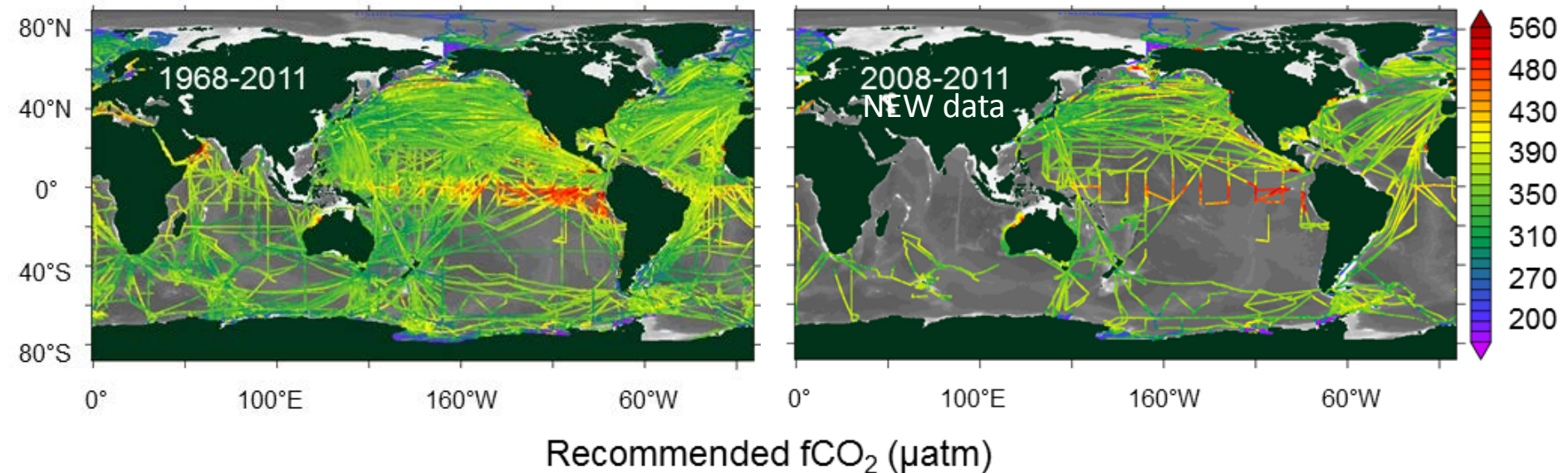
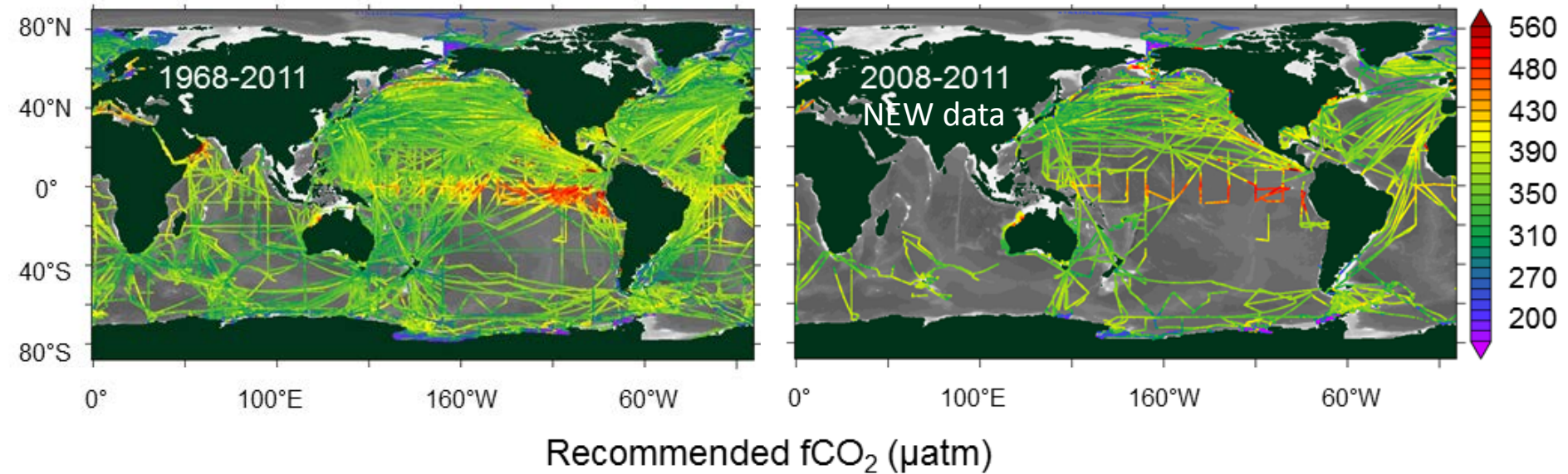


# An update to the Surface Ocean CO<sub>2</sub> Atlas (SOCAT version 2)

*D. C. E. Bakker, S. Hankin, A. Olsen, B. Pfeil, K. Smith, S. R. Alin, C. Cosca, B. Hales, S. Harasawa, A. Kozyr, Y. Nojiri, K. O'Brien, U. Schuster, M. Telszewski, B. Tilbrook, C. Wada and all SOCAT contributors*



# Surface Ocean CO<sub>2</sub> Atlas, version 2



2007: Many formats, many data not public. No public global fCO<sub>2</sub> data set.

