

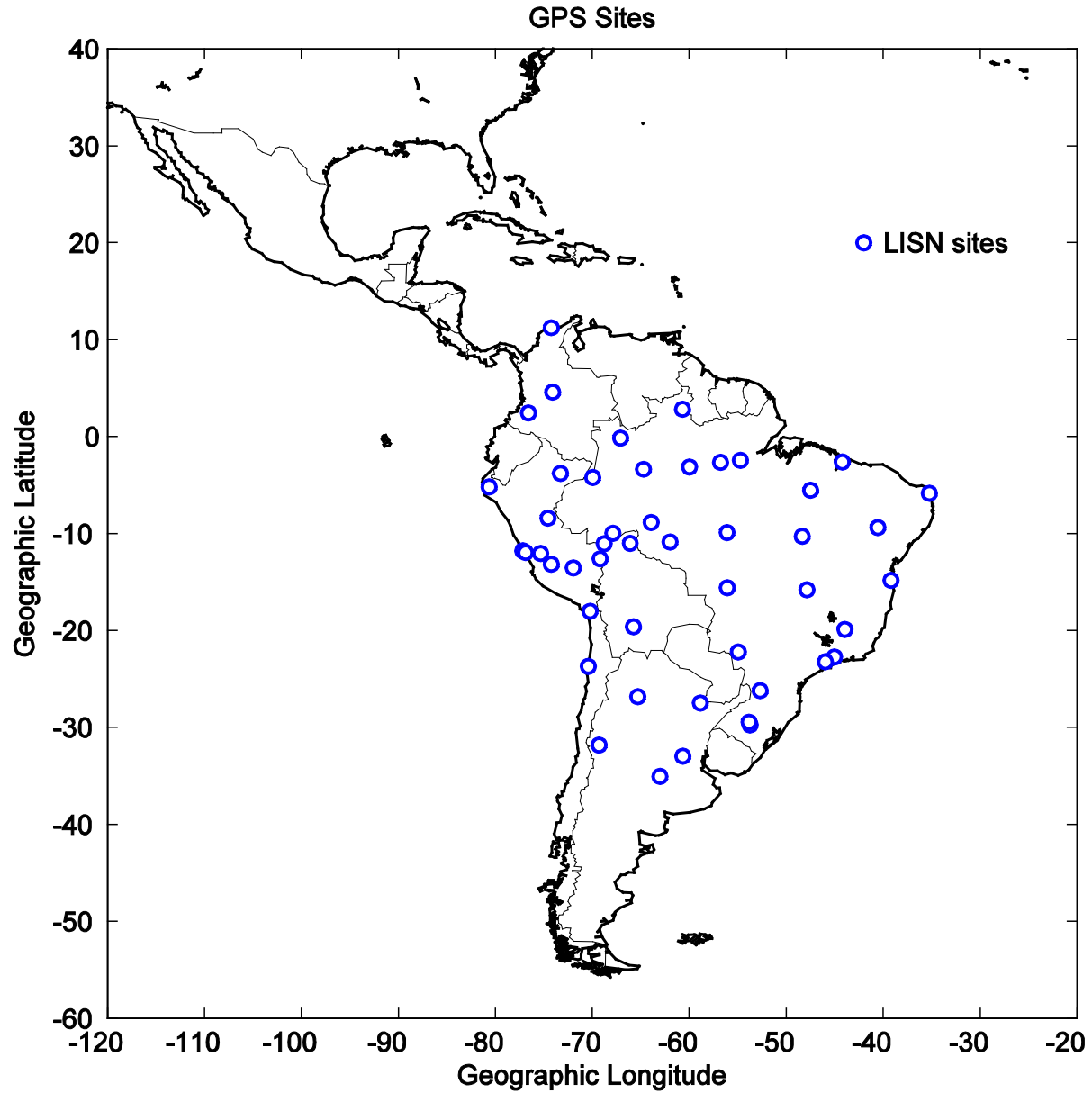
Observations of MSTIDs over South and Central America

Cesar E. Valladares
Boston College – ISR
<http://lisn.igp.gob.pe>

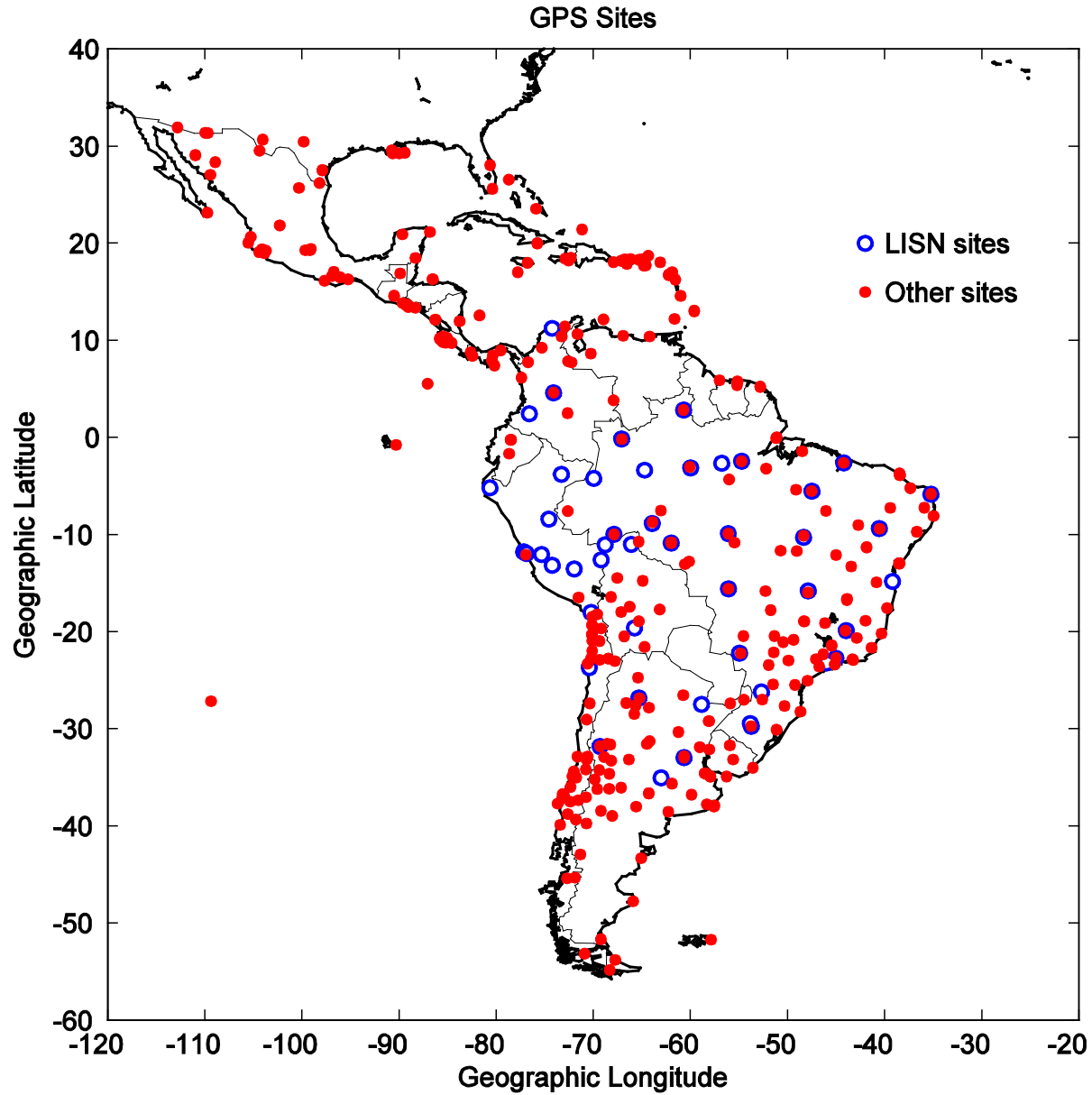


Alexandria, May 12, 2015

LISN GPS Stations



LISN and other GPS Stations in South and Central Americas



Outline

Locations of GPS receivers.

GOES-12 and TRMM satellite data (Tropical storms and convective plumes).

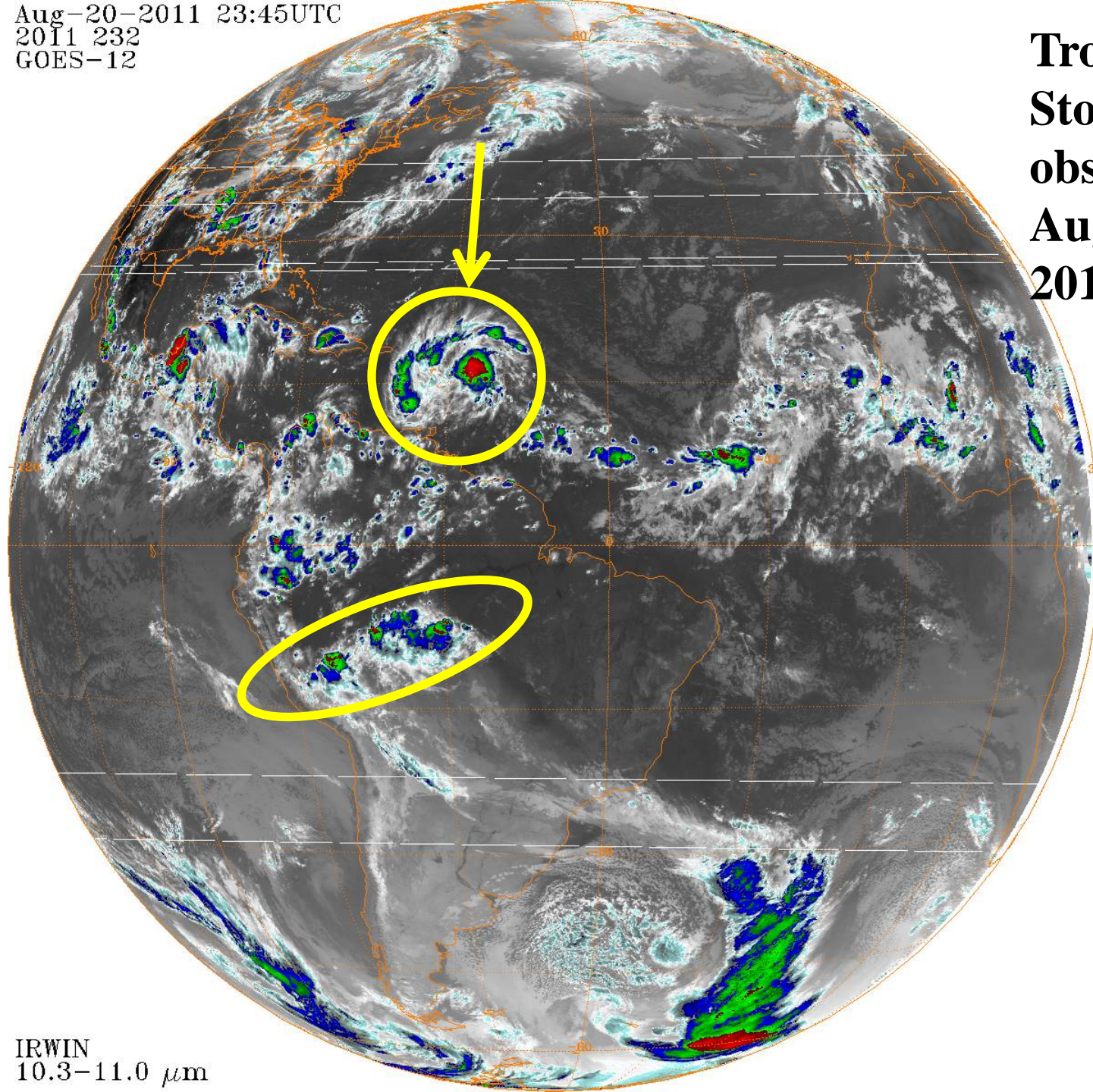
Analysis of TEC data to derive TID's velocity and propagation direction. Summary plots

Regional plots of TIDs distributions and velocities.

