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How do salt-marsh ecosystems respond to changes in the environmental forcings?

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How do salt-marsh ecosystems respond to changes in the environmental forcings? This is a question of paramount importance due to the critical role exerted by salt-marsh ecosystems within the tidal landscape. Salt marshes in fact buffer coastlines against, filter nutrients and pollutants from tidal waters, provide nursery areas for coastal biota, and serve as a sink for organic carbon.
Observations of marsh degradation worldwide and the acceleration in the rate of global sea level rise highlight the importance of improving our understanding of the chief processes controlling salt-marsh response to current natural climate changes and to the effects of changes in sediment supply. To address this important issue, we have applied a analytical model of biomorphodynamic evolution of salt-marsh ecosystems in the vertical plane, accounting for two-way interactions between ecological and geomorphological processes.
Our results show that marshes are more resilient to a step decrease in the rate of relative sea level rise (RRSLR) rather than to a step increase of the same magnitude. However, marshes respond more rapidly to an increase in sediment load or vegetation productivity, rather than to a decrease (of the same amount) in sediment load or vegetation productivity. We also observe that marsh stability is therefore positively correlated with tidal range: marshes with high tidal ranges respond more slowly to changes in the environmental forcings and therefore are less likely to be affected by perturbations. Finally, the model suggests that, in the case of a oscillating RRSLR, marsh stratigraphy will be unable to fully record short[U+2010]term fluctuations in relative mean sea level, whereas it will be able to capture long[U+2010]term fluctuations particularly in sediment rich, microtidal settings.