Geophysical Research Abstracts, Vol. 8, 02065, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02065

Wind, ACE and Cluster detections of a magnetic reconnection X-line extending more than 390 Earth radii in the solar wind

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Magnetic reconnection in a current sheet is a magnetic to particle energy conversion process that is important in many space and astrophysical contexts. It is not presently known whether reconnection is fundamentally a process that can occur over an extended region in space or whether it is patchy and unpredictable in nature. Here we report Wind, ACE, and Cluster observations of accelerated flow associated with reconnection in a current sheet embedded in the solar wind flow where the reconnection X-line extended at least 390 R_E (or 2.5 million km). Observations of this and 30 similar events imply that reconnection is fundamentally large scale. Patchy and transient reconnection often reported in the magnetosphere is likely to be a geophysical effect associated with boundary conditions rather than a fundamental property of reconnection. Our observations also reveal, somewhat surprisingly, that reconnection can operate in a quasi-steady-state manner even when not driven by the external flow.