

Supplementary Information

Deducing acidification rates based on short-term time series

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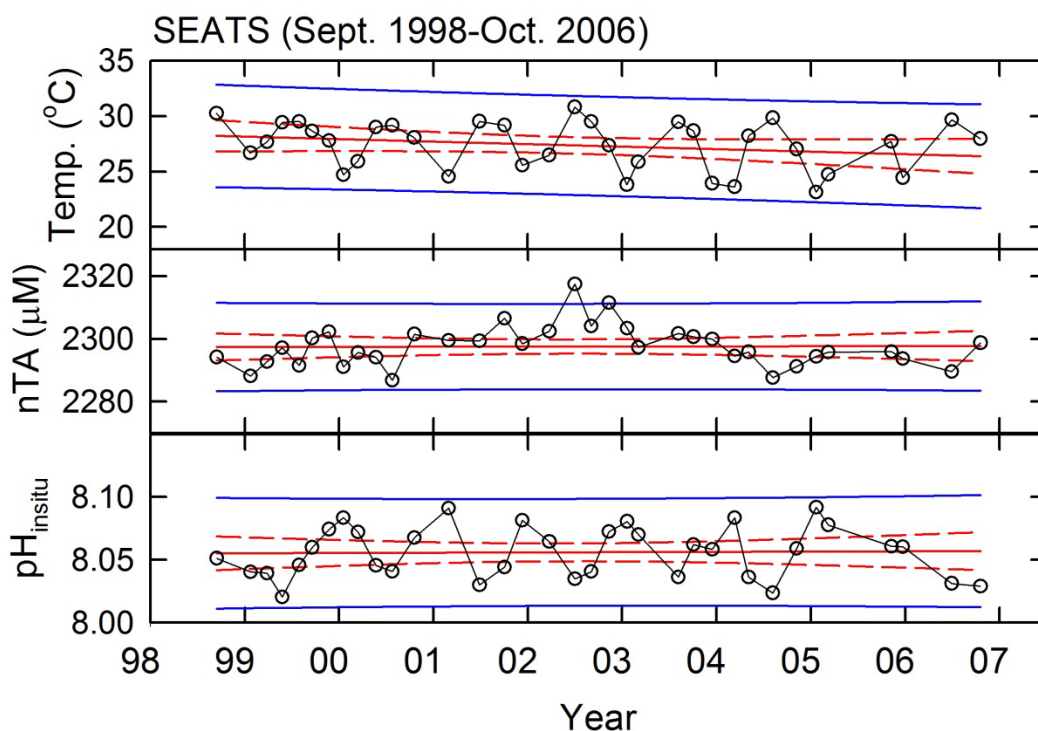
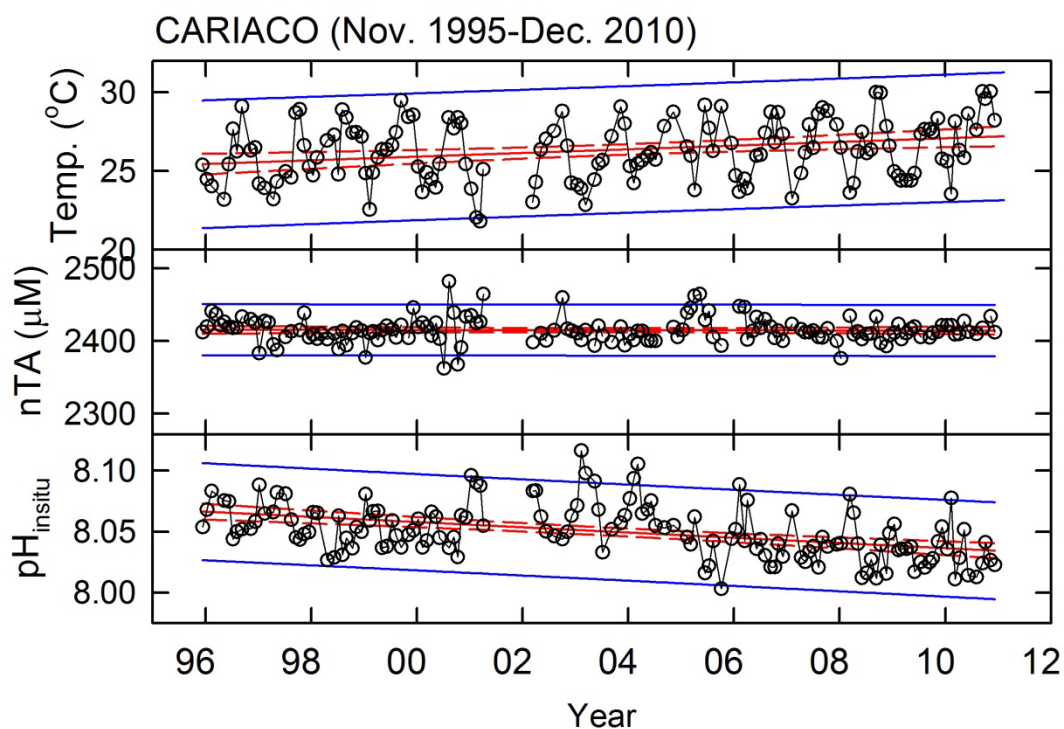
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Supplementary Figure S1. Time series of temperature, normalized total alkalinity (nTA) and $\text{pH}_{\text{in situ}}$ at CARIACO and SEATS. The red solid and dashed lines are the linear regressions and 95 % confidence intervals, respectively, while blue lines are the 95% prediction intervals of linear regressions. Rates of temporal changes in temperature, nTA and $\text{pH}_{\text{in situ}}$ at CARIACO and SEATS are shown in Table S1.

