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Large Eddy Simulations Of A Turbulent Auto-Igniting C2H4 Flame DNS EDWARD KNUDSEN, SHASHANK, Stanford University, HEINZ PITSCH, RWTH Aachen, ED RICHARDSON, JACKIE CHEN, Sandia National Laboratories — Large eddy simulations of a turbulent auto-igniting flame are performed to analyze the interaction of different combustion regimes in a flamelet modeling framework. The case that is considered is a direct numerical simulation (DNS) of a non-premixed jet flame at Re=10,000 with heated co-flow. This DNS was performed by Yoo et al. (Proc. Comb. Inst., 2010) using 1.29 billion cells and a 22 species mechanism. A series of flamelet-type approaches are applied in successive large eddy simulations of the flame to understand the importance and interaction of dissipation and auto-ignition. Simulations are first performed by relying either on purely 0-D auto-ignition chemistry or on purely steady non-premixed flamelet chemistry. These simulations significantly under- and over-predict the lift-off height, respectively. Two approaches are then considered that simultaneously account for these processes: a well known tabulated unsteady flamelet formulation and a multi-regime formulation that combines the limiting steady and auto-ignition solutions according to a regime indicator. Comparisons with the DNS demonstrate that these approaches lead to improved liff-off height predictions.

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