

Dataset Expocode AGFO20140412

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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:** AGFO20140412
Campaign/Cruise Name: SKO20140412
Campaign/Cruise Info: AOML_SOOP_CO2
Platform Type:
CO2 Instrument Type: Equilibrator-IR or CRDS or GC
Survey Type: SOOP Line
Vessel Name: M/V Skogafoss
Vessel Owner: Bockstiegel Reederei, Emden, Germany
Vessel Code: AGFO

Coverage **Start Date (yyyymmdd):** 20140412
End Date (yyyymmdd): 20140508
Westernmost Longitude: 70.2 W
Easternmost Longitude: 15.5 E
Northernmost Latitude: 68.7 N
Southernmost Latitude: 42.6 N
Port of Call: Portland, Maine, USA
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 (hPa)
Variable	Name: PRES_ATM@SSP_hPa Unit: Description: Barometric pressure measured outside, corrected to sea level (hPa)
Variable	Name: TEMP_EQU_C Unit: Description: Water temperature in equilibrator (°C)
Variable	Name: SST_C Unit: Description: Sea surface temperature (°C)
Variable	Name: SAL_permil Unit: Description: Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	Name: fCO ₂ _SW@SST_uatm Unit: Description: Fugacity of CO ₂ in sea water at SST and 100% humidity (µatm)
Variable	Name: fCO ₂ _ATM_interpolated_uatm Unit: Description: Fugacity of CO ₂ in air corresponding to the interpolated xCO ₂ at SST and 100% humidity (µatm)
Variable	Name: dfCO ₂ _uatm Unit: Description: Sea water fCO ₂ minus interpolated air fCO ₂ (µatm)
Variable	Name: WOCE_QC_FLAG Unit: Description: Quality control flag for fCO ₂ values (2=good, 3=questionable)
Variable	Name: QC_SUBFLAG Unit: Description: Quality control subflag for fCO ₂ 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, Inc. 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; Maintained by ship.
Sea Surface Salinity	Location: Next to the pCO ₂ 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; Maintained by the SOOP group at AOML.

Atmospheric Pressure

Location: On mast above bridge at ~25 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 ~25 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 μ atm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 μ atm in fCO2_ATM

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 7 meters
Intake Location: Sea chest under the engine room, at the stern of the ship
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 μ atm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 μ atm 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 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: 4
Calibration Gases:

Std 1: CA05998, 205.07 ppm, owned by AOML, used every ~4.5 hours.
Std 2: JB03284, 287.45 ppm, owned by AOML, used every ~4.5 hours.
Std 3: JB03592, 397.80 ppm, owned by AOML, used every ~4.5 hours.
Std 4: CA07923, 428.07 ppm, owned by ESRL, used every ~4.5 hours.
Std 5: 0.00 ppm, owned by AOML, used every ~5.0 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: 0.001 (°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: This was a very problematic cruise where the LICOR analyzer overheated due to a faulty fan. This caused the LICOR output to be sometimes erratic. An effort was made to try to salvage as much data as possible. Data was flagged 4 whenever the standards were off by too much (~>30 ppm). When std offsets were a bit less but still high, data was flagged 3. This data set is to be taken with caution. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/skogafoss/skogafoss_introduction.html

Citation for this Dataset:

Other References for this Dataset: