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Simulation of the evolution of a condensing aerosol in homogeneous isotropic turbulence AMJAD ALSHAARAWI, ANTONIO ATTILI, FABRIZIO BISETTI, Clean Combustion Research Center, CLEAN COMBUSTION RESEARCH CENTER TEAM — The nucleation, growth, and coagulation of liquid droplets in three-dimensional homogeneous isotropic turbulence at $\mathrm{Re}_\lambda \approx 150$ is simulated. Patches of dry and cold gas mix with patches of hot carrier gas saturated with vapor of a condensable species, inducing the homogeneous nucleation of particles due to supersaturation. The simulation consists of a three-dimensional direct numerical simulation of homogeneous isotropic turbulence with a statistically stationary forced velocity field. All length and time scales of fluid motion and scalar mixing are resolved adequately. A model based on the quadrature method of moments and Lagrangian transport of the moments is adopted for the transport and dynamics of the liquid droplets. Our results show that droplets form early in the evolution of the flow field and their concentration peaks on the cold side of the mixing layers separating the patches of hot and cold gas, where droplets nucleate most intensely. Conversely, the droplets grow most rapidly on the hot side of the mixing layers. As turbulent mixing displaces the droplets into regions of hot and moist gas, the droplets' size increases markedly. Conditional statistics of the aerosol phase in the mixture fraction space are employed to investigate this trend.

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