

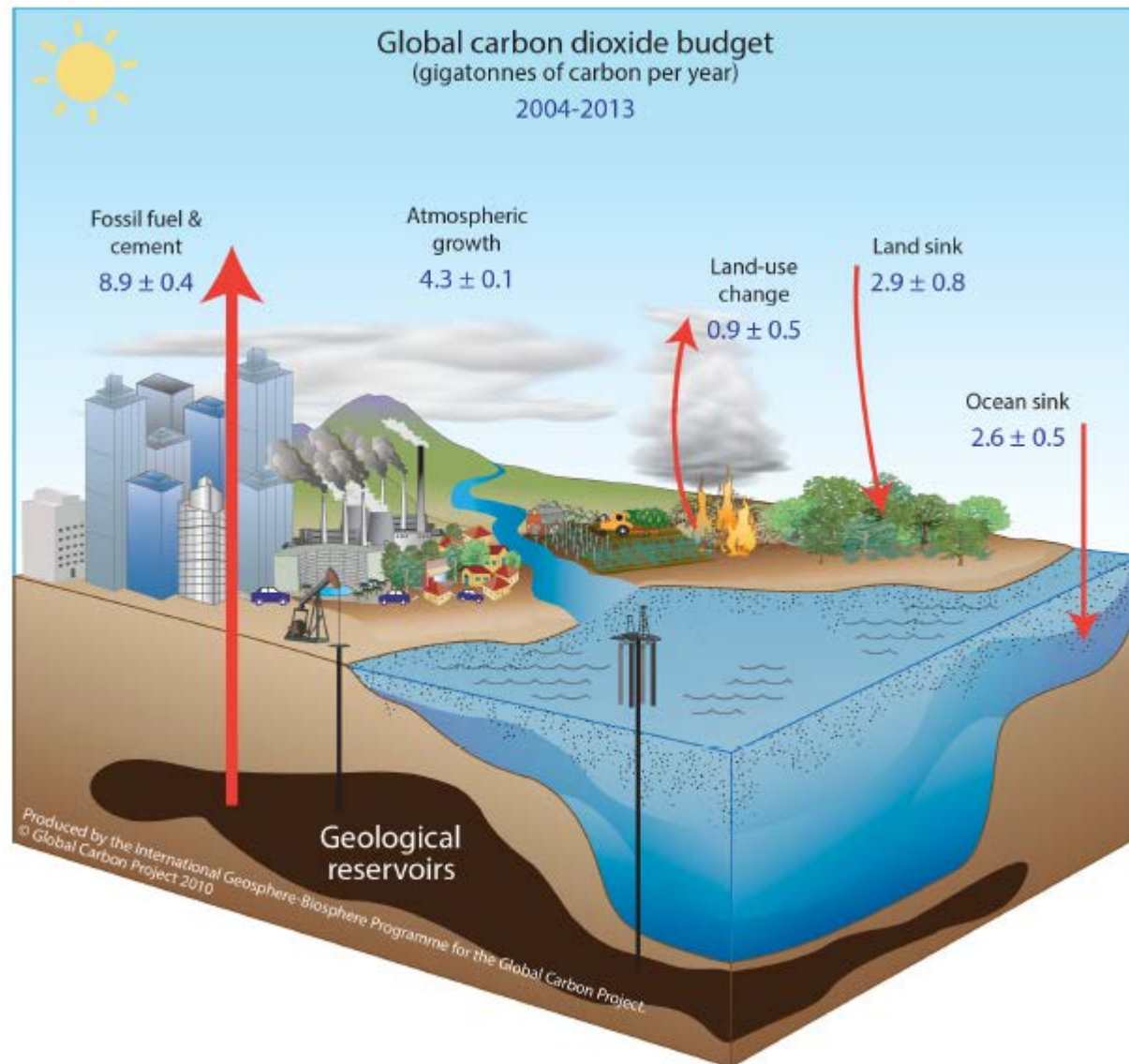
The Surface Ocean CO₂ Atlas (SOCAT) enables detection of changes in the ocean carbon sink

D. C. E. Bakker, B. Pfeil, K. Smith, S. Hankin, A. Olsen, S. R. Alin, C. Cosca, S. Harasawa, A. Kozyr, Y. Nojiri, K. M. O'Brien, U. Schuster, M. Telszewski, B. Tilbrook, C. Wada, J. Akl, L. Barbero, N. R. Bates, J. Boutin, Y. Bozec, W.-J. Cai, R. D. Castle, F. P. Chavez, L. Chen, M. Chierici, K. Currie, H. J. W. de Baar, W. Evans, R. A. Feely, A. Fransson, Z. Gao, B. Hales, N. J. Hardman-Mountford, M. Hoppema, W.-J. Huang, C. W. Hunt, B. Huss, T. Ichikawa, T. Johannessen, E. M. Jones, S. D. Jones, S. Jutterström, V. Kitidis, A. Körtzinger, P. Landschützer, S. K. Lauvset, N. Lefèvre, A. B. Manke, J. T. Mathis, L. Merlivat, N. Metzl, A. Murata, T. Newberger, A. M. Omar, T. Ono, G.-H. Park, K. Paterson, D. Pierrot, A. F. Ríos, C.L. Sabine, S. Saito, J. Salisbury, V. V. S. S. Sarma, R. Schlitzer, R. Sieger, I. Skjelvan, T. Steinhoff, K. F. Sullivan, H. Sun, A. J. Sutton, T. Suzuki, C. Sweeney, T. Takahashi, J. Tjiputra, N. Tsurushima, S. M. A. C. van Heuven, D. Vandemark, P. Vlahos, D. W. R. Wallace, R. Wanninkhof and A. J. Watson

Version 2: 81 contributors from 51 organisations in 17 countries on 5 continents



Global carbon dioxide (CO₂) Budget



Le Quéré et al., 2014. Global Carbon Budget 2014. ESSDD 7: 521-610.

Fate of anthropogenic CO₂ emissions (2004-2013 average)

8.9 ± 0.4 PgC/yr 91%



0.9 ± 0.5 PgC/yr 9%



4.3 ± 0.1 PgC/yr
44%



2.9 ± 0.8 PgC/yr
29%

Calculated as the residual
of all other flux components

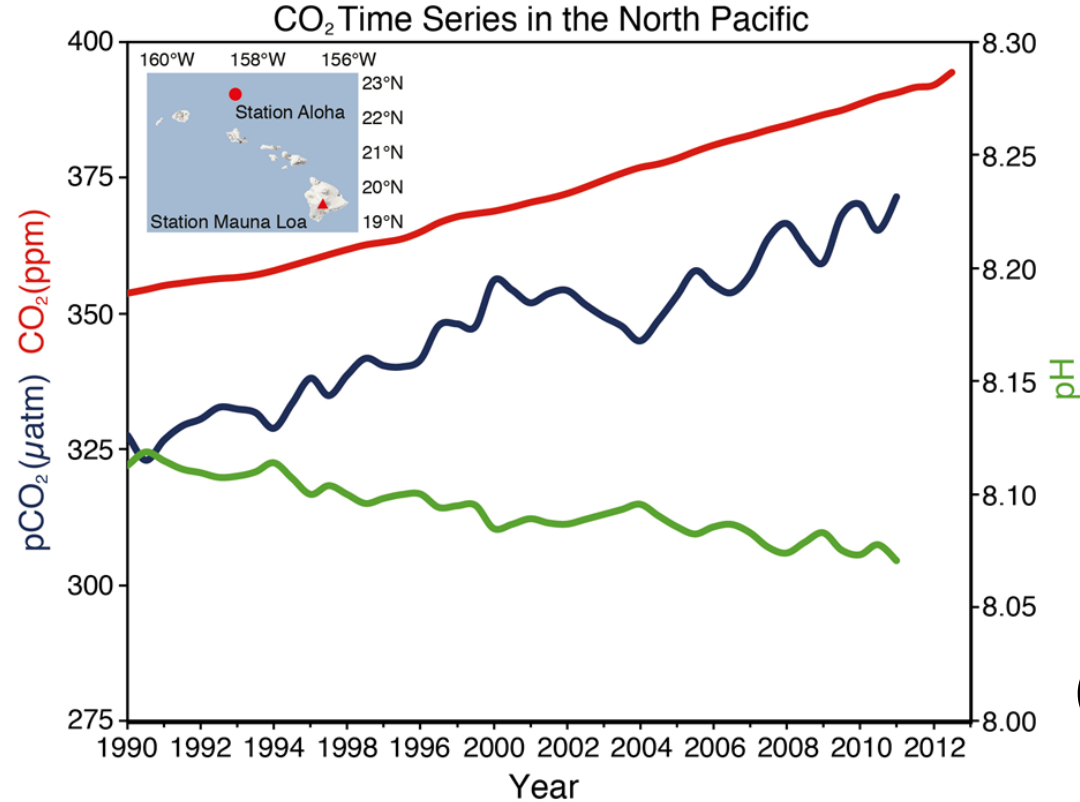


2.6 ± 0.5 PgC/yr
26%



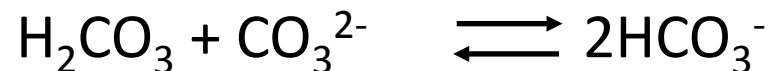
+

Ocean CO₂ uptake promotes ocean acidification

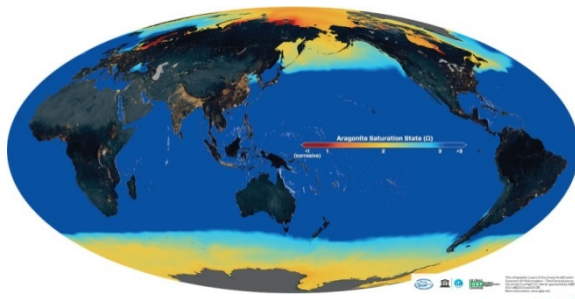


(Rhein et al., 2013)

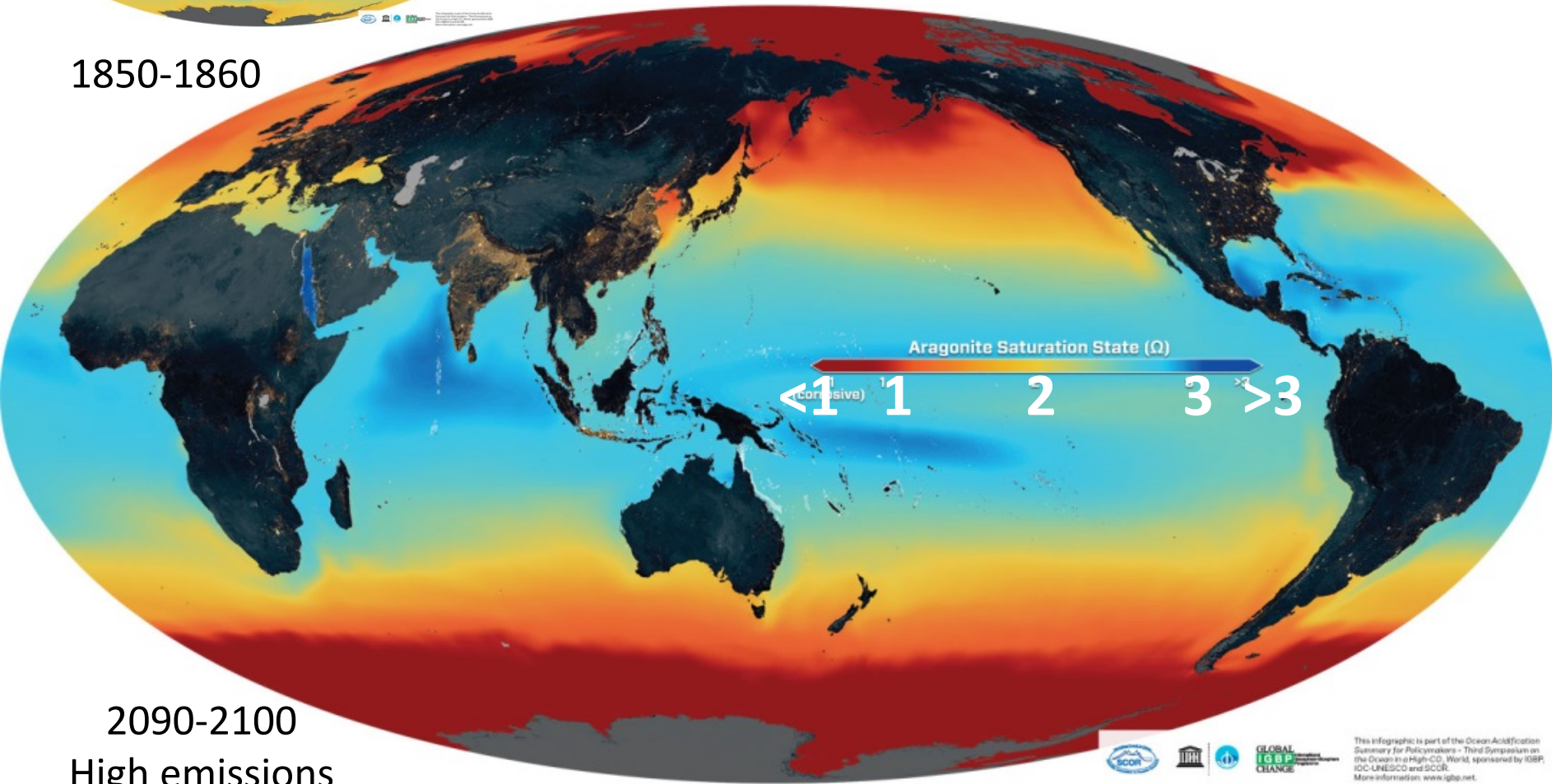
Ocean CO₂ uptake decreases pH and the saturation state
For the calcium carbonates aragonite, calcite.



