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**Temperature variance profiles of turbulent thermal convection at high Rayleigh numbers**[1] XIAOZHOU HE, Harbin Institute of Technology Shenzhen Graduate School, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization, GUENTER AHLERS, University of California Santa Barbara — We present measurements of the Nusselt number $Nu$, and of the temperature variance $\sigma^2$ as a function of vertical position $z$, in turbulent Rayleigh-Bénard convection of two cylindrical samples with aspect ratios (diameter D/height L) $\Gamma = 0.50$ and 0.33. Both samples had $D = 1.12$ m but different $L$. We used compressed $SF_6$ gas at pressures up to 19 bars as the fluid. The measurements covered the Rayleigh-number range $10^{13} < Ra < 5 \times 10^{15}$ at a Prandtl number $Pr \simeq 0.80$. Near the side wall we found that $\sigma^2$ is independent of $Ra$ when plotted as a function of $z/\lambda$ where $\lambda \equiv L/(2Nu)$ is a thermal boundary-layer thickness. The profiles $\sigma^2(z/\lambda)$ for the two $\Gamma$ values overlapped and followed a logarithmic function for $20 \lesssim z/\lambda \lesssim 120$. With the observed "-1"-scaling of the temperature power spectra and on the basis of the Perry-Townsend similarity hypothesis, we derived a fitting function $\sigma^2 = p_1 \ln(z/\lambda) + p_2 + p_3(z/\lambda)^{-0.5}$ which describes the $\sigma^2$ data up to $z/\lambda \simeq 1500$.

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