Comparison of daytime medium-scale traveling ionospheric disturbance between GPS observation and GAIA simulation

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Traveling ionospheric disturbances (TIDs) are wave-like perturbations of the ionospheric plasma. Depending on the wave parameters such as wavelength, phase speed and period TIDs are categorised into medium and large scale TIDs. Medium scale traveling ionospheric disturbances (MSTIDs) have wavelength, phase speed and period in the range of 100-500 km, 100-250 m/s and 15-90 minutes respectively. Most often, the MSTIDs propagate towards southeast or south during daytime and southwest during nighttime, which gives an evidence showing that generation mechanisms are different between daytime and nighttime. Though the observational results show that occurrence of daytime MSTID is maximum during the winter, the day-to-day and longitudinal variation of occurrence are not yet explored well.

We have analysed total electron content (TEC) data obtained from more than 1,200 GPS receivers in Japan in 2011. To obtain perturbation component of TEC, which could be caused by MSTID, we have subtracted 1-hour running average from the original TEC time series for each pair of satellites and receivers, and converted the slant to vertical TEC. We have defined MSTID activity as dI/I, where dI is the standard deviation of the perturbation component within 1 hour, and I is 1-hour average absolute vertical TEC. MSTID activity is found to be higher in winter than in other seasons. We have compared the observed MSTID activity with the MSTID activity obtained from TEC simulated by the GAIA (Ground-to-topside model of Atmosphere-ionosphere for Aeronomy). To estimate the MSTID activity from the GAIA TEC data, we obtained detrended TEC by subtracting 2-hour running average from the TEC, and calculated standard deviation of the detrended TEC in 2 hours. MSTID activity was obtained as a ratio of the standard deviation to the 2-hour averaged TEC. Present analysis shows that daytime MSTID activities simulated by the GAIA are also higher in winter (December-February) than in other season, indicating that the GAIA succeeded to reproduce seasonal variation of the MSITD activity during daytime. In addition to this, day-to-day and longitudinal-latitudinal variation of daytime MSTID activity will also be detailed in the presentation.