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Influence of a recent Transition Model on Complex Nonsteady Boundary Layer Flows with Dynamic Stall and Multiple Phases ADAM LAVELY, MICHAEL KINZEL, GANESH VIJAYAKUMAR, JAMES BRASSEUR, ERIC PATERSON, JULES LINDAU, Penn State University — Computational fluid dynamics (CFD) simulations are prone to inaccuracies associated with incorrectly formulated physical models. Common in CFD is the spurious treatment as locally laminar flow regions as turbulent, resulting in incorrect turbulent-boundary-layer profiles, separated-flow behavior, and local skin-friction coefficients. The combined effects impacts global measures like drag, lift coefficient, and wake intensity. Recently, Menter & Langtry (AIAA **47** 2009) developed a transition model applicable to unsteady three-dimensional CFD codes that shows promise to improve the prediction of local laminar regions. Our aim is to evaluate the accuracy of this model with the additional complexities of unsteady flow around rotating wind turbine blades and multiphase flows using codes designed within OpenFOAM. We investigate how transition and locally laminar flow regions impact various complex problems of interest including: (1) stationary S809 airfoil through stall, (2) an oscillating S809 airfoil in dynamic stall, and (3) a ventilated gaseous cavity in a liquid flow. We will evaluate the efficacy of the model by comparing with experimental results, and shall evaluate the impact on integral measures and flow details. *Supported by NSF & DOE.*

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