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Local Dissipation Scales in Homogeneous Sheared Turbulence
RYAN KING, PETER HAMLINGTON, University of Colorado at Boulder — The effects of shear on local dissipation scales in turbulent flows have been examined using direct numerical simulations (DNS) of homogeneously sheared turbulence. In the classical theory of turbulence it is assumed that there is a universal equilibrium range and effects of a large-scale shear are lost at small spatial scales. Recent numerical and experimental studies have shown that large-scale anisotropy can remain significant at small scales. Furthermore, the local dissipation scale distributions have been found to depend on wall distance in turbulent pipe and channel flows and on measurement location in backward-facing step flows. The exact influence of mean shear and large-scale flow properties in these flows remains unclear due to the presence of confounding wall effects or flow separation. We use DNS of homogeneously sheared turbulence to determine the dependence of local dissipation scales on the shear and Reynolds number in the absence of these wall or flow separation effects. This study also tests the assumption that a universal equilibrium range exists and that small-scale behavior is independent of large-scale flow properties. Finally, comparisons are made with prior studies of local dissipation scales in both homogeneous, isotropic and wall-bounded shear flows.

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