SOCAT sensors, automation and vision

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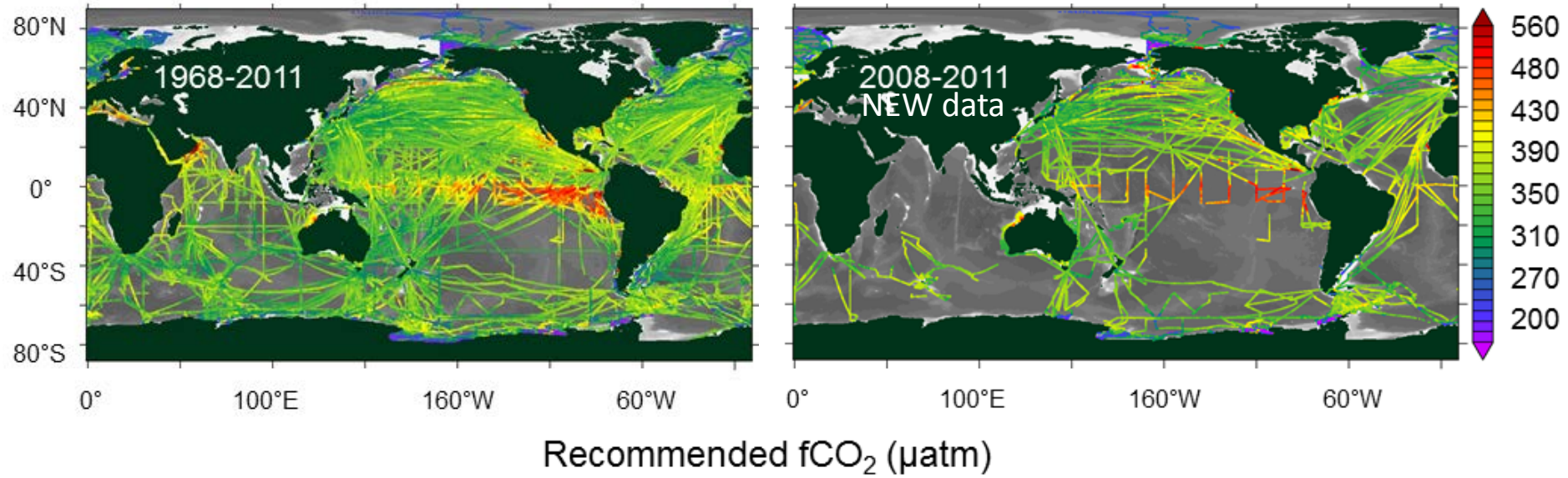
Dorothee Bakker,

***Sensor team*: Rik Wanninkhof**, *Nick Bates, Are Olsen, Tobias Steinhoff, Adrienne Sutton (also DB)*

***Automation team*: Steve Hankin**, *Steve Jones, Karl Smith, Alex Kozyr, Ansley Manke, Kevin O'Brien, Benjamin Pfeil, Roland Schweitzer (also DB, AO)*



surface ocean solas lower atmosphere study

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT IOCCP

IMBER Integrated Marine Biogeochemistry and Ecosystem Research

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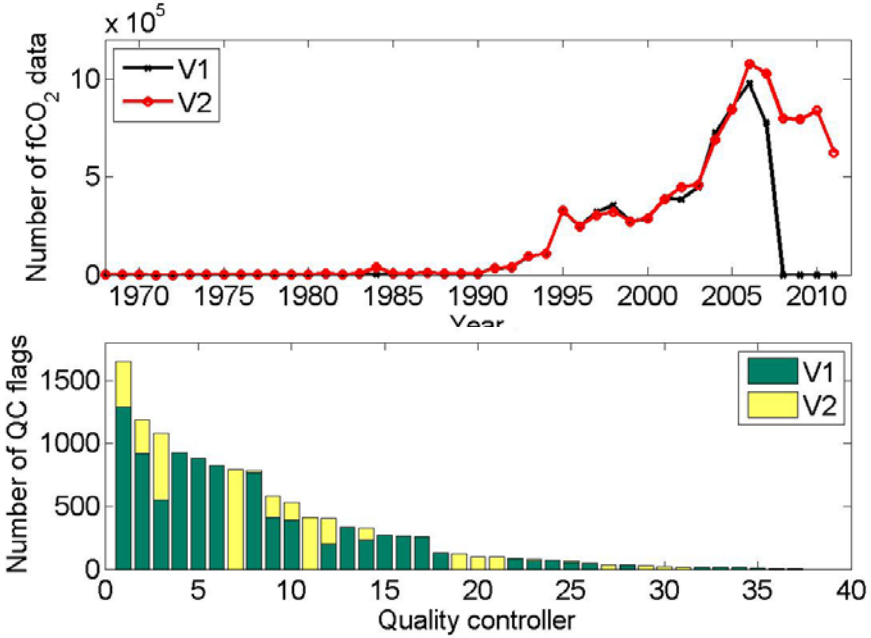
Releases in 2011, 2013, …



