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A combined volume-of-fluid method and low-Mach-number approach for DNS of evaporating droplets in turbulence MICHAEL DODD, ANTONINO FERRANTE, University of Washington — Our objective is to perform DNS of finite-size droplets that are evaporating in isotropic turbulence. This requires fully resolving the process of momentum, heat, and mass transfer between the droplets and surrounding gas. We developed a combined volume-of-fluid (VOF) method and low-Mach-number approach to simulate this flow. The two main novelties of the method are: (i) the VOF algorithm captures the motion of the liquid gas interface in the presence of mass transfer due to evaporation and condensation without requiring a projection step for the liquid velocity, and (ii) the low-Mach-number approach allows for local volume changes caused by phase change while the total volume of the liquid-gas system is constant. The method is verified against an analytical solution for a Stefan flow problem, and the D^2 law is verified for a single droplet in quiescent gas. We also demonstrate the schemes robustness when performing DNS of an evaporating droplet in forced isotropic turbulence.

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