Aragonite saturation state from 1850 to 2100



1850-1860



2090-2100

High emissions
scenario

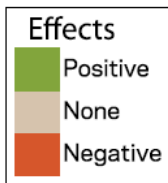
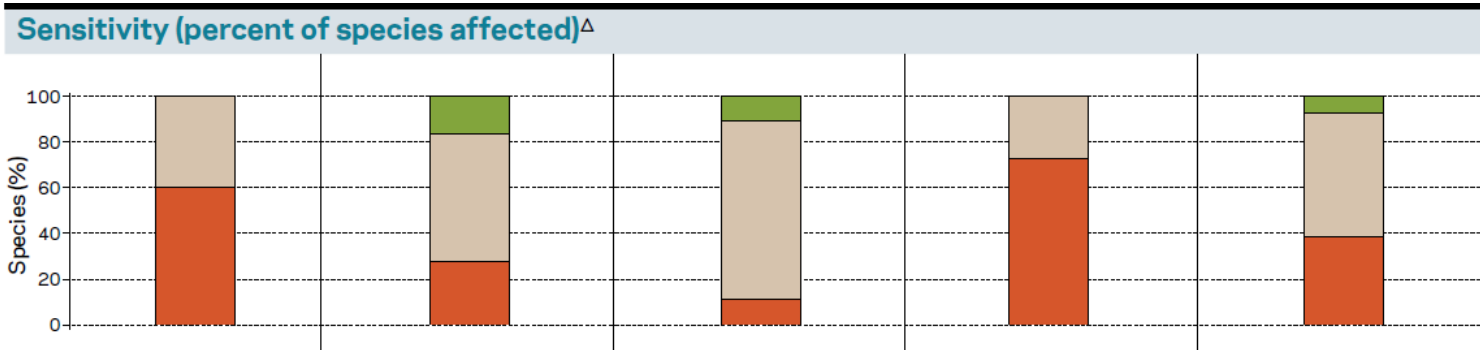


This infographic is part of the Ocean Acidification
Summary for Policymakers - Third Symposium on
the Ocean in a High- CO_2 World, sponsored by IGBP,
IOC-UNESCO and SCOR.
More information: www.igbp.net

(IGBP, IOC, SCOR, 2013)

Ocean acidification will promote large changes in marine ecosystems

GROUPS				
Molluscs	Echinoderms	Crustaceans	Finfish	Corals
				
Clams, scallops, mussels, oysters, pteropods, abalone, conchs and cephalopods (squid, cuttlefish and octopuses)	Sea urchins, sea cucumbers, starfish	Shrimps, prawns, crabs, lobsters, copepods (zooplankton), etc.	Small (herrings, sardines, anchovies), large (tuna, bonitos, billfishes), demersal (flounders, halibut, cod, haddock), etc.	Warm and cold water coral



Doney et al., 2009; Hofmann et al., 2010;
 IGBP, IOC, SCOR, 2013; Kroeker et al., 2013; Whittman and Pörtner, 2013

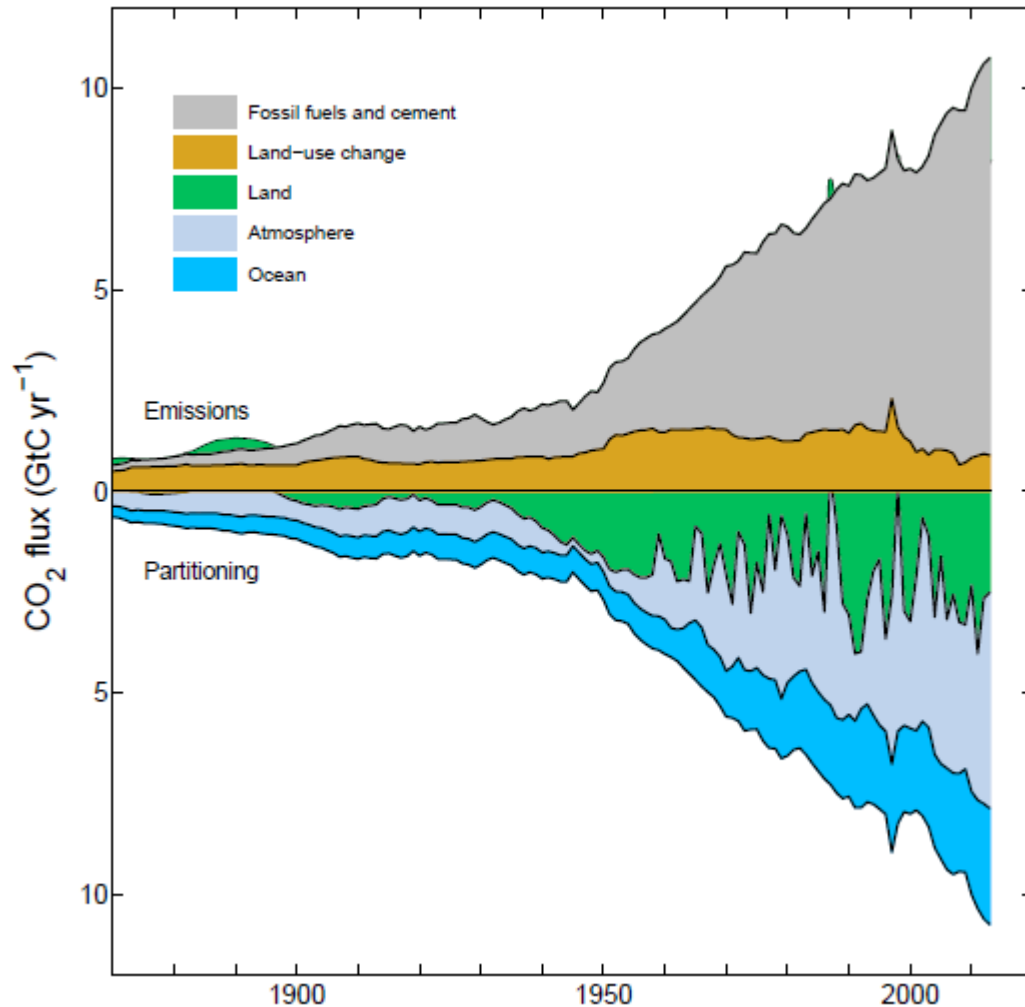
Anthropogenic carbon dioxide (CO₂) emissions affect global climate and the global oceans



UN Climate Summit – 23 September 2014, New York

Photo by Brian Ward, University of Galway, Ireland

Global Carbon Budget



For 2004-2013:

**Fossil fuel and cement sources
(91%)**

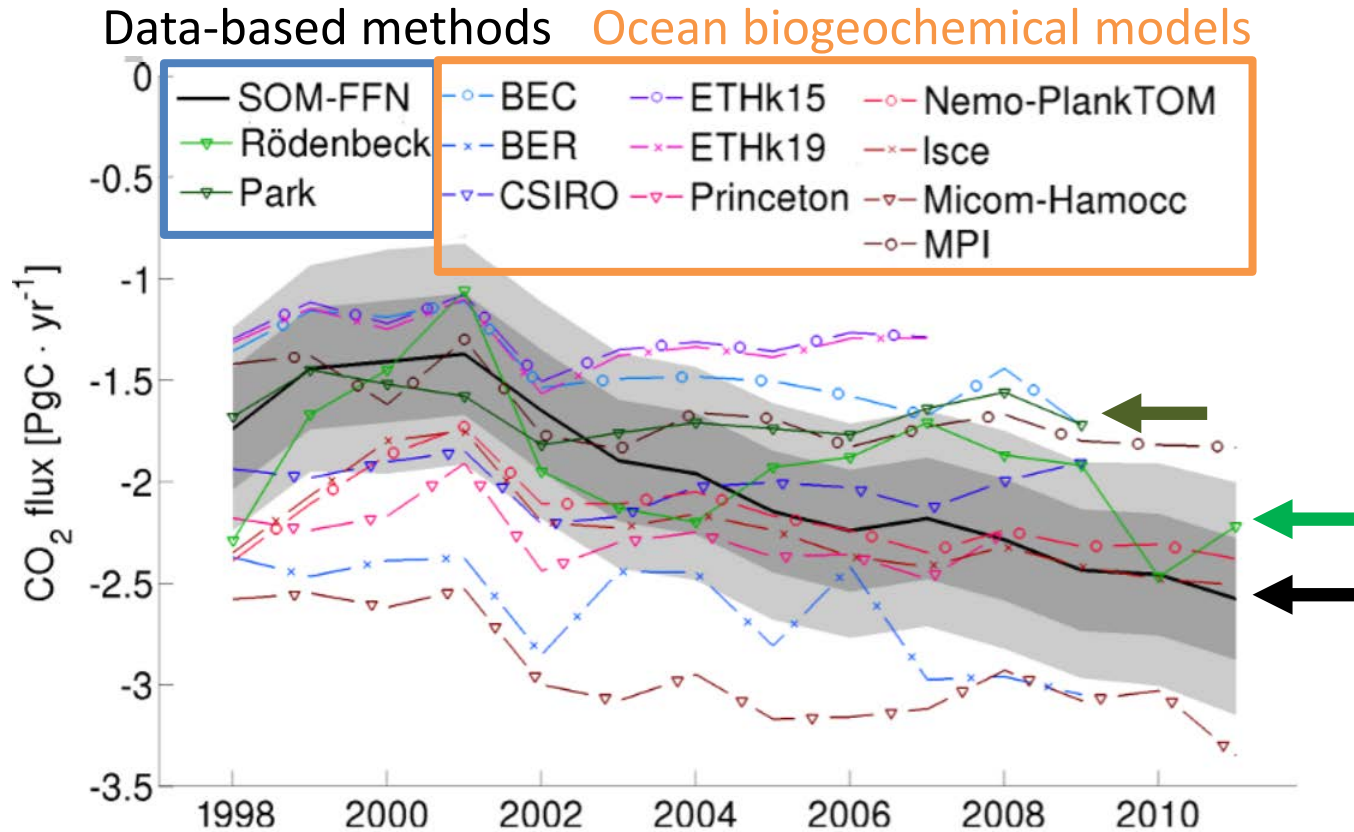
Land-use change (9%)

Land sink (as residual) (29%)

Atmosphere sink (44%)

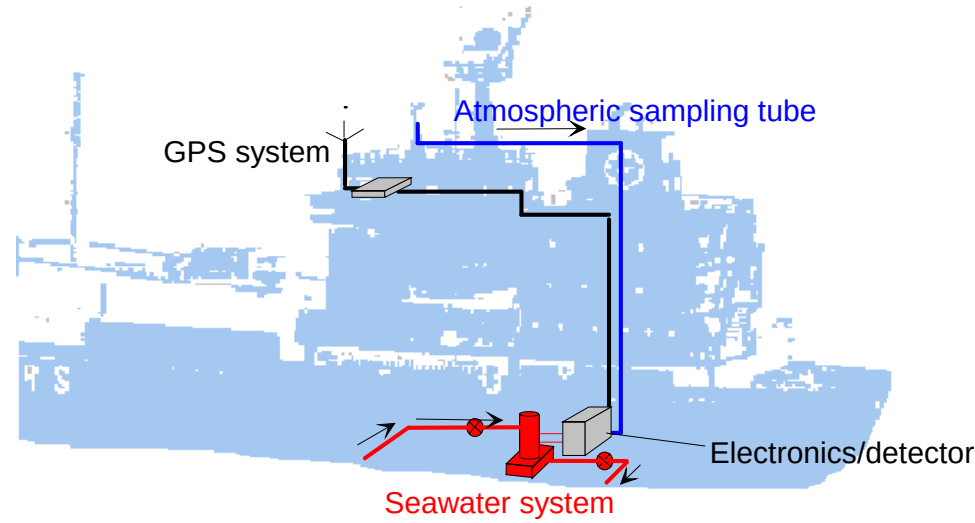
Ocean CO₂ sink (26%)
2.6 ± 0.5 Pg C yr⁻¹

The ocean CO₂ sink and its uncertainty



Mean ocean CO₂ sink? ($2.6 \pm 0.5 \text{ Pg C yr}^{-1}$, 2004-2013)
 Riverine carbon inputs? ($0.45 \pm 0.2 \text{ PgC yr}^{-1}$)
 Year-to-year variation?
 Trend in ocean CO₂ sink?
 Regional variation?

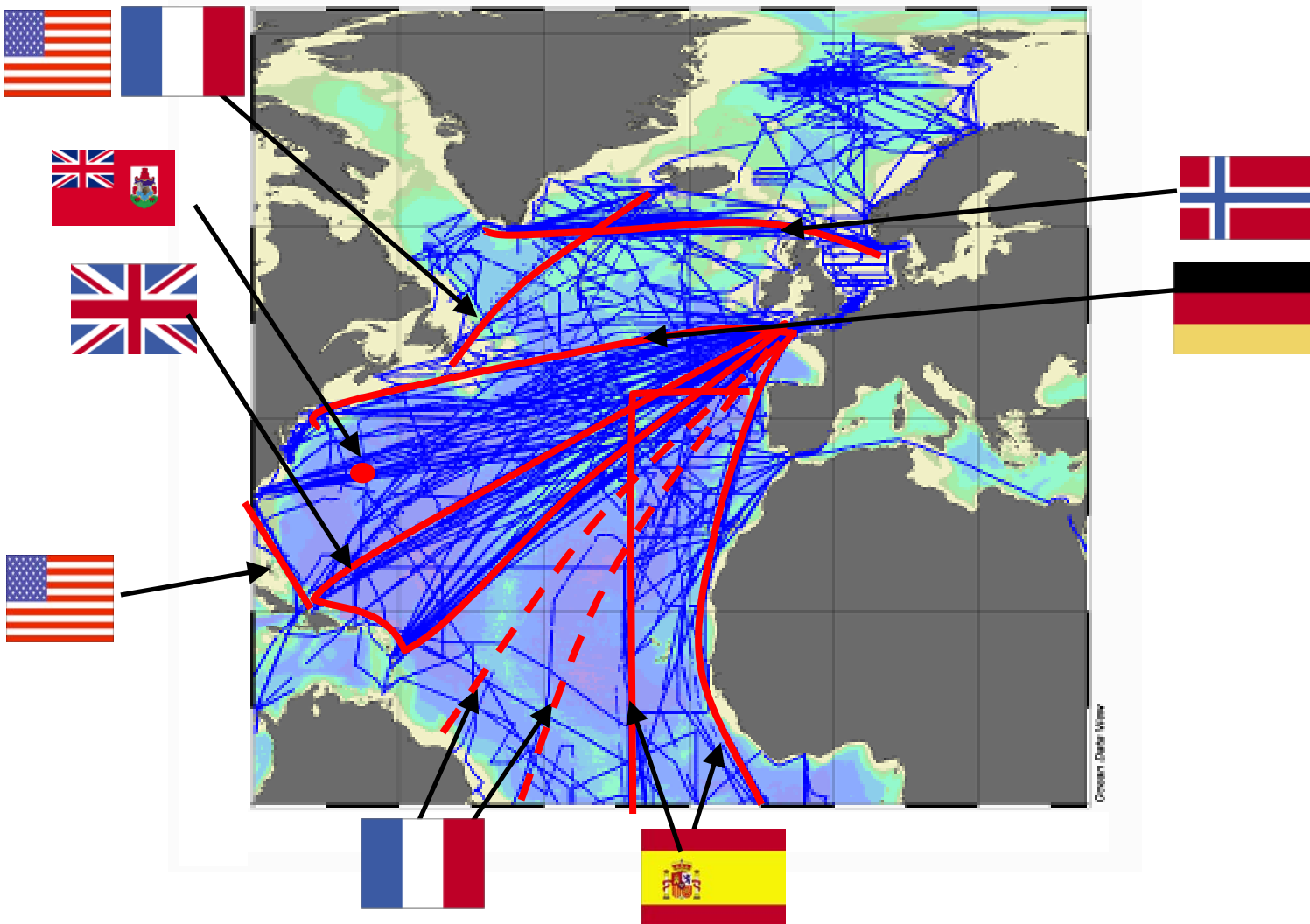
Surface water fCO₂ observations on Ships of Opportunity