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

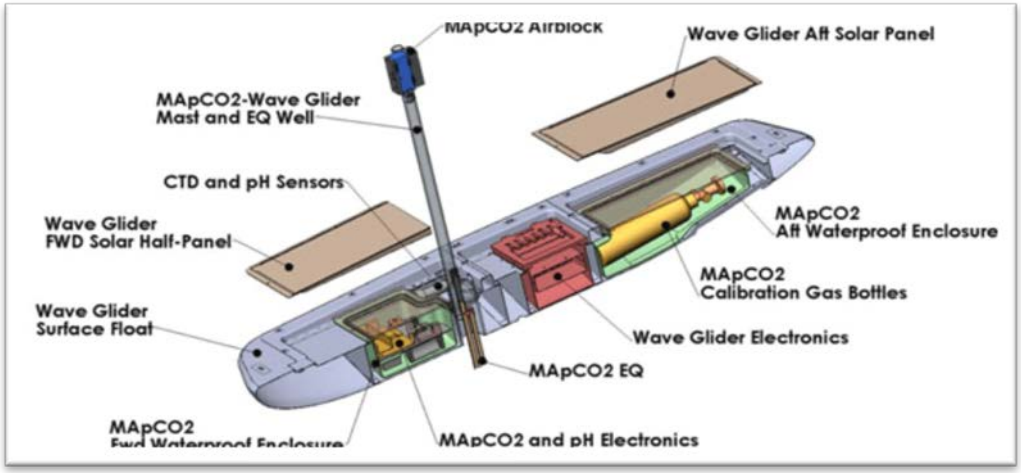
>100 contributors and data providers;
Multiple funding sources, but no long-term funding;
Please, acknowledge SOCAT, data providers and contributors;

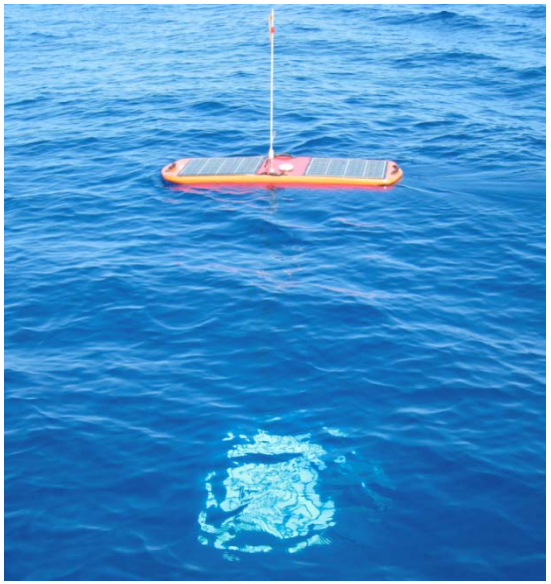
Bakker et al. (2012) Eos 93(12); Pfeil et al. (2013) ESSD 5: 125-143;
Sabine et al. (2013) ESSD 5: 145-153; V2: Bakker et al. ESSD in preparation.

Alternative sensor data in SOCAT

Observations from alternative platforms and alternative sensors do not fit well in the current quality assessment scheme. In the future there will be more data from alternative approaches.

How can we incorporate alternative sensor data in SOCAT, while maintaining adequate quality control and documentation?

