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Large-eddy simulation of particle-laden atmospheric boundary layer MARCEL ILIE, STEFAN LLEWELLYN SMITH, University of California San Diego — Pollen dispersion in the atmospheric boundary layer (ABL) is numerically investigated using a hybrid large-eddy simulation (LES) Lagrangian approach. Interest in prediction of pollen dispersion stems from two reasons, the allergens in the pollen grains and increasing genetic manipulation of plants leading to the problem of cross pollination. An efficient Eulerian-Lagrangian particle dispersion algorithm for the prediction of pollen dispersion in the atmospheric boundary layer is outlined. The volume fraction of the dispersed phase is assumed to be small enough such that particle-particle collisions are negligible and properties of the carrier flow are not modified. Only the effect of turbulence on particle motion has to be taken into account (one-way coupling). Hence the continuous phase can be treated separate from the particulate phase. The continuous phase is determined by LES in the Eulerian frame of reference whereas the dispersed phase is simulated in a Lagrangian frame of reference. Numerical investigations are conducted for the convective, neutral and stable boundary layer as well different topographies. The results of the present study indicate that particles with small diameter size follow the flow streamlines, behaving as tracers, while particles with large diameter size tend to follow trajectories which are independent of the flow streamlines. Particles of ellipsoidal shape travel faster than the ones of spherical shape.

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