2021 OCEAN ENERGY EUROPE

WESE

WAVE ENERGY IN SOUTHERN EUROPE

ENVIRONMENTAL MONITORING

[1]Bald, J., [1]Galparsoro, I., [1]Menchaca, I., [1]De Santiago, I., [1]Uriarte, A., [1]M.C. Uyarra, [1]S. Pouso, [1]I. Muxika, [2]Cruz, E., [3]Torre-Enciso, Y., [3]Marina, D., [4]Etxaniz, P., **[4]De Miguel, B.**, [5]Felis, I., [5]Madrid, E., P., [6]Leitao, J.C., [7]Pech, M., [7]Nyman, N.J.C.

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This project has been funded by the European Union

AZTI MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

WavEC Offshore Renewables

IDOM

BiMEP Biscay Marine Energy Platform

CTN

WAVEROLLER by AW-Energy

HIDROMOD

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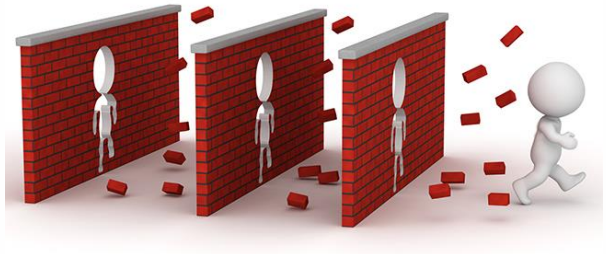
WAVE ENERGY
IN SOUTHERN EUROPE

WESE Project



The main objective of WESE project is to contribute to **overcome** the **non-technological barriers** that could hinder the future development of Wave Energy (WE) in EU

(i) the environmental risk and **uncertainty** about the potential **environmental impacts** of WE developments;

(ii) the need of a **Maritime Spatial Planning (MSP)** approach to overcome the potential competition and conflicts between WE and other marine users;

(iii) the complex and long environmental **consenting processes**

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HOW?

(1) Environmental Research Strategy

(2) Strategy for Planning and Consenting Procedures

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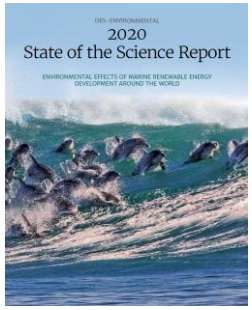
WESE Project



Environmental Research Strategy based on

Monitoring:

(i) Underwater noise

(ii) Seafloor Integrity

(iii) EMF

Modelization:

(i) Underwater noise

(ii) Marine dynamics

(iii) EMF

Sharing data:

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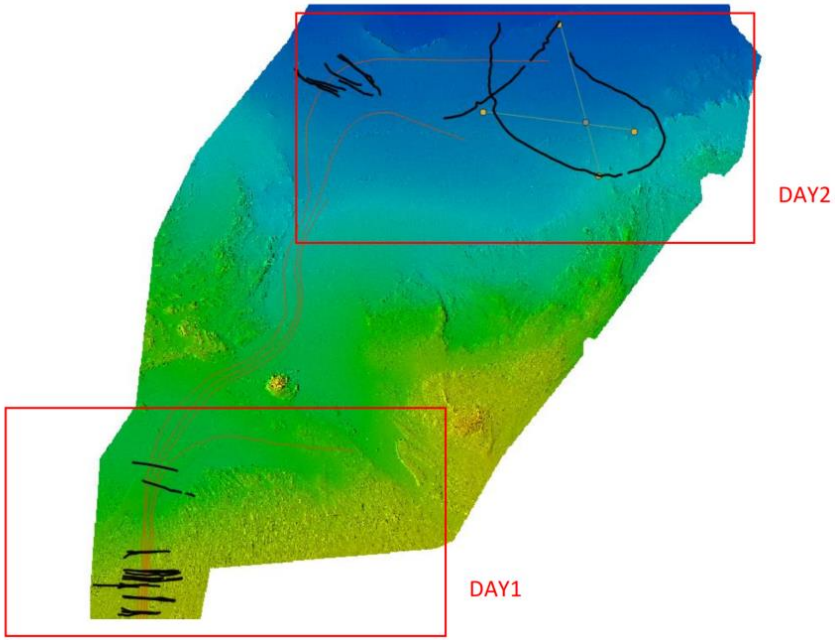
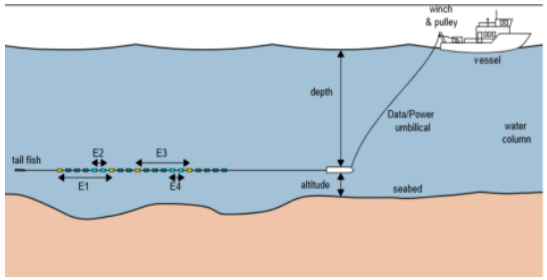
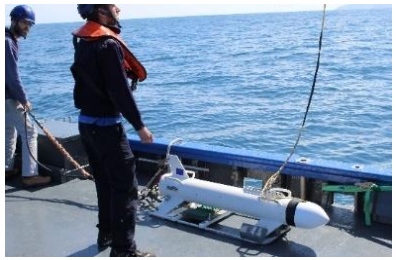
EMF

