The statistical study of the growth rates of Medium-Scale Traveling Ionospheric Disturbances observed with GPS-TEC

*池田 孝文[1]、齊藤 昭則[1]、津川 卓也[2]、品川 裕之[2]
*Takafumi Ikeda[1], Akinori Saito[1], Takuya Tsugawa[2], Hiroyuki Shinagawa[2]

1. 京都大学大学院理学研究科地球物理学教室、2. 情報通信研究機構
1. Department of Geophysics, Graduate School of Science, Kyoto University, 2. National Institutes of Information and Communications Technology

We think two mechanism, E-F coupling and Perkins Instability, will relate to growth for nighttime-MSTID in mid-latitude [Tsunoda and Cosgrove., 2001 ; Perkins., 1973]. Linear growth rate of perturbation intensity of Pedersen conductivity expected from E-F coupling is around 15 minutes [Yokoyama et al., 2009], which is far shorter than one expected from Perkins Instability [Fukao and Kelley, 1991 ; Miller et al., 1997 ; Shiokawa et al., 2003]. However, Es layer’s spatial and temporal scale is less than 100km and 15min [Maeda et al., 2013 ; S.Saito et al., 2007]. They are different from MSTID’s ones, which are 200-400 km and around 2hours [Otsuka et al., 2011]. To decide which instability is responsible for growth of nighttime MSTID, the growth rate of MSTID was observationally determined with ground-based GPS network data.

We statistically investigated the growth rate of nighttime-MSTID in Japan in 2014 observed with GPS-TEC. The growth rate of nighttime -MSTID observed was 1.0 - 6.0 $\times 10^{-4}$ s^{-1} during 1800LT-2400LT in summer.Linear growth rate of Perkins instability in summer was 1.0 - 6.0 $\times 10^{-4}$ s^{-1} during 1800LT - 2400LT, so they were less than one of the E-F coupling instability. Also,Seasonal distribution of observed growth rate before midnight was similar to that of linear growth rate.U×B derived by GAIA model was high in spring - summer and seasonal distribution of U×B was similar to that of linear growth rate. Therefore, the growth of MSTID when propagating is not determined by E-F coupling instability but Perkins instability and neutral wind.

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