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Modelling impacts of tidal stream turbines on surface waves

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Abstract

A high resolution Computational Flow Dynamics (CFD) numerical model is built based on a laboratory experiment in this research to study impacts of tidal turbines on surface wave dynamics. A reduction of $\sim 3\%$ in wave height is observed under the influence of a standalone turbine located 0.4 m from the free surface. The artificial wave energy dissipation routine 'OBSTACLE' within FVCOM is shown to effectively capture the correct level of wave height reduction, reproducing the CFD results with significantly less computational effort.

The turbine simulation system is then applied to a series of test cases to investigate impact of a standalone turbine on bed shear stress. Results suggest an apparent increase in bed stress ($\sim 7\%$) upstream of the turbine due to the inclusion of surface waves. However, in the immediate wake of the turbine, bed stress is dominated by the presence of the turbine itself,

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