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The sensivity of geomagnetic reversal frequency to core-mantle boundary heat flux magnitude and heterogeneity.

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For a number of decades the core-mantle boundary (CMB) heat flux has been thought to be a key parameter controlling the geomagnetic field. A CMB heat flow increase is assumed to destabilize the geodynamo, increasing and decreasing the reversal frequency and dipole moment, respectively. The opposite case where a CMB flux decrease induces a relatively high dipole moment, as well as a low reversal frequency, would correspond to the characteristics of a superchron (Biggin et al., 2012).

So far, only the magnitude of the CMB heat flux has been subject of research. However, the temporal and spatial heat flux distribution across the CMB also appears to have an influence on the geomagnetic reversal frequency. For example, the amount of heat flux heterogeneity may also be associated with a destabilization of the dynamo, increasing the reversal frequency (Olson et al., 2010).

In this work we set out to assess:

– (1) How the geomagnetic field intensity and reversals are predominantly sensitive to CMB heat flux magnitude or heterogeneity;

– (2) what combination of magnitude and heterogeneity best reproduces the geomagnetic record on the 10 Myr timescale.

To this end we use the PARODY software and test for a number of CMB heat flow modes (spherical harmonics of increasing degree and order, with an amplitude of 10 mW/m$\hat{}$2) and magnitudes (ranging from 20 to 100 mW/m$\hat{}$2). We will show our modeling results of how CMB heat flow magnitude and heterogeneity control the paleomagnetic record in terms of reversal frequency and dipole moment. Also relevant snapshots in time of outer core convection and thermal/magnetic structure will be shown.

References

Biggin et al. (2012). Nature Geoscience, 5(8):526–533.
Olson et al. (2010). PEPI, 180(1–2):66 – 79.