Twenty-years forecast of coastline evolution on sandy coastal stretches in mainland Portugal

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Introduction: An assessment of worldwide sandy coastlines performed using satellite images suggests that about 30% of the world's coastlines are sandy [1]. Among those sandy beaches, about 25% are retreating. This retreat is usually analysed based on the time evolution of a spatial contour (i.e. coastline), that is associated with some tidal level, or based on the dune toe or vegetation line.
Besides the factors that contribute to coastline advance or retreat and from a coastal management point-of-view, coastal managers often need to plan the most appropriate interventions to be performed in the upcoming future (e.g., 20 to 100 years). This planning can be undertaken through a cost-benefit analysis among different intervention scenarios [2]. These scenarios can range from do-nothing to advance the coastline seawards. Moreover, they may consider implementing coastal protection works, such as groynes, seawalls, or soft measures, such as beach or shoreface nourishments [3,4].
In this project COBE, we used a coastline numerical model to forecast the 20yr coastline position among different intervention scenarios. This forecast was performed to five sandy coastal stretches, in the high-energy wave-dominated western coast on mainland Portugal.

Methods: Long-term forecast *O*(decades) of coastal evolution is usually performed using one-line numerical models [5]. In general, they use the sediment conservation equation to predict the future coastline position as a function of the gradients in the wave-induced longshore sediment transport rate. Therefore, they calculate wave propagation and transformation based on linear wave theory and the potential longshore sediment transport is based on semi-empirical equations (e.g., CERC equation).
Here, we used a newly developed coastline model called ShorelineS [6]. This model has the same physical processes as previous coastline models but it can handle complex shorelines due to its vectorised conceptualization.

Results: The project is still in an early stage. In more details, ShorelineS is being applied to the Aveiro coastal stretch that ranges from Costa Nova to Mira (Fig. 1). Along that stretch, several authors obtained a net longshore sediment transport value of $1x10^6$ m^3/yr directed towards South. To attain a similar value in ShorelineS, a time and space constant sediment transport factor (*qscalc*) of about 0.2 is needed to multiply by the potential longshore sediment transport rate obtained with the CERC formula.

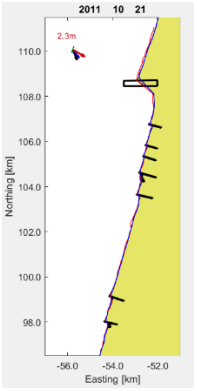

Fig. 1: *Output of ShorelineS numerical model for the coastal stretch between Costa Nova and Vagueira.*

Discussion: The required modification in the sediment transport factor is likely to incorporate uncertainties associated with: (1) the use of linear wave theory during wave propagation and transformation; and (2) the use of semi-empirical longshore sediment transport formulas (e.g., CERC formula). Although *ad-doc*, this modification is proposed by Kamphuis [7] to account for the difference between the potential longshore sediment transport rate, obtained by the formula, and the actual longshore sediment transport rate that occur in the field.

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