

Effects of discontinuous submerged breakwater on water surface elevation

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Abstract. Submerged breakwaters are used to prevent shore line erosion and sediment transportation. One of their advantages is low visual impact. In this paper, the effects of discontinuous submerged breakwaters over water surface elevation was numerically studied considering the extended Boussinesq equations as governing equations using MIKE21 software. The result of discontinuous breakwater was compared with a beach without breakwater. The results showed that the gap dramatically effects on surface elevation from shore line to offshore. It is also evident from results that with approaching the center of the gap, fluctuation of surface elevation is generated. It is because of passing longshore currents towards offshore through the gap which leads to an increase in sediment transportation rate. Nevertheless, transferring water mass from breakwater gap results in powerful rip currents leading to high changes on longshore wave profile.

Keywords: submerged breakwater; Boussinesq equations; wave-breakwater interaction; rip currents

1. Introduction

As waves propagate towards shore line the transformation phenomena occurs related to sea bottom bathymetry changes. The length and the height of waves moving from deep water to shallow water change and as the wave slope goes over the critical limit and waves reach the breaking line they break and most of the wave energy releases. When high waves approaching the shoreline, water fluctuations occurs leading to beach erosion and sediment transportation. Therefore, preventing land erosion by wave attacks and decreasing the impact of inducing waves on shore structures are important subjects in coastal engineering.

Breakwater is a structure which is mainly used to protect the area in its lee from wave attack. In reality, the purpose of building breakwaters is providing a sheltered area for loading and offloading of the ships; as well as to manipulate the littoral transport conditions by trapping the moving sand particles. There are different types of breakwaters like detached breakwater that is completely isolated from shore and attached breakwater that is connected to the shoreline. Both of these types of breakwaters can be floating, emerged and submerged structures.

Today the use of detached low-crested or submerged breakwaters in conjunction with beach nourishment is advised for stabilization of beaches. This is mainly related to their small

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