

The forenoon-afternoon asymmetry of DP2 electric field penetrated to the dip equator

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DP2 oscillation is quasi-periodic disturbance whose period is from 30 min to a few hours, and it is well known that DP2 synchronize with IMF Bz oscillation [Nishida, 1968] and can be observed globally from polar to equator [Nishida, 1968], [Kikuchi et al., 1996]. These two characteristics indicate that the disturbance associated with solar wind comes into ionosphere at polar region and M-I coupled current system like penetrating to dip equator is produced, however, this mechanism of the inversion of electric field from polar to equator is not well understood.

The purposes of this study are to clarify how the electric field at polar region is penetrated to dip equator region and to identify the global distribution of DP2 current system. To attain these goals, we analyzed longitudinal and latitudinal distribution of DP2 oscillation observed at dip equator region that is the final destination of M-I coupling system. The electric field is calculated from magnetic field and electric conductivity based on Ohm's law, and magnetic field data used in this study are MAGDAS data [K. Yumoto et al., 2006 and 2007] and electric conductivity data are calculated using data of WDC for geomagnetism. We analyzed the real local time distribution of the electric field during DP2 event in 2007 and 2008 using these data. It is used the data Equatorial Magnetometer Network [T.-I. Kitamura, 1985] to derive latitudinal distribution of DP2 oscillation.

The result of this analysis shows that there is an asymmetry of electric field between forenoon and afternoon. It is difficult to explain this asymmetry from the view point of only the electric field at polar region on northern and southern hemisphere which makes global DP2 current system, so this result indicates that there is some mechanism to produce this asymmetry of electric field when the polar electric field is penetrated to equator. As this mechanism, we suggest that the polarization electric field along dip equator and the terminator line of day and night can change global potential structure by Cowling channel model [Yoshikawa et al., 2012, AGU], and the electrostatic potential distribution assumed from our observational result is consistent with the distribution derived from the calculation result based on this model.

Keywords: DP2 oscillation, dip equator, ionospheric current