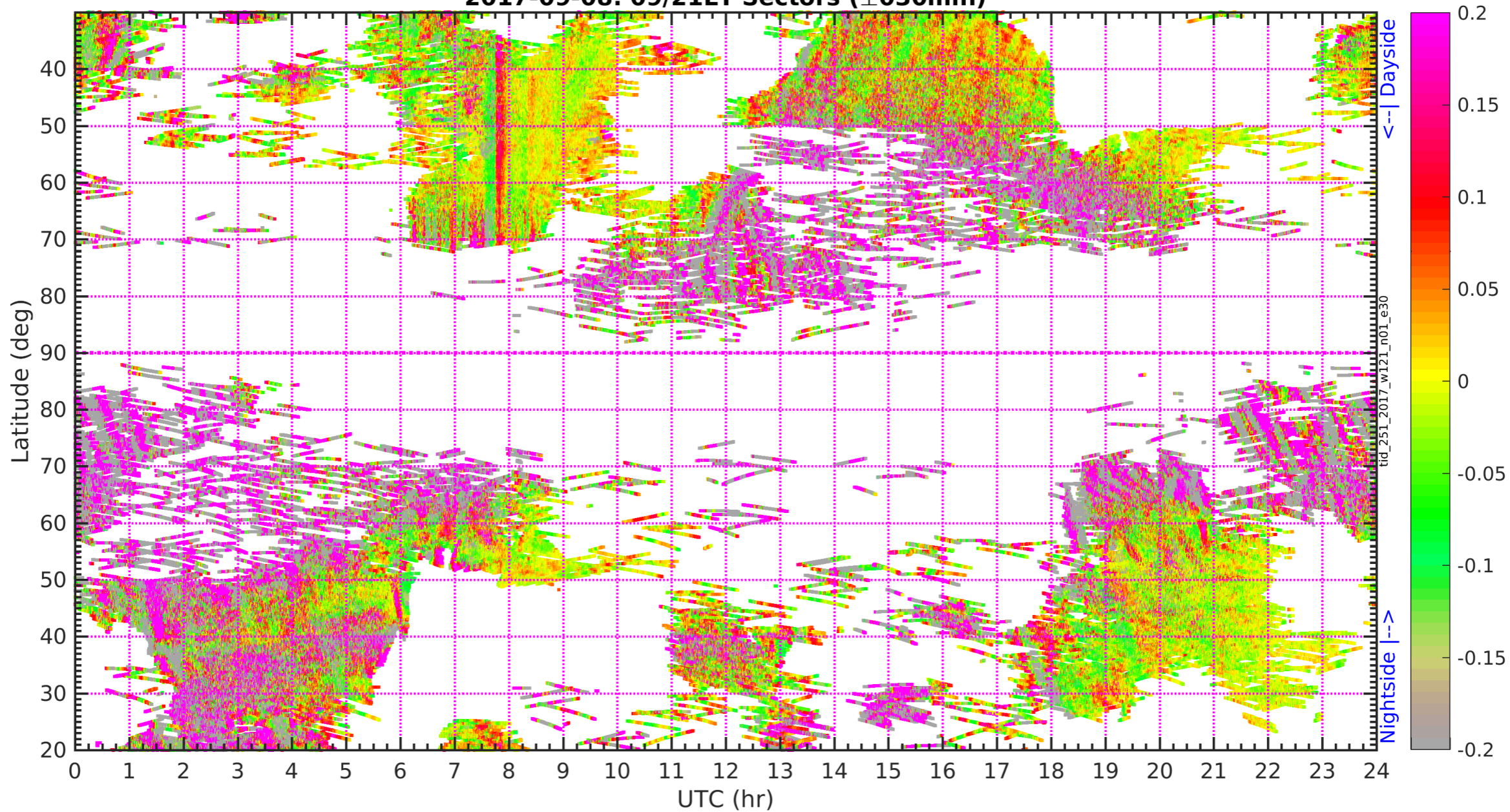
2017-09-08: dTEC @ Latitude: $65 \pm 05.0^\circ$ N



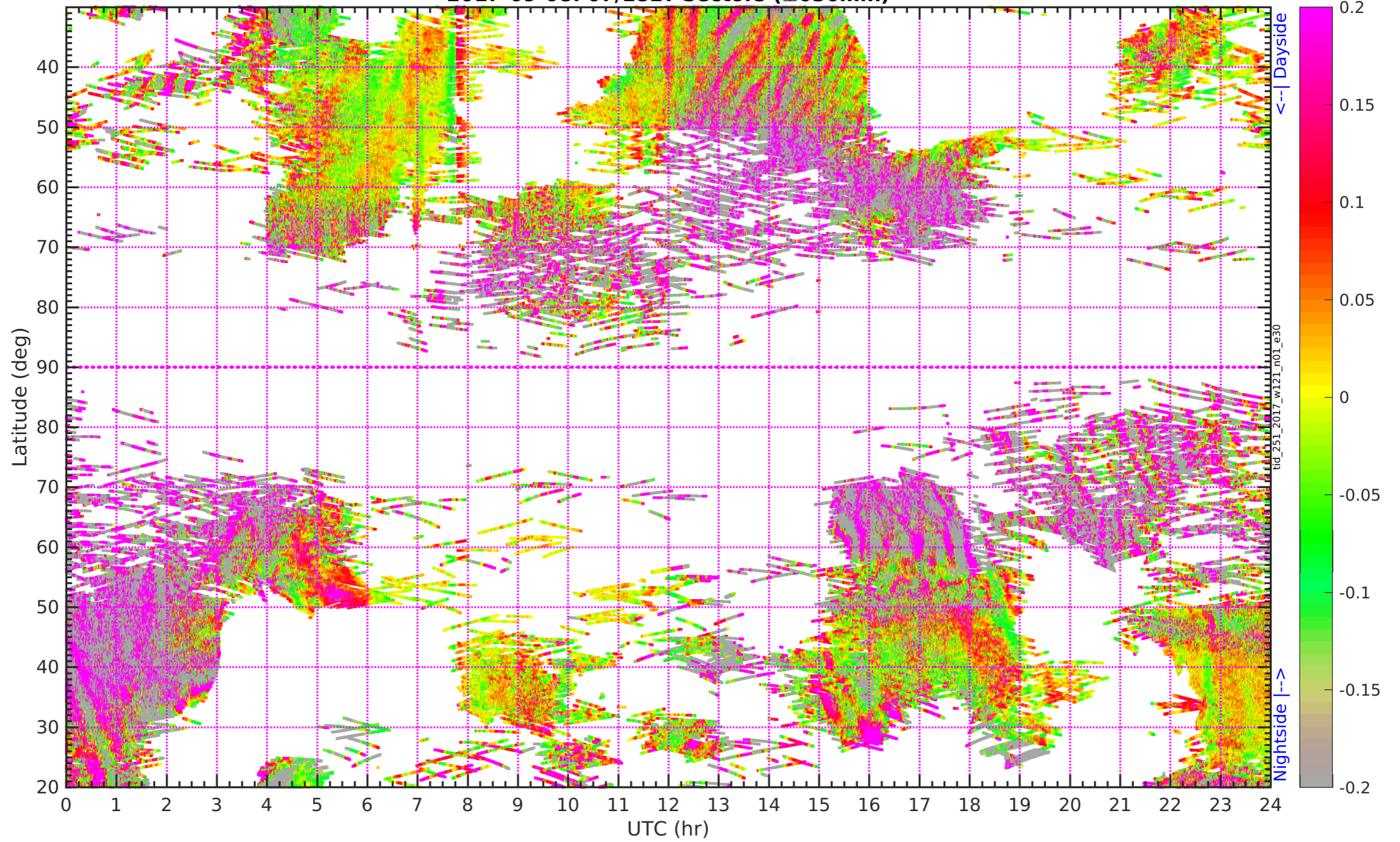
