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A Novel A Posteriori Investigation of Scalar Flux Models for Passive Scalar Dispersion in Compressible Boundary Layer Flows KALEN BRAMAN, VENKAT RAMAN, The University of Texas at Austin — A novel direct numerical simulation (DNS) based a posteriori technique has been developed to investigate scalar transport modeling error. The methodology is used to test Reynolds-averaged Navier-Stokes turbulent scalar flux models for compressible boundary layer flows. Time-averaged DNS velocity and turbulence fields provide the information necessary to evolve the time-averaged scalar transport equation without requiring the use of turbulence modeling. With this technique, passive dispersion of a scalar from a boundary layer surface in a supersonic flow is studied with scalar flux modeling error isolated from any flowfield modeling errors. Several different scalar flux models are used. It is seen that the simple gradient diffusion model overpredicts scalar dispersion, while anisotropic scalar flux models underpredict dispersion. Further, the use of more complex models does not necessarily guarantee an increase in predictive accuracy, indicating that key physics is missing from existing models. Using comparisons of both a priori and a posteriori scalar flux evaluations with DNS data, the main modeling shortcomings are identified. Results will be presented for different boundary layer conditions.

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