



# PROSE+ : PProject for Offshore research by Seismic and geo-Electrics methods

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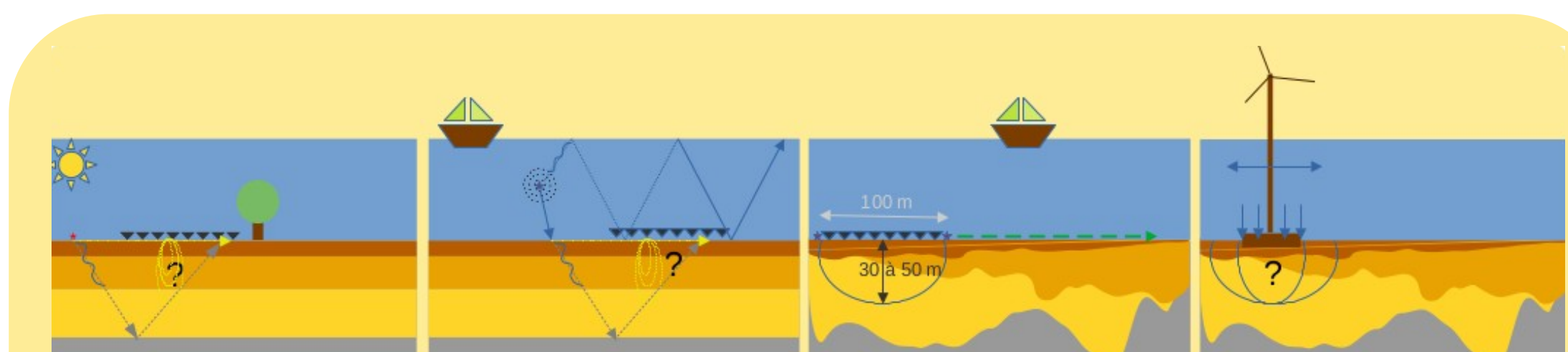
## Context and challenges

**When siting offshore wind turbines in a pre-defined zone :** one needs to know the mechanical parameters of the subsoil and their local variations. Geotechnical surveys provide information at depth but are 1) localised at the survey-hole, 2) destructive (boreholes) and 3) expensive.

→ **We propose to** adapt and extend on-shore non destructive geophysical methods to the marine environment for quantitative assessment of the mechanical properties and their local variations based on the seismic surface waves and geo-electrics techniques.

**The purpose of this first study** concerns the seismic part of the project for which the major key issues are as follows :

- Optimizing the sensors and measurement configuration for recording Seismic interface waves that propagate in the shallower part of the geological medium at the seafloor interface, known as Scholte waves, different from body waves classically used in seismic marine method
- validating numerical tools developed for 2D variations of the underground medium in context of marine seismic data.



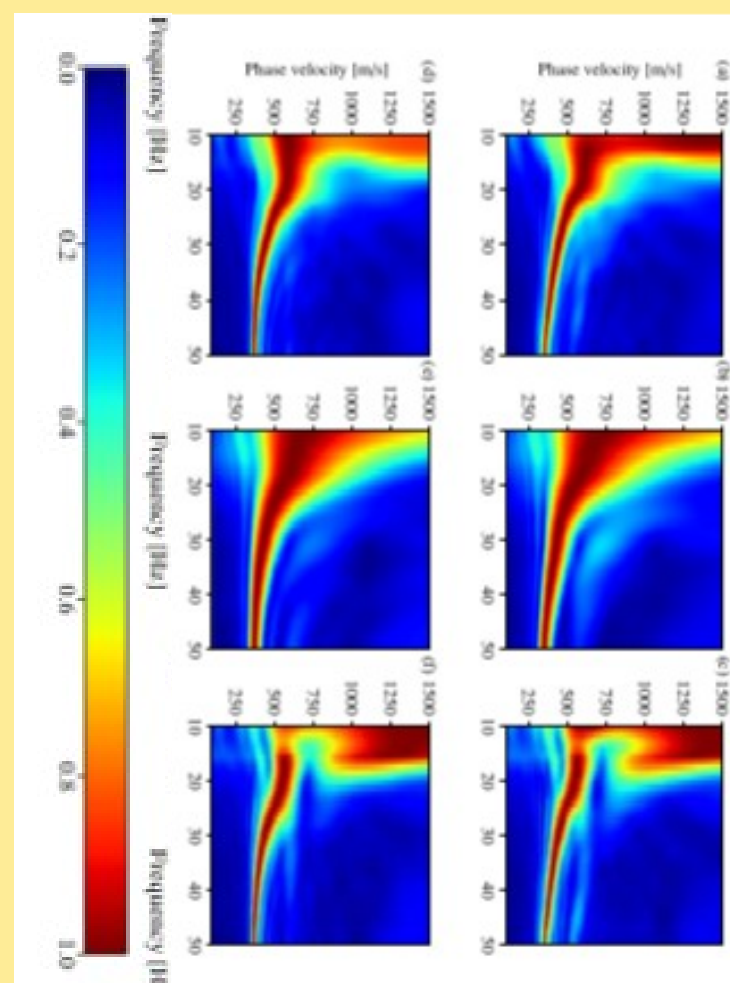
« Adpatation and extension of on-shore seismic method in marine environment for quantitative assessment of mechanical properties in 2D media »

## Objectives

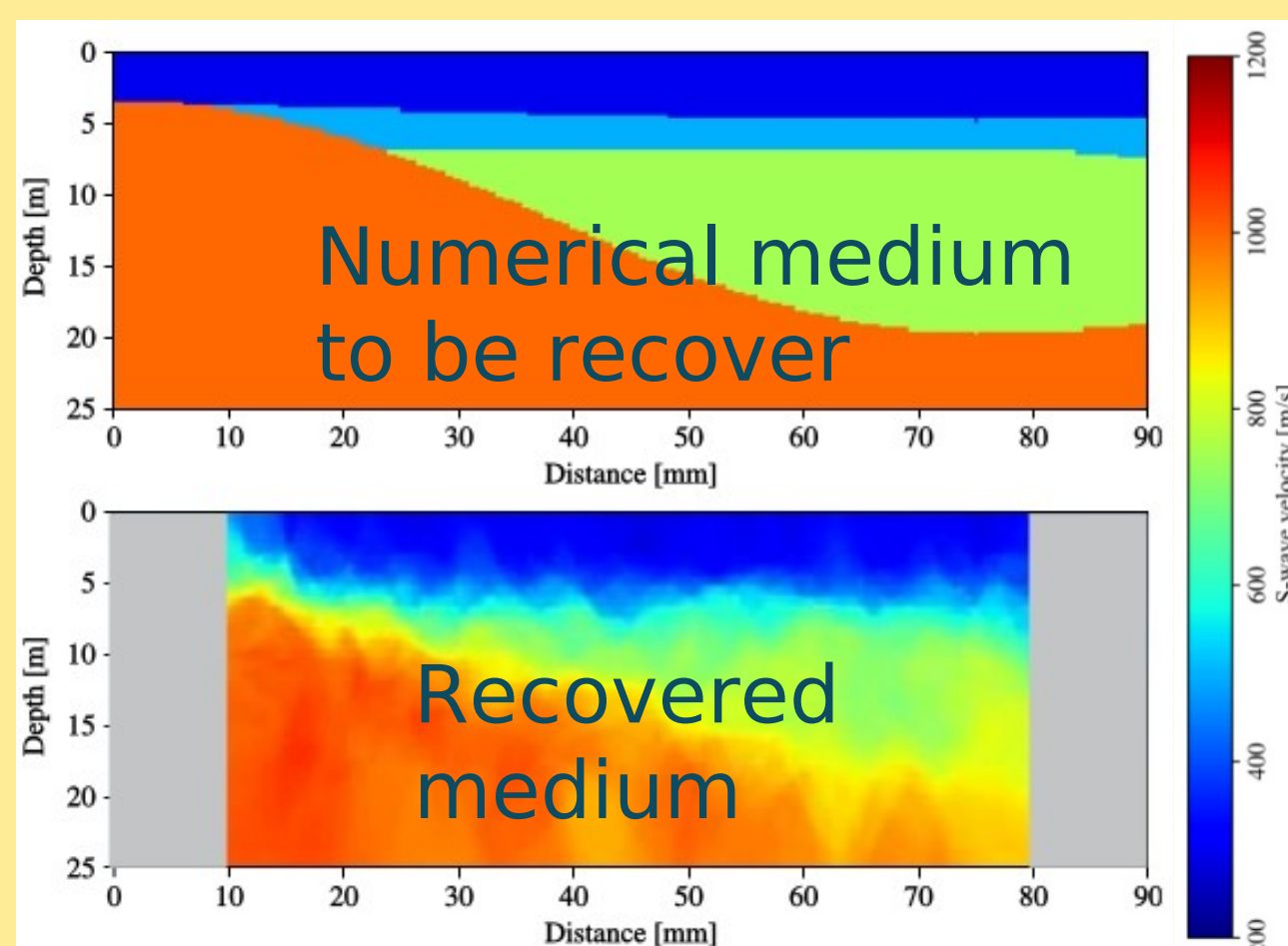
- Providing measurement in 2D media in real marine environment at scale 1
- Testing different new configurations of seabed sensors and source depth for optimizing Sholte waves in wind-turbine offshore context

