**Investigators:** Wiley Evans (Hakai Institute), Katie Pocock (Hakai Institute), Shawn Hateley (Hakai Institute), and Jessy Barrette (Hakai Institute)

**Title:** Surface seawater and marine boundary layer CO2 observations made from the Kwakshua Channel (KC) Buoy on the central coast of British Columbia

**Abstract:** Kwakshua Channel, located near Fitz Hugh Sound on the central coast of British Columbia, has been a site for moored, high-resolution measurements of surface seawater and marine boundary layer CO2 content since May 2018. Measurements of in situ temperature, salinity, seawater and atmospheric CO2 partial pressure are made using a Battelle Seaology (MApCO2) System. The effort to collect these data are part of the Hakai Institute’s directive to advance the understanding of carbon cycling in northeast Pacific coastal settings with specific emphasis on ocean acidification. This data contribution consists of measurements from May 1, 2018 to January 11, 2020.

**Cite as:** Evans, W., K. Pocock, S. Hateley, and J. Barrette (2020). Surface seawater and marine boundary layer CO2 observations made from the Kwakshua Channel (KC) Buoy on the central coast of British Columbia. Version 1.0. Hakai Institute. Dataset. [access date].

**Type of Study:** Measurements of surface ocean and marine boundary layer CO2 from a surface buoy

**Temporal Coverage:** May 1, 2018 to January 11, 2020

**Spatial Coverage:** Surface ocean and marine boundary layer CO2 measurements from the mouth of Kwakshua Channel; Fitz Hugh Sound; central British Columbia coast; 51.6507°N, 127.9697°W

**Geographic Names:** Kwakshua Channel; Fitz Hugh Sound; central British Columbia coast; Gulf of Alaska; North Pacific Ocean

**Platforms:** KC Buoy

**Version:** 1.0

**Submission Date:** April 21, 2020

**Filename:** KC\_BUOY\_May2018\_Jan2020.txt

**Column Header Information:** (1) Mooring Name (2) Latitude (3) Longitude (4) Date (UTC) (5) Time (UTC) (6) xCO2 SW (wet) (umol/mol) (7) CO2 SW QF (8) H2O SW (mmol/mol) (9) xCO2 Air (wet) (umol/mol) (10) CO2 Air QF (11) H2O Air (mmol/mol) (12) Licor Atm Pressure (hPa) (13) Licor Temp (C) (14) MAPCO2 %O2 (15) SST (C) (16) Salinity (17) TS QF (18) xCO2 SW (dry) (umol/mol) (19) xCO2 Air (dry) (umol/mol) (20) fCO2 SW (sat) uatm (21) fCO2 Air (sat) uatm (22) dfCO2 (23) pCO2 SW (sat) uatm (24) pCO2 Air (sat) uatm (25) dpCO2

Quality Flags: 2 = good, 3 = questionable, 4 = bad (values are -999), 5 = missing (values are -999)

**Researcher Contact:** Please direct questions regarding these data to Wiley Evans (wiley.evans@hakai.org).

**Researcher institution:** Hakai Institute

**Core Variables:**

*Seawater partial pressure of carbon dioxide at sea surface temperature*

**Abbreviation:** pCO2 SW (sat)

**Unit:** µatm

**Observation type:** Measurements from moored buoy with MApCO2 system

**In-situ/Manipulation/Response variable:** In situ observation

**Measured or calculated:** Calculated from measured CO2 mole fractions (xCO2) at ambient atmospheric pressure.

**Sampling instrument:** MApCO2 bubble equilibrator

**Analyzing instrument:** Battelle Seaology (MApCO2) System with LI-COR LI-820

**Detailed sampling and analyzing 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 Hz 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 xCO2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment. The infrared detector is calibrated at the beginning of every sampling period using a zero and span gas. To calculate the dry measurements, the water mole fraction in the Licor detector is measured using a relative humidity sensor located immediately downstream of the detector. Sampling frequency during this deployment varies from 30 to 180 minutes.

**Replicate information:** N/A

**Standardization description:** 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 with a known concentration, standard concentrations for this deployment were 907 ppm (Praxair), 514.47 ppm (ESRL), and 901 ppm (Praxair).

**Standardization frequency:** Every measurement

**CRM manufacturer:** Earth System Research Laboratories (ESRL), or Praxair Inc.

**Poison name:** N/A

**Poison volume:** N/A

**Poison correction:** N/A

**Uncertainty:** 2 ppm for calibrated xCO2; ~2 µatm for pCO2

**Quality flag convention:** No quality flag applied

**Method reference:** Sutton, A.J., Sabine, C.L., Maenner-Jones, S., Lawrence-Slavas, N., Meinig, C., Feely, R.A., Mathis, J.T., Musielewicz, S., Bott, R., Mclain, P.D., Fought, H.J., and Kozyr, A. (2014). A high-frequency atmospheric and seawater pCO2 data set from 14 open-ocean sites using a moored autonomous system. *Earth System Science Data* 6**,** 353-366.

