

Changes in the magnetotail configuration before near-Earth reconnection

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We have examined three typical substorm growth phase signatures in the magnetotail two hours before near Earth reconnection; namely current sheet thinning, field line stretching and increase in the lobe magnetic pressure. The reconnection events were identified from in situ measurements in the plasma sheet by the Cluster spacecraft. The events were signified by high speed plasma flows, often lasting more than one hour. The list of events contains time intervals with high solar wind driving and strong intensification in the auroral westward electrojet, and other intervals with weak driving and no intensification in the electrojet. Irrespective of the amount of driving, there was usually a significant thinning of the current sheet prior to the reconnection onsets. Multi-spacecraft measurements of the magnetic field revealed that the average thinning was from 24000 to 12000 km, lasting about an hour. In those events without thinning, the current sheet was thin for an extended period before reconnection. Furthermore, the thinning happens even when there is no increase in the lobe magnetic pressure in the same time interval. The magnetotail is often stretched for a long time before reconnection onset, and reconnection seems to commence only when the current sheet is thin enough. In those events with large increase in the lobe magnetic pressure before onset, there is also significant field line stretching.

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