Earth's Future

Supporting Information for

Accelerated Sea-Level Rise Limits Vegetation Capacity to Sequester Carbon in Coastal Wetlands

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Introduction

This supporting information provides a description of soil carbon sampling methods, results from hydrodynamic and vegetation models calibration, parameters calibrated for the eco-geomorphic accretion model, results from using a simplified bathtub approach, soil carbon soil carbon profiles in the region and synthetic soil carbon profiles calculated for the study site.

Text S1. Soil carbon sampling in Area E.

Soil carbon densities (ρ_{sd}) in Area E were obtained for the top 20 cm of the top soil layer of different vegetated and non-vegetated areas by extracting 45 different soil cores (Howe et al., 2009). Core samples were obtained by inserting a 5.5 cm diameter, 25 cm long polyvinyl chloride tube to a depth of 20 cm. In the laboratory, length and mass of the core samples were measured and then samples were air dried to obtain dry bulk density. Soil was then sieved with a fine mesh to remove the fine root material and soil samples were selected from the sieved soil forming samples of less than 1 g. Samples were treated with HCl to remove carbonates, and total carbon and organic carbon was determined with a LECO CNS 2000 analyser. Mean organic soil carbon densities were 0.0406 $MgC \cdot m^{-3}$ (SD = 0.010 $MgC \cdot m^{-3}$, n = 19) for saltmarsh, 0.0287 $MgC \cdot m^{-3}$ (SD = 0.009 $MgC \cdot m^{-3}$, n = 9) for mangrove, and 0.0193 $MgC \cdot m^{-3}$ (SD = 0.006 $MgC \cdot m^{-3}$, n = 8) for unvegetated tidal pools and mudflats.

