Smetacek, Victor; de Baar, Hein JW; Bathmann, Ulrich; Lochte, Karin; Rutgers van der Loeff, Michiel M (1997): Ecology and biogeochemistry of the Antarctic circumpolar current during austral spring: Southern Ocean JGOFS Cruise ANT X/6 of R.V. Polarstern. *Deep-Sea Research Part II-Topical Studies in Oceanography*, **44(1-2)**, 1-21, doi:10.1016/S0967-0645(96)00100-2

6. Carbondioxide system

Dorothee Bakker , Joop Rommets, Michel Stoll, Hein de Baar (all NIOZ)

Partial pressure of CO2 in atmosphere and ocean

Dorothee Bakker

{pCO2.GC-cm, pCO2.GC-tp}

The partial pressure of CO_2 of discrete samples.

Discrete samples of 600 ml were taken in glass bottles with a screw cap containing a rubber septum from 1500, 1000, 500, 300, 200, 150, 100, 80, 60, 40, 20 and 10 meter from the CTD at all whole degree stations. Also all depths in deep casts to the bottom were sampled. Samples were poisoned by adding 0.1 ml of a saturated mercury chloride solution and put in a waterbath of 4.5 to 5 C for minimally one hour. 20 ml of water in each bottle was replaced by calibration gas of 473 ppm CO_2 by volume in artificial dry air. After at least another hour in the waterbath the headspace of the sample was injected into the gaschromatograph. A GC-run typically consisted of one discrete sample and calibration gas of 473 ppm CO_2 by volume. The temperature of the waterbath was registered continuously. The temperature correction of Copin-Montegut (1988, 1989) was applied. Results were checked by comparing them with measurements of alkalinity and total CO_2.

Copin-Montegut, C., 1988. A new formula for the effect of temperature on the partial pressure of CO_2 in seawater. *Marine Chemistry*, **25**, 29-37.
Copin-Montegut, C., 1989. Corrigendum. *Marine Chemistry*, **27**, 143-144.

Continuous measurements of the partial pressure of CO_2 in surface water and marine air.

Seawater was pumped continuously from 12 meter below sealevel to an equilibrator. The temperature difference between water at the intake and in the equilibrator was typically less than a degree. Every 10 minutes the CO_2 content of the headspace of the equilibrator was measured by a gaschromatograph. Marine air was pumped from 22 meter above sea level. Calibration gases of 259, 361 and 473 parts per million by volume in artificial dry air by BOC, UK were used. Each GC-run consisted of two calibration gases, an equilibrator sample, followed by marine air and a second equilibrator sample. CO_2 was converted to methane by a nickel catalyst and detected by an FID-detector.The temperature correction of Copin-Montegut (1988, 1989) was used.

Files are per day with nomenclature CO2Dmmdd.XLS and CO2Smmdd.XLS

- Files containing the suffix D contain ONLINE data per 10 minute interval
- Files containing the suffix S contain ONLINE data and air-sea fluxes computed with different methods.
- mm stands for the month
- dd stand for the day

CO2D????	Explanation	Unit	Parameterisation	Skin temperature difference	Length wind interval	Length atmospheric pressure
Date	Date	m/d/yr	-	-	-	-
Time	Time	hh:mm	-	-	-	-
Wvel	wind velocity	m·s-1	-	-	-	-
AirTemp	air temperature	°C	-	-	-	-
Humidity	humidity	%	-	-	-	-
Latitude	Latitude	N+, S-	-	-	-	-
Longitude	Longitude	E+, W-	-	-	-	-
SpeedAh	speed ahead	m·s-1	-	-	-	-
Air pressure	atmospheric pressure	hPa	-	-	-	-
Glob rad	global radiation	W·m-2	-	-	-	-
Visibility	visibility	m	-	-	-	-
Cloud base	cloud base	m	-	-	-	-
Depth	water depth	m	-	-	-	-
DewPoint	dew point	°C	-	-	-	-
Wdir	wind direction	°	-	-	-	-
Chlorophyll	chlorophyll a content	mg·m-3	-	-	-	-