MARMOK-A-5 EMF survey

- Magnetic and electric field measurment
- Offshore towed instrument
  - 3-axis fluxgate magnetometer (≤10pT/vHz)
  - 4 Electric dipoles (≤1nV/vHz)
  - USBL and altitude sensor
- At least 5 transects perpendicular to the cable







No electromagnetic signature from the cable could be found -> Potential reasons:

- Sea conditions were very calm during the survey (Hs<1m) -> small power generation, thus small phase currents (estimated at 0.26Amps) .
- Instrumentation distance to seabed (around 5m in average).
- A potential faulty vessel generator was inducing a 53Hz EMF signal, visible in the spectrograms. This could have masked any small cable EMF signals.

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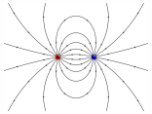

EMF

LESSOSN LEARNT

- The EMF campaign should be coordinated with the project developer, to **guarantee the device is operating**.
- The campaign should be conducted in **sea-states which are relevant for WEC power production**, so the EMF generated outside of the cable is distinguishable of the naturally occurring EMF.
- If it's not possible to operate the towed instrumentation in higher sea-states, e.g. due to vessel operability limitations, it should be **considered a different methodology** consisting of:
  - Fixed **sea-bottom instrumentation**,
  - **Installed as close as possible to the cable surface, accurate distance measurement** whenever possible.
  - The duration of each campaign should allow to **capture different WEC operation regimes**, which is more realistic towards the end goal of measuring real-operation impact of EMF by the power cables.

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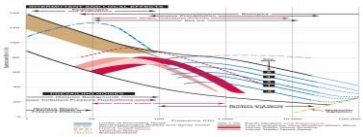


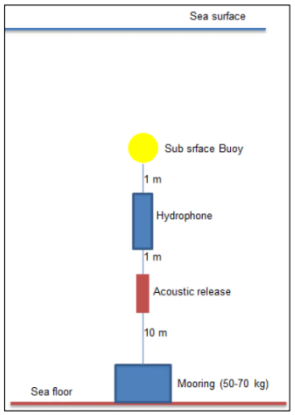
UNDERWATER NOISE

Mutriku power plant and MARMOK-A-5
During operation

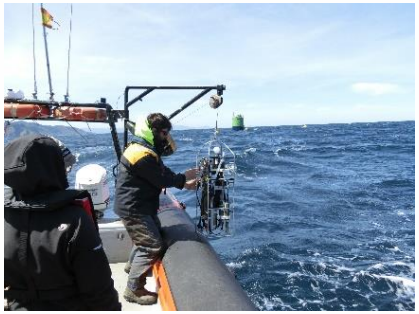
Temporal monitoring
- 1 moored hydrophone per WEC
- 10 min/h for 42 days
- Sampling frequency: 192 kHz

Mobile monitoring
- 5 min/location
- 1 day duration campaigns
- Sampling frequency: 192 kHz

Fixed hydrophone installation scheme



Mobile monitoring



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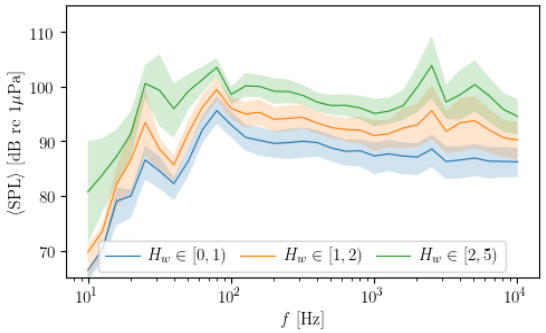