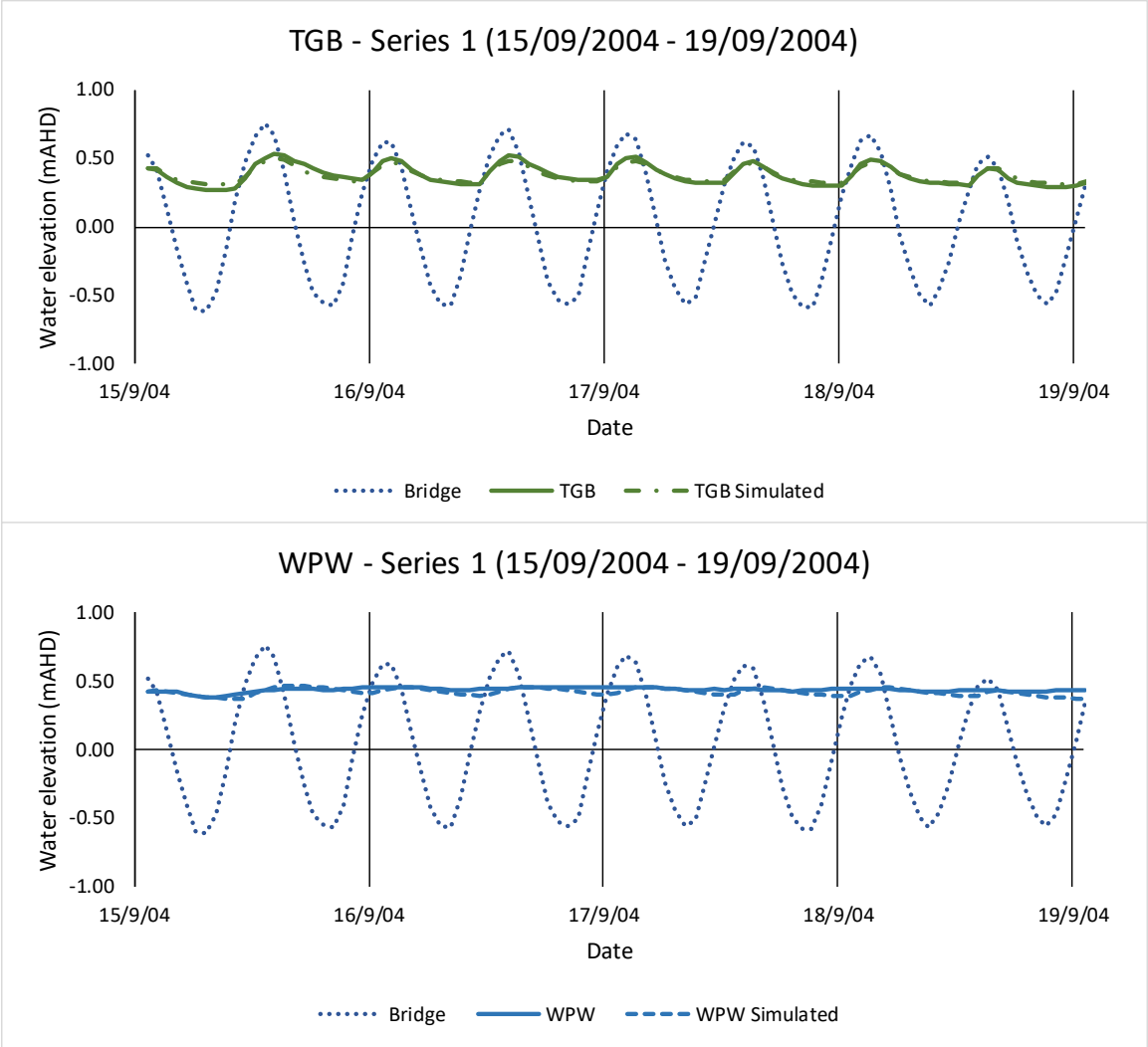

Figure S1. Comparison plot of simulated water levels for Series 1 at locations TGB and WPW. Input water level at Bridge location is also presented.

Note: Adapted from Sandi et al. (2018).

