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Three dimensional visualization of the interaction between energetic coherent motions and tip vortices in the wake of an axial-flow marine turbine DANIEL TROOLIN, Fluid Mechanics Research Instruments, TSI Incorporated, Shoreview, MN, USA, LEONARDO CHAMORRO, SEUNG-JAE LEE, ROGER ARNDT, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, College of Science and Engineering, University of Minnesota — Tip vortices of axial-flow turbines play a key role in modulating the mean and turbulent characteristics of the wake. Understanding their evolution and the mechanisms that trigger instability is crucial to improve bulk power extracted in a wind farm. In this study, we study the interaction between the tip vortices generated by a miniature axial-flow turbine and strong coherent motions present in the flow. The turbine was placed in a water flume at the St. Anthony Falls Laboratory at the University of Minnesota under subcritical conditions. A circular cylinder was placed upstream of the turbine to induce the energetic coherent structures in the flow. Three-dimensional three-component (3D3C) velocity measurements were made in the flow downstream of the miniature turbine. The focus was placed on visualizing the complex interaction between the von Karman vortices shed by the cylinders and the turbine tip vortices. New insights on the tip vortex dynamics and three dimensional characteristics of the wake flow will be discussed.

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