R005-38
Zoom meeting C ：11/2 PM1 （13:45-15:30）
14:00-14:15

全球 GNSS-TEC とあらせ衛星観測による中緯度トラフとプラズマ圏界面の位置関係

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Relationship between the locations of the mid-latitude trough and plasmapause by global GNSS-TEC and Arase satellite measurements

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The equatorial plasma density structure in the vertical direction above the F-region of the ionosphere shows a gradual decrease with an increasing L-value and the plasma density sharply decreases around L = 4-6. This boundary and the inner region with a high plasma density has been called the plasmapause and plasmasphere, respectively (Carpenter, 1966). The plasmapause is formed at the location of counteraction of corotation and dawn-to-dusk convection electric fields in the magnetosphere (Nishida, 1966). Therefore, when the convection electric field is intensified associated with geomagnetic disturbances, the plasmapause moves toward the Earth. On the other hand, the mid-latitude trough is characterized by a significant plasma depletion in the F-region of the ionosphere at sub-auroral and mid-latitudes below the auroral oval. The structure of the mid-latitude trough shows a latitudinally narrow density depletion with a wide longitudinal extent. The mid-latitude trough is believed to be formed by four processes: flow stagnation (Kelley, 2009), transportation and frictional heating by SAID/SAPS (Spiro et al., 1979), auroral particle precipitation and the replenishment of plasma from the nighttime plasmasphere (Roger et al., 1986). These two structures in between the ionosphere and inner magnetosphere are generally believed to appear on the same magnetic field line. Recently, Shinbori et al. (2018) also reported that the location of the plasmapause almost agrees with that of the mid-latitude trough minimum during a geomagnetic storm that occurred on April 4 2017 from a comparison between the electron density in the inner magnetosphere obtained from the Arase satellite and global navigation satellite system (GNSS) ?TEC observations. In this study, we analyze long-term observation data of global GNSS-TEC and electron density in the inner magnetosphere obtained from the Arase satellite with high time and spatial resolutions to clarify the relationship between the locations of the plasmapause and mid-latitude trough minimum during geomagnetically quiet times, main and recovery phases of geomagnetic storms. In this analysis, we identify the mid-latitude trough minimum as a minimum value of GNSS-TEC at sub-auroral and mid-latitude regions, and determine the plasmapause as an electron density decrease by a factor of 3-5 or more within ?L < 0.5 in the inner magnetosphere. As a result, the position of the plasmapause does not always coincide with the mid-latitude trough minimum in all magnetic local time (MLT) sectors under all geomagnetic conditions. During the geomagnetically quiet periods, the mid-latitude trough minimum is located at a lower geomagnetic latitude (GMLAT) of the plasmapause except for the evening sector (16?19 h, MLT). This implies that the mid-latitude trough and plasmapause may not be on the same magnetic field line. On the other hand, during the main phase of geomagnetic storms, the mid-latitude trough minimum and plasmapause move toward a low-latitude region with day-night and dawn-dusk asymmetries and the correlation becomes highest, compared with other geomagnetic conditions. This suggests that the formation of the mid-latitude trough and erosion of the plasmasphere occur on almost the near magnetic field line due to an enhancement of convection electric field and sub-auroral polarization stream during the main phase of geomagnetic storms.