

EFFECTS OF BIOLOGICAL TRAITS ON SALT-MARSH-SPECIES DISTRIBUTION AND ESTUARINE BAR MORPHOLOGY

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The ability of vegetation to modify local conditions in fluvial and coastal environments has been extensively studied and widely acknowledged. However, bio-geomorphological modelling studies only incorporated simplified spatio-temporal vegetation dynamics, limiting their applicability to real ecosystems especially when long-term morphodynamic changes are of interest. By including species-specific strategies for establishment, growth and resilience against physical pressures in our numerical model, we underline the necessity for a more detailed description of vegetation dynamics to reproduce more realistic patterns than before, and thereby quantify the bio-geomorphological effects.

We coupled our new vegetation model to a two-dimensional hydro-morphodynamic model in Delft3D. To validate the vegetation zonation produced by the model, we analysed the 2-km-long tidal bar “Plaat van Walsoorden” in the Western Scheldt estuary, the Netherlands, where vegetation establishment has been mapped at 0.25 m spatial resolution since the mid-1990s and large parts are now covered by various salt-marsh species.

We show that mortality due to desiccation and inundation period determines the density of salt-marsh growth and hence reproduces zonation (Figure 1). Resilience against fast flow determines die-off not only at the bar margins but also on the tidal flat itself. The first model runs also suggest that seasonal variation in biomass modifies the morphological development of the flat as it directly affects sedimentation in winter. Ongoing runs for decadal development include mud and sensitivity to species traits.

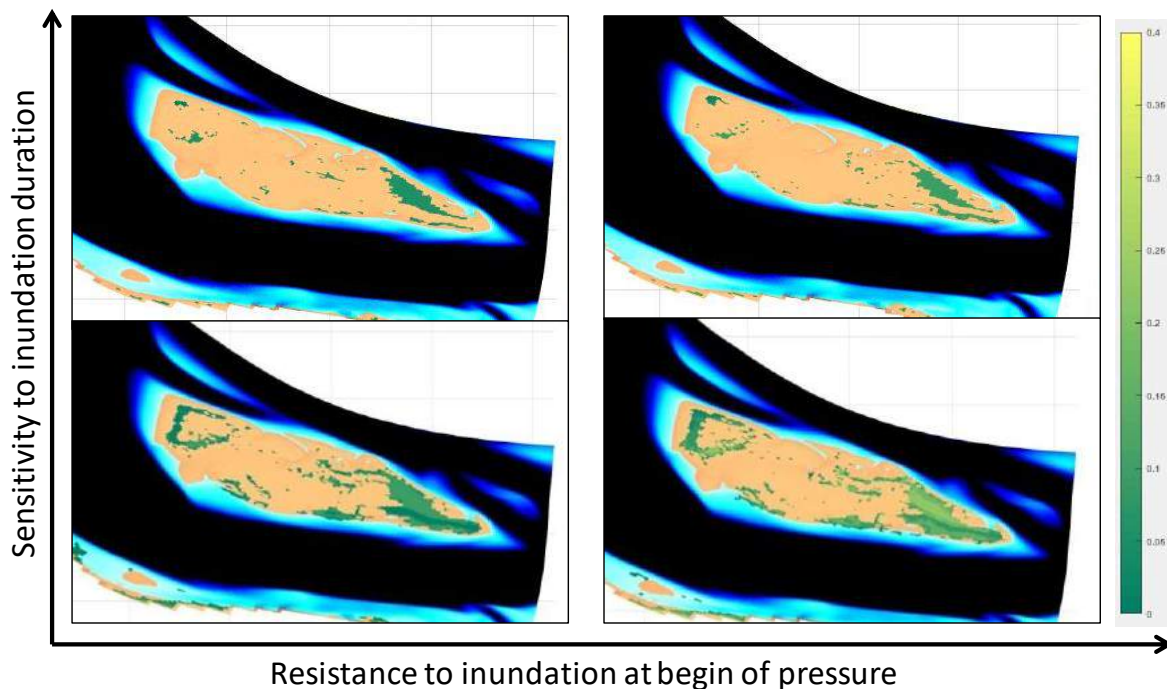


Figure 1. Salt-marsh vegetation cover after 5 years as a cover fraction of the cell depending on the degree of resilience against mortality caused by desiccation and inundation duration. The x-axis represents resistance against the start of mortality with regard to duration of the pressure, the y-axis the speed of mortality after the start of dying. The brown color is bare soil, black-blue the water depth.