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Numerical Modeling of Hydrokinetic Turbines and their Environmental Effects[1] TEYMOUR JAVAHERCHI, ALBERTO ALISEDA, University of Washington — Energy extraction from ocean tides via hydrokinetic turbines has recently attracted scientists and engineers attention as a highly predictable source of renewable energy. However, since the most promising locations in terms of resources and proximity to the end users are in fragile estuarine ecosystems, numerous issues concerning the environmental impact of this technology need to be addressed a priori before large scale deployment. In this work we use numerical simulations to study the possible environmental effects of hydrokinetic turbines through their influence on physical flow variables such as pressure and velocity. The velocity deficit created in the turbulent wake of a turbine affects the settling of suspended sediment in the water column and can lead to deposition into artificial patterns that will alter the benthic ecosystem. On the other side of the spectrum, pressure fluctuation through turbine blades and in blade tip vortices can damage internal organs of marine species as they swim through the device, particularly for small juveniles that behave like Lagrangian trackers. We present sedimentation statistics to understand the sensitivity of this phenomena to turbine operating conditions and sediment properties. We also show pressure history for slightly buoyant Lagrangian particles moving through the turbine and correlations with damage thresholds obtained from laboratory experiments.

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