

SUPPLEMENTARY MATERIALS

Table S1. Annual trends in carbonate chemistry parameters based on Theil-Sen regression analyses. NS is reported when the regression was not significant based on $\alpha = 0.05$. Model significance is denoted by asterisks (* <0.05 , ** <0.01 , *** <0.0001). Stations are grouped into estuaries, and estuaries are listed from north to south.

Estuary	Sta	Data Range (yrs)	Temp ($^{\circ}\text{C yr}^{-1}$)	Salinity (yr^{-1})	pH (yr^{-1})	$[\text{H}^+]$ ($\text{mol kg}^{-1} \text{yr}^{-1}$)	TA ($\mu\text{mol kg}^{-1} \text{yr}^{-1}$)	$p\text{CO}_2$ ($\mu\text{atm yr}^{-1}$)	DIC ($\mu\text{mol kg}^{-1} \text{yr}^{-1}$)	Ω_{Ar} (yr^{-1})	β_{DIC} ($\text{mmol kg}^{-1} \text{yr}^{-1}$)
SNE	13302	34	NS	NS	0.0063 *	-6.03^{-10} *	-7.9 *	-10.4 *	-7.3 **	NS	-0.001 *
TSJ	13303	20	NS	-0.24 ***	-0.0073 **	1.85^{-10} *	-15.8 ***	11.7 **	-7.5 ***	-0.0721 ***	-0.003 ***
	13305	38	0.18 **	-0.03 *	-0.0094 ***	1.81^{-10} ***	-17.4 ***	8.0 **	-12.1 ***	-0.0746 ***	-0.003 ***
	13315	21	0.10 *	0.04 *	NS	NS	3.6 **	NS	4.7 ***	NS	0.001 **
	13320	39	NS	-0.29 ***	-0.0225 ***	5.26^{-10} ***	-30.3 ***	20.9 ***	-22.7 ***	-0.1032 ***	-0.005 ***
	13325	21	NS	NS	NS	NS	NS	NS	NS	NS	NS
	13346	27	NS	NS	-0.0174 ***	5.42^{-10} ***	NS	26.1 ***	NS	-0.0621 ***	-0.001 **
	13351	39	0.10 *	NS	0.0017 *	-4.22^{-11} *	NS	NS	NS	0.0141 *	NS
	13364	20	NS	-0.08 **	-0.0021 **	4.36^{-11} **	-1.6 **	5.3 ***	-2.1 **	-0.0050 *	-0.001 **
	13366	27	NS	-0.26 ***	-0.0218 ***	4.72^{-10} ***	-9.6 ***	26.1 ***	NS	-0.0811 ***	-0.003 ***
	13369	39	NS	NS	-0.0079 ***	2.00^{-10} ***	-5.7 ***	7.5 **	NS	-0.0634 ***	-0.002 ***
LCE	13375	36	NS	0.49 ***	NS	NS	-19.5 ***	NS	-17.9 ***	NS	NS
	13377	27	0.11 *	NS	-0.0081 ***	1.98^{-10} ***	-21.3 ***	9.0 **	-12.7 ***	-0.0569 ***	-0.003 ***
	13378	39	0.05 *	0.17 ***	-0.0026 ***	6.95^{-11} ***	-4.9 ***	3.3 *	-3.4 ***	-0.0071 **	NS

