

MHDシミュレーションによるサブストーム発達過程における磁気共役点移動の再現

Tracing geomagnetic conjugate points during a substorm development reproduced by a global MHD simulation

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It is generally considered that the auroral particle guided along the geomagnetic field lines falls to Earth's atmosphere. Thus we can expect that nightside auroras appear simultaneously at both the conjugate points. However, simultaneous auroral observations at the conjugate points have not always show that auroral features may not always be conjugate.

Previous observations [e.g., Sato et al., 1998; Ostgaard et al., 2005] have shown that the interplanetary magnetic field (IMF) penetrates the magnetotail and that IMF orientation affects the location of the nightside aurora. Ostgaard et al. [2005] have demonstrated that IMF orientation acts as the main controlling factor of the relative displacement of the aurora in the conjugate hemispheres on the statistical basis. Comparing their results with the displacement predicted by empirical magnetospheric models (T96, & T02), these models have provided a strong observational support, but underestimated this effect by an order of magnitude. The distortion of the magnetospheric magnetic field line geometry by the penetrated IMF B_y is inversely proportional to the strength of the ambient geomagnetic field. The geomagnetic field lines extended from active auroral arc are most likely mapped into the transient regions of low magnetic field. These transient and spatially localized substorm-related depressions of B are not adequately reproduced by these empirical models.

In this study, we studied relative displacements of geomagnetic conjugate points during a course of substorm reproduced by southward IMF in a global MHD simulation model. A case study for the penetrated IMF B_y shows that drastic displacements of geomagnetic conjugate points occur during the development of the substorm onset.

キーワード:オーロラ,サブストーム, 3Dビジュアライゼーション, MHDシミュレーション, 磁気共役点, 地球磁気圏

Keywords: aurora, substorm, 3-D visualization, MHD simulation, geomagnetic conjugate point, magnetosphere