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The spectral evolution of surface waves and interfacial waves in a strongly stratified ocean.

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Surface waves in intermediate to large water depth are commonly treated as deep water waves in a homogenous fluid, and the non-linear evolution of the spectrum is governed by four-wave interactions. However, three-wave resonant interactions are possible in a two-layer fluid, even if the total water depth is much greater than the dominant wave length. In particular, the so-called class III resonance between two surface waves and an interfacial wave, all travelling in the same direction, might be relevant to ocean waves in the presence of a shallow, strongly stratified surface layer. These interactions are limited to high wavenumbers and the range depends on the density ratio of the two layers, and the thickness of the surface layer relative to the dominant wave length.
We use a numerical spectral model to map out the parameter range of idealized but realistic oceanic conditions of these three-wave interactions, and track the evolution of the surface and interfacial wave spectra. The most prominent effects are the steepening of short surface waves, which results in an increased energy dissipation due to wave breaking, and the generation and growth of interfacial waves, which might contribute to interfacial mixing.
This process is likely to be relevant to the evolution of the surface wave field in the increasingly ice-free Arctic where an often shallow, cold and fresh surface layer overlays a saltier and warmer layer, and the generated interfacial waves could contribute to warming of the surface waters.