Conclusions.

Aug-20-2011 23:45UTC
2011 232
GOES-12

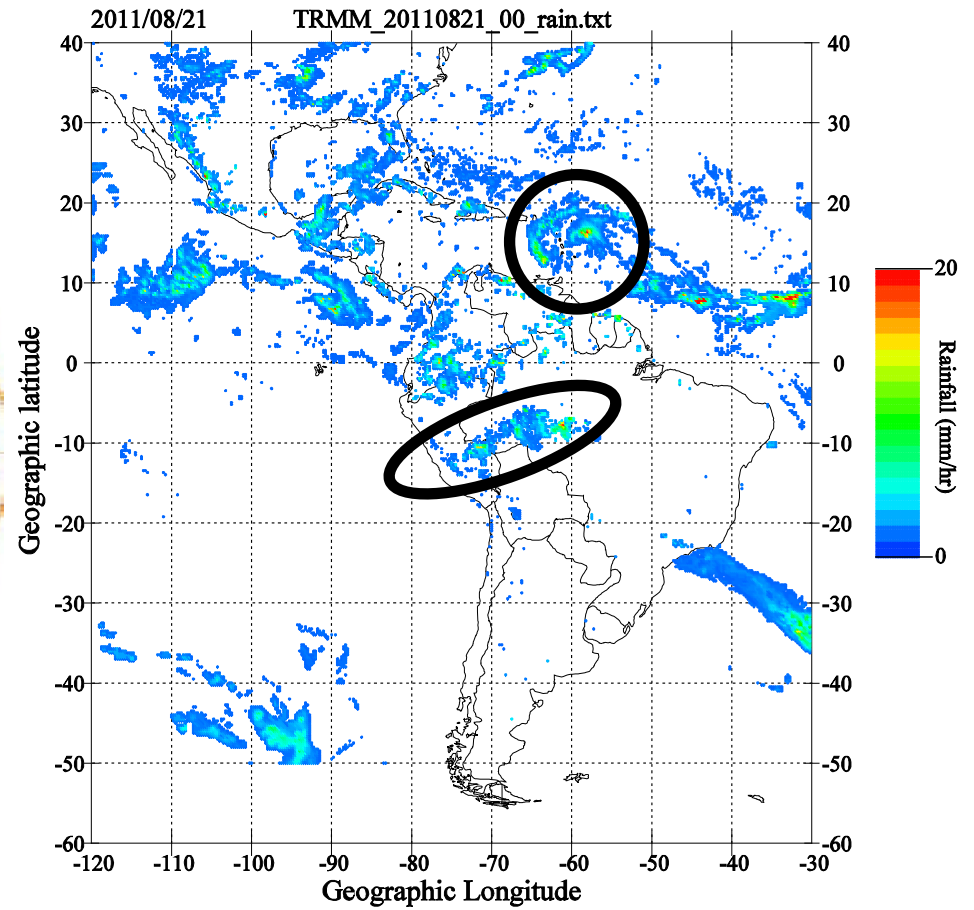
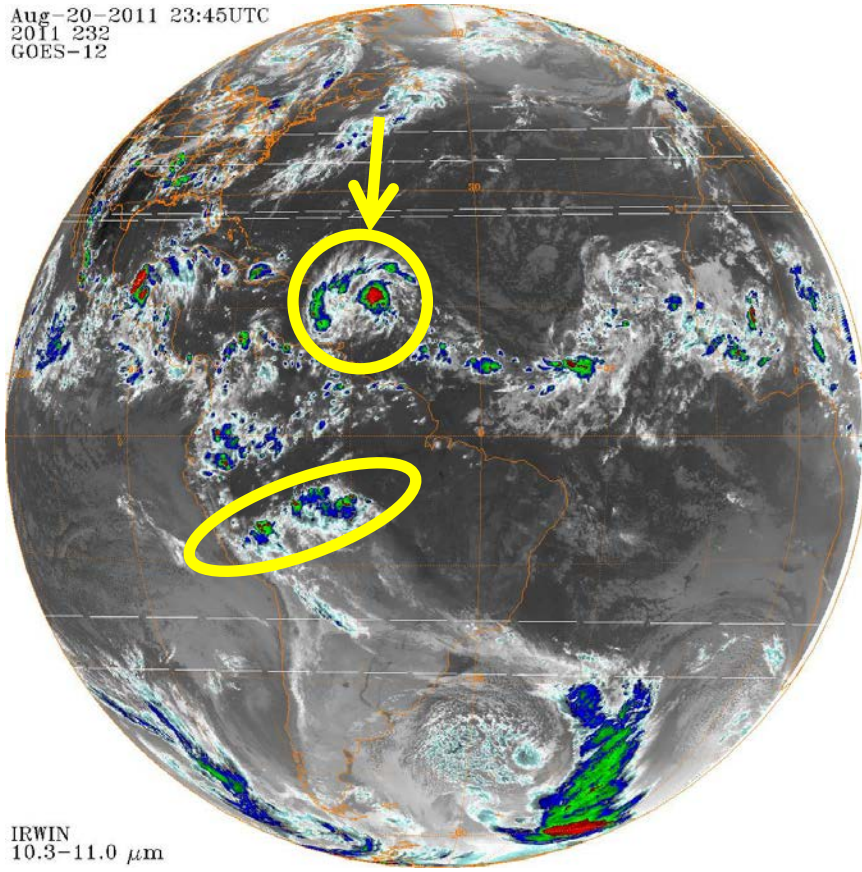
**Tropical
Storm Irene
observed on
August 21,
2011, at 00 UT**



IRWIN
10.3-11.0 μm

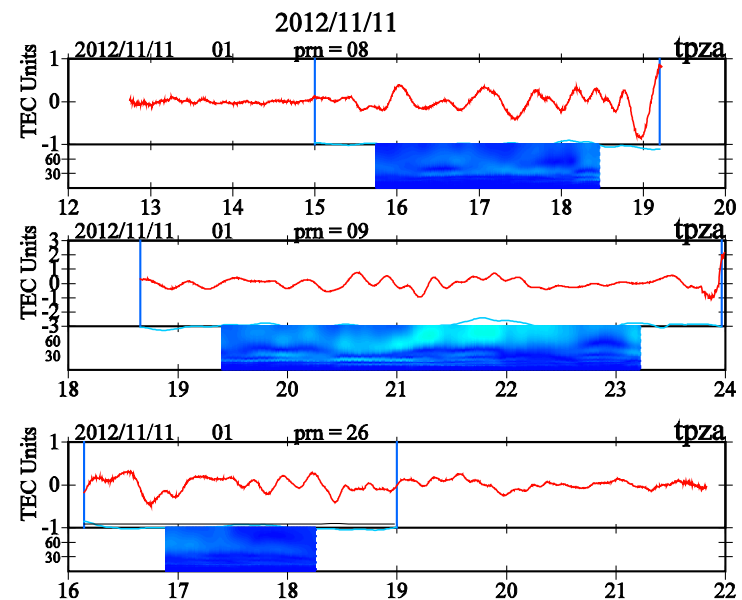
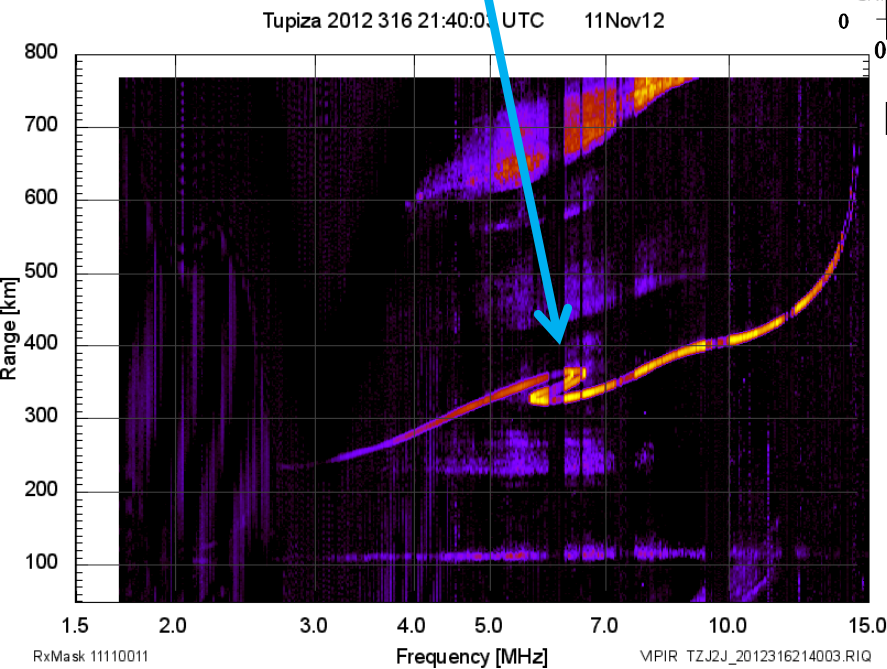
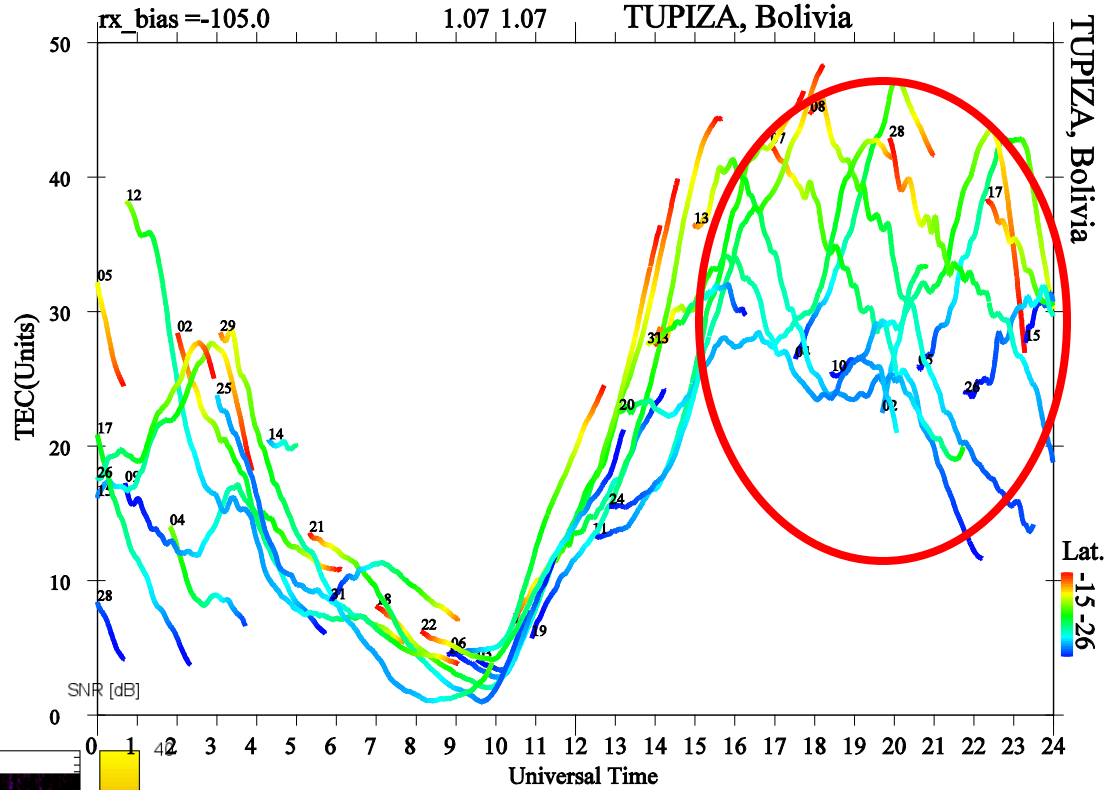
Comparison of GOES-12 brightness temperature and TRMM rain data