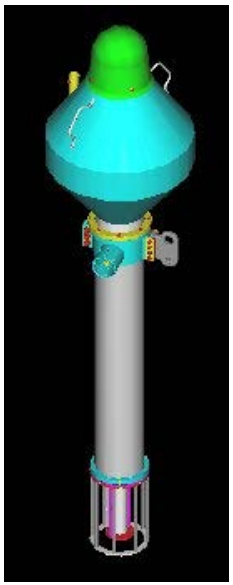




Example of new platform and alternative sensors: Wave Glider with MApCO2

Examples of alternative sensors

Sensor	Principle	Platform	Website
CARIOCA	Spec/dye	Mooring/Drifter	www.dt.insu.cnrs.fr/carioca/carioca.php
SAMI CO2	Spec/dye	Ship/buoy	www.sunburstsensors.com
PSI CO2-pro	Sealed IR	Ship	www.pro-oceanus.com
Contros HydroC	Sealed IR	Buoy/ Wave Glider	www.contros.eu
Seaology /MApCO_2	IR	Buoy	battelle.org/our-work/national-security/undersea-systems
SubCtech OceanPack	IR	Ship	subctech.eu



See http://www.ioccp.org/instruments-and-sensors

Recommendations sensors

(Wanninkhof et al., draft white paper)

Technology

- Encourage manufacturers to provide on board calibration/standardisation routines;
- Obtain more information on long term deployments over ranges of environmental conditions (through side-by-side studies);
- Improve understanding of membrane (bio-fouling);

SOCAT documentation

- Update metadata forms to reflect specific sensor criteria;
- Include platform type in the documentation;
- Revise dataset quality control flags based on accuracy of analyses at sea;
- Enable entry of provisional dataset flags during data submission (NA-NF).

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Recommendations sensors

(Wanninkhof et al., draft white paper)

Flag	Changes to dataset quality control flags
A	: Strict cross-over definition;
C & D	: (At sea) accuracy < 5 µatm;
E (NEW)	: Mainly for alternative sensors, (At sea) accuracy < 10 µatm;

NA-NF (NEW): Flags by the data contributor prior to independent quality control.

Platform type in SOCAT	
Ships of opportunity	Default
Moorings	Selectable
Drifters	Selectable
Autonomous propelled surface vehicles	Selectable
Autonomous underwater vehicles	Not in SOCAT data holdings
Data from below 15 m depth	Not in SOCAT data holding

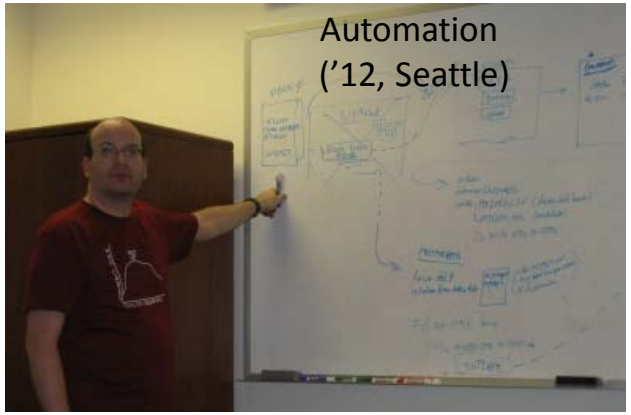
SOCAT automation

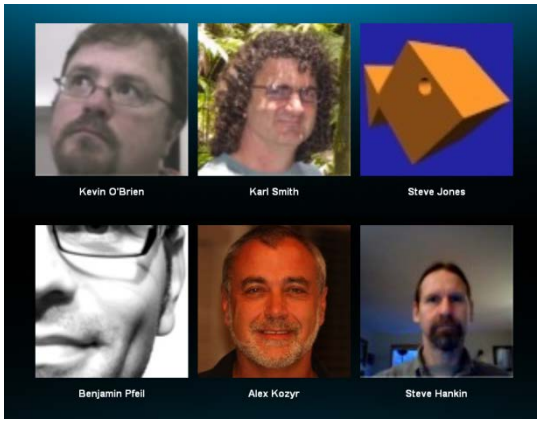
Reduce effort for SOCAT to be sustainable.

Much manual effort is needed to organise and reformat the data;
Commitments to data centers.

