

**Dataset Expocode** 09AR20131015

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**Dataset** **Funding Info:** Integrated Marine Observing System  
**Initial Submission (yyyymmdd):** 20160201  
**Revised Submission (yyyymmdd):**

**Campaign/Cruise** **Expocode:** 09AR20131015  
**Campaign/Cruise Name:** AAV1  
**Campaign/Cruise Info:** AAV1  
**Platform Type:**  
**CO2 Instrument Type:** Equilibrator-IR or CRDS or GC  
**Survey Type:** Research Cruise  
**Vessel Name:** Aurora Australis  
**Vessel Owner:** P&O Maritime Services  
**Vessel Code:** 09AR

**Coverage** **Start Date (yyyymmdd):** 20131015  
**End Date (yyyymmdd):** 20131207  
**Westernmost Longitude:** 79.68 E  
**Easternmost Longitude:** 147.35 E  
**Northernmost Latitude:** 42.88 S  
**Southernmost Latitude:** 65.64 S  
**Port of Call:** Hobart  
**Port of Call:** Davis Base

**Variable** **Name:** Group/Ship  
**Unit:** IMOS/Aurora Australis  
**Description:**

**Variable** **Name:** CruiseID  
**Unit:** AAYyYyV#  
**Description:** Cruise designation

**Variable** **Name:** JD\_GMT  
**Unit:** ddd.hhhh  
**Description:** Decimal day of year, UTC

**Variable** **Name:** Date  
**Unit:** yyyymmdd  
**Description:** Date of year, UTC

**Variable** **Name:** Time  
**Unit:** HH:MM:SS  
**Description:** UTC time

**Variable** **Name:** Lat

**Unit:** degree  
**Description:** Latitude, decimal degrees -=S

**Variable**

**Name:** Long  
**Unit:** degree  
**Description:** Longitude, decimal degrees +=E

**Variable**

**Name:** xCO2EQ\_PPM  
**Unit:** ppm  
**Description:** Mole fraction CO2 in equilibrator head space (dry)

**Variable**

**Name:** xCO2ATM\_PPM  
**Unit:** ppm  
**Description:** Mole fraction of CO2 in the atmosphere (dry)

**Variable**

**Name:** xCO2ATM\_PPM\_INTERPOLATED  
**Unit:** ppm  
**Description:** Mole fraction of CO2 in the atmosphere (dry) interpolated

**Variable**

**Name:** Press\_Equil  
**Unit:** hPa  
**Description:** Equilibrator pressure

**Variable**

**Name:** Press\_ATM  
**Unit:** hPa  
**Description:** Atmospheric pressure

**Variable**

**Name:** Teq  
**Unit:** °C  
**Description:** Equilibrator water temperature

**Variable**

**Name:** SST  
**Unit:** °C  
**Description:** Sea surface temperature

**Variable**

**Name:** SAL  
**Unit:**  
**Description:** Salinity

**Variable**

**Name:** fCO2SW\_UATM  
**Unit:**  
**Description:** Fugacity of carbon dioxide at sea surface temperature and salinity

**Variable**

**Name:** fCO2ATM\_UATM\_INTERPOLATED  
**Unit:** microatmosphere  
**Description:** Fugacity of carbon dioxide in air

**Variable**

**Name:** DfCO2  
**Unit:** microatmosphere  
**Description:** Sea to air gradient in the fugacity of carbon dioxide, fCO2SW-fCO2ATM

**Variable**

**Name:** LICORflow  
**Unit:** millilitre per minute  
**Description:** Gas flow through infrared gas analyser

**Variable**

**Name:** H2Oflow  
**Unit:** litre per minute  
**Description:** Seawater flow to equilibrator

**Variable**

**Name:** WindSpd\_True

**Unit:** meters per second  
**Description:** Wind speed, true

**Variable** **Name:** WindDir\_True  
**Unit:** degree  
**Description:** Wind direction, true

**Variable** **Name:** Type  
**Unit:**  
**Description:** Type of measurement (EQU = equilibrator; ATM= air)

**Variable** **Name:** WOCE\_QC\_FLAG  
**Unit:**  
**Description:** Quality flag, 2=good, 3=questionable

**Variable** **Name:** SUBFLAG  
**Unit:**  
**Description:** Quality Control sub flag for questionable data after Pierrot et al., 2009

**Sea Surface Temperature** **Location:** Approximately 150mm inboard from the intake at 4m depth  
**Manufacturer:** Sea-Bird Electronics  
**Model:** SBE-38  
**Accuracy:** 0.01 (°C if units not given)  
**Precision:** 0.0005 (°C if units not given)  
**Calibration:** Calibrated at certified national testing facility for temperature at CSIRO, Hobart.  
**Comments:** The SST sensor is maintained by the Australian Antarctic Division and are calibrated each year before the beginning of the Antarctic field season by either Seabird Electronics or the a National Australian Testing Authority testing facility at CSIRO, Hobart that is certified for temperature calibrations