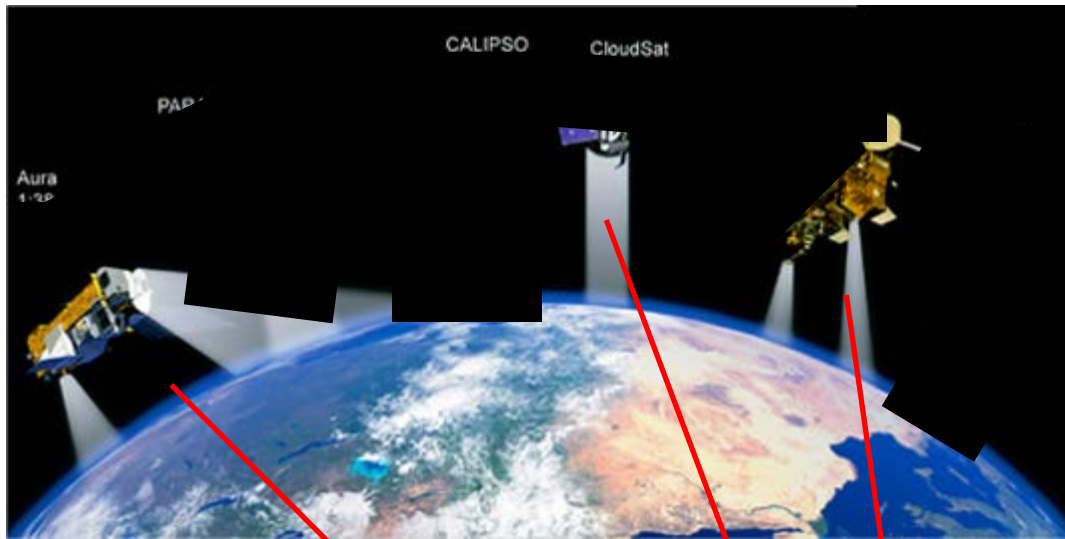
Fugacity of CO₂ (fCO₂) and partial pressure of CO₂ (pCO₂)
 $f\text{CO}_2 = \gamma \text{ pCO}_2 = [\text{CO}_2] / K'_0$

($\gamma \sim 0.996\text{-}0.997$)

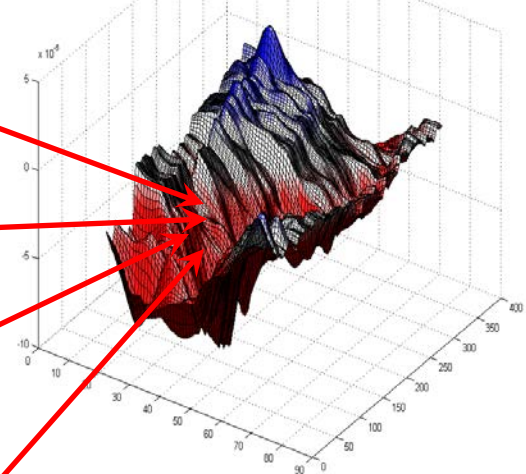
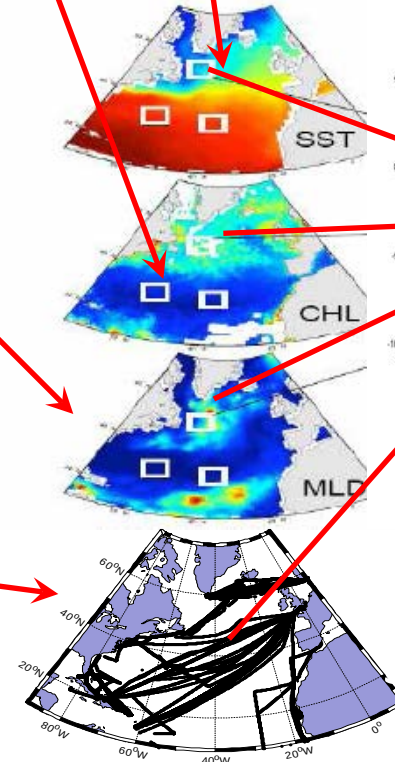
A North Atlantic CO₂ observing network



2002-2004 (Cavassoo), 2005-2009 (CarboOcean),
2011-2015 (CarboChange), ICOS?

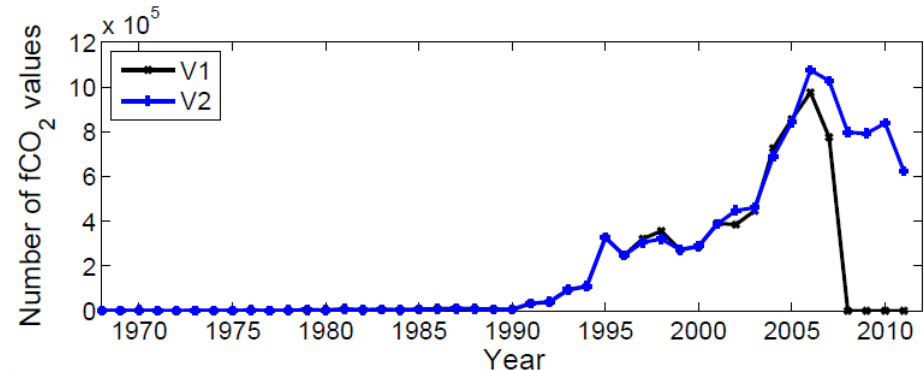
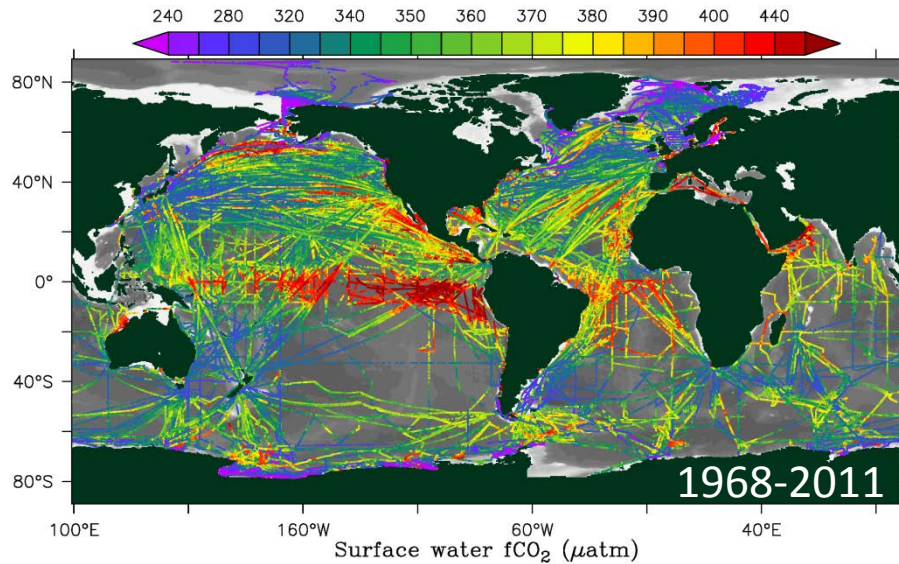


CO₂ mapping




 SURFACE OCEAN CO₂ ATLAS

Surface Ocean CO₂ Atlas



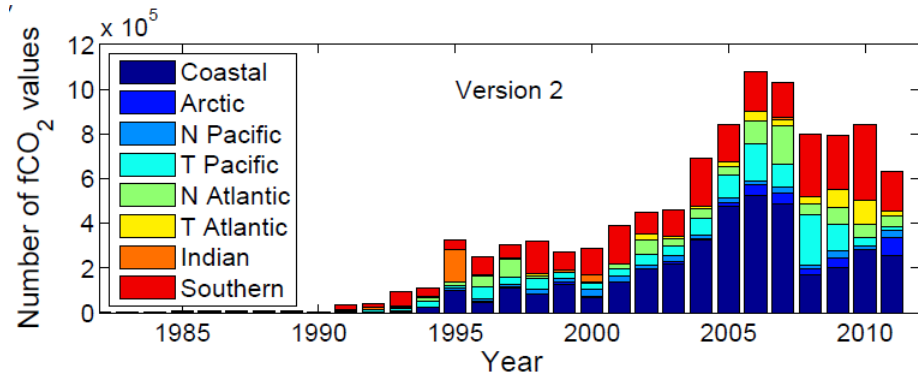
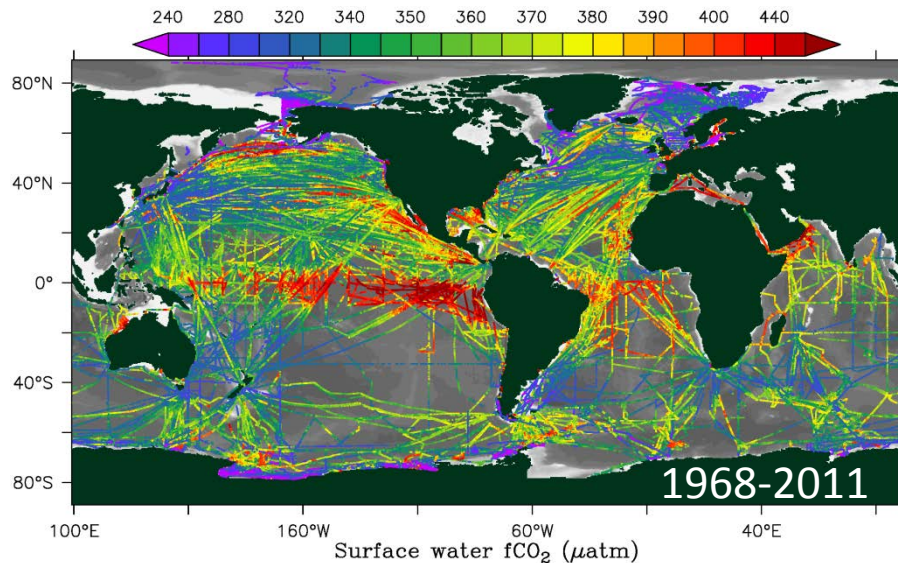
2007: No public, global fCO₂ data set. Many formats, many data not public.

SOCAT: Surface ocean fCO₂ (fugacity of CO₂) in uniform format with quality control;

2011: SOCAT Version 1: 1968-2007, 6.3 million fCO₂, 1851 cruises;

2013: SOCAT Version 2: 1968-2011, 10.1 million fCO₂, 2660 data sets;

Surface Ocean CO₂ Atlas



Surface ocean fCO₂ (fugacity of CO₂) in uniform format with quality control;

- Individual data set files;
- Global synthesis product for the global oceans and coastal seas;
- Global gridded products, no interpolation (1° x 1° global, ¼° x ¼° coastal);

Public access via <http://www.socat.info/>;

Interactive online viewers (Live Access Server);

Various formats, e.g. text, NetCDF, Ocean Data View, Matlab;

Documented in 3 ESSD articles.

Earth Syst. Sci. Data, 5, 125–143, 2013
www.earth-syst-sci-data.net/5/125/2013/
doi:10.5194/essd-5-125-2013
© Author(s) 2013. CC Attribution 3.0 License.

