Precessional-convectional instabilities in a spherical system

L. Echeverria*, N. Lardeli, F. Munch, P. Marti, J. Noir, and A. Jackson
ETH Zurich

The Earth's magnetic field has been used for centuries by navigators for orientation. This magnetic field protects our planet from cosmic radiation and solar wind, and it is an fundamental ingredient for life to thrive. Therefore, extensive research is essential to better understand the driving mechanisms of this magnetic shield within our planet and other celestial objects. In the early 50s, W. M. Elsasser proposed the dynamo theory to explain the generation of the Earth's magnetic field. Such theory states that the heat flux generated by a hot inner core triggers convective instabilities that deviate the flow from a solid body rotation, and these instabilities may induce a magnetic field. Brito et al. (2004) shown that an unstable thermal stratification might strengthen shear driven instabilities. Additionally, gravitational pulls from the Moon and other planets trigger precessional movements in the mantle. Such mechanism generates, even in thermally homogeneous systems, a steady centre-symmetric flow in a low Poincar number (Po) regime and can generate instabilities for larger Po (see Lin et al. (2015) and Hollerbach et al. (2013)). Previous research, such as the work of Wei and Tilgner (2013) showed the interaction of the aforementioned forcings for fairly large Ekman numbers(E). The present study aims at extending this analysis to moderately low Ekman numbers focusing on the unstable stratification of the flow, as proposed by Brito et al. (2004) on a similar configuration.
