Geophysical Research Abstracts
Vol. 20, EGU2018-14888, 2018
EGU General Assembly 2018

Modelling coastal dynamics under sea level rise with the Coastline Evolution Model 2D (CEM2D)

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Coasts are among the most intensely used environments on the planet, but they also present dynamic and unique hazards including flooding and erosion. Over the next century, the risk of flooding and erosion in many coastal localities is likely to intensify due to changes in environmental conditions including sea level rise and changing wave climate patterns, as induced by climate change. Managing these hazards and protecting vulnerable areas is challenging and requires an understanding of the behavior of coastal systems and longer-term prediction of their future evolution in the face of a changing climate.

Many existing one-dimensional coastal evolution models can effectively simulate the evolution of coastal environments. However, due to their 1D nature, they are unable to model the additional and combined effects of a variable water level and sea level rise. The paper will present results from a new model, the Coastline Evolution Model 2D (CEM2D), which has been built from the 1D CEM parent model, that incorporates these influences. CEM2D is capable of simulating fundamental cause-effect relationships in coastal systems and exploring the influence that sea level rise could have on sediment transport and the formation and evolution of morphological features and landforms over meso-scales.

Presented, will be results of an exploratory set of simulations using CEM2D. These will be compared to results using the CEM parent model, as a form of validation. A set of simulations will also be presented that explore: (1) the influence of changing wave patterns on the evolution of shorelines and the formation and lifecycle of coastal features, and (2) the effect that sea level rise may have on the morphodynamics of these landforms as the risk of inundation and submergence increases. The implications of the results on both our ability to model longer-term climate driven morphodynamics and our understanding of fundamental coastal evolution under changing boundary conditions will be discussed.