## Numerical results

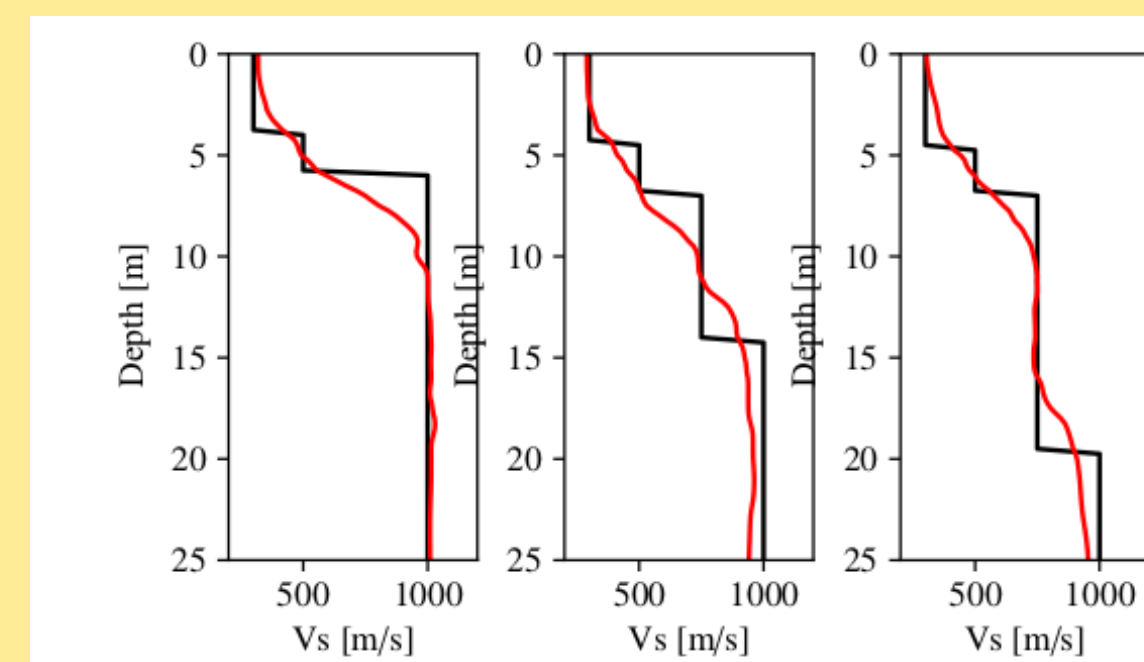
2D imaging method using interface waves developed for marine underground medium (Pageot et al., 2020)



Numerically simulated data (dispersion diagrams) for inversion using particle swarm optimization.



The colours correspond to the velocities of S waves linked to the shear modulus



3 depth profiles for 3 positions of the medium to be recovered (black lines) and the recovered medium (red lines).