	13379	39	NS	-0.17 **	-0.0030 *	6.91 ⁻¹¹ *	-15.7 ***	NS	-11.8 ***	-0.0197 **	-0.002 ***
	13381	39	0.13 **	0.17 **	-0.0041 **	1.07 ⁻¹⁰ **	-10.9 **	NS	-5.0 **	-0.0225 **	-0.001 **
	13382	39	NS	0.13 ***	NS	1.16 ⁻¹⁰ *	-10.5 ***	NS	-8.0 ***	NS	NS
	13383	39	NS	0.23 ***	-0.0071 ***	1.83 ⁻¹⁰ ***	-3.9 **	5.6 ***	-4.1 **	-0.0176 ***	-0.001 *
	13384	23	0.07 *	0.19 ***	-0.0072 ***	1.82 ⁻¹⁰ ***	-1.4 *	8.2 ***	NS	-0.0243 ***	0.000 **
	13385	27	NS	0.13 ***	-0.0081 ***	1.97 ⁻¹⁰ ***	-2.1 **	8.1 ***	-0.9 *	-0.0214 ***	-0.001 **
	13386	38	NS	0.18 ***	-0.0090 ***	1.86 ⁻¹⁰ ***	-2.1 **	7.4 ***	NS	-0.0259 ***	-0.001 **
	13387	27	NS	0.18 ***	-0.0058 ***	1.21 ⁻¹⁰ ***	-2.6 **	4.4 ***	-2.0 **	-0.0147 ***	NS
	13388	27	0.07 **	0.05 *	-0.0086 ***	1.66 ⁻¹⁰ ***	-3.4 *	8.5 ***	-4.9 *	-0.0301 ***	NS
	13563	39	NS	0.73 ***	-0.0031 *	NS	16.7 **	NS	15.0 **	NS	0.002 **
GE	13396	36	0.08 **	0.10 ***	-0.0049 ***	1.09 ⁻¹⁰ ***	-6.1 ***	4.3 **	-4.7 ***	-0.0188 ***	-0.001 ***
	13397	39	0.11 **	0.20 ***	-0.0030 **	6.88 ⁻¹¹ **	-9.8 ***	NS	-7.7 ***	-0.0211 **	NS
MAE	12945	38	NS	0.33 ***	-0.0013 *	3.33 ⁻¹¹ *	-5.9 ***	-6.9 **	-8.4 ***	NS	NS
	13400	39	NS	0.18 ***	-0.0012 **	2.48 ⁻¹¹ *	-6.6 ***	NS	-6.4 ***	-0.0011 **	NS
	13402	39	NS	NS	-0.0033 ***	6.82 ⁻¹¹ ***	-7.6 ***	1.6 **	-6.4 ***	-0.0145 ***	0.000 **
	13404	39	NS	0.16 ***	-0.0052 ***	1.40 ⁻¹⁰ ***	-8.4 ***	5.2 **	-4.8 ***	-0.0149 ***	-0.001 *
	13406	34	NS	0.09 ***	NS	NS	-18.0 ***	-3.5 *	-20.3 ***	NS	-0.001 *
NE	13407	39	NS	0.10 ***	-0.0027 ***	7.09 ⁻¹¹ ***	-3.9 ***	2.7 ***	-2.3 ***	-0.0267 ***	-0.001 ***
	13409	39	0.09 *	0.11 ***	-0.0037 ***	8.75 ⁻¹¹ ***	-5.0 ***	3.5 ***	-4.3 ***	-0.0327 ***	-0.001 **
	13410	39	NS	0.10 ***	-0.0053 ***	1.25 ⁻¹⁰ ***	-4.6 ***	6.3 ***	-3.1 ***	-0.0317 ***	-0.001 ***

