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Core Flow Modelling from Satellite-Derived 'Virtual Observatories'

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The last decade has seen a significant improvement in the capability to observe the global field at high spatial resolution. Several satellite missions have been launched, providing a rich new set of scalar and vector magnetic measurements from which to model the global field in detail. These data complement the existing record of ground-based observatories, which have continuous temporal coverage at a single point. We wish to exploit these new data to model the secular variation (SV) globally and improve the flow models that have been constructed to date.

Using the approach developed by Mandea and Olsen (2006) we create a set of 648 evenly distributed 'Virtual Observatories' (VO), at 400km above the Earth's surface, encompassing satellite measurements from the CHAMP satellite over five years (2001-2005). We invert the SV calculated at each VO to infer flow along the core-mantle boundary. Direct comparison of the SV generated by the flow model to the SV at individual VO can be made. Thus, the residual errors can be investigated in detail.

We show comparisons of flow models generated from a number of VO datasets. We show evidence, in the residual distributions of the field and SV models derived from the VO, of signals that are consistent with external field effects in the satellite data. We show that using only the internal field (derived from the VO data using spherical harmonics) to generate the flow models produces the best fit of the model to the data.