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New method for the detection and monitoring of subsea power cable

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Marine renewable energy farms, no matter what kind of, have in common that they need a connection with the onshore power grid. Thus, not only their offshore generation facilities could have impacts on the surrounding environment, but also associated submarine power cables. These cables have to be buried in the seabed – at least in coastal heavy shipping environments – for safety reasons. Cable laying disturbs the local seafloor and the sub-bottom. Refillment of dredged sediments are expected softer than the original material and could be washed away by currents. Therefore, buried cables have to be repeatedly monitored to ensure their burial depth.

This study presents a new method for efficient cable detection. A parametric echosounder system using 15 kHz as secondary frequency was adapted to investigate the angular response of sub-bottom backscatter strength of layered mud and to introduce a new method for enhanced acoustic detection of buried targets. Adaptations to achieve both vertical (0°) and non-vertical inclination of incident sound on the seabed (1-15°, 30°, 45°, and 60°) comprise mechanical tilting of the acoustic transducer and electronic beam steering. A sample data set was acquired at a study site at 18 m water depth and a flat and muddy seafloor. At this site, a 0.1 m diameter power cable is buried 1-2 m below the sea floor. Surveying the cable with vertical incidence revealed that the buried cable can hardly be discriminated against the backscatter strength of the layered mud. However, the backscatter strength of layered mud was found to strongly decrease at >3±0.5° incidence and the layered mud echo pattern vanished beyond 5°. As a consequence the visual recognition of the cable echo in acoustic images improves for higher incidence angles of 15°, 30°, 45°, and 60°. Data analysis support this visual impression. The size of the cable echo pattern was found to linearly increase with incidence, whereas the signal-to-noise ratio peaks at about 40°. At the peak, the signal-to-noise ratio is up to 2.6 times higher than at normal incidence. The effects are attributed to reflection loss from layered mud at larger incidence and to the scattering of the 0.1 m diameter buried cable.

Thus, the presented method is suitable for cable detection and monitoring and can also provide information of the surrounding sedimentological strati. One of its advantages is that it is based on small and mobile transducers and is therefore useable on reasonable small survey platforms. We foresee a large potential using the presented mechanic or electronic sound inclination approach for enhanced sub-bottom classification and to better detect shallow buried acoustic scatterers like cables, pipelines, stones, dumping material (mines, waste), submerged shipwrecks, archaeological settlement remains, manganese nodules and shallow gas.