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Study of Hydrokinetic Turbine Arrays with Large Eddy Simulation DANNY SALE, ALBERTO ALISEDA, University of Washington — Marine renewable energy is advancing towards commercialization, including electrical power generation from ocean, river, and tidal currents. The focus of this work is to develop numerical simulations capable of predicting the power generation potential of hydrokinetic turbine arrays–this includes analysis of unsteady and averaged flow fields, turbulence statistics, and unsteady loadings on turbine rotors and support structures due to interaction with rotor wakes and ambient turbulence. The governing equations of large-eddy-simulation (LES) are solved using a finite-volume method, and the presence of turbine blades are approximated by the actuator-line method in which hydrodynamic forces are projected to the flow field as a body force. The actuator-line approach captures helical wake formation including vortex shedding from individual blades, and the effects of drag and vorticity generation from the rough seabed surface are accounted for by wall-models. This LES framework was used to replicate a previous flume experiment consisting of three hydrokinetic turbines tested under various operating conditions and array layouts. Predictions of the power generation, velocity deficit and turbulence statistics in the wakes are compared between the LES and experimental datasets.

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