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On potential driving mechanisms of core convection - a numerical study

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We present a numerical study of core convection based on a model of a rotating spherical shell where different driving mechanisms are investigated. Two different sources are potentially available to act as driving forces. The first is based on the super-adiabatic temperature gradient in the outer core. The second is of chemical nature and results from light elements emerging at the boundary of the inner and the outer core as a result of the freezing process of the outer core. So far, it is uncertain if the convective flow in the outer core is dominated by thermal or by compositional buoyancy. Dynamically, both components differ mainly in terms of their diffusional time scales, whereas the thermal component diffuses faster than the compositional one. To investigate the influence of the driving mechanisms on the convective flow pattern, we consider different scenarios including the two extreme cases of purely thermally and purely compositionally driven convection and the more likely situation of a joint action of both sources. We show that the driving mechanism strongly affects the resulting flow pattern, e.g. differential rotation and helicity being important for the dynamo process. Additionally, it is shown that a small fraction of compositional driving leads to a significant enhancement of the flow.