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Interaction of acoustic-gravity waves with an elastic shelf-break

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In contrast to surface gravity waves that induce flow field which decays exponentially with depth, acoustic-gravity waves oscillate throughout the water column. Their oscillatory profile exerts stresses to the ground which provides a natural explanation for the earth's microseism (Longuet-Higgins, 1950).

This work is an extension of the shelf-break problem by Kadri and Stiassnie (2012) who considered the sea floor and the shelf-break to be rigid, and the elastic problem by Eyov et al. (2013) who illustrated the importance of the sea-floor elasticity. In this study we formulate and solve the two-dimensional problem of an incident acoustic-gravity wave mode propagating over an elastic wall and interacting with a shelf-break in a weakly compressible fluid. As the modes approach the shelf-break, part of the energy is reflected whereas the other part is transmitted. A mathematical model is formulated by matching particular solutions for each subregion of constant depth along vertical boundaries; the resulting matrix equation is then solved numerically. The physical properties of these waves are studied, and compared with those for waves over a rigid bottom. The present work broadens our knowledge of acoustic-gravity-waves propagation in realistic environment and can potentially benefit the early detection of tsunami, generated from landslides or submarine earthquakes.

References

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