

Statistical study of large-scale traveling ionospheric disturbances using the GEONET total electron content data(3)

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Fifty-four Large-Scale Traveling Ionospheric Disturbances (LSTIDs) were identified during thirty-nine months from April 1999 to June 2002 using GEONET data. We determined the damping rate, propagation velocity, and period of each LSTID with the method developed by Tsugawa et al. [2003]. The damping rates of the LSTIDs were scattered within the range from -2 to +3 [hour⁻¹] in the night side and from 0 to +2 [hour⁻¹] in the day side. The negative damping rates mean that the LSTIDs grow large as they travel southward. The angle between the vertical propagation directions of the atmospheric gravity waves generating were these LSTIDs and the vertical direction, X , found to be between 5 and 40 degrees. The damping of LSTIDs would be caused by the ion-drag effect, which is mainly dependent on the background plasma density and the angle between the geomagnetic field and the vertical propagation direction of the atmospheric gravity waves (AGWs) [Liu and Yeh, 1969]. The statistical analysis revealed a non-linear relation between the damping rates of the LSTIDs and the background TEC. The positive damping rates have a positive correlation with the angle X and the negative damping rates have a negative correlation. Considering the inclination angle of the geomagnetic field over Japan, this fact indicates that the LSTIDs with positive damping rates would be generated by the upward propagating AGWs. As the angle X increases, the variations of the neutral winds in the AGWs become perpendicular to the geomagnetic field and the ion-drag effect becomes large. On the other hand, the downward propagating AGWs would cause the negative damping rates because the variations of the neutral winds become parallel to the geomagnetic field and the plasma mobility along the geomagnetic field becomes large as the LSTIDs travel southward. In this case, the plasma mobility becomes large and the ion-drag effect becomes small as the angle X increase. This study revealed that the vertical and horizontal scale of the LSTIDs mainly control their damping rates.