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Scaling of Structure Functions in Turbulent Rayleigh-Bénard Convection R.P.J. KUNNEN[1], TU/e, H.J.H. CLERCX[2], TU/e, UT, B.J. GEURTS, UT, TU/e — Turbulent convection is actively driven by buoyancy effects, i.e., temperature is an active scalar. Hence a considerable influence of buoyancy on the velocity and temperature structure function is expected. Bolgiano and Obukhov (BO) derived scaling laws for this regime that are different from the classical Kolmogorov (K41) result. The BO scaling is valid at length scales larger than the so-called Bolgiano length, while for smaller scales K41 is recovered. Whether a BO scaling regime can be found in Rayleigh-Bénard convection is an ongoing debate. We present numerical and experimental evidence for BO scaling. Numerical simulations provide insight in the local turbulent length scales. These are found to behave very differently from the global estimates that follow directly from the Navier-Stokes equations. Besides temporal also spatial calculations of structure functions confirm BO scaling. In measurements using stereoscopic particle image velocimetry the BO scaling was also found, in agreement with the numerical data.

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