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A Comparison between Oceanographic Parameters and Seafloor Pressures; Measured, Theoretical and Modelled, and Terrestrial Seismic Data

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Microseisms are continuous seismic vibrations which propagate mainly as surface Rayleigh and Love waves. They are generated by the Earth's oceans and there are two main types; primary and secondary microseisms. Primary microseisms are generated through the interaction of travelling surface gravity ocean waves with the seafloor in shallow waters relative to the wavelength of the ocean wave. Secondary microseisms, on the other hand are generated when two opposing wave trains interact and a non-linear second order effect produces a pressure fluctuation which is depth independent.

The conditions necessary to produce secondary microseisms are presented in Longuet-Higgins (1950) through the interaction of two travelling waves with the same wave period and which interact at an angle of 180 degrees. Equivalent surface pressure density (p2l) is modelled using the numerical ocean wave model Wavewatch III and this term is considered as the microseism source term. This work presents an investigation of the theoretical second order pressures generated through the interaction of travelling waves with varying wave amplitude, period and angle of incidence.

Predicted seafloor pressures calculated off the Southwest coast of Ireland are compared with terrestrially recorded microseism records, measured seafloor pressures and oceanographic parameters. The work presented in this study suggests that a broad set of sea states can generate second order seafloor pressures that are consistent with seafloor pressure measurements.

Local seismic arrays throughout Ireland allow us to investigate the temporal covariance of these seafloor pressures with microseism source locations.