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Using DAS with an Optical Fibre Cable in Galway Bay for Ocean Noise Monitoring

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The oceans are a vast and dynamic part of our planet's ecosystem, especially in a geophysical and oceanographic sense. The sea state is naturally constantly changing as a result of underlying currents, ocean surface waves and the tides. Alongside this, the acoustic and seismic noise fields are also highly diverse with a plethora of natural (marine wildlife, ocean microseisms, earthquakes) and anthropogenic (ship traffic, seafloor construction) sources. Distributed acoustic sensing (DAS) applied on submarine fibre optic cables offers a means of unprecedented spatial resolution within the ocean environment for detailed analysis of seismic and acoustic noise. With telecommunication optical fibres around the globe, there's a wealth of information waiting to be tapped into.

Within this research project a 10 day long DAS dataset, acquired using a Febus Optics interrogator, from an optical fibre (5.56km length) connected to the Galway SmartBay offshore laboratory is being studied to characterise the submarine seismic and acoustic noise fields. In order to understand the cable sensitivity to seismic and acoustic signals present in the bay during the experiment, we compare the DAS data with data from other instruments such as seismometers (Irish National Seismic Network), hydrophones and wave buoys (both Galway SmartBay and Marine Institute Ireland).

The spectrum of the noise field is being studied through generating spectrograms for the entire acquisition period for various channels along the cable, showing the strongest signal in the 0.1-0.2Hz frequency band, which can be attributed to ocean surface gravity waves. Analysis in the frequency-wavenumber domain is also being employed to separate the seaward and landward travelling waves. This analysis has also shown the presence of weaker signals in the 0.5-1.5Hz and 3.5-5.5Hz frequency bands which were not apparent in the initial spectrograms and could be evidence of high frequency seismic noise (>1Hz).