	13411	39	NS	0.11***	-0.0006 *	NS	-4.7 ***	NS	-2.6 ***	-0.0093 *	-0.001 *
	13421	39	NS	0.18 ***	-0.0002 *	4.52 ⁻¹² *	-3.4 **	NS	-3.4 ***	-0.0189 **	NS
	13422	39	NS	0.20 ***	-0.0024 **	7.81 ⁻¹¹ **	-5.1 ***	NS	-5.2 ***	-0.0214 ***	NS
	13423	39	NS	0.60 ***	-0.0110 *	3.08 ⁻¹⁰ *	-13.6 **	NS	-26.1 ***	-0.0735 *	NS
	13425	39	NS	0.77***	-0.0040 **	1.14 ⁻¹⁰ **	NS	NS	NS	NS	0.002 **
	13426	39	NS	0.09 ***	0.0022 **	-4.51 ⁻¹¹ **	-8.8 ***	-4.7 ***	-12.6 ***	NS	NS
	13430	20	NS	0.11 ***	-0.0042 ***	1.26 ⁻¹⁰ ***	-6.6 ***	5.6 **	-5.5 ***	-0.0345 ***	-0.001 ***
	13432	23	NS	0.11 ***	-0.0040 ***	1.25 ⁻¹⁰ ***	-7.0 ***	6.6 ***	-4.0 ***	-0.0343 ***	-0.001 ***
	13439	34	NS	0.09 ***	-0.0025 ***	7.69 ⁻¹¹ ***	-5.3 ***	5.7 **	-4.8 ***	-0.0358 ***	-0.002 ***
	13440	39	-0.13 **	0.17 *	0.0035 ***	-6.48 ⁻¹¹ ***	NS	-2.8 **	NS	0.0279 **	0.002 ***
LM	13443	38	NS	0.12 ***	-0.0040 **	7.51 ⁻¹¹ **	-3.6 ***	4.3 **	-1.4	-0.0249 ***	-0.001 **
	13444	38	NS	0.19 ***	NS	NS	7.2 **	NS	5.0 *	0.0073 **	0.001 ***
	13445	39	0.06 *	0.17 ***	NS	NS	NS	NS	NS	0.0128 **	0.001 **
	13446	38	-0.09 **	0.10 ***	NS	NS	NS	NS	NS	NS	NS
	13447	38	NS	0.23 ***	NS	NS	NS	NS	NS	NS	0.001 *
	13448	37	0.13 **	NS	0.0029 **	-5.65 ⁻¹¹ **	NS	-4.8 **	-6.5 **	0.0292 ***	0.001 ***
	13449	36	0.15 ***	0.08 *	NS	NS	NS	NS	-7.8 **	0.0275 *	0.001 **
	13450	37	NS	0.10 *	NS	NS	NS	NS	NS	NS	NS
	13452	35	NS	0.18 **	NS	NS	7.2 **	NS	NS	NS	0.001 *
	13459	37	NS	0.09 ***	NS	NS	1.9 **	NS	NS	NS	0.001 *

Table S2. Mean carbonate system characteristics (across all stations, 1974 – 2015) in the estuaries of the nwGOM. Estuaries are listed from northeast to southwest. Estuaries that had multiple stations within the primary and secondary bays have separate means reported for primary (P) and secondary (S) stations, while means for the entire estuary (E) are reported for estuaries without multiple sampling stations.

Estuary	Estuary Section	Salinity	pH	TA ($\mu\text{mol kg}^{-1}$)	$p\text{CO}_2$ (μatm)	DIC ($\mu\text{mol kg}^{-1}$)	Ω_{Ar}	β_{DIC} (mmol kg^{-1})
SNE	E	6.7 ± 4.4	7.28 ± 0.37	973 ± 322	2377 ± 2266	1043 ± 317	0.2 ± 0.2	0.10 ± 0.07
TSJ	P	20.2 ± 6.4	7.98 ± 0.25	2050 ± 241	580 ± 341	1899 ± 225	2.7 ± 1.6	0.16 ± 0.05
	S	13.0 ± 6.8	8.10 ± 0.30	1924 ± 311	505 ± 413	1787 ± 258	3.1 ± 2.0	0.14 ± 0.06
LCE	P	25.0 ± 6.6	8.01 ± 0.23	2335 ± 278	577 ± 380	2131 ± 267	2.5 ± 1.2	0.20 ± 0.06
	S	19.7 ± 8.7	7.99 ± 0.27	2269 ± 364	676 ± 548	2110 ± 331	2.4 ± 1.4	0.17 ± 0.06
GE	E	22.0 ± 8.6	8.05 ± 0.25	2563 ± 378	641 ± 525	2428 ± 372	3.8 ± 2.2	0.22 ± 0.06
MAE	P	24.4 ± 8.4	8.04 ± 0.23	2523 ± 290	584 ± 456	2291 ± 281	3.2 ± 1.6	0.22 ± 0.06
	S	16.0 ± 11.6	7.93 ± 0.25	2556 ± 502	961 ± 788	2438 ± 487	2.3 ± 1.4	0.16 ± 0.06
NE	P	31.2 ± 5.4	7.99 ± 0.20	2537 ± 255	608 ± 405	2279 ± 236	3.2 ± 1.4	0.24 ± 0.06
	S	26.4 ± 10.3	7.93 ± 0.25	2556 ± 293	789 ± 538	2364 ± 277	2.2 ± 0.2	0.21 ± 0.07
LM	P	33.7 ± 9.3	8.05 ± 0.26	2792 ± 459	626 ± 672	2437 ± 494	4.0 ± 1.9	0.29 ± 0.09
	S	37.5 ± 12.3	8.04 ± 0.27	2840 ± 593	594 ± 483	2437 ± 516	4.2 ± 2.2	0.31 ± 0.12

