Abstract Submitted
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Boundary layers and scaling relations in natural thermal convection[1] OLGA SHISHKINA, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, DETLEF LOHSE, University of Twente, Enschede, The Netherlands, SIEGFRIED GROSSMANN, Philipps-University Marburg, Germany — We analyse the boundary layer (BL) equations in natural thermal convection, which includes vertical convection (VC), where the fluid is confined between two differently heated vertical walls, horizontal convection (HC), where the fluid is heated at one part of the bottom plate and cooled at some other part, and Rayleigh–Benard convection (RBC). For BL dominated regimes we derive the scaling relations of the Nusselt and Reynolds numbers (Nu, Re) with the Rayleigh and Prandtl numbers (Ra, Pr). For VC the scaling relations are obtained directly from the BL equations (Shishkina, Phys. Rev. E 93 (2016)), while for HC they are derived by applying the Grossmann–Lohse theory (J. Fluid Mech. 407 (2000)) to the case of VC (Shishkina, Grossmann, Lohse, Geophys. Res. Lett. 43 (2016)). In particular, for RBC with large Pr we derive $\mathrm{Nu}\sim\mathrm{Pr}^0\mathrm{Ra}^{1/3}$ and $\mathrm{Re}\sim\mathrm{Pr}^{-1}\mathrm{Ra}^{2/3}$.

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