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Primary instability of an air-water mixing layer: convergence between simulations, experiments and linear theory[1] CYRIL BOZONNET, GUILLAUME BALARAC, Grenoble Alpes University, OLIVIER DESJARDINS, Cornell University, JEAN-PHILIPPE MATAS, Claude Bernard University Lyon 1
— The Kelvin-Helmholtz instability occurring at the interface between a slow liquid and a fast gas is the first in a cascade of instabilities leading to spray formation. Recent progress made in the understanding of the nature of this instability and its driving mechanisms (confinement by the gas stream, surface tension, viscosity) allows now to reconcile linear theory and experiments. While numerical simulations can be used to deepen the analysis of such complex phenomena, the codes have to be carefully validated first. Multiphase code validation is made challenging by several factors: high density and momentum flux ratio, high Reynolds number, and complex topology changes. In this work, we present a systematic validation of our multiphase flow solver against experiments and linear theory for the canonical configuration of a two-dimensional air-water mixing layer. Particular attention is given to the characteristics of the instability in both its linear and non-linear regime. We discuss the accuracy of our results and the convergence of the statistics. Finally, we explore the effects of the injector geometry on the stability of the flow.

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