

Statistics and Preferential Distribution of Micro-Particles in Turbulent Boundary Layer: Implications for Resuspension Mechanisms

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The distribution of inertial particles dispersed in turbulent flows is highly non-homogeneous and may exhibit a complex pattern which is driven by the structures of the turbulence field. We simulate a turbulent channel flow of air laden with a dilute concentration of inertial micro-particles for different values of their inertial parameter. We focus on the statistical description of particle velocity and distribution field and we specifically quantify particle deposition and resuspension in the near wall region. Direct Numerical Simulation of a turbulent boundary layer, calculated for a shear Reynolds number of 150, is used on a $128 \times 128 \times 129$ grid and is coupled with Lagrangian particle tracking of 100.000 particle trajectories (Stokes number: 0.2, 1, 5, 25). Forces acting on particles are: drag and inertia. We also quantify the relative effects of gravitational and turbophoretic mechanisms in wall transfer of inertial particles for two different configurations: vertical upward and horizontal channel flow. We further examine the influence of one-way and two-way coupling assumptions on particle statistics and transfer mechanisms.

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