PhD Topic

Impact of storm waves on defence structures: the case of the Artha breakwater (Saint Jean de Luz - France)

Study area and storm wave impacting the Artha breakwater

Supervision

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Funding Program

PSGAR CORALI

Research Laboratory

Laboratoire SIAME (Anglet, 64)

Salary

In accordance with the French government recommendation

Duration

3 years from September 2025

Topic description

The overall aim of this research project is to gain a better understanding of the impact of storm waves on defence structures, in the specific context of rocky coastlines. The study site is the Artha breakwater protecting the bay of St Jean de Luz, which is regularly monitored by the IVS team of the SIAME laboratory, combining measurements of impact pressures during storms using an autonomous system (Poncet et al., 2022), hydrodynamic measurement campaigns during winter and photogrammetric monitoring. In particular, we aim to understand how storm waves are able to move 50t concrete blocks to the top of the dike on this particular site. The applications of this

work concern both coastal engineering (in-situ structure behaviour) and geosciences (cyclopean block displacements - e.g., Cox et al., 2018).

The specific objectives of the thesis work include:

- Upstream of the impact on the seawall, understanding wave transformation in this type of environment, which is distinguished from sandy beach systems by high roughness associated with complex bathymetry. Based on existing experimental data and various spectral and/or phase-resolved wave models, we will seek to discriminate the processes involved in the transformation along the foreshore: breaking, friction, refraction, spectral transfers,

- In the near-field of the structure, Navier-Stokes modeling will be deployed to understand and predict the forces imposed on the blocks by the largest waves documented in existing databases,

- The final part of the work will focus on fluid-structure interaction, via modeling and theoretical analysis, to understand why and how the concrete blocks that make up the breakwater's armor can be mobilized by waves.

Cited references

Cox, R., Jahn, K. L., Watkins, O. G., & Cox, P. (2018). Extraordinary boulder transport by storm waves (west of Ireland, winter 2013–2014), and criteria for analysing coastal boulder deposits. Earth-Science Reviews, 177, 623-636.

Poncet, P. A., Liquet, B., Larroque, B., D'Amico, D., Sous, D., & Abadie, S. (2022). In-situ measurements of energetic depth-limited wave loading. Applied Ocean Research, 125, 103216.

Requested background and skills

Master in physical oceanography, fluid mechanics or applied mathematics. Background on nearshore wave dynamics will be highly appreciated.

Application

Documents to send: 1 CV, covering letter, Master 2 grades and 2 letters of recommendation. Application deadline: **May 15, 2025**.

Aspects of the application to be highlighted: interest in the subject and research, theoretical knowledge and methodological skills related to the subject, ability to write in French and English, ability to integrate into the team.

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