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Spectral Analysis of Cluster Induced Turbulence RAVI PATEL, PETER IRELAND, Cornell University, JESSE CAPECELATRO, University of Illinois at Urbana-Champaign, RODNEY FOX, Iowa State University, OLIVIER DESJARDINS, Cornell University — Particle laden turbulent flows are an important feature of many industrial processes such as fluidized bed reactors. The study of cluster-induced turbulence (CIT), wherein particles falling under gravity generate turbulence in the carrier gas via fluctuations in particle concentration, may lead to better models for these processes. We present a spectral analysis of a database of statistically stationary CIT simulations. These simulations were previously performed using a two way coupled Eulerian-Lagrangian approach for various mass loadings and particle-scale Reynolds numbers. The Lagrangian particle data is carefully filtered to obtain Eulerian fields for particle phase volume fraction, velocity, and granular temperature. We perform a spectral decomposition of the particle and fluid turbulent kinetic energy budget. We investigate the contributions to the particle and fluid turbulent kinetic energy by pressure strain, viscous dissipation, drag exchange, viscous exchange, and pressure exchange over the range of wavenumbers. Results from this study may help develop closure models for large eddy simulation of particle laden turbulent flows.

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