



ChEESE

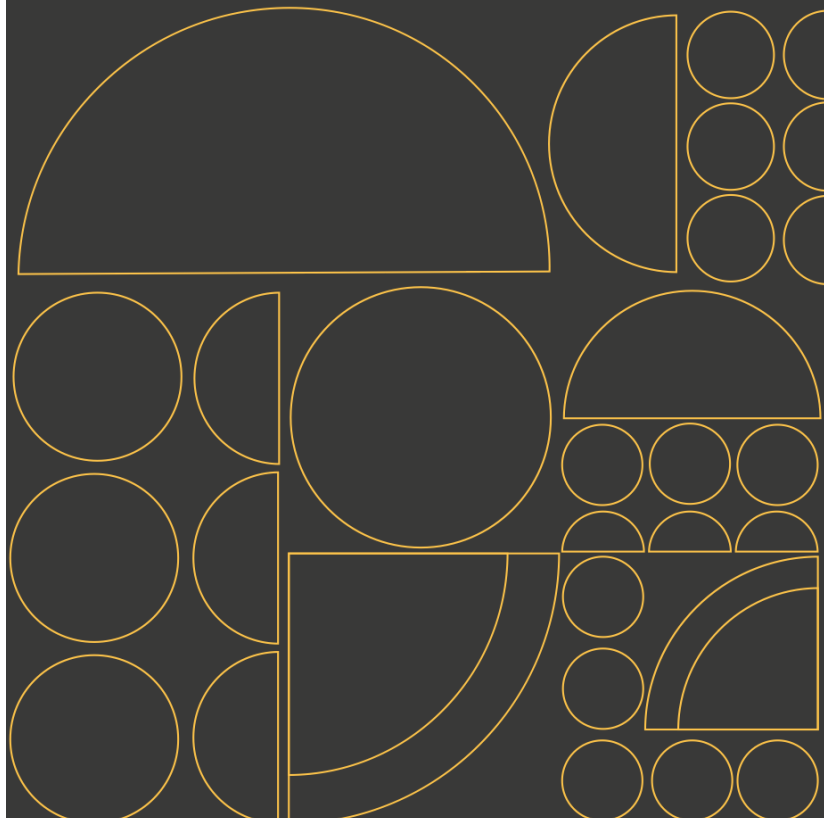
**SC1.1. (potential SGC)
Anthropogenic noise and
seismicity, wave propagation at
higher frequencies in the Bay of
Hyères (France)**

General Assembly, Reykjavik (Iceland), 17-19
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CNRS-LMA



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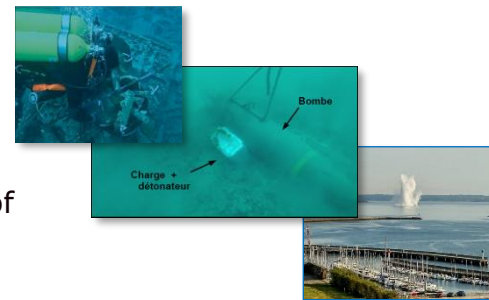


Context & General Objectives

Historical unexploded ordnance (UXO) from WWII almost weekly discovered in the French marine areas

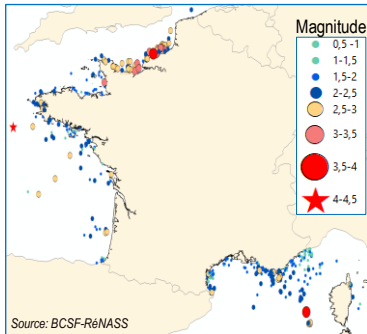
Need to be cleared to guarantee safety for people and to secure areas prior to deployment of offshore wind farms

Procedure operated by the French Navy : **higher-order detonation** on seabed



01

Seismic risks



2020-2022 : **675 earthquakes ($M < 3.8$)** generated by the detonation of large-charge UXO (> 50 kg TNT eq.)

