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Effect of nacelle on the wake meandering in Horns Rev wind farm[1]

XIAOLEI YANG, Stony Brook University, DANIEL FOTI, University of Minnesota, FOTIS SOTIROPOULOS, Stony Brook University — Turbine wake meandering has considerable effects on the velocity deficit and turbulence intensity in the wake. However, the mechanism for wake meandering is still not well understood and low-order models cannot take into account the wake meandering effects accurately. A recent work by Kang, Yang and Sotiropoulos (Journal of Fluid Mechanics 744 (2014): 376-403) showed that the nacelle has a significant effect on the wake meandering of a hydrokinetic turbine. To examine the nacelle contributions to wake meandering and wake interactions in utility-scale wind farms, we simulate the atmospheric turbulent flow over the Horns Rev wind farm using large-eddy simulation with actuator type models. In a preliminary simulation on a coarse grid using actuator line model for turbine blades without a nacelle model, the computed power shows overall good agreement with field measurements. Fine grid simulations using an actuator surface model for turbine blades with and without a nacelle model are being carried out. The corresponding results will be presented with analysis on wake meandering dynamics using the technique proposed by Horward et al. (Physics of Fluids 27 (2015): 075103) and Foti et al. (Physical Review Fluids, accepted).

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