Open Access
Earth System
Science
Data

38 citations

A uniform, quality controlled Surface Ocean
CO₂ Atlas (SOCAT)

B. Pfeil^{1,2,3}, A. Olsen^{1,2,4,5}, D. C. E. Bakker⁶, S. Hankin⁷, H. Koyuk⁸, A. Kozyr⁹, J. Malczyk¹⁰, A. Manke⁷, N. Metz¹¹, C. L. Sabine¹², J. Akl^{12,13}, S. R. Allen¹⁴, N. Bates¹⁴, R. G. J. Bellerby^{15,16,2}, A. Borges¹⁷, J. Boutin¹¹, P. J. Brown^{5,18}, W.-J. Cai¹⁹, F. P. Chavez²⁰, A. Chen²¹, C. Cosca⁷, A. J. Fassbender²², R. A. Feely⁷, M. González-Dávila²³, C. Goyet²⁴, B. Hales²⁵, N. Hardman-Mountford^{26*}, C. Heinze^{1,2,5,16}, M. Hood²⁷, M. Hoppema²⁸, C. W. Hunt²⁹, D. Hydes³⁰, M. Ishii³¹, T. Johannessen^{1,2}, S. D. Jones³², R. M. Key³³, A. Körtzinger³⁴, P. Landschützer³⁵, S. K. Lauvset^{1,2}, N. Lefèvre³¹, A. Lenton¹², A. Lourantou¹³, L. Merlivat¹³, T. Midorikawa³⁶, L. Mintrop³⁸, C. Miyazaki³⁷, A. Murata³⁸, A. Nakadate³⁹, Y. Nakano³⁸, S. Nakaoka⁴⁰, Y. Nojiri⁴⁰, A. M. Omar^{2,16}, X. A. Padin⁴¹, G.-H. Park⁴², K. Paterson^{12,13}, F. F. Perez⁴³, D. Pierrot⁴², A. Poisson⁴⁴, A. F. Rios⁴¹, J. M. Santana-Casiano²³, J. Salisbury²⁵, V. V. S. S. Sarma³⁸, R. Schlitzer³⁸, B. Schneider⁴⁵, U. Schuster⁴⁶, R. Sieger²⁸, I. Skjelvan^{1,2,16}, T. Steinhoff³⁴, T. Suzuki⁴⁰, T. Takahashi⁴⁰, K. Tedesco^{17,44}, M. Telszewski^{46,44}, H. Thomas⁴⁶, B. Tilbrook^{12,13,30}, J. Tjiputra^{1,2}, D. Vandemark²⁹, T. Veness^{12,13}, R. Wanninkhof⁴¹, A. J. Watson⁴, R. Weiss³², C. S. Wong³⁵, and H. Yoshikawa-Inoue³⁸

14 citations

Surface Ocean CO₂ Atlas (SOCAT) gridded data products

C. L. Sabine¹, S. Hankin¹, H. Koyuk^{1,2}, D. C. E. Bakker³, B. Pfeil^{4,5,6}, A. Olsen^{7,8}, N. Metz⁹, A. Kozyr¹⁰, A. Fassbender^{1,20}, A. Manke^{1,2}, J. Malczyk¹¹, J. Akl^{12,13}, S. R. Allen¹⁴, R. G. J. Bellerby^{14,44}, A. Borges¹⁵, J. Boutin¹¹, P. J. Brown^{5,16}, W.-J. Cai¹⁷, F. P. Chavez¹⁸, A. Chen¹⁹, C. Cosca⁷, R. A. Feely¹, M. González-Dávila²¹, C. Goyet²², N. Hardman-Mountford^{23,44}, C. Heinze^{4,5,8,14}, M. Hoppema²⁴, C. W. Hunt²⁵, D. Hydes²⁶, M. Ishii²⁷, T. Johannessen^{4,5}, R. M. Key²⁸, A. Körtzinger²⁹, P. Landschützer³¹, S. K. Lauvset^{1,5}, N. Lefèvre⁹, A. Lenton¹³, A. Lourantou¹³, L. Merlivat¹³, T. Midorikawa³⁶, L. Mintrop³¹, C. Miyazaki³², A. Murata³³, A. Nakadate³⁴, Y. Nakano³⁵, S. Nakaoka³⁵, Y. Nojiri³⁵, A. M. Omar^{8,14}, X. A. Padin¹⁶, G.-H. Park³⁷, K. Paterson^{12,13}, F. F. Perez³⁸, D. Pierrot³⁷, A. Poisson²², A. F. Rios³⁶, J. Salisbury²⁵, J. M. Santana-Casiano²¹, V. V. S. S. Sarma³⁸, R. Schlitzer³⁴, B. Schneider³⁹, U. Schuster⁴⁰, R. Sieger²⁴, I. Skjelvan^{5,14,4}, T. Steinhoff²⁹, T. Suzuki⁴⁰, T. Takahashi⁴¹, K. Tedesco^{17,44}, M. Telszewski^{41,44}, H. Thomas⁴¹, B. Tilbrook^{12,13,43}, D. Vandemark²³, T. Veness¹³, A. J. Watson¹, R. Weiss⁴⁶, C. S. Wong⁴⁷, and H. Yoshikawa-Inoue³¹

11 citations

An update to the Surface Ocean CO₂ Atlas (SOCAT
version 2)

D. C. E. Bakker¹, B. Pfeil^{1,3}, K. Smith^{4,5}, S. Hankin⁴, A. Olsen^{2,3,6}, S. R. Allen⁴, C. Cosca⁴, S. Harasawa⁷, A. Kozyr⁸, Y. Nojiri⁹, K. M. O'Brien^{4,5}, U. Schuster^{9,9}, M. Telszewski¹⁰, B. Tilbrook^{11,12}, C. Wada¹, J. Akl¹¹, L. Barbero¹², N. R. Bates¹⁴, J. Boutin¹⁵, Y. Boze^{16,17}, W.-J. Cai¹⁸, R. D. Castle¹⁹, F. P. Chavez²⁰, L. Chen^{21,22}, M. Chierici^{23,24}, K. Currie²⁵, H. J. W. de Baar²⁶, W. Evans²⁷, R. A. Feely⁴, A. Fransson²⁸, Z. Gao²¹, B. Hales²⁹, N. J. Hardman-Mountford³⁰, M. Hoppema³¹, W.-J. Huang³², C. W. Hunt³², B. Hus¹⁹, T. Ichikawa³³, T. Johannessen^{2,3,6}, E. M. Jones³⁴, S. D. Jones³⁴, S. Jutterström³⁵, V. Kitidis³⁶, A. Körtzinger³⁷, P. Landschützer³⁸, S. K. Lauvset³⁹, N. Lefèvre^{39,39}, A. B. Manke⁴⁰, J. T. Mathis⁴¹, L. Merlivat¹³, N. Metz¹⁵, A. Murata⁴⁰, T. Newberger⁴¹, A. M. Omar^{42,43}, T. Ono⁴³, G.-H. Park⁴², K. Paterson¹¹, D. Pierrot⁴⁴, A. F. Rios⁴⁵, C. L. Sabine⁴⁶, S. Saito⁴⁷, J. Salisbury²², V. V. S. S. Sarma⁴⁸, R. Schlitzer³¹, R. Sieger³¹, I. Skjelvan^{6,23}, T. Steinhoff³⁷, K. F. Sullivan¹³, H. Sun⁴⁹, A. J. Sutton^{4,5}, T. Suzuki⁴⁶, C. Sweeney⁴⁴, T. Takahashi⁴¹, J. Tjiputra⁴⁰, N. Tsurushima⁴¹, S. M. A. C. van Heuven⁴⁹, D. Vandemark⁴², P. Vlahos⁵⁰, D. W. R. Wallace⁵¹, R. Wanninkhof⁴⁹, and A. J. Watson⁴⁹

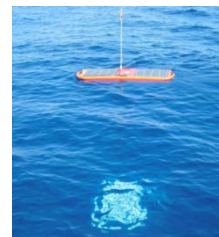
SOCAT data policy:
Recognise the contribution of SOCAT data contributors and quality controllers by invitation to co-authorship or citation of articles. Regional studies: Invite data contributors as co-authors.

Cite the relevant SOCAT ESSD publication:

V1: Pfeil et al. (2013) ESSD 5: 125-143;

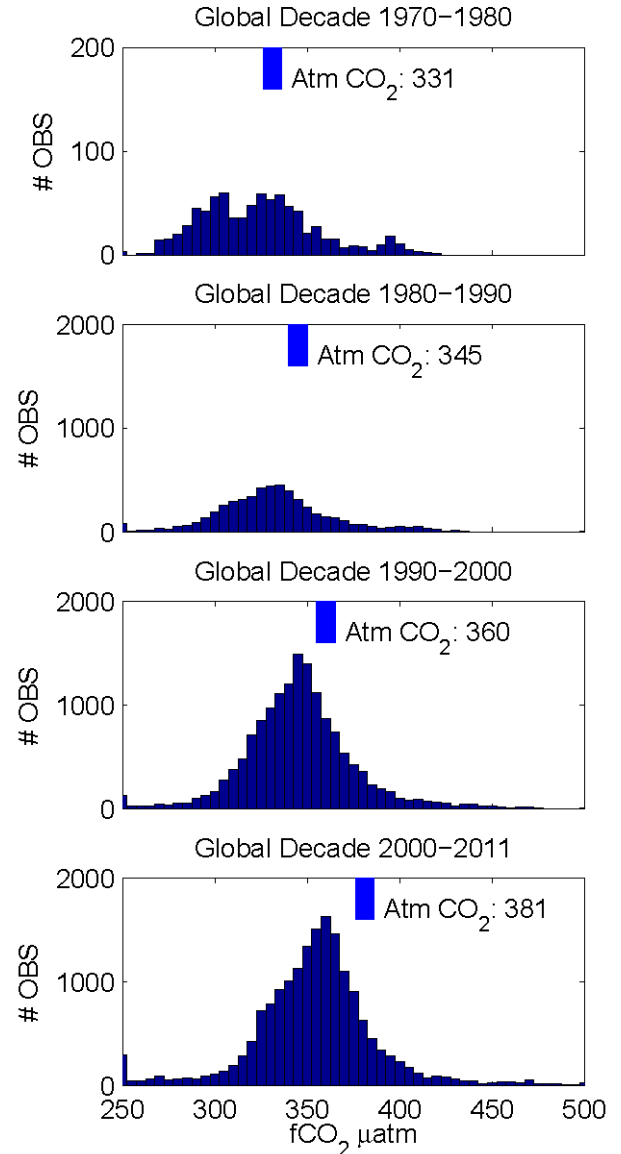
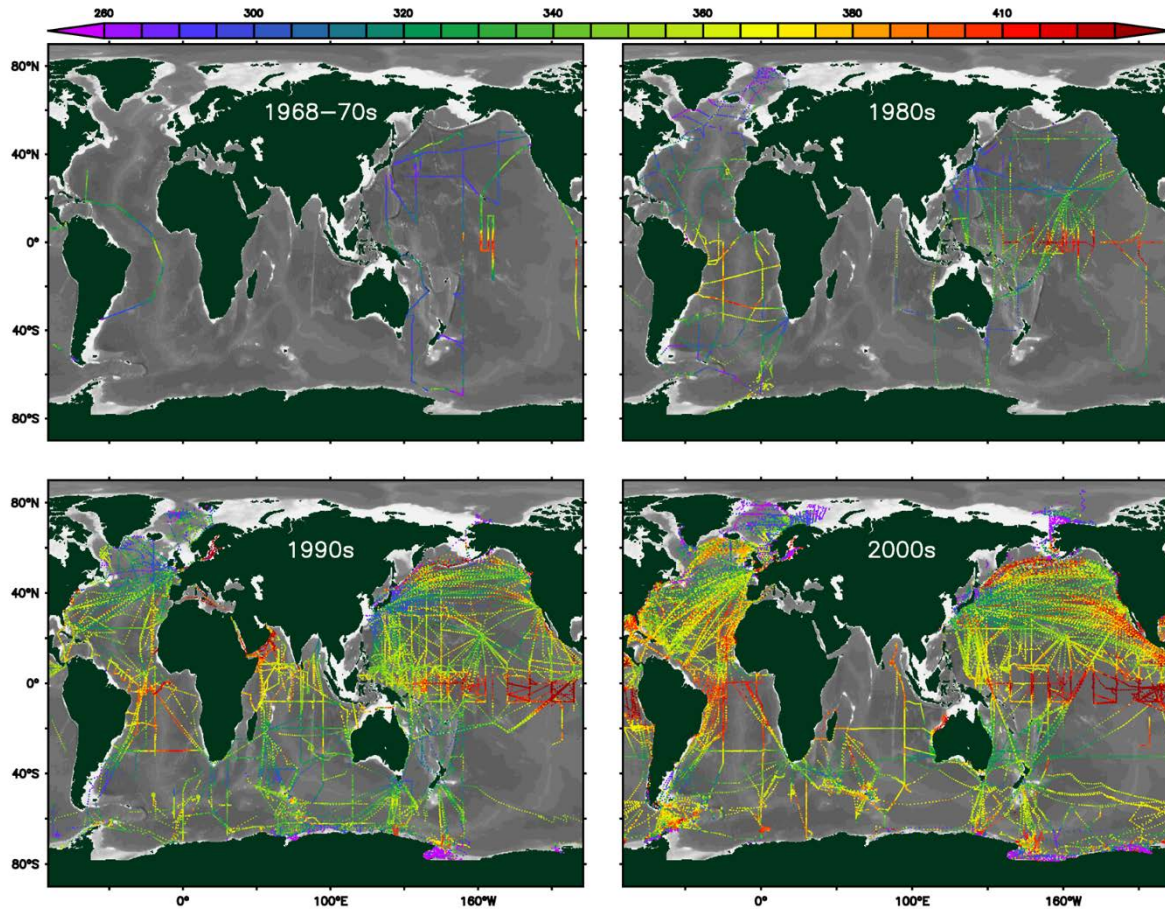
V1: Sabine et al. (2013) ESSD 5: 145-153;

V2: Bakker et al. (2014) ESSD 6: 69-90.