02

Noise impact on marine life

Impulsive, highly-energetic sounds and strong seabed vibrations



Context & General Objectives

01

Develop a decision-support tool, based on **reliable numerical modeling of wave propagation**, that would enable to assess, upstream of the UXO disposal (underwater explosion):

- **the seismic risks** and the potential damage on coastal buildings
- **the underwater noise pollution** and the impact on marine biodiversity

02

According to UXO disposal conditions, seek for **mitigation solutions**

Synergy with



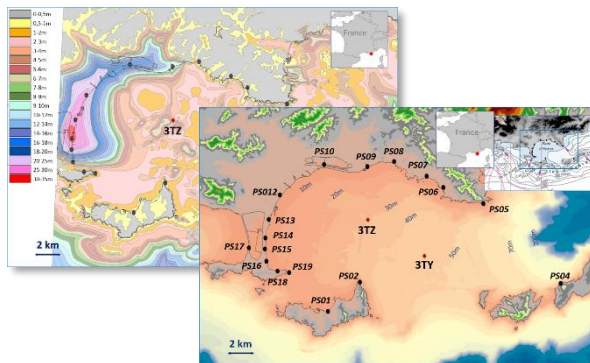
(2024-27)

Innovative marine soundscape characterization
to effectively mitigate ocean and sea noise pollution

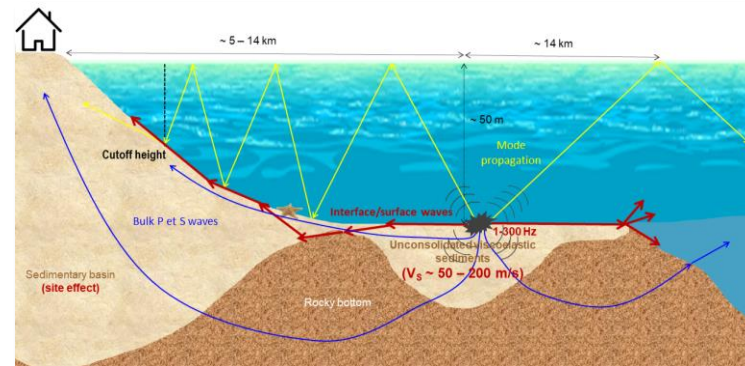
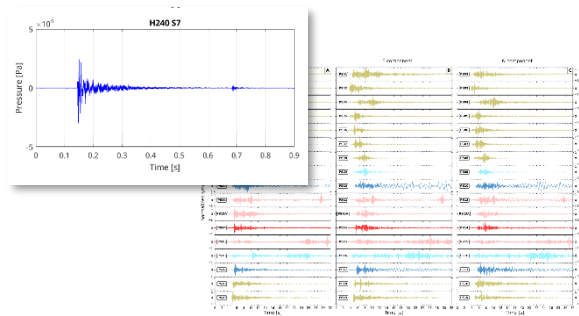


Research challenges

Case of UXO disposal in the Bay of Hyères (France)



Favretto-Cristini et al. 2022 IEEE JOE (Parts I & II)
Bonnin et al. 2023 Bull. Seism. Soc. Am.



Generation of **complex seismo-acoustic wave propagation in the LF range (1-150 Hz)** depending on

- the location of underwater explosion
- the environment properties (e.g., geometry, presence of islands, presence of sedimentary basins, bathymetry, etc.)

2D modeling or approximate methods not suitable

Need for a 3D full-wave modeling

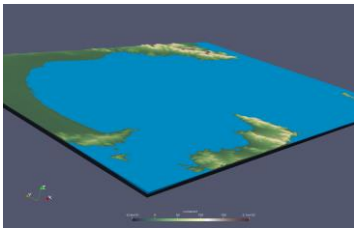
Technical challenges

Spectral Element Method implemented in **SPECFEM 3D**

01

Mesh of the environment

- Large domain : 20 km x 15 km x 1 km
- Up to 100 Hz/150 Hz
- Fluid/solid interface
- Low shear-wave velocities in the sediments : ~ 200 m/s
- Coast zone



02

Computation

- Call : capability, extreme, Leonardo, oct. 2024
- $\sim 5\,000$ GPUs (100 Hz), full machine required for 150 Hz

