Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Field scale simulation of axial hydrokinetic turbines in a natural marine environment[1] SAURABH CHAWDHARY, St. Anthony Falls Laboratory, Department of Mechanical Engineering, University of Minnesota, DIONYSIOS ANGELIDIS, St. Anthony Falls Laboratory, University of Minnesota, LIAN SHEN, St. Anthony Falls Laboratory, Department of Mechanical Engineering, University of Minnesota, FOTIS SOTIROPOULOS, Department of Civil Engineering, Stony Brook University — Commercialization of marine and hydrokinetic (MHK) energy technologies is still in the development stage. Existing technologies need fundamental research to enable efficient energy extraction from identified MHK sites. We propose a large eddy simulation (LES)-based framework to investigate the site-specific flow dynamics past MHK arrays in a real-life marine environment. To this end, we use advanced computational tools developed at the Saint Anthony Falls Laboratory (SAFL) to resolve the vast range of scales present in the flow. The new generation unstructured Cartesian flow solver, coupled with a sharp interface immersed boundary method for 3D incompressible flows, is used to numerically investigate New York City's East River, where an array of MHK turbines is to be deployed as part of the Roosevelt Island Tidal Energy (RITE) Project. Multi-resolution simulations on locally refined grids are used to simulate the flow in a section of the East River with detailed river bathymetry and inset turbines at field scale. The results are analyzed in terms of the wake recovery, overall wake dynamics, and the power produced by the turbines. These results will help develop design guidelines for the site-specific turbine array configuration.

[1]This work was supported by NSF grant IIP-1318201.

Saurabh Chawdhary
St. Anthony Falls Laboratory, University of Minnesota

Date submitted: 01 Aug 2016 Electronic form version 1.4