

CO2_readme.txt
University of New Hampshire Coastal Ocean Observing Center

Underway Carbon Dioxide Data description

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PLEASE NOTE: Users of data will be required to provide proper credit and acknowledgment of the provider. Users of data are encouraged to discuss relevant findings with the provider early in the research. The user is required to give all providers of the data being used a copy of any manuscript resulting from use of the data prior to the initial submission for publication, thus giving the data provider an opportunity to comment on the paper. The provider(s) shall have the right to be named as a co-author.

List of variables included in this dataset:

<u>COLUMN</u>	<u>HEADER</u>	<u>EXPLANATION</u>
1.	year	Year measurements were taken
2.	day_of_year	Sequential day of year measurements were taken
3.	secDay	Sequential seconds of day of measurement (e.g. 60,000 secDay=16:40:00)
4.	lat	Latitude in decimal degrees (negative values are in the Southern Hemisphere)
5.	lon	Longitude in decimal degrees (negative values are in the Western Hemisphere)
6.	speed	Ship speed in meters per second
7.	Water_temp	Sea surface temperature measured by a SBE-45 thermosalinograph, in degrees Celcius
8.	salinity	Sea surface salinity measured by a SBE-45 thermosalinograph, on the Practical Salinity Scale
9.	pressure_atm	Barometric pressure from either ship's barometer, nearby buoy barometer, or standard atmospheric pressure (1013.25 hPa), in hectopascals
10.	xCO2_w	Mole fraction of CO2 (dry) in equilibrator headspace at equilibrator temperature, in parts per million
11.	fCO2_w	Fugacity of CO2 in seawater, in microatmospheres
12.	xCO2_a	Mole fraction of CO2 (dry) in air, in parts per million
13.	fCO2_a	Fugacity of CO2 in air, in microatmospheres
14.	air_temp	Air temperature in degrees Celcius

The following fields have been QC'ed by the UNH Coastal Ocean Observing Center:

year
day_of_year
secDay
lat
lon
speed
Water_temp
Salinity
xCO2_w
fCO2_w
xCO2_a
fCO2_a

The following fields came at least partly from National Buoy Data Center data, and cannot be verified:
pressure_atm
air_temp

CO2 Analyzer: Licor 6262 or Licor 840 infrared (IR) analyzer (Li-cor Biosciences Inc, Lincoln NE).

Drying method: Nafion selectively permeable membrane drying loop (Perma Pure, Toms River NJ) with counter-flowing nitrogen stream.

Equilibrator type: Three-chamber fast-rate equilibrator similar to that of Wanninkhof and Thoning (1993, reference below), flow rate 1.5 l/min.

CO2 calibration standards: Two-point calibration using ultrapure nitrogen and a mixture of CO2 in nitrogen, ranging from 832.3 to 856.1 ppm. Mixtures of CO2 in nitrogen, analyzed to within +/- 1%, were obtained from Scott-Marrin Inc (Riverside, CA). These standards are then adjusted based on comparison to a series of standards ranging from 378-515 ppmv obtained from NOAA/ESRL (<http://www.esrl.noaa.gov/>).

Seawater temperature and salinity were measured using a SBE 45 thermosalinograph, pumped at 1.5 l/min. Tests using a handheld temperature and salinity sensor (YSI 85, YSI Instruments Yellow Springs OH), aboard the RV Gulf Challenger indicate temperature differences are less than 0.01 degree Celcius between equilibrator outflow and intake sea surface water. Therefore, no temperature correction is applied to data taken aboard the RV Gulf Challenger. A temperature correction of 0.15 degrees Celcius is applied to data taken aboard the RV Oceanus (cruises from 10/31/2006 to 11/11/2006).

CO2 data calculation: Corrections of the data for water vapor pressure and sea surface temperature and conversion from pCO₂ to the fugacity of carbon dioxide (fCO₂) were carried out according to the DOE handbook (1994).

CO2 data quality: all data, excepting those from 20040721, have been verified to an accuracy of +/- 2 mmol/mol or uatm.

References:

DOE (2007) *Guide to Best Practices for Ocean CO2 Measurements*, A.G. Dickson, C.L. Sabine and J.R. Christian, eds. PICES Special Publication, 191 pp.

Wanninkhof, R. and Thoning, K. 1993. Measurement of fugacity of CO₂ in surface water using continuous and discrete sampling methods. *Marine Chemistry* 44: 189-204.