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Estimating model error using sparsity-promoting ensemble Kalman inversion JINLONG WU, TAPIO SCHNEIDER, ANDREW STUART, California Institute of Technology — Closure models are widely used in simulating complex systems such as turbulence and Earths climate, for which direct numerical simulation is too expensive. Although it is almost impossible to perfectly reproduce the true system with closure models, it is often sufficient to correctly reproduce time-averaged statistics. Here we present a sparsity-promoting, derivative-free optimization method to estimate model error from time-averaged statistics. Specifically, we show how sparsity can be imposed as a constraint in ensemble Kalman inversion (EKI), resulting in an iterative quadratic programming problem. We illustrate how this approach can be used to quantify model error in the closures of dynamical systems. In addition, we demonstrate the merit of introducing stochastic processes to quantify model error for certain systems. We also present the potential of replacing existing closures with purely data-driven closures using the proposed methodology. The results show that the proposed methodology provides a systematic approach to estimate model error in closures of dynamical systems.

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