**Sea Surface Salinity** **Location:** Next to fCO2 system and inline with water supply to fCO2 system  
**Manufacturer:** Seabird Electronics  
**Model:** SBE-45  
**Accuracy:** 0.01  
**Precision:** 0.003  
**Calibration:** Calibrated prior to Antarctic field season at National Australian Testing Authority testing facility at CSIRO, Hobart, and checked occasionally during season by comparison with salinity samples collected from the underway seawater line and analysed using a Guideline Autosol, references to IAPSO seawater  
**Comments:**

**Atmospheric Pressure** **Location:** Mounted ~16m above sea level on the bridge deck outside the Meteorological lab on the port side with a velocity head.  
**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:** Calibrated prior to each field season by the Australian Bureau of Meteorology against a reference barometer  
**Comments:** Sensor maintained by Australian Antarctic Division

**Atmospheric CO2** **Measured/Frequency:** Yes, 3 hourly  
**Intake Location:** Mounted ~16m above sea level on the bridge deck outside the Met lab on the port side of ship

**Drying Method:** Thermoelectric condenser (2-5 °C), and Perma Pure (Nafion dryers). Dried to <2 H<sub>2</sub>O mmol/mol.

**Atmospheric CO<sub>2</sub> Accuracy:** 2 ppm

**Atmospheric CO<sub>2</sub> Precision:** 0.01 ppm

## Aqueous CO<sub>2</sub> Equilibrator Design

**System Manufacturer:**

**Intake Depth:** 4

**Intake Location:** Ship propeller shaft tunnel approximately 4m below the water line and 10m forward of the stern gland on the port side of the vessel.

**Equilibration Type:** Shower equilibrator

**Equilibrator Volume (L):** 1.2

**Headspace Gas Flow Rate (ml/min):** 70-150

**Equilibrator Water Flow Rate (L/min):** 2.3

**Equilibrator Vented:** Yes

**Equilibration Comments:** Equilibrator is water jacketed

**Drying Method:** Thermoelectric condenser (2-5 °C), and Perma Pure (Nafion dryers). Dried to <2 H<sub>2</sub>O mmol/mol

## Aqueous CO<sub>2</sub> Sensor Details

**Measurement Method:** IR

**Method details:**

**Manufacturer:** LICOR

**Model:** 7000

**Measured CO<sub>2</sub> Values:** xCO<sub>2</sub>(dry)

**Measurement Frequency:** Every 120 sec, except during calibration routines

**Aqueous CO<sub>2</sub> Accuracy:** 2 ppm

**Aqueous CO<sub>2</sub> Precision:** 0.01 ppm

**Sensor Calibrations:** Sensor is checked and calibrated against a set of CO<sub>2</sub> in air reference gases prior to cruise. During cruises, the sensor is calibrated with

**Calibration of Calibration Gases:** CSIRO, Melbourne, Victoria

**Number Non-Zero Gas Standards:** 3

**Calibration Gases:**

Manufacturer, CSIRO

Reference standards were calibrated on WMO-X2007 mole fraction scale for CO<sub>2</sub>-in-air at CSIRO Oceans and Atmosphere, Melbourne. Uncertainty = ± 0.05 ppm.

Std 1 CA06898: 0 ppm 04 Jun 2008,

Std 2 CA01610: 299.41 ppm 17 Aug 2004,

Std 3 CA01669: 353.00 ppm 17 Aug 2004,

Std 4 CA01673: 402.15 ppm 23 Aug 2004.

Reference standards were calibrated on WMO-X2007 mole fraction scale for CO<sub>2</sub>-in-air at CSIRO Marine and Atmospheric Research, Melbourne. Uncertainty = ± 0.05 ppm.

**Comparison to Other CO<sub>2</sub> Analyses:**

**Comments:**

**Method Reference:**

## Equilibrator Temperature Sensor

**Location:** Probe 6mm below water line in equilibrator

**Manufacturer:** Fluke Hart Scientific

**Model:** 1521

**Accuracy:** 0.025 (°C if units not given)

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

**Calibration:** Calibrated prior to each Antarctic field season at National Australian Testing Authority facility, at CSIRO, Hobart

**Comments:**

**Equilibrator  
Pressure Sensor**

**Location:** Attached to equilibrator headspace

**Manufacturer:** Setra

**Model:** 239

**Accuracy:** 0.05 (hPa if units not given)

**Precision:** 0.01 (hPa if units not given)

**Calibration:** factory calibration

**Comments:**

**Additional  
Information**

**Suggested QC flag from Data Provider:** NA

**Additional Comments:**

**Citation for this Dataset:**

Tilbrook, B., C. Neill and J. Akl (2013) Integrated Marine Observing System underway CO2 data for Aurora Australis voyage AA1314V1, <http://www.imos.org.au>.

**Other References for this Dataset:**