Post Modern View of McIntosh/Equinoctial Effect

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Hisorically, it is well known that geomagnetic activities show diurnal and semiannual variations. Three effects (Axial effect, McIntosh effect, and Russel-McPherron effect) has been proposed and discussed to explain these variations.

McIntosh/Equinoctial effect is a hypothesis that the geomagnetic activity shows maximum when the angle between the Earth's dipole axis and Sun-Earth line is 90 degrees [McIntosh, 1959].

In 1990's, diurnal and seasonal variations of geomagnetic activities have been studied based on the Russell and McPherron Effect. Because the R-M effect explained the enhancement of north-south component due to the geometrical relationship between the Earth's dipole axis and Parker spiral plane. The enhancement of southward IMF can develop the magnetospheri c convection.

On the other hand, Cliver et al. [2000] pointed out the importance of McIntosh effect again. This triggers the debate of diurnal and semiannual variations of geomagnetic activities these days.

The problem of the Mcintosh/Ecuinoctial effect is that no physical mechanism can explain this effect well, although several mechanisms have been proposed.

Recently, dynamics of the magnetosphere have been interpreted as a compound system of S-M-I coupling.

Based on this point of view, it is clarified that the geomagnetic convection system is a nonlinear system and the efficiency of S-M-I coupling depends on the total Pedersen conductivities in northern and southern polar caps [Nagatsuma, 2003].

This result suggest that the Mcintosh effect is not caused by the variations of the tilt angle, but caused by the variations of the total Pedersen conductivities which can changes the efficiency of S-M-I coupling. Further, this interpretation can explain the diurnal variations of geomagnetic activities under the same tilt angle condition.

Reference

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