



## **An extended comparison of Cluster magnetic data with the Tsyganenko 2001 model**

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We have extended our investigation of the magnetic effects of external currents in the magnetosphere using Cluster data and the Tsyganenko 2001 (T01) field model. Cluster data are not included in the T01 database and therefore can be used to independently verify the model. In our previous study covering data from 2003 and 2004 we found that the model performs very well in a global sense; nevertheless, absolute residuals between the data and the model can reach approximately 20 nT near perigee. These deviations take two forms: a sharp, bipolar signature and well-defined trends over a larger spatial region. The bipolar signatures in the residuals are moderately stable, repeating on the phase period of the Cluster orbit. The bipolar nature of the signatures reflects variations in the Cluster data, therefore indicating that the spacecraft may be observing a field-aligned current. Although the size of the magnetic field perturbation in this region is not well determined by T01, the location of the observed field-aligned current system is accurately predicted. The bipolar signatures are observed in close proximity to the edge of the ring current, estimated from Cluster energetic electron spectrograms, indicating that they are associated with region 2 field-aligned currents. Longer-duration trends in the residuals indicate a slight difference between the model predictions and the Cluster data for various locations and seasons. For example, throughout most of 2003 and the first half of 2004, there is a residual in the total magnetic field for an hour centred on perigee, of approximately 20 nT. To investigate the source of these longer term trends we have extended the data coverage to include more recent data.