

Shift of the magnetopause reconnection line to the winter hemisphere under southward IMF conditions: Geotail and MMS observations

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Recent global modeling studies and remote observations have indicated that the location of the dayside magnetopause reconnection line under southward interplanetary magnetic field (IMF) conditions tend to shift toward the winter hemisphere from the subsolar point owing to the effect of geomagnetic dipole tilt. We examined this idea using the data obtained by the Geotail and MMS (Magnetospheric Multi Scale mission) spacecraft near the GSM $Z = 0$ plane under southward IMF conditions. Around 0213 UT on 18 November 2015, the MMS spacecraft observed southward reconnection jets at the subsolar magnetopause (GSM $Z = -0.33 R_E$) under southward and dawnward IMF conditions. We estimated the plane of the magnetopause current sheet using the minimum variance analysis of current densities that were derived by the curlometer technique. The N axis of the LMN coordinates was defined as the normal to this plane. The L axis was defined as the nearest direction in this plane from the maximum variance direction of magnetic fields. Using the ratio between the N and L components of the magnetic field, the reconnection rate was estimated to be 0.03. The distance between the ion edge and the center of the current sheet (weakest magnitude of the magnetic field) was estimated as ~540 km, using the N component of the deHoffmann-Teller velocity and the time period between the two. On the basis of the estimated distance and reconnection rate, the reconnection line was ~2.8 R_E northward from the MMS. This corresponds to GSM $Z \sim 2.5 R_E$. About 30 minutes later, the Geotail spacecraft also observed southward reconnection jets at the dawnside magnetopause even though Geotail was in the northern hemisphere (GSM $Z = 1.3 R_E$). The effect of IMF B_y was very small around this time, since the MMS spacecraft observed purely southward directed magnetic fields in the magnetosheath. These observations are consistent with the idea that the dayside magnetopause reconnection line shifts toward the winter hemisphere under southward IMF conditions.

Keywords: MMS spacecraft, magnetic reconnection, magnetopause, Geotail spacecraft