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At breaking point – The impact of biophysical plant properties and seasonality on the resistance of tidal marsh vegetation to hydrodynamic forcing

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Abstract

Authors of the *IPCC Special Report on the impacts of global warming of 1.5°C (2018)* predict that storms and wave action and thus their potential impact on coastal wetlands, may be amplified in a warmer world. The coastal protection function provided by the vegetation of wetland ecosystems, like tidal marshes or mangrove forests, will therefore (a) play an important role in defending coastlines against storm surges in the future and (b) depend on how these systems respond to such forcing. If the physical stress of hydrodynamic forces becomes too high, the risk of vegetation failure and thereby its loss of functionality in coastal protection increases. Yet, this crucial knowledge on how hydrodynamics in turn affects tidal marsh plants is missing.

First results will be presented of a true-to-scale flume study, which was conducted to better understand and predict responses of tidal marsh vegetation to extreme hydrodynamic forces. Five tidal marsh plant species differing in their biophysical properties were exposed to varying wave conditions. Additionally, some species were artificially weakened as we expected seasonal changes in plant resistance, as the leaves and stems of examined species die off during the winter and their biophysical properties may undergo considerable modifications. In addition to non-destructive methods to detect plant disturbance, biogenic silica and lignin content as well as stem flexibility were quantified as they are known to affect the plant's resistance to hydrodynamic forces. Results indicate a higher plant resistance than expected, even under highest wave energy levels. This might be of significance for models that expect aboveground biomass to disappear during initial storm surge exposure and thus not continue to contribute to wave attenuation at later stages of the storm or successive storm events.

Keywords

Flume experiment, Plant disturbance, Nature-based coastal protection, Climate change