Supplementary Table S1. The observed surface seawater β_{pH} , β_T and β_{nTA} at various time-series stations.

Time series study	Studied Period	β_{pH} ($\times 10^{-3}$ pH unit yr ⁻¹)	β_T (°C yr ⁻¹)	β_{nTA} (μmolkg^{-1} yr ⁻¹)
BATS ¹	1983-2005	-1.7±0.3	0.017±0.030	0.06±0.04
CARIACO ^a (Figure S1)	1995-2010	-2.14±0.37	0.093±0.034	-0.067±0.305
CARIACO ²	1996-2008			0.1±0.33
CARIACO (deseasoned)	1995-2014	-2.5±0.4 ³	0.1±0.04 (1996-2008) ²	
ESTOC ^{4,5}	1995-2004	-1.4±0.7	0.002±0.019	Reported to have no observable change
ESTOC ^b (Figure 1, blue crosses)	1995-2009	-1.84±0.39	0.023±0.039	-0.028±0.039
ESTOC ^b (Figure 1, red circles)	1995-2009	1.61±0.37	-0.273±0.036	
HOT ⁶	1988-2007	-1.9±0.2	0.026±0.016	-0.06±0.06
SEATS ^c (Figure S1)	1998-2006	0.206±1.50	-0.226±0.157	0.04±0.48
137 °E ⁷	1983-2007	Winter: -1.8±0.2 Summer: -1.3±0.5	0.02±0.02 -0.01±0.02	Reported to have no observable change

^aData taken from the Institute of Marine Remote Sensing, College of Marine Science, University of South Florida.

<http://www.imars.usf.edu/CAR/>

^bData taken from Gonzalez-Davila and Santana-Casiano⁸.

^cData provided by the Ocean Data Bank (ODB), Ministry of Science and Technology, Taiwan.

Supplementary Table S2. SLR equations of the $\text{pH}_{\text{insitu}}$ and T time series at various time-series stations. (Units: T is $^{\circ}\text{C}$, t is year)

Station	Year	$\text{pH} = \text{pH}^{\circ} + \beta_{\text{pH}}(t - 1988)$ $T = T^{\circ} + \beta_T(t - 1988)$	Standard error	R^2	n
BATS	1991-	$\text{pH} = 8.1297 - 0.0022(t - 1988)$	0.034	0.122	215
	2010	$T = 22.85 + 0.033(t - 1988)$	3.10	0.004	
CARIACO	1995-	$\text{pH} = 8.0835 - 0.00214(t - 1988)$	0.020	0.194	144
	2010	$T = 24.82 + 0.093(t - 1988)$	1.86	0.049	
ESTOC	1995-	$\text{pH} = 8.1155 - 0.00184(t - 1988)$	0.020	0.135	144
	2009	$T = 20.46 + 0.023(t - 1988)$	1.96	0.002	
HOT	1988-	$\text{pH} = 8.1172 - 0.00183(t - 1988)$	0.014	0.399	222
	2010	$T = 24.68 + 0.015(t - 1988)$	1.20	0.006	
SEATS	1998-	$\text{pH} = 8.0531 + 0.000206(t - 1988)$	0.021	0.0006	35
	2006	$T = 30.63 - 0.226(t - 1988)$	2.17	0.059	

References:

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