The solar wind control of ionosphere dynamics during geomagnetic storms

L. Biktash (1), T. Maruyama (2), K. Nozaki (2)

(1) IZMIRAN, Troitsk, Moscow region, 142190, Russia, e-mail: lsizova@izmiran.rssi.ru (2) NICT, 4-2-1, Nukui-Kitamchi, Koganey, Tokyo 184-8795, Japan, e-mail: tmaru@.nict.go.jp, nozaki@nict.go.jp

The interplanetary magnetic field (IMF), geomagnetic variations, virtual ionosphere height and critical frequency foF2 data during the magnetic storms of different intensity are investigated to show relationships between these phenomena. We have used several moderate geomagnetic storms from the first Western Pacific Ionosphere Campaign (1998 - 1999) observations when evolution of high- to low- latitude of F-region perturbations were available to trace. It is shown that mid and low latitude ionosphere dynamics during the moderate storms were defined by the direction of the Bz-component of the IMF and the solar wind velocity. For example, the ionospheric heights h'F and the critical frequency foF2 at mid and low latitudes during the northward IMF Bz (the quiet day conditions) and the southward IMF Bz (the main phase of magnetic storms) were very distinguished. Distinction between quiet and disturbance periods in the heights reached up to150 km. The critical frequency foF2 was markedly lower during southward IMF Bz. Some of the last enormous geomagnetic storms when the daytime critical frequency foF2 decreased up to nighttime level have viewed. We show that ionospheric dynamics can mainly be explained by the solar wind - magnetosphere - ionosphere coupling by the electric field of the field-aligned currents (FAC). The FAC electric field can penetrate throughout the mid latitude ionosphere to the equator and can serve as a coupling agent between the auroral and the equatorial ionosphere. Intensity and location of the field-aligned currents connected with DP systems mainly defined by Bz component of the IMF. Model of direct penetration of electric field from the field-aligned currents of Polar Regions 1 and Region 2 to the equatorial ionosphere is presented. Taking into account the time delay between the solar wind and the ionosphere parameters, the relationship can be used for prediction of ionosphere dynamics and could make clear a complicated picture of auroral phenomena during magnetic storms.