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Asymmetry in the magnetic field signatures of flux transfer events

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Flux transfer events (FTEs) are bursts of magnetic reconnection at a planetary magnetopause and have been observed at Earth, Jupiter and Mercury. They are usually identified by their bipolar signatures in the component of the magnetic field normal to the magnetopause (B_N). Several conceptual models have been proposed for FTE formation, including models based on reconnection at a single reconnection line (X-line) and at multiple X-lines. Two-dimensional magnetohydrodynamic models have previously been used to simulate both scenarios and have found a tendency for FTEs generated by single X-line reconnection to exhibit an asymmetry in the B_N signature, with the leading peak being substantially smaller in magnitude than the trailing peak. On the other hand, FTEs generated by multiple X-line reconnection led to more symmetric signatures. We present a comparison of these simulation results with observations made at the Earth's magnetopause by the Cluster spacecraft, using a dataset of 213 FTEs which were observed by all four spacecraft in 2002/3. A tendency is found for the B_N signatures to be asymmetric, but with the leading peak stronger than the trailing peak - opposite to the prediction made by the 2D models. We also compare the observations with the results of a more recent global MHD simulation and find similar trends to those observed by Cluster.