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Environmental Sensing with Operational Submarine Cables

We review opportunities afforded by emerging optical submarine cable-based technologies for sensing the marine environment including earthquakes, water waves and explosions. The goal of the submarine fiber sensing Working Group is to enable tsunami early warning based on operational submarine cables. Monitoring changes in water height and temperature in the deep ocean is challenging because deploying and maintaining sensors there is hard. There are more than a million kilometers of submarine telecommunication cables on the seafloor. To take advantage of these cables for geophysics, we developed a new cost-effective technology based on fiber optic sensing techniques that does not disrupt telecommunication service. We applied it to a trans-Atlantic cable between Portugal and Brazil. Comparing the observed signals to predicted ocean tide heights and seafloor temperature variations, we found that the primary reason for our observation of the ocean tidal signals could be the cable stretching and contracting in response to ocean tide pressures, and a secondary factor of strong seafloor temperature variations at shallow depths. Our findings demonstrate the effectiveness of our method for recording seafloor temperature and pressure and suggest it could be broadly useful, given the extensive length of submarine cables. Cooperation with CTBTO opens interesting opportunities.

E-mail

vkamalov@gmail.com

In-person or online preference

Primary author: Dr KAMALOV, Valey

Presenter: Dr KAMALOV, Valey

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