VARIATION OF THE MAGNETOTAIL ELECTRIC FIELDS DURING MAGNETOSPHERIC SUBSTORMS

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The behaviour of the midtail electric fields during two magnetospheric substorms on November, 22, 1995, is investigated. The magnetospheric electric field is supposed to consist of two components: a potential electric field penetrating into the magnetosphere from the solar wind, and an inductive electric field associated with variation of the geomagnetic field. The first component is supposed to be proportional (with some time delay) to the Y-component of the solar wind electric field, and the second one is estimated from the time derivative of the tail lobe magnetic flux. The latter is obtained by converting total pressure to lobe magnetic field by assuming pressure balance between lobe and plasma sheet (Nakamura et al., 1999). The Y-component of the total electric field is calculated from GEOTAIL spacecraft data as $E_y=-[V^* B]_y$.

Analysis of experimental data shows that the inductive electric field (E_c) is "switched on" in the magnetotail practically simultaneously with the intensification of the IMF southern component. At the preliminary phase of the substorm, the E_c field within the plasma sheet is directed from dusk to dawn compensating the potential field E_p, so that the total field E_y is rather small there (Semenov and Sergeev, 1981). With the beginning of the active phase, the E_c changes its sign, and adding to the E_p, provides a rapid increase of the dawn--dusk E_y field. As the intensity of E_p during the active phase of the substorm is less than the intensity of the induced field, E_y is determined during this period by the latter mainly and does not correlate with the Esw field. However, the intensity of the potential electric field at this time may be obtained from the data on the velocity of the auroral arc motion (Pudovkin et al., 1992). So, judging by the dynamics of aurorae at the Poker Flat (Alaska) station, E_p field in the inner magnetosphere ($X\sim -10\ R_E$) amounts the value of 0.7 mV/m, and it varies in proportion to Esw with the time delay of about 20 minutes.

Intensity of the inductive electric field E_c during the active phase of the substorm depends on the amount of the magnetic field energy accumulated in the magnetotail lobes, and is determined by the rate of the reconnection of the magnetotail magnetic fields.

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