CO2S????	Explanation	Unit	Parameterisation	Skin temperature difference	Length wind interval	Length atmospheric pressure
Date	Date	m/d/yr	-	-	-	-
Wanted time	Time	hh:mm	-	-	-	-
xCO2DryAir	dry volume fraction of CO2 in dry air	µmol·mol-1	-	-	-	-
fCO2Air	fugacity of CO2 in with water saturated air	µatm	-	-	-	-
fCO2Eq	fugacity of CO2 in the equilibrator	µatm	-	-	-	-
fCO2w	fugacity of CO2 in water	µatm	-	-	-	-
Gamma eq	fugacity coefficient of CO2 for the equilibrator	-	-	-	-	-
K0_Air	solubility of CO2 at the sea surface	mol·kg-1·atm-1	-	-	-	-
K0_H2O	solubility of CO2 in bulk water	mol·kg-1·atm-1	-	-	-	-
Cair (uMol/Kg)	concentration of CO2 at the sea surface	µmol·kg-1	-	-	-	-
Cwater(uMol/Kg)	concentration of CO2 in bulk water	µmol·kg-1	-	-	-	-
Tempeq	temperature of the equilibrator	°C	-	-	-	-
TskTemp	Water temperature bow salinometer	°C	Bow salinometer			
TPyro	Uncorrected Pyrometer signal	°C	Detected signal (before correction)			
TPyroCorr 40°	Corrected pyrometer temperature 40°	°C	Detected and corrected to 40°			
TskSal	Salinity bow salinometer		-	-	-	-
Density	Density of seawater	kg·m-3	-	-	-	-
TWVel	wind velocity	m·s-1	-	-	-	-
AirTemp	air temperature	°C	-	-	-	-
Humidity	humidity	%	-	-	-	-
PosLat	Latitude	N+, S-	-	-	-	-
PosLon	Longitude	E+, W-	-	-	-	-
SpeedAh	speed ahead	m·s-1	-	-	-	-
SpeedAc	speed across	m·s-1	-	-	-	-
Airpressure	atmospheric pressure	hPa	-	-	-	-
GlRad	global radiation	W·m-2	-	-	-	-
Vis	visibility	m	-	-	-	-
CloudBase	cloud base	m	-	-	-	-
SysDepth	water depth	m	-	-	-	-
DewPoint	dew point	°C	-	-	-	-
WDir	wind direction	°	-	-	-	-
Chloro	chlorophyll a content	mg·m-3	-	-	-	-
Flux LMno skin	CO2 air-sea flux	mmol/(m2·d)	Liss-Merlivat	none	10 min	10 min
Flux LM meas	CO2 air-sea flux	mmol/(m2·d)	Liss-Merlivat	detected	10 min	10 min
Flux LMskin02	CO2 air-sea flux	mmol/(m2·d)	Liss-Merlivat	0.2°C	10 min	10 min
Flux LM1002	CO2 air-sea flux	mmol/(m2·d)	Liss-Merlivat	none	10 min	6 weeks
Flux LMwind	CO2 air-sea flux	mmol/(m2·d)	Liss-Merlivat	none	6 weeks	10 min
Flux Wno skin	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	none	10 min	10 min
Flux W meas	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	detected (40°)	10 min	10 min
Flux Wskin02	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	0.2°C	10 min	10 min
Flux W1002	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	none	10 min	6 weeks
Flux Wwind	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	none	6 weeks	10 min
Flux Hasse	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Hasse	10 min	10 min
Flux Saun8	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Saunders, l=8	10 min	10 min
Flux Saun var	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Saunders, l=variable	10 min	10 min
Flux Schnacht	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Schlüssel et al, night	10 min	10 min
Flux Schtot	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Schlüssel et al, day+night	10 min	10 min

Flux Soloviev	CO2 air-sea flux	mmol/(m2·d)	Wanninkhof	Skin effect, Soloviev and Schlüssel	10 min	10 min
dTsch-D	Skin temperature difference	°C	Model Schlüssel et al, day	-	-	-
dTsch-N2	Skin temperature difference	°C	Model Schlüssel et al, night	-	-	-
dTsch-tot	Skin temperature difference	°C	Model Schlüssel et al, day+night	-	-	-
dTsa, l=8	Skin temperature difference	°C	Model Saunders, labda =8	-	-	-
dTsa, l=var	Skin temperature difference	°C	Model Saunders, variable labda	-	-	-
dThasse	Skin temperature difference	°C	Model Hasse	-	-	-
dTso-tot	Skin temperature difference	°C	Model Soloviev and Schlüssel	-	-	-