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Bayesian Calibration and Comparison of RANS Turbulence Models for Channel Flow TODD OLIVER, ROBERT MOSER, University of Texas — A set of RANS turbulence models—including Baldwin-Lomax, Spalart-Allmaras, k-ϵ, and $\overline{v^2}$-f—are calibrated and compared in the context of fully-developed channel flow. Specifically, a Bayesian calibration procedure is applied to infer the parameter values for each turbulence model from channel flow DNS data. In this process, uncertainty arises both from uncertainty in the data and inadequacies in the turbulence models. Various stochastic models of the turbulence model inadequacy are formulated, and the impacts of different uncertainty modeling choices are examined. The calibrated turbulence models are compared in terms of two items: posterior plausibility and predictions of quantities of interest such as centerline velocity and the location of the maximum Reynolds shear stress. The posterior plausibility indicates which model is preferred by the data according to Bayes' theorem, while the predictions allow assessment of how strongly the model differences impact the quantities of interest. The implications of these comparisons for turbulence model validation will be discussed. This work is supported by the Department of Energy [National Nuclear Security Administration] under Award Number [DE-FC52-08NA28615].

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