Aug-20-2011 23:45UTC
2011 232
GOES-12

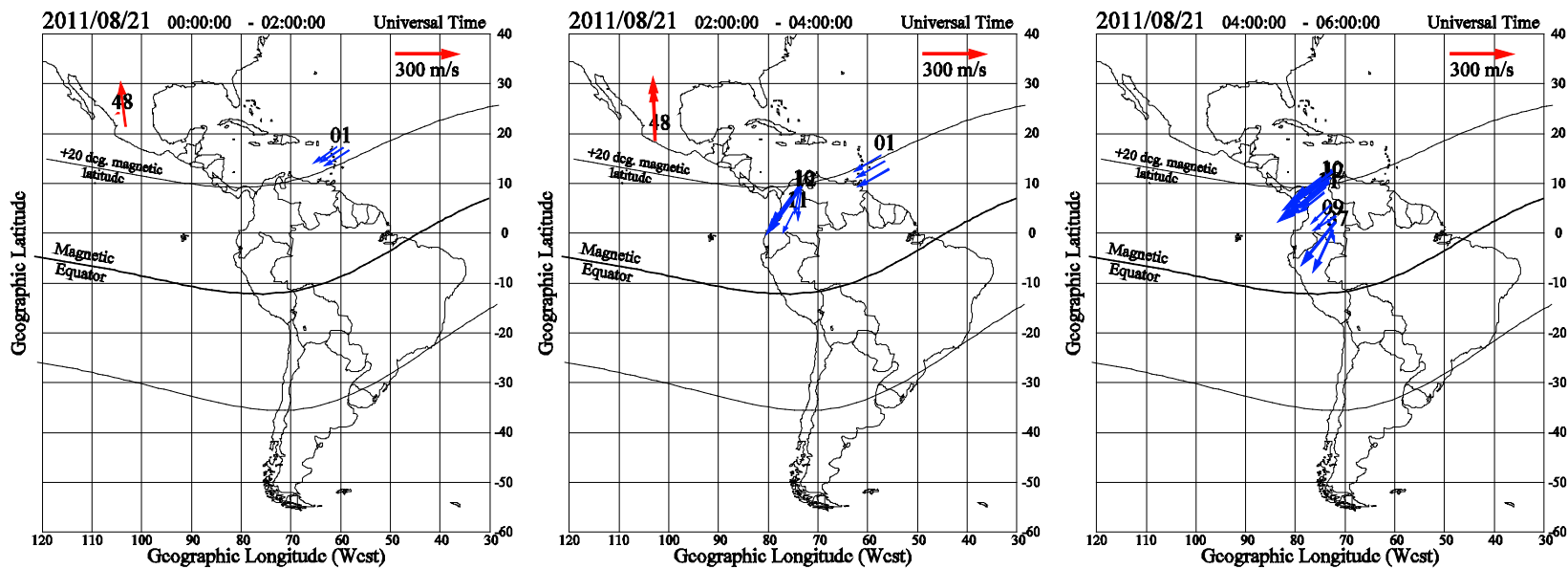
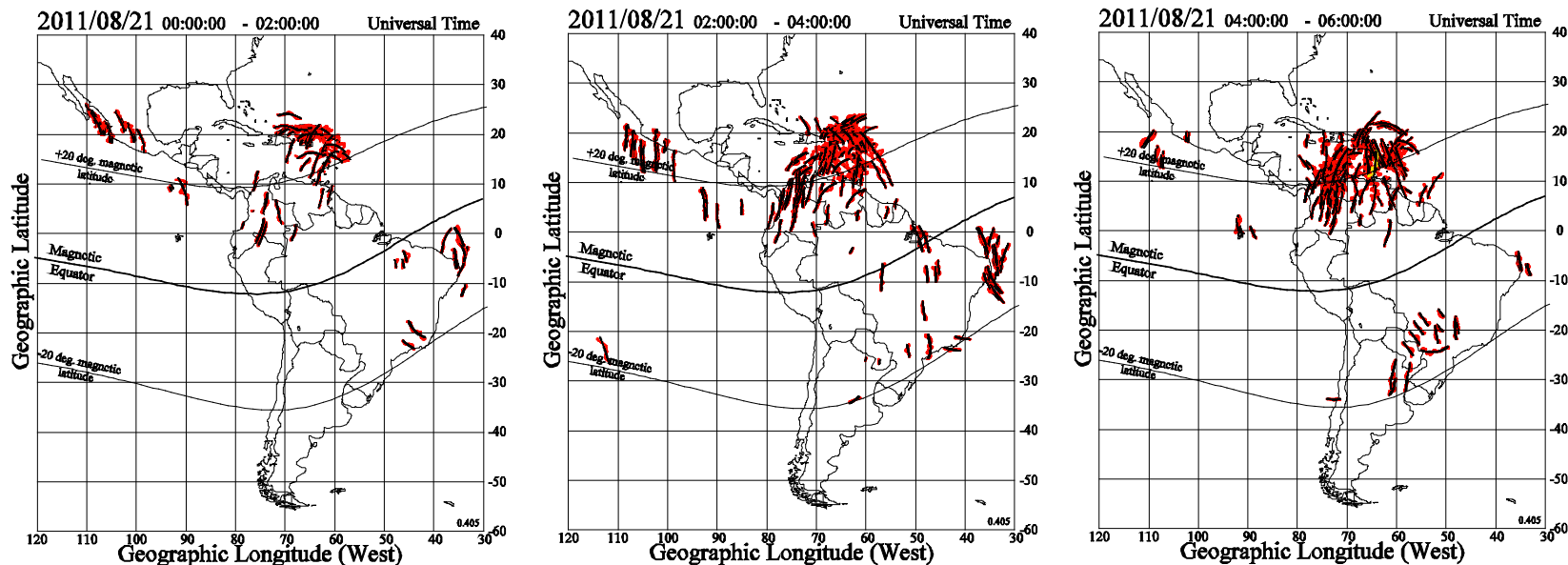


TEC perturbations associated with TIDs are detrended to study AGWs.

Due to passage of GW over field-of-view of VIPIR ionosonde.



Summary plots of TIDs and wave velocity for 3 periods

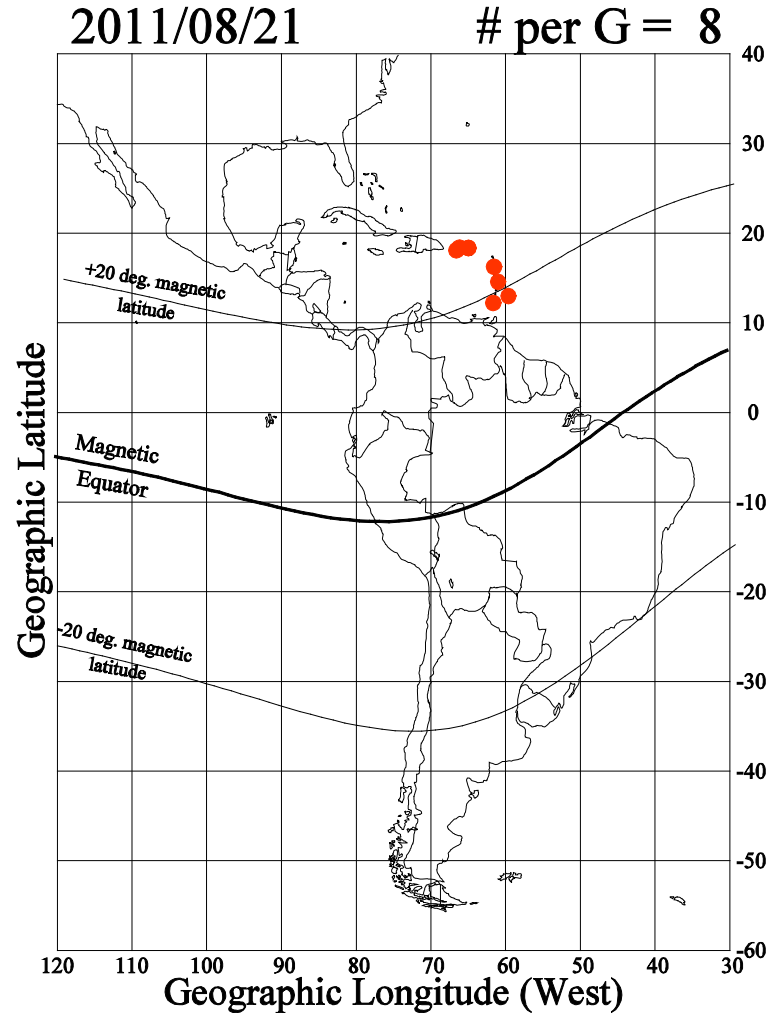
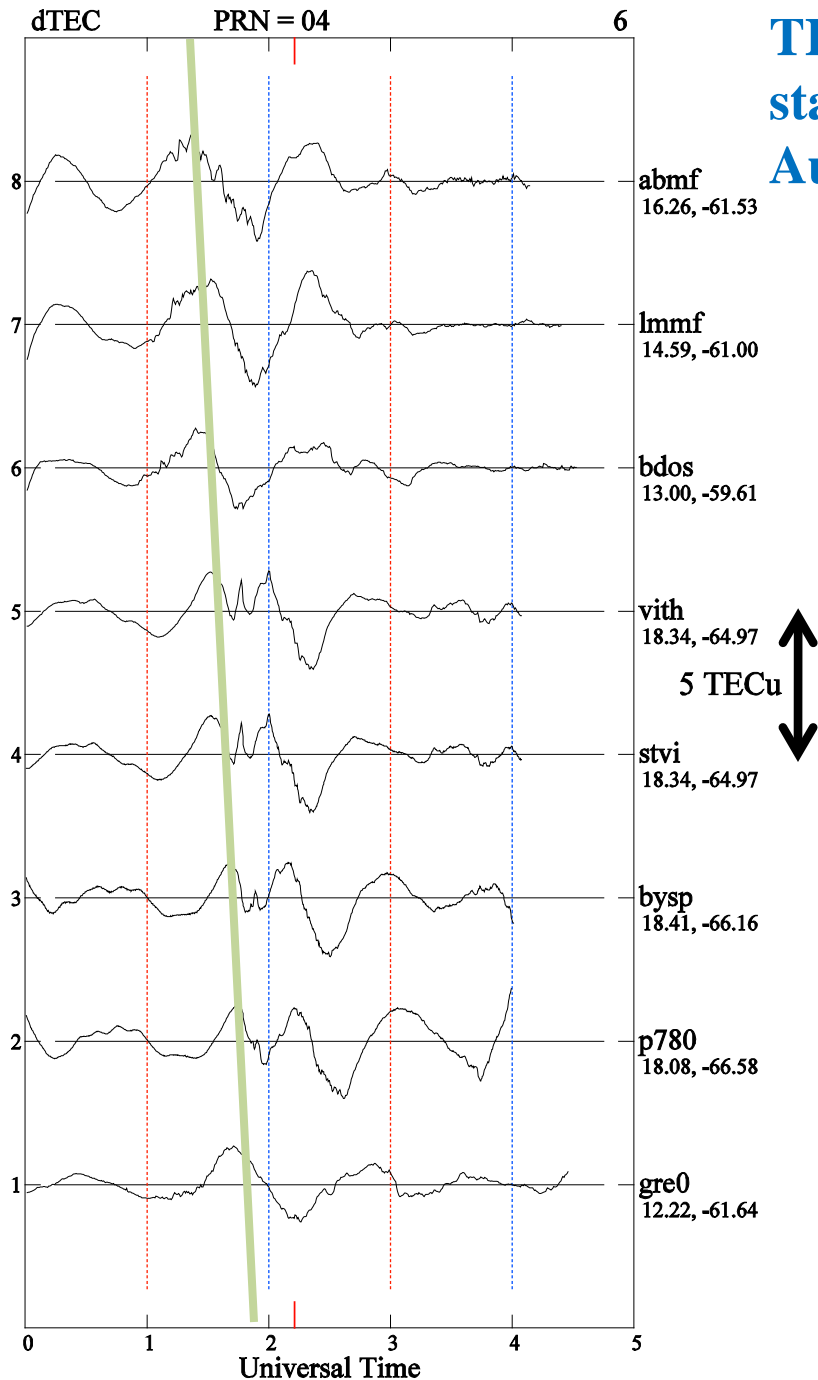


