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DNS of particle dispersion in a spatially developing turbulent boundary layer MICHAEL DODD, KEEGAN WEBSTER, ANTONINO FERRANTE, University of Washington, Seattle — We performed DNS of particle-laden spatially developing turbulent boundary layer at $\mathrm{Re}_\theta = 1000 - 3200$. We computed the Lagrangian trajectories of millions of fluid points and solid particles of three different Stokes number, St=0.1, 1, and 5. The particles were gradually released from a line source. We computed the time development of particle mean displacement, dispersion, and turbulent diffusivity. Our DNS results of fluid point mean-displacements are in excellent agreement with those of Batchelor's (1964) theory. Also, our DNS results show that in general particle statistics are strongly influenced by particle's Stokes number. Such dependence is mostly caused by the particles tendency to preferentially accumulate in the viscous sublayer as their Stokes number increases. Furthermore, for $t/T_L < 1$ where T_L is the Lagrangian integral time scale, the streamwise and wall-normal dispersions are $\propto t^2$ for fluid points and $\propto t^3$ for solid particles. For $20 < t/T_L < 80$, the streamwise dispersion of fluid points and particles with $\mathrm{St} = 0.1$ is approximately $\propto t^{5/3}$, while that of particles with $\mathrm{St} = 1$ and 5 is approximately $\propto t^{5/2}$. For all cases studied and for $20 < t/T_L < 80$, the wall-normal dispersion is approximately $\propto t$.

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