Abstract Submitted
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Effects of droplet deformation and breakup/coalescence on turbulence kinetic energy ANTONINO FERRANTE, PABLO TREFFTZ-POSADA, University of Washington, Seattle — We have performed direct numerical simulations (DNS) of droplet-laden homogeneous isotropic and shear turbulence (DLHIT & DLHST) using our volume-of-fluid/pressure-correction method for two-fluid incompressible flows, FastP* (Dodd & Ferrante, *J. Comp. Phys.*, 2014). For the DLHIT case, we validate the DNS results of the droplet deformation by comparison with available experiments for droplet diameter of order of the Taylor length scale of turbulence. Then, we have derived the governing equations of turbulence kinetic energy (TKE) for DLHIT & DLHST for the carrier-phase, droplet-phase and two-fluid flow. In the two-fluid TKE equation, there is the power of surface tension term, $\Psi_\sigma(t)$, which represents the rate of change of the surface energy for the interface between the two fluids. $\Psi_\sigma(t)$ is proportional, with opposite sign, to the rate of change of total droplet surface area. Thus, as the total droplet surface area changes in time through droplet deformation and breakup/coalescence, $\Psi_\sigma(t)$ acts as source (or sink) of turbulence kinetic energy. Accordingly, through the power of the surface tension, droplet coalescence acts as a source of TKE and breakup acts as a sink of TKE.

Antonino Ferrante
University of Washington, Seattle

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