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On the generation of internal wave modes by surface waves

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Internal gravity waves play an important role in the ocean since they transport energy and momentum and the can lead to mixing when they break. Surface waves and internal gravity waves can interact. On the one hand, long internal waves imply a slow varying shear current that modifies the propagation of surface waves. Surface waves generated by the atmosphere can, on the other hand, excite internal waves by nonlinear interaction. Thereby a surface wave packet consisting of two close frequencies can resonate with a low frequency internal wave (Phillips, 1966). From a theoretical point of view, the latter has been studied intensively by using a 2-layer model, i.e. a surface layer with a strong density contrast and an internal layer with a comparable weak density contrast (Ball, 1964; Craig et al., 2010). In the present work we analyse the wave coupling for a continuously stratified fluid using a fully non-linear 2D numerical model (OpenFoam) and compare this with laboratory experiments (see Lewis et al. 1974). Surface wave modes are used as initial condition and the time development of the dominant surface and internal waves are studied by spectral and harmonic analysis. For the simple geometry of a box, the results are compared with analytical spectra of surface and gravity waves.

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