NEW PROCESS BASED EQUATION FOR A STATIC EQUILIBRIUM BEACH PLANFORM

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INTRODUCTION

Equilibrium planform formulations of beaches are engineering tools for providing solutions for beach erosion problems. They aim at defining the final orientation of the beach on a scale of years and thus they are used for evaluating the shoreline response due to human interference (ports, breakwaters, protection works…etc). These formulations create engineering solution to numerous coastal stability problems. The Parabolic Bay Shape Equation (PBSE) proposed by Hsu and Evans (1989) is the most used equation and allow to solve problems such as the one in Figure 1.

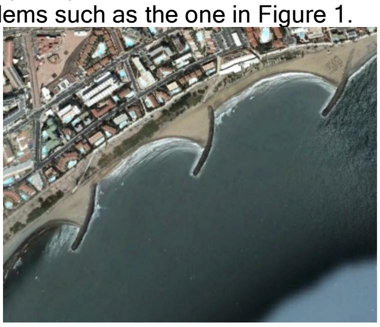

Figure 1- Beach stabilization with hard structures

However, these shape equations are valid under certain simplifications. Therefore, they are unable to determine the beach planform when the bathymetry is complex, with rocky areas or/and islands (see Fig.2).

Figure 2 - A beach with rocky zones and small islands.

The aim of this study is to present a new equilibrium beach planform equation (Gainza et al. 2018) that overcomes the problem previously mentioned. What is more, an extension of the model is presented in order to modeled the shape of a shoreline on a given day,

SCOPE OF THE PRESENTATION

First the new process based shape equation is presented in this study. Secondly, it is demonstrated that the model is able to simulate the beach planform of a given day by applying the concept of beach memory.

A new process based shape equation that is capable of determining the shoreline of complex bathymetry beaches has been developed. As it was previously mentioned PBSE cannot predict the effect of the nearshore islands or/and rocky bottom. The new static equilibrium planform equation (Eq. 1) is based on the hypothesis that a beach reaches the static equilibrium shape when the surf-zone velocity averaged over a period of time is negligible ($\bar{V} = 0$). Therefore the equation is based on the longshore current velocity formula and the three driving mechanisms are the wave obliquity (θ_{comp}), the wave height gradient (∂_{comp}) and the turbulence term (T_{comp}).

$$\bar{V} = \int_0^{X_b} \theta_{comp} + \partial_{comp} + dx = 0 \qquad (1)$$

The equation has been successfully validated by applying it to beaches with rocky zones, semi-immersed breakwater…

Additionally, combining the process based shape equation with the concept of beach memory, the beach planform shape of a given day can be modeled (see Fig.3).

Figure 3 - Beach shoreline variation due to changes in wave conditions

The memory of the beach defined as function that describes the weight of the preceding energetic conditions and their contribution in the current state of the beach is used as wave variables input (Eq.2).

$$\bar{X} = \frac{\sum(B_m F)_i \cdot X_i}{\sum(B_m F)_i}$$

Where *X* is the wave characteristic to be weighed, $B_m F$ is the weight obtained from the beach memory function and *i* refers to each sea state.

In the presentation, the findings will be explained in detailed by presenting examples in real beaches.

REFERENCES

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