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SEASONAL WIND AND BIOTA DRIVE TIDAL MUDFLAT DYNAMICS

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Extreme storm events and sea-level rise in the coastal zone emerge as an insurmountable consequence of global climate change. Nature-based flood defences have the potential to satisfy the need for cost-effective and sustainable coastal defence. Although salt marshes are unequivocally proven to be stable under extreme storm conditions (Möller et al. 2014), they can only be implemented in coastal defence schemes if their long-term stability under future climate change is guaranteed. The long-term stability is driven by short-term (i.e. seasonal and shorter changes) bed-level dynamics of the tidal mudflat (Bouma et al. 2016). In this study we want to explore the seasonal bed level dynamics of a tidal mudflat using an established equilibrium model.

The dynamic equilibrium theory-ESTMORF (DET-ESTMORF) was used for obtaining bed-level dynamics over a tidal mudflat. The model explicitly uses spatiotemporal bed shear stress variations to predict tidal flat morphodynamics (Hu et al. 2015). The model was extended with stochastic wind forcing (Weibull) for calculating wind waves, to be able to study climate change scenarios. Moreover the fixed-equilibrium bed shear stress was adapted to be able to change over space and time, for including biological influences. Seasonal bed-level dynamics obtained from model runs with different settings for wind forcing (Weibull distribution per season and a single Weibull distribution) indicate largest differences in winter and summer (Figure 1). Moreover, including biology in spring and summer results in a drastic decrease of the erosion (Figure 1).

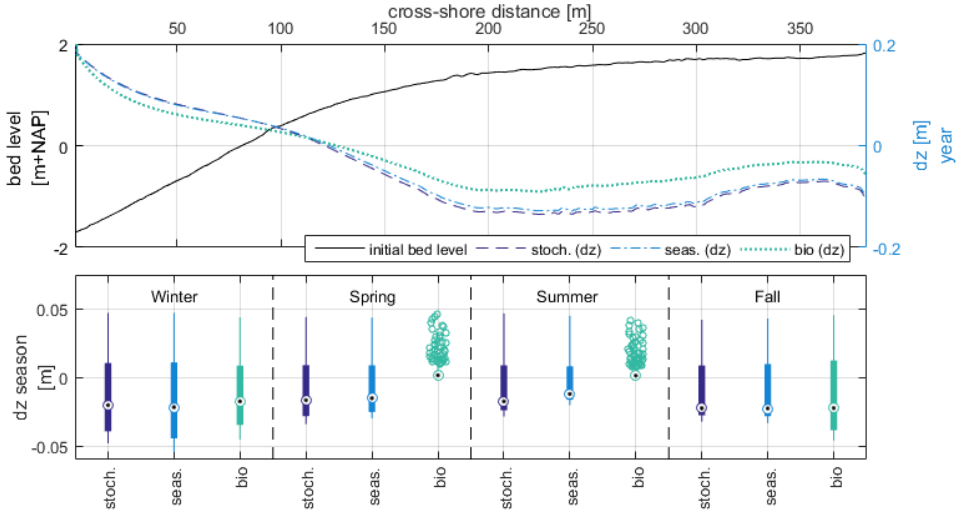

Figure 1. The initial convex profile of a tidal flat (top panel; left axis) and the resulting bed-level differences (top panel; right axis) after 4 seasons (winter, spring, summer and fall), forced by a single Weibull distribution (stoch.; dark blue/dashed) and a Weibull distribution per season without biology (seas.; light blue/dashed-dotted) and with biology (bio; green/dotted). The distribution of the bed-level differences over the entire profile per season per run (bottom panel) indicates the differences per run.

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