00 – 02 UT

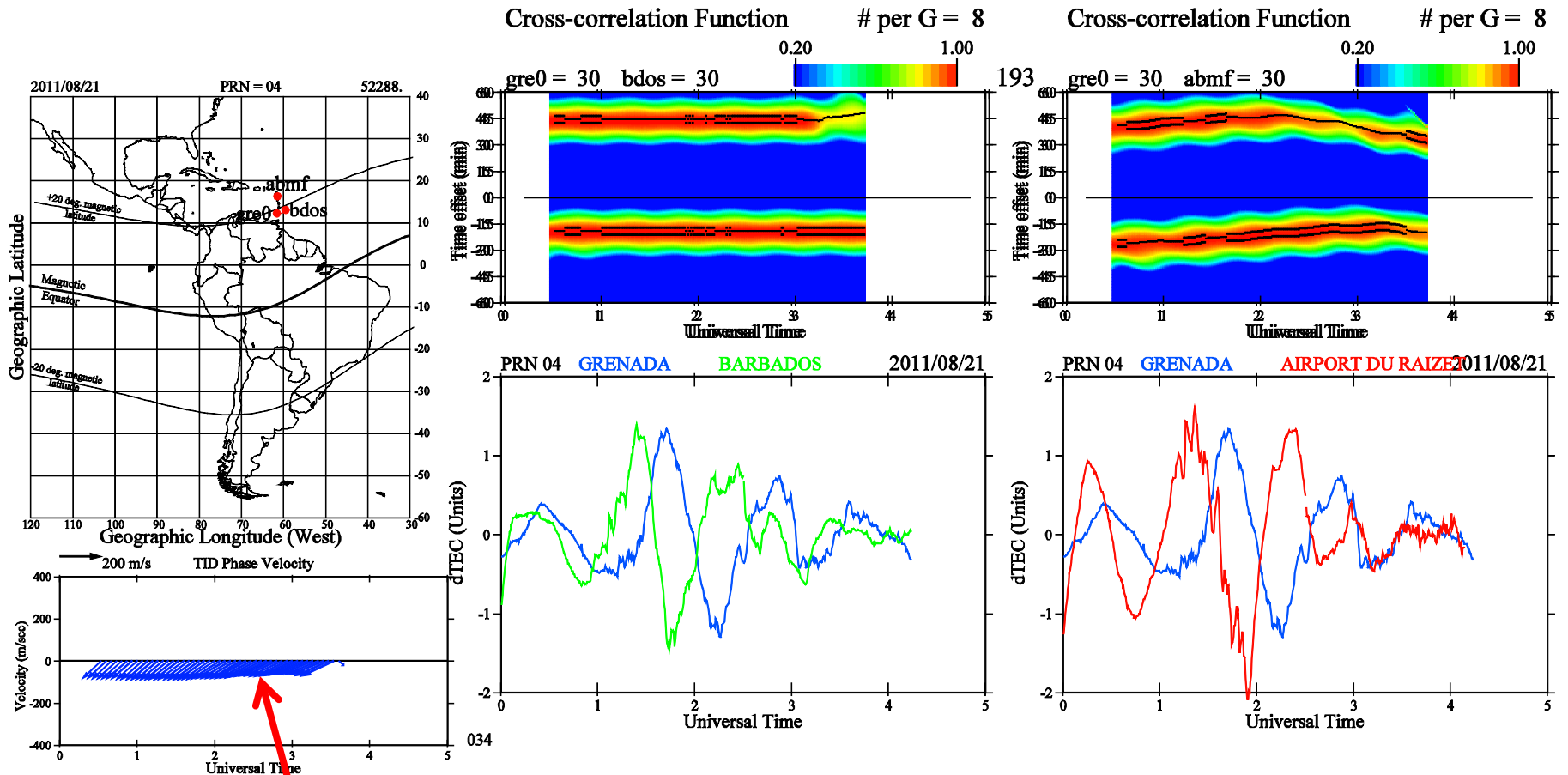
02 – 04 UT

04 – 06 UT

TIDs (dTEC traces) observed at 8 stations in the Caribbean region on August 21, 2011 between 00 and 05 UT.

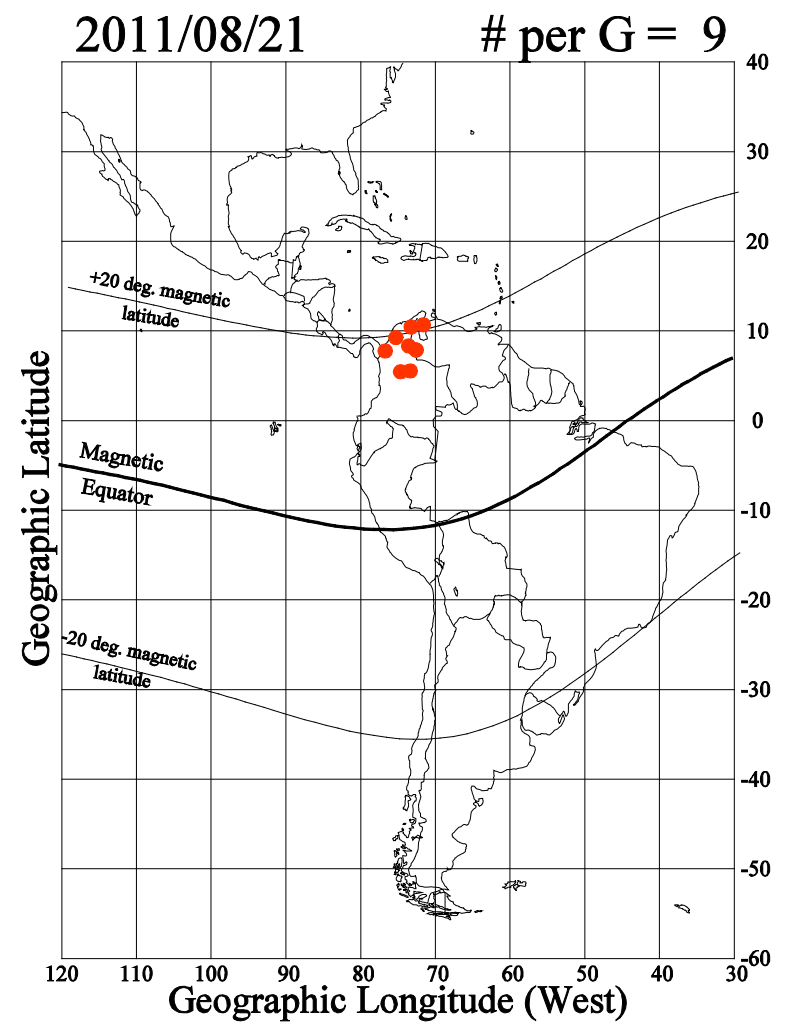
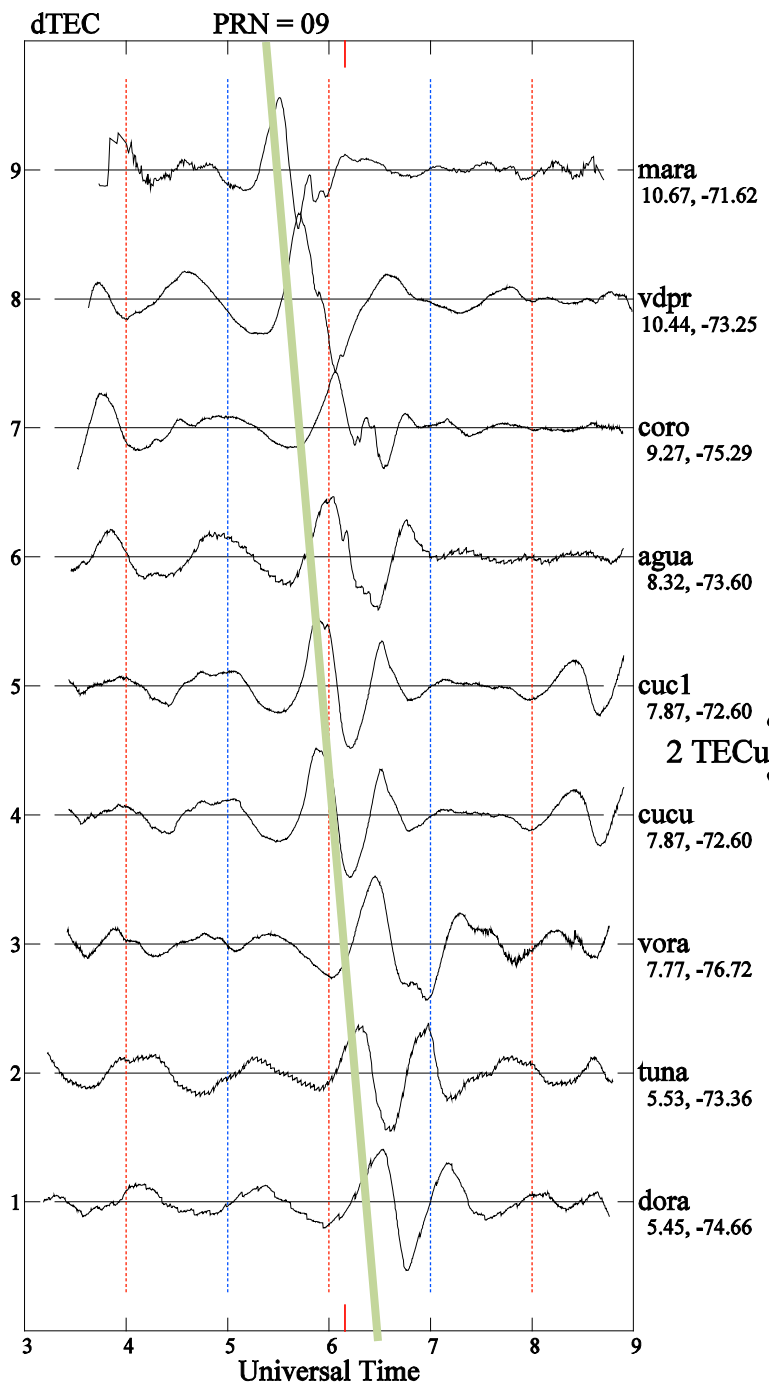


