Toward Data Assimilation in a Quasi-geostrophic Model

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Abstract

There are currently several attempts to assimilate geomagnetic data (or derived products such as core surface flows) in geodynamo models. However, observational constraints are available at the core-mantle boundary only. Our research program exploits the axial invariance of large scale and rapidly varying flows in the Earth's core interior. This enables us to ignore variations in z (the coordinate parallel to the rotation axis) and to reduce drastically the size of the problem. This simplified model (Canet et al., 2009) omits magnetic diffusion and gives the coupled time evolution of a stream function $\psi(s, \phi)$ and of z-integrals of quadratic products of the magnetic field : B_s^2 , B_ϕ^2 , $B_s B_\phi$ (where (s,ϕ,z) are cylindrical coordinates). We focus on short time scales (1-100 years). We have coded the direct problem and we are currently studying whether this 'reduced' model can be used for data assimilation. We hope to report at the conference a first step, which consists in comparing predictions of our diffusionless 2D model with the output of the fully 3D numerical model of Schaeffer, Fournier and Aubert (article in preparation).