SOCAT: Surface ocean fCO<sub>2</sub> (fugacity of CO<sub>2</sub>) in uniform format with quality control;

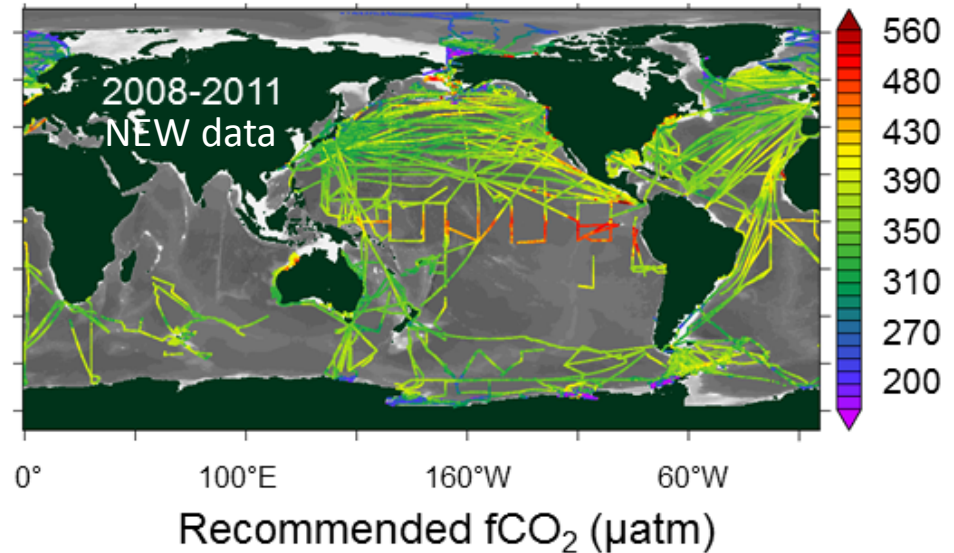
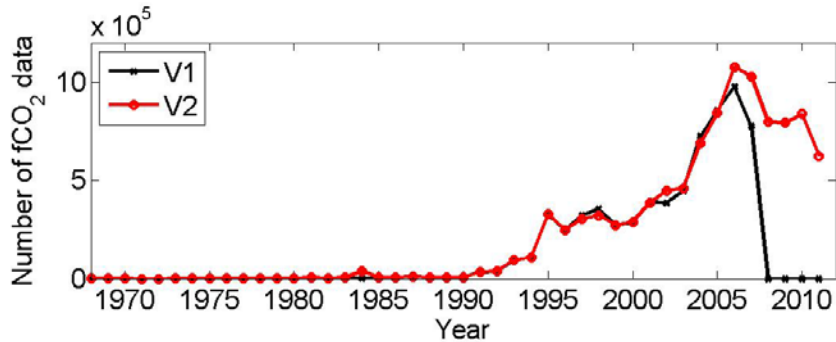
Version 1: 6.3 million fCO<sub>2</sub>, 1851 cruises, 1968 to 2007 (09/2011);

Version 2: 10.1 million fCO<sub>2</sub>, 2660 cruises, 1968 to 2011 now public;

