

Appropriate Data for Validation of Large Eddy Simulation of Flows with Evaporating Drops

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Abstract

A methodology is developed to identify experimental results appropriate for validating Large Eddy Simulation (LES) for spray computations. Validation is defined as a process through which the fidelity of a mathematical model (and a numerical scheme) to represent a process is ascertained. The purpose of validation is to discriminate correct from incorrect physics so as to identify a model which can be used with confidence for situations in which experimental data is not available. It is proposed that validation should be user driven in that objectives should be first defined, and then the required experimental data for validation can be identified in a rigorous manner for those objectives. A database of Direct Numerical Simulation (DNS) is considered as an ideal experimental database in which all information is available. LES errors are defined with respect to the filtered-and-coarsened DNS (FC-DNS) which is the ideal, unachievable LES. Objectives are defined, and LES is compared to the FC-DNS for these objectives. Through error computations based on physical quantities one can identify those physical quantities which can discriminate among various LES models. Physical quantities which cannot discriminate among various LES models are considered unsuited to be appropriate data for model validation since they fail in their primary goal of distinguishing between correct and incorrect physics. Results are presented for several objectives, testing the proposed concept and methodology.

Key words: necessary data for spray LES validation

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