Cross-correlation method to derive wave velocities using dTEC values from 3 stations for August 21, 2011 between 00 and 03 UT

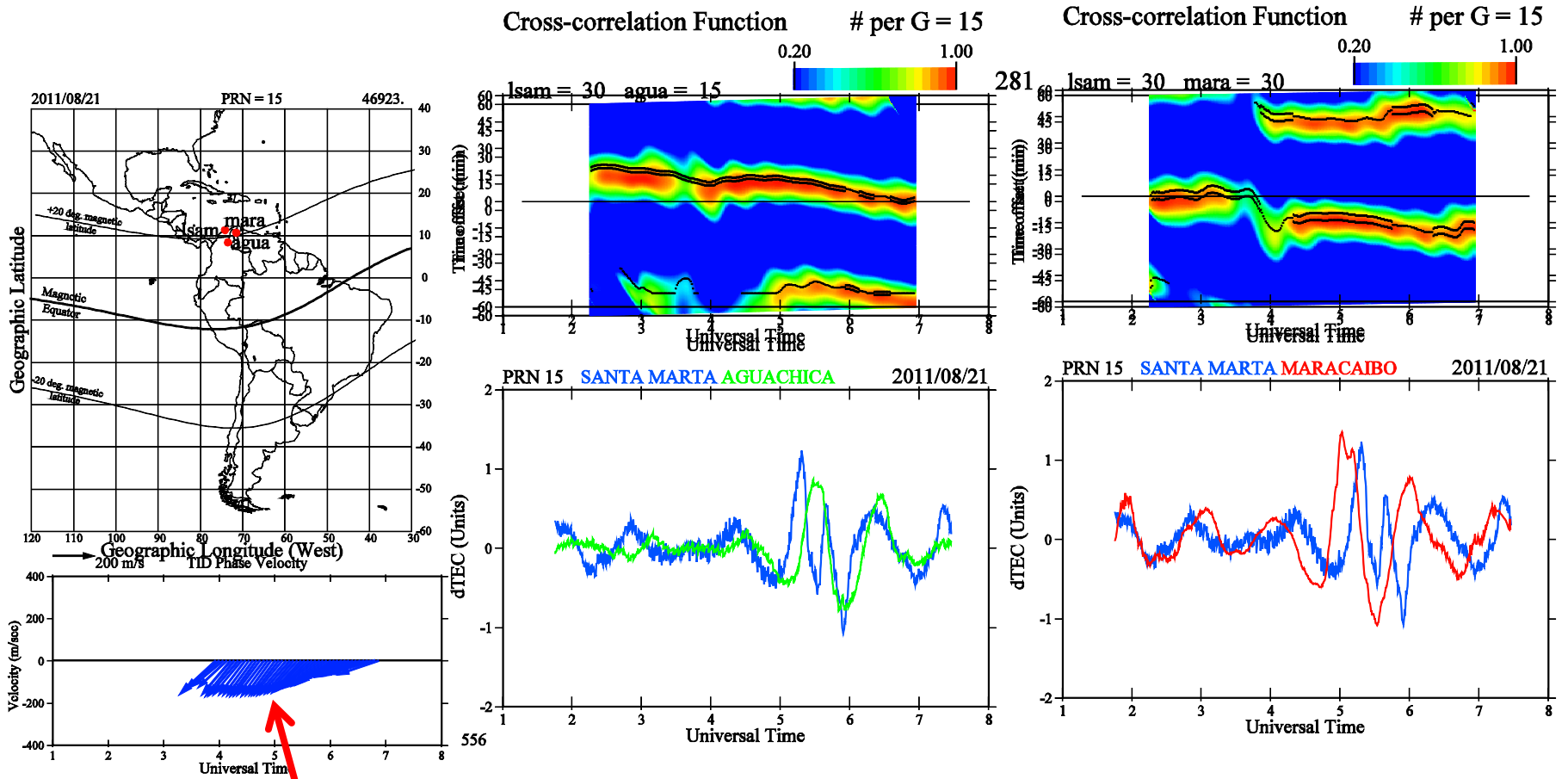


Velocities ~150 m/s

TIDs (dTEC traces) observed at 8 stations in Northern Colombia on August 21, 2011 between 03 and 09 UT.

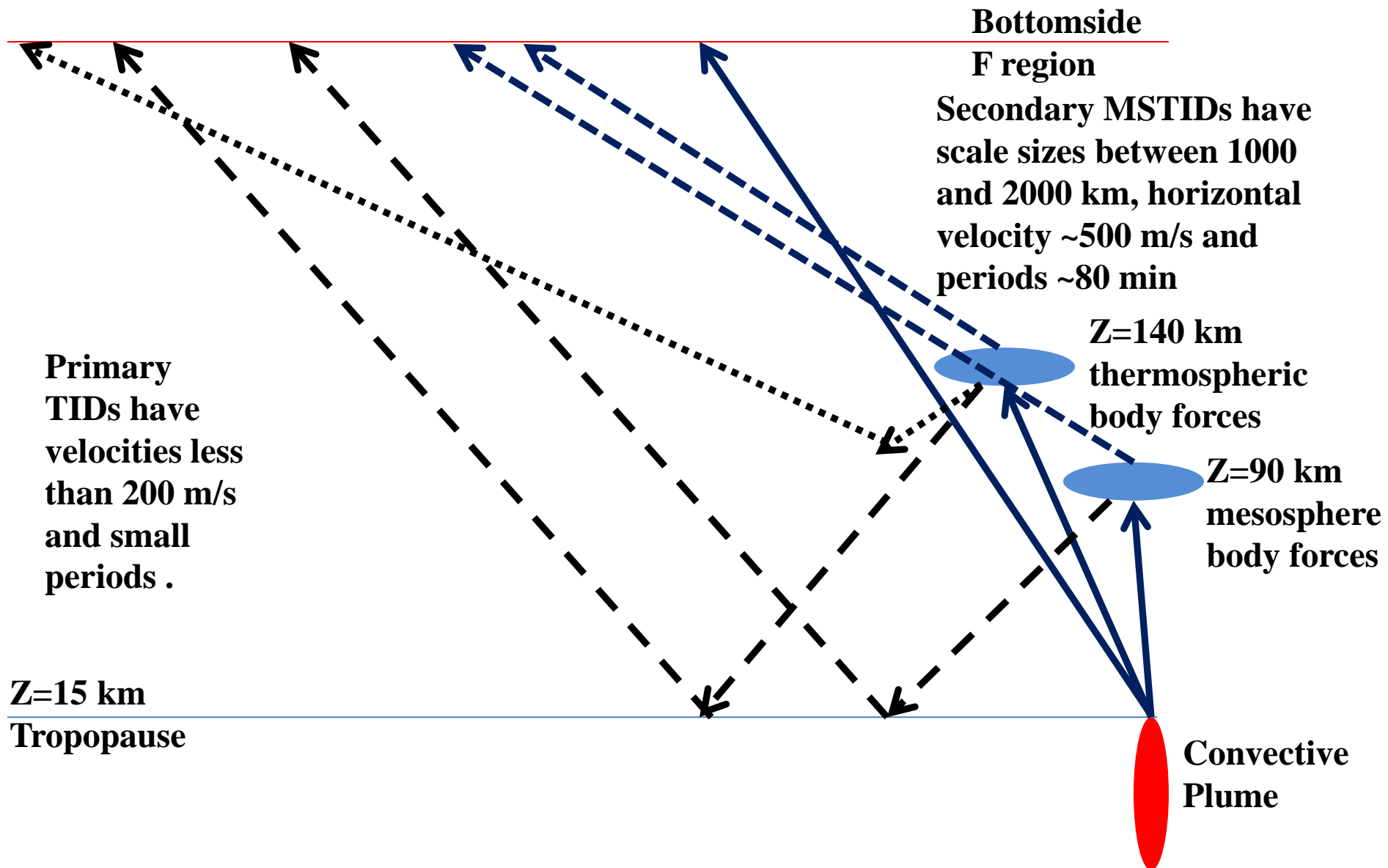


Cross-correlation method to derive wave velocities using dTEC values from 3 stations

