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Dispersion of Particles Emitted from Area Sources into the Unstable Atmospheric Boundary Layer YING PAN, MARCELO CHAMECKI, SCOTT ISARD, Pennsylvania State University — Dispersion of heavy particles emitted from area sources into the atmospheric boundary layer is of broad applications in diverse fields. Chamecki and Meneveau (JFM, 2011) used large-eddy-simulation (LES) to study properties of the particle plumes in the neutrally stratified atmosphere, providing theoretical expressions to predict mean particle concentration profiles, plume height, and horizontal transport above the source and ground deposition flux downwind. Here effects of unstable temperature stratification are considered. LES results suggest that particle plume heights, horizontal mass fluxes, and particle loadings downwind from the source increase as the atmospheric instability increases. The Obukhov length and the free-convection velocity are introduced to characterize the deposition fluxes in addition to friction and settling velocities used in the neutral case. The new theoretical predictions that consider the local atmospheric instability in the expression of the vertical velocity variance agree well with LES results when the particle plume is within the surface layer, where the assumption of self-preservation of concentration profiles holds.

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