Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Reduced 1D population dynamics model for inflow size distribution in LES of oil droplet plumes[1] ADITYA AIYER, CHARLES MENEVEAU, Johns Hopkins University — In the context of many applications of turbulent multiphase flows, knowledge of the dispersed phase size distribution is critical to predicting important macroscopic features. Often the inflow size distribution is unknown and a mono-disperse injection is commonly used. In order to provide an inflow condition for the size distribution in coarse large eddy simulations (LES) of oil jets, we replace the near nozzle region by a reduced 1D model for the downstream evolution of the centerline concentration due to the combined effects of advection, eddy diffusion and breakup. The droplet breakup due to turbulence is modeled by treating droplet-eddy collisions as in kinetic theory of gases. To model drops comparable to the Kolmogorov scale, we extend the droplet breakup kernels using a structure function smoothly transitioning between inertial to viscous ranges. The results from the 1D reduced model are compared to oil jet experiments of *Brandvik et al. (2013)* with good agreement. The size distribution obtained from the 1D model is used as an inflow condition for LES of a turbulent jet including the population dynamics model for the entire drop size distribution. Among others, LES results allow quantifying the variability of the total surface area and the Sauter mean diameter.

[1]This research was made possible by a grant from the Gulf of Mexico Research Initiative

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Date submitted: 27 Jul 2019 Electronic form version 1.4