Abstract Submitted
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On the effects of density ratio on droplet-laden isotropic turbulence ANTONINO FERRANTE, MICHAEL DODD, University of Washington, Seattle — Our objective is to determine the effects of varying the droplet- to carrier-fluid density ratio (ρ_d/ρ_c) on the interaction of droplets with turbulence. We performed DNS of 3130 finite-size, non-evaporating droplets of diameter approximately equal to the Taylor lengthscale and with 5 % droplet volume fraction in decaying isotropic turbulence at initial Taylor-scale Reynolds number $\mathrm{Re}_\lambda = 83$. We varied ρ_d/ρ_c from 1 to 100 while keeping the Weber number and dynamic viscosity ratio constant, $\mathrm{We}_{\mathrm{rms}}$=1 and μ_d/μ_c=1. We derived the turbulence kinetic energy (TKE) equations for the two-fluid, carrier-fluid and droplet-fluid flow. These equations allow us to explain the pathways for TKE exchange between the carrier turbulent flow and the flow inside the droplet. We show that increasing ρ_d/ρ_c increases the decay rate of TKE in the two-fluid flow. The TKE budget shows that this increase is caused by an increase in the dissipation rate of TKE and a decrease in the power of the surface tension. The underlying physical mechanisms for these behaviors will be presented.

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