* =mandatory field)

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- **Dataset_Info**:*
  - o Dataset_ID*:   GraysRf_81W_31N_Jul2009_May2010
  - o **Submission_Dates**:*
    - Initial_Submission: 20120522   (YYYYMMDD)
    - Revised_Submission: (YYYYMMDD)
- **Cruise_Info**:*
  - o **Experiment**:
    - Experiment_Name*:
    - **Cruise**:(-)
      - Cruise_ID: (EXPOCODE)
      - Section: (Leg)
      - **Geographical_Coverage**:*
        - Geographical_Region:
        - **Bounds**:
          - Westernmost_Longitude:
            Enter decimal fractions of degrees:
            or Degrees, Minutes, Seconds:
          - Easternmost_Longitude:
            Enter decimal fractions of degrees: - 80.87(+ = E, - = W)
            or Degrees, Minutes, Seconds:
          - Northernmost_Latitude:
            Enter decimal fractions of degrees:+31.40 (+ = E, - = W)
          - Southernmost_Latitude:
            Enter decimal fractions of degrees:
      - **Temporal_Coverage**:
        - Start_Date: 20090726   (YYYYMMDD)
        - End_Date: 20100517   (YYYYMMDD)
  - o **Vessel**:* Mooring platform
    - Vessel_Name:
    - Vessel_ID:
    - Country:
    - Vessel_Owner:
- **Variables_Info**:*
  - o **Variable**:
    - Variable_Name and Description*:
- xCO_2 SW (wet) (umol/mol) - Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature and measured humidity.

- CO2 SW QF – Quality Flag for xCO_2 SW (wet).

- H_2O SW (mmol/mol) - Mole fraction of H_2O in air from equilibrator.

- xCO_2 Air (wet) (umol/mol) - Mole fraction of CO_2 in air from airblock, 4 feet above the sea surface at measured humidity.

- CO2 Air QF – Quality Flag for xCO_2 Air (wet)

- H_2O Air (mmol/mol) - Mole fraction of H_2O in air from airblock, 4 feet above the sea surface.

- Licor Atm Pressure (hPa) – Atmospheric pressure at the airblock, 4 feet above the sea surface

- Licor Temp (C) – Temperature of the Infrared Licor 820 in degrees Celsius

- % O_2 - The percent oxygen of the surface seawater divided by the percent oxygen of the atmosphere at 4 feet above the sea surface. Disclaimer: The oxygen measurement is made in the equilibrated air. We have found that the oxygen does not come to complete equilibrium so any rapid changes in oxygen do not get properly captured using this system. Therefore, we tend to use the oxygen data only as a qualitative sense of the biology. It is not a quantitative measure.

- SST (C) - Sea Surface Temperature measured by CTD (MicroCAT C-T Recorder). Temperature data is internally recorded and collected during the equilibration period. Data not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO_2 calculation (within the degree of accuracy of the CO_2 measurement). Contact us if you would like the CTD post-calibration information.

- Salinity - Sea Surface Salinity measured by CTD (MicroCAT C-T Recorder). Conductivity data is internally recorded and collected during the equilibration period. Data not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO2 calculation (within the degree of accuracy of the CO_2 measurement). Contact us if you would like the CTD post-calibration information.

- xCO_2 SW (dry) (umol/mol) – Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature (dry air).

- xCO_2 Air (dry) (umol/mol) – Mole fraction of CO_2 in air at the airblock, 4 feet above the sea surface (dry air).

- fCO_2 SW (sat) uatm – Fugacity of CO_2 in air in equilibrium with the seawater at sea surface temperature (100% humidity). Since the measurements are taken at the sea surface, warming calculations are not necessary.

- fCO_2 Air (sat) uatm – Fugacity of CO_2 in air at the airblock, 4 feet above the sea surface (100% humidity).

- $dfCO_2$ – Difference of the fugacity of the CO_2 in seawater and the fugacity of the CO_2 in air (fCO_2 SW - fCO_2 Air).

