Abstract View

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Wave Attenuation and Wave Drift in the Marginal Ice Zone

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ABSTRACT

Surface gravity waves in a viscous rotating ocean are studied theoretically when they penetrate an area covered by highly concentrated brashlike ice. The motion is described by a Lagrangian formulation, and the brash is modeled by a viscous Newtonian fluid. Results for wave attenuation and wave drift are obtained in the asymptotic limit of a thin, very viscous upper layer. The derived damping rate compares favorably with field data from the marginal ice zone (MIZ). The drift velocity in the ocean exhibits a marked maximum in the viscous boundary layer near the ice-ocean interface. At the outer edge of the boundary layer it exceeds the inviscid Stokes drift by a factor of 7/4. Computed values for the mean viscous drag on the ice induced by the wave motion show that this effect may compete with the frictional effected of the wind in packing the ice. Finally it is demonstrated that the integrated horizontal mass transports in the open ocean and under the ice do not match, which leads to upwelling in the vicinity of the ice edge.