Modelling and interpretation of the fast variations of the Earth's magnetic field

Ropp, G. [1], Lesur, V.[1]

[1]Université de Paris, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France.

Abstract

Geomagnetic field models derived from satellite data, obtained through the processing and analyses of a massive amount of vector magnetic data, now cover more than twenty years. The field measured at the surface of the Earth results from the contributions of multiple external and internal sources. The description and understanding of the fast dynamics of the geomagnetic field, in particular the core field, requires for field models to describe more and more sources with deep mathematical and physical accuracy. To address this increasing complexity as well as ever larger amounts of available data, we use a sequential modelling approach (a Kalman filter), combined with a correlation based modelling step. In order to reach high temporal resolution for the core field (close to the year), a sequence of snapshot models, 3-months apart, has been built. The main characteristics of the derived series of Gauss coefficients are the same as those of recently released field models based on classic modelling techniques. The results we obtained show the importance of a careful calibration of the Kalman prediction step as well as the application of the Kalman smoother at the end of the modelling. We identified induced fields in the core as the main limitation for an increased resolution of the core field. We will present how these currents have been handled in a recent version of the model. We also discuss the future steps that should allow us to progress further in the representation and understanding of the Earth's core magnetic field.

Keywords— Magnetism, Geodynamics