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Effect of nacelle on wake meandering in a laboratory scale wind turbine using LES[1] DANIEL FOTI, XIAOLEI YANG, MICHELE GUALA, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, University of Minnesota —
Wake meandering, large scale motion in the wind turbine wakes, has considerable effects on the velocity deficit and turbulence intensity in the turbine wake from the laboratory scale to utility scale wind turbines. In the dynamic wake meandering model, the wake meandering is assumed to be caused by large-scale atmospheric turbulence. On the other hand, Kang *et al.* (*J. Fluid Mech.*, 2014) demonstrated that the nacelle geometry has a significant effect on the wake meandering of a hydrokinetic turbine, through the interaction of the inner wake of the nacelle vortex with the outer wake of the tip vortices. In this work, the significance of the nacelle on the wake meandering of a miniature wind turbine previously used in experiments (Howard *et al.*, *Phys. Fluid*, 2015) is demonstrated with large eddy simulations (LES) using immersed boundary method with fine enough grids to resolve the turbine geometric characteristics. The three dimensionality of the wake meandering is analyzed in detail through turbulent spectra and meander reconstruction. The computed flow fields exhibit wake dynamics similar to those observed in the wind tunnel experiments and are analyzed to shed new light into the role of the energetic nacelle vortex on wake meandering.

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