Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PEM06-24 Room:304 Time:May 22 10:05-10:25

Seasonal and Local Time Variation of Ionospheric Migrating Tides in 2007-2011 FORMOSAT-3/COSMIC and TIE-GCM TEC

Loren Chang[1*], Charles Lin[2], Jann-Yenq Liu[1], Nanan Balan[1], Jia Yue[3], Jia-Ting Lin[2]

[1]Institute of Space Science, National Central University, Taiwan, [2]Department of Earth Science, National Cheng Kung University, Taiwan, [3]Atmospheric and Planetary Science Department, Hampton University, USA

In this study, we examine the seasonal and interannual variation of the major migrating tidal components in total electron content (TEC) observations from the FORMOSAT-3/COSMIC GPS occultation satellite constellation from 2007 through 2011, and their contributions to local time variation in the mid- to low latitudes. We find that the zonal time mean TECs as well as the absolute amplitudes of all of the examined tidal components show a strong positive relation to changes in F10.7 due to the 11 year solar cycle. The relative importance of these components to the local time variation of the ionosphere away from maximum background values differs, with the relative amplitudes of DW1 and TW3 components inversely related to solar activity, while SW2 shows some signs of positive correlation. The features of ionospheric local time variation produced by individual migrating tidal components are consistent from year to year, with DW1 forming the equatorial daytime peak in TEC, SW2 corresponding to the generation of the equatorial ionization anomaly (EIA) crests, and TW3 contributing to the equatorial TEC trough. Numerical experiments using TIE-GCM are also performed to determine the sensitivity of the ionospheric migrating tides to upwards propagating migrating tidal components from the neutral mesosphere and lower thermosphere (MLT). The zonal time mean TECs decrease when MLT tidal forcing is applied, and are particularly sensitive to the MLT DW1. The majority of the ionospheric SW2 response is attributable to the MLT SW2 component, and enhances the poleward shift of the EIA crests by amplifying the equatorial fountain. TW3 in the model is generated through both in-situ photoionization and nonlinear interaction between DW1 and SW2.

Keywords: FORMOSAT-3/COSMIC, TIEGCM, atmospheric tides, migrating tides, ionosphere, mesosphere lower thermosphere