Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Modulation of coherent structures by inertial particles in a turbulent channel flow HIMANSHU DAVE, MOHAMED KASBAOUI, Arizona State University — In this study, we explore how skin friction drag can be reduced by carefully modulating the near-wall coherent structures using inertial point particles. The particles in this study have a diameter $d_p^+ = 0.2$ in wall units and are smaller than the smallest turbulent eddies. Owing to the preferential concentration mechanism, these particles are able to modulate the coherent structures as they get expelled from the vortical regions and gather in the extensional regions of the flow. In doing so, these particles may remove momentum from the energetic core of hairpin vortices while damping fluctuations in the sweep and ejection regions. This mechanism is investigated in Euler-Lagrangian simulations of a two-way coupled turbulent channel flow at a friction Reynolds number $Re_\tau = 180$. The particles are inertial, with a Stokes number $St^+ = 1$, and present at a semi-dilute concentration, i.e., such that the average volume fraction is low ($\langle\phi\rangle = 2.23\ 10^{-4}$) but the mass loading is significant ($M = 0.1$). We explore how particles distribute in the near-wall region, and how they modulate the turbulent structures in the fluid.

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Date submitted: 30 Jun 2019 Electronic form version 1.4