- **Method_Description:***
  - **Equilibrator_Design**:
    - Equilibrator_Type: (show pick list)   Bubble Equilibrator
    - Equilibrator_Volume: (L)   N/A
    - Water_Flow_Rate: (L/min)   N/A
    - Headspace_Gas_Flow_Rate: (L/min)   ~600 cc/min
    - Vented: (show pick list)   Yes
  - Measurement_Method: Absolute, non-dispersive infrared (NDIR) gas analyzer

  - Manufacturer_of_Calibration_Gas: NOAA Earth System Research Laboratory (ESRL)

  - **CO_2_Sensors**:
    - **CO_2_Sensor**:
      - Manufacturer: Licor
      - Model: Environmental_Control: LI-820
      - Resolution: 0.01 ppm
      - Uncertainty: < 2.5% of reading with 14 cm bench (stated) <1.5 ppm determined in lab
      - CO_2_Sensor_Calibration: (For each calibration gas, document traceability to an internationally recognized scale, including date and place of last calibration. Include uncertainty of assigned value.)
        At the beginning of each sample, the instrument self-calibrates using a zero and high standard. The zero standard is generated by cycling a small amount of air through a soda lime chamber. The high standard is from a cylinder of calibrated standard reference gas from ESRL: 533.3 umol/mol for 7/20/2009

through 4/26/2010 and 519.46 umol/mol for 5/5/2010 to 5/17/2020. The span gas was replaced on 5/5/2010 when the transmitter battery was also replaced. ESRL standards are traceable to WMO x93 scale with a stated reproducibility of 0.06 micromole/mole.

- o **Other_Sensors**: Oxygen Sensor
  - Manufacturer: Maxtec
  - Model: Max-250
  - Resolution: 0.01 %
  - Uncert-ainty: ± 2.0% Full Scale over operating temperature range

    ± 1.0% Full Scale @ constant temperature and pressure
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase. Recalibrated to sea level atmospheric air every 7 days.

- o **Other_Sensors**: Humidity Sensor
  - Manufacturer: Sensirion
  - Model: SHT71
  - Resolution: 0.01 %
  - Uncertainty: Measurement range: 0-100% RH
    Absolute. RH accuracy: +/- 3% RH (20-80% RH)
    Repeatability RH: +/- 0.1% RH
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase.

- o Method_References: (Publication(s) describing method)

  Sabine, C. (2005): High-resolution ocean and atmosphere pCO_2 time-series measurements. The State of the Ocean and the Ocean Observing System for Climate, Annual Report, Fiscal Year 2004, NOAA/OGP/Office of Climate Observation, Section 3.32a, 246–253.

- Additional Information

- All measurements are at sea surface temperature and atmospheric pressure.

- During the equilibration cycle, a closed loop of air equilibrates with seawater for 10 minutes. Once the equilibration period is complete, the pump stops and the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- During the air cycle, fresh air is pumped through the detector for 1 minute. Once the pump stops, the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- The gas streams for both the air cycle and equilibrator cycle are partially dried before entering the detector. The values listed as wet xCO_2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment.

- Sampling occurs every 3 hours. The infrared detector is calibrated at the beginning of every sampling period. Averaged data and standard deviations for each measurement are transmitted back daily.

- To calculate the dry measurements, the water mole fraction in the Licor detector must be known. A relative humidity sensor is located immediately downstream of the detector.

- Data_set_References: (Publication(s) describing data set)   None

- Citation: (How to cite this data set)   Sabine, C., A. Sutton, W.-J. Cai, S. Noakes, S. Musielewicz, S. Maenner, and R. Bott. 2012. High-resolution ocean and atmosphere pCO2 time-series measurements from Gray's Reef mooring.
- **Data_Set_Link**:
- URL*: http://www.pmel.noaa.gov/co2/story/Grays+Reef

- Label*:PMEL CO2 Group – Gray's Reef mooring
    o Link_Note: (Optional instructions or remarks)**(m s t)**

Quality Flags definitions:

2   =   Acceptable measurement;
3   =   Questionable measurement;
4   =   Bad measurement
5   =   Not reported;
9   =   Sample not drown for this measurement from this bottle.