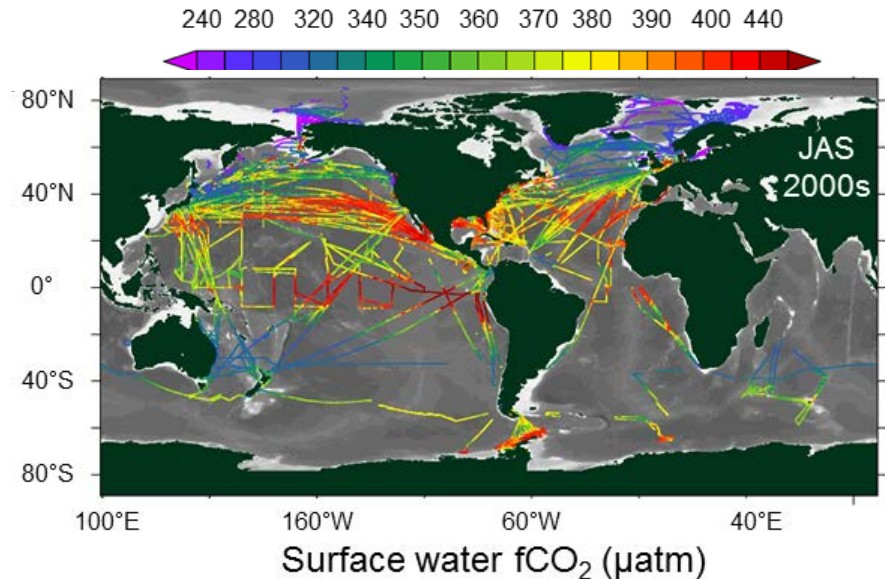
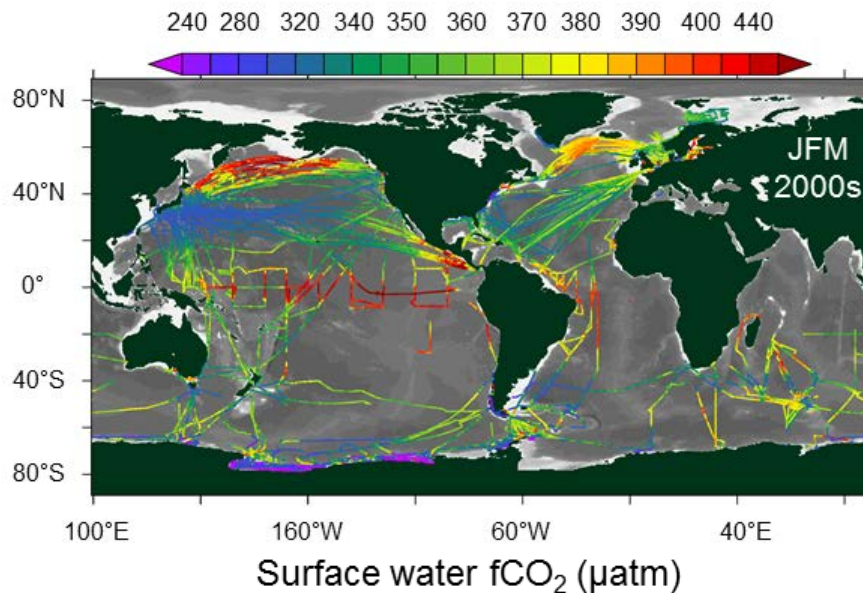


Surface water fCO₂ per decade

fCO₂ recomputed (μatm)



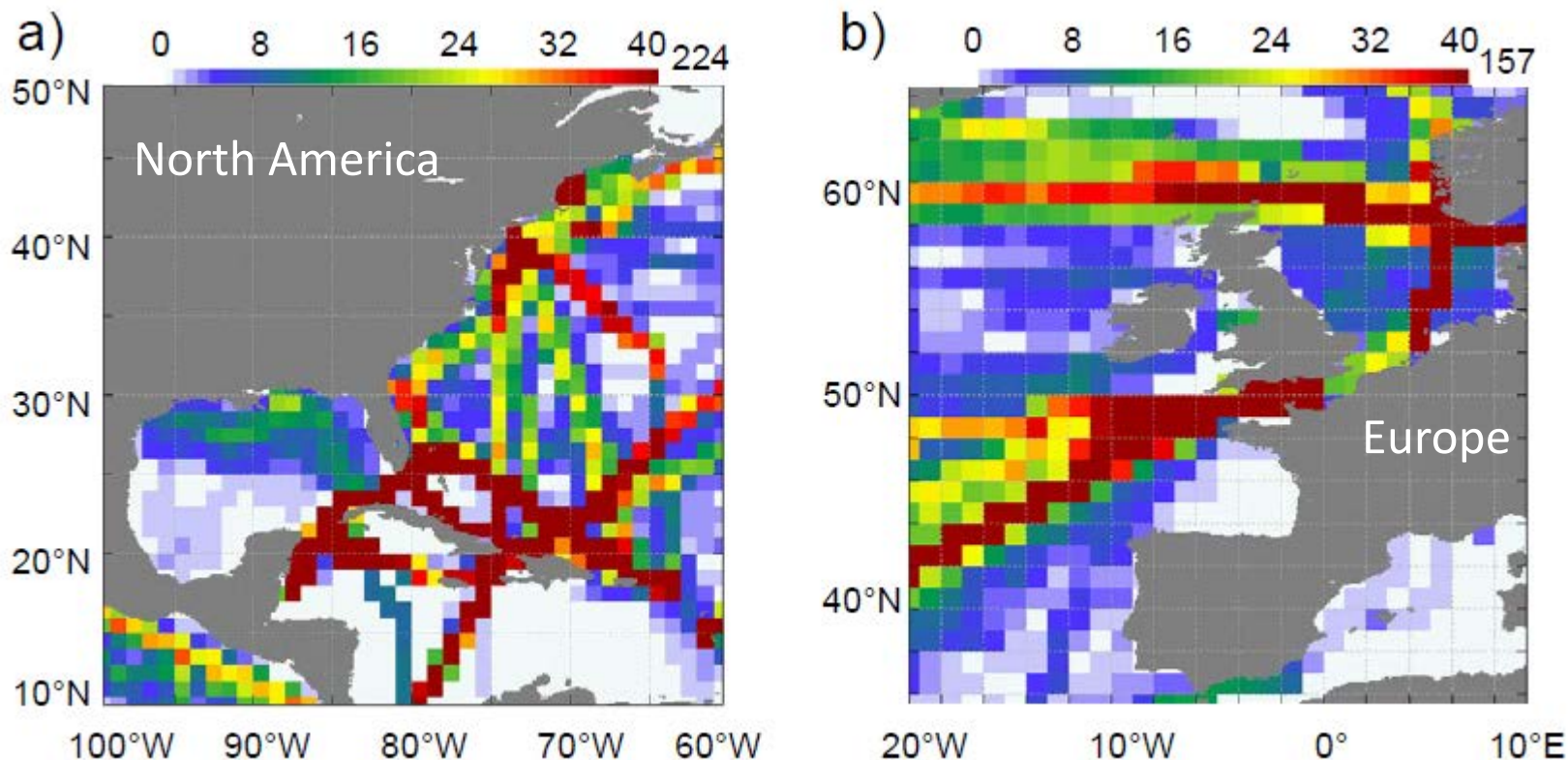
Seasonal data coverage in SOCAT



Repeat observations on Ships of Opportunity stand out.
Poor data coverage in much of the southern hemisphere oceans.
Lack of winter data in high-latitude oceans;
Increasing coverage of Arctic summer data.

SOCAT near the continents (2000-2009)

Number of data sets with fCO₂ values per 1° x 1° grid cell (2000-2009)



Additional parameters

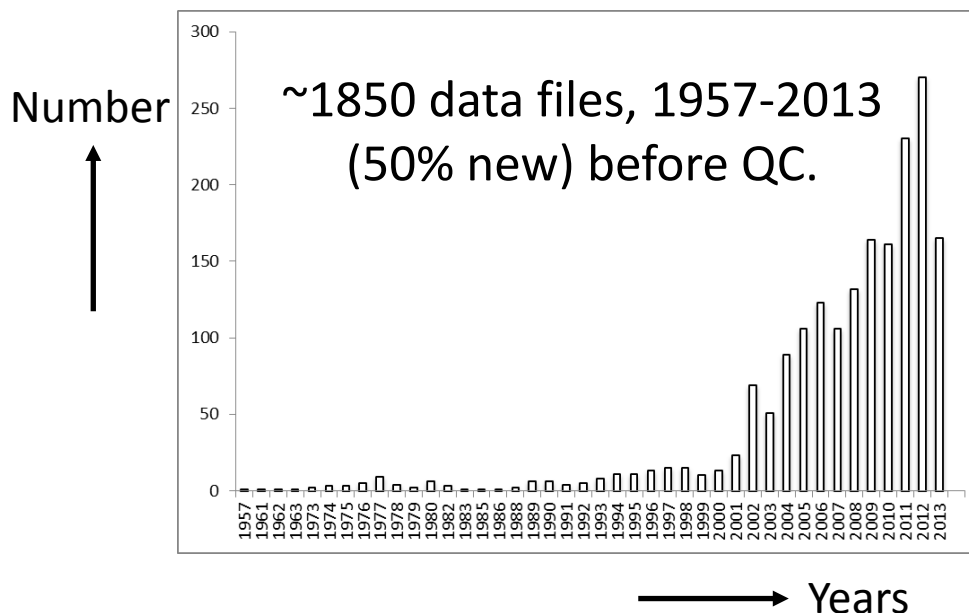
Salinity and sea surface temperature (SST) in SOCAT are **not quality controlled**. SOCAT encourages data providers to submit high-quality salinity and SST.

SOCAT will accept **additional surface water parameters**, accompanying fCO₂ data (e.g. CH₄, N₂O, DIC, TA, pH, nutrients) from version 4 onwards. These additional parameters will **not be quality controlled** and will be reported in separate files.

The SOCAT data policy will be revised to state that data providers should be invited for **co-authorship** in regional studies.



Version 3, QC starting soon



- ~1850 data files from 1957-2013 (50% new) for QC.
- Revision of QC flags for sensor data;
- Update of quality control system;
- **Quality control by regional groups (asap, 3 months);**
- **QC webinars / meetings (20-23 Oct 2014, Seattle, others?);**
- Early release (spring/summer 2015);
- Public release (September 2015, SOLAS OSC, Kiel)

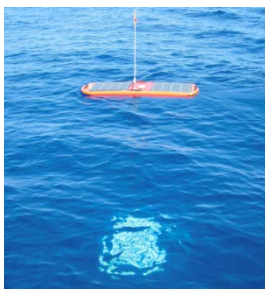
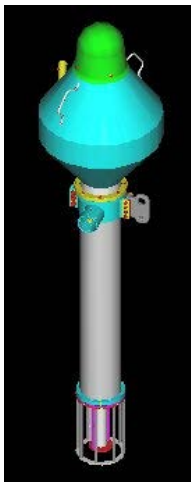
Inclusion of sensor data in SOCAT v3

- Encourage calibration of sensors;
- Revision of data set quality control flags, based on accuracy;
- Update metadata forms for sensors (calibration!);
- Identification of platform type;

Table 3. Proposed criteria for dataset quality control flags of the SOCAT database version 3.0

Flag	Criteria ^a
A (11)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than $2 \mu atm$ (2) A high-quality cross-over with another dataset is available (3) Followed approved methods/SOP ^a criteria (4) Metadata documentation complete (5) Dataset QC was deemed acceptable
B (12)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than $2 \mu atm$ (2) Followed approved methods/SOP criteria (3) Metadata documentation complete (4) Dataset QC was deemed acceptable
C (13)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than $5 \mu atm$ (2) Followed approved methods/SOP criteria (3) Metadata documentation complete (4) Dataset QC was deemed acceptable
D (14)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than $5 \mu atm$ (2) Did or did not follow approved methods/SOP criteria (3) Metadata documentation incomplete (4) Dataset QC was deemed acceptable
E (17)	(Primarily for alternative sensors) (1) Accuracy of calculated fCO_{2w} (at SST) is better than $10 \mu atm$ (2) Did not follow approved methods/SOP criteria (3) Metadata documentation complete (4) Dataset QC was deemed acceptable
NA...NF (version 4)	Submitted data to SOCAT that has not undergone independent dataset quality control as indicated by the "N". The NA though NF are the flags provided by the submitting group

NEW



Update of QC system

File Edit View History Bookmarks Tools Help

Background photo ... Surface Ocean CO2...

xtra.pmel.noaa.gov:8580/SOCAT/

Google

Communications NOAA TMAP UW Reference Programming



A Collection of Underway Ocean CO₂ Observations

Welcome to the SOCAT Data Access System

SOCAT Data Products:

Cruise Data Viewer (v3)

Gridded Data Viewer (v2)

Data Download (v2)

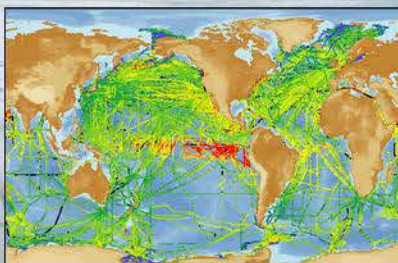


Cruise QC Editor (v3)

Publications*

SOCAT Credits*

Previous SOCAT versions*



SOCAT Documentation:

About*

News*

Meetings*

Data Use Policy*

SOCAT Help:

Videos*

Frequently Asked Questions*

SOCAT v3 QC cookbook



SOCAT v3 Video Tutorials:

