Abstract View

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Continental Shelf Circulation Induced by a Moving, Localized Wind Stress

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ABSTRACT

A linear, two-dimensional model of a rotating, stratified fluid is constructed to investigate the circulation induced by a moving, localized line of surface stress. This model is used to analyze the effect of moving cold fronts on continental shelf circulation.

The nature of the induced circulation depends on the relative magnitude of the translation speed of the storm and the natural internal wave speed. If the surface stress moves slower than the internal wave speed. the disturbance is quasi-geostrophic and moves with the storm. If the storm moves faster than the internal wave speed, two sets of internal-inertial waves are produced. One set of waves is forced by the surface forcing and travels at the speed of the storm. Another set of waves is produced by reflection of the directly forced waves from the coastal wall.

We conclude that free surface deflection (slope) is responsible for the low-frequency. quasi-geostrophic currents due to passing cold fronts. The internal response is composed of tree inertia waves which radiate away from the coast, leaving no residual circulation.

Model results are compared to current meter data collected during the passage of a cold front over the South Atlantic Bight on 9 January 1978. The inertia frequency response observed at the mooring is reproduced by the model calculation.

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