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Cluster observations of magnetic merging and current sheet dynamics

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The magnetotail current sheet has been, and remains, one of the key targets for the Cluster mission. To date there have been 4 magnetotail seasons in which the spacecraft apogee has precessed across the magnetotail at a geocentric distance of about ˜19 Earth radii. The 4-spacecraft separation scale for each of these seasons was 2000 km, 4000 km, 250 km and 1000 km respectively. Cluster has proved a powerful tool for studying the dynamics of the tail current sheet, with the 4-point measurements enabling the separation of temporal and spatial effects, the determination of speed and orientation of boundaries, and the derivation of currents and vorticity from the curl of the magnetic field and plasma flow measurements. In this presentation, we briefly review some highlights of the first 3 years of Cluster magnetotail analysis, and then detail some more recent results from these efforts. In particular, we will discuss Cluster observations of active magnetic reconnection neutral lines, the structure and dynamics of thin current sheets and the occurrence of magnetic flux ropes within the plasma sheet. The relationship of these small-scale processes with the global structure and dynamic of the magnetosphere will also be discussed.