Observations of ionospheric electric fields by FM-CW radar at low latitude

Toshiki Shimbaru[1]; Kiyohumi Yumoto[2]; Akimasa Yoshikawa[1]; Takashi Tanaka[3]; Kentarou Kitamura[2]; Kenro Nozaki[4]; Manabu Shinohara[5]

[1] Earth and Planetary Sci., Kyushu Univ.; [2] Space Environ. Res. Center, Kyushu Univ.; [3] Kyushu University; [4] CRL; [5] SERC, Kyushu University

http://denji102.geo.kyushu-u.ac.jp/denji/student/shinbaru/shinbaru.html

To investigate the penetration process of ionospheric electric fields from the polar to the equatorial ionosphere, we have performed correlation analysis between ionospheric Doppler data obtained at Sasaguri station (geomagnetic latitude =23.2 degree, geomagnetic longitude =199.6 degree) and geomagnetic variations observed at the Circum-pan Pacific Magnetometer Network (CPMN) stations. In this study we focus on DP2 type current systems associated with SC and Pc 5, which show equatorial enhancements of magnetic field variations at the dip equator

At the onset time of SC preceded by PRI on November 4, 2003, the initial change in the ionosphere was observed simultaneous with the geomagnetic initial change in the accuracy of 10s at 0625UT. However, the quasi -periodic waveform (about 90s) of geomagnetic variation for about 1 min after the initial change had about 40-50 degree phase delay to the ionospheric variation. These results were in agreement with the event at 0519UT on May 9, 2003, except that phase delay was about 30-40 degree . Simultaneous observations of the initial changes are not contradictory to the result of the past, and approve of the nearly instantaneous penetration of the electric fields to the equatorial latitude. At the same time, it proved the quality of the FM-CW radar as an useful tool for detection of ionospheric electric fields. In the future, we may argue about the more precise timings of electric field penetrations by measuring the STP phenomenon.

The electric field variations (period of about 5 min) associated with Pc5 magnetic pulsations were also observed at the low latitude ionosphere during the recovery phase of geomagnetic storm on October 30-31, 2003. This is the evidence of Pc5 magnetic pulsations produced by DP2 type current system in the low latitude ionosphere. In this case, the phase delay of geomagnetic variations was found to be about 20-40 degree to the ionospheric variations.

We can not ignore the self-inductance effect of enhanced ionospheric current caused by the Cowling conductivity to understand the phase delay of geomagnetic variations observed at the dip equator in daytime.