EQUILIBRIUM MODELING OF CURRENT AND FUTURE BEACH EVOLUTION: VOUGOT BEACH, FRANCE

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INTRODUCTION

Understanding and predicting shoreline changes is a growing societal concern with increasing human pressure in the coastal zone. The impacts of climate change, including sea level and wave climate changes, may also increase erosion risks. Coastal managers and policy makers seek assistance in evaluating coastal risks in order to mitigate them. Thus, it is important to improve knowledge of the dominant physical processes controlling medium- to long-term shoreline evolution, as well as the performance of beach evolution models reproducing past observations and predicting future changes. Empirical equilibrium beach change models may be an optimal choice at these spatial and temporal scales. Recent work has focused on extending cross-shore equilibrium-based models to take into account alongshore transport, the tide level, and climate change impacts. Here, morphological changes at Vougot Beach (Brittany, France) are analyzed by evaluating the cross-shore evolution of contour elevations (-1 to 6m) along six intertidal beach profiles using observations and an equilibrium beach change model.

STUDY SITE

Vougot beach is a 2 km-long, macrotidal (maximum tidal range >7m) sandy beach backed by dunes. Analysis of monthly intertidal beach profiles (8-15 years) has shown the importance of alongshore sediment transport and a strong seasonal cycle of cross-shore exchanges between the upper and lower beach (Suanez et al., 2015). Short-term, storm-induced erosion has an important role in the longer term beach evolution, with subsequent, partial recovery occurring over multiple years.

METHODS AND RESULTS

Once calibrated with data, the empirical equilibrium model of Lemos et al. (2018), modified from Yates et al. (2009), reproduces well (R^2>0.6) the cross-shore evolution of the lower and upper intertidal zone for profiles 5 and 6 (Fig. 1). However, the long-term trends observed at profiles 1-4 are not predicted well with the equilibrium-based model. Model runs with an additional linear trend term are also compared to the equilibrium-only approach.

To evaluate the impacts of climate change to both changes in sea level rise and the wave climate, three approaches are compared: (1) extrapolation of current trends, (2) application of the Bruun Rule, and (3) application of the equilibrium model using a Monte Carlo approach. The sensitivity of each approach is tested relative to the selected parameters, and uncertainties are estimated.

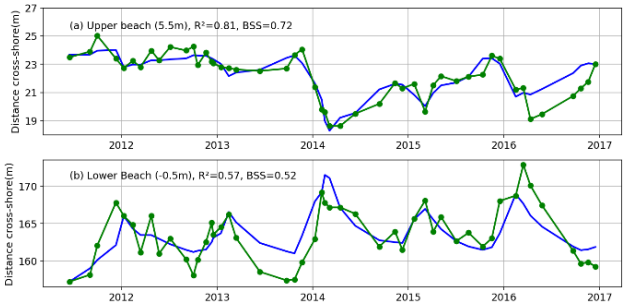

Figure 1 – Observed and modeled (a) upper and (b) lower beach contour changes at profile 6 of Vougot Beach.

CONCLUSIONS AND FUTURE WORK

Preliminary work evaluates the efficiency and accuracy of empirical equilibrium beach change modeling approach at Vougot Beach, demonstrating skill in reproducing past observations (R^2>0.6 along some profiles), and the uncertainties between different approaches used to predict future changes. Ongoing work includes coupling this model, which takes into account the effects of the tide level, with a longshore sediment transport model, as well as the development of a new approach for taking into account the impacts of changes in sea level.

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