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Coastal processes, erosion control and shoreline management

Shoreline Changes Behind Detached Breakwaters

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A laboratory experiment and a numerical study for the wave-induced currents in the vicinity of submerged and emerged detached breakwaters were performed to study the effect of crest dimensions of an offshore breakwater on the deformation of shoreline due to on-off shore sediment transport resulted from normal wave attack. The physical study is divided into two experiments, one for the effect of the crest elevation above or under the water surface, while the other is to study the effect of crest width. The problem contains many variables which are consolidated in few non_dimensional parameters such as the relative distances from the shoreline to the structure and to the apex of the salient or tombolo, the relative breakwater length, the relative breakwater crest level and width. The results are presented in non_dimensional graphs in addition to empirical formula relating the mentioned variables. The numerical model studies the same cases which studied by the physical model and there will be a comparison between the physical and numerical model results. A series of experiments and computer runs were conducted to study shoreline changes caused by the presence of a multiple offshore breakwater due to normal wave attack. The breakwater length B, its offshore distance XB, gab width between breakwaters G are the main parameters investigated. Non_dimensional graphs and formula are presented relating the above mentioned variables with wave height, wave length, the salient size and the erosion of the shoreline. A formula of the final shoreline configuration is also presented. From this paper we can conclude that the offshore distance of the breakwater has a slight effect on the formation of the salient for both emerged and submerged breakwaters. The increase in breakwater crest height and/or crest width will result in increase in the salient amplitude. If the structure is wide enough so that, the waves will break on its crest, a turbulent current will be generated just behind the breakwater which prevents the formation of tombolo and causes a local scour just behind the structure. The transmitted waves and/or the reformed waves will cause wave set up behind the structure thus a circulating current will be generated opposite in direction to the current generated from the diffracted waves. This phenomenon will decrease the salient amplitude and prevent the formation of the tombolo. Non-dimensional formulas relating breaking wave height, breaking wave length, crest level, crest width, offshore distance and the salient amplitude are presented together with non-dimensional graphs relating the above variables.