Dependence of the latitudinal extent of the substorm auroral bulge on the interplanetary medium parameters

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Using the Polar satellite UV images of aurora and data from the Wind satellite we investigated the dependence of the poleward propagation extent of the auroral bulge during substorm on interplanetary electric field. The extent (ΔL) is determined as difference between of latitude of maximal poleward boundary of the bulge (Lm) and latitude of the auroral substorm onset (Lo). It is shown that the latitudinal size of the auroral bulge increases as the dawn-to-dusk component of the electric field (Ey=- V*Bs) increases. We interpret this as a natural consequence of the reconnection concept. Indeed, the IEF is proportional to the reconnection rate at the magnetopause and, correspondingly, to surplus of the magnetic flux in the tail lobes. In turn, the size of auroral bulge is proportional to the magnetic flux reconnected during substorm at the near-Earth neutral line.

We considered how the southward interplanetary magnetic field component Bs and solar wind velocity V affect Lm and Lo. Lm is affected by both Bs and V. It increases as Bs and V increase. As to Lo, it decreases as Bs increases, and weakly depends on V.

Using data from the IMAGE meridional magnetometer chain the dependencies on IEF, Bs and V were also studies for the substorm westward electrojet. An essential difference from the aurora behavior is the fact that in average Lm for electrojet does not increase, and even decreases as Bs increases. Perhaps, it happens because the substorm related particle precipitation from the inner magnetotail produces the enhanced conductivity channel mainly in the equarward part of the auroral bulge . This fact along with the decrease of Lo may, in particular, explain why the occurrence of substorms electrojet at very high latitude is weakly dependent on IEF and Bs, but strongly on V.