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# Utilizing Codensity Approach to Assess How Core-Mantle Boundary Properties Influence Geomagnetic Reversal Frequency

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Over the past decade, advances in data assimilation techniques combined with a rapid increase in computational power have allowed for increasingly realistic dynamo simulations. One of the key parameters controlling the dynamics of the magnetic field is the amount of heat loss through the core-mantle boundary (CMB), highlighting the crucial role of the lower mantle in the dynamo processes. Previous studies (Kutzner and Christensen, 2004) suggest that heat flux variations at the lower mantle may explain the observed changes in reversal frequency on time scales of some 10 million years.

To study the effect of the mantle on reversals, we use the numerical code MagIC, simulating the dynamo process over geological timescales. The long required simulation time forces us to use a relatively large Ekman number of $E = 3 \cdot 10^{-4}$. Following Frasson et al. (2024), we first explore the impact of several fundamental heat-flux patterns (spherical harmonic degree $Y_{10}$, $Y_{20}$, $Y_{22}$, ...) and amplitudes imposed at the outer boundary. Secondly, we use a codensity approach to explore whether a higher degree of compositional driving reduces the impact of the core-mantle boundary heat flux pattern. Finally, we investigate the impact of the stably stratified layer at the top of the outer core (Buffett et al., 2016) on the geodynamo process and the stability of the magnetic field.