WAVE TRANSFORMATION OVER A STEEP COMPOSITE COASTAL BREAKWATER, IN-SITU EXPERIMENT RESULTS

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INTRODUCTION

South west of France is exposed to an energetic wave climate (Dodet 2010). Coastal structure in that area are submitted to extreme wave conditions that can be destructive. In order to better understand wave impact on breakwater and in the lineage of experiments by De Rouville (1938) and Bullock (2007), a set of pressure sensors have been embedded in the submerged armor and in the wall of the Artha breakwater in St-Jean Luz, bay of Biscay. A first analysis of impact pressure by Larroque et al. (2018) showed the difficulty to predict the most critical impacts from offshore statistics only and calls for finer investigations on wave dynamics near the breakwater. While wave transformation over low to mild sloping beaches have been widely studied, shoaling, breaking, reflection and dissipation over steep and very rough slopes are much less documented, (Van der Meer 1992 ;Dodet et al. 2018) especially in situ. Having detailed measurements of wave transformation in the breakwater block armor will therefore provide key informations to predict wave impact pressure on the structure.

DESCRIPTION OF THE EXPERIMENT

During fall 2018 a measurement campaign was conducted close to the Artha breakwater. Offshore spectral parameters were measured at a directional wave buoy in 20 m water depth, 1 km offshore. A directional currentmeter was installed at the foot of the block armor unit at 15m deep while five pressure sensors were attached directly on the concrete blocks to obtain a complete cross-shore survey of wave transformation over the armor. In addition, high frequency impact pressure measurements are carried out on the dike wall together with ponctual video recordings of wave impacts. The whole setup therefore provides a unique comprehensive in-situ dataset of wave transformation over a coastal breakwater.

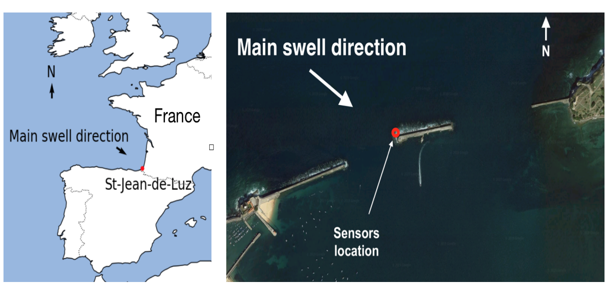

Figure 1 - Situation of the experiment

METHOD AND RESULTS

The primary aim of the present study is to understand the physical processes governing the wave transformation, including reflection, shoaling, wave breaking, frictional dissipation and harmonic transfers toward infragravity band. The first focus is put on the separation of the incident and reflected wave components, in order to quantify the reflection coefficient in the swell and infragravity bands. This result is obtained from a PUV analysis of the directional currentmeter datas. The second step is to assess the extent to which the classical assumptions for nearshore wave transformation (linear theory, radiation stresses, depth averaged momentum balance, breaking point prediction, roughness parameterization) can hold in such steep and highly fractured environment. This step is conducted on the basis of pressure data from the sensor network in the block armor.
The PUV method has already demonstrated the major role of reflection in this environnement. In regard to the different conditions observed during the measurement at the directional currentmeter, the influence of water level and swell parameters on the reflection coefficient is investigated. The correlation between the reflection coefficient and high frequency impact pressure on the emerged vertical wall is finally assessed.

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