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Effect of gravity profiles on Rayleigh-Benard convection in spherical shells. LUCA SANTELLI, Gran Sasso Science Institute, GUIQUAN WANG, DETLEF LOHSE, RICHARD J.A.M. STEVENS, Physics of Fluids Group, University of Twente, ROBERTO VERZICCO, Universita' di Roma Tor Vergata — Rayleigh-Benard convection of flows confined by spherical boundaries is analysed by three-dimensional direct numerical simulations in spherical coordinates. The dynamics under different radial gravity profiles have been explored: the different gravity laws can often be absorbed by the introduction of an effective Rayleigh number Ra_e, although this is not true for a few particular cases with non-monotonic gravity. Two different fluids have been studied: air (Prandtl number $Pr = 0.71$) and water ($Pr = 7.1$), and in both cases, onset of convection is at $Ra_e = 1800$ for a domain aspect ratio $\eta = 0.71$. On the other hand unsteady convection, occurring when the inertial terms overcome the viscous terms, has a clear dependence on Pr and is thus different between the two fluids. In between these two regimes, a series of different quasi-stable states, with a non trivial dependence on the Prandtl number, appear as Ra is increased: this behaviour can induce hysteresis in the system and initial conditions are crucial to determine the final flow configuration.

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