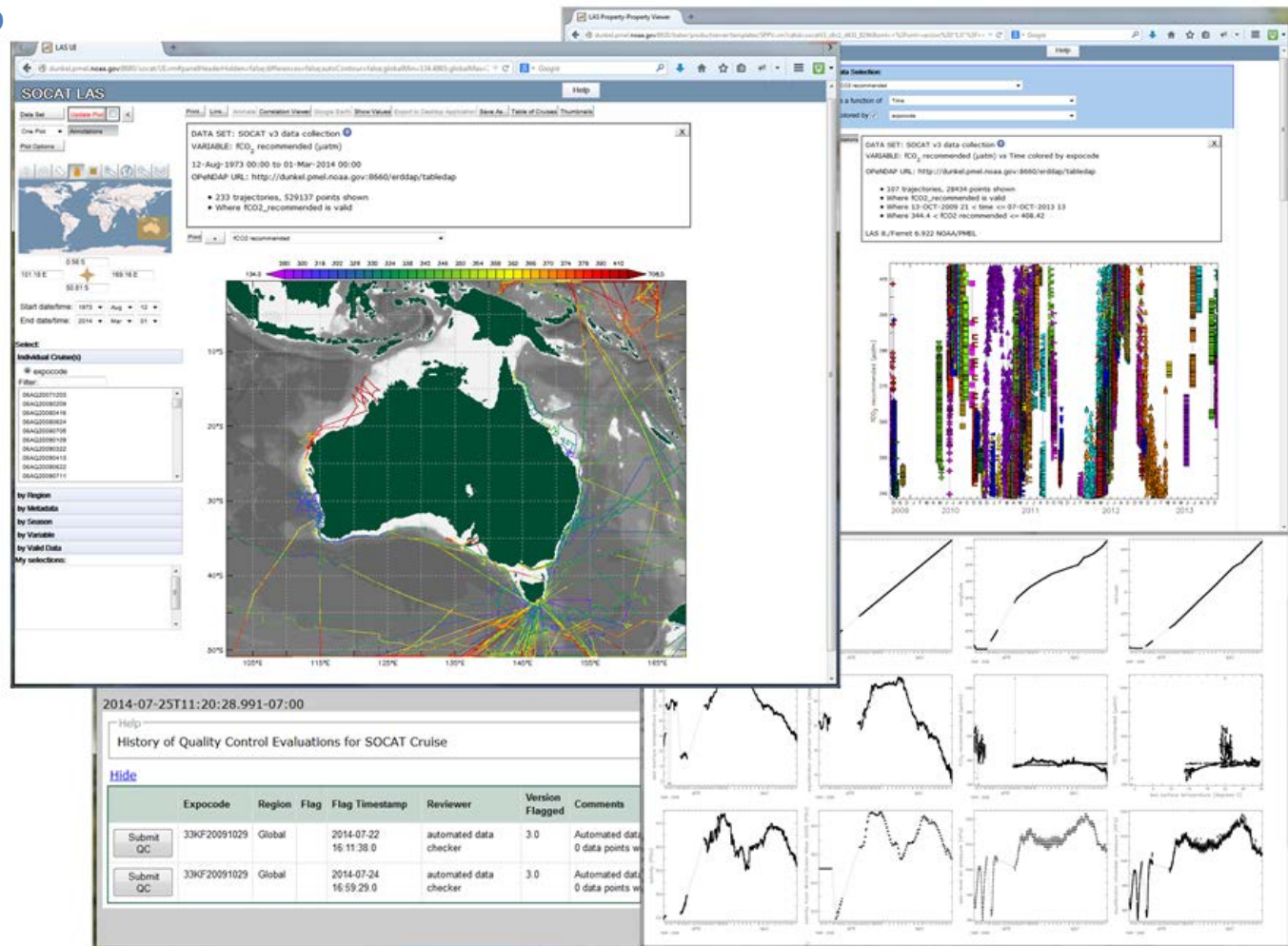


LAS QC System tutorial

How to set QC flags

How to set WOCE flags

Update of SOCAT QC system



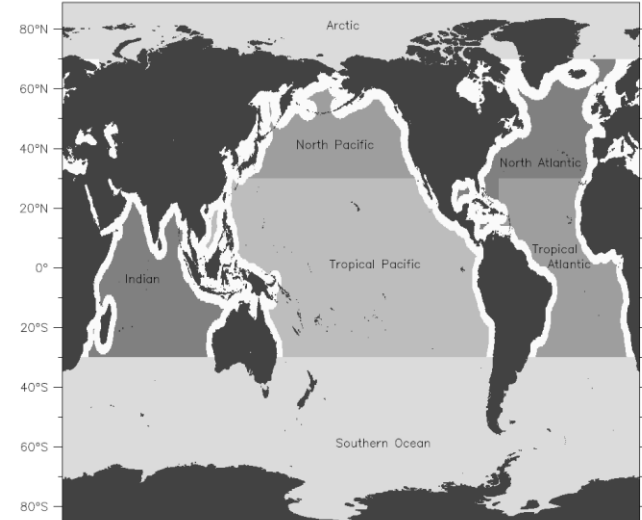
Update of SOCAT QC system for version 3 (part of SOCAT automation);
 Quality control: As soon as tests complete, 3 months.

(Figure by Kevin O'Brien)

Quality control by regional groups

Coastal Seas: 30°S to 66/70°N,
Arctic: north of 66-70°N
North Atlantic: north of 30°N
Tropical Atlantic: 30°N to 30°S
Indian Ocean: north of 30°S
North Pacific: north of 30°N
Tropical Pacific: 30°N to 30°S
Southern Ocean: south of 30°S,
Global

*Hales, Alin, Cai
Mathis
Schuster
Lefèvre
VVSS Sarma
Nojiri
Cosca
Tilbrook, Metzl
Bakker, Currie, Kozyr, Metzl, O'Brien,
Olsen, Pfeil, Pierrot, Telszewski*

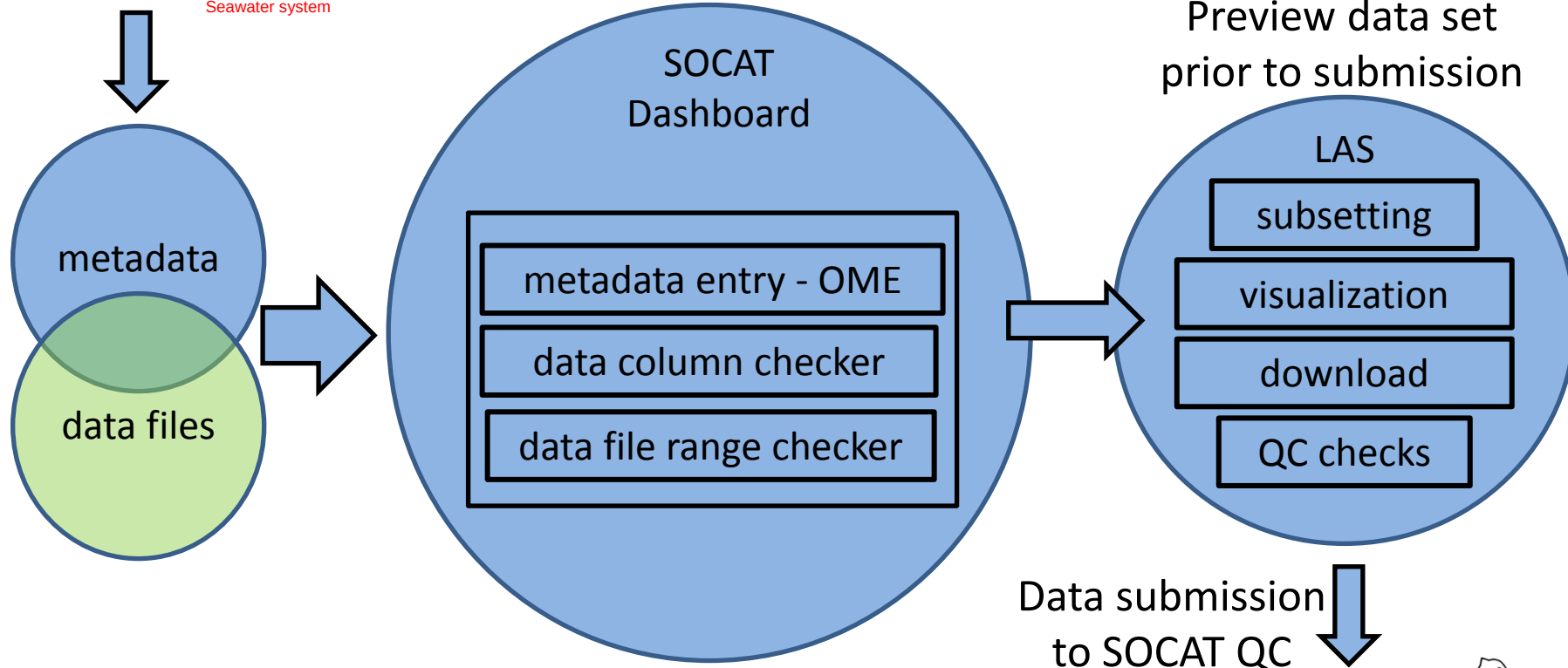
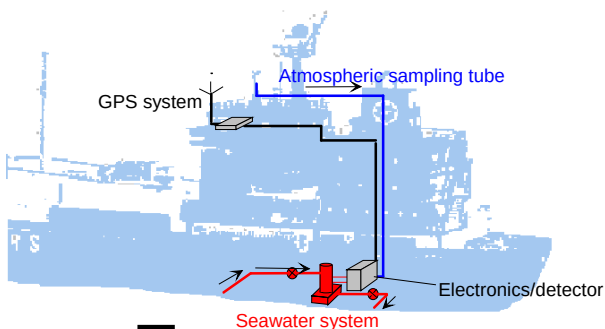


Interested to join the QC effort? d.bakker@uea.ac.uk

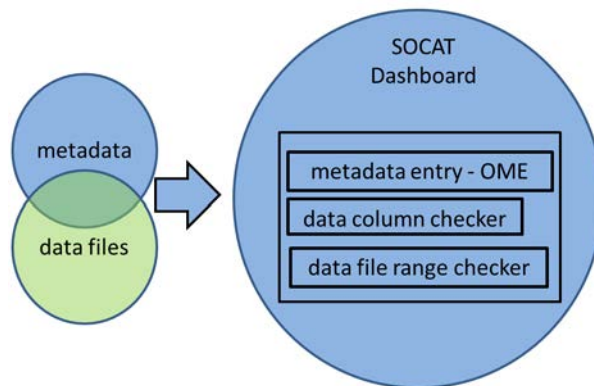


Automated data upload, version 4

Kevin O'Brien, Karl Smith, Steve Jones, Alex Kozyr, Biva Shrestha, Ranjeet Devarakonda, Benjamin Pfeil, Are Olsen, Steve Hankin, Denis Pierrot et al.



Automated data and metadata upload



SOCAT Upload Dashboard x

dunkel.pmel.noaa.gov:8580/SocatUploadDashboard/#SHOW_DATASETS

My SOCAT Version: Datasets

Logged in as a.manke Logout

	Date	Data Status	Metadata	QC Status	Archival	Filename	Supplemental Documents	Owner
	08:44	No warnings	(no metadata)	Private	Not specified	00XX00111210.tsv	(no documents)	a.manke

Upload Dataset

Identify Columns

Edit Metadata

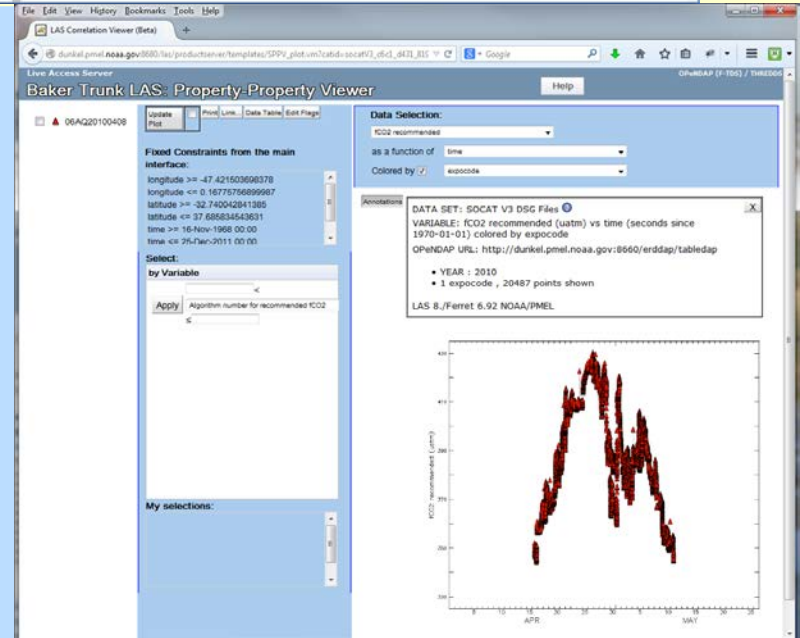
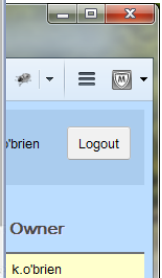
Supplemental Documents

Submit QC

Preview Dataset

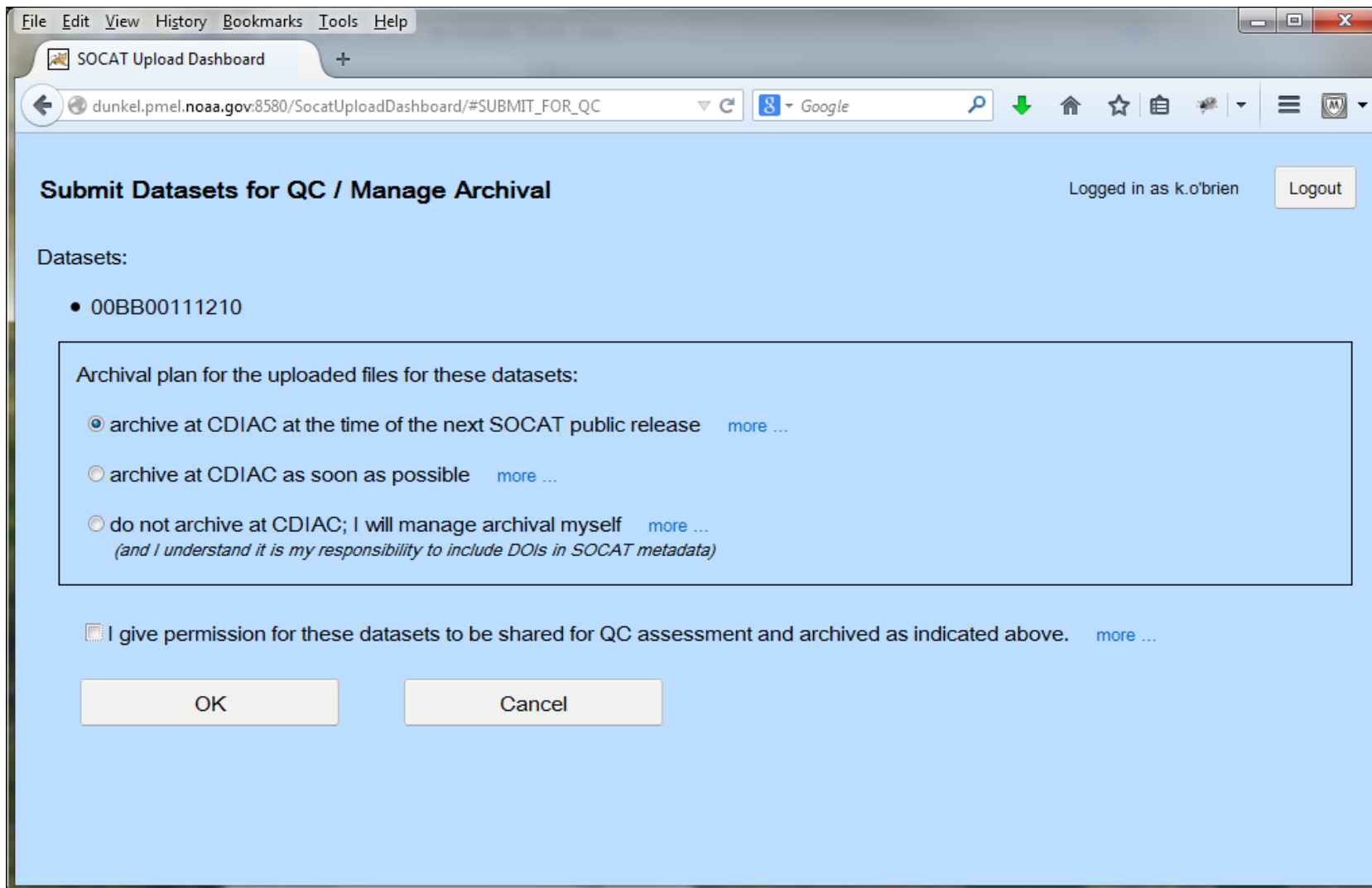
Delete Datasets

After a slide by Kevin O'Brien and Karl Smith, NOAA-PMEL



After Kevin O'Brien, Karl Smith

Submission to SOCAT QC and make original data public



File Edit View History Bookmarks Tools Help

SOCAT Upload Dashboard

dunkel.pmel.noaa.gov:8580/SocatUploadDashboard/#SUBMIT_FOR_QC

Submit Datasets for QC / Manage Archival

Logged in as k.o'brien Logout

Datasets:

