



Spatial distribution of TID signatures on GPS TEC observed in the Eastern Mediterranean longitude sector

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Understanding the background ionospheric processes for developing precursors to occurrence of spread-F remains a challenge to the scientific community even after seven decades of research. Ionospheric dynamics in the transition region from the equatorial to the mid-latitudes, which have not been extensively studied, present some interesting features and has the potential to develop innovative tools for such forecast. The steeper gradient of ionization beyond the northern crest has been illustrated by *Rastogi and Klobuchar* [1990]. *Paul et al.* [2015] reported post-midnight L-band scintillations from the transition region in the Indian longitude sector. In an effort to understand the possible coupling mechanisms in the zone of transition from the equatorial to mid-latitudes, ionosphere TEC and spread F data were analyzed from a chain of stations located at Nicosia, Cyprus (Lat: 35.15°N, Lon: 33.39°E geographic; 51.07°N magnetic dip), Haifa, Israel (Lat: 32.77°N, Lon: 35.02°E geographic; 48.02°N magnetic dip), Jerusalem, Israel (Lat: 31.59°N, Lon: 35.39°E geographic; 44.79°N magnetic dip) and Ramen, Israel (Lat: 30.59°N, Lon: 34.76°E geographic; 35.14°N magnetic dip), situated along the longitude swath of 33°-35°E, during the summer solstice of 2014, a high solar activity year. An elevation angle greater than 20° was used so that the ionosphere could be tracked from 29.61°N geomagnetic dip south of Ramen to 60.89°N geomagnetic dip north of Nicosia. It is important to note that the TEC data used have been obtained from the IGS stations situated at the four above mentioned places while the spread F data is from Nicosia, Cyprus. The effects of TIDs over GPS TEC are prominent in both equatorial and mid-latitude ionosphere. *Chen et al.* [2011] proposed that TID patterns can be derived from the perturbations of TEC. Efforts have made to study the TEC profiles over the above stations lying in the equatorial to mid-latitude transition region on days spread F was observed from Nicosia under magnetically quiet conditions. Periodic variations in TEC were noticed from all four stations prior to the occurrence of spread F over Nicosia, predominantly within a latitude swath (26°-36°N) from all stations over the longitude interval of 33°-35°E. During summer solstice of 2014, a peak to peak amplitude range of the periodic structures in TEC were noted around 4 to 9 TECU whereas the average periods of these structures were recorded around 50 to 120 minutes. Presence of TID patterns in GPS TEC in the mid-latitude region is a common phenomenon prior to the occurrence of spread F [*K. S. Paul et al.*, 2018] but the latitudinal confinement of such periodicity in TEC is unique in nature even from a mid-latitude station like Nicosia. The present study reports, perhaps for the first time from Eastern Mediterranean longitude sector, confinement of such periodic structures in TEC primarily within a latitude swath of 26°-36°N almost over a longitude zone of 33°-35°E.

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