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| **Dataset Expocode** | **33HH20220209** |
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| **Dataset** | **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program<br>**Initial Submission (yyyymmdd):** 20220711<br>**Revised Submission (yyyymmdd):** 20220711 |
| **Campaign/Cruise** | **Expocode:** 33HH20220209<br>**Campaign/Cruise Name:** HB2201, Harmful Algal Bloom<br>**Campaign/Cruise Info:** AOML_SOOP_OA<br>**Platform Type:**<br>**CO2 Instrument Type:** Equilibrator-IR or CRDS or GC<br>**Survey Type:** Research Cruise<br>**Vessel Name:** R/V Henry B. Bigelow<br>**Vessel Owner:** NOAA<br>**Vessel Code:** 33HH |
| **Coverage** | **Start Date (yyyymmdd):** 20220209<br>**End Date (yyyymmdd):** 20220215<br>**Westernmost Longitude:** 71.4 W<br>**Easternmost Longitude:** 67.5 W<br>**Northernmost Latitude:** 44.4 N<br>**Southernmost Latitude:** 41.3 N<br>**Port of Call:** Newport, RI |
| **Variable** | **Name:** xCO2_EQU_ppm<br>**Unit:** ppm<br>**Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm) |
| **Variable** | **Name:** xCO2_ATM_ppm<br>**Unit:** ppm<br>**Description:** Mole fraction of CO2 measured in dry outside air (ppm) |
| **Variable** | **Name:** xCO2_ATM_interpolated_ppm<br>**Unit:** ppm<br>**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 |

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| | **Unit:** hPa<br>**Description:** Barometric pressure in the equilibrator headspace (hPa) |
| **Variable** | **Name:** PRES_ATM@SSP_hPa<br>**Unit:** hPa<br>**Description:** Barometric pressure measured outside, corrected to sea level (hPa) |
| **Variable** | **Name:** TEMP_EQU_C<br>**Unit:** Degree C<br>**Description:** Water temperature in equilibrator (°C) |
| **Variable** | **Name:** SST_C<br>**Unit:** Degree C<br>**Description:** Sea surface temperature (°C) |
| **Variable** | **Name:** SAL_permil<br>**Unit:** ppt<br>**Description:** Sea surface salinity on Practical Salinity Scale (o/oo) |
| **Variable** | **Name:** fCO2_SW@SST_uatm<br>**Unit:** µatm<br>**Description:** Fugacity of CO2 in sea water at SST and 100% humidity (µatm) |
| **Variable** | **Name:** fCO2_ATM_interpolated_uatm<br>**Unit:** µatm<br>**Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm) |
| **Variable** | **Name:** dfCO2_uatm<br>**Unit:** µatm<br>**Description:** Sea water fCO2 minus interpolated air fCO2 (µatm) |
| **Variable** | **Name:** WOCE_QC_FLAG<br>**Unit:** None<br>**Description:** Quality control flag for fCO2 values (2=good, 3=questionable) |
| **Variable** | **Name:** QC_SUBFLAG<br>**Unit:** None<br>**Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3 |
| **Sea Surface Temperature** | **Location:** Through starboard hull at 3 meters depth<br>**Manufacturer:** AirMar<br>**Model:** B17-S-Temp<br>**Accuracy:** 0.17 (°C if units not given)<br>**Precision:** 0.01 (°C if units not given)<br>**Calibration:** Factory calibration<br>**Comments:** Manufacturer's Resolution is taken as Precision; 'MidSea' Sensor, maintained by the ship. |
| **Sea Surface Salinity** | **Location:** In dry lab after a debubbler, next to CO2 system<br>**Manufacturer:** Seabird<br>**Model:** SBE 45<br>**Accuracy:** ± 0.005 o/oo<br>**Precision:** 0.0002 o/oo<br>**Calibration:** Factory calibration<br>**Comments:** Manufacturer's Resolution is taken as Precision; Maintained by the ship. |

**Atmospheric Pressure**

**Location:** On mast above the bridge at ~18 m above sea surface water
**Normalized to Sea Level:** yes
**Manufacturer:** Vaisala
**Model:** PTB220
**Accuracy:** ± 0.15 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; Maintained by ship.

**Atmospheric CO2**

**Measured/Frequency:** Yes, 5 readings in a group every 3.5 hours
**Intake Location:** Mast above the bridge, ~18 meters above 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:** 3 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:** 6262
**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 3.5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO X2019 scale. The zero gas is ultra-high purity air.
**Number Non-Zero Gas Standards:** 4
**Calibration Gases:**

Std 1: JA02280, 233.51 ppm, owned by AOML, used every ~4.5 hours.
Std 2: JA02264, 326.30 ppm, owned by AOML, used every ~4.5 hours.
Std 3: JB03592, 422.43 ppm, owned by AOML, used every ~4.5 hours.
Std 4: JA02647, 561.46 ppm, owned by AOML, used every ~4.5 hours.
Std 5: LL100000, 0.00 ppm, owned by AOML, used every ~23.5 hours.
**Comparison to Other CO2 Analyses:**
**Comments:**
**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:** 1523
**Accuracy:** 0.015 (°C if units not given)
**Precision:** 0.0003 (°C if units not given)
**Calibration:** Factory calibration
**Comments:** Resolution is taken as Precision.

**Equilibrator Pressure Sensor**

**Location:** Attached to equilibrator headspace. Differential pressure reading from Setra 239 attached to the equilibrator headspace is added to the pressure reading from the LICOR, which is measured by an external Setra 270 connected to the exit of the analyzer.
**Manufacturer:** Setra
**Model:** 270
**Accuracy:** 0.15 (hPa if units not given)
**Precision:** 0.015 (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:** The analytical system operated fine during this cruise; however, the ship had installed a new pump on the seawater delivery system which presented issues. For the first 8 hours of the cruise there was no seawater flow through the pCO2 instrument. For the following 23 hours, the SW flow was poor; and for the rest of the cruise, the SW flow was suboptimal. The SBE38 SST sensor was replaced at the start of this field season, and for an undetermined reason, the measured SST values were not reliable. The data from one of the ship's through hull sensors (MidSea at 3 meters) was used for SST values. A bracketed 1-minute average of this sensor showed smooth, reliable behavior and was used for data processing. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/bigelow/bigelow_introduction.html . Full unprocessed data files from analytical instrument including flow information plus meteorological and TSG data at time of sampling can be obtained upon request.
**Citation for this Dataset:**
**Other References for this Dataset:**