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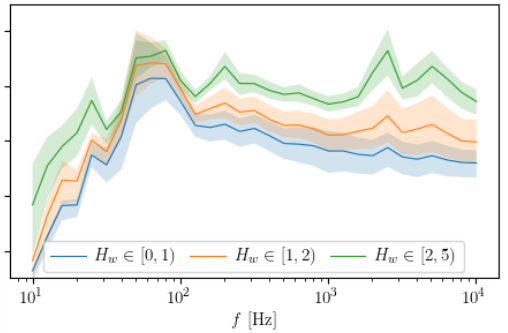

- Chains: 2500-5000 Hz signature that increases with wave height.
- Hull/turbine: 40-120 Hz more or less constant through wave height.

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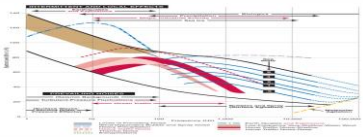

UNDERWATER NOISE

LESSOSN LEARNT

- **Temporal monitoring** is the most useful
  - **1-2 months** seems enough.
  - Greater variability could be captured by **sampling in different seasons**.

- Hydrophones should be moored at distances not too far from the source
  - We recommend **< 200 m from the devices**.

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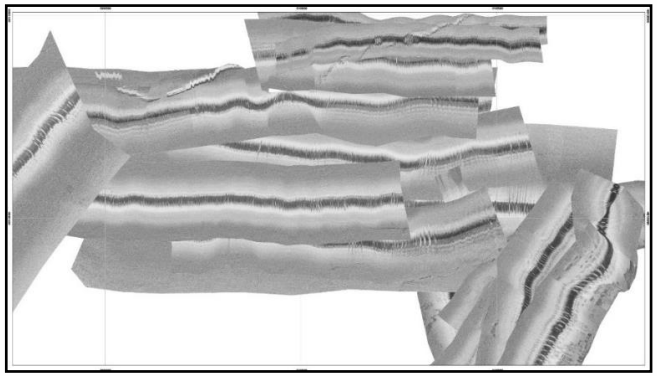
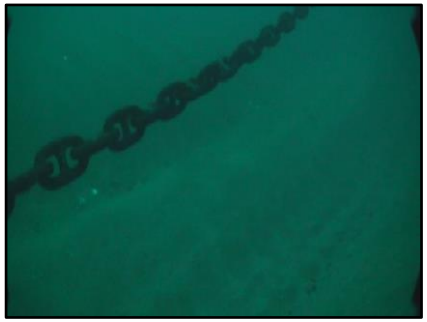
SEAFLOOR INTEGRITY

Side-scan SONAR



- **Mostly sandy bottoms** with SSW-NNE crest direction ripples
- **Rock outcrops** were also observed

Video recordings ROV



- Sections of the **moorings and the cable moving over the sediment** physically impact on sediment morphology, **removing the ripple marks in the area**
- The **affected area is estimated to be ~0.1%** (250-300 m^2) **of total occupied area** (290.000 m^2)

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SEAFLOOR INTEGRITY

LESSOSN LEARNT

- **Appropriate sea conditions are essential** for operating both the ROV and the side-scan SONAR:
    - Towed systems, such as the side-scan SONAR used in BiMEP, are extremely dependent on wave height and wind speed, that prevent the towing vessel from maintaining fixed heading and constant speed. This causes **vertical and horizontal displacements and low quality in the data acquired**.
    - In highly hydrodynamic areas and events, it is also **difficult for both the side-scan SONAR and the ROV to maintain heading and speed.**
- **Operating the ROV**
    - **Fixed heading and constant speed**, together with **position tracking**, increase the value of the data acquired by the ROV and may **allow for quantitative analyses**.
- Video sampling is an **appropriate non-destructive monitoring technique** (unless more precise quantification is required)
- The **impact caused by the devices, moorings and anchors of surveyed devices seem local** and affects a non-significant area compared to the total occupied area

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Lessons learnt

Seafloor integrity

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