Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Subgrid model evaluation through lockstep DNS/LES of a turbulent jet ANKIT BHAGATWALA, Sandia National Laboratories, VENKAT RAMAN, University of Texas Austin, JACQUELINE CHEN, Sandia National Laboratories — The aim of this study is to analyze the validity of the common Smagorinsky type closure assumptions employed in LES scalar mixing and scalar dissipation rate models. This is done using a unique DNS-LES lockstep methodology, wherein a DNS is run simultaneously with several LES instances. The LES only solves for the scalar fields and obtains the velocity fields directly from the filtered DNS solution at every substep of time. The LES is also solved on the same grid as the DNS. This eliminates two primary sources of error in LES, numerical error associated with a coarser grid and modeling error arising from the modeled velocity field. The only source of error then, is from the closure assumption made for the LES model. One instance of DNS and three LES instances of a 3D turbulent slot jet at a Reynolds number of 7500 are simulated. The three LES simulations correspond to three different filter widths. Predictions of resolved and subgrid contributions of scalar second moment, scalar variance and scalar dissipation rate are compared. Implications for turbulent combustion models that heavily rely on these parameters are discussed.

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Date submitted: 02 Aug 2013 Electronic form version 1.4