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TITLE: A model integrating longshore and cross?shore processes for predicting long?term shoreline response to climate change

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ABSTRACT:

Abstract We present a shoreline change model for coastal hazard assessment and management planning. The model, CoSMoS?COAST (Coastal One?line Assimilated Simulation Tool), is a transect?based, one?line model that predicts short?term and long?term shoreline response to climate change in the 21st century. The proposed model represents a novel, modular synthesis of process?based models of coastline evolution due to longshore and cross?shore transport by waves and sea level rise. Additionally, the model uses an extended Kalman filter for data assimilation of historical shoreline positions to improve estimates of model parameters and thereby improve confidence in long?term predictions. We apply CoSMoS?COAST to simulate sandy shoreline evolution along 500 km of coastline in Southern California, which hosts complex mixtures of beach settings variably backed by dunes, bluffs, cliffs, estuaries, river mouths, and urban infrastructure, providing applicability of the model to virtually any coastal setting. Aided by data assimilation, the model is able to reproduce the observed signal of seasonal shoreline change for the hindcast period of 1995?2010, showing excellent agreement between modeled and observed beach states. The skill of the model during the hindcast period improves confidence in the model's predictive capability when applied to the forecast period (2010?2100) driven by GCM?projected wave and sea level conditions. Predictions of shoreline change with limited human intervention indicate that 31% to 67% of Southern California beaches may become completely eroded by 2100 under sea level rise scenarios of 0.93 to 2.0 m.

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