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Motions of particles falling under gravity in a weakly turbulent Rayleigh-Bnard convection SANGRO PARK, CHANGHOON LEE, Yonsei University — Motions of particles falling under gravity in a weakly turbulent convective flow within two parallel walls is studied numerically. Despite the importance of particle-laden convective flows, the vast majority of studies on Rayleigh-Bénard convection in the last decade have focused on single-phase fluids. Therefore detailed analysis on the behaviors of particles in Rayleigh-Bénard convection is required for fundamental understanding and practical purposes, i.e. prediction of precipitation, design of industrial cooling systems. In this study we use a direct numerical simulation using a pseudo-spectral method in a horizontally periodic channel. The particle motion is tracked by using four point-Hermite and fifth order-Lagrangian interpolation scheme. The flow condition is Rayleigh number 10^6, Prandtl number 0.7 with a large aspect ratio 6. Particles are influenced by drag force by fluid and gravity for the range of Stokes number 0.01 - 10 and Froude number 0.45. Collisions of particles or force on fluid by particle are not considered. We found that weak particle clustering near the bottom wall is observed at large Stokes number, a similar behavior of particle alignment along gravitational direction in isotropic turbulence, whereas small Stokes number particles quickly follow the motion of thermal structures. The mechanism is discussed using probability density functions of particle locations and average distances between closest particles, etc.

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