

Dataset Expocode AGFO20141217

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Dataset **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial Submission (yyyymmdd): 20160715
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Campaign/Cruise **Expocode:** AGFO20141217
Campaign/Cruise Name: SKO20141217
Campaign/Cruise Info: AOML_SOOP_CO2
Platform Type:
CO2 Instrument Type:
Survey Type: SOOP Line
Vessel Name: M/V Skogafoss
Vessel Owner: Bockstiegel Reederei, Enden, Germany
Vessel Code: AGFO

Coverage **Start Date (yyyymmdd):** 20141218
End Date (yyyymmdd): 20150114
Westernmost Longitude: 70.2 W
Easternmost Longitude: 15.5 E
Northernmost Latitude: 68.8 N
Southernmost Latitude: 43.1 N
Port of Call: Portland, ME
Port of Call: Argentia, Newfoundland, Canada
Port of Call: St. Anthony, Newfoundland, Canada
Port of Call: Sortland, Norway
Port of Call: Reykjavik, Iceland

Variable **Name:** xCO2_EQU_ppm
Unit:
Description: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Variable **Name:** xCO2_ATM_ppm
Unit:
Description: Mole fraction of CO2 measured in dry outside air (ppm)

Variable **Name:** xCO2_ATM_interpolated_ppm
Unit:
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:

Description: Barometric pressure in the equilibrator headspace (hectopascals)

Variable

Name: PRES_ATM@SSP_hPa

Unit:

Description: Barometric pressure measured outside, corrected to sea level (hectopascals)

Variable

Name: TEMP_EQU_C

Unit:

Description: Water temperature in equilibrator (degrees Celsius)

Variable

Name: SST_C

Unit:

Description: Sea surface temperature (degrees Celsius)

Variable

Name: SAL_permil

Unit:

Description: Sea surface salinity on Practical Salinity Scale (permil)

Variable

Name: fCO2_SW@SST_uatm

Unit:

Description: Fugacity of CO2 in sea water at SST and 100% humidity (microatmospheres)

Variable

Name: fCO2_ATM_interpolated_uatm

Unit:

Description: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (microatmospheres)

Variable

Name: dfCO2_uatm

Unit:

Description: Sea water fCO2 minus interpolated air fCO2 (microatmospheres)

Variable

Name: WOCE_QC_FLAG

Unit:

Description: Quality control flag for fCO2 values (2=good, 3=questionable)

Variable

Name: QC_SUBFLAG

Unit:

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 ~10 meters of pipe (~0.1-0.25meter dia). During the transit, the seawater warms an estimated 0.2-0.25 deg C. The reported SST is the value measured at the side port.

Manufacturer: Seabird

Model: SBE-38

Accuracy: ± 0.001 °C (°C if units not given)

Precision: 0.00025 °C (°C if units not given)

Calibration: Factory calibration.

Comments: Manufacturer's Resolution is taken as Precision.

Sea Surface Salinity

Location: In alcove of the ship's air-conditioned engine room next to CO2 system.

Manufacturer: Seabird

Model: SBE 45

Accuracy: ± 0.005 permil

Precision: 0.0002 permil

Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure

Location: On mast above bridge at ~9 m above sea surface.
Normalized to Sea Level:
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 ~9 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: ~0.2 ppm
Atmospheric CO2 Precision: 0.01 ppm

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 7 meters
Intake Location: Sea chest under the engine room
Equilibration Type: Sprayhead 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: Infrared absorption of dry sample gas
Method details:
Manufacturer: LI-COR
Model: 6262
Measured CO2 Values:
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ~1 microatmospheres
Aqueous CO2 Precision: 0.01 microatmosphere
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 and using other field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. Ultra-High Purity air (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.
Number Non-Zero Gas Standards:
Calibration Gases:
ESRL, Boulder for Std1 & 4; Scott-Marrin, Inc. for others -Std 1: CA05998, 205.07 ppm /Std 2: JB03284, 287.45 ppm /Std 3: JB03592, 397.80 ppm /Std 4: CA07923, 428.07 ppm /Std 5: LL104118, 0.0 ppm
Comparison to Other CO2 Analyses:

Comments: Instrument is located in an alcove of ship's air-conditioned 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 the water level.

Manufacturer: Hart

Model: 1523

Accuracy: ± 0.015 °C (°C if units not given)

Precision: 0.001 °C (°C if units not given)

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision.

**Equilibrator
Pressure Sensor**

Location: Attached to equilibrator headspace

Manufacturer: Setra

Model: 239

Accuracy: ± 0.052 hPa (hPa if units not given)

Precision: 0.01 hPa (hPa if units not given)

Calibration: Factory calibration

Comments: Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the Setra-270 on the exit of the analyzer to yield equilibrator pressure. Manufacturer's Resolution is taken as Precision.

Other Sensor

Description:

Manufacturer: Setra

Model: 270

Accuracy: ± 0.05 hPa

Precision:

Calibration: Factory calibration

Comments: Pressure reading from the Setra-270 on the exit of the analyzer was added to the differential pressure reading from Setra-239 attached to the equilibrator headspace to yield the equilibrator pressure.

**Additional
Information**

Suggested QC flag from Data Provider:

Additional Comments: Water flow was OK, ranging from >2 to ~1.5 L/min. The CO₂ trace still shows delay in equilibration. Points that have clearly not equilibrated have been flagged 4. Usually only the first few points after atm measurements.

Citation for this Dataset:

Other References for this Dataset: