



Supplement of

Including high-frequency variability in coastal ocean acidification projections

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Supplement

Phosphate concentrations were estimated (PO_4^{est}) for the hydrographic data by establishing a regional empirical relationship from historical data using the approach described in *Juranek et al.*, 2009 and *Alin et al.*, 2012. The North American Carbon Program 2007 West Coast Cruise data at all depths were used to calculate the coefficients for the equation:

$$\text{PO}_4^{\text{est}} = \alpha_0 + \alpha_1(O_2 - O_{2,r}) + \alpha_2(T - T_r) + \alpha_3(O_2 - O_{2,r}) \times (T - T_r) \quad (1)$$

where the subscript r refers to a mean reference value ($O_{2,r} = 156.7 \text{ } \mu\text{mol kg}^{-1}$ and $T_r = 9.045 \text{ } ^\circ\text{C}$).

The PO_4^{est} values were in excellent agreement with measured values (Figure S1; RMSE = 0.15 $\mu\text{mol kg}^{-1}$). This error in PO_4^{est} propagated to a $\sim 4 \mu\text{mol kg}^{-1}$ uncertainty in preformed total alkalinity. The coefficients of the regression were $\alpha_0 = 1.758$, $\alpha_1 = -6.52 \times 10^{-3}$, $\alpha_2 = -0.102$, and $\alpha_3 = -1.88 \times 10^{-4}$.

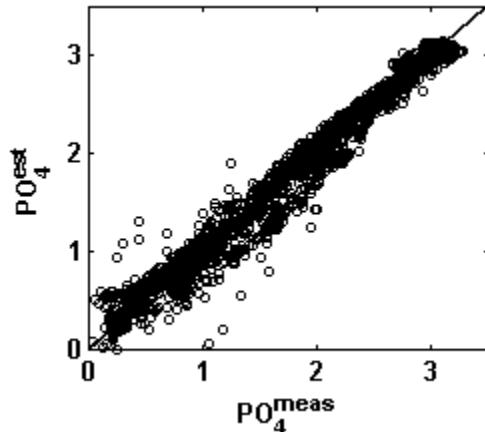


Figure S1: Measured phosphate ($\text{PO}_4^{\text{meas}}$) versus estimated phosphate (PO_4^{est}) ($R^2 = 0.98$). Solid line represents a 1:1 relationship

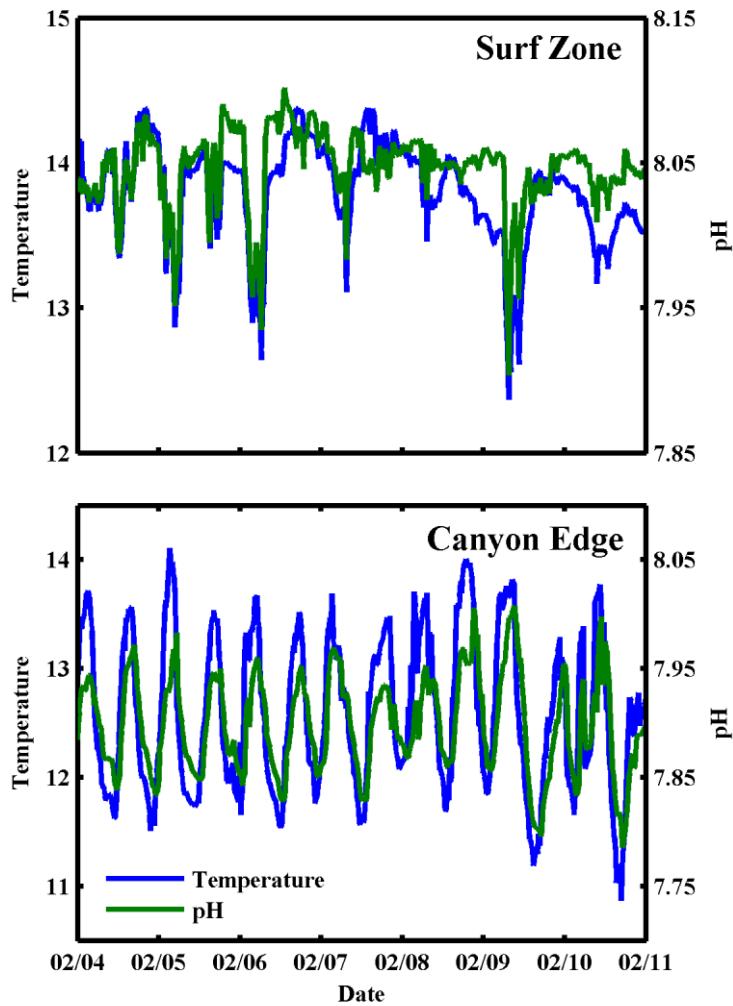


Figure S2: Week long time series of temperature and pH at the surf zone (top) and canyon edge (bottom).

Alin, S. R., Feely, R. A., Dickson, A. G., Hernández-Ayón, J. M., Juranek, L. W., Ohman, M. D. and Goericke, R.: Robust empirical relationships for estimating the carbonate system in the southern California Current System and application to CalCOFI hydrographic cruise data (2005–2011), *J. Geophys. Res.*, 117(C5), C05033, doi:10.1029/2011JC007511, 2012.

Juranek, L. W., Feely, R. a., Peterson, W. T., Alin, S. R., Hales, B., Lee, K., Sabine, C. L. and Peterson, J.: A novel method for determination of aragonite saturation state on the continental shelf of central Oregon using multi-parameter relationships with hydrographic data, *Geophys. Res. Lett.*, 36(24), L24601, doi:10.1029/2009GL040778, 2009.