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Turbulent Free Convection Over a Heated Plate JUAN PEDRO MELLADO, Max Planck Institute for Meteorology — Temporally-evolving turbulent free convection above a heated plate is investigated by means of direct numerical simulations. This study complements previous work in Rayleigh-Bénard convection and in the convective boundary layer. Results show a vertical structure with distinct, overlapping inner and outer layers. Townsend scaling using the surface flux and the molecular diffusivity characterizes the former and Deardorff scaling using the convection scales does so in the latter. It is also observed that the inner layer approaches a quasi-steady behavior. Then, some statistics inside this region coincide with the corresponding ones in classical Rayleigh-Bénard convection if the plate is interpreted as half of the convection cell, which justifies the transfer of results between the two configurations. Despite the moderate Rayleigh numbers, of the order of 10^9, the overlap region between the inner and outer layers starts to show the power-law scaling of the buoyancy variance predicted by the classical similarity theory and seen in the atmosphere. Results also indicate a growth rate of the convective boundary layer in neutral conditions larger than previous estimates derived by extrapolation from related configurations.

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