*Bakker et al. (2012) Eos 93(12); Pfeil et al. (2013) ESSD 5: 125-143;*

*Sabine et al. (2013) ESSD 5: 145-153; V2: Bakker et al. ESSD in preparation.*

# Surface Ocean CO<sub>2</sub> Atlas, version 2



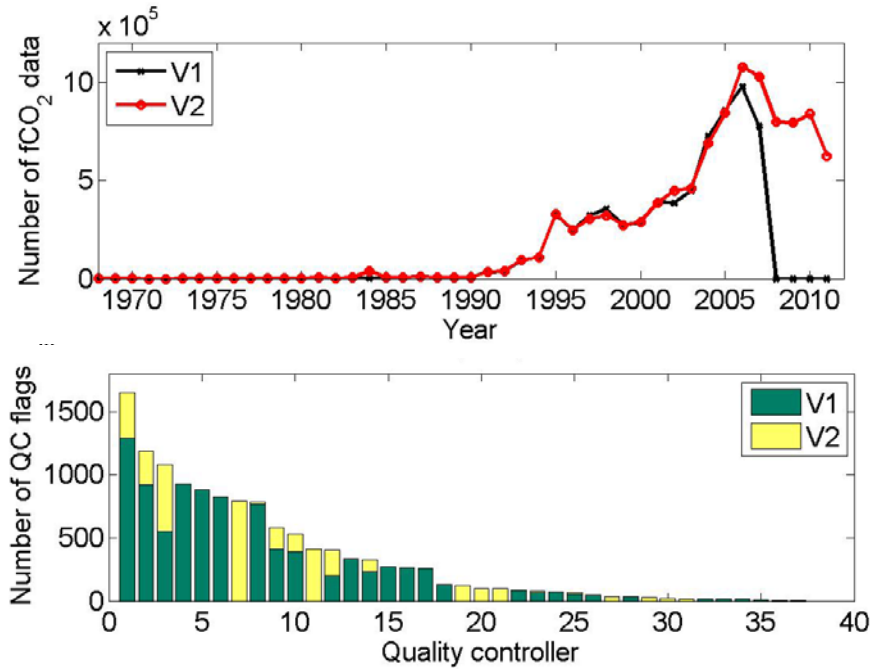
Recalculated surface ocean fCO<sub>2</sub> in uniform format with quality control;  
Transparent, fully documented, regular updates;

Global synthesis product for the global oceans and coastal seas;  
Global gridded products without interpolation (1° x 1° global, ¼° x ¼° coastal);

Interactive online viewers (Live Access Server);  
Available in various formats, including in Ocean Data View;  
Access via <http://www.socat.info/>



# Community effort since 2007



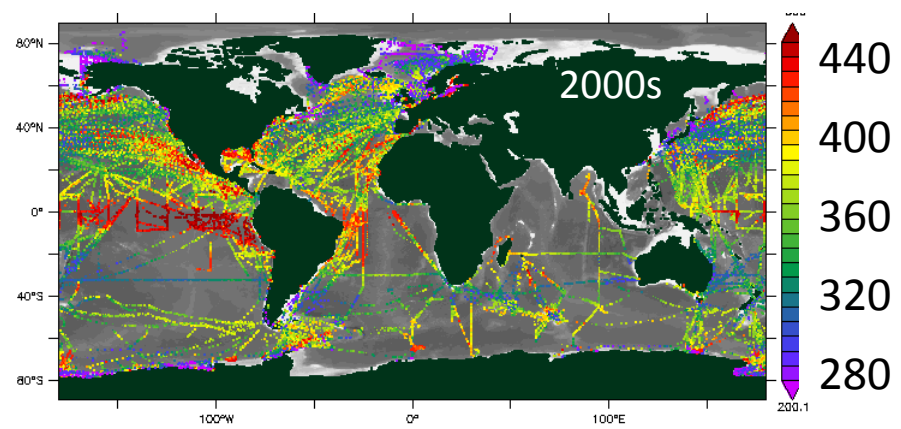
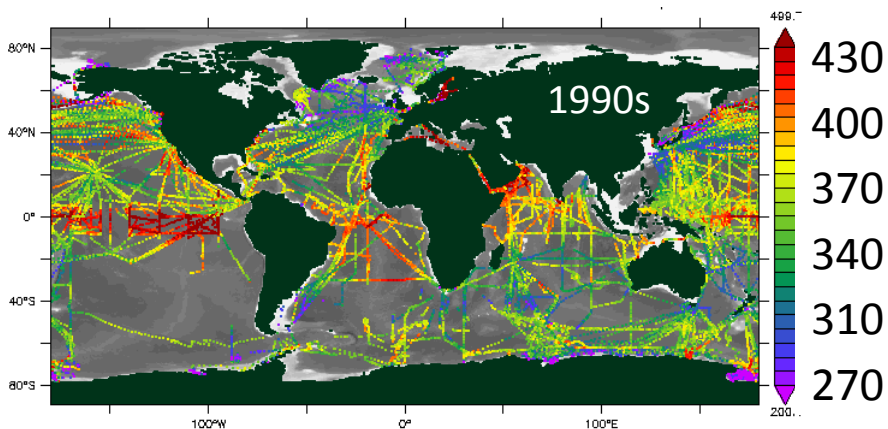
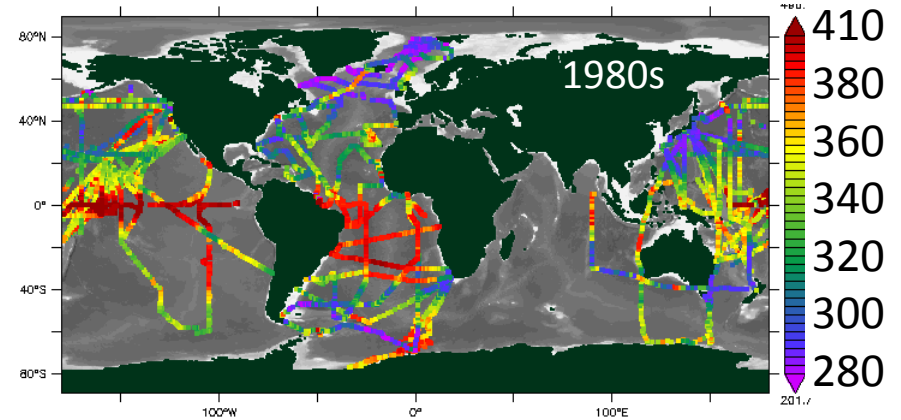
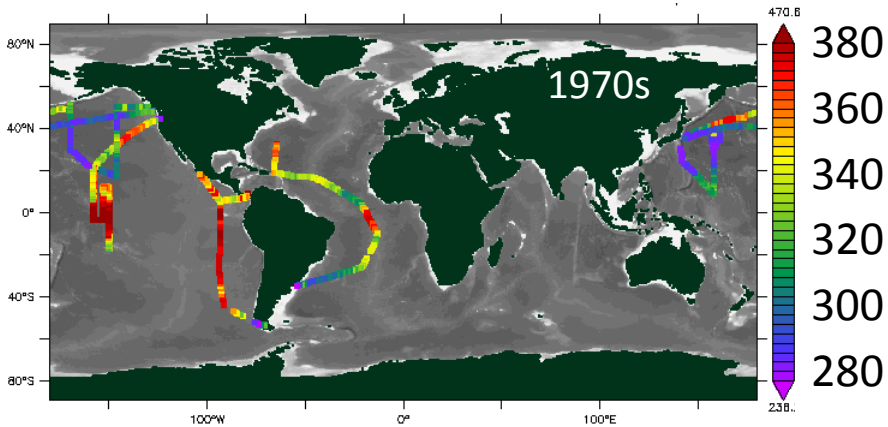
9,045 QC flags in V1  
3,473 QC flags in V2