- 00BB00111210

Archival plan for the uploaded files for these datasets:

☒ archive at CDIAC at the time of the next SOCAT public release [more ...](#)

☐ archive at CDIAC as soon as possible [more ...](#)

☒ do not archive at CDIAC; I will manage archival myself [more ...](#)
(and I understand it is my responsibility to include DOIs in SOCAT metadata)

☐ I give permission for these datasets to be shared for QC assessment and archived as indicated above. [more ...](#)

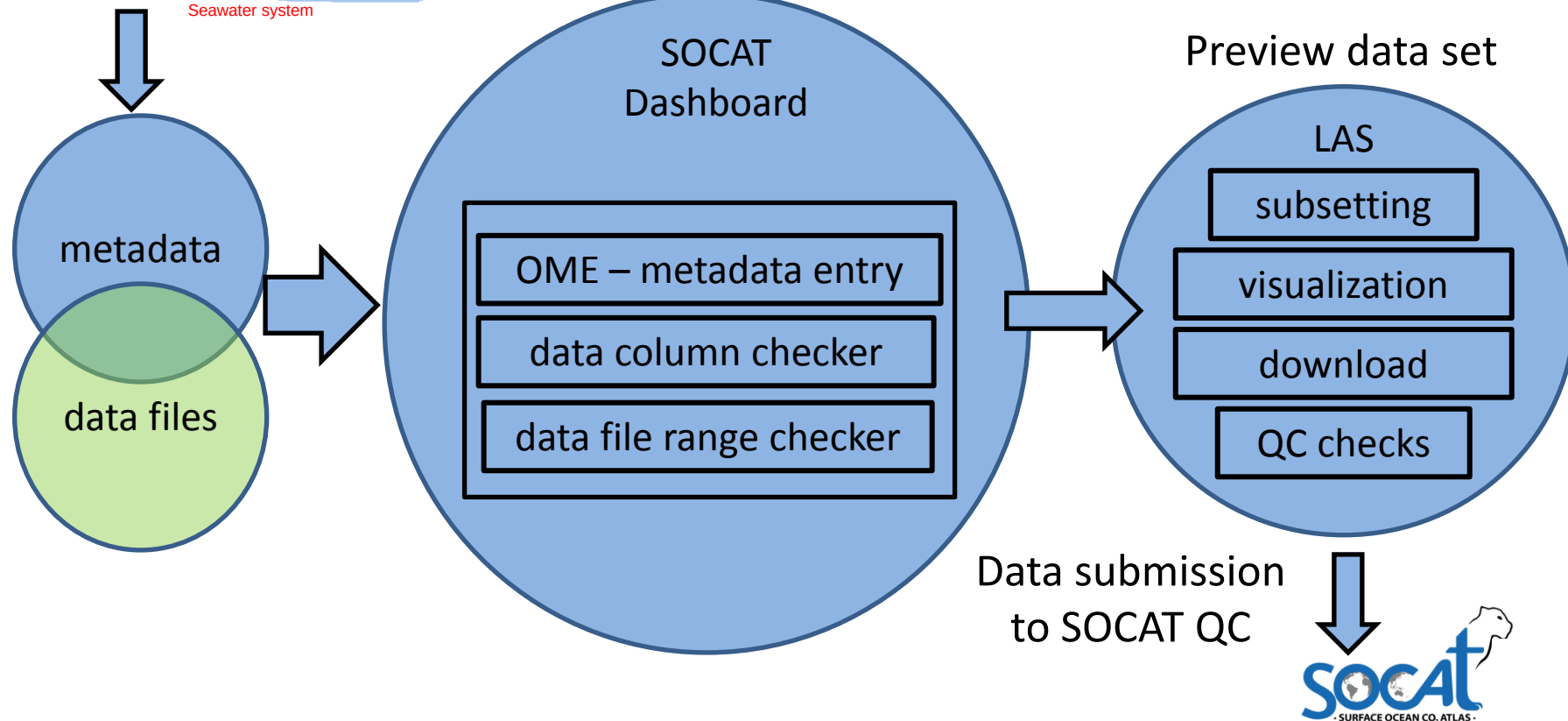
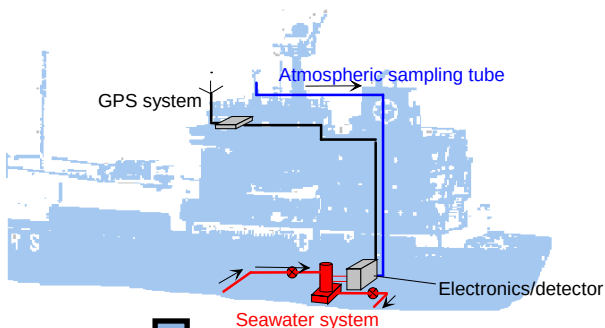
OK Cancel

Automated data upload, version 4

Automation meeting (Seattle, 21-23 Oct' 14)

Tests automated data upload (autumn'14)

Data submission system live (early '15)

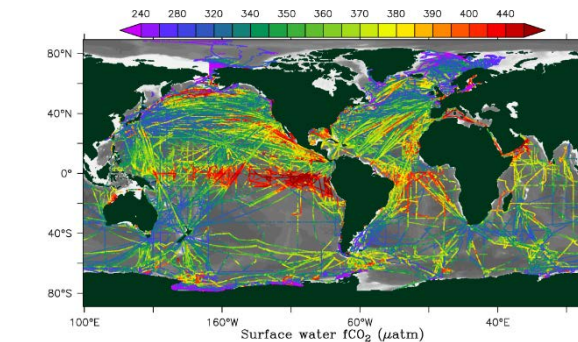


Scientific applications of SOCAT

≥ 56 peer-reviewed scientific articles (2014-24; 2013-20; 2012-3; 2011-2; 2010-6; 2009–1) and 3 book chapters (2014-3) cite or mention SOCAT.

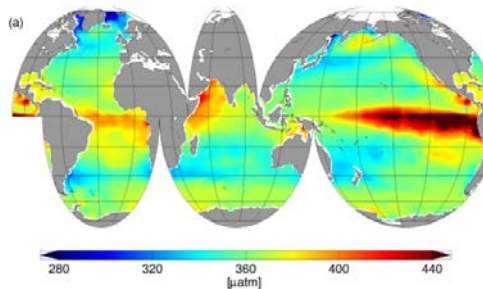
Application	Number of publications
Reference to SOCAT data set or $f\text{CO}_2$ measurements	30
Use of SOCAT tools	1
Figure of $f\text{CO}_2$ data distribution	5
Regional $f\text{CO}_2$ in process studies, incl. of ocean acidification and genomics	4
Coastal CO_2 sink estimates	4
Data-based $f\text{CO}_2$ maps and ocean CO_2 sink estimates	8
Model validation	6
Regional pH trends	1

Mapping of surface ocean $f\text{CO}_2$ for air-sea CO_2 flux estimates



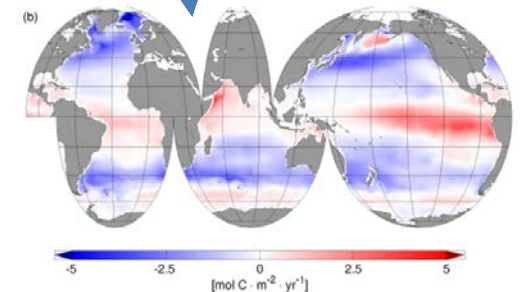
A SOCAT data product
(synthesis or gridded)

A mapping method



Surface water $f\text{CO}_2$
(here 1998-2011)

Gas transfer parameterisation,
wind speed

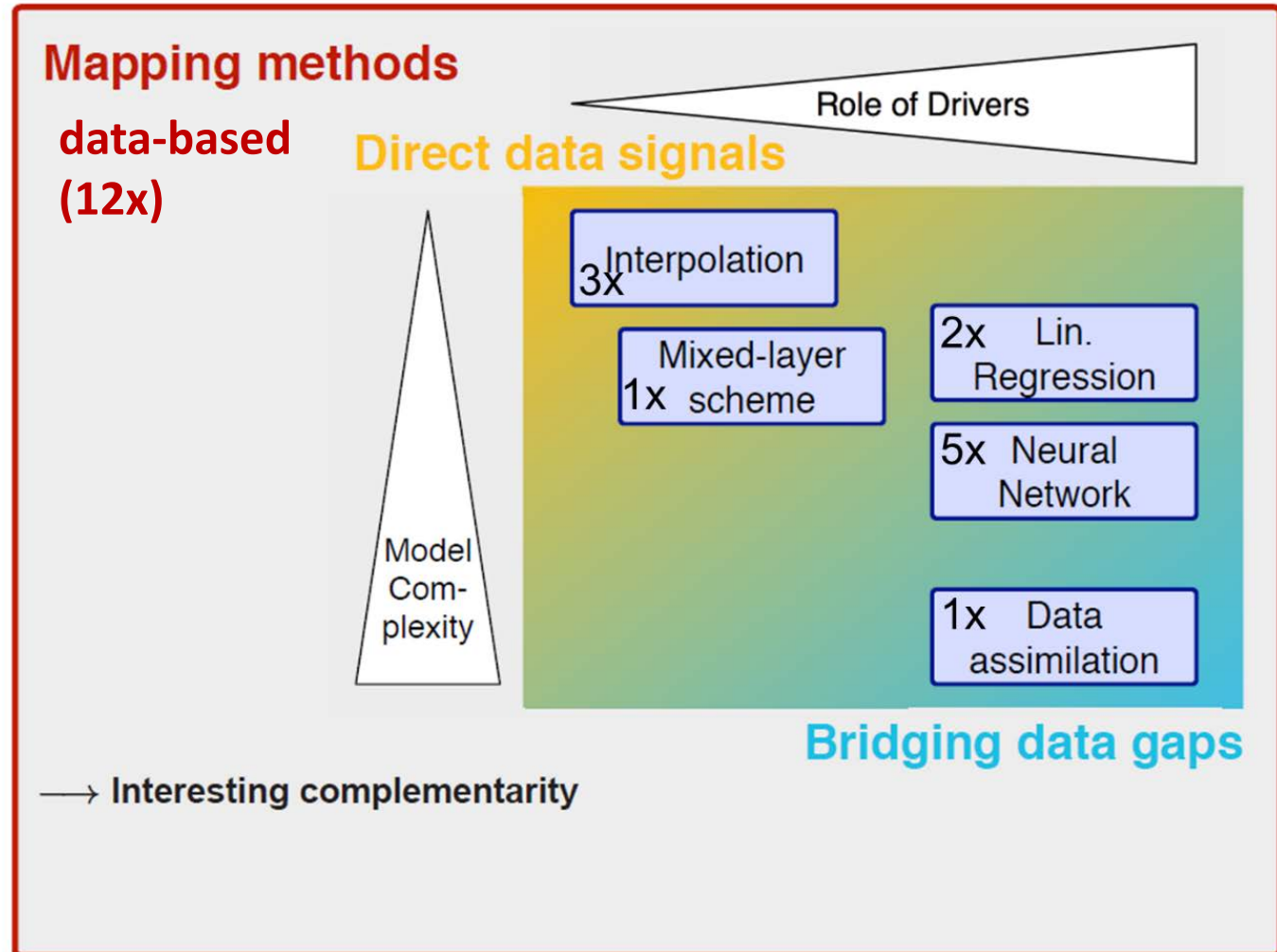


Air-sea CO_2 flux
(here 1998-2011)

