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グローバル MHD モデルで再現される「2 null - 2 separator」磁気圏におけるリコネクション電場
Reconnection electric fields in the ”2 null - 2 separator” magnetosphere simulated by a global magnetohydrodynamic model

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It is known that the magnetic reconnection rate is proportional to the field-aligned electric field along the so-called X line. It represents the rate of the magnetic field vanishing in the diffusion region. In global magnetohydrodynamic (MHD) modeling of the magnetosphere, the field-aligned electric field can be used to identify the reconnection mode occurring in the simulated magnetosphere. This is particularly useful when antiparallel field line geometry are not formed. One example is the magnetosphere for northward interplanetary magnetic field (IMF). Global MHD simulations generally reproduces the magnetospheric structure characterized by two magnetic nulls and two separators (which we call here the ”2 null - 2 separator” structure, or ”null-separator” structure for short). In this configuration, antiparallel magnetic fields do not exist. In addition, the field line geometry for northward IMF is often too complicated to grasp intuitively. In this study, in order to identify the reconnection mode clearly, we explicitly calculate the reconnection electric fields in the simulated magnetosphere during northward IMF periods. We apply this approach to the modeling of the interchange cycle proposed by Watanabe and Sofko [2009, doi:10.1029/2008JA013426]. Although Watanabe et al. [2010, doi:10.1029/2009JA015041] reported observations showing ionospheric signatures of the interchange cycle, there seem to be some debates on the interpretation of the observational data. We aim to support Watanabe et al. [2010] from the modeling point of view. We also discuss the partial collapse of the null-separator structure when the IMF clock angle (measured from due north) is around 45 degrees. In this case, unconnected IMF lines tangle in the closed field lines on the nightside, showing a collapse of the null-separator structure. We argue how such a topology is created by analyzing the field-aligned electric field on separatrices.