

# Partial pressure of carbon dioxide (pCO<sub>2</sub>), temperature, salinity and other variables collected from surface underway observations using shower head equilibrator, carbon dioxide gas detector, and other instruments from container ship Cap Vilano in the Pacific Ocean from 2013-02-01 to 2013-06-06 (NCEI Accession 0132054)

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**ABSTRACT:** This archival package contains underway measurements of pCO<sub>2</sub>, salinity, sea surface temperature, and other parameters were collected during 3 trans-Pacific crossings in 2013 on the container ship Cap Vilano. Cruise names and expocodes: CV2013\_02 (AGB620130201), CV2013\_03 (AGB620130328), CV2013\_05 (AGB620130524) . All cruises started in Long Beach California and ended in New Zealand. This effort was conducted in support of NOAA's Climate Program Office (CPO), and Ocean Acidification Program (OAP).

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## IDENTIFICATION INFO OF THIS DATA PACKAGE:

NCEI ACCESSION: 0132054  
NCEI DOI:  
EXPOCODE: AGB620130201, AGB620130328, AGB620130524  
CRUISE ID: CV2013\_02, CV2013\_03, CV2013\_05  
SECTION/LEG:

## TYPES OF STUDY:

Surface underway;

## TEMPORAL COVERAGE:

START DATE: 2/1/2013                      END DATE: 6/6/2013

## SPATIAL COVERAGE:

NORTH BOUND: 31.799  
WEST BOUND: 178.942                      EAST BOUND: -117.98  
SOUTH BOUND: -35.664

## GEOGRAPHIC NAMES:

Pacific Ocean, Equatorial Pacific;

## LOCATION OF ORGANISM COLLECTION:

N/A;

## PLATFORMS:

Cap Vilano (ID: C4NQ2);

## VARIABLES / PARAMETERS:

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*pCO<sub>2</sub> (fCO<sub>2</sub>) autonomous*

