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Modelling secular variation and acceleration of the geomagnetic main field

I. Wardinski, V. Lesur
Sec. 2.3 Earth's Magnetic Field, GFZ Potsdam

In this paper we report on the progress made in setting up a time–dependent geomagnetic main field model, C^3FM2, which covers the period from 1956 to 2006. The C^3FM2 combines the methodologies used to derive C^3FM1 (Wardinski Holme, 2006) and GRIMM (Lesur et al., 2008). Similar to C^3FM1, the new model fits satellite main field models in 1980 and 2001 to 2006 and is built from annual differences of monthly or annual observatory means (secular variation estimates). For the period 2001 to 2006 the model is constraint to match the GRIMM model. The most likely set of Gauss coefficients which account for the observed secular variation is sought iteratively, where the error covariance matrix within the least squares solving is assumed to be non–diagonal. This in turn, allows a better distinction between internal field variations and contamination due to external field variations. Like in GRIMM the temporal model constraint comprises of the smoothness of the secular acceleration.

The faith of this modelling approach is to provide a detailed description of the secular variation and acceleration over the last 50 years. A period in which six geomagnetic jerks occurred. We focus on these events and discuss their relation to the morphology of the secular acceleration at the Earth's and core surface.

We conclude with an interpretation of the secular variation evolution, in terms of physical core processes associated to motion in the liquid outer core.