

Statistical estimation of growth time of medium-scale traveling ionospheric disturbances by three dimensional spectral method

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Medium scale traveling ionospheric disturbance is one of phenomenon in ionosphere and has been long studied. Nighttime MSTID will be caused by Perkins instability. Linear growth time(e folding time) of Perkins instability is very slow as growth time from random thermal noise . Therefore , we expect explanation of growth of MSTID by including electric field of Sporadic E layer . However, we have not almost estimated observational growth time of MSTID.

Using this method, we statistically estimated growth rates of nighttime MSTID in japan in summer 2014 observed by GNSS. We used 3DFFT for total electron content(TEC) grid data ,and estimated propagation velocity. Using this velocity, we tracked movement of one wavefront of MSTID. We estimated the maximum growth time of each event by using wavenumber spectra when tracking. As a result, growth time is slower than 16 minutes. Propagation direction when growth time is fastest is southwestward(205° - 245°). Growth time is maximum when 240°. This magnitude is too slow as growth time of MSTID, and is within the range of one perkins instability expects. We will show the detail about the relation between this growth time and both mechanisms, and also show the solar activation and the seasonal dependence of growth time.

Keywords: Medium-scale traveling ionospheric disturbances, GPS-TEC, Perkins instability, Three dimensional spectral method