

Abstract Submitted
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Measurement-augmented large eddy simulations¹ YIFAN DU, Johns Hopkins University, VINCENT MONS, 1. Johns Hopkins University 2. ONERA The French Aerospace Lab, TAMER ZAKI, Johns Hopkins University — Data assimilation techniques are adopted to improve the fidelity of large-eddy simulations (LES) by infusing them with measurement data. By exploiting knowledge of low-order flow statistics from experiments or theory, the resulting LES model provides a higher fidelity representation of the instantaneous flow that recovers those statistics. The approach starts with a definition of the cost functional which is proportional to the difference between the reference and predicted statistics, and the coefficients of the sub-grid scale model are adjusted using ensemble variational optimization to minimize the cost functional. A proper orthogonal decomposition (POD) representation of the ensemble is adopted to improve robustness of the algorithm. Numerical experiments are performed in turbulent channel flow over a range of Reynolds numbers, and the results demonstrate the superiority of the data-assimilated LES approach over standard subgrid models.

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Yifan Du
Johns Hopkins University

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