LONG-TERM MORPHOLOGICAL EVOLUTION MODEL

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INTRODUCTION

Nearshore morphology models predicting storm-scale erosion have been in use for the past several decades. These empirical tools typically focus on a single time-scale, which limits the utilization. For example, models developed to predict cross-shore storm erosion are poorly suited for longer-term simulations that include the beach recovery between events and gradients in longshore transport. Herein, the one-dimensional model CSHORE is extended to include shoreline change associated with alongshore variation in transport. A comparison of model predictions with long-term shoreline data from South Carolina demonstrate reasonable agreement with both erosion and accretion.

MODEL

The one-dimensional model CSHORE is a practical and accurate code that predicts beach profile evolution over the nearshore region (Kobayashi *et al.* 2009). The model accounts for wave and current interaction, bedload, suspended load, and wave-related sediment transport. The model, however, was developed for cases with alongshore uniformity where gradients in longshore directed transport are negligible. The present effort details the development of a new numerical model that incorporates the cross-shore profile evolution as well as the alongshore variation at two distinct time-scales. The new method assumes that frequent (seconds) bed-level updates due to cross-shore transport gradients are necessary, while the longshore sediment balance can be accumulated numerically over times of about a day before the resultant bottom evolution is imposed. The new model remains consistent for use in a single storm as well as predictions for evolution over several decades. Although the requirements for gradual alongshore variation limits applicability, the model is efficient enough to predict change over climate-relevant time periods and as accurate as a fully 3D morphology model.

ONSLOW BEACH

An initial comparison of 20 years of morphological evolution is conducted for Onslow Beach, NC, a gently-varying contiguous sandy barrier island. Shoreline position data are available for the 10 km of coast fronting the Marine Corps Base Camp Lejeune. Wave conditions from the long-term WIS wave hindcast are used, while water levels are developed from the available NOAA tide gauge records. With a complete set of boundary and initial conditions, numerical model results constitute a complete 20 year history of transport and morphological evolution. The wave energy directional spectrum is nearly symmetric relative to the shore-normal transect, and although large sand transport is predicted to the North and to the South at times, a relatively small average residual longshore transport is computed. The measured and predicted morphological changes are provide in Fig 1 where the South exhibits 100 m of erosion and the North end has about 50 m of accretion. The modeled bathymetric changes are in general agreement with well-predicted erosion, and the accretional regions are predicted within a factor of two.

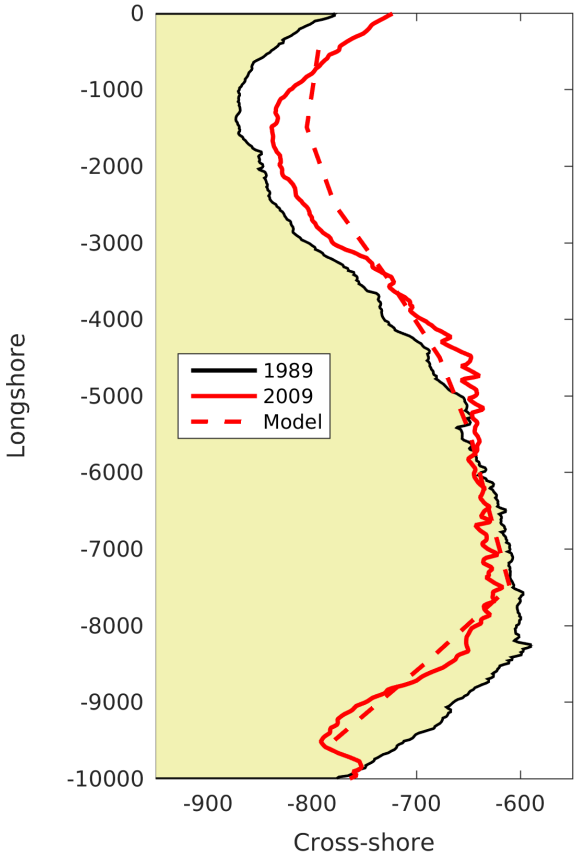

Figure 1: Onslow Beach morphology change.