Coastal and marine protected areas

## Numerical Study Of Detached Breakwaters

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Offshore or detached breakwaters are commonly used to protect beaches against erosion by reducing the wave energy behind these structures. Two types of offshore-detached breakwaters are used in practice; emerged and submerged breakwaters. Submerged breakwaters, introduce an additional design parameter namely the crest level. The crest level affects the amount of energy transmitted behind the breakwaters. The effect of submerged breakwaters introduces a sudden change in depth and is thus difficult to include in numerical models for calculating the nearshore wave field. The main objective of this study is to obtain a better understanding of the effects of both submerged and emerged detached breakwaters on the nearshore physical processes. For submerged breakwaters, a robust modelling technique for wave and energy transformation over its crest is accomplished by using an analytical formulation to predict the wave transmission over the crest of the breakwater. This formulation is incorporated in a wave module based on the Mild Slope Equations. The wave module includes the effects of wave shoaling, refraction, diffraction, and energy dissipation due to wave breaking in the surf zone. The wave module is coupled with a hydrodynamic module to calculate the wave-induced currents in the vicinity of the detached breakwaters. The hydrodynamic module solves the depth integrated time-averaged equations of motion in two horizontal dimensions. The numerical model is validated using published data for both emerged and submerged offshore breakwaters.