Forecasts of geomagnetic secular variation

Ingo Wardinski

Helmholtz Centre Potsdam - GFZ, Potsdam, Germany (ingo@gfz-potsdam.de)

We attempt to forecast the geomagnetic secular variation based on stochastic models, non-parametric regression and singular spectrum analysis of the observed past field changes. Although this modelling approach is meant to be phenomenological, it may provide some insight into the mechanisms underlying typical time scales of geomagnetic field changes. We follow two strategies to forecast secular variation: Firstly, by applying time series models, and secondly, by using time-dependent kinematic models of the advected secular variation. These forecasts can span decades, to longer periods. This depends on the length of the past observations used as input, with different input models leading to different details in the forecasts. These forecasts become more uncertain over longer forecasting periods. One appealing reason is the disregard of magnetic diffusion in the kinematic modelling. But also the interactions of unobservable small scale core field with core flow at all scale unsettle the kinematic forecasting scheme. A further (obvious) reason is that geomagnetic secular variation can not be mimicked by linear time series models as the dynamo action itself is highly
non-linear. Whether the dynamo action can be represented by a simple low-dimensional system requires further analysis.