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Abstract View

Barotropic Continental Shelf Waves on a β-Plane

A. Dorr and R. Grimshaw

Department of Mathematics, university of Melbourne, Parkville, Victoria, 3052 Australia

ABSTRACT

In this paper we consider the effect of the variation of the Coriolis parameter with latitude on barotropic shelf waves, using a β-plane model. Solutions are constructed using the method of inner and outer asymptotic expansions, where the inner expansions hold over the shelf, and the outer expansions hold in the deep ocean. Three cases are identified, depending on the relationship between the shelf wave frequency and the allowed frequencies for deep-ocean Rossby waves. The connection is provided by the matching of the longshore wave-numbers. In the first case, the shelf wave frequency is too large to permit Rossby wave radiation, and the variation of the shelf wave amplitude is governed by conservation of longshore energy flux. In the second case, the shelf wave frequency is sufficiently small to permit Rossby wave radiation at high latitudes, and in the third case there is Rossby wave radiation at all latitudes. In both these cases the longshore shelf wave energy flux decays at a rate determined by the radiated Rossby wave energy flux.

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