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A Predictive Model for Wind Farms Using Dynamic Mode Decomposition[1] VAUGHAN THOMAS, CHARLES MENEVEAU, DENNICE GAYME, Johns Hopkins University — In this work we extend traditional dynamic mode decomposition (DMD) to develop a linear predictive model for the time evolution of the velocity field for a multiple-turbine wind farm. Traditional DMD identifies a set of DMD modes which can be used to produce a linear system that approximates the dynamics of the original system. Typically, these DMD modes consist of those that both grow and decay, but in order to develop a predictive model we need a system that evolves along a manifold that neither grows nor decays. Here we modify the DMD calculation to build such a model. We then apply this method to three dimensional large eddy simulations (LES) of a multi-turbine wind farm. Our predictive wind farm model is initialized with a small time series of data independent of the original data used to create the system. When initialized in this manner our DMD based model can reproduce the subsequent time evolution of the velocity field over ten inter-turbine convective timescales with a gradual falloff in performance.

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