



## **Magnetic field in the core interior inferred from quasi-geostrophic flow**

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We describe the dynamics of the core responsible for the yearly to decadal geomagnetic secular variation with a quasi-geostrophic model. The flow in the earth's core is assumed to be almost invariant in the direction of rotation of the earth, its ageostrophic component being controlled by its interaction with the magnetic field in the bulk of the core. The flow in turn impacts the temporal evolution of the radial component of the magnetic field at the core-mantle boundary. In an attempt to consider the time-dependent, magnetic structures in the bulk of the core, we describe the field using a single magnetic scalar potential.

Here, we focus in particular on the connection between the velocity field at the core surface and the magnetic field in the core interior. In order to propose maps of the magnetic scalar potential in the bulk of the core, we assimilate pseudo-data consisting of time-dependent maps of the flow at the top of the core. To that end, we construct formally the relationship between the model and these pseudo-observations in the framework of variational data assimilation.