THE RESPONSE OF THE NEAR EARTH MAGNETOTAIL TO SUBSTORM ACTIVITY

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The large scale structure of the current sheet in the terrestrial magnetotail is often represented as the superposition of a constant northward-oriented magnetic field component (B_z) and a component along the Earth-Sun direction (B_x) that varies with distance from the center of the sheet (z_o in GSM) as in a Harris neutral sheet. The latter implies that $B_x = B_{xL} \tanh((z-z_o)/h)$ where B_{xL} is the magnitude of the B_x component in the northern lobe. Correspondingly, the cross tail current should be approximated by $j_y = (B_{xL}/h)\,\mathrm{sech}^2((z-z_o)/h)$. Using data from the fluxgate magnetometer (FGM) on the Cluster II spacecraft tetrad, we have used measured fields and currents to ask if this model represents the large scale properties of the system. During very quiet crossings of the plasmasheet, we find that the model gives a satisfactory estimate of the average current and field distributions, but during disturbed intervals, the best fit fails to represent the data. If, however, the parameters z_o and h of the model are taken as variable functions of time, the fits become reasonably good. The temporal variation of the fit parameter h that characterizes the thickness of the current sheet can be interpreted in terms of thinning during the growth phase of a substorm and thickening following the expansion phase. Ground signatures that give insight into the local time of substorm onset will be used to interpret the response of the plasmasheet to substorm related changes of the global system.