**Researcher name:** Wiley Evans

**Researcher institution:** Hakai Institute

*Atmospheric partial pressure of carbon dioxide*

**Abbreviation:** pCO2 Air (sat)

**Unit:** µatm

**Observation type:** Measurements from moored buoy with MApCO2 system

**In-situ/Manipulation/Response variable:** In situ observation

**Measured or calculated:** Calculated from measured CO2 mole fractions (xCO2) at ambient atmospheric pressure.

**Sampling instrument:** Air intake

**Analyzing instrument:** Battelle Seaology (MApCO2) with LI-COR LI-820

**Detailed sampling and analyzing information:** All measurements are at sea surface temperature and atmospheric pressure. 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 Hz 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 xCO2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment. The infrared detector is calibrated at the beginning of every sampling period using a zero and span gas. To calculate the dry measurements, the water mole fraction in the Licor detector is measured using a relative humidity sensor located immediately downstream of the detector. Sampling frequency during this deployment varies from 30 to 180 minutes.

**Replicate information:** N/A

**Standardization description:** 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 with a known concentration, standard concentrations for this deployment were 907 ppm (Praxair), 514.47 ppm (ESRL), and 901 ppm (Praxair).

**Standardization frequency:** Every measurement

**CRM manufacturer:** Earth System Research Laboratories (ESRL), or Praxair Inc.

**Poison name:** N/A

**Poison volume:** N/A

**Poison correction:** N/A

**Uncertainty:** 2 ppm for calibrated xCO2; ~2 µatm for pCO2

**Quality flag convention:** No quality flag applied

**Method reference:** Sutton, A.J., Sabine, C.L., Maenner-Jones, S., Lawrence-Slavas, N., Meinig, C., Feely, R.A., Mathis, J.T., Musielewicz, S., Bott, R., Mclain, P.D., Fought, H.J., and Kozyr, A. (2014). A high-frequency atmospheric and seawater pCO2 data set from 14 open-ocean sites using a moored autonomous system. *Earth System Science Data* 6**,** 353-366.

**Researcher name:** Wiley Evans

**Researcher institution:** Hakai Institute

*Sea surface temperature*

**Abbreviation:** SST

**Unit:** °C, ITS-90 scale

**Observation type:** Surface measurements from moored buoy

**In-situ/Manipulation/Response variable:** In situ observation

**Measured or calculated:** Measured

**Sampling instrument:** N/A

**Analyzing instrument:** SBE16plusV2

**Detailed sampling and analyzing information:** Temperature measurements are recorded by a SeaBird 16 plus mounted on the mooring bridle approximately one meter below the sea surface. The sensor is powered directly from the buoy battery and data is captured using a Campbell Scientific data logger. Sensors are replaced and sent to the factory for calibration and service annually. Data are not post-calibrated. Annual drift during the deployment was minimal and does not impact the fCO2 and pCO2 calculations (within the degree of accuracy of the CO2 measurement). No temperature data was collected on the mooring from April 25th to August 19th 2019, for this period data from a dock tide gauge sensor (OTT PLS-C) approximately 11 km away was used (data was given a TS quality flag of 2). The dock sensor data was corrected by comparing with the SBE 16 data from the mooring between August 19th and December 31st 2019.

**Replicate information:** N/A

**Standardization description:** N/A

**Standardization frequency:** N/A

**CRM manufacturer:** N/A

**Poison name:** N/A

**Poison volume:** N/A

**Poison correction:** N/A

**Uncertainty:** 0.005°C

**Quality flag convention:** No quality flag applied

**Method reference:**

**Researcher name:** Wiley Evans

**Researcher institution:** Hakai Institute

*Seawater Salinity*

**Abbreviation:** Salinity

**Unit:** 1978 Practical Salinity Scale

**Observation type:** Surface measurements from moored buoy

**In-situ/Manipulation/Response variable:** In situ observation

**Measured or calculated:** Calculated from conductivity and temperature measurements

**Sampling instrument:** N/A

**Analyzing instrument:** SBE16plusV2

**Detailed sampling and analyzing information:** Temperature and conductivity measurements are recorded by a SeaBird 16 plus mounted on the mooring bridle approximately one meter below the sea surface. The sensor is powered directly from the buoy battery and data is captured using a Campbell Scientific data logger. Salinity data are derived from calibrated conductivity and temperature measurements. Sensors are replaced and sent to the factory for calibration and service annually. Data are not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO2 and pCO2 calculations (within the degree of accuracy of the CO2 measurement). No temperature or conductivity data were collected on the mooring from April 25th to August 19th 2019, for this period data from a dock tide gauge sensor (OTT PLS-C) approximately 11 km away was used. The dock sensor data was corrected by comparing data from the two sensors between August 19th and December 31st 2019.

**Replicate information:** N/A

**Standardization description:** N/A

**Standardization frequency:** N/A

**CRM manufacturer:** N/A

**Poison name:** N/A

**Poison volume:** N/A

**Poison correction:** N/A

**Uncertainty:** 0.0005 S/m

**Quality flag convention:** No quality flag applied

**Method reference:**

**Researcher name:** Wiley Evans

**Researcher institution:** Hakai Institute