
 ABSTRACTS (MASTER THESIS)

Study of Medium Scale Traveling Ionospheric Disturbance with Sounding Rockets and Ground Observation

(Graduate School of Informatics,
Laboratory of Radar Atmospheric Science, RISH, Kyoto University)

Tomohiro Kato

In the midlatitude ionospheric F-region, mainly in summer, wave structures of electron density that have wave length of 100-200 km and period of one hour are observed. This phenomena is called Medium Scale Traveling Ionospheric Disturbance; MSTID. MSTID has been observed by GPS receiver network, and its characteristic were studied. In the past, MSTID was thought to be generated by the Perkins instability, but its growth ratio was too small to be effective. Recently coupling process between ionospheric E- and F- regions are studied by using two radars and by computer simulations. Through these studies, we now have hypothesis that MSTID is generated by the combination of E-F region coupling and Perkins instability. To clarify this hypothesis, an experiment using two sounding rockets (S-520-27 and S-310-42) was conducted. The rockets are launched on July 20, 2013 from JAXA Uchinoura Space Center. Rockets have several equipments, and observe electric field, electron density, etc. In this thesis, the electric field of E- and F region is analyzed. The method and principle of estimating natural electric field is explained. By applying this method to a previous rocket (S-520-26) that was launched in January 2012, the method is confirmed to be correct, and the value of the natural electric field was nearly 1mV/m. In the experiment of S-520-27, the natural electric field ranged about -5mV/m , and the time variation from southeast ward to east ward, and period of 100 seconds (Figure 1). The Pedersen conductivity is estimated by the observation of electron density. By using this, the electric field was mapped to the horizontal plane at 280km height along the geomagnetic field line. By comparing with GPS-TEC, the correlation between the natural electric field and TEC variation was found. From the above, in this thesis, the vector of electric field in MSTID is estimated and the characteristic of polarization electric field is elucidated.

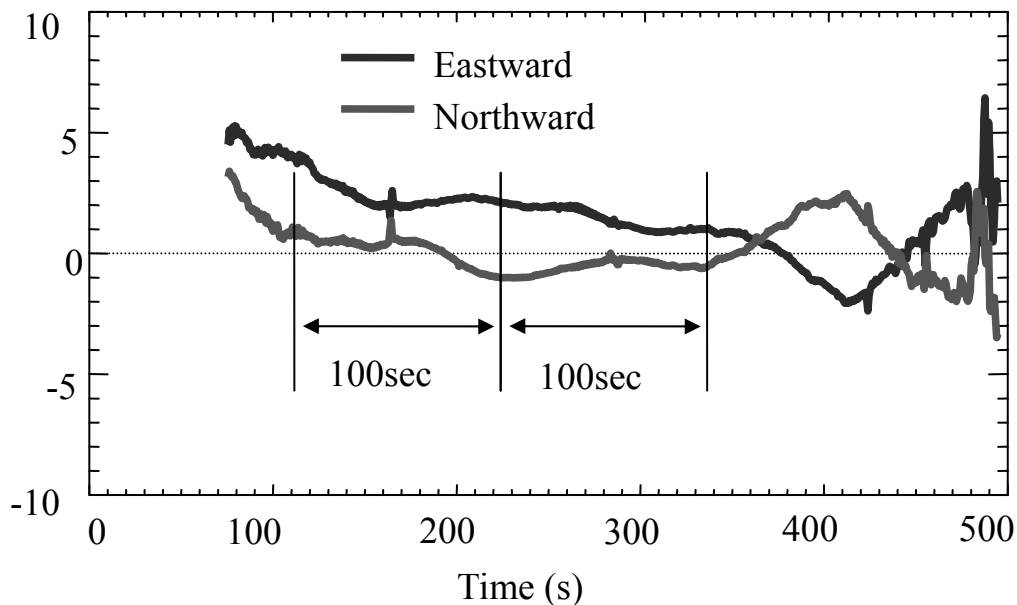


Figure 1: Electric field time variation measured by the double-probe on board of S-520-27 sounding rocket.