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A variety of surface waves in ocean-bottom DAS records

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Distributed acoustic sensing (DAS) can transform existing telecommunication fiber-optic cables into arrays of thousands of sensors, enabling meter-scale recordings over tens of kilometers. Recently, DAS has demonstrated its utility for many seismological applications onshore. However, the use of offshore cables for seismic exploration and monitoring is still in its infancy.

In this work, we introduce some new results and observations obtained from a fiber-optic cable offshore the coast of Sanriku, Japan. In particular, we focus on surface wave retrieved from various signals and show that ocean-bottom DAS can be used to extract dispersion curves (DC) over a wide range of frequencies. We show that multi-mode DC can be easily extracted from ambient seismo-acoustic noise cross-correlation functions or F-K analysis. Moderate magnitude earthquakes also contain multiple surface-wave packets that are buried within their coda. Fully-coupled 3-D numerical simulations suggest that these low-amplitude signals originate from the continuous reverberations of the acoustic waves in the ocean layer.