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**Fluid-particle characteristics in fully-developed cluster-induced turbulence**[1] JESSE CAPECELATRO, OLIVIER DESJARDINS, Cornell University, RODNEY FOX, Iowa State University — In this study, we present a theoretical framework for collisional fluid-particle turbulence. To identify the key mechanisms responsible for energy exchange between the two phases, an Eulerian-Lagrangian strategy is used to simulate fully-developed cluster-inudced turbulence (CIT) under a range of Reynolds numbers, where fluctuations in particle concentration generate and sustain the carrier-phase turbulence. Using a novel filtering approach, a length-scale separation between the correlated particle velocity and uncorrelated granular temperature (GT) is achieved. This separation allows us to extract the instantaneous Eulerian volume fraction, velocity and GT fields from the Lagrangian data. Direct comparisons can thus be made with the relevant terms that appear in the multiphase turbulence model. It is shown that the granular pressure is highly anisotropic, and thus additional transport equations (as opposed to a single equation for GT) are necessary in formulating a predictive multiphase turbulence model. In addition to reporting the relevant contributions to the Reynolds stresses of each phase, two-point statistics, integral length/timescales, averages conditioned on the local volume fraction, and PDFs of the key multiphase statistics are presented and discussed.

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