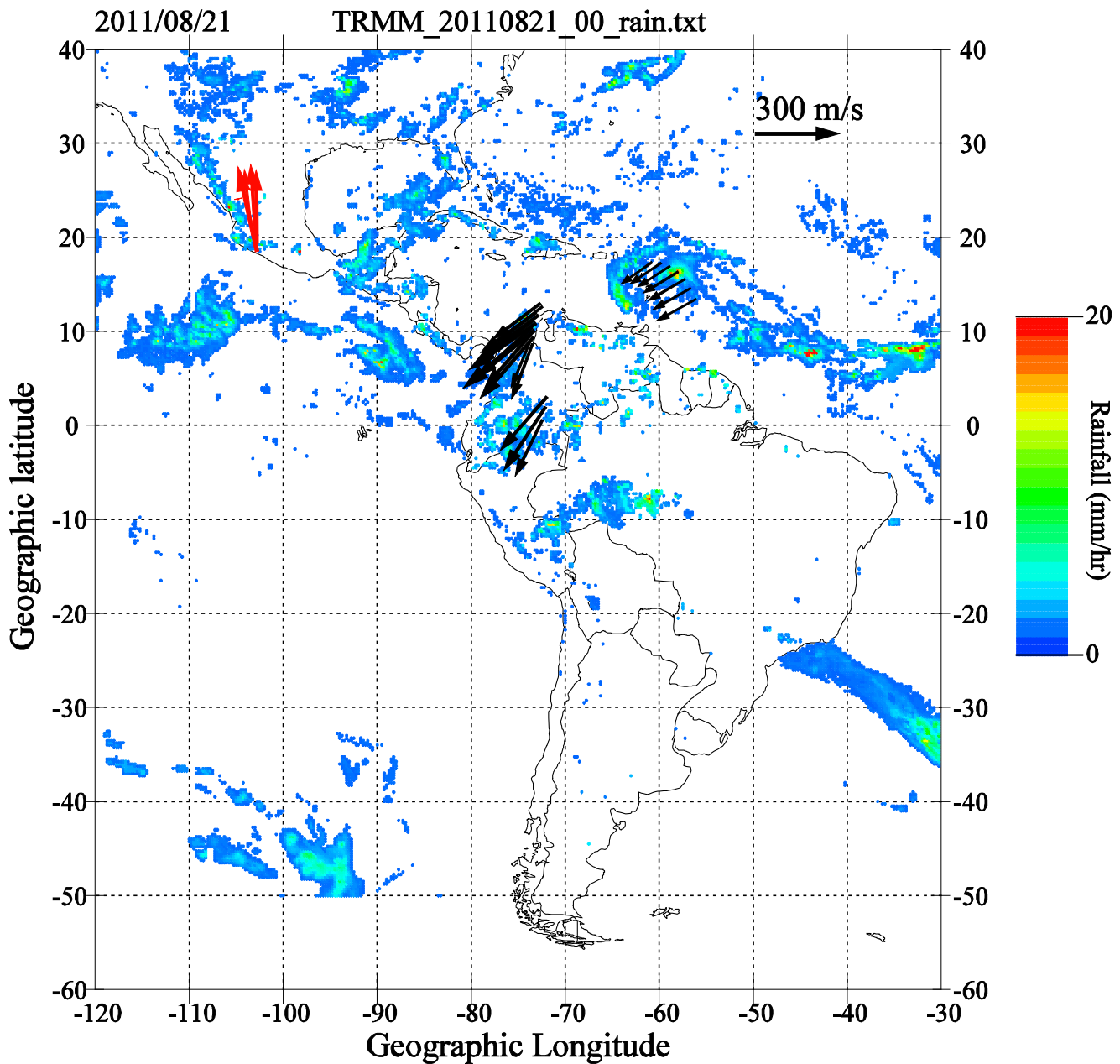


Velocites ~300 m/s

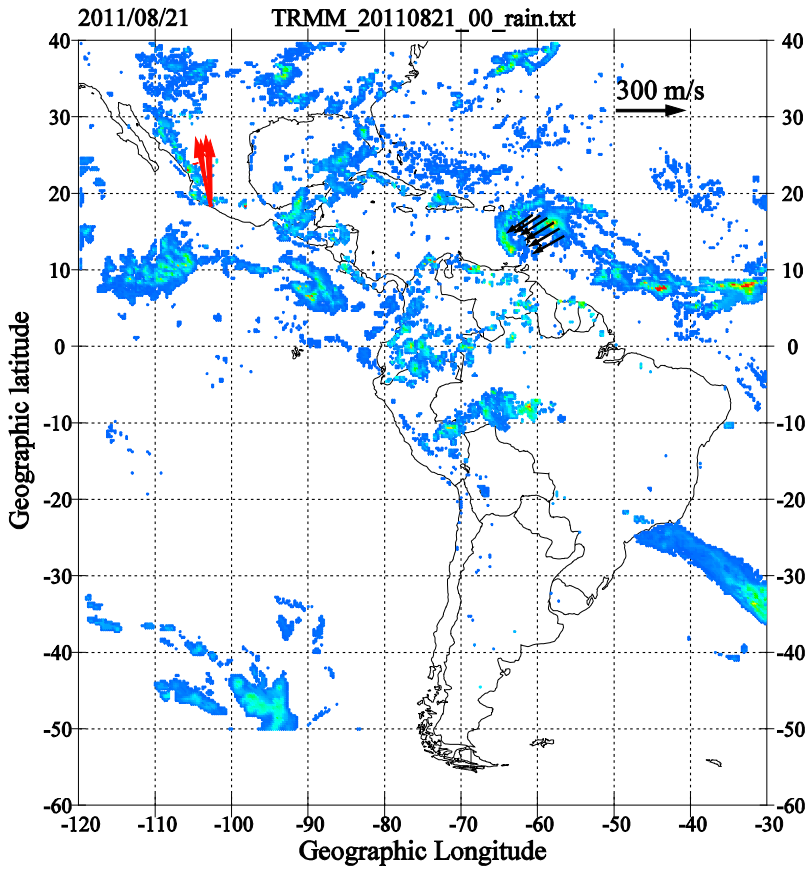
Vadas and Crowley (2010) JGR Sources of the traveling ionospheric disturbances observed by the ionospheric TIDDBIT sounder near Wallops Island on 30 October 2007.



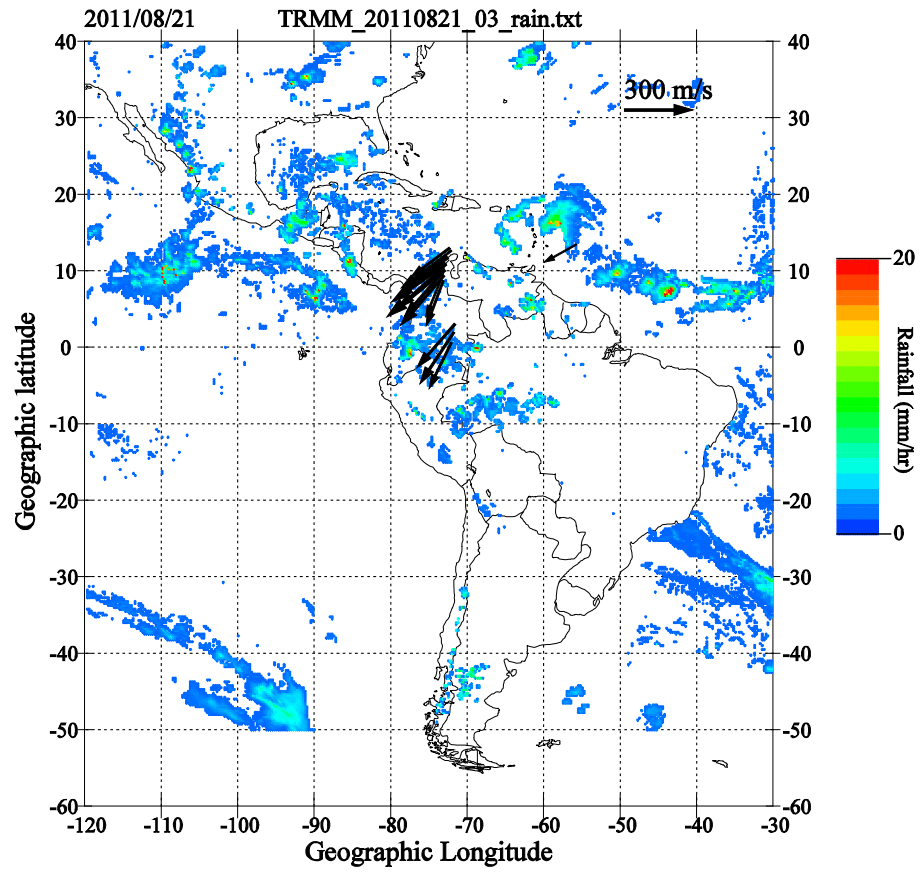
TRMM rain data and wave velocity for August 21, 2011 (00 – 06 UT)



TRMM rain data and wave velocity for August 21, 2011 (00 – 06 UT)



00 – 03 UT



03 – 06 UT

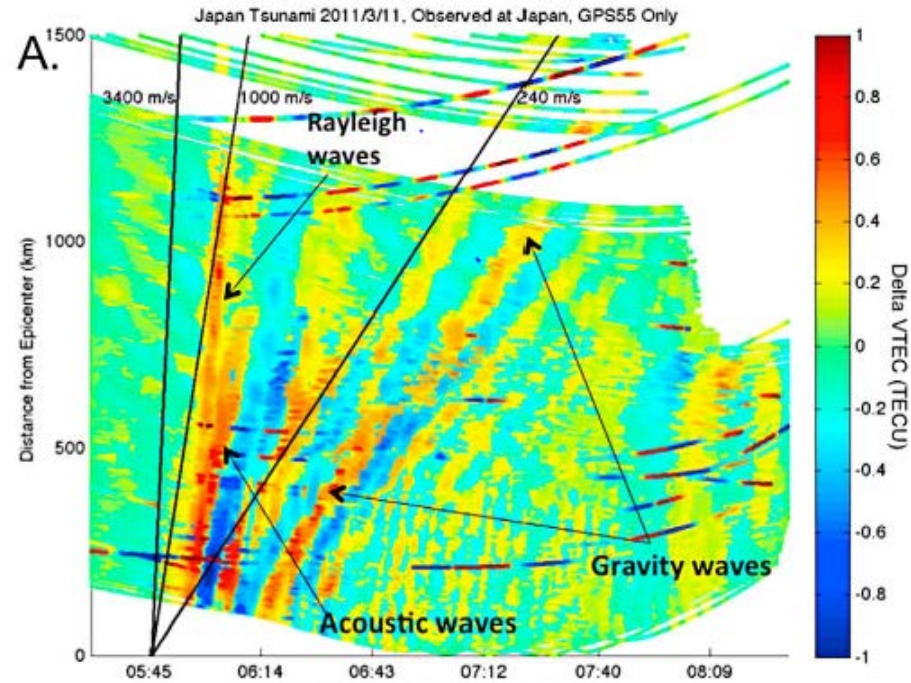
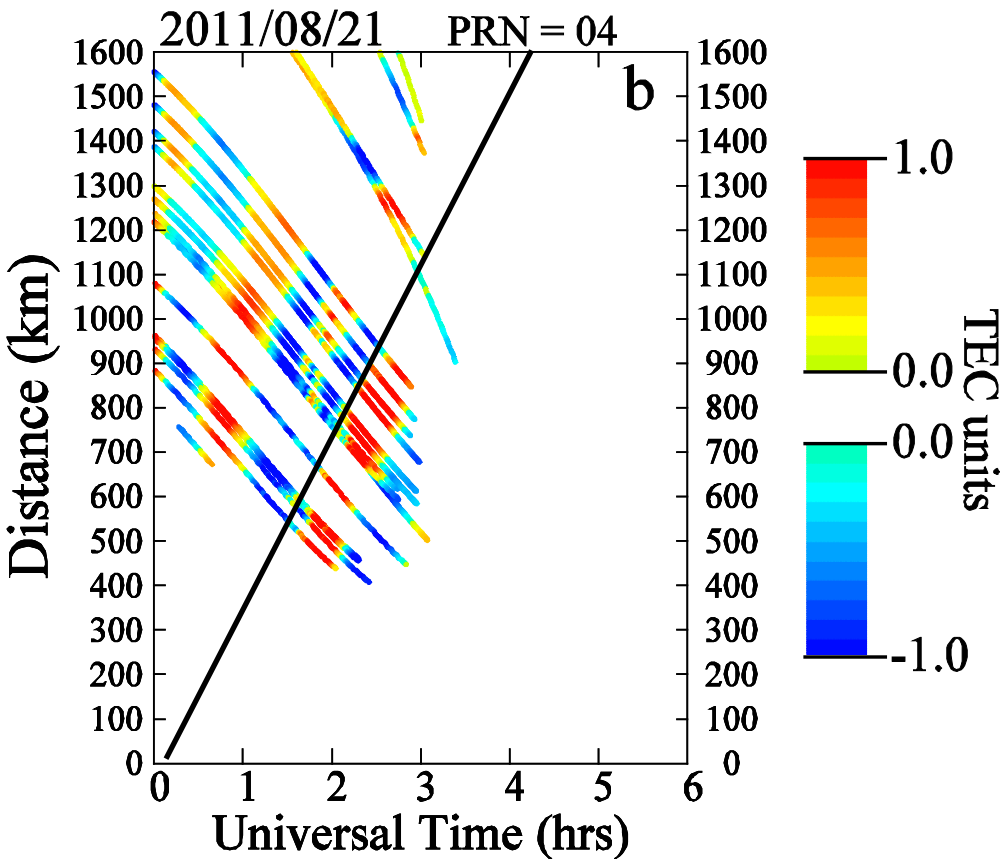
Conclusions

LISN is providing regional maps of TIDs over South and Central America and the Caribbean region.

This is a study to assess the role of a tropical storm and clusters of convective cells on the initiation of TIDs in the America sector.