The automation system (Poster 140, Hankin et al.) will provide:

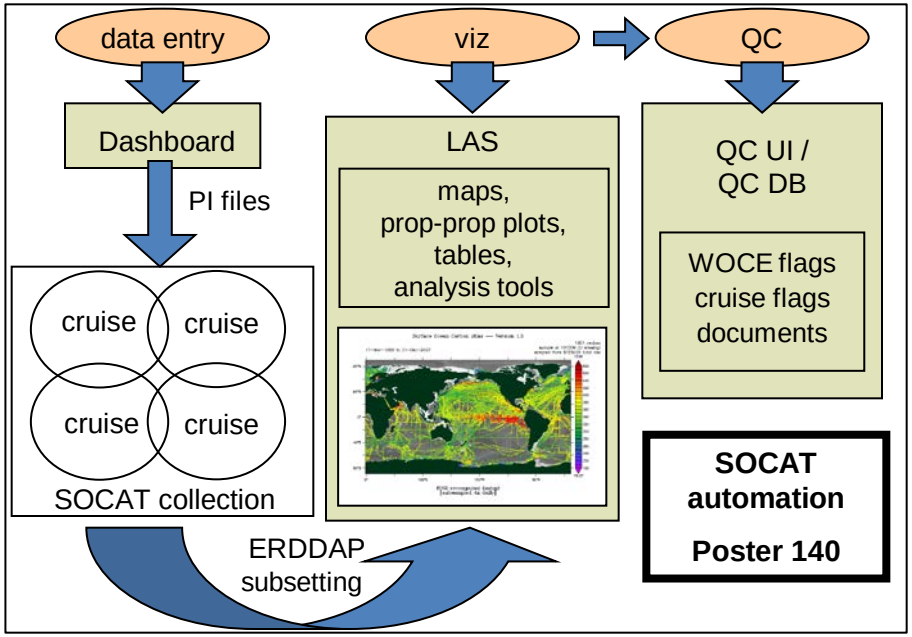
- Automated data submission;
- Tools for initial quality control by data provider;
- Option to make original data public via CDIAC prior to SOCAT release.





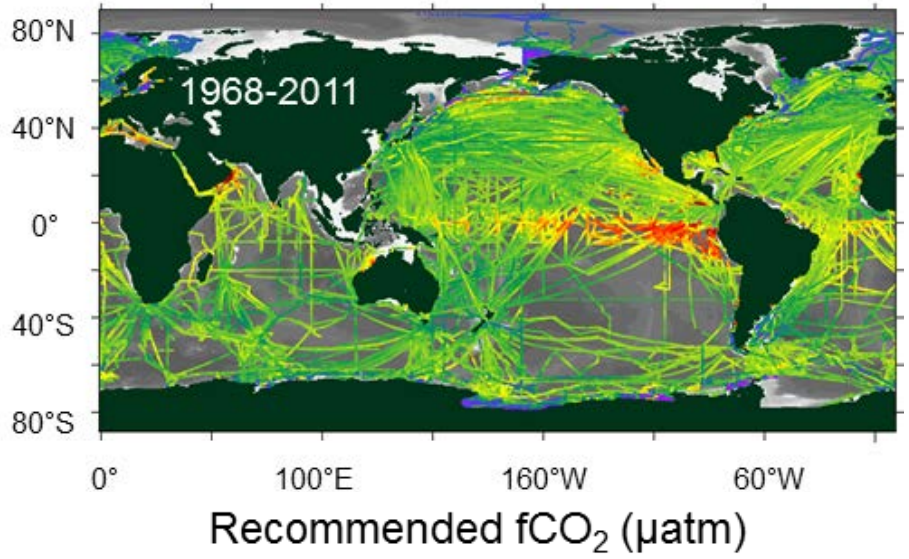
SOCAT automation system: tools & functions

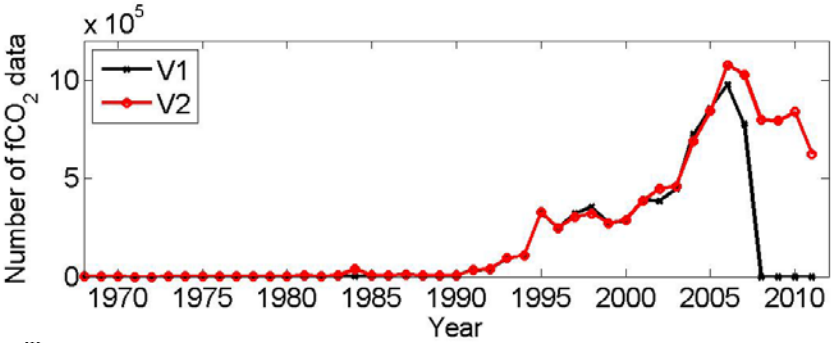
- Metadata entry and edit;
- Metadata checker (e.g. spelling);
- File upload with version tracking;
- Identification of columns;
- Ranger checker for data values;
- Computation recommended fCO_2;
- Preliminary WOCE flagging;
- Visualisation and analysis;
- Cross-over detection;



Ready by January 2014;
Invite large data providers to submit data via the automation system;
Automation system fully operational for version 4.

