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Toward data-driven stochastically forced turbulence closure models ARMIN ZARE, University of Texas at Dallas, ANUBHAV DWIVEDI, University of Minnesota, MIHAILO JOVANOVIC, University of Southern California — We build on work by Zare, Jovanovic, and Georgiou (JFM, vol. 812, 2017) to develop stochastically forced closure models for the mean flow equations of a turbulent channel flow. Given a subset of steady-state velocity correlations for a turbulent channel flow at a friction Reynolds number of 186, we formulate an inverse problem to determine the forcing statistics to the linearized model that provide consistency with DNS. The resulting stochastically forced linearized model is used to drive the mean flow equations in time-dependent simulations. This provides a correction to the mean velocity profile which perturbs the linearized Navier-Stokes dynamics. The feedback connection of mean flow equations with stochastically forced linearized equations incorporates a two-way interaction between the mean flow and second-order statistics of the fluctuating velocity field. By analyzing conditions under which this feedback connection converges, we take a step toward the development of new classes of data-driven turbulence closure models.

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