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Observations of internal waves in the Saint John River Estuary New Brunswick, Canada

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The Saint John River Estuary New Brunswick, Canada is influenced by tides, irregular bathymetry and seasonal stratification. This study presents observations of the generation and decay of internal waves in a 4.5 km stretch of the estuary. Under highly stratified conditions, for the duration of a tidal cycle observations are made of the density, velocity and acoustic volume backscatter structure. In general observations show that in the areas where the bathymetry shoals then deepens, at the time period of maximum velocity shear (on the rising tide): (1) an increase in thickness of the pycnocline, (2) a decrease in density at the lower interface layer occurs and (3) the acoustic volume backscatter images illustrate the dipping of the pycnocline from the lower interface into the adjacent bottom layer.

At the time of the dipping of the pycnocline interfacial mixing is calculated to occur and results from a linear stability analysis show that non-symmetric Holmboe waves should be present when this takes place. Detail inspection of the acoustic backscatter images show the presence of the non-symmetric Holmboe waves at the period of mixing. However the images also show the appearance of Soliton wave packets at late falling tide and the disappearance of these waves when interfacial mixing occurs (which also coincides with the dipping of the pycnocline).

Thus this study shows that interfacial mixing is observed to be occurring at rising tide within the vicinity of lateral and vertical constrictions. The source of the mixing can

possibly be due to Soliton wave packets and/or, non-symmetric Holmboe waves and/or the influence of the stratification and flow as it passes over irregular bathymetry.