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

MSD04-04 Room:101A Time:May 24 10:15-10:30

A study of electro-dynamical coupling between E and F regions

Yuichi Otsuka[1*], Kazuo Shiokawa[1], Yasunobu Ogawa[2]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University, [2]National Institute of Polar Research

Electro-dynamical coupling between E and F regions is one of important subjects for the ionospheric study. Recently, horizontal structures of sporadic E layer (Es) is required to be observed in order to understand effects of Es on generation and propagation of Medium-Scale Traveling Ionospheric Disturbances (MSTIDs), which are wavy structures of the plasma density in the F region. Whereas MSTIDs have been considered to be generated by atmospheric gravity waves, recent studies suggest that electro-dynamical process including polarization electric fields could play an important role in generating nighttime MSTIDs. The Perkins instability, which is a plasma instability operating at mid-latitudes, could explain most of features of the observed MSTIDs, but two major discrepancies between the observations and theory for the Perkins instability are pointed out. First, the growth rate predicted by the theory is too small (on the order of 10^{-4} s^{-1}) to explain the observations. Second, the instability theory cannot explain the equatorward and westward propagation of the MSTIDs. According to the Perkins instability theory, the structures generated by this instability should propagate at the same velocity as the background ExB drift, which is almost always to the east. However, this propagation direction is opposite to that of the observed MSTIDs. These two discrepancies could be resolved by considering E- and F-region coupling processes. However, horizontal structures of Es with scale-sizes of several hundred kilometers corresponding to the horizontal wavelength of the nighttime MSTIDs have not been revealed due to the limitation of instruments. EISCAT_3D is expected to observe the horizontal structures of Es and reveal the E- and F-region electro-dynamical coupling operating in the MSTID generation and propagation.

Keywords: EISCAT_3D, EISCAT, MSTID, sporadic E, ionospheric disturbance