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Semi-Numerical Studies of the Three-Meter Spherical Couette Experiment Utilizing Data Assimilation[1] SARAH BURNETT, RUBEN ROJAS, ARTUR PEREVALOV, DANIEL LATHROP, KAYO IDE, University of Maryland - College Park, NATHANAEL SCHAEFFER, ISTerre Laboratory at CNRS —
The model of the Earth's magnetic field has been investigated in recent years through experiments and numerical models. At the University of Maryland, experimental studies are implemented in a three-meter spherical Couette device filled with liquid sodium. The inner and outer spheres of this apparatus mimic the planet's inner core and core-mantle boundary, respectively. These experiments incorporate high velocity flows with Reynolds numbers $\sim 10^8$. In spherical Couette geometry, the numerical scheme applied to this work features finite difference methods in the radial direction and pseudospectral spherical harmonic transforms elsewhere [Schaeffer, N. G3 (2013)]. Adding to the numerical model, data assimilation integrates the experimental outer-layer magnetic field measurements. This semi-numerical model can then be compared to the experimental results as well as forecasting magnetic field changes. Data assimilation makes it possible to get estimates of internal motions of the three-meter experiment that would otherwise be intrusive or impossible to obtain in experiments or too computationally expensive with a purely numerical code. If we can provide accurate models of the three-meter device, it is possible to attempt to model the geomagnetic field.

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