Quality Flag Log for this dataset.

Date	Measurement	Value (Dry)	Flag	Comments
8/10/2009 21:17	xCO2_SW	523.316872	3	CO2 data submitted was adjusted by - 13 ppm b/c span calibration was off as predicted by change in Licor temperature
8/10/2009 21:17	xCO2_Air	391.3565552	3	CO2 data submitted was adjusted by - 13 ppm b/c span calibration was off as predicted by change in Licor temperature
8/13/2009 0:17	xCO2_SW	503.7064421	4	bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 0:17	xCO2_SW	457.7423563	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 3:17	xCO2_SW	456.4919742	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 6:17	xCO2_SW	461.4584241	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 9:17	xCO2_SW	450.0032363	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 12:17	xCO2_SW	447.3982812	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 15:17	xCO2_SW	450.1195953	3	likely bad CO2 sw measurement due to equilibrator pressure problem

9/2/2009 18:17	xCO2_SW	458.3603072	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/2/2009 21:17	xCO2_SW	464.6686679	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/3/2009 0:17	xCO2_SW	448.6654509	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/3/2009 3:17	xCO2_SW	446.9319135	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/3/2009 6:17	xCO2_SW	444.5499203	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/5/2009 18:17	xCO2_SW	487.0598687	3	likely bad CO2 sw measurement due to equilibrator pressure problem
9/10/2009 18:17	xCO2_SW	513.4344525	4	bad CO2 sw measurement due to equilibrator pressure problem
9/23/2009 9:17	xCO2_SW	504.2313745	4	bad CO2 sw measurement due to equilibrator pressure problem
10/18/2009 0:17	xCO2_SW	463.8404443	3	likely bad CO2 sw measurement due to equilibrator pressure problem
10/18/2009 3:17	xCO2_SW	471.6164334	3	likely bad CO2 sw measurement due to equilibrator pressure problem
10/18/2009 12:17	xCO2_SW	464.0088507	3	likely bad CO2 sw measurement due to equilibrator pressure problem
10/30/2009 21:17	xCO2_SW	426.3514439	4	bad CO2 sw measurement due to equilibrator pressure problem
11/11/2009 21:17	xCO2_SW	365.0357789	4	bad CO2 sw measurement due to equilibrator pressure problem
11/12/2009 3:17	xCO2_SW	379.4745898	4	bad CO2 sw measurement due to equilibrator pressure problem
11/12/2009 21:17	xCO2_SW	380.4911582	4	bad CO2 sw measurement due to equilibrator pressure problem
11/13/2009 3:17	xCO2_SW	398.2217314	4	bad CO2 sw measurement due to equilibrator pressure problem
11/13/2009 15:17	xCO2_SW	383.3006602	4	bad CO2 sw measurement due to equilibrator pressure problem
11/22/2009 18:17	xCO2_SW	383.7877715	4	bad CO2 sw measurement due to equilibrator pressure problem
11/27/2009 3:17	xCO2_SW	382.5773582	4	bad CO2 sw measurement due to equilibrator pressure problem
11/27/2009 6:17	xCO2_SW	348.1493371	4	bad CO2 sw measurement due to equilibrator pressure problem
12/1/2009 12:17	xCO2_SW	342.7269192	4	bad CO2 sw measurement due to equilibrator pressure problem
12/1/2009 15:17	xCO2_SW	356.5218116	4	bad CO2 sw measurement due to equilibrator pressure problem
12/3/2009 0:17	xCO2_SW	343.2785212	4	bad CO2 sw measurement due to equilibrator pressure problem
12/7/2009 6:17	xCO2_SW	357.687685	4	bad CO2 sw measurement due to equilibrator pressure problem
12/12/2009 6:17	xCO2_SW	321.4184892	4	bad CO2 sw measurement due to equilibrator pressure problem
12/12/2009 9:17	xCO2_SW	354.6573265	4	bad CO2 sw measurement due to equilibrator pressure problem
12/16/2009 12:17	xCO2_SW	351.4134472	4	bad CO2 sw measurement due to equilibrator pressure problem
12/16/2009 15:17	xCO2_SW	361.9695025	4	bad CO2 sw measurement due to equilibrator pressure problem
12/16/2009 18:17	xCO2_SW	366.0425013	4	bad CO2 sw measurement due to equilibrator pressure problem

