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Seismic interval velocity in the matte of *Posidonia oceanica* meadows: Towards a non-destructive approach for large-scale assessment of blue carbon stock

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ABSTRACT

High-resolution seismic reflection data have been used over the last decades to estimate the thickness of the long-term Blue Carbon sink associated to the below-ground sediment deposit (matte) of the *Posidonia oceanica* meadows. Time-to-depth conversion of these geophysical datasets was usually performed assuming a sound velocity in this structure, but appropriate seismic interval velocity measurements is necessary to achieve accurate calibration. This study describes the first methodology to estimate the seismic interval velocity in the matte. This approach performed on the eastern continental shelf of Corsica island (France, NW Mediterranean) is based on measurements of the vertical matte profile from high-resolution seismic reflection profiles (s TWTT) and from seafloor morpho-bathymetric DTM (multibeam echosounders - MBES and Light Detection and Ranging - LiDAR surveys) calibrated with ground-truthing data. A biogeosedimentological analysis of horizontal cores sampled in vertical matte escarpments has been undertaken to identify the potential relationship of sediment and environmental parameters with sound velocity. The cross-comparison and the data intercalibration show significant correlation of MBES ($R^2 = 0.872$) and LiDAR datasets ($R^2 = 0.883$) with direct underwater measurements. Seismic interval velocities ($n = 367$) have been found to range between 1631.9 and 1696.8 m s^{-1} (95% confidence interval) and are estimated on average at 1664.4 m s^{-1}, which is similar to the literature for unconsolidated marine sediments. The prediction map provided by the ordinary kriging method emphasized, however, a high variability of sound velocity within the study area. The results showed that changes in sound velocity in the matte are positively and strongly correlated with sand and gravel content and environmental factors such as distance to coastal river mouths and coastline. However, it was found that a negative relationship linked sound velocity with total and coarse organic content of matte deposits.

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