Physics > Fluid Dynamics

Particle drift in turbulent flows: the influence of local structure and inhomogeneity

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The way particles interact with turbulent structures, particularly in regions of high vorticity and strain rate, has been investigated in simulations of homogeneous turbulence and in simple flows which have a periodic or persistent structure e.g. separating flows and mixing layers. The influence on both settling under gravity and diffusion has been reported and the divergence (compressibility) of the underlying particle velocity field along a particle trajectory has been recognized as an important quantity in quantifying these features. This paper shows how these features can be incorporated in a formal way into a two-fluid model of the dispersed particle phase. In particular the PDF equation for the particle velocity and position is formerly derived on the basis of a stochastic process that involves the statistics of both the particle velocity and local compressibility along particle trajectories. The PDF equation gives rise to contributions to both the drift and particle diffusion coefficient that depend upon the correlation of these quantities with the local carrier flow velocity. Key Words: turbulent structures, particle dispersion, drift, PDF approach

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