2017-09-08: 12/00LT Sectors ($\pm 030\text{min}$)



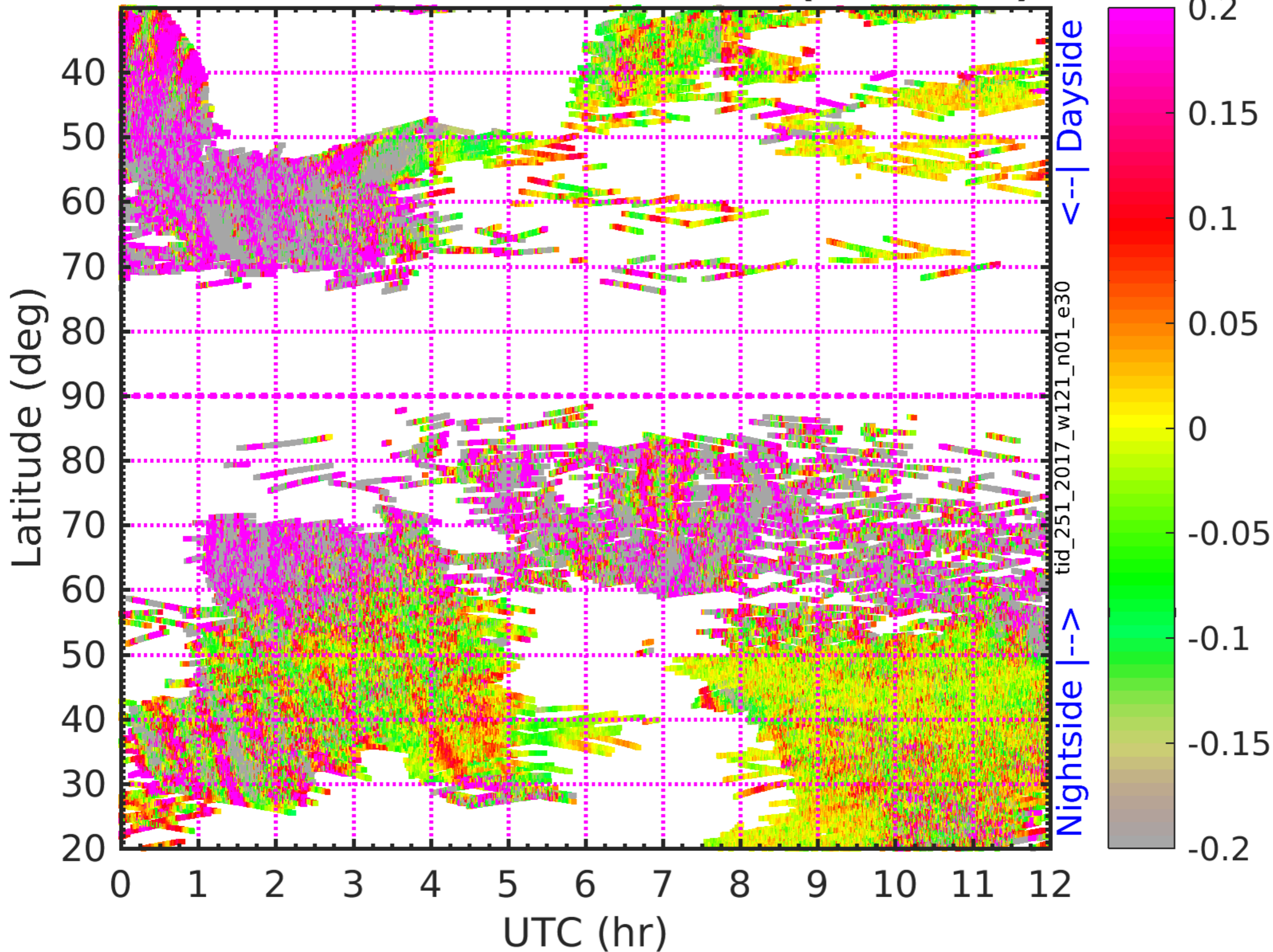
2017-09-08: 09/21LT Sectors ($\pm 030\text{min}$)



