Investigation of the relationship between current density and potential in the auroral current regions with Cluster spacecraft

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Auroral particle acceleration is the result of the transmission of electromagnetic energy along auroral field lines and its dissipation in the auroral acceleration region [1]. Field-aligned current resulting from a potential drop can be described by Knight relation (K) [2]. In our study, we have investigated this correlation using data from 50 Cluster passes of auroral acceleration region during the years 2001-2003. This ensemble of these chosen events has been used to characterize the electric field and to investigate the dependence of K on MLT, geomagnetic indexes, and IMF. Values of K vary between 10e-11 and 10e-9.

We have calculated current the density from the magnetic field data, assuming the current sheet approximation. In presented study we have used only electric field measurements for estimation of field-aligned potential drop. The results show clear correlation between MLT and Knight constant. Smaller values of K were observed usually for high (night) MLT. On the other hand, the dependence of K on AE and DST indexes was not statistically significant.

Moreover, influence of direction and magnitude of IMF is small. The largest values of K correspond to IMF lying in the ecliptic plane. In a follow-up study we would like to calculate K from other spacecraft at different altitudes, but located at the same magnetic field line as Cluster, or probably from a pair of Cluster spacecraft.

References

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