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Baroclinic Boundary Currents and Long Edge-Waves in Basins with Sloping Shores

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ABSTRACT

Earlier work on baroclinic “coastal jets” and Kelvin waves in constant-depth basins is extended to basins with sloping shores. Baroclinic coastal jets are again found to be set up by an inflow or outflow of water to or from the shore zone, but the center of these is now somewhat displaced from shore (under typical Great Lakes conditions by a distance of order 10 km). Shore-bound waves (edge-waves) of long wavelength are found to be possible only at frequencies below the inertial and are associated with quasi-geostrophic flow. Moreover, these waves propagate in the same sense as Kelvin waves. However, an infinite sequence of such edge-waves appear, replacing the simple Kelvin waves of the constant-depth model (of given wavelength). The frequency of all of these is well below the Kelvin wave frequency in a constant depth basin. The structure of the basic mode is very similar to that in a constant-depth basin, but that of the higher modes becomes progressively more complex, containing bands of opposing currents.

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