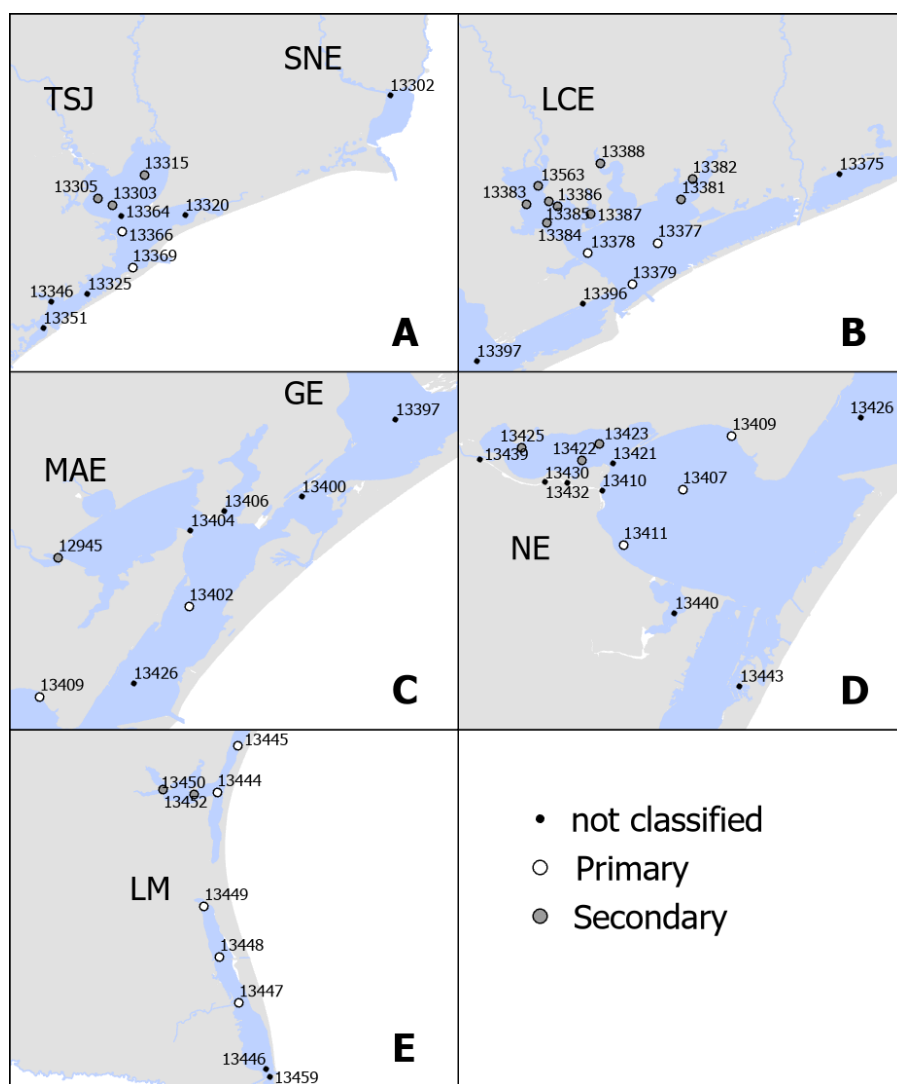


Figure S1. Location of numbered TCEQ stations within the estuaries of the nwGOM. Map subsets A-E are ordered from north to south.

