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Numerical studies of microscopic oil droplets under intense turbulence MURRAY SNYDER, US Naval Academy, OMAR KNIO, Johns Hopkins University — The rise of small oil droplets in water experiencing isotropic turbulence conditions is analyzed computationally under four different turbulence intensities. The computational method combines DNS of the turbulent flow with Lagrangian tracking of the slightly buoyant droplets using a dynamical equation with buoyancy, virtual mass, pressure, drag, lift and history forces. In our recent work, Snyder *et al.* (2008), we showed that the puzzling behavior observed by Friedman and Katz (2002), where the rise velocity of droplets smaller than 800 μm in diameter is enhanced by turbulence whereas the rise of larger droplets is retarded, could be explained by significant drop then enhancement of the droplet drag coefficient, and corresponding drop in the virtual mass coefficient. In this study we use the same technique to explain the recent experimental results of Gopalan and Katz (2008), who also showed both suppression and enhancement of droplet rise velocities. Using drag and virtual mass coefficients which vary with Reynolds number, our computations approximate the experimental behavior observed by Gopalan and Katz in isotropic turbulence with 79, 100 and 151 μm Kolmogorov length scales. Combined with close agreement with the Friedman and Katz results, with an 88 μm Kolmogorov scale, our results provide further evidence that both the quasi-steady drag and virtual mass coefficients may be heavily modified under intense turbulence.

Murray Snyder
US Naval Academy

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