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Closure modeling using field inversion and machine learning KARTHIK DURAISAMY, University of Michigan, Ann Arbor — The recent acceleration in computational power and measurement resolution has made possible the availability of extreme scale simulations and data sets. In this work, a modeling paradigm that seeks to comprehensively harness large scale data is introduced, with the aim of improving closure models. Full-field inversion (in contrast to parameter estimation) is used to obtain corrective, spatially distributed functional terms, offering a route to directly address model-form errors. Once the inference has been performed over a number of problems that are representative of the deficient physics in the closure model, machine learning techniques are used to reconstruct the model corrections in terms of variables that appear in the closure model. These machine-learned functional forms are then used to augment the closure model in predictive computations. The approach is demonstrated to be able to successfully reconstruct functional corrections and yield predictions with quantified uncertainties in a range of turbulent flows.

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