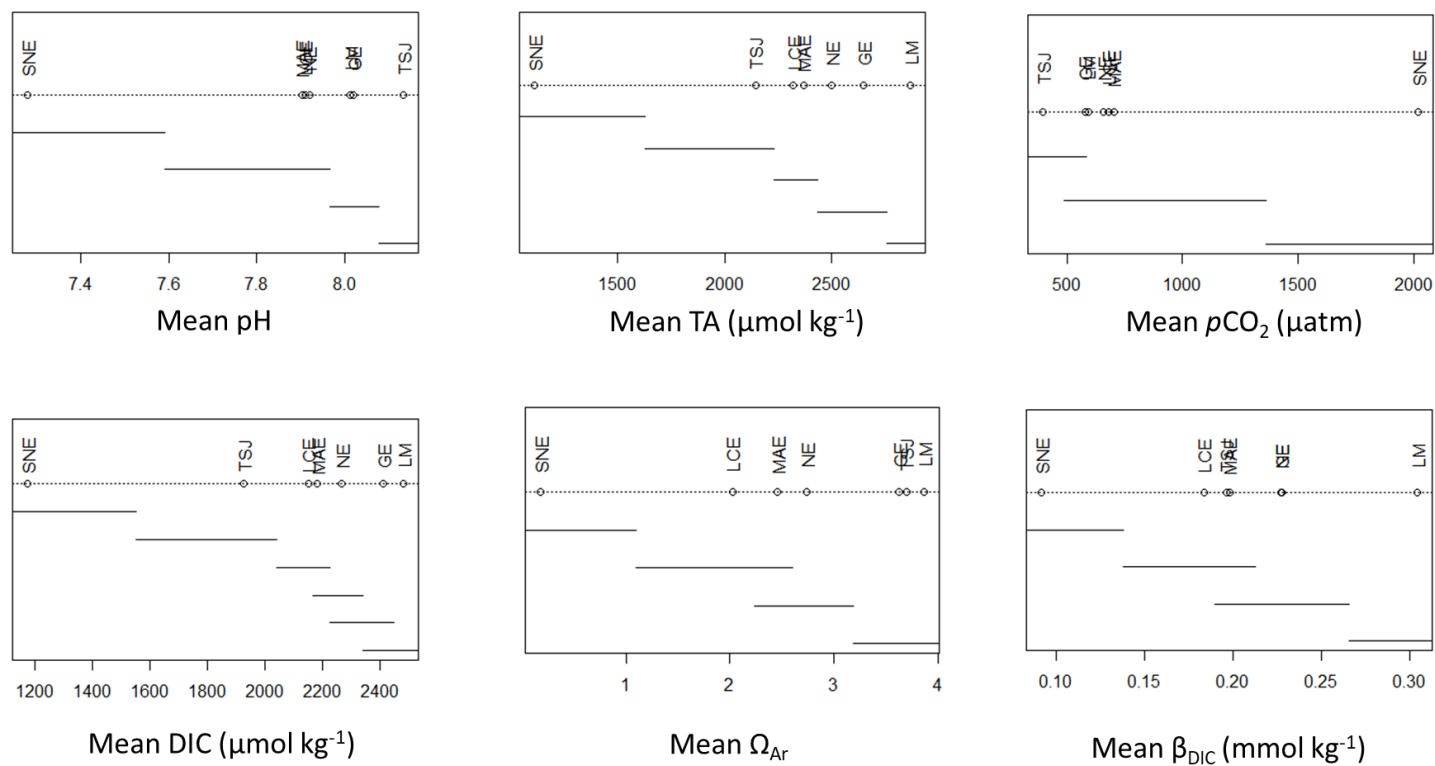


Figure S2. Mean values of measured and calculated carbonate system parameters within each estuary (2010 – 2015 data only, except for SNE – see Materials and Methods section, also see Table S2 for the mean values). Means of estuaries connected by a line are not significantly different based on the results of post hoc multiple comparisons (Tukey's test, $\alpha=0.05$).

