Comparison of vertical and temporal variations in hydrodynamics on macro-tidal mudflat and salt marsh surfaces in the Bay of Fundy

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Vertical and temporal variations in hydrodynamics were investigated within and above a salt marsh canopy and the adjacent mudflat through a vertical profiling method, where profiles represent flow velocity throughout the water column. Hydrodynamics were quantified using resolved horizontal velocity, turbulence intensities, turbulent kinetic energy, and 2D and 3D Reynolds stresses. The impacts of vegetation were assessed through comparative analysis of in-canopy and mudflat profiles, with in-canopy profiles showing a marked reduction in flow velocity and turbulent kinetic energy. Accelerated flow zones identified above the mudflat surface showed general correlation with the location of higher flow velocities within the vegetated canopy, suggesting that incoming tidal energy had a direct impact on in-canopy profiles, as large-scale circulation patterns influence flow within the marsh system.

Vegetation effectively acts to control flow velocity and turbulence on the surface of a salt marsh, although overall tidal and wave climate features (e.g. the location, relative to the surface, of accelerated flow zones) showed impacts in resulting in-canopy flow conditions. The attenuation of the vertical component of turbulence within the vegetated canopy was prominent, where horizontal turbulence dominated in-canopy profiles. Progressive vegetation conditions at the end of the growing season provided unique profiling conditions, and a consistent overall reduction in flow velocity and turbulence throughout the water column is identified, despite a lowering canopy and degraded plant material.

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