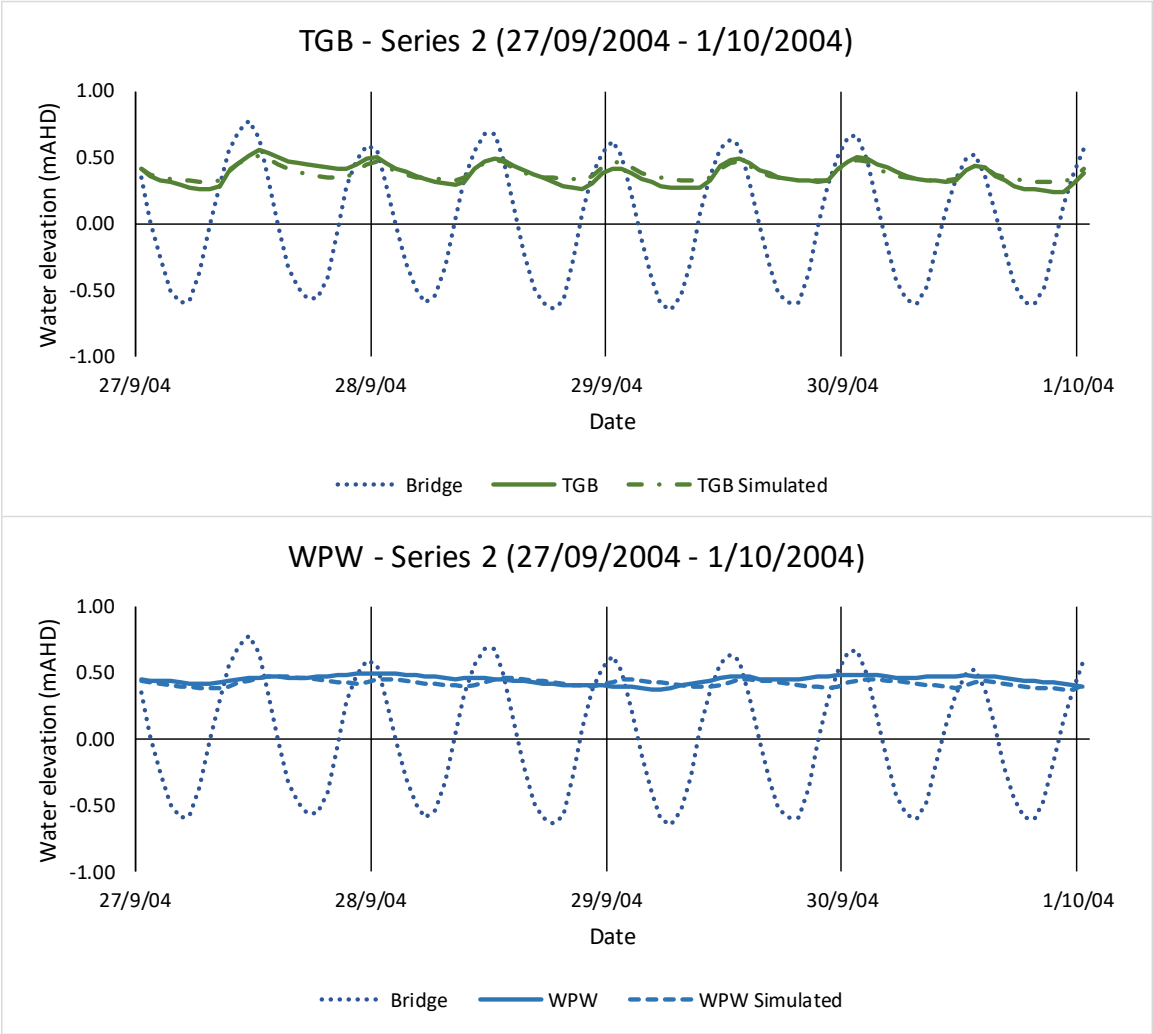

Figure S2. Comparison plot of simulated water levels for Series 2 at locations TGB and WPW. Input water level at Bridge location is also presented.

Note: Adapted from Sandi et al. (2018).