>100 contributors and data providers;  
Multiple funding sources, but no long-term funding;  
Please, acknowledge SOCAT, data providers and contributors;



# Increasing data coverage per decade

[www.socat.info](http://www.socat.info)



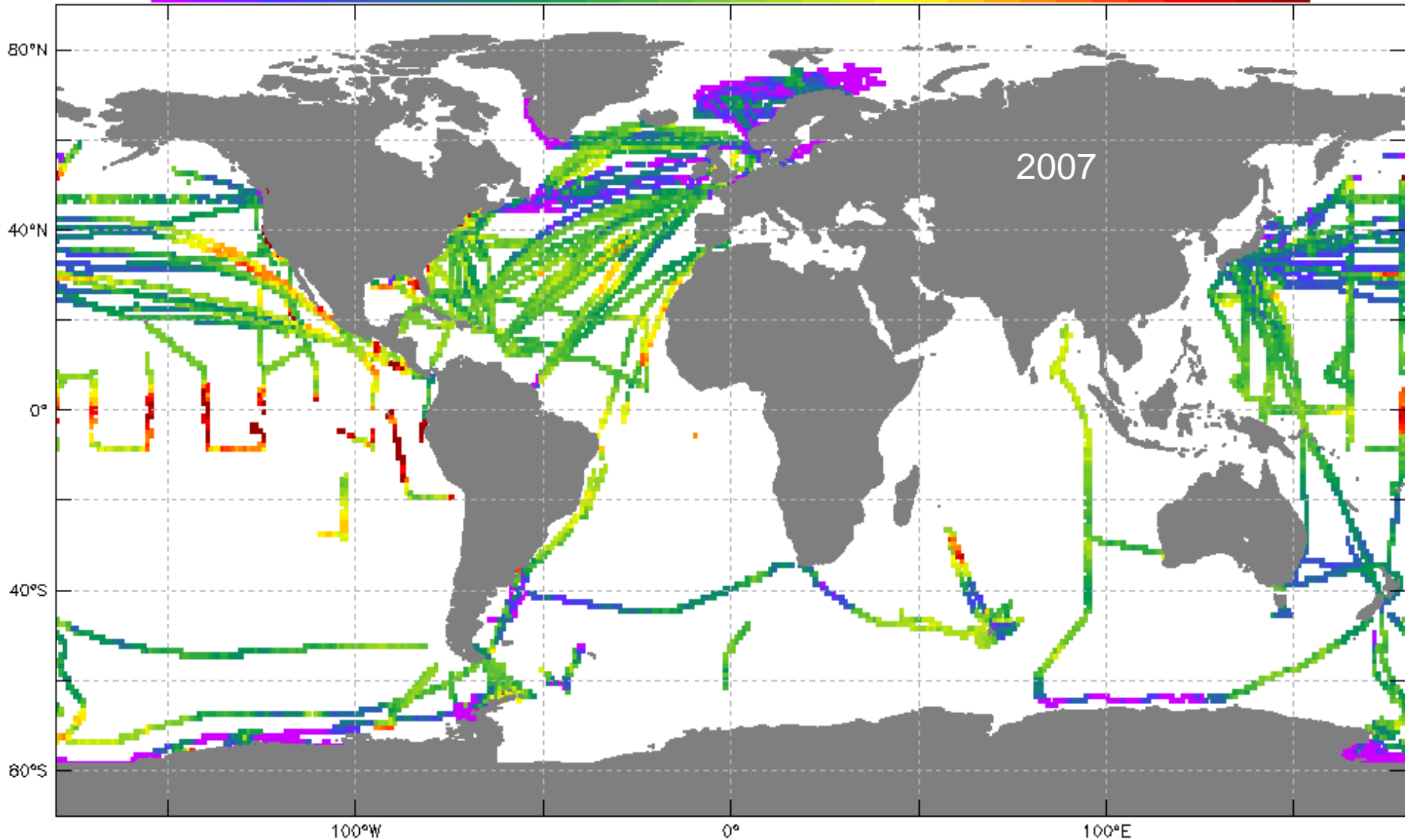
Recommended  $f\text{CO}_2$  ( $\mu\text{atm}$ )

