Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Numerical modeling of the effects of a free surface on the operating characteristics of Marine Hydrokinetic Turbines[1] SAMANTHA ADAMSKI, ALBERTO ALISEDA, University of Washington — Marine Hydrokinetic (MHK) turbines are a growing area of research in the renewable energy field because tidal currents are a highly predictable clean energy source. The presence of a free surface may influence the flow around the turbine and in the wake, critically affecting turbine performance and environmental effects through modification of wake physical variables. The characteristic Froude number that control these processes is still a matter of controversy, with the channel depth and turbine's depth, blade tip depth and diameter as potential candidates for a length scale used in literature. We use the Volume of Fluid model to track the free surface dynamics in a RANS simulation with a BEMT model of the turbine to understand the physics of the wake-free surface interactions. Pressure and flow rate boundary conditions for channel's inlet, outlet and air side have been tested in an effort to determine the optimum set of simulation conditions for MHK turbines in rivers or estuaries. Stability and accuracy in terms of power extraction and kinetic and potential energy budgets are considered. The goal of this research is to determine, quantitatively in non dimensional parameter space, the limit between negligible and significant free surface effects on MHK turbine analysis.

[1]Supported by DOE through the National Northwest Marine Renewable Energy Center

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Date submitted: 03 Aug 2012 Electronic form version 1.4