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Turbulent thermal convection: the differential heating effects[1]
PHILIPP REITER, Max-Planck Institute for Dynamics and Self-Organization, Goettingen, RODION STEPANOV, Institute of Continuous Media Mechanics, Perm, OLGA SHISHKINA, Max-Planck Institute for Dynamics and Self-Organization, Goettingen — A significant class of geophysical and astrophysical flows are excited by temperature variations along a surface of the fluid layer. Using 3D direct numerical simulations, we study the effects of different temperature and velocity boundary conditions in Rayleigh-Benard convection and horizontal convection, under the requirement that the area-averaged temperatures of the heated and cooled plates are kept constant. For these systems we analyze the global flow structures and the heat transport and investigate their dependences on the particular parameters of the boundary conditions. To explain our findings, we exploit a decomposition of the flow fields into the mean and fluctuation components. For some configurations (in horizontal convection) we also extract different Rayleigh-number regimes and present stability thresholds above which the flow exhibits characteristic global structures and give theoretical explanations for the underlying mechanisms of these structures.

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