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Experimental study of turbulent Rayleigh-Bénard convection of air ANNA MAYSTRENKO, RONALD DU PUITS, CHRISTIAN RESAGK, ANDRE THESS, Ilmenau University of Technology — We have studied turbulent Rayleigh-Bénard convection in air (Pr = 0.71) in two large-scale experimental facilities, one cylindrical cell of 7.15 m diameter and 6.30 m hight and one rectangular box of 2.50 m length, 0.50 m width and 0.50 m height. Profiles of the mean temperature $\Theta(z)$, rms temperature fluctuations $\sigma(z)$ as well as higher moments have been measured simultaneously on the cooling and heating plates in the rectangular box for Rayleigh numbers between $Ra = 6 \times 10^7$ and $Ra = 6 \times 10^8$. The structure of the temperature profiles has been analysed with the results that three different behaviors in the temperature profile has been proved: linear behavior $\Theta \sim z$ in the very thin viscous sublayer directly at the wall, power law $\Theta \sim z^A$ in the boundary layer and a logarithmic behavior $\Theta \sim \ln z$ in the overlap layer between the boundary layer and outer flow. The symmetry of the plume advection from the cooling and heating plates as well as their temporal correlations have been investigated. The local heat flux on the plates surfaces has been measured and compared to the global heat flux in the cell. In the large cylindrical cell the profiles of the horizontal mean velocity $v(z)$ have been studied in the highly turbulent regime - $10^{11} < Ra < 10^{12}$. In contradiction to presently accepted predictions all measured profiles do not match the classical profiles of a wall-bounded shear flow.

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