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Numerical Errors in Scalar Variance Models for LES COLLEEN KAUL, VENKAT RAMAN, The University of Texas at Austin, GUILLAUME BALARAC, HEINZ PITSCH, Center for Turbulence Research, Stanford University — Large eddy simulation (LES) has emerged as an indispensable tool for modeling turbulent combustion. While large-scale mixing is accurately captured by LES, the small-scale combustion process itself has to be modeled. Developing LES models is further complicated by the interaction of discretization errors with the models. Most numerical methods, due to their dissipative nature, preferentially impact the smallest resolved scales that are critical for modeling combustion and can undermine the predictive accuracy of LES. The focus of this work is to evaluate the impact of numerical methods on subfilter modeling. A key quantity in combustion modeling is the subfilter conserved scalar variance that determines the level of mixing between fuel and oxidizer at the subfilter level. The study here demonstrates that conventional notions about truncation errors and accuracy of higher-order methods are invalid in the context of subfilter modeling. In particular, it is demonstrated that the commonly used dynamic procedure counteracts numerical diffusion associated with computing derivatives, thereby reducing the model error. When using transport equation based variance models, it is shown that certain model forms cancel numerical errors, giving superior performance in the context of LES modeling.

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