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Statistical survey on the magnetic structure in magnetotail current sheets

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Based on the multi-point observations of Cluster on the 15-19 R_E downtail, the magnetic field structure at current sheet(CS) center are statistically surveyed. It is found that the B_y component distributes mainly within $|B_y|$ <5*nT* while B_z component is mostly positive and distributes mainly within 1∼10nT(in GSM). The plane of magnetic field lines (MFLs) is mostly vertical to the equatorial plane with curvature of MFLs directing earthward and bi-normal directing azimuthally. The curvature radius of MFLs reaches the minimum, $R_{c,min}$ at CS center, which is larger than the corresponded local half-thickness of neutral sheet, h. Statistically, the surface of CS, with normal directing basically along the south-north direction, could be approximately to be a plane parallel to equatorial plane though the local CS is frequently tilted to equatorial plane. The tilted CS (normal inclines to equatorial plane) is apt to be observed near both flanks relative to that around mid-night regions, most of which are associated with the slippage of magnetic flux tube. It statistically verifies, the minimum curvature radius,$R_{c,min}$, half-thickness of neutral sheet, h, and the slipping angle of MFLs, δ, in CS, satisfies $h = R_{c,min}\ cos\delta$. The current density, with the strength 4∼8nA/m^2, basically flows azimuthally and tangentially to the surface of CS from the dawnside to the duskside. There is an obvious dawn-dusk asymmetry of CS. In magnetic local times ∼21:00–∼01:00, the CS is relatively thinner, the minimum curvature radius of MFLs,$R_{c,min}$ (0.6-1R_E) and the half-thickness of neutral sheet, h(0.2-0.4R_E) are relatively smaller, B_z (3-5nT) and the minimum magnetic field B_{min}(5-7nT) are weaker, negative B_z has higher probability to occur, cross-tail current density j_Y is dominant (2-4nA/m^2) , comparing with those near both flanks, which implies that magnetic activities, e.g. magnetic reconnection and current disruption could be triggered more frequently there. Accordingly, if mapped the region to the auroral ionosphere, it is expectable that the substorm onset would be optically observed with higher probability in the MLT ∼21:00–∼01:00, which is well agreeable with the statistical substorm onset observations by IMAGE-FUV [Frey et al., 2004,see their Figure 2].