The Low-latitude Ionospheric Sensor Network (LISN). How can a distributed observatory increase scientific breakthroughs?

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TIDs associated with Tropical storm Irene (August 20-21, 2011)

Due to Secondary GWs

Due to Primary GWs

Bottomside F region

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

Primary TIDs have velocities less than 200 m/s and small periods.

Z=140 km thermospheric body forces

Z=90 km mesosphere body forces

Z=15 km Tropopause

Convective Plume

Investigation to correlate existence of TIDs and tropospheric phenomena.
Electro-buoyancy waves (MSTIDs) detected with LISN

Continuous measurements of all conjugate structures (MSTIDs) that develop in the American sector (~20 cases per year) between 2010 and now.
Hour-by-hour TEC variability over South and Central America.

Decays at 18 LT when zonal wind reverses. Appear at longitudes with significant declination.

TEC results of the numerical model LLIONS using 90 planes along parallel field lines. Any complete model of the ionosphere should include these large-scale features.
SWARM Constellation and LISN to study low-latitude structuring

To correlate SWARM and LISN data
How velocities of large scale and small scale within bubbles relate?
To study Ne enhancements and BSS irregularities

Valladares, Hanson et al. 1983
\(\Delta \text{Ne} \) and \(\Delta \text{Ti} \) are anticorrelated

Analytical solution of the joint gradient drift instability and ion temperature gradient convective instability by Keskinen et al [2004] predicts a peak at scale sizes near 1 km.
Summary

LISN is a distributed observatory that offers an extended field of view of the ionosphere and continuous operations.

MSTIDs (also called electro-buoyancy waves) can be regularly studied as both conjugate structures can be observed simultaneously in the American sector. Correlations between tropospheric phenomena and TIDs observed with the distributed observatory can be conducted.

LISN has been instrumental to discover the occurrence of an anomaly at tropical latitudes. The anomaly occurs during the solstices and the afternoon hours at longitudes when the declination is greater than zero.

TEC data together with density values collected by the Langmuir probe on-board the SWARM satellites have provided important clues on the formation of BSS-type structures.