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Wind velocities and their connection to boundary layer characteristics in turbulent Rayleigh-Bénard convection[1] SEBASTIAN WAGNER, OLGA SHISHKINA, CLAUS WAGNER, German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Goettingen — Highly resolved direct numerical simulations have been performed for turbulent Rayleigh-Bénard convection in a cylindrical container with aspect ratio unity and Prandtl number Pr=0.786. The Rayleigh numbers in the simulations are up to 10^9. The calculated fields are reduced to the plane of the large scale circulation and analyzed with respect to the viscous and thermal boundary layer thickness and corresponding quantities in a statistical manner, i.e. probability density functions and their characteristics have been calculated a posteriori from instantaneous flow fields. Different methods to determine the boundary layer thickness are suggested and compared. The results are analyzed and compared with the Prandtl-Blasius theory of laminar boundary layers as well as the Grossmann-Lohse theory of states in Rayleigh-Bénard convection. Thereby fundamental relations between wind velocities and the generated wall shear stress are determined.

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