Abstract View

Volume 15, Issue 7 (July 1985)

Journal of Physical Oceanography
Article: pp. 855–864 | Abstract | PDF (649K)

Frictional Continental Shelf Waves and the Circulation Response of a Continental Shelf to Wind Forcing

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(Manuscript received April 5, 1984, in final form March 4, 1985)

DOI: 10.1175/1520-0485(1985)015<0855:FCSWAT>2.0.CO;2

ABSTRACT

This paper is an examination of the wind-forced circulation on continental shelves with bottom friction. Since the response is integrally dependent on the cross-shelf structures and dispersion characteristics of continental shelf waves modified by bottom friction, these are examined first. Theoretical shelf-wave forms are obtained for the North West Shelf of Australia, a wide shelf for which bottom friction is expected to be of major dynamic importance. The presence of strong bottom friction (r=0.1 cm s^{-1}) introduces substantial modifications to the shelf wave structures on the inner part of the shelf and also causes decay of the wave forms in the direction of energy propagation. As for the frictionless case, the wind-driven circulation with bottom friction can be expanded in terms of the appropriate set of continental shelf waves. Even with strong bottom friction, the circulation close to the coast is still mostly due to low-mode shelf waves generated along an extended section of shelf. However, the section of shelf that must be considered in the forcing problem depends on the decay rates of the shelf waves contributing to the total circulation. These decay rates in turn depend on frequency, mode number, and the amount of bottom friction. The results of this study have implications for the modeling of shelf circulation.