MODELLING THE EARTH'S MAGNETIC FIELD WITH SATELLITE AND OBSERVATORY DATA

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When selecting satellite and observatory data for magnetic field modelling it is normal practice to use magnetically quiet data collected when the local time is between certain hours during the night and perhaps additionally when the data are not sunlit. However this approach results in gaps in the temporal distribution for the satellite data (because of the precession of the satellite orbit with local time) and this is likely to compromise the model parameters that depend on time, particularly the secular variation, secular acceleration, annual and semi-annual variations. If the solar zenith angle is also a selection criterion, parameters which depend on location will also be compromised as an annual signal is introduced into the data distribution at high latitudes.
Here we strive for a more continuous coverage in time and space for the satellite data. Rather than eliminating large amounts of data which are normally considered to be too noisy to include in the model, we downweight these data. This builds on work done previously involving small-scale noise estimators along a satellite track and larger-scale disturbance estimators (the "LAVA" index) derived from nearby observatory data.
For the observatory data the weighting is simpler and takes account of correlation between components. We use selected observatory hourly mean values directly (rather than secular variation estimates), and the crustal biases are estimated as part of the model. These data provide important constraints on the time-dependent parameters in the model despite their spatial coverage being sparse and uneven.
We produce a number of models, varying the selection criteria, the relative weighting of the satellite and observatory data, and the time-dependent parameters. The models have internal and external spherical harmonic terms which vary in the time domain in a variety of ways. Final models are presented and will form the basis of candidate models for the 11th Generation International Geomagnetic Reference Field due for release by the end of 2009.

Satellites, Observatories, Models

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