On the Day-to-day Variabilities in the GPS TEC and EEJ Strength Over India: Effect of the Neutral Atmospheric Waves from Below

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In this paper, we present simultaneous observations of magnetic and GPS TEC data obtained under GAGAN project at the time of **S**udden **S**tratospheric **W**arming (SSW's) events to understand the day-to-day variabilities in the GPS TEC and Equatorial Electrojet (EEJ) strength and their association to SSW events over Indian region during January-February 2006, a low solar activity period. It may be pointed out that while possible sources for the day-to-day variabilities in TEC are mainly attributed to the solar flux, geomagnetic storms and the vertical **E**X**B** drift, variabilities in the EEJ strength could be due to changes in the zonal electric field that is produced through atmospheric tides. Our analysis of GPS TEC and EEJ strength suggests that a strong co-relation exists between the variabilities in EEJ strength and TEC observations. Further, our observations also point out that a large wave like oscillations exists in the EEJ strength during SSW period which in turn is prominently reflected in the GPS TEC over Equatorial Ionization Anomaly (EIA) zone. Wavelet and Fourier analysis suggests that variations in the EEJ strength and variations in the TEC are having a periodicity of nearly 12-16 days. It is well known that zonal electric field over equator drives the daytime ionization to higher altitudes through vertical **E**X**B** drift and this ionization slowly descends to higher latitudes through diffusion along the magnetic field lines. Since the TEC data used in the present analysis belong to magnetically quiet periods and also solar flux does not show any periodic variations, we are left with the sources which can influence the vertical **E**X**B** drift. Since the zonal electric field is produced mainly through atmospheric tides, wave like oscillations observed in the EEJ strength and GPS TEC could be attributed due to the variabilities in the zonal electric field through the interaction of planetary scale waves with tides. In order to identify that such periodic oscillations do exists in the MLT region, we have analyzed TIMED TIDI wind data during the same period. Daily longitude average zonal winds obtained using TIDI observations at low latitude suggest that 16-day wave oscillations do exist. Since we have identified almost similar periods in MLT zonal wind, EEJ strength and TEC over equatorial and low latitude regions, it is conjectured that these large wave like oscillations in TEC may be associated with atmospheric planetary scale waves which is modifying the zonal electric field through atmospheric tides and hence EEJ current. Observations of electron density obtained using CHAMP satellite indicate large periodic variations in the background electron density measured at 400 km altitude during the same period validating our hypothesis.