# Surface water fCO<sub>2</sub> (μatm)

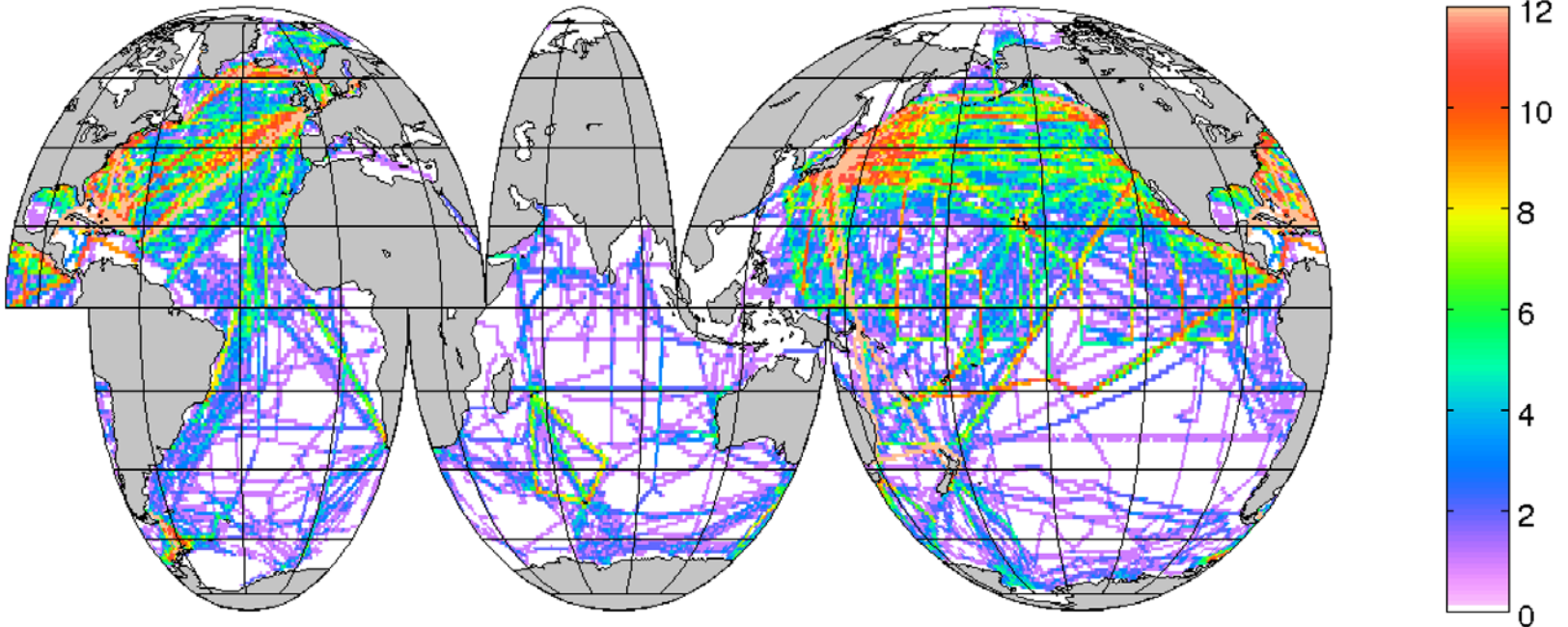
Movie (1970) 1978 – 2011, annual, gridded 1° x 1°

