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Direct Numerical Simulation of small particles by two-way coupling over irregular rough surface

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In the present analysis numerical simulations are carried out to investigate suspended sediment transport and its effect on the dynamics of the turbulent flow. To this aim, Direct Numerical Simulations (DNSs) are addressed, in which the three dimensional, time-dependent fluid motion is calculated in an Eulerian frame, and a large number of particles are tracked in a Lagrangian frame. The distribution of inertial particles in turbulent flows is highly non uniform and is driven by the local dynamics of the turbulent structures of the underlying carrier flow field. In the specific context of dilute particle–laden wall–bounded flows, deposition and resuspension mechanisms are dominated by the interaction between the inertial particles and the coherent turbulent structures characteristics of the wall region. These turbulent structures, which control the turbulent regeneration cycles, are strongly affected by the wall roughness. The effect of the roughness on turbulent transport in dilute suspension has been still poorly investigated. The issue is discussed here by addressing DNS at a relatively low Reynolds number $Re_\tau = 180$, of a dilute dispersion of heavy particles in a turbulent channel flow, spanning two orders of magnitude of particle inertia. Looking at the effect of roughness on particle distribution, the results are presented for both one-way coupling, when the fluid flow is not affected by the presence of the particles, and two-way coupling, when the particles exert a feedback force on the fluid. The first case, already analysed in pervious researches, clearly showed that wall roughness strongly modify the particle accumulation process, observed in the classical flat walls. Here the effect of two-way coupling is shown comparing the concentration profiles between one-way and two-way coupling in both smooth and irregular rough surface.