
Aspect ratio dependence of laminar horizontal convection

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Abstract

Horizontal convection (HC) provides a minimal paradigm for studying buoyancy-driven transport that is central to ocean circulation and climate (Hughes & Griffiths 2008, *Annu. Rev. Fluid Mech.*). In the standard HC configuration, buoyancy is supplied and removed exclusively through the bottom boundary of a horizontal fluid layer, and the dynamics are commonly characterized by the Rayleigh and Prandtl numbers. However, an often underemphasized control parameter is the domain aspect ratio Γ , which can strongly influence the flow organization and, consequently, the results of direct numerical simulation spanning a broad range of Rayleigh numbers and aspect ratios. We find that domain geometry has a remarkably strong impact on horizontal convection. In particular, as Γ increases, the laminar regime Il (Rossby 1965, *Deep-Sea Res. Oceanogr. Abstr*) to the Il^* regime predicted by the Shishkina et al. (2018) is extended to higher Rayleigh numbers.

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