



Comparisons of eight years magnetic field data from Cluster with Tsyganenko models

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An investigation of comparing eight years magnetic field data from the 4-spacecraft Cluster array with Tsyganenko 1989 (T89), 1996 (T96), and 2001 (T01) field models has been carried out, which extends that of Woodfield et al. (2007), while Cluster passes through, or adjacent to, the equatorial ring current. There are some differences in the comparisons of the data with the different models and with different spacecraft. During the Cluster ring current crossing (through perigee, at 4-5 R_E), the T01 and T89 models underestimate the ring current, while T96 overestimates it. The study shows that the deviations between the data and the model take two forms: a sharp, bipolar signature and well-defined trends over a larger spatial region and that these residuals can reach order 20 nT near perigee. These deviations are much weaker during the later years, which might be because they are near the solar minimum year and the southward dropping of the Cluster orbit. The sharp bipolar signatures are suggested to be Cluster crossings of the region 2 field-aligned currents (FACs) or low-altitude cusp FACs, depending on orientation. For Cluster region 2 crossings, only T96 and T01 include the region 2 FACs and T01 perform better. The deviations for T01 are much weaker than from the other models for all of field components, indicating that this model achieves the best fit to the data. The four spacecraft observe nearly the same signatures at the small separations during the early years of the mission, but do sample different signatures at the large separations during the later years, allowing comparisons to be made during similar external conditions.