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Computational and Experimental Studies of Turbulence in Wind and Hydrokinetic Energy: From Turbines to Farms[1] FOTIS SOTIROPOULOS, SEOKKOO KANG, XIAOLEI YANG, LEONARDO CHAMORRO, CRAIG HILL, ROGER ARNDT, St. Anthony Falls Laboratory, University of Minnesota — Recent computational and experimental advances at the St. Anthony Falls Laboratory (SAFL) aimed at understanding the structure of turbulence past wind and hydrokinetic turbines and farms will be presented. A powerful computational framework has been developed for carrying out LES of turbulent flow past complete turbine configurations as well as large-scale wind farms. For the former, the geometrical details of the turbine are resolved on fine computational grids using the CURVIB method with a wall model (Kang et al., Adv. in Water Resources, 34(1), 98-113, 2011) while for the latter the turbines are parametrized as actuator disks. Laboratory experiments in the SAFL atmospheric boundary layer wind tunnel and a large water flume have provided data sets for model validation. The computed and experimental results yield novel insights into the structure of turbulence in turbine wakes and suggest strategies for optimizing layouts of multi-turbine arrays for maximizing energy capture.

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Fotis Sotiropoulos
St. Anthony Falls Laboratory, University of Minnesota

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