Analysis of Dispersion Process of Evaporating Spray Droplets Using Novel Scale Adaptive Simulation Approach coupled to a Langevin Dispersion Model

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Abstract

In this paper, an advanced scale adaptive simulation approach (SAS) is developed and used to achieve time dependent and three dimensional space resolved simulation of large-scale structures which describe the turbulence dynamics. This features a zonal hybrid URANS-LES strategy that allows to capture needed unsteady flow structures using economical computational costs. In order to quantify the small-scale instantaneous velocity seen by the particle as it appears in the droplet motion equation and its effect on the droplet distribution, three different dispersion models are used. The evaporating droplets are captured using the Lagrangian procedure in which all numerical droplets are tracked by solving their equations of motion that include only the drag and gravitation force. The spray is diluted as the droplet volume fraction has a maximum value of $2.6.10^{-4}$micrometer allowing a full two way coupling. With regard to evaporation, the Uniform Temperature Model is applied. Note that all the assumptions required for the use of the model set are valid in the investigated configuration.

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