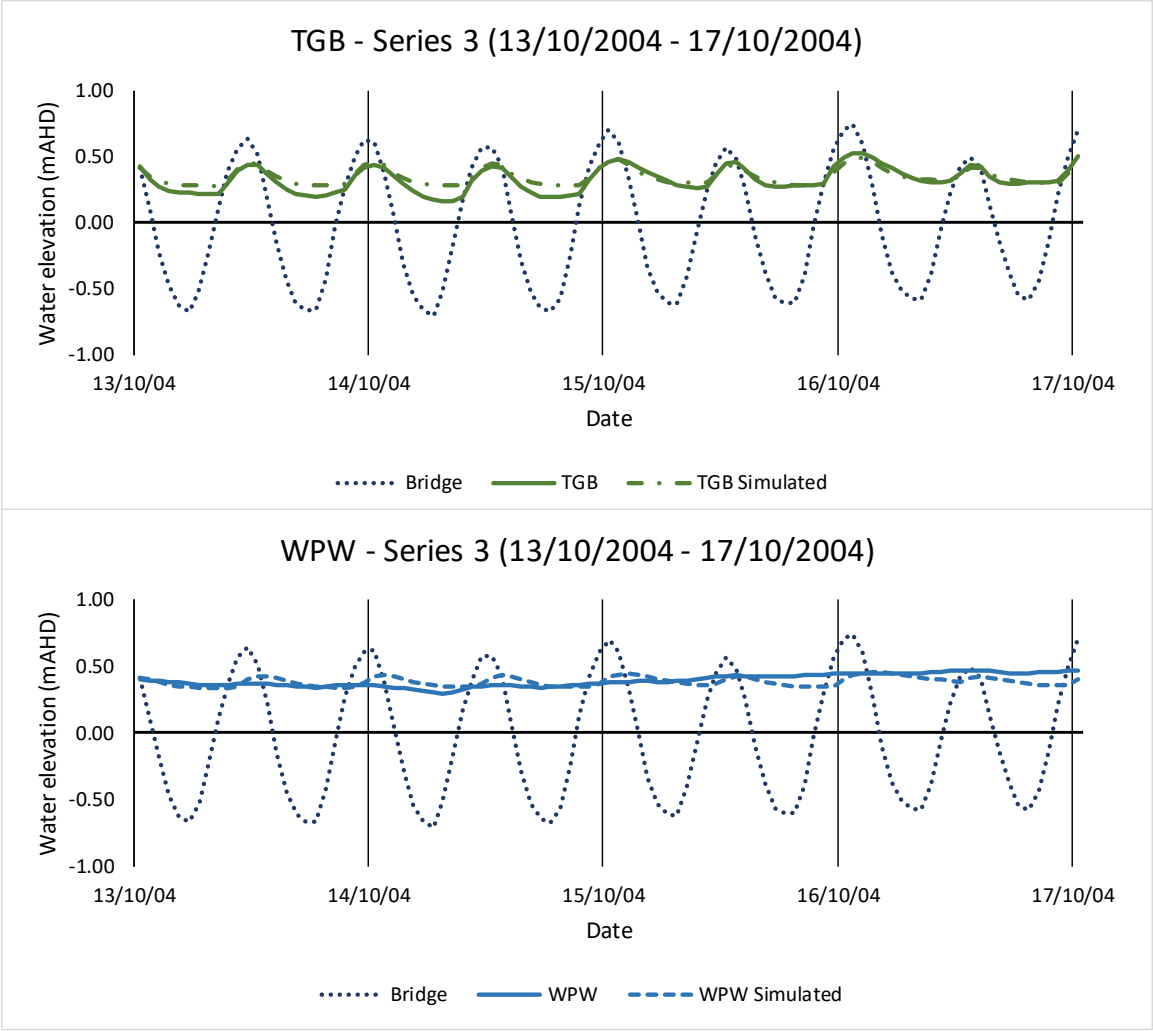

Figure S3. Comparison plot of simulated water levels for Series 3 at locations TGB and WPW. Input water level at Bridge location is also presented.

Note: Adapted from Sandi et al. (2018).

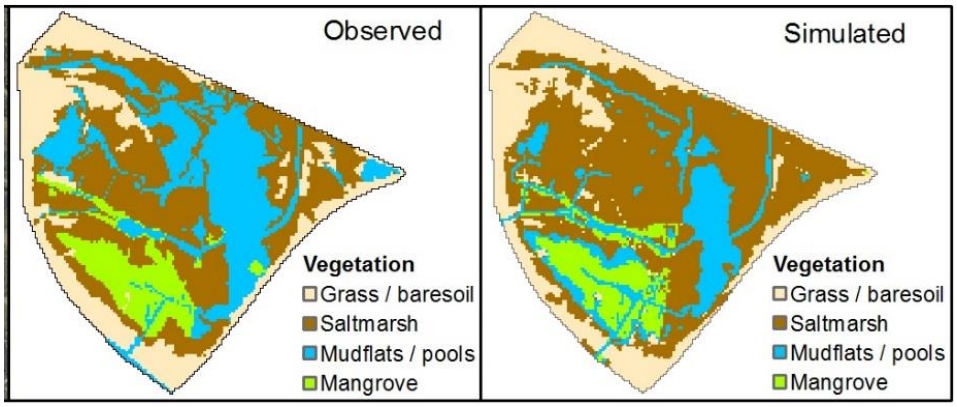

Figure S4. Comparison of observed and simulated vegetation in Area E.
Note: based on data from Rodríguez et al. (2017).

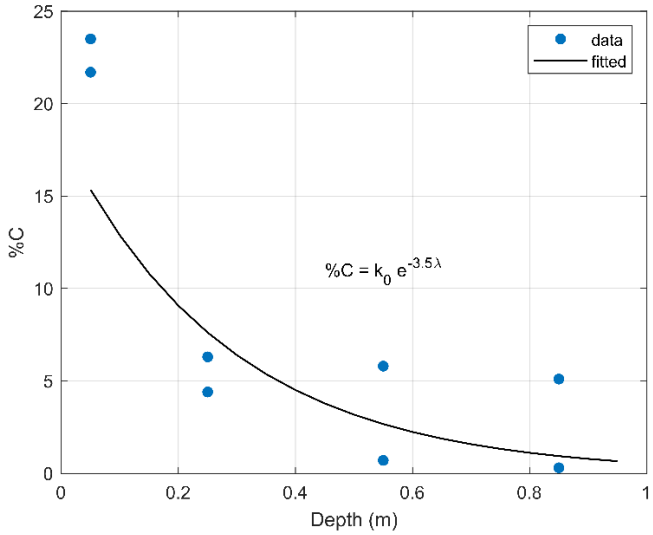

Figure S5. Soil carbon profile to 1 m depth.
Note: based on data from Saintilan et al. (2013).

