PREDICTING THE RESPONSE OF A SEA-TURTLE NESTING BEACH IN SEA-LEVEL RISE, GERAKAS, ZAKYNTHOS ISL., GREECE

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Abstract

This study evaluates the effect of sea level rise on the Gerakas sea turtle nesting beach in the Marine Protected area (MPA) of the National Marine Park of Zakynthos. Spatial, meteorological and grain-size data of the coastal area were collected and introduced to the Leont'yev's morphodynamic model in order to estimate the potential retreat of the beach under 4 scenarios of sea level change. The results have shown that the beach is projected to suffer a considerable retreat/inundation that will directly diminish the available nesting space and consequently pose constrains in the nesting success of the endangered species *caretta caretta*.

Keywords: Ionian Islands, Coastal models, Marine parks, Sea level, Turtles

Introduction

The sea level rise (SLR) is considered as one of the major impacts of climate change that will unavoidably produce significant beach recession [1]. This will affect, among other issues, areas of considerable ecological importance such as sea turtle nesting beaches. This study focuses on the response of Gerakas nesting beach (Gulf of Laganas, Zakyntos, Ionian Sea) on the expected SLR. The Gulf of Laganas is considered as one of the most important nesting areas of the loggerhead sea turtle (*Caretta caretta*) in the Mediterranean since it hosts almost 25% of the total nesting activity [2]. Gerakas is the easternmost beach of the gulf, being 930m in total length, 610m of which formed on fine sand and the remainder (320m) on coarse gravelly material (from East to West). The greater part of the beach is backed by eroding clay cliffs with a small sand dune occurring at the widest section of the beach. The mean nesting density of the beach is about 80 nests per year [2] with an average distance and elevation from the sea ranging from 18.7 to 21.5m and 1m, correspondingly.

Methodology

An RTK GPS together with an echo-sounder was used for the coastal area topographic and the bathymetric surveys, respectively. 10 onshore and offshore bed (sand) samples were collected and analyzed with dry sieving. The wave regime was hindcasted from local wind data (by the National Meteorological Service). Future beach retreat was assessed through the 1-D Leont'yev's morphodynamic model that uses the energetic approach, with the cross-shore changes of the wave energy flux estimated by the wave energy dissipation due to breaking. Sediment transport rates are predicted separately for the refraction, surf and swash zones. Two types of sediment transport are distinguished: (i) the transport due to wave/current interaction and (ii) the run-up induced transport. Beach retreat was estimated for three sea level rises scenarios (0.2m, 0.5m and 1m) [1,3] and also for a storm surge event that produces 2m short-term sea level rise [4] (Fig. 1).

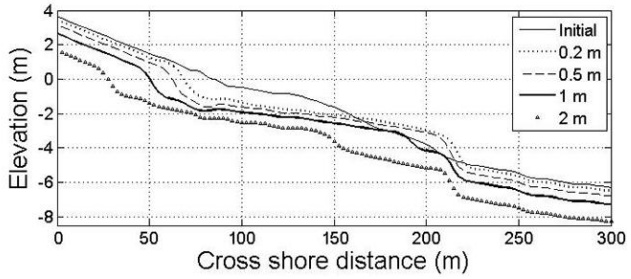

Fig. 1. Profiles of beach retreat under 4 scenarios of SLR.

Results and Discussion

The model outputs were compared with the width/elevations of Gerakas beach (Fig 2). It was found that the sea-level increases will have considerable impacts. In the case of a 0.2m rise the beach retreat was estimated as 13.95m, whereas for the 0.5m and 1.0m rises, 18.8m and 30.1m, respectively. For the worst case scenario (a 2.0m storm surge) beach recession was estimated as 50.75m. These estimates suggest that the beach will potentially lose 44-94% of its width for the first 3 SLR scenarios, whilst in the worst case of a 2.0m storm surge it will be entirely inundated. The beach cannot adapt to the SLR by transgression, as is backed by cliffs. This will promote coastal squeezing, which in return will dramatically reduce the available nesting space and increase conflict issues related to the recreational use of the beach. Ongoing research concerning all the nesting beaches of the MPA (6 in total) will further reveal the possible overall consequences of SLR on the nesting activity in the largest rookery of the endangered species *Caretta caretta* in the Mediterranean, thus allowing for the design and implementation of suitable management measures.

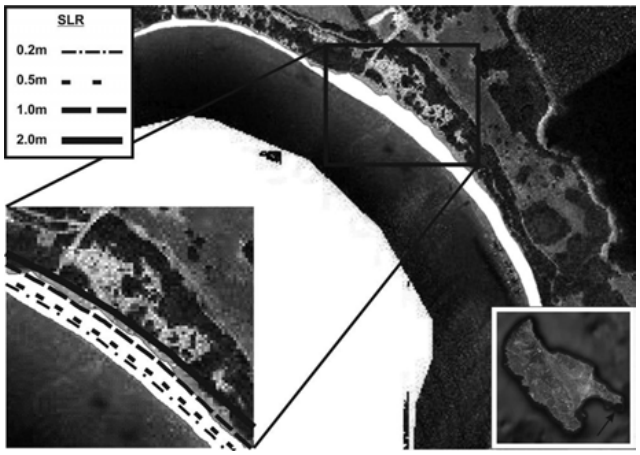

Fig. 2. Google image showing beach retreat at the central part of Gerakas beach under 4 scenarios of SLR.

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