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Boundary layer fluctuations and their effects on mean and variance temperature profiles in turbulent Rayleigh-Bénard convection YIN WANG, Department of Physics, Hong Kong University of Science and Technology, Hong Kong, XIAOZHOU HE, Shenzhen Graduate School, Harbin Institute of Technology, Shenzhen, China, PENGER TONG, Department of Physics, Hong Kong University of Science and Technology, Hong Kong — We report simultaneous measurements of the mean temperature profile $\theta(z)$ and temperature variance profile $\eta(z)$ near the lower conducting plate of a specially designed quasi-two-dimensional cell for turbulent Rayleigh-Bénard convection. The measured $\theta(z)$ is found to have a universal scaling form $\theta(z/\delta)$ with varying thermal boundary layer (BL) thickness δ, and its functional form agrees well with the recently derived BL equation by Shishkina et al. The measured $\eta(z)$, on the other hand, is found to have a scaling form $\eta(z/\delta)$ only in the near-wall region with $z/\delta < 2$. Based on the experimental findings, we derive a new BL equation for $\eta(z/\delta)$, which is in good agreement with the experimental results. The new BL equations thus provide a common framework for understanding the effect of BL fluctuations. *This work was supported by the Research Grants Council of Hong Kong SAR and by the China Thousand Young Talents Program.

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