Abstract View

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Low-Frequency Trapped Waves an a Wide, Reef-Fringed Continental Shelf

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ABSTRACT

The properties of low-frequency waves, trapped on a wide, reef-fringed continental shelf are predicted theoretically and compared with limited observations from the northeast coast of Australia. A theoretical model of free topographically trapped waves is developed for a simple step-shaped shelf geometry with a shallow reef on the outer shelf. Dimensional arguments show that the flow across the reef obeys a balance between pressure gradient, Coriolis and frictional effects. Relative to the results for a shelf having no reef, the theoretical dispersion relation for a reef-fringed shelf predicts some modification of the baroclinic and Kelvin modes, a more substantial increase in phase speed of the equatorward propagating shelf-wave mode for shorter wavelengths and the existence of an additional poleward propagating mode, trapped on the continental shelf by the reef. Rotary transfer functions, relating the wind stress vectors to the current vectors, are used to remove the wind-driven contribution from the currents leaving wind-reduced current vector time series. Spectral estimates of the wind-reduced data show features consistent with free wave theory and, in addition, wavenumber-frequency points calculated from the wind-reduced current vectors by rotary coherence techniques show good support for modes with properties consistent with the presence of the reef.