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Magnetic reconnection at the dayside magnetopause with Double Star Tc1 data

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Abstract. In a previous study we examined all the dayside magnetopause crossings that occurred during the first year of the Double star Tc1 mission, and identified 23 passage of Tc1 near the X-line. This observations indicated the presence of a reconnection line hinged near the subsolar point and tilted according to the observed magnetosheath clock angle, consistently with the component merging model. Here we show the results of a new analysis that confirms the agreement of the observations with the model.

Key words. magnetopause reconnection – X line – component merging

1. Introduction.

When reconnection is occurring magnetosheath plasma enters in the magnetosphere and the magnetic tension implied by the sharp bend in the reconnected field lines causes the reconnection jets. In *Trenchi et al.*, (in press), 207 MP crossings have been studied and the Walén test has been used to select the reconnection events. The crossings with plasma jets observed at the magnetopause or in the boundary layer that satisfied the Walén test continuously for more than 12 seconds were considered as reconnection events. The requirement of the extent of the reconnection jet helps to avoid accidental fulfilments of the Walén relation. 143 events were found to have reconnection jets, and in 23 crossings opposite-directed reconnection jets (jet reversals) indicated the passage of the X-line near the satellite. The reconnection events were characterized by smaller values of the plasma β and Alfvén Mach number in comparison with no reconnection cases. Moreover the jet reversals suggested the presence of an extended reconnection line hinged near the subsolar point and tilted according to the observed magnetosheath clock angle, consistently with the component merging model (Gonzalez & Mozer 1974; Sonnerup & Ledley 1974).

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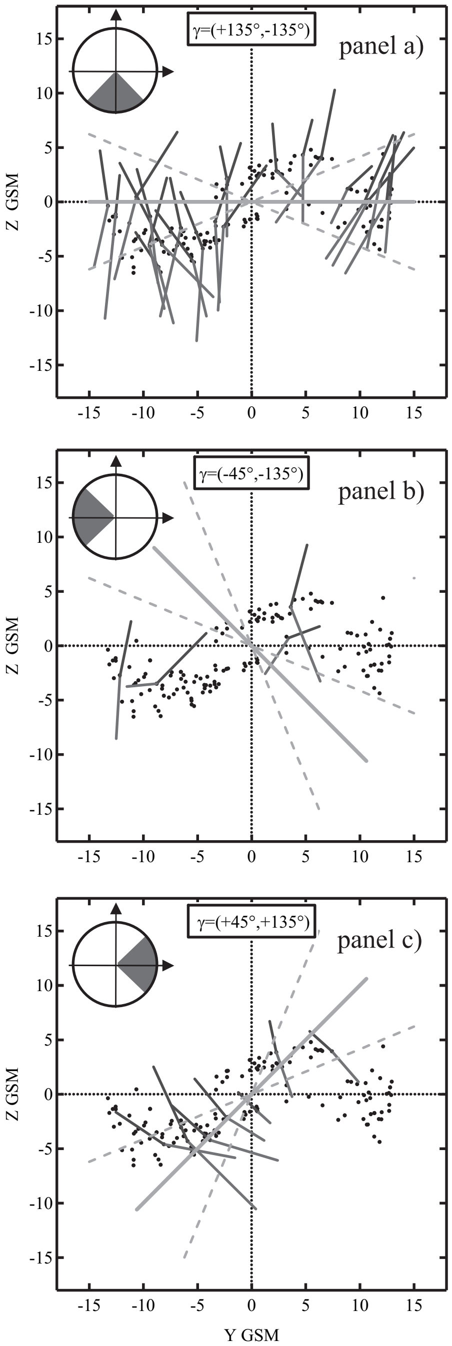

Fig. 1. Velocity and positions of the reconnection jet reversals for B_z negative dominating (panel a), B_y negative dominating (panel b) and B_y positive dominating (panels c). The sectors are indicated in the upper left corner of each panel.

2. Jet reversals.

We analyzed the same dataset, reducing the requirement on the duration of the Walén test to 8 seconds. With this criteria we found 33 jet reversals, 10 more with respect to the old analysis. The totality of the jet reversals is presented in figure 1: velocities are projected in the YGSM-ZGSM plane and plotted at the positions of the corresponding MP crossing. The jets are divided with respect to the magnetosheath magnetic field clock angle, γ, defined as $\tan^{-1}(B_{1y}/B_{1z})$: the sectors are indicated in the upper left corner of each panel. In panel a), b) and c) the continuous grey lines represent the predicted reconnection line locations for $\gamma = 180°$, $\gamma = -90°$ and $\gamma = 90°$, respectively, and the dashed grey lines illustrate the maximum rotation of the reconnection line due to the variation of γ in each sector. No jet reversals are observed in case of B_z positive dominating, as expected: there is no reconnection at the dayside low latitude magnetopause with northward magnetosheath magnetic field. In the sector with B_z negative dominating 22 jet reversals are observed. These move mainly along Z_{GSM} direction, and their position lies between the two dotted X-lines. In the sector with B_y negative dominating 4 jet reversals are observed (2 out of 4 have clock angles very close to the sector with B_z negative dominating). In the sector with B_y positive dominating the 7 jets reversals lies between the two dotted X-lines, and moves perpendicular to it. These observations are in agreement with the 'component merging' model and confirm the results obtained by *Trenchi et al* (in press).

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