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L. Pellet, P. Christodoulides, S. Donne, C.J. Bean, F. Dias

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Pressure induced by the interaction of water waves with nearly equal frequencies and nearly opposite directions

L. Pellet,[1] P. Christodoulides,[2] S. Donne,[3] C. J. Bean,[4] and F. Dias[5,*]

[1]*Ecole Centrale Marseille, Marseille, France; now at France Air*

[2]*Faculty of Engineering and Technology,*

Cyprus University of Technology, Limassol, Cyprus

[3]*School of Earth Sciences, University College Dublin, Belfield Dublin 4, Ireland*

[4]*School of Cosmic Physics, Dublin Institute for Advanced Studies, Dublin 2, Ireland*

[5]*School of Mathematics and Statistics,*

University College Dublin, Belfield Dublin 4, Ireland

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Abstract We present second-order expressions for the free-surface elevation, velocity potential and pressure resulting from the interaction of surface waves in water of arbitrary depth. When the surface waves have nearly equal frequencies and nearly opposite directions, a second-order pressure can be felt all the way to the sea bottom. There are at least two areas of applications: reflective structures and microseisms. Microseisms generated by water waves in the ocean are small vibrations of the ground resulting from pressure oscillations associated with the coupling of ocean surface gravity waves and the sea floor. They are recorded on land-based seismic stations throughout the world and they are divided into primary and secondary types, as a function of spectral content. Secondary microseisms are generated by the interaction of surface waves with nearly equal frequencies and nearly opposite directions. The efficiency of microseism generation thus depends in part on ocean wave frequency and direction. Based on the second-order expressions for the dynamic pressure, a simple theoretical analysis that quantifies the degree of nearness in amplitude, frequency and incidence angle, which must be reached to observe the phenomenon, is presented.

Keywords: Ocean wave-wave interaction, pressure, microseisms

* Corresponding Author. Email: frederic.dias@ucd.ie.