Dataset Expocode	**BMBE20121220**
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Dataset	**Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program **Initial Submission (yyyymmdd):** 2016mmdd **Revised Submission (yyyymmdd):** 2016mmdd
Campaign/Cruise	**Expocode:** BMBE20121220 **Campaign/Cruise Name:** BarX20121220 **Campaign/Cruise Info:** AOML_SOOP_CO2 **Platform Type:** **CO2 Instrument Type:** Equilibrator-IR or CRDS or GC **Survey Type:** SOOP Line **Vessel Name:** Barcelona Express **Vessel Owner:** Anglo Eastern Ship Management **Vessel Code:** BMBE
Coverage	**Start Date (yyyymmdd):** 20121220 **End Date (yyyymmdd):** 20130206 **Westernmost Longitude:** 97.9 W **Easternmost Longitude:** 10.3 E **Northernmost Latitude:** 44.4 N **Southernmost Latitude:** 0.1 S **Port of Call:** Cagliari, Italy **Port of Call:** Leghorn, Italy **Port of Call:** Genoa, Italy **Port of Call:** Barcelona, Spain **Port of Call:** Valencia, Spain **Port of Call:** Port Everglades, FL, USA **Port of Call:** Veracruz, Mexico **Port of Call:** Altamira, Mexico **Port of Call:** Houston, TX, USA **Port of Call:** New Orleans, LA, USA
Variable	**Name:** xCO2_EQU_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Variable	**Name:** xCO2_ATM_ppm **Unit:** ppm **Description:** Mole fraction of CO2 measured in dry outside air (ppm)
Variable	**Name:** xCO2_ATM_interpolated_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)
Variable	**Name:** PRES_EQU_hPa **Unit:** hPa **Description:** Barometric pressure in the equilibrator headspace (hPa)
Variable	**Name:** PRES_ATM@SSP_hPa **Unit:** hPa **Description:** Barometric pressure measured outside, corrected to sea level (hPa)
Variable	**Name:** TEMP_EQU_C **Unit:** Degree C **Description:** Water temperature in equilibrator (°C)
Variable	**Name:** SST_C **Unit:** Degree C **Description:** Sea surface temperature (°C)
Variable	**Name:** SAL_permil **Unit:** ppt **Description:** Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	**Name:** fCO2_SW@SST_uatm **Unit:** µatm **Description:** Fugacity of CO2 in sea water at SST and 100% humidity (µatm)
Variable	**Name:** fCO2_ATM_interpolated_uatm **Unit:** µatm **Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
Variable	**Name:** dfCO2_uatm **Unit:** µatm **Description:** Sea water fCO2 minus interpolated air fCO2 (µatm)
Variable	**Name:** WOCE_QC_FLAG **Unit:** None **Description:** Quality control flag for fCO2 values (2=good, 3=questionable)
Variable	**Name:** QC_SUBFLAG **Unit:** None **Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3
Sea Surface Temperature	**Location:** In ship's engine room at a side port off the piping carrying cooling water for the engines. Between the sea chest and the side port there is ~5 meters of pipe (~0.25 diameter). During the transit, the seawater warms an estimated 0.2-0.5 deg C. The reported SST is the value measured at the side port. **Manufacturer:** Seabird **Model:** SBE 38 **Accuracy:** 0.001 (°C if units not given)

	Precision: 0.0003 (°C if units not given) **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Sea Surface Salinity	**Location:** In the ship's engine room next to CO2 system. **Manufacturer:** Seabird **Model:** SBE 45 **Accuracy:** ± 0.005 o/oo **Precision:** 0.0002 o/oo **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Atmospheric Pressure	**Location:** On deck above bridge at ~20 m above sea surface. **Normalized to Sea Level:** yes **Manufacturer:** Druck **Model:** RPT350 **Accuracy:** ± 0.08 hPa (hPa if units not given) **Precision:** 0.01 hPa (hPa if units not given) **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Atmospheric CO2	**Measured/Frequency:** Yes, 5 readings in a group every ~4.5 hours **Intake Location:** On mast above the bridge at ~20 meters above the sea surface **Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry). **Atmospheric CO2 Accuracy:** ± 0.5 µatm in fCO2_ATM **Atmospheric CO2 Precision:** ± 0.01 µatm in fCO2_ATM
Aqueous CO2 Equilibrator Design	**System Manufacturer:** **Intake Depth:** 5 meters **Intake Location:** Bow **Equilibration Type:** Spray head above dynamic pool, with thermal jacket **Equilibrator Volume (L):** 0.95 L (0.4 L water, 0.55 L headspace) **Headspace Gas Flow Rate (ml/min):** 70 - 150 ml/min **Equilibrator Water Flow Rate (L/min):** 1.5 - 2.0 L/min **Equilibrator Vented:** Yes **Equilibration Comments:** Primary equilibrator is vented through a secondary equilibrator. **Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Aqueous CO2 Sensor Details	**Measurement Method:** IR **Method details:** details of CO2 sensing (not required) **Manufacturer:** LI-COR **Model:** 840A **Measured CO2 Values:** xCO2(dry) **Measurement Frequency:** Every 140 seconds, except during calibration **Aqueous CO2 Accuracy:** ± 2 µatm in fCO2_SW **Aqueous CO2 Precision:** ± 0.01 µatm in fCO2_SW **Sensor Calibrations:** **Calibration of Calibration Gases:** The analyzer is calibrated every ~4.5 hours using ESRL standards that are directly traceable to the WMO scale. Ultra-High

Purity air (0.0 ppm CO2) and the high standard (when both present) are used to zero and span the LI-COR analyzer.
Number Non-Zero Gas Standards: 4
Calibration Gases:
Std 1: CA05585, 280.18 ppm, owned by ESRL, used every ~5.0 hours.Std 2: CA06368, 328.12 ppm, owned by ESRL, used every ~5.0 hours.Std 3: CA03910, 372.81 ppm, owned by ESRL, used every ~5.0 hours.Std 4: CC71588, 531.98 ppm, owned by ESRL, used every ~5.0 hours.
Comparison to Other CO2 Analyses:
Comments: Instrument is located below a walkway in the engine room.
Method Reference:
Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Equilibrator Temperature Sensor

Location: Inserted into equilibrator ~5 cm below water level
Manufacturer: Hart
Model: 1521
Accuracy: 0.025 (°C if units not given)
Precision: 0.001 (°C if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure Sensor

Location: Inside LICOR connected to ambiant air. The differential pressure reading from A Setra 239, which is attached to the equilibrator headspace, is added to the pressure reading from the LICOR analyzer.
Manufacturer: Licor
Model: 840-P
Accuracy: 15 (hPa if units not given)
Precision: 1 (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Additional Information

Suggested QC flag from Data Provider: NA
Additional Comments: ATM pressure was not measured. It was estimated from the EQU pressure using a relationship determined on 2010 cruises for the offset between equ P and NCEP R2 product.for BarX20101014: amP = equP + 2.47 (+/- 1.45) mbar over the whole cruise.for BarX20101202: amP = equP + 2.67 (+/- 2.07) mbar over the whole cruise.Applied +2.60 to equP to generate atmP.A lot of SST measurements were dropped. The offset between equ temp and SST on regions were both sensors were working well (Cruise Days ~12-25 and ~38-48) was determined. The relationship found was:sst=equT - 0.24 (+/- 0.04)All the dropped value were replaced by this estimate and flagged appropriately. Because of a bug in the program, there were issues in the flagging of data. Data has been re-treated on Dec. 8, 2016 after fixing the bug. Data has been re-submitted. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/barcelona/barcelona_introduction.html
Citation for this Dataset:
Other References for this Dataset: