# Temporal and spatial developments of mid-latitude ionospheric electric field as observed with magnetometers during magnetic storms

# Yuji Tsuji[1]; Atsuki Shinbori[2]; Takashi Kikuchi[3]; Shinichi Watari[4]

[1] Particle and Astrophysical Sci.,Nagoya Univ; [2] Solar-Terrestrial Environment Laboratory, Nagoya Univ.; [3] STELab; [4] NICT

In order to clarify the distribution of electric field and current in the middle- and low-latitude ionosphere during a geomagnetic storm, we have analyzed ground magnetic disturbances for the storm on September 7, 2002, with the minimum SYM-H value of -168 nT. In this analysis, we investigated magnetic field deviations of the H component from the SYM-H value as functions of the magnetic latitude (MLAT) and local time (MLT). The deviations in the low-latitude regions (10-30 degrees in MLAT) showed positive and negative values in the dawn and dusk sectors, respectively, during the main phase of the storm. This local time tendency represents a remarkable dawn-dusk asymmetry in the storm-time ring current. On the other hand, the deviations in the middle-latitude regions (35-55 degrees in MLAT) showed negative and positive values in the morning (9-12 h MLT) and afternoon (13-15 h MLT) sectors, respectively. This tendency coincides with the magnetic disturbances produced by the DP2 currents associated with penetration of convection electric field to the middle-latitude ionosphere. When the interplanetary magnetic field turned northward, the storm started the recovery phase. We found that the deviations in the middle-latitude regions in this phase were in opposite sense to those during the main phase. This implies that the overshielding occurred in the middle-latitude regions, due to an abrupt decrease of the convection electric field associated with the recovery phase. The above results suggest that the competition between the convection and shielding electric fields determines the characteristics of magnetic disturbances of mid-latitude ionospheric currents. Moreover, the influence of resultant Hall current associated with the development of the main phase reached less than 30 degrees (CGM latitude). This result indicates that the convection electric field penetrated deeply (at least L = 1.5) into the inner magnetosphere. However, during the further development of main phase, strength of the Hall current didn’t very change in the middle-latitude regions. This may imply that a shielding electric field is gradually intensified in the middle-latitude regions (40-50 degrees) as the asymmetric ring current grows during the main phase. In this talk, we will investigate the temporal and spatial developments of ionospheric currents and electric field at middle latitudes for some storms to interpret the relationship between the convection and shielding electric fields during each storm phase.