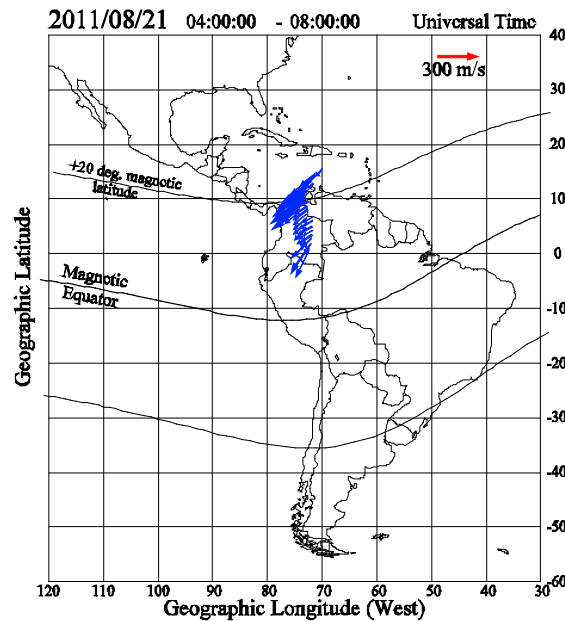
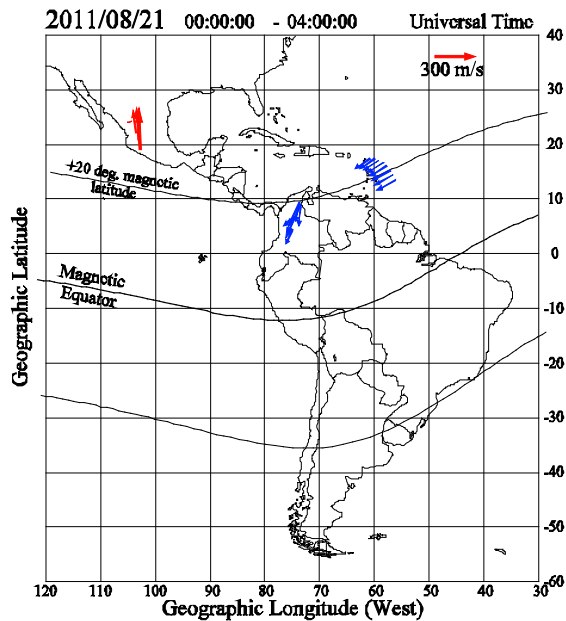
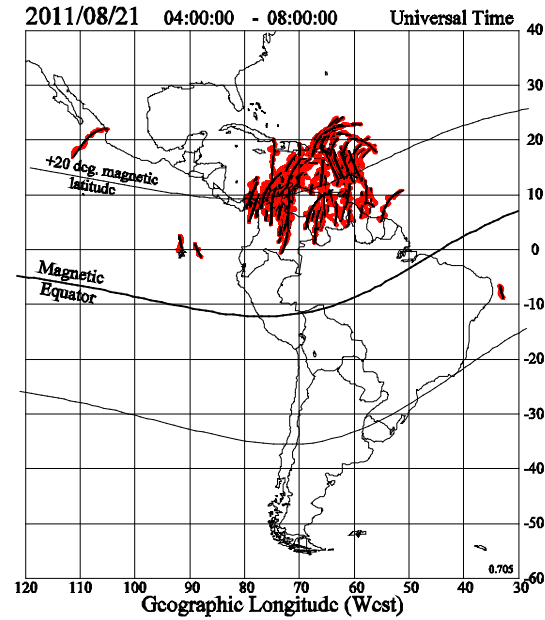
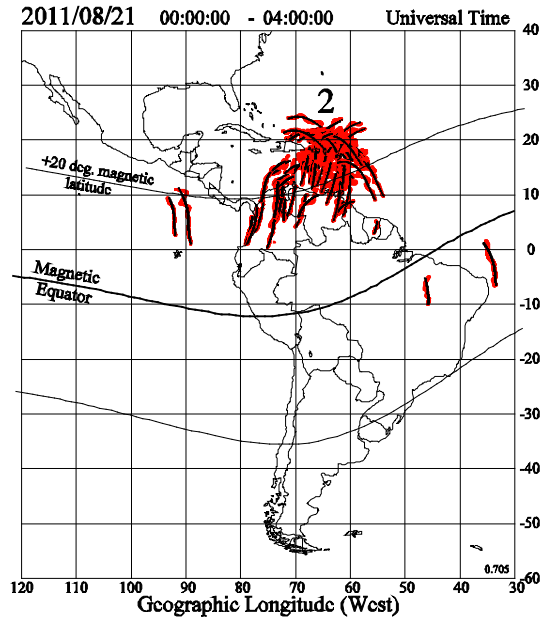
A group of MSTIDs, observed in the Caribbean region between 0 and 06 UT on August 21, 2011, were associated with primary AGWs. These waves were triggered within the region of TS Irene. These TIDs were moving eastward at 140 m/s and had a scales size of 500 km.

Galvan et. al., Radio Science (2012)
 Ionospheric signatures of Tohoku-Oki tsunami of March 11, 2011: Model comparisons near the epicenter.

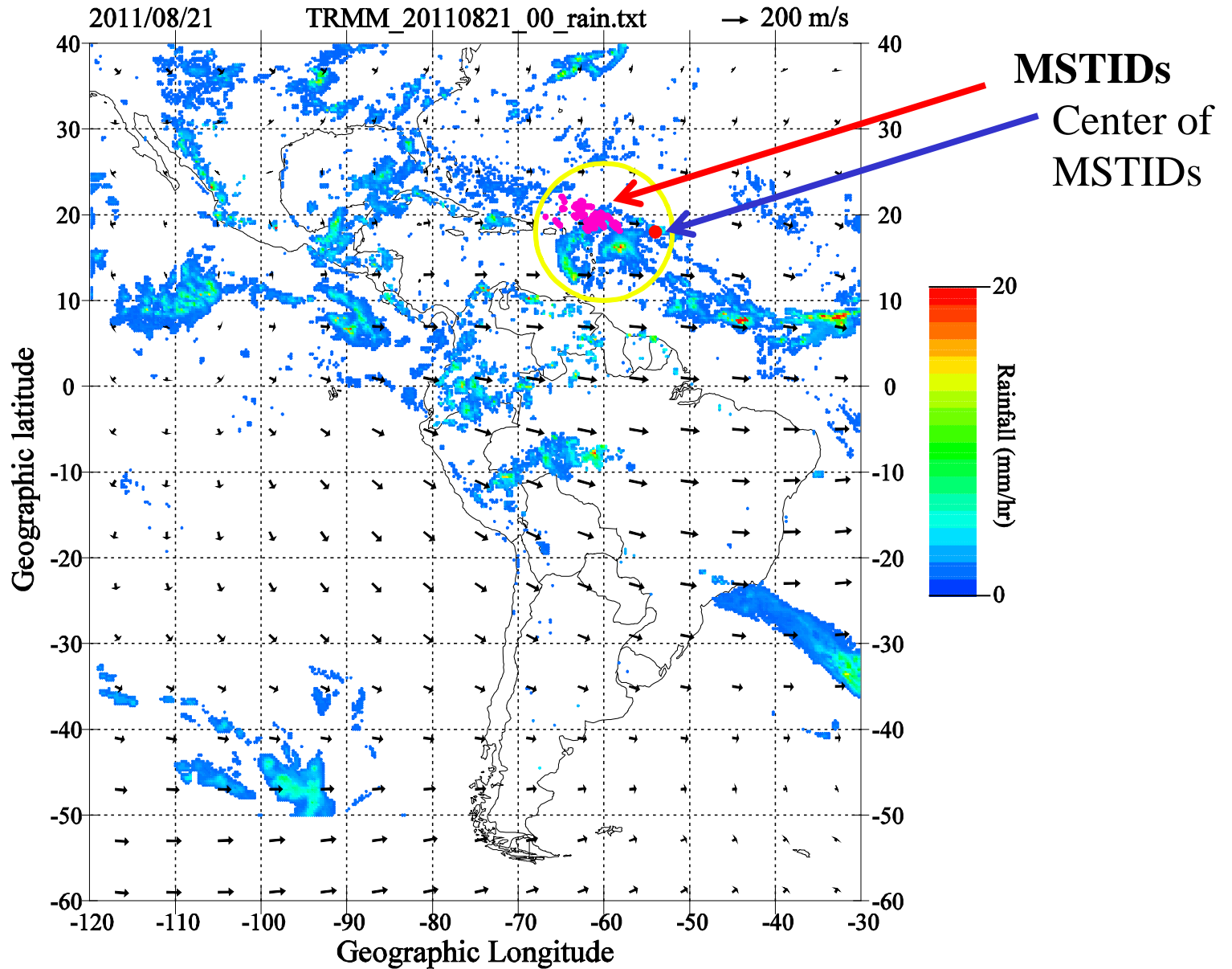


We have used Distance vs UT diagram to determine the origin of TIDs.

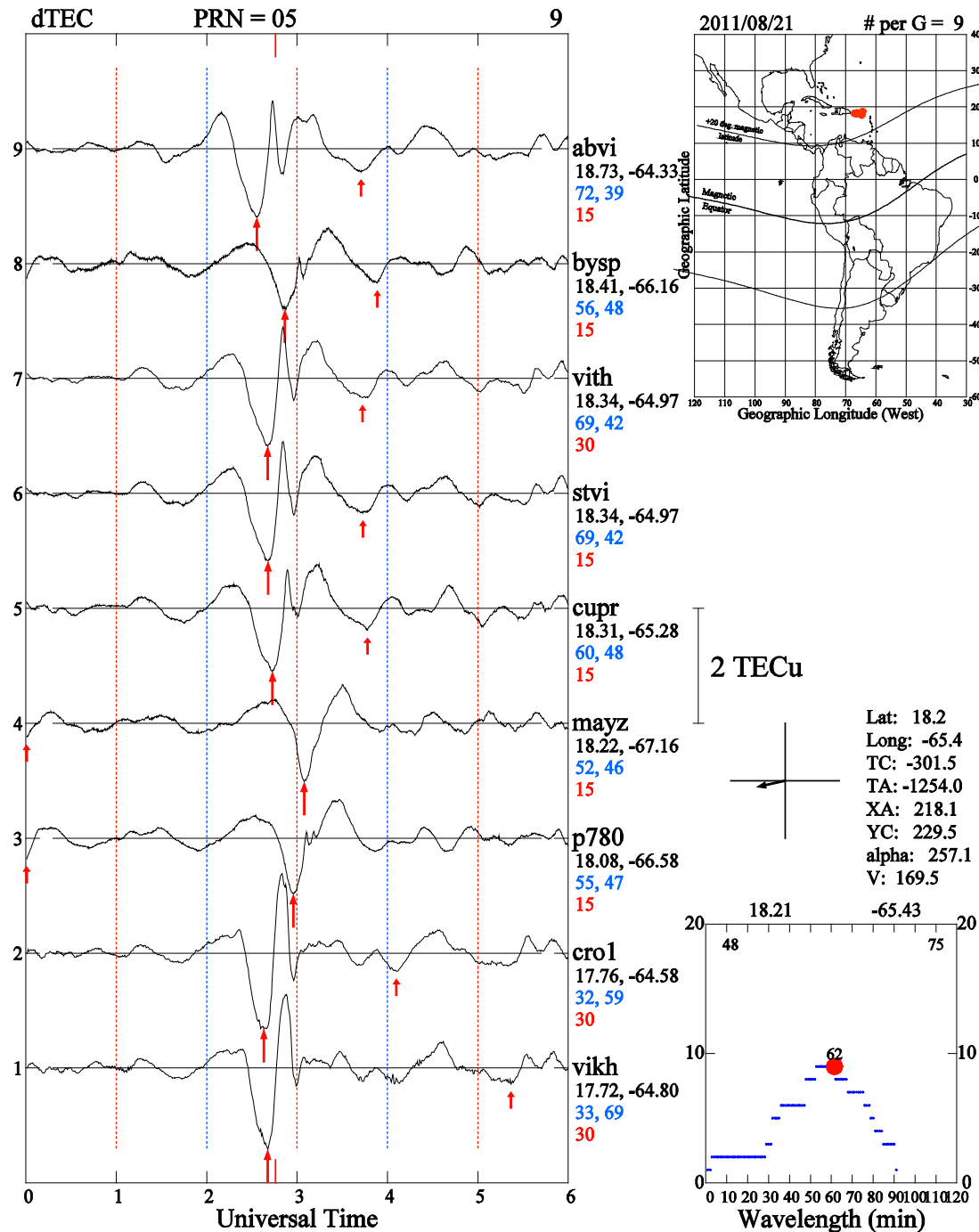
Delta(TEC) in upper row and MSTID velocity in lower frames