**Abbreviation:** fCO<sub>2</sub>W@SST

**Observation type:** Surface underway

**In-situ / Manipulation /**  
**Response variable:** In-situ observation

**Unit:** uatm

**Measured or calculated:** Measured

**Sampling instrument:** Seawater pump

<b>Location of seawater intake:</b>	Bow
<b>Analyzing instrument:</b>	General Oceanics 8050. PMEL system ID: GO7
<b>Detailed sampling and analyzing information:</b>	The sampling and analyzing methods of the Neill/General Oceanics Underway pCO <sub>2</sub> systems are described in detail in: Pierrot, D.; Neill, C.; Sullivan, K.; Castle, R.; Wanninkhof, R.; Luger, H.; Johannessen, T.; Olsen, A.; Feely, R.A.; and Cosca, C.E. (2009). Recommendations for autonomous underway pCO <sub>2</sub> measuring systems and data-reduction routines. Deep-Sea Res., II, v. 56, pp. 512-522.
<b>Equilibrator type:</b>	Shower head
<b>Equilibrator volume:</b>	~0.5 L
<b>Is the equilibrator vented or not:</b>	Vented
<b>Water flow rate:</b>	3 L/min
<b>Gas flow rate:</b>	~0.8 L/m
<b>How was temperature inside the equilibrator measured:</b>	Hart Scientific model 1521 digital thermometer, serial number A77488, with an NIST traceable model 5610 thermistor probe, serial number A690613. Accurate to plus/minus 0.01 degrees Celsius.
<b>How was pressure inside the equilibrator measured:</b>	Setra 239 differential pressure transducer, accurate to plus/minus 0.15 hPa. The equilibrator was passively vented to a secondary equilibrator, and the Licor sample output was vented to the laboratory when CO <sub>2</sub> measurements were made, thus equilibrator headspace pressure was assumed to be laboratory pressure. Pressure in the laboratory was measured with a GE Druck barometer, serial number 3013024, with an accuracy of plus/minus 0.01%.
<b>Drying method for gas:</b>	From Pierrot, et al.: Sample air is dried in a condenser that is cooled to 4-5 oC by a Peltier thermoelectric device. This partially dried air flushes a chamber that is vented and remains at ambient pressure. The dried air inside the chamber is used as the counter flow in the Nafion tubing. A vacuum pump pulls the dried air from the chamber first through a fixed restrictor and then through the Nafion tubes, thus creating an absolute pressure and corresponding partial pressure gradient for water vapor across the membrane. When atmospheric air is measured, some of the partially dried air (80- 100 ml/min) is pushed through a Nafion tube, the analyzer and out a vent instead of flushing the chamber. The headspace gas, when being measured, is circulated in a closed loop through the analyzer at a rate similar to that of the atmospheric air (80-100 ml/min). It is dried first in the condenser, then in a Nafion tube prior to entering the analyzer and being returned to the equilibrator. Typically, the water mole fraction (xH <sub>2</sub> O) in the dried gas is about 2 parts per thousand (ppt), which corresponds to a dew point temperature of about -20 degrees Celsius. The liquid water condensed out of the sample air streams is removed by peristaltic pumps into the vent equilibrator at intervals determined by the user.
<b>Gas detector manufacturer:</b>	Licor, Inc
<b>Gas detector model:</b>	Licor 7000, IRG4-0560
<b>Gas detector resolution:</b>	0.2 uatm
<b>Gas detector uncertainty:</b>	0.3 uatm for equilibrator measurements, 0.2 uatm for atmospheric measurements
<b>Standardization technique:</b>	The system runs a full cycle in approximately 7 hours. The cycle starts with 4 standard gases, then measures three rounds of 6 atmospheric samples followed by 50 surface water samples. Each new gas is flushed through the Licor Analyzer for 2 minutes prior to a stop-flow measurement.
<b>Standardization frequency:</b>	Every 7 hours
<b>Standard gas manufacturer:</b>	Standard gases are supplied by NOAA's Earth System Research Laboratory, Global Monitoring Division, in Boulder, CO, and are directly traceable to the WMO scale.
<b>Standard gas concentration:</b>	LL83535, 246.77 ppm; LL108050, 399.22 ppm; LL108059, 496.103 ppm; LL154371, 628.59 ppm
<b>Standard gas uncertainty:</b>	0.01 ppm
<b>Water vapor correction method:</b>	Details of the data reduction are described in Pierrot, et.al. (2009).
<b>Temperature correction method:</b>	Details of the data reduction are described in Pierrot, et.al. (2009).
<b>At what temperature was pCO<sub>2</sub> reported:</b>	In situ sea surface temperature
<b>Uncertainty:</b>	plus/minus 0.01 degrees Celsius
<b>Quality flag convention:</b>	WOCE quality control flags are used: 2 = good value, 3 = questionable value, 4 = bad value
<b>Method reference:</b>	Pierrot, D.; Neill, C.; Sullivan, K.; Castle, R.; Wanninkhof, R.; Luger, H.; Johannessen, T.; Olsen, A.; Feely, R.A.; and Cosca, C.E. (2009). Recommendations for autonomous underway pCO <sub>2</sub> measuring systems and data-reduction routines. Deep-Sea Res., II, v. 56, pp. 512-522.
<b>Researcher name:</b>	Catherine E. Cosca
<b>Researcher institution:</b>	Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration

**Abbreviation:** SST(TSG)\_C  
**Observation type:** Surface Underway  
**In-situ / Manipulation / Response variable:** In-situ observation  
**Unit:** Degree Celcius  
**Measured or calculated:** Measured  
**Sampling instrument:** Seabird 38, serial number 3848581-0383  
**Uncertainty:** 0.0025 degrees Celsius

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*Salinity*

**Abbreviation:** SAL(TSG)\_PERMIL  
**Observation type:** Surface Underway  
**In-situ / Manipulation / Response variable:** In-situ observation  
**Unit:** permil  
**Measured or calculated:** Measured  
**Sampling instrument:** Seabird 45, serial number 4539646-0143  
**Uncertainty:** 0.005 PSU

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**DATA PACKAGES RELATED TO THIS ONE:**

**PUBLICATIONS DESCRIBING THIS DATA SET:**

Pierrot, D.; Neill, C.; Sullivan, K.; Castle, R.; Wanninkhof, R.; Luger, H.; Johannessen, T.; Olsen, A.; Feely, R.A.; and Cosca, C.E. (2009). Recommendations for autonomous underway pCO<sub>2</sub> measuring systems and data-reduction routines. Deep-Sea Res., II, v. 56, pp. 512-522.  
Feely, R.A., R. Wanninkhof, H.B. Milburn, C.E. Cosca, M. Stapp, and P.P. Murphy, A new automated underway system for making high precision pCO<sub>2</sub> measurements onboard research ships, Analytica Chim. Acta, 377, 185-191, 1998.  
Wanninkhof and Thoning, Measurement of fugacity of Carbon Dioxide in surface water and air using continuous sampling methods, Marine Chemistry, 44, 189-205, 1993.

**ADDITIONAL INFORMATION:**

<http://www.pmel.noaa.gov/co2/>

**FUNDING AGENCY:**

NOAA's Ocean Acidification Program  
*PROJECT TITLE:* West Coast Ocean Acidification Monitoring Network: Volunteer Observing Ships  
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