Study of global heat transport and plume morphology in severely-confined Rayleigh-Bénard convection\(^1\) KE-QING XIA, KAI LEONG CHONG, The Chinese University of Hong Kong — We study systematically how severe geometrical confinement influences the global heat transport (expressed as Nusselt number \(Nu\)) and the plume morphology in Rayleigh-Bénard convection (RBC) by means of direct numerical simulations. Broad ranges of width-to-height aspect-ratio \(1/128 \leq \Gamma \leq 1\) and Rayleigh number \(3 \times 10^4 \leq Ra \leq 10^{11}\) at fixed Prandtl number \(Pr = 4.38\) are considered in present study. It is found that \(Nu\) exhibits the scaling \(Nu - 1 \sim Ra^{0.61}\) over three decades of \(Ra\) at \(\Gamma = 1/128\) and the flow is dominated by finger-like, long-lived plume columns for such severely-confined situation. The \(Nu\) scaling and the flow structures contrast sharply to that found at \(\Gamma = 1\) for which \(Nu\) exhibits the scaling \(Nu - 1 \sim Ra^{0.31}\) and the flow is dominated by mushroom-like, fragmented thermal plumes. Analogy is made between the severely-confined RBC and strongly rotating RBC. 1. This work was supported by RGC of HKSAR (No. CUHK404513), CUHK Direct Grant (No. 3132740) and through a HKPhD Fellowship.

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