Evolution of equivalent current patterns in auroral zone ionosphere during substorms

*Osuke Saka[1]

1. Office Geophysik

Evolution of the ionospheric equivalent current patterns in auroral zone was examined during substorms using ground magnetometer network data. Results obtained are as follows; (1) Preceding the substorm onset by 20 min, ionospheric convection was initiated in the auroral zone consistent with polar cap convection directing to the equatorward latitudes. At the conjugate geosynchronous orbit, increase of thermal ion flux directing towards the equatorial plane (inflow) was observed. (2) At substorm onset, ionospheric convections were enhanced in a narrow longitudinal sector in association with the convection surge at geosynchronous orbit. (3) Following the substorm onset, vortical structure of the equivalent currents (or convections) expanded eastward as well as poleward directions from the onset longitudes in the midnight sector. The size of the vortex increased, in one hour after the onset, to cover 50N to 70N and 220E to 340E in geomagnetic latitudes and longitudes, respectively. (4) The vortical currents (convections) were left in the auroral zone ionosphere after the ionospheric convection subsided.

We propose a new substorm scenario in that substorms were initiated in the auroral zone ionosphere by the transmission of enhanced convection electric fields from the magnetosphere. Convection electric fields penetrated into auroral zone ionosphere develop vortical flows in pre-existing ionospheric convections. The vortical flow increased its scale size in latitudes and in longitudes after onset. The observations outlined above indicate development of the Harang Discontinuity.

Keywords: substorms, ionospheric equivalent currents, Convection surge