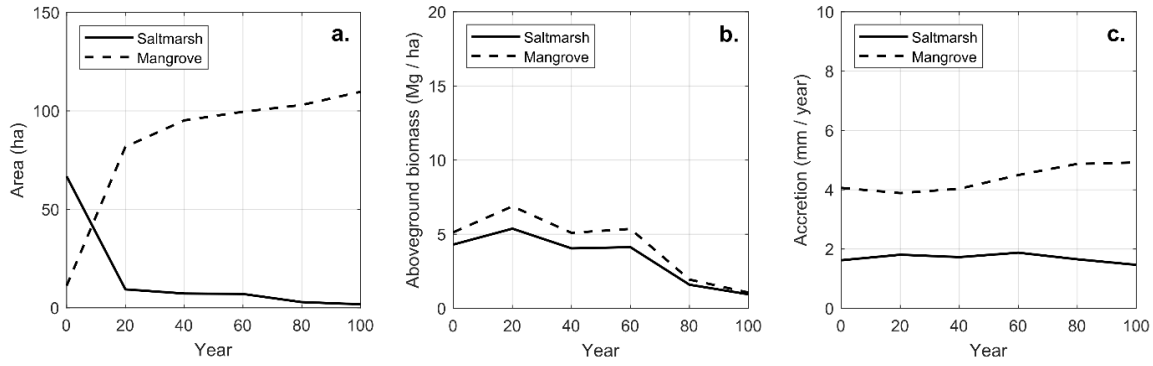

Figure S6. Simulated changes in vegetation extent in ha (a), aboveground biomass in MgC ·ha^{-1} (b), and accretion rates in mm·year^{-1} (c) using a bathtub mode.

Table S1. Model performance for 3 water depth time series used in calibration and model testing of the hydrodynamic model.

Series and location		**RSR**	**PBIAS (%)**	**NS**
S1 Calibration (15/09/2004) – (19/09/2004)	TGB	0.03 (Excellent)	-0.29 (Excellent)	0.99 (Excellent)
	WPW	0.04 (Excellent)	3.68 (Excellent)	0.99 (Excellent)
S2 model testing (27/09/2004) – (01/10/2004)	TGB	0.06 (Excellent)	-1.69 (Excellent)	0.99 (Excellent)
	WPW	0.05 (Excellent)	6.04 (Excellent)	0.99 (Excellent)
S3 model testing (13/10/2004) – (17/09/2004)	TGB	0.08 (Excellent)	-6.96 (Excellent)	0.99 (Excellent)
	WPW	0.07 (Excellent)	2.27 (Excellent)	0.99 (Excellent)

Note: based on data from Sandi et al. (2018).

Table S2. General confusion matrix for evaluation of vegetation prediction model.

	Predicted: Other	Predicted: Saltmarsh	Predicted: Mangrove	
Observed: Other	4518	2410	77	7005
Observed: Saltmarsh	946	4160	206	5312
Observed: Mangrove	278	108	840	1226
	5742	6678	1123	

Note: based on data from Sandi et al. (2018).

Table S3. Parameters for eco-geomorphic accretion model.

Model parameters	**Saltmarsh**	**Mangrove**
Average depth below mean high tide ***D*** *(m)*	0.142	0.474
Average *suspended sediment concentration* ***SSC*** *(g/m^3)*	15	22
Average aboveground biomass production ***B*** *(g/m^2/year)*	900	1000
Average surface elevation change ***dE/dt*** *(m/year)*	0.00139	0.00223
Equation 1	$\frac{dE}{dt} = SSC(q + kB)D$	
Sediment entrapment rate k (m^5/g^2)	6.2x10^{-7}	1.2x10^{-7}
Sediment settling rate q (m^3/year)	0.00009	0.00009
Equation 2	$B = aD + bD^2 + c$	
Empirical parameters		
a (g/m^3/year)	8384	7848
b (g/m^4/year)	-16767	-6038
c (g/m^2/year)	0	-1328
Maximum *B (g/m^2/year)*	1050	1223

Note: based on data from Rodríguez et al. (2017) and Sandi et al. (2018).

Table S4. Soil organic carbon density (Mg C /m³) profiles for different habitats in Area E.

	Organic carbon density (Mg C /m^3)		
Soil depth	Saltmarsh	Mudflat / pool	Mangrove
0 – 20	0.0406	0.0193	0.0287
20 – 40	0.0202	0.0096	0.0143
40 – 60	0.01	0.0048	0.0071
60 – 80	0.005	0.0024	0.0035
80 – 100	0.0025	0.0012	0.0017

References

Howe, A. J., Rodríguez, J. F., & Saco, P. M. (2009). Surface evolution and carbon sequestration in disturbed and undisturbed wetland soils of the Hunter estuary, southeast Australia. *Estuarine, Coastal and Shelf Science, 84*(1), 75-83. http://www.sciencedirect.com/science/article/pii/S0272771409002856

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