Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Rayleigh-Benard turbulence modified by two-way coupled particles[1] HYUNGWON PARK, KEVIN O'KEEFE, DAVID RICHTER, Univ of Notre Dame — Direct numerical simulation (DNS) with Lagrangian point particles is used to study Rayleigh-Bnard convection to understand modifications due to the interaction of inertial particle, gauged by the turbulent kinetic energy (TKE) and Nusselt number (Nu). The initially dispersed particles experience gravitational settling, and become introduced at the lower wall such that turbulence must overcome the settling velocity for the particles to vertically distribute throughout the domain. The particle properties of interest are inertia, as characterized by the Stokes number, and settling velocity. Furthermore, individual contributions by the momentum-coupling and thermal-coupling are studied to see which most significantly changes Nu and TKE. Our results show that particles with Stokes number of order unity maximize Nu, corresponding to a peak of clustering and attenuation of TKE. It is also shown that particles two-way coupled only through momentum attenuate Nu and weaken TKE, while thermal-only coupling also weakens TKE but enhances Nu. When both couplings are present, however, thermal coupling overwhelms the attenuation caused by momentum coupling and the net result is an enhancement of Nu.

[1]NSF - Grant No. AGS-1429921, ONR - Grant No. N00014-16-1-2472, and Notre Dame Center for Research Computing

Hyungwon Park
Univ of Notre Dame

Date submitted: 01 Aug 2017 Electronic form version 1.4