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Direct numerical simulation of coalescing droplets in turbulence[1]

MELANIE LI SING HOW, LANCE COLLINS, Cornell University — There is a rich body of numerical, experimental and theoretical work looking at the role of turbulence in particle collisions, with a particular emphasis on how it might accelerate the evolution of clouds in the atmosphere. This study is a continuation of that lineage. We perform direct numerical simulations of isotropic turbulence with embedded droplets that, upon collision, coalesce to produce a daughter droplet that conserves the mass and momentum of the parent droplets. As a consequence of coalescence, the droplet size distribution evolves over time from its monodisperse initial condition. The work is an extension of Reade and Collins (J. Fluid Mech. 415:45-64, 2000), which considered the same problem at a much lower Reynolds number. We observe important effects of intermittency at Reynolds numbers that are several-fold higher. The collisions do not yet take into account the effect of the lubricating gas layer, which will be the topic of future work.

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