12/17/2009 21:17	xCO2_SW	374.8232533	4	bad CO2 sw measurement due to equilibrator pressure problem
12/18/2009 0:17	xCO2_SW	352.2685356	4	bad CO2 sw measurement due to equilibrator pressure problem
12/18/2009 3:17	xCO2_SW	382.4461773	4	bad CO2 sw measurement due to equilibrator pressure problem
12/18/2009 15:17	xCO2_SW	380.979433	4	bad CO2 sw measurement due to equilibrator pressure problem
12/18/2009 18:17	xCO2_SW	363.1658016	4	bad CO2 sw measurement due to equilibrator pressure problem
12/19/2009 6:17	xCO2_SW	365.2196775	4	bad CO2 sw measurement due to equilibrator pressure problem
12/19/2009 9:17	xCO2_SW	329.6530423	4	bad CO2 sw measurement due to equilibrator pressure problem
12/19/2009 12:17	xCO2_SW	343.5886493	4	bad CO2 sw measurement due to equilibrator pressure problem
12/19/2009 18:17	xCO2_SW	338.4024748	4	bad CO2 sw measurement due to equilibrator pressure problem
12/20/2009 9:17	xCO2_SW	345.2089472	4	bad CO2 sw measurement due to equilibrator pressure problem
12/29/2009 0:17	xCO2_SW	345.9288246	4	bad CO2 sw measurement due to equilibrator pressure problem
12/30/2009 15:17	xCO2_SW	324.5165285	4	bad CO2 sw measurement due to equilibrator pressure problem
1/2/2010 15:17	xCO2_SW	346.7992634	4	bad CO2 sw measurement due to equilibrator pressure problem
1/5/2010 21:17	xCO2_SW	285.8246842	3	likely bad CO2 sw measurement due to equilibrator pressure problem
1/6/2010 6:17	xCO2_SW	286.4893894	3	likely bad CO2 sw measurement due to equilibrator pressure problem
1/25/2010 6:17	xCO2_SW	321.9643635	4	bad CO2 sw measurement due to equilibrator pressure problem
1/25/2010 9:17	xCO2_SW	302.6416249	4	bad CO2 sw measurement due to equilibrator pressure problem
1/30/2010 6:17	xCO2_SW	303.6517893	4	bad CO2 sw measurement due to equilibrator pressure problem
1/31/2010 15:17	xCO2_SW	304.6862837	4	bad CO2 sw measurement due to equilibrator pressure problem
2/1/2010 18:17	xCO2_SW	293.9493565	4	bad CO2 sw measurement due to equilibrator pressure problem
2/1/2010 21:17	xCO2_SW	330.0279451	4	bad CO2 sw measurement due to equilibrator pressure problem
2/4/2010 21:17	xCO2_SW	352.9124444	4	bad CO2 sw measurement due to equilibrator pressure problem
2/5/2010 0:17	xCO2_SW	362.8776635	4	bad CO2 sw measurement due to equilibrator pressure problem
2/5/2010 3:17	xCO2_SW	321.7520005	4	bad CO2 sw measurement due to equilibrator pressure problem
2/5/2010 21:17	xCO2_SW	325.5058651	4	bad CO2 sw measurement due to equilibrator pressure problem
2/6/2010 0:17	xCO2_SW	361.2893829	4	bad CO2 sw measurement due to equilibrator pressure problem
2/7/2010 0:17	xCO2_SW	364.6705807	4	bad CO2 sw measurement due to equilibrator pressure problem
2/7/2010 6:17	xCO2_SW	345.8467507	4	bad CO2 sw measurement due to equilibrator pressure problem
2/10/2010 9:17	xCO2_SW	373.5912481	4	bad CO2 sw measurement due to equilibrator pressure problem