Towards future releases





Time table version 3

December 2013 : Close data submission to CDIAC;
Jan-March 2014 : Data submission via automation system (invitation only);
October 2014 : Quality control complete;
June 2015 : Release (provisional).

Additional parameters, e.g. nutrients, pH, DIC, TA (Japan, July 2012):

- 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 Ocean CO_2 Atlas, version 2

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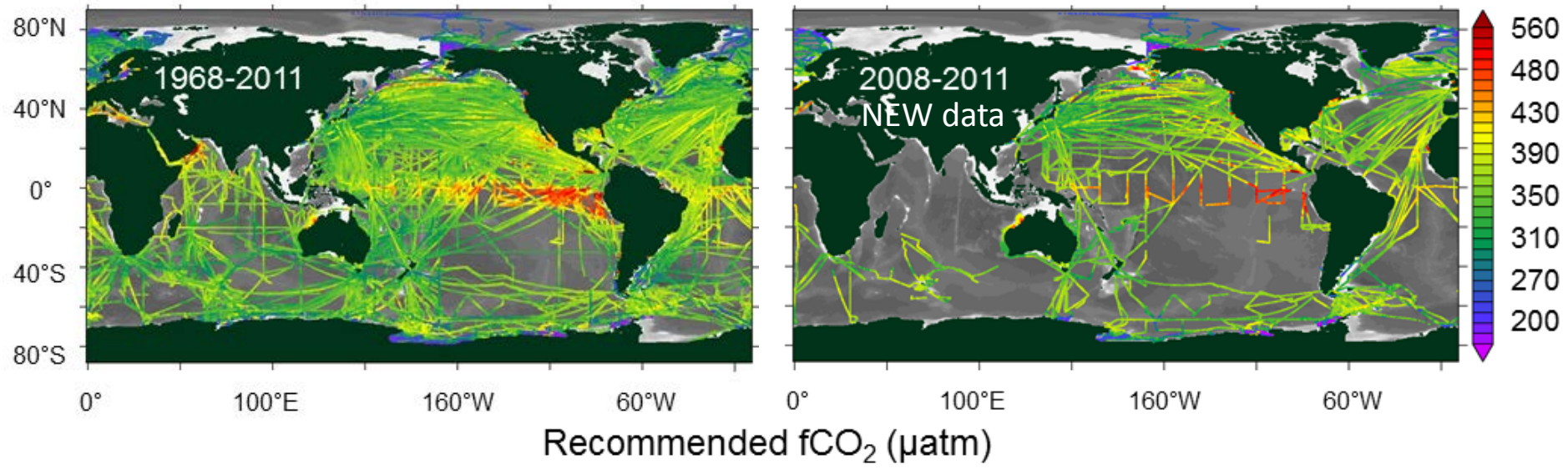

2007: Many formats, many data not public. No public global fCO_2 data set.

Surface ocean fCO_2 (fugacity of CO_2) in uniform format with quality control;
Version 2: 10.1 million fCO_2, 2660 cruises, 1968 to 2011 now public;
Version 1: 6.3 million fCO_2, 1851 cruises, 1968 to 2007 (09/2011);

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_2 Atlas (SOCAT): Release of Version 2 and Science Highlights

Chair: Dorothee Bakker, Maciej Telszewski

12:15 **IOCCP sponsor** (Maciej Telszewski)

12:20 **Release of SOCAT version 2** (Benjamin Pfeil)

12:30 **SOCAT automation and vision** (Dorothee Bakker)

12:40 **A Neural Network Approach to Estimate the Global Carbon Sink based on SOCATv1.5 from 1998-2007** (Peter Landschützer, et al.)

12:50 **Global sea-air CO_2 flux variability from an ocean mixed-layer scheme driven by SOCAT pCO_2 observations** (Christian Rödenbeck, et al.)

13:00 **Discussion: How to move SOCAT forward?** (Dorothee Bakker)

13:15 End of session

Revision of dataset quality control flags for v3

(Blue highlights