# Hydrodynamic influence on vegetation establishment and biomass storage in coastal wetland systems

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**Abstract:** Coastal wetlands, in particular mangrove and saltmarsh systems, provide a wide range of ecosystem services including habitat provision for a significant number of fish and migratory bird species as well as other fauna. Vegetation in coastal wetlands is also highly productive in terms of biomass, leading to efficient accumulation of carbon in soils over time. Around the globe, wetlands are under threat from anthropogenic pressures, wetland use conversion, and submergence occurring from rising sea levels, a recognized effect of climate change. As such, the capacity of coastal wetlands to continue providing habitat and serve as soil carbon sinks in the long term is uncertain.

Coastal wetland conservation and rehabilitation projects require the use of the best available tools to describe the dynamics of such systems so they can guarantee objectives of habitat provision and carbon sequestration. Eco-geomorphic processes in coastal systems are complex and occur over long periods of time; therefore, simulating these environments using regression models requires of significant data for establishing representative relationships, but long-term data availability is a common issue in coastal systems. A way to overcome this issue is to implement a physically based approach where different equations are used to represent the main processes of vegetation establishment and growth, soil surface elevation change and carbon accumulation as a response to external drivers. In this contribution, we discuss the implications of management scenarios in the context of hydrodynamic control as the main external driver of wetland dynamics by comparing the use of different methodologies. We make use of a model that integrates hydrodynamic simulations with a vegetation and a bio-geomorphic accretion module that updates changes to soil surface elevation under sea-level rise (Sandi et al, 2018; Breda et al, 2018). This approach allows for the study of feedbacks between the hydrodynamic conditions and vegetation. In addition, we make use of a soil carbon module to estimate changes in the storage of soil carbon stocks (Sandi et al, 2021). We compare the implementation of this model against simplified or empirical representations for each of the modules (establishment, biomass storage and soil carbon accumulation) and see the influence hydrodynamic control.

Though simplified relationships are useful for establishing baselines for comparison, we show these are not able to simulate the complex dynamics present in coastal wetlands on their own; however, by integrating empirical formulations and physically based approaches with outputs from a hydrodynamic model as the main external driver, we can simulate the feedbacks and the influence of diverse management strategies. The modelling approach also allows for the integration of additional modules if consideration of more processes is required.

## REFERENCES

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