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Abstract:

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Intertidal Flows over Vegetated Salt Marsh Surfaces and Drainage Channel Networks with Cohesive Sediments in a Macrotidal Basin

In the Cornwallis river estuary, a sub-estuary of the Bay of Fundy, there are extensive tidal flats and a mean tidal range of 15 m. In-situ measurements of flow velocity profiles, suspended sediment concentrations and bed level changes made over multiple tidal cycles were used to validate a the Delft3D hydrodynamic/sediment model. The model grid, constructed using high resolution LiDAR data and spatially variable roughness maps based on concurrent seabed characterization studies, resolves fine details of the intertidal channels and vegetation coverage. The model was run for a period of 12 days for three scenarios: 1) constant bottom roughness; 2) spatially varying bottom roughness; and 3) roughness added to the flow from a vegetation sub-model that uses the plant density and stem geometry. The model results indicate that the implementation of the vegetation sub-model causes significant differences in flow patterns across the marsh surfaces and improves the predicted velocity profiles in intertidal drainage channels. Understanding sediment and water fluxes for varying tidal conditions provides a critical baseline to improve predictions of energy extraction using in-stream tidal turbines on sensitive intertidal ecosystems in tidal flats and salt marshes.