

R005-43

Zoom meeting C : 11/2 PM2 (15:45-17:30)
15:45-16:00

Propagation characteristics of Sporadic-E and MSTIDs: Statistics using HF Doppler and GPS-TEC data

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Sporadic-E (Es) is a thin layer in the E-region ionosphere (~100 km) composed of dense metallic ions and electrons. Es is known to appear in the mid-latitude region during summer months. Extremely high electron density within Es sometimes reflects radio waves in VHF frequency range, especially above 100 MHz. Such a Es-related reflection of radio waves causes anomalous long-distance propagation of waves leading to radio interferences of commercial/navigation signals. Thus, Es is one of the important ionospheric phenomena which should be studied in the framework of space weather applications. Recent theoretical studies and numerical simulations have suggested that Es plays an important role in generating wave-like structures at F-region altitudes in summer nighttime, which are known as Medium-Scale Traveling Ionospheric Disturbances (MSTIDs). However, there have been only a few studies investigating the simultaneous observations Es and MSTIDs appearing in the E and F regions, respectively. Such a situation is primarily due to the lack of instruments that can directly observe Es in summer night time. To overcome this limitation, we employed data from HF Doppler (HFD) sounder network in Japan to detect Es and tried to evaluate the E-F coupling, i.e., Es in the E-region and MSTIDs in the F-region. The HFD system is composed of a transmitting station in Chofu, Tokyo (35.7N, 139.5E) and receiving stations at ~10 places in Japan. Based on such multi-point observations, we can derive the dynamical characteristics of Es layer, for example, its moving speed and direction.

In this paper, we carried out a statistical analysis of the propagation characteristics of Es and MSTIDs observed in the nighttime by combining HFD and Total Electron Content (TEC) obtained from the GPS receivers of GEONET (GPS-TEC) data for 4 years from 2014 to 2017. We made use of Es reflection data from the HFD receivers in Sugito, Saitama (36.0N, 139.7E), Fujisawa, Kanagawa (35.3N, 139.5E) and Sugadaira, Nagano (36.4N, 138.3E). By using this triangle observation, we succeeded in deriving the horizontal speed and direction of the motion of Es. In addition, we estimated the phase velocity of MSTIDs seen in the simultaneously obtained maps of GPS-TEC with the same triangle observation procedure. The speeds of Es and MSTIDs were commonly less than 100 m/s in most cases and the propagation direction of most of Es and MSTIDs was southwestward. This result is consistent with the statistical characteristic of nighttime MSTIDs in the previous studies. More importantly good correspondence between the propagation characteristics of the two phenomena confirms that Es and MSTIDs move in tandem with each other, further suggesting that Es plays an important role in the generation process of MSTIDs.