2/10/2010 12:17   xCO2_SW   373.3185811   4   bad CO2 sw measurement due to equilibrator pressure problem
2/10/2010 15:17   xCO2_SW   369.2039316   4   bad CO2 sw measurement due to equilibrator pressure problem
2/10/2010 21:17   xCO2_SW   323.4276448   4   bad CO2 sw measurement due to equilibrator pressure problem
2/11/2010 0:17 xCO2_SW   368.834396   4   bad CO2 sw measurement due to equilibrator pressure problem
2/11/2010 3:17 xCO2_SW   371.2492984   4   bad CO2 sw measurement due to equilibrator pressure problem
2/11/2010 6:17 xCO2_SW   4   bad CO2 sw measurement due to equilibrator pressure problem
2/13/2010 3:17 xCO2_SW   355.7982396   4   bad CO2 sw measurement due to equilibrator pressure problem
2/13/2010 12:17   xCO2_SW   321.0237228   4   bad CO2 sw measurement due to equilibrator pressure problem
2/14/2010 3:17 xCO2_SW   339.1568726   4   bad CO2 sw measurement due to equilibrator pressure problem
2/25/2010 9:17 xCO2_SW   4   bad CO2 sw measurement due to equilibrator pressure problem
2/25/2010 12:17   xCO2_SW   366.697464   4   bad CO2 sw measurement due to equilibrator pressure problem
2/25/2010 15:17   xCO2_SW   347.3818548   4   bad CO2 sw measurement due to equilibrator pressure problem
2/26/2010 0:17 xCO2_SW   363.8202953   4   bad CO2 sw measurement due to equilibrator pressure problem
2/26/2010 6:17 xCO2_SW   355.9422285   4   bad CO2 sw measurement due to equilibrator pressure problem
2/28/2010 6:17 xCO2_SW   327.360433   4   bad CO2 sw measurement due to equilibrator pressure problem
2/28/2010 15:17   xCO2_SW   319.7005159   4   bad CO2 sw measurement due to equilibrator pressure problem
3/3/2010 3:17   xCO2_SW   338.0604514   4   bad CO2 sw measurement due to equilibrator pressure problem
3/3/2010 6:17   xCO2_SW   318.1106188   4   bad CO2 sw measurement due to equilibrator pressure problem
3/14/2010 12:17   xCO2_SW   361.114876   3   likely bad CO2 sw measurement due to equilibrator pressure problem
3/15/2010 12:17   xCO2_SW   381.4730467   3   likely bad CO2 sw measurement due to equilibrator pressure problem
3/27/2010 15:17   xCO2_SW   417.9716111   4   bad CO2 sw measurement due to equilibrator pressure problem
3/27/2010 21:17   xCO2_SW   413.0790535   4   bad CO2 sw measurement due to equilibrator pressure problem
3/30/2010 3:17 xCO2_SW   426.357404   3   likely bad CO2 sw measurement due to equilibrator pressure problem
4/14/2010 18:17   xCO2_SW   417.7153023   3   CO2 data submitted was adjusted by + 15 ppm b/c span calibration was off as predicted by change in Licor temperature
4/14/2010 18:17   xCO2_Air   395.2430682   3   CO2 data submitted was adjusted by + 15 ppm b/c span calibration was off as predicted by change in Licor temperature