100 305 315 325 335 345 355 365 375 385 395 405 415 425 435 445 1000

140.1 674.7



# Data coverage (1970-2011)

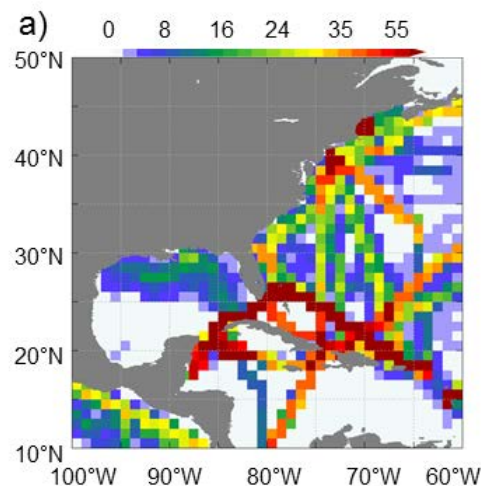


Number of unique months with fCO<sub>2</sub> observations  
per 1° x 1° grid cell (1970-2011)

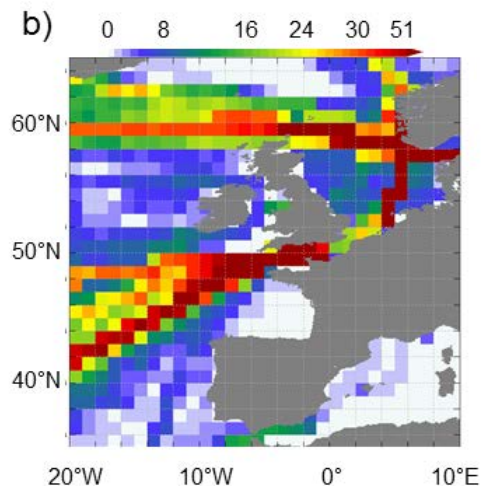


# Data coverage in coastal regions

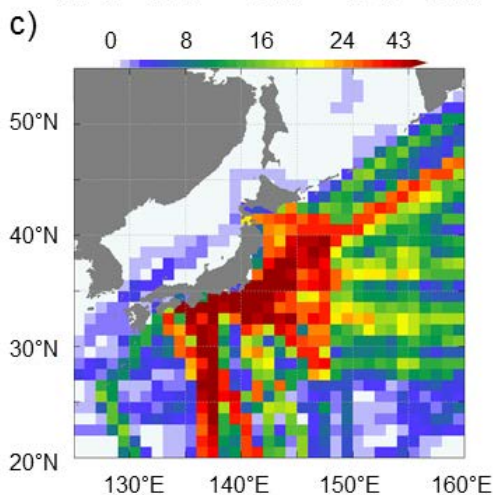
US East Coast  
& Caribbean



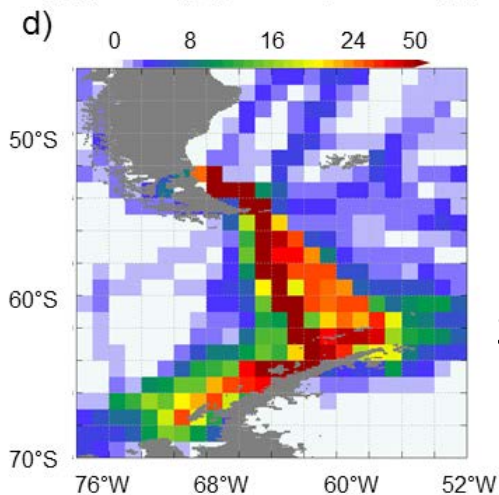
W Europe



Japan

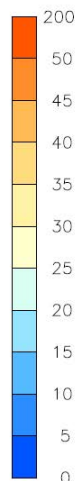
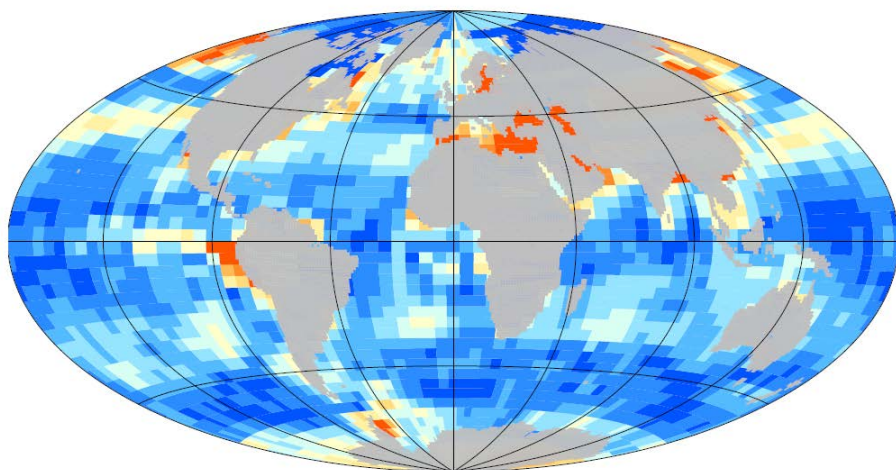


Drake Passage,  
Southern Ocean



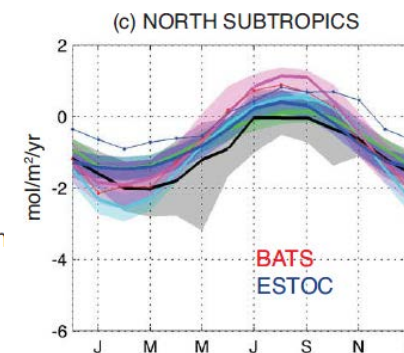
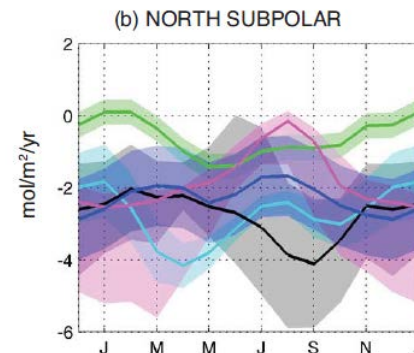
Number of cruises with fCO<sub>2</sub> data for 2000 to 2009  
per 1°x 1° grid cell





pCO<sub>2</sub> climatology  
 Atmospheric inversion  
 Ocean models  
 SOCAT MPR  
 pCO<sub>2</sub> data base

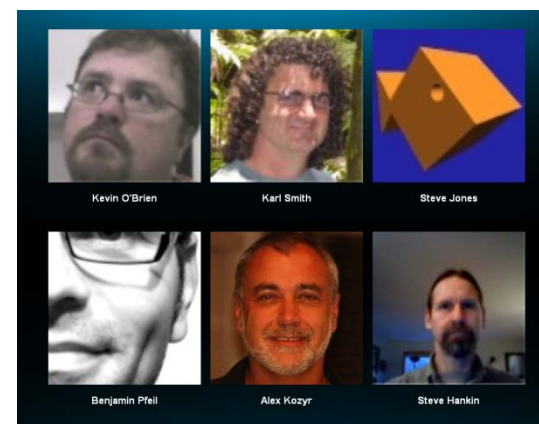
Amplitude seasonal pCO<sub>2w</sub> cycle (μatm)  
 (Rödenbeck et al., 2013, OS)



Seasonal Atlantic CO<sub>2</sub> air-sea fluxes  
 (Schuster et al., 2013, Biogeosciences)

- Process studies;
- Ocean carbon sink and its seasonal, year-to-year, decadal variation;
- Initialisation and validation of ocean carbon cycle models.
- Widely used (≥9 publications, ≥3 in preparation).

# Future SOCAT



V3 Data submission to CDIAC by **December 2013**.

**Alternative sensor recommendations** (White paper by Wanninkhof et al.):

- Flag A: strict cross-over definition;
- Flag C and D: accuracy  $< 5 \mu\text{atm}$ ;
- Flag E: for alternative sensors, accuracy  $< 10 \mu\text{atm}$  (**NEW**);

**Automation system** (Poster 140, Hankin et al.) ready by January 2014;

Some V3 data submission via automation system (invitation only);

Automation system in use for version 4.