## Offshore tests

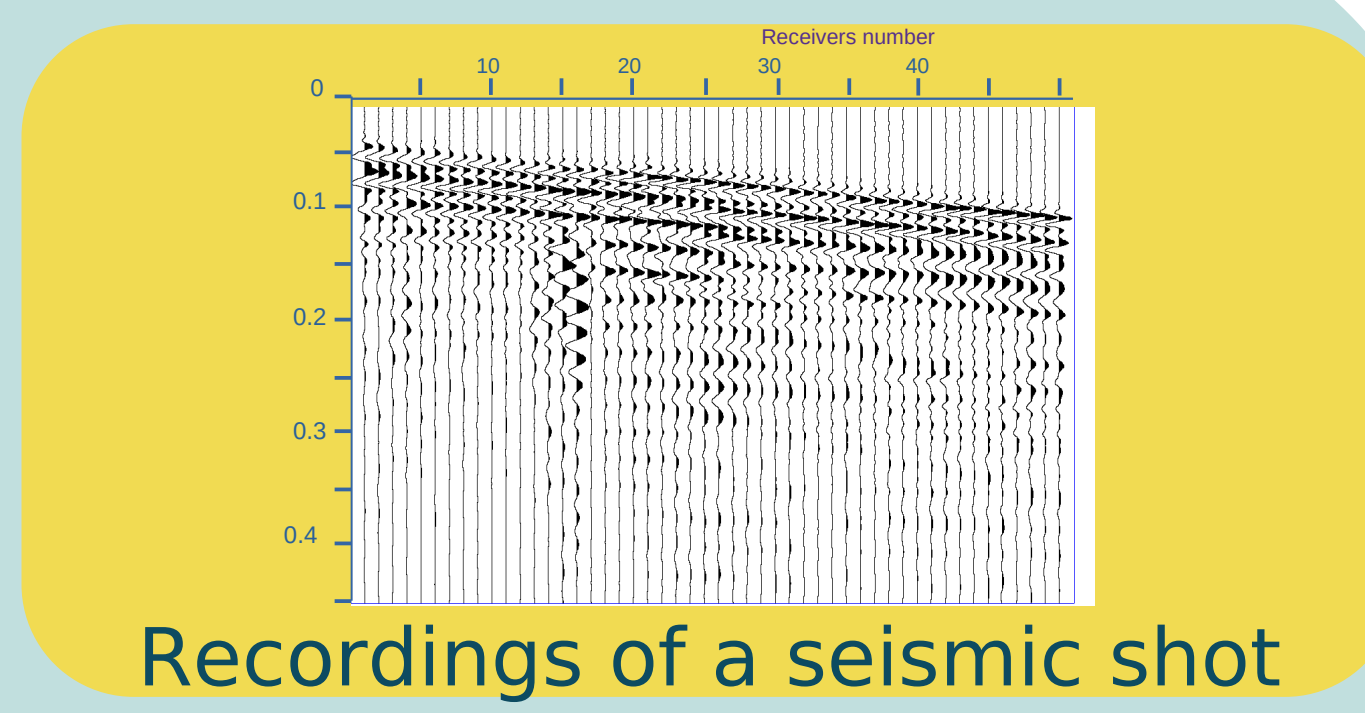
Measurements from the seabed at a depth of 30 m off Concarneau (Brittany, France) in September and October 2023



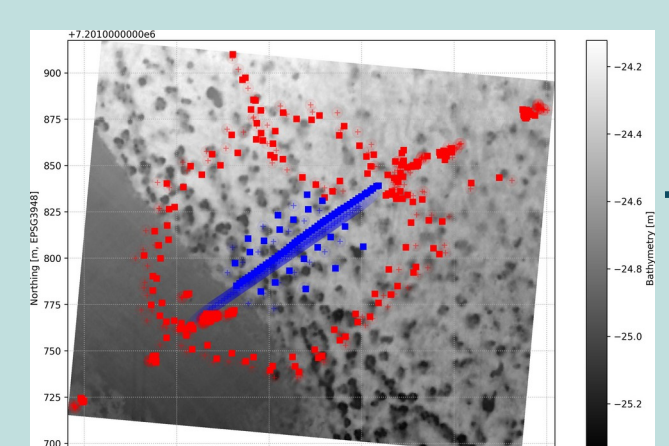
Measurement Location



Deployment of receiver lines by workboat operated by Sercel



Recordings of a seismic shot

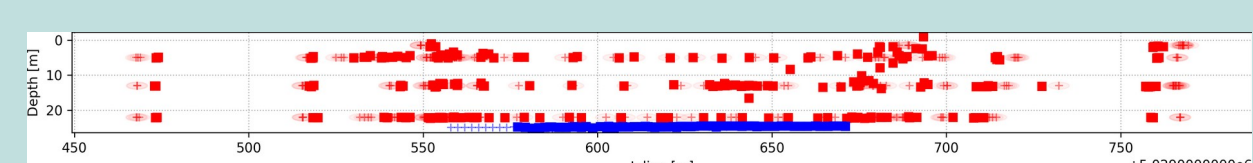


5 lines of receivers  
The main line in the centre comprises 50 nodes spaced 2 m apart



