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Settling of hot particles through turbulence[1] FILIPPO COLETTI, University of Minnesota, ARI FRANKEL, HADI POURANSARI, ALI MANI, Stanford University — Particle-laden flows in which the dispersed phase is not isothermal with the continuous phase are common in a wealth of natural and industrial setting. In this study we consider the case of inertial particles heated by thermal radiation while settling through a turbulent transparent gas. Particles much smaller than the minimum flow scales are considered. The particle Stokes number (based on the Kolmogorov time scale) and the nominal settling velocity (normalized by the root-mean-square fluid velocity fluctuation) are both of order unity. In the considered dilute and optically thin regime, each particle receives the same heat flux. Numerical simulations are performed in which the two-way coupling between dispersed and continuous phase is taken into account. The momentum and energy equations are solved in a triply periodic domain, resolving all spatial and temporal scales. While falling, the heated particles shed plumes of buoyant gas, modifying the turbulence structure and enhancing velocity fluctuations in the vertical direction. The radiative forcing does not affect preferential concentration (clustering of particles in low vorticity regions), but reduces preferential sweeping (particle sampling regions of downward fluid motion). Overall, the mean settling velocity varies slightly when heating the particles, while its variance is greatly increased.

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