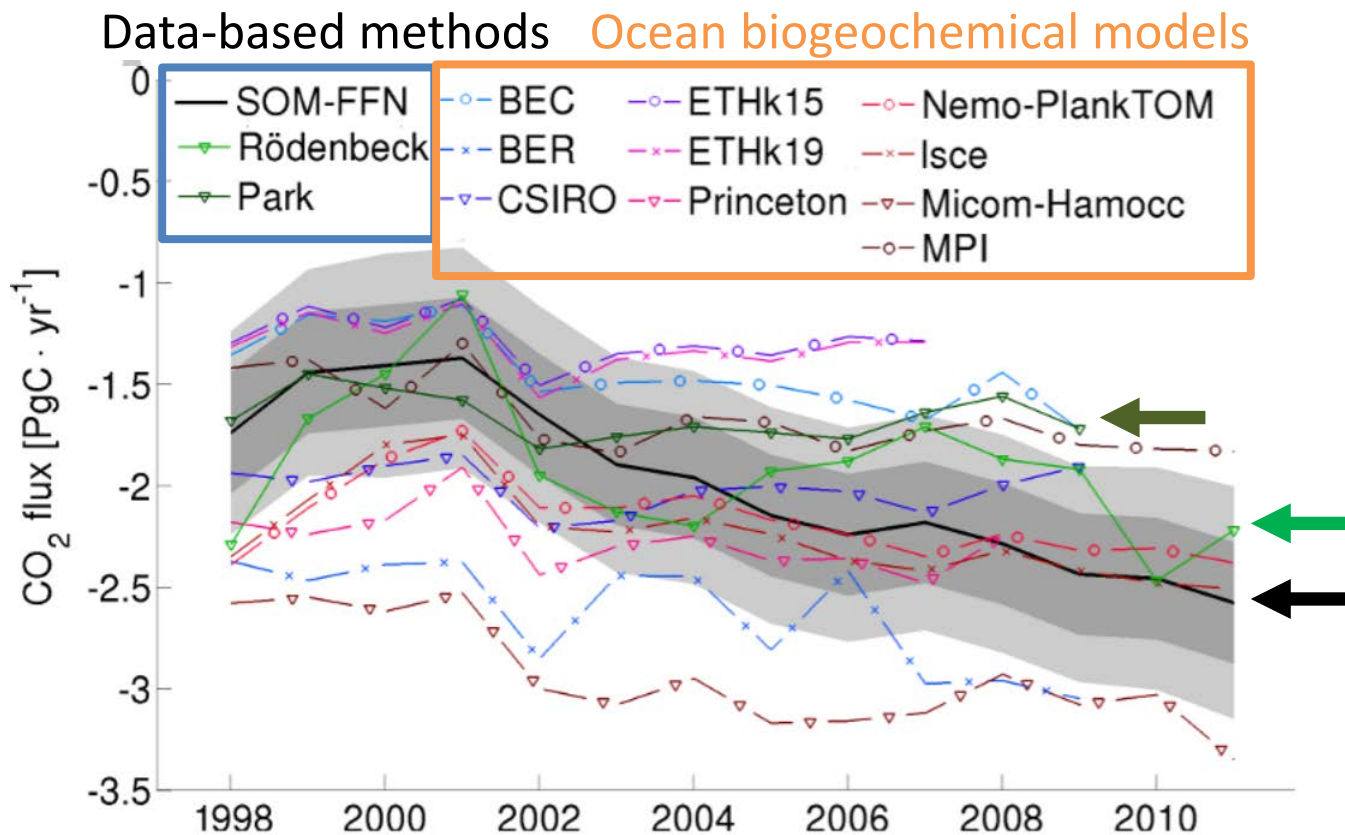
The (spatial/temporal) variability in data-based air-sea CO_2 flux estimates can improve land CO_2 flux estimates by atmospheric inversion (Rödenbeck et al., 2014). (Figures Bakker et al., 2014; Landschützer et al., 2014).

Surface Ocean pCO₂ Mapping Intercomparison (SOCOM)

(lead Christian Rödenbeck)

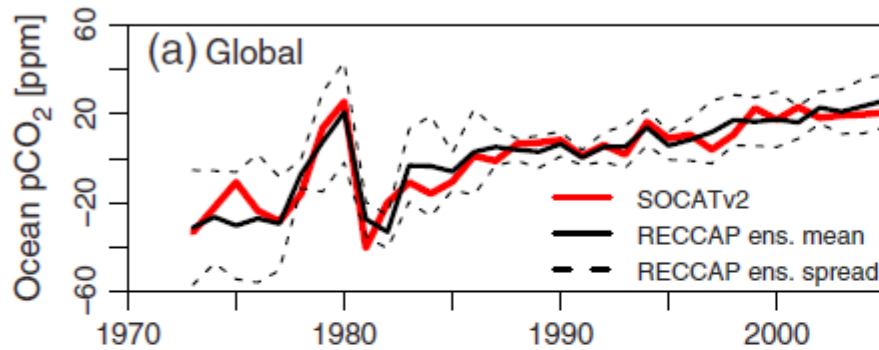


Ocean CO₂ sink from data-based methods

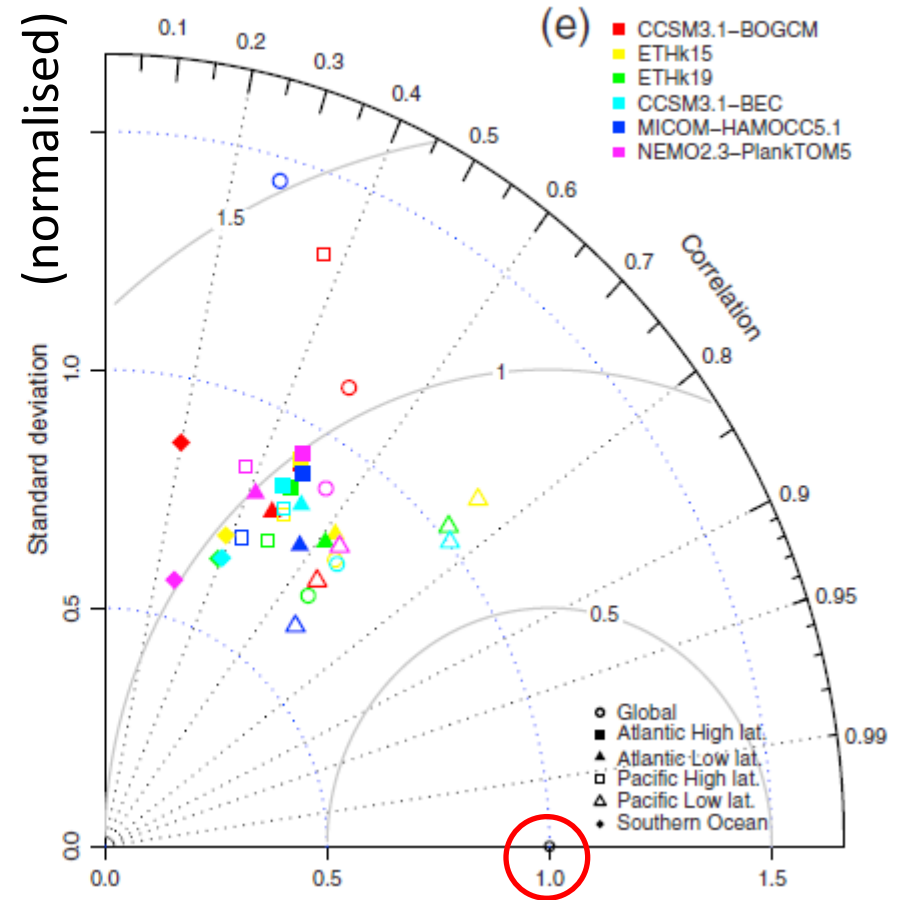


Data-based methods	Interannual variation	Long-term change
— SOM-FFN L et al. (2014)	Low IAV	Large change
— Rödenbeck R et al. (2014)	High IAV	Small change
— Park P et al. (2010)	Low IAV	No change

Model-data comparison

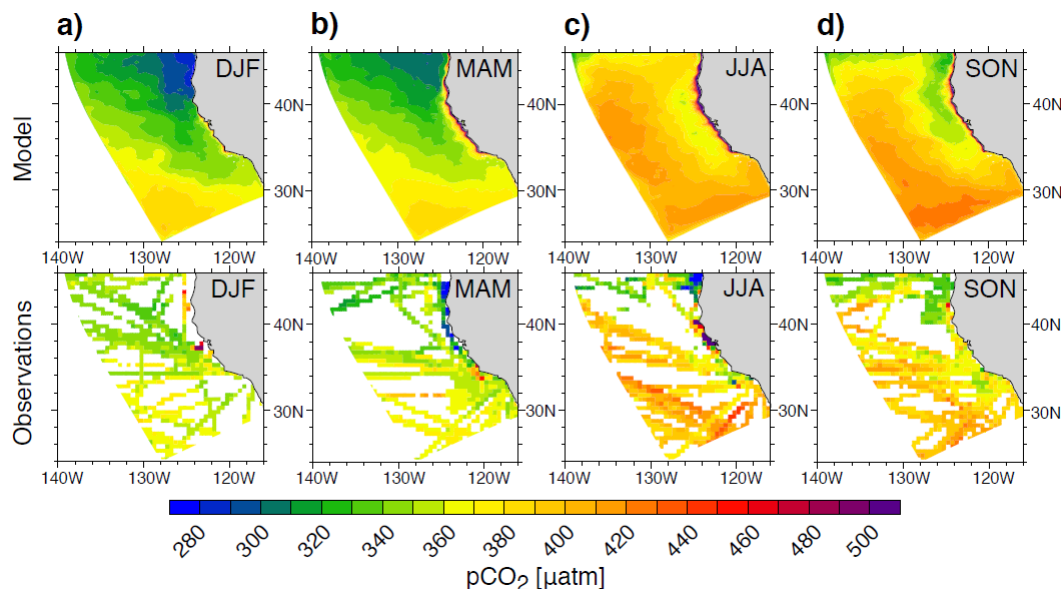


- Comparison of annual mean anomalies;
- Subsampling of 6 RECCAP models to SOCAT v2 data;
- Global ocean biogeochemical models underestimate spatial and temporal variation in $f\text{CO}_2$.



○ Perfect comparison

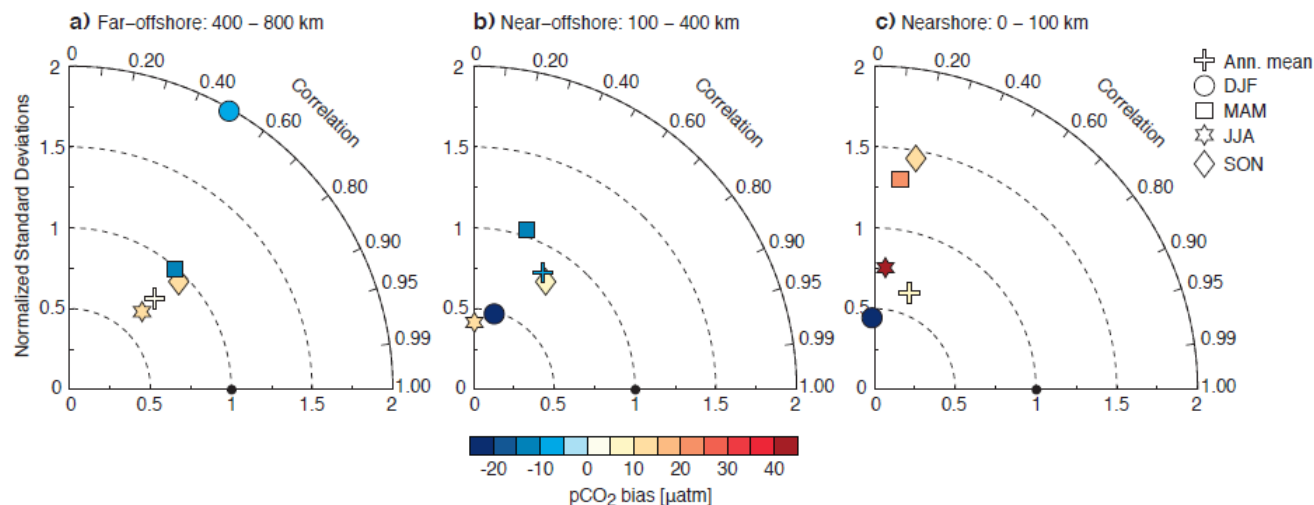
Model validation, US West Coast



$p\text{CO}_2$ data from SOCAT v2, LDEO (v2012) and CalCOFI

Model does better for far-offshore than for nearshore.

G. Turi et al.: Spatiotemporal variability and drivers of $p\text{CO}_2$ and air-sea CO_2 fluxes in the CalCS (2014)



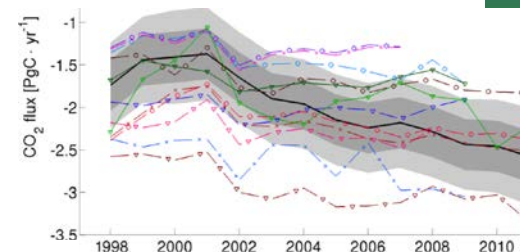
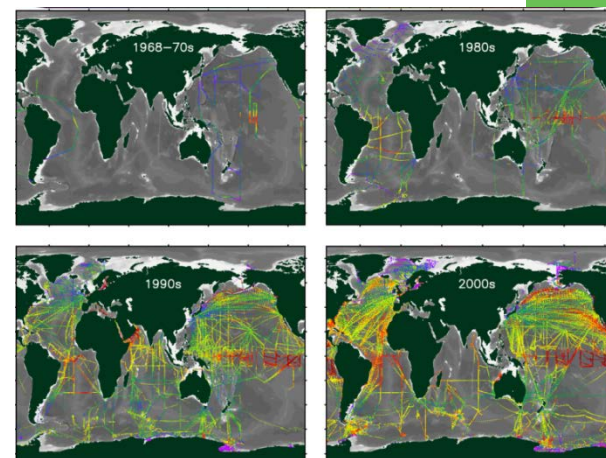
Long-term observations

‘No substitute exists for **adequate observations**.’



‘Models will evolve and improve, but, without data, will be untestable, and observations not taken today will be lost forever.’

‘Today’s climate models will likely prove of little interest in 100 years. **But adequately sampled, carefully quality controlled and archived data** for key elements of the climate system will be useful indefinitely.’



Wunsch et al. (2013) PNAS 110 (12) 4435-4436;
Bryden, H., 2014 Challenger Medal Lecture;
Bakker et al., 2014; Landschützer et al., 2014.



Conclusions

SOCAT is a powerful data synthesis product documenting the ocean carbon cycle.

Applications include:

- Quantification of the ocean CO₂ sink (e.g. Global Carbon Budget, SOCOM);
- Assessments of ocean acidification;
- Validation of ocean biogeochemical models.

SOCAT has >> 100 contributors. Contribute to and/or use SOCAT. Acknowledge the contribution of the data providers, e.g. by invitation to co-authorship, notably in regional studies. **d.bakker@uea.ac.uk**.

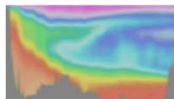
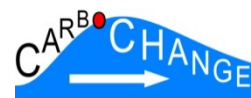
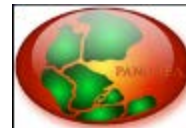


Integrated Marine Biogeochemistry and
Ecosystem Research



UK Ocean Acidification
Research Programme





SOCAT is a community activity!

*>100 data contributors, group leads,
quality controllers and data
managers!*

