Abstract Submitted
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Passive moist transfer in Rayleigh-Benard convection[1] LU ZHANG, KEQING XIA, Department of Physice, The Chinese University of Hong Kong — We present the heat transfer measurement of moist Rayleigh-Benard convection in a rectangular cell at $Pr \sim 0.7$, $Sc \sim 0.6$. The overall heat transfer rate is much larger than that of single gas phase due to the presence of phase transition on both boundaries. In addition, the measured heat transfer rate may be expressed approximately as $(dM/dt) \times L$, where dM/dt is the moist (mass) transfer rate and L is latent heat of water. We found $(dM/dt)/\Delta_{ep} \sim Ra^{0.28}$, where Δ_{ep} is the saturated vapor pressure difference between the two plates. Since the body force is dominated by the temperature rather than the partial pressure of water vapor in the parameter range of the experiment, we can treat the vapor pressure as a passive scalar. Furthermore, we explore the Sc number dependence of passive scalar transport in a 2D square domain at $Ra = 10^8$. The nondimensionalized passive scalar transport rate, Nu_C, scales as $Sc^{0.47}$ for $0.2 \leq Sc \leq 1.4$, and $Sc^{0.36}$ for $1.4 \leq Sc \leq 60$. The transition of the Sc scaling is found to be related to the cross-over of the viscous boundary layer and the passive scalar boundary layer.

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