Response of morphology and tissue properties of tidal marsh plants to wave activity

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The notion that coastal salt marsh plants attenuate waves and hence play a key role in ecosystem-based coastal defence becomes more and more accepted in recent literature (Möller *et al.*, 2014; Temmerman *et al.*, 2013). However, little is known about the response of vegetation to these incoming waves. Field observations of *Scirpus maritimus* dominated pioneer marshes suggest effects of wave exposure on plant morphology: at the marsh edge, where wave height is maximum, plants are typically short with thick basal stem diameters while they are taller and thinner a few meters into the marsh. With a field study we investigated whether observed differences in morphology are due to different exposition to hydrodynamic forcing which is generally stronger at the marsh edge compared to the inner marsh. We further hypothesize that exposure to hydrodynamic forcing might cause differences in biomechanical properties (e.g. more flexible plants at the marsh edge). Two sites of contrasting wave exposition with *S. maritimus* as dominating pioneer, equal elevation and similar slopes were selected in the brackish part of the Scheldt Estuary north of Antwerp (Belgium). From April to September 2014, we monitored plant growth and plant morphology (stem diameter, size of plants…) of *S. maritimus* at these two sites on three levels close to the marsh edge (i.e. at the marsh edge, at 4m and at 12m into the marsh). Waves, ground and surface water levels were measured continuously from April to October 2014. In September, a more extensive field campaign including soil and root core samples as well as pore and ground water samples, was carried out. Furthermore, flexibility of basal plant stems was determined for plants of each plot. As control, tubers from the marsh edge and from 12m into the marsh were sampled at both sites in March 2014 and grown under ideal, equal conditions in the greenhouse until June 2014. Preliminary data show that clear site and edge effects occurred in the field while these effects were only observed to a limited extend in the greenhouse experiment. Our preliminary results indicate that the morphology of the plants is indeed correlated to the differing hydrodynamics at the different sites and plots, and that they are the result of stress avoidance strategies of the plants (e.g. smaller and more flexible plants at the most exposed plots).

References

Moller I. *et al.* 2014. Wave attenuation over coastal salt marshes under storm surge conditions. Nature Geoscience 7:727–731.

Temmerman S. *et al.* 2013. Ecosystem-based coastal defence in the face of global change. Nature 504:79–83.