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Calibration and repositioning of an optical fibre cable from acoustic noise obtained by DAS technology

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DAS (Distributed Acoustic Sensing) turns fibre optic cables used for telecommunications into multi-sensor antenna arrays. This technology makes it possible to detect an acoustic signal from a natural source such as cetacean or micro-earthquakes, or a man-made source by measuring the deformation of the cable. At sea, the coupling between the optical fibre and the ground on which it rests, as well as the calibration of the cable, is a critical point when the configuration of the cable is unknown. Is the fibre buried or suspended? What is the depth of the sensor being studied? What impact do these parameters have on the signal? The answers to these questions have an impact on the quality of the results obtained, the location of sources - seismic or acoustic - and the characterisation of the amplitude of signals are examples of this. Here, a first approach to study this calibration is proposed. Acoustic noise generated by passing ships in the vicinity of a 42km long optical fibre off Toulon, south-east France, is used to obtain signals for which the position and the signal of the source are known. Then, the synthetic and theoretical signal representing the ship's passage is modelled (3D model, AIS Long/Lat coordinates and depth, propagation speed in water c□ = 1530m/s). This simulation allows us to compare the real and synthetic signals, in order to make assumptions about the actual cable configuration. We compare the signals through beamforming, f-k diagram and time-frequency diagram in particular. The grid search approach allowed us to determine the new position or orientation of a portion of the antenna. This new position is then evaluated from the signals of different vessels.