Boundary layer dynamics in Rayleigh-Bénard convection using Direct Numerical Simulations

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Abstract

Rayleigh-Bénard cavity flows consist of boundary layers sheared by a turbulent wind, which itself is generated by buoyant convection, creating a turbulent bulk. Recently, it has been shown that accounting for the wind Reynolds number resolves the apparent contradiction between the large number of experimental results in the literature obtained under different operating conditions (Brichet et al., 2025). A universal critical Reynolds number has also been identified, which distinguishes two turbulent regimes.
This presentation focuses on the second regime, which corresponds to Reynolds numbers greater than 1E4, but is not necessarily the so-called ultimate regime. Based on numerical simulations of water flows for Rayleigh numbers up to 1E12, we examine the nature and the structure of the kinetic and thermal boundary
layers.
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