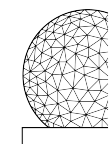
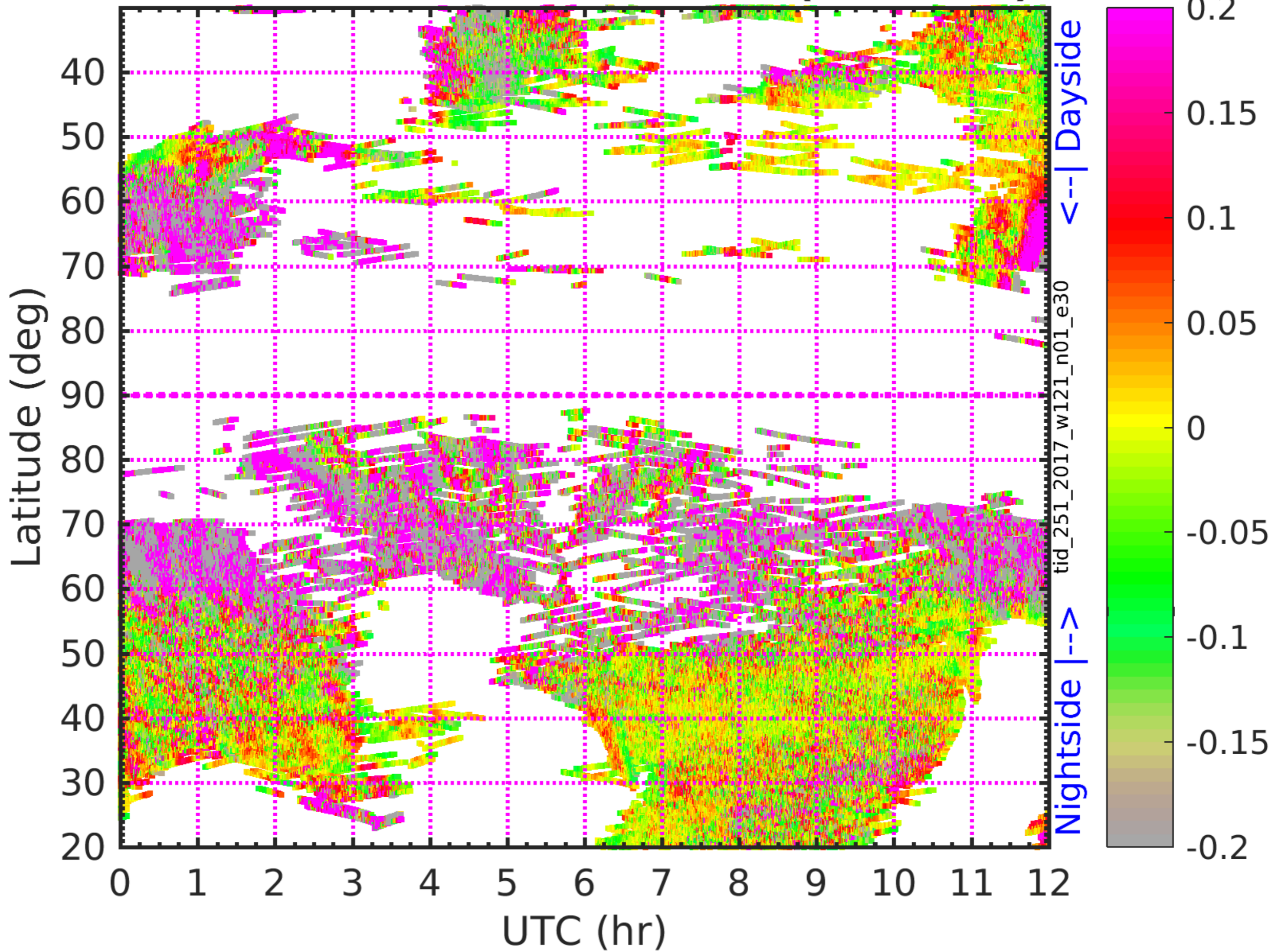
2017-09-08: 07/18LT Sectors ($\pm 030\text{min}$)



2017-09-08: 16/04LT Sectors (± 030 min)



2017-09-08: 14/02LT Sectors ($\pm 030\text{min}$)



2017-09-08: 14/02LT Sectors ($\pm 030\text{min}$)

