Geophysical Research Abstracts
Vol. 17, EGU2015-4897, 2015
EGU General Assembly 2015

Secular variation and core-flow modelling with stable strafication at the top of the core

Richard Holme (1) and Bruce Buffett (2)

(1) University of Liverpool, School of Environmental Sciences, Liverpool, United Kingdom (r.t.holme@liverpool.ac.uk), (2) Department of Earth and Planetary Science, University of California, Berkeley, California 94720, USA

Observed geomagnetic secular variation has been used for many years to provide an observational constraint on the dynamics of the core through the modelling of its surface flow. Recent results in both seismology and mineral physics provide strong evidence of a stably stratified layer at the top of the core, which has substantial implications for the calculation of such flows. It has been assumed for many years that the dynamic state at the core surface is close to tangentially geostrophic, and pure stable stratification also requires a flow to be toroidal. Combining these two conditions requires variations in flow that are completely zonal toroidal, which are known not to provide an adequate explanation of the observed secular variation.

However, a stably stratified layer can support flow instabilities of a more general character. Buffett (2014) has recently provided a model in which zonal toroidal motions are associated with the excitation of a zonal poloidal instability. This model is able to explain the broad variation of the axial dipole over the past 100 years, and also to explain feature of geomagnetic jerks that cannot be explained by purely torsional motions. This model has inspired a new generation of core-flow models, with a substantial time-varying zonal poloidal component, something that is absent from most models of core surface flow.

Here, we present these new models, and consider to what extent this flow structure can explain the details of secular variation. We also consider the implications for the connection between core-surface flow and length-of-day variation - a stably stratified layer has implications for the interpretation of core flow and the Earth's angular momentum budget. Finally, we consider the ability of core-surface flow models to probe the structure of the stably-stratified layer.

Buffett (2014). Geomagnetic fluctuations reveal stable stratification at the top of the Earth's core, *Nature* **507**, 484-487, doi:10.1038/nature13122