ON THE SURFACE SIGNATURE OF INTERNAL WAVES IN THE OCEAN

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Based on a Hamiltonian formulation of a two-layer ocean, we consider the situation in which internal waves are treated in the long-wave regime while surface waves are described in the modulation regime. We derive an asymptotic model for surface-internal wave interactions, in which the nonlinear internal waves evolve according to a KdV equation while the smaller-amplitude surface waves propagate at a resonant group velocity and their envelope is described by a linear Schrodinger equation. In the case of an internal soliton of depression, for small depth and density ratios of the two layers, the Schrodinger equation is shown to be in the semi-classical regime in analogy with quantum mechanics, and thus admits localized bound states. This leads to the phenomenon of trapped surface modes, which propagate as the signature of the internal wave, and thus it is proposed as a possible explanation for bands of surface roughness above internal waves in the ocean. Some numerical simulations taking oceanic parameters into account are also performed to illustrate this phenomenon. This is joint work with Walter Craig and Catherine Sulem.