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Large-Scale Eulerian-Lagrangian Simulations of Turbulent Particle-Laden Riser Flows OLIVIER DESJARDINS, JESSE CAPECELATRO, Cornell University — Turbulent gas-particle flows play fundamental roles in a wide range of technical systems. Understanding and predicting particle-laden turbulent flows is key to ensuring optimal performance and improving the design of devices such as fluidized bed reactors. In this work, a Lagrangian description of the particles is combined with state-of-the-art schemes for high-fidelity turbulence simulations in order to enable predictive numerical modeling of particle cluster formation in turbulent riser flows. The simplified riser configuration of He et al is used to answer several key questions regarding meso-scale structures in risers, in particular regarding (1) the onset of instability, especially in the limit of low volume fractions, (2) the role played by the drag model formulation (in particular the dependence of the drag law on void fraction) and (3) the collision model in the formation and dynamics of particle structures. Simulation results are compared with experimental results in terms of cluster size and shape, as well as gas and particle statistics. Then, a wall-free fully periodic configuration is considered and differences in cluster statistics are discussed.

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