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Influence of thermal plumes on Lagrangian acceleration in thermally-driven turbulence[1] XIAO-MING LI, RUI NI, SHI-DI HUANG, KE-QING XIA, The Chinese University of Hong Kong — We report an experimental study of local acceleration measurement in turbulent Rayleigh-Bénard (RB) convection. The experiment was conducted in a cylindrical cell of unity aspect ratio, spanning the range of Rayleigh number from 6.0×10^8 to 1.3×10^{10} at Prandtl number 4.3 and 6.2 respectively. We focus on the regions that are close to the thermal boundary layer and sidewall where thermal plumes dominate. The measurements were made in two tracking regions that are located 1 cm away from the sidewall and 1.5 cm above the bottom plate, respectively, both with a volume of about 5 cm^3. We find that, near the bottom thermal boundary layer, the most probable acceleration deviates from zero. This may be understood as a result of the circular motion of large-scale circulation rather than the buoyancy. We also find that, at small Ra, the acceleration variances measured at both sidewall and bottom plate show a different power law scaling and are larger than those in the cell center. As Ra increases, the variances gradually merge with those measured in the center. This result suggests that the influence of thermal plumes, or buoyancy, is significant under moderate levels of turbulent background fluctuations.

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