Control and adjustment of receivers positions by Ifremer divers

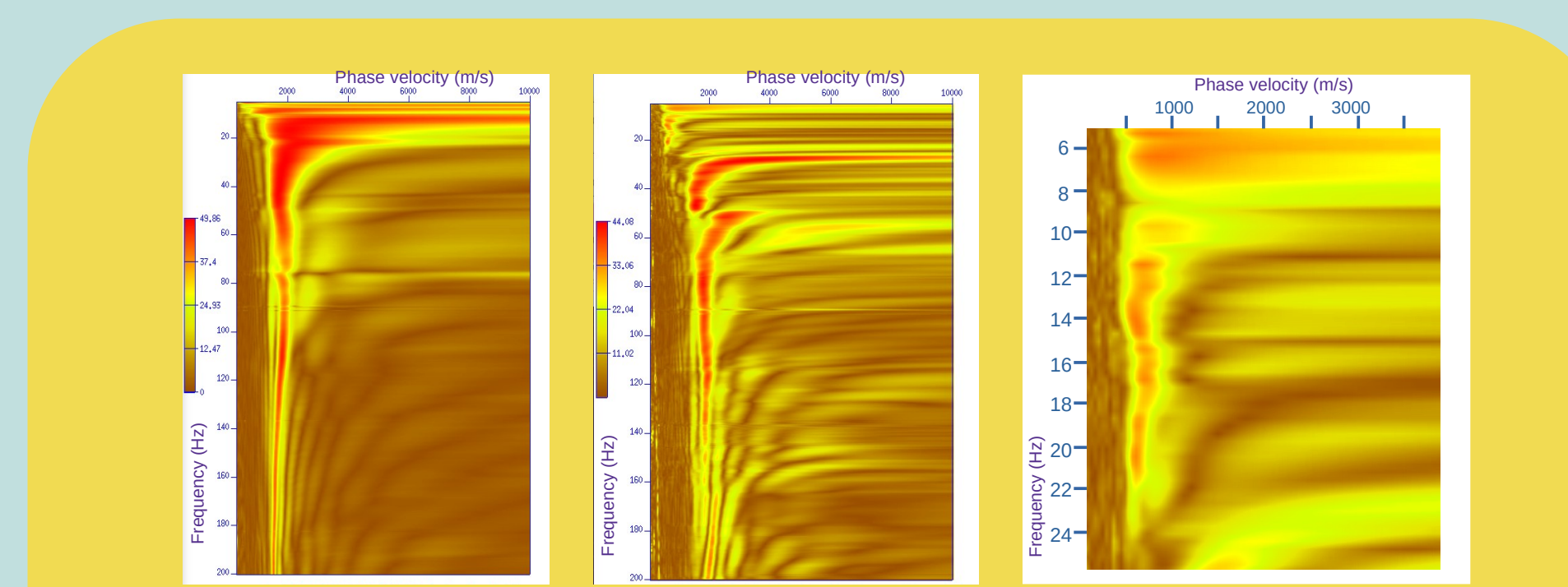
241 source positions (red points)  
And 70 receivers positions (blue points)



Source depths (red points)  
And receivers depths (blue points)



Seabed receivers : 4C GPR Nodes from Sercel



Dispersion diagrams calculated from recordings of seismic shot by (a : hydrophones, b : vertical accelerometers c : zoom of b). Source depth : 5 m above the seafloor

The first data analysis of this measurement campaign shows the interest of using seabed accelerometer sensors for assessing the dispersion diagrams in the aim to image the subsurface as well as the importance of the source depth.

## References and Aknowledgements

Pageot D., Leparoux D., Capdeville Y. and Côte P., 2018, Alternative surface wave analysis method for 2D near-surface imaging using particle swarm optimization, Oral Pres, 3<sup>e</sup> Applied Shallow Marine Geoph Conf, 10-12 sept 20

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