**Additional parameters**, e.g. nutrients, pH, DIC, TA:

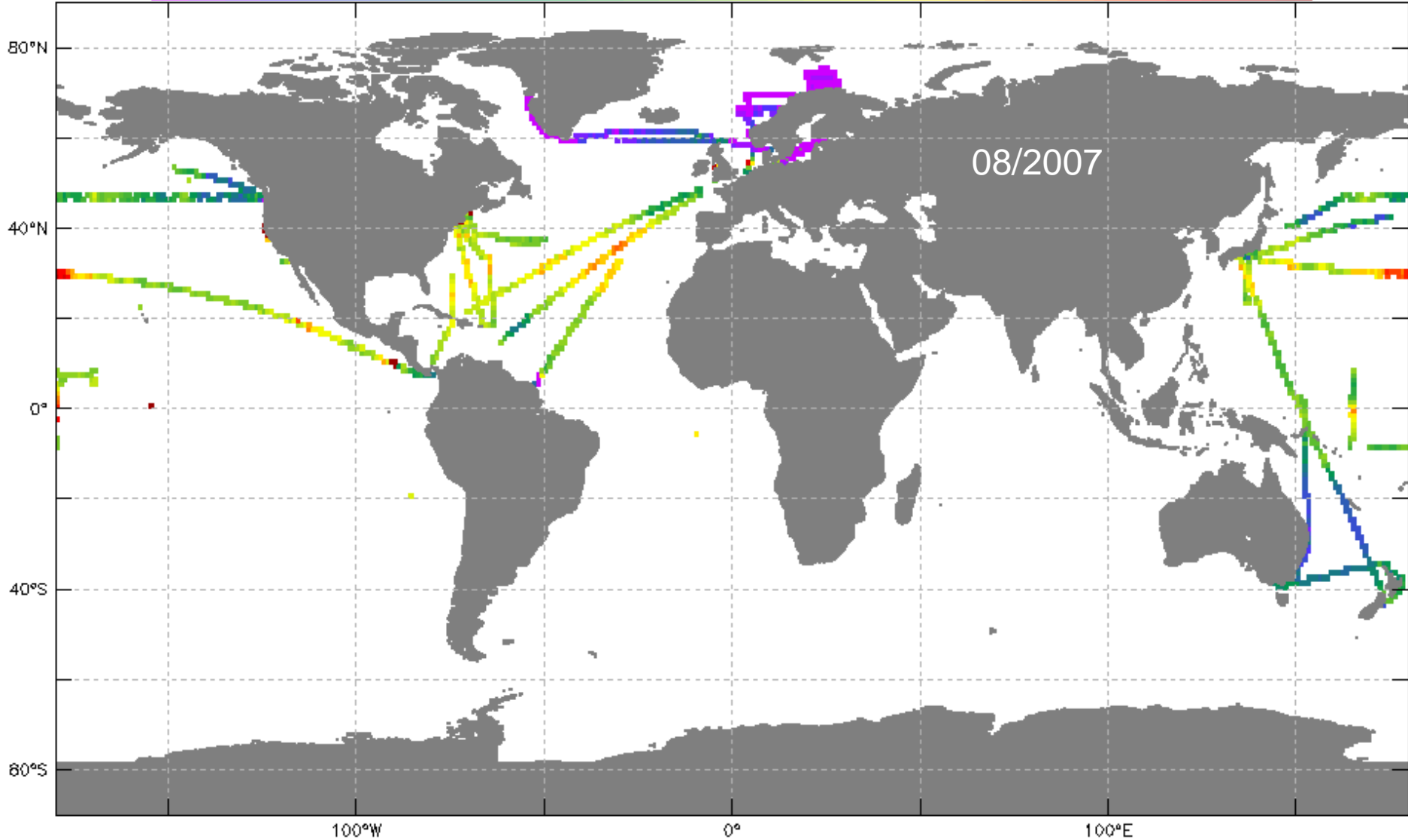
- No extra parameters until version 4 or later.
- Only include extra parameters, if they can be quality controlled and if sufficient manpower and/or automation is in place to do this QC.

# Surface water fCO<sub>2</sub> (μatm)

Movie 2006 – 2008, monthly, gridded 1° x 1°

100 305 315 325 335 345 355 365 375 385 395 405 415 425 435 445 1000

176.7 650.1





## Welcome to SOCAT

A Collection of Underway Ocean CO<sub>2</sub> Observations Quality Controlled by  
the Science Community



### SOCAT Version 2 Data Products:

[Cruise Data Viewer](#)

[Gridded Data Viewer](#)

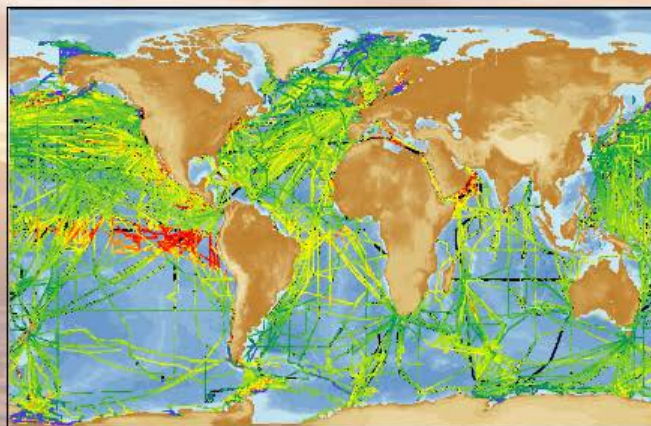
[Table of Cruises](#)

[Data Download](#)

[Publications/Presentations](#)

[SOCAT Credits](#)

[SOCAT Version 1.5](#)



### SOCAT Documentation:

[About](#)

[News](#)

[Meetings](#)

[Data Use Policy](#)

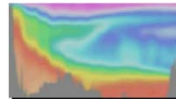
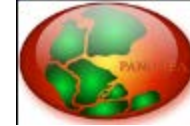
### SOCAT Help:

[Videos](#)

[Frequently Asked Questions](#)

Please contact [submit@socat.info](mailto:submit@socat.info) to report problems.





*Many thanks to all data managers,  
data contributors, regional and  
global group leads, and quality  
controllers!*