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Towards a quantification of ocean wave heights off the west coast of Ireland using land based seismic data

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Ocean gravity waves are driven by atmospheric pressure systems. Their interactions with one another and the production of standing waves in the water column generate pressure changes at the sea floor. These pressure fluctuations are the cause of continuous background seismic noise known as microseisms. The levels of microseism activity vary as a function of the sea state and increase during periods of intensive ocean wave activity.

In 2011 a seismic network was deployed along the west coast of Ireland to continuously record microseisms generated in the Atlantic Ocean. This project aims to determine the characteristics of the causative ocean gravity waves through calibration of the microseism data with ocean buoy data. In initial tests we are using a Backpropagation Feed-forward Artificial Neural Network (BP ANN) to establish the underlying relationships between microseisms and ocean waves. If successful these tools could then be used to estimate ocean wave heights and wave periods using a land-based seismic network and complement current wave observations being made offshore by marine buoys. Preliminary ANN results are promising with the network successfully able to reconstruct trends in ocean wave heights and periods.

Microseisms can provide significant information about oceanic processes. With a deeper understanding of how these processes work there is potential for 1) locating and tracking the evolution of the largest waves in the North-East Atlantic and 2) reconstructing the wave climate off the west coast of Ireland using legacy seismic data on a longer time scale than is currently available using marine based observations.