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On the effects of energetic coherent motions on power and wake dynamics of an axial-flow marine turbine in an open channel[1] CRAIG HILL, LEONARDO CHAMORRO, University of Minnesota, VINCENT NEARY, BUDI GUNAWAN, Oak Ridge National Laboratory, ROGER ARNDT, FOTIS SOTIROPOULOS, University of Minnesota, U. OF MN - SAFL TEAM, ORNL COLLABORATION — Laboratory experiments are carried out to study the effect of energetic coherent motions on the performance of a model axial-flow hydrokinetic turbine in the main channel at Saint Anthony Falls Laboratory. A mechanical system allows the turbine angular velocity to be precisely specified and maintained via a controller. Power fluctuations are tracked using a torque sensor connected to the turbine structure. Periodic energetic coherent motions are introduced in the flow by placing a cylinder at various locations upstream of the turbine on the plane of symmetry. Three acoustic Doppler velocimeters and a torque sensor are used to obtain synchronous high resolution measurements of the flow and turbine power at a rate of 200 Hz, respectively. Flow measurements are obtained at various locations upstream and downstream of the turbine. The measurements provide novel insights into the role of strong energetic coherent motions on turbine power fluctuations, tip vortex instability, and mean wake recovery. The implications of these findings for the efficient operation of hydrokinetic turbines in natural waterways will be discussed.

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