Hybrid morphological modelling of shoreline response to a detached breakwater

We present a new type of model for calculating morphological changes induced by the presence of breakwaters. The model combines a process based area model, used to calculate the sediment transport field in the two horizontal dimensions, with a simplified morphological updating scheme where the evolving cross-shore profile is described by a limited number of parameters. The hybrid morphological model is a strong tool for medium and long term modelling because it is cost effective while containing important features of the sediment transport description. Two versions of the model are developed in order to study the evolution of beach morphology: one suited for offshore breakwaters (1D model) and one mainly dedicated to coastal breakwaters (“1.5D” model). The version for offshore breakwaters is first presented and tested against field observations of salient evolution. The model is then applied to a model study of the principle correlations between evolving salients (spatial and temporal scales), the characteristic dimensions of the breakwater (distance to shore and alongshore length) and wave climate (wave height, normal and oblique wave incidence). The second version is applied to investigate in more detail the evolving morphology behind coastal breakwaters. It is demonstrated how the model is able to calculate the evolution of either salient or tombolo planforms, and furthermore it is shown that the results are in reasonable agreement with existing rules.