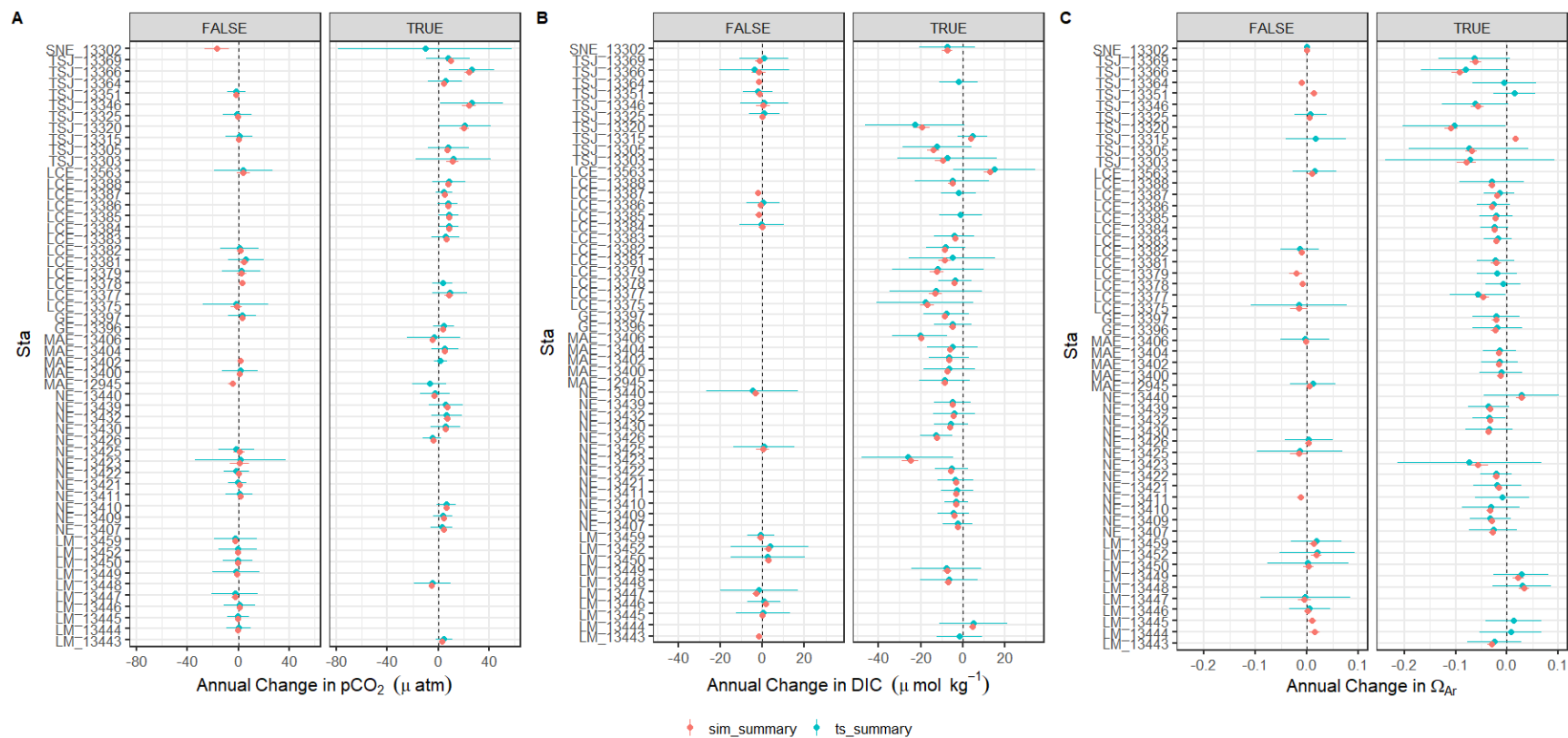


Figure S3. Comparison of single Theil-Sen regressions (blue) and TS regressions from simulations accounting for the propagated error (red) associated with $p\text{CO}_2$ (A), DIC (B), and Ω_{Ar} (C). The FALSE column displays those stations where the parameter did not have a significant long-term trend, while the TRUE column represents those stations that did have a significant long-term trend. The bounds of each data point indicate the median absolute difference (MAD) of slopes associated with the single TS regression or the 95% confidence interval in the slopes from 1000 simulations.