Supporting Information for "Simple metrics predict salt-marsh sediment fluxes"

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Introduction The supporting material includes Text S1, which describes an analysis of estimated sediment-flux errors, as well as five figures and two tables. Figure S1 includes error analysis as described in Text S1. Figure S2 shows relationships between ΔC and Q_s with different scaling of Q_s on flood and ebb, as described in Text S1. Figure S3 shows the turbidity–SSC calibration for Grand Bay. Figures S4 and S5 are similar to Figures 3 and 4 in the main text, but with additional data points from the other studies described in the text. Table S1 presents similar information to that of Table 1 in the main text, but with separate fits for each site. Table S2 contains the turbidity and SSC values used for the Grand Bay turbidity–SSC calibration.

Text S1.

There are nine constituent terms that comprise the sediment flux, each with an associated error: (a) measured velocity, (b) slope and (c) intercept of regression between measured velocity and channel mean velocity, (d) measured pressure, (e) slope and (f) intercept between measured pressure reading and channel area, (g) measured turbidity, (h) slope and (i) intercept of regression between measured turbidity and SSC. The errors for (a), (d), and (g) were obtained from manufacturer documentation, and the regression errors were computed using standard statistical techniques. In this context, the sediment flux is defined as

$$Q_s = (ab + c)(de + f)(gh + i),$$

and the total error in Q_s is

$$\delta Q_s = \sqrt{\left(\frac{\partial Q_s}{\partial a}\delta a\right)^2 + \cdots + \left(\frac{\partial Q_s}{\partial i}\delta i\right)^2},$$

where $\delta a \ldots \delta i$ are the errors associated with the constituent terms, following standard error-propagation techniques.

We are interested in whether the propagated error will meaningfully influence the predictive power of ΔC. Using the Bayou Middle data as an example, the visual relationship between ΔC and Q_s is maintained when error bars derived from the above equations are included (Figure S1). The fractional sign agreement between ΔC and Q_s for Bayou Middle assuming no error is 0.77. Considering variability from the error, the sign agreement ranges from 0.67 to 0.79, suggesting that error does not dominate the relationship.

Error may also be introduced if conditions in the channel do not fully reflect the total flux into or out of the wetland complex. For example, mass exchange between creeksheds via sheet flow over the wetland surface during periods of high water could reduce the representativeness of the channel measurements. Table S1 includes an assessment of the creekshed area delineation and the likelihood for mass exchange between creeksheds. Of the 13 sites, five were very well constrained with little to no opportunity for cross-creekshed flow. Creekshed boundaries in this category consisted of uploads, roads, and constructed levees. Four sites were well constrained, with uplands, natural levees, and topographic highs serving as the creekshed boundaries. In this category, there was more opportunity for flow across creeksheds not captured by the channel measurements. Four sites were relatively unconstrained, and creekshed boundaries typically consisted of topographic highs of the wetland platform, which could facilitate cross-creekshed exchange during high water levels. There is no apparent grouping or biasing based on this assessment of creekshed delineation in the ΔC–Q_s relationships (Figure 3 and Figure S4).

If mass were preferentially delivered to the wetland via the channel on floods but drained via other pathways (potentially across creekshed boundaries) on ebb, or vice versa, the channel would not be representative of conditions in the creekshed. To simulate this condition, we constructed two scenarios: in the first, we scaled flood fluxes by 80%, and in the second we scaled ebb fluxes by 60%. Considering the 14 d averaging interval, the scaled relationships between ΔC and Q_s have poorer correlations than that of the unscaled data (Figure S2). The two-sided p-value for all relationships, however, is small, suggesting that we can reject the null hypothesis that the slope between ΔC and Q_s is zero, and that a meaningful relationship between these quantities exists even when scaled in this manner.

Figure S1. ΔC versus Q_s for Bayou Middle at the diurnal interval with estimated errors shown.

Figure S2. ΔC versus Q_s at the 14 d averaging interval for (a) no scaling, (b) a scenario where floods are scaled by 80%, (c) a scenario where ebbs are scaled by 60%. Symbols are the same as in Figure 3.

Figure S3. Turbidity–SSC calibration for Grand Bay.

Figure S4. ΔC versus Q_s for full deployments. "Other studies" are the four additional investigations from the literature described in the main text.

Figure S5. Absolute value of ΔC versus $\langle C \rangle$ for full deployments. Circled symbols indicate negative ΔC. "Other studies" are the four additional investigations from the literature described in the main text.

Table S1. Statistics for the nine sites considered in this study, and the four other studies. Creekshed area in km^2, slope (m) and standard error and intercept (b) for 24.8 h least-squares regression between ΔC and Q_s, Pearson's r, average $\langle C \rangle$, average ΔC, and an assessment of the creekshed boundaries. BH: Bayou Heron, BM: Bayou Middle, BW: Blackwater, FB: Fishing Bay, RC: Reedy Creek, DC: Dinner Creek, OG: Ogunquit, SB1: Seal Beach 1, SB2: Seal Beach 2, S77: *Settlemyre et al.* 1977, W81: *Ward* 1981, D84: *Dankers et al.* 1984, S99: *Suk et al.* 1999.

Site	Area	m	b	r	$\langle C \rangle$	ΔC	Creekshed
BH	4.51	0.105 ± 0.013	-0.167	0.65	17.91	2.14	Relatively unconstrained
BM	1.52	0.134 ± 0.011	-0.131	0.70	21.84	-0.47	Relatively unconstrained
BW	70.00	0.042 ± 0.001	0.068	0.99	63.53	-17.14	Very well constrained
DC	4.16	0.175 ± 0.009	0.090	0.82	16.33	1.83	Relatively unconstrained
FB	1.74	0.314 ± 0.014	1.416	0.94	38.51	5.06	Well constrained
OG	1.37	0.102 ± 0.014	0.109	0.69	3.67	0.55	Very well constrained
RC	0.52	0.270 ± 0.018	0.215	0.83	9.50	-0.77	Well constrained
SB1	0.46	0.057 ± 0.141	0.130	0.05	9.24	0.05	Very well constrained
SB2	0.63	0.230 ± 0.033	0.577	0.67	18.09	-1.67	Very well constrained
S77	1.08	0.310 ± 0.016	0.329	0.98	34.19	-3.27	Well constrained
W81	5.00	0.093 ± 0.010	0.118	0.95	36.99	-8.02	Well constrained
D84	0.18	0.019 ± 0.003	-0.262	0.84	257.02	109.71	Very well constrained
S99	0.20	0.086 ± 0.033	0.018	0.71	13.21	2.30	Relatively unconstrained

Table S2. Turbidity and SSC values used for the Grand Bay turbidity–SSC calibration.