Abstract Submitted
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Three-dimensional Numerical Simulations of Turbulent Surfactant-laden Jets[1] JALEL CHERGUI, LIMSI, CNRS, France, RICARDO CONSTANE-AMORES, ASSEN BATCHVAROV, LYES KAHOUADJI, Imperial College London, SEUNGWON SHIN, Hongik University, South Korea, DAMIR JURIC, LIMSI, CNRS, France, RICHARD CRASTER, OMAR MATAR, Imperial College London — Liquid atomisation processes are widely used to break down a liquid stream into smaller droplets to enhance its mixing with a stagnant phase. These streams may be contaminated with surfactants, whose concentration variations lead to gradients in surface tension and associated Marangoni stresses. Here, we study, for the first, the effect of surfactant on the complex interfacial dynamics associated with a turbulent jet. We use a hybrid front-tracking/level-set method to capture the dynamics of the complex topological changes in this flow. The numerical method allows the natural tracking of the concentration of interfacial surfactant species and the faithful modelling of its spatio-temporal evolution. Our model also accounts for surfactant solubility and bulk-interface mass exchange. We perform a full parametric study of the effect of surfactant properties on the dynamics. The effect of Marangoni stresses is analysed in terms of the mechanisms giving rise to the droplet size distributions depending on the elasticity number. An attempt to understand the interaction between the observed vortical structures accompanying the flow and the regions of elevated surfactant concentration will also be presented.

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