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Generation of Annual Rossby Waves in the North Pacific

Lawrence A. Mysak

Departments of Mathematics and Oceanography, University of British Columbia, Vancouver, B.C., Canada V6T 1W5

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ABSTRACT

A new mechanism is proposed for the generation of the annual-period baroclinic Rossby waves which have been observed in the central North Pacific by Kang and Maggaard. It is shown that annual north-south fluctuations in the eastern boundary current off Vancouver Island can efficiently generate first baroclinic mode Rossby waves throughout the central North Pacific. In particular, to the southwest of Vancouver Island the direction, wavelength and speed of phase propagation associated with the far field (asymptotic) wave solution agree favorably with observations. Also, along and fixed latitude contained within the observed latitude band (30–40°N), the amplitudes of the vertical displacement at 300 m and surface horizontal current speed both monotonically increase to the west, in agreement with the observed trends for these quantities. However, the existence of this monotonicity in the solution appears to be quite sensitive to the north-south spatial structure of the fluctuating coastal current. For example, the oscillations of a point source (delta function) current excite a wave field with a fairly uniform amplitude across most of the observation region.

Within the context of a reduced gravity, quasi-geostrophic model, the theory presented here is quite general. For example, baroclinic waves of other than annual period could be investigated, and the radiation pattern due to a number of coastal sources could be determined.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693

DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826

amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718

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