Abstract View

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A Formal Theory of Internal Wave Scattering with Applications to Ocean Fronts

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ABSTRACT

A concise theory for scattering of internal waves at localized inhomogeneities (i.e., topographic features, baroclinicity in the density field, variations of the mean sea level, jetlike currents) in the oceanic waveguide is presented within the formal framework of quantum mechanical scattering theory. The equations of motion of the wave system are reduced to a form resembling the Schrödinger equation with an interaction operator describing the effect of the ambient inhomogeneities. By standard Green's function techniques integral equations for the scattered field and its Fourier transform (which relates to the amplitudes of the scattered waves) are derived, both for a scattering region of finite extent (representing a two-dimensional scattering problem) and a “wall-like” scattering region of infinite extent (representing a one-dimensional scattering problem). As an example, the theory is applied to the scattering at a straight geostrophic front. The far-field is described in the Born approximation valid for $(U/c)(kL_s)$ L< 1, where U is the speed of the geostrophic current of width L_s, and c and k are the phase speed and wavenumber of the incident wave. It is found that the scattering process has a significant directional signature while modal redistribution appears to be weak.