Abstract View

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Three-Dimensional Model Simulations of Tides and Buoyancy C the West Coast of Vancouver Island

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ABSTRACT

A three-dimensional finite element model is used to calculate the barotropic tides and seasonal buoyancy flows off the western and northern coasts of Vancouver Island. The model buoyancy currents and the harmonics of eight tidal constituents are compared with those from previous models, and those from tide gauge and current meter observations. The rms differences between observed and calculated sea level tidal amplitudes are within 2.3 cm for all constituents, whereas the rms differences between observed and calculated phases are, with the exception of Q_1, within 3.5°. The model currents are more accurate than those from previous models.

Of particular interest are the diurnal continental shelf waves. It is shown that these waves are generated through the conservation of potental vorticity arising when the strong diurnal tidal currents in Juan de Fuca Strait encounter the abrupt topography near the entrance to the strait. These waves do not appear to propagate beyond Brooks Peninsula, a large promontory cutting across the continental shelf. A power budget analysis reveals that the reason for this is not the blocking effect but rather there is little energy left in the waves when they reach that point. This energy loss is prim frictional dissipation in a series of trapped eddies along the shelf break. The location of these eddies forcing frequency and appears to be related to the spacing of canyons. It is also demonstrated that t currents observed over the shallow banks in Queen Charlotte Sound to the north of Brooks Peninsu from the oscillatory diurnal flows in Queen Charlotte Strait. Unlike the case for Juan de Fuca Strait, offshore of Queen Charlotte Strait does not support diurnal coastally trapped waves. Seasonal chan wavelengths of the Vancouver Island shelf waves are shown to arise through an advective interacti with the buoyancy-driven Vancouver Island coastal current and the wind-driven shelf break curren

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