Dependence of the ionospheric potential on solar wind parameters derived from a global MHD simulation

Hiroyuki Nakata[1], Manabu Shinohara[2], Yohsuke Kamide[3], Tatsuki Ogino[1]

[1] STEL, Nagoya Univ., [2] STE Lab., Nagoya Univ., [3] STEL, Nagoya Univ

Using the results of a global MHD simulation and the KRM method, we calculate ionospheric potentials during substorms and investigate the dependence of the potential on solar wind parameters (i.e. IMF Bz, solar wind density and solar wind speed).

We derive ionospheric potentials from field-aligned currents and ionospheric conductivities. The distribution of field-aligned currents in the ionosphere is derived from the results of the global MHD simulation developed by Ogino et al.[1996]. In this simulation, substorms are reproduced by the southward turning of the northward IMF. We also use the conductivity distributions used in Kamide et al.[1996] which adopted the KRM inversion method combined with a conductivity model of Ahn et al.[1983]. The conductivity distributions are derived in different phases of substorms. In deriving the ionospheric potential, we use the distribution corresponded to the phase of substorms.

Comparing with Kamide et al.[1996], the present procedure can derive realistic distributions of the ionospheric potential. However, the potential drop is not consistent after peak of substorm. In growth and expansion phases, not only the ionospheric potential drop but the distribution are affected only by the southward IMF and the ionospheric potential is well fitted by the interplanetary electric field. It is noted that the ionospheric potential increase with the solar wind density in the present study. But this tendency is opposite to some theoretical studies [e.g. Vasyliunas, 1970; Alexeev, 1998].