Geophysical Research Abstracts
Vol. 21, EGU2019-9594, 2019
EGU General Assembly 2019

Are saltmarshes in the USA and the UK too high to exist without extremes-driven deposition?

Guillaume Goodwin and Simon Mudd
University of Edinburgh, School of Geosciences, Department of Geography, Edinburgh, United Kingdom (g.c.h.goodwin@sms.ed.ac.uk)

Coastal wetland degradation has been repeatedly associated with considerable losses in blue carbon storage and storm surge attenuation. Despite salt marshes responding to sea level variations and storm-driven erosion through biologically mediated accretion, uncompensated drowning and retreat are observed in many populated coastal areas. In particular, the Mississippi Delta and the Venice Lagoon display rates of wetland loss which raise concern as to the durability of salt marshes in the face of accelerated sea level rise in the 21st century. However, recent studies suggest that where sediment delivery to wetlands is not as heavily impacted by human activities, established marsh platforms keep pace with relative sea level rise (RSLR). More importantly, accretion rates in excess of rates of RSLR have been observed in pioneer marsh zones, suggesting a sediment supply sufficient to avoid marsh drowning. These results are in agreement with numerical models revealing accretion rates on marsh platforms to be a non-linear increasing function of elevation. Resilience to rising sea levels also increases with tidal amplitude, which plays a role in stabilising the expansion of creek and pool networks during marine transgression.

We combine sea level records and repeat lidar surveys at multiple sites across the United Kingdom and the United States to explore controls on marsh accretion. We compare marsh elevations relative to sea level as well as lidar-derived marsh accretion rates to simple settling models in order to explore constraints on suspended sediment concentration and particle size. We find that marsh platforms examined occupy a narrow range of elevations in the tidal frame, situated between Mean High Tide MHT and the Observed Highest High Tide OHHT. Under sinusoidal tidal forcing, common in marsh accretion models, marshes at these elevations are never inundated, highlighting the inadequacy of sinusoidal forcing in numerical models of salt marshes. We also observe that when using a median sediment grain size D50 = 50 μm and a sediment concentration derived from satellite data, modelled deposition rates do not allow accretion to match observed elevation changes, even when considering hypothetical scenarios wherein 40% of the sedimentation is due to organic accretion. This is particularly true for marshes that are very high in the tidal frame. Simulating accretion with higher sediment concentrations and grain sizes makes up for this mismatch, suggesting that accretion is increasingly storm-driven as marsh platforms elevate within the tidal frame. Finally, we investigate the consequences of changing sediment supply on the future equilibrium of coastal marshes.