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Trench Wave Generation by Incident Baroclinic Rossby Waves

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ABSTRACT

We consider the response of a two-layer fluid in a coastal trench to the incidence of low-frequency Rossby waves from the open ocean. While both barotropic and baroclinic incident waves have been incorporated into the theory, the focus of this paper is on the nature of the response in the trench to first-mode baroclinic Rossby waves. In particular, we show that in both the Izu and Peru trenches, deep (lower-layer) longshore currents of $0(5 \text{ cm s}^{-1})$ are generated by annual-period Rossby waves whose interfacial amplitude is 5 m. The longshore current speed is particularly large (up to 8 cm s^{-1}) when the longshore wavenumber (l) and frequency (ω) of the incident wave are close to the complex (ω , l) roots of the free trench-wave dispersion relation for a β -plane.

In view of the published evidence (summarized by Magaard) of annual-period Rossby waves in the vicinity of the Izu trench, it is conjectured that forced trench waves of the type described here may be detected in this trench from measurements of subthermocline currents.

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