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Exploration of turbulence/surface tension interaction through direct numerical simulation JEREMY MCCASLIN, OLIVIER DESJARDINS, Cornell University — Two canonical multiphase flows are constructed that provide a platform for a statistical description of surface tension effects on a surrounding turbulent flow field. In the first flow, short-time behavior is studied by inserting an initially flat interface into a triply periodic box of decaying homogeneous isotropic turbulence (HIT). Long-time behavior is studied in the second flow by inserting a randomly distributed interface into forced HIT. Simulations are performed for a variety of turbulent Reynolds and Weber numbers, including an infinite Weber number (no surface tension), on mesh sizes ranging from 256^3 to 1024^3. The interaction between fluid inertia and the surface tension force is isolated by utilizing unity density and viscosity ratios. The probability density function of principal curvature and global interface statistics are presented and discussed, highlighting the importance of the Kolmogorov critical radius on the spatial scales of interfacial corrugations that form. A spectral analysis of energy transfer is conducted, shedding light on the role played by surface tension in this process.

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