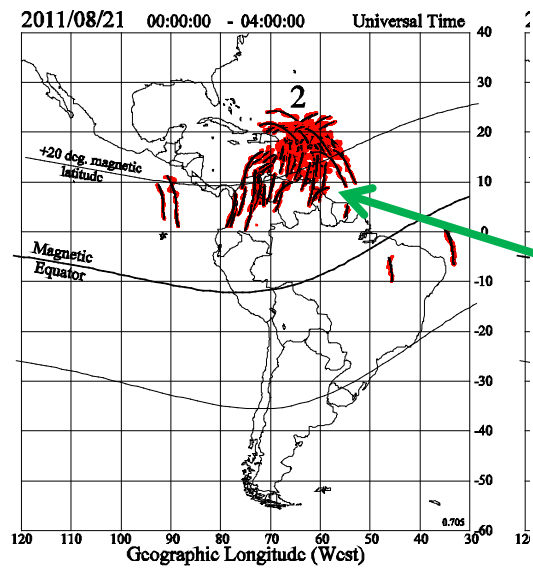


Amount of Rain associated with Irene measured with TRMM satellite

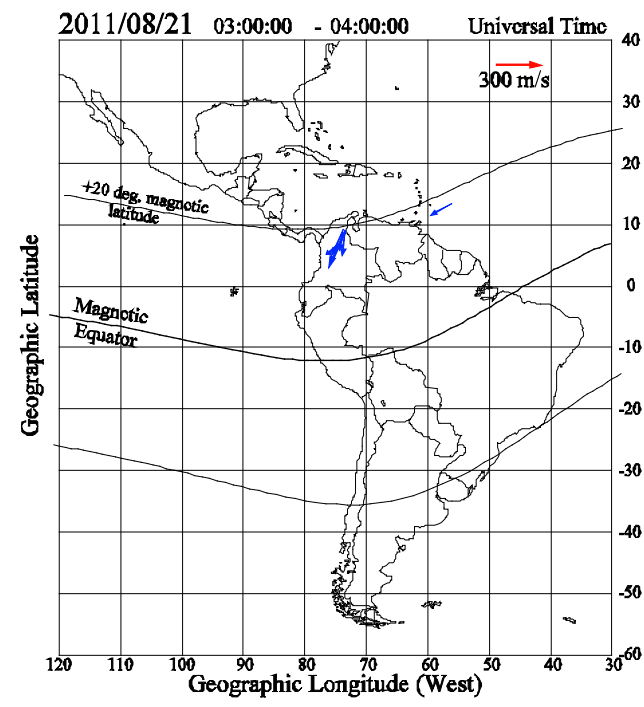
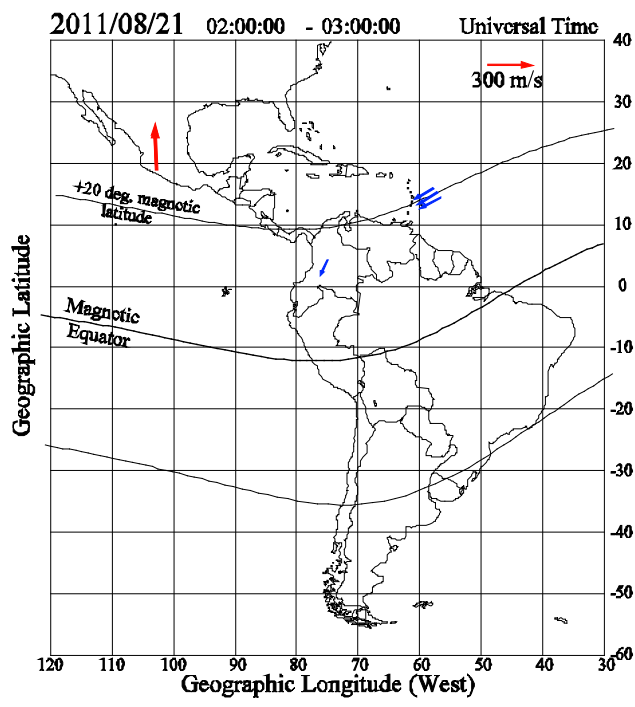
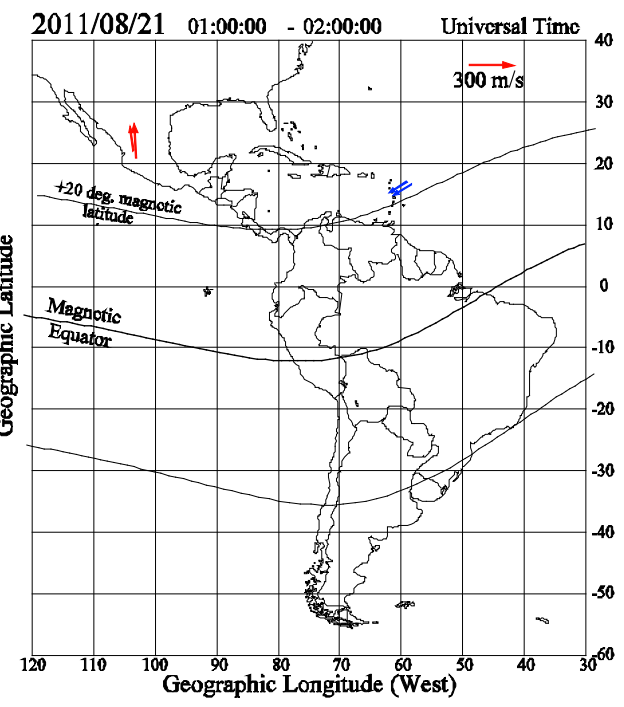


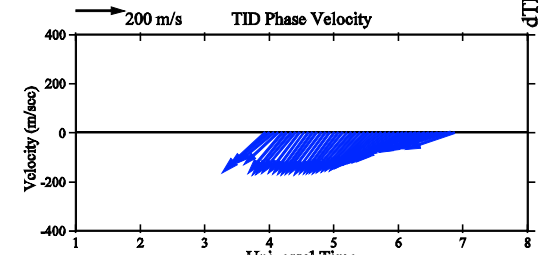
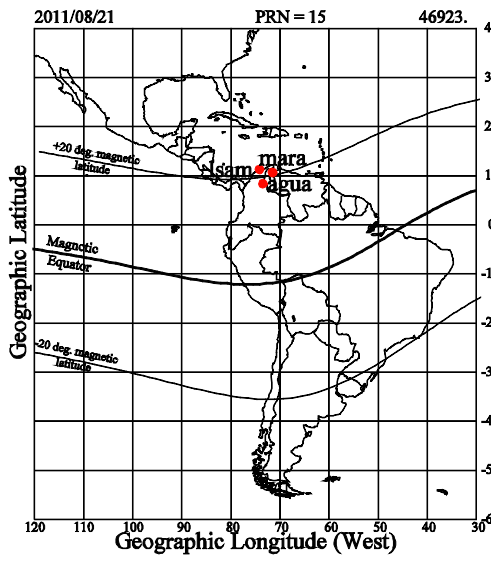
**Delta(TEC)
corresponding to
August 21, 2011
measured in the
Caribbean region near
the region of storm
Irene. The MSTIDs
were moving away from
storm Irene.**



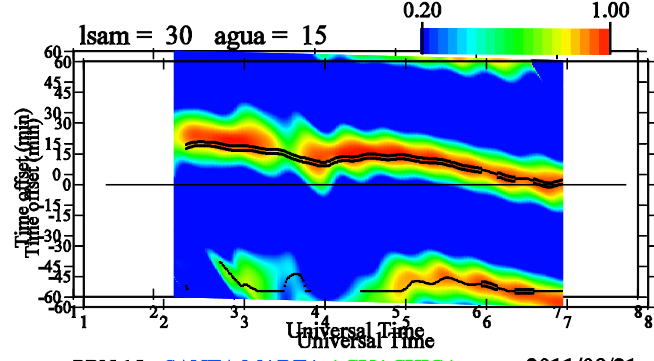


TID population

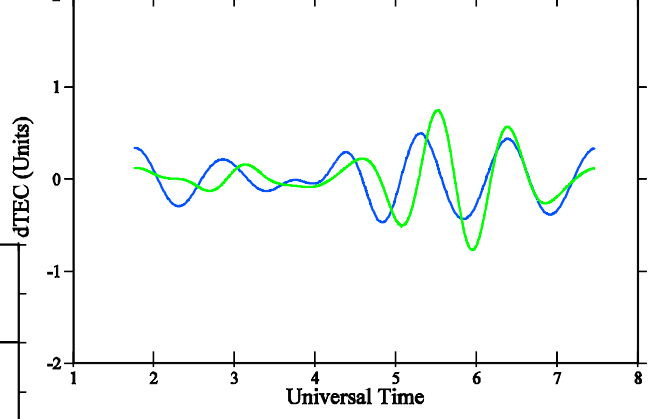




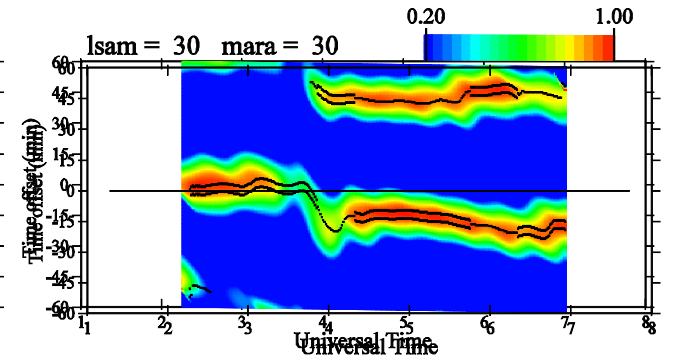
Cross-correlation Function # per G = 15



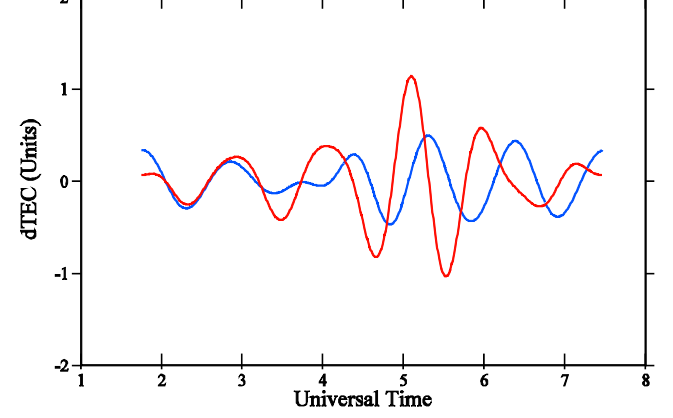
PRN 15 SANTA MARTA AGUACHICA 2011/08/21



Cross-correlation Function # per G = 15



PRN 15 SANTA MARTA MARACAIBO 2011/08/21



Vadas and Crowley (2010) Sources of the traveling ionospheric disturbances observed by the ionospheric TIDDBIT sounder near Wallops Island on 30 October 2007. **JGR**

Primary TIDs have velocities less than 200 m/s and periods less than 30 min. Smaller scale AGWs (20 – 30 km) dissipate at 90 km and others with larger sizes (50 – 150 km) at 140 km.

Secondary MSTIDs have scale sizes between 1000 and 2000 km, horizontal velocity ~500 m/s and periods ~80 min

