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In the nearshore area, both wave propagation and currents are influenced by the bathymetry. For a better understanding of wave – current interactions in the presence of a 3D bathymetry, a large scale experiment was carried out in the Ocean Basin FIRST, Toulon, France. The 3D bathymetry consisted of two symmetric underwater mounds on both sides in the mean wave direction. The water depth at the top the mounds was hm=1,5m, the slopes of the mounds were of about 1:3, the water depth was h=3 m elsewhere.

For opposite current conditions (U of order 0.30m/s), a huge focusing of the wave up to twice its incident amplitude was observed in the central part of the basin for T=1.4s. Since deep water conditions are verified, the wave amplification is ascribed to the current field. The mean velocity fields at a water depth hC=0.25m was measured by the use of an electromagnetic current meter. The results have been published in Rey et al [4].

The elliptic form of the "mild slope" equation including a uniform current on the water column (Chen et al [1]) was then used for the calculations. The calculated wave amplification of factor 1.2 is significantly smaller than observed experimentally (factor 2). So, the purpose of this study is to understand the physical processes which explain this gap. As demonstrated by Kharif & Pelinovsky [2], geometrical focusing of waves is able to modify significantly the local wave amplitude. We consider this process here.

Since vertical velocity profiles measured at some locations have shown significant vertical shears, further theoretical expansions have considered this shearing following the hypothesis proposed by Kirby [3]. A numerical solver for this new equation is being developed. Results obtained with this new equation will be compared to a new set of experiments. This comparison will allow us to quantify the role of a sheared current in the geometrical focusing of the wave.

References :

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