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Large-Scale Effects near the Surface and in the Entrainment Zone of Convective Boundary Layers KATHERINE FODOR, JUAN-PEDRO MELLADO, Max-Planck Institute for Meteorology — Free convection in the atmospheric boundary layer organises on large-scales into a distinct cellular pattern, similar to that found in Rayleigh-Bénard convection. How these large-scales affect small-scale properties near the surface and in the entrainment zone remains poorly understood, partly due to a lack of accurate data. We address this issue by comparing direct numerical simulations of convective boundary layers with Rayleigh-Bénard convection, using filter operators to define the large-scales. We find that spatial filtering according to the decorrelation length, L_d, of the vertical velocity, and not the depth of the convective region, leads to comparable kinetic energy partition between large- and small-scales across cases. Hence we use this spatial filter to study small-scale statistical properties conditioned separately in large-scale updraught and downdraught regions. We also find that temporal filtering according to the decorrelation time, T_d, yields similar results, both qualitatively and quantitatively, but spatial filtering is preferable as T_d is highly variable and unpredictable, whereas L_d scales with the boundary layer depth.

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