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Global heat transport scaling in plume-controlled regime in turbulent Rayleigh-Bénard convection[1] KAI LEONG CHONG, SHI-DI HUANG, KE-QING XIA, The Chinese University of Hong Kong — Previous study by Chong et al.[2] has introduced a normalized aspect-ratio Γ/Γ_{opt} ($\Gamma_{opt} = 29.37Ra^{-0.31}$) where the plume coverage at fixed Γ/Γ_{opt} is invariant with respect to Ra in the so-called plume-controlled regime in Rayleigh-Bnard convection. We have studied the global heat transport scaling (expressed as Nusselt number Nu) at fixed Γ/Γ_{opt} with the Rayleigh number Ra between 10^7 and 10^{10} at fixed Prandtl number $Pr = 4.38$ by direct numerical simulations. It is found that at $\Gamma/\Gamma_{opt} = 1$ where the thermal plume becomes highly coherent and system-sized, Nu exhibits the scaling $Nu - 1 \sim Ra^{0.327\pm0.001}$ over three decades of Ra. This scaling is different from that found at $\Gamma = 1$ for which $Nu - 1 \sim Ra^{0.308\pm0.001}$, and this difference in scaling can be shown evidently in the compensated plots. 1. This work was supported by RGC of HKSAR (No. CUHK404513), CUHK Direct Grant (No. 3132740) and through a HKPhD Fellowship. 2. Chong, K. L., Huang, S.-D., Kaczorowski, M. & Xia, K.-Q. 2015 Condensation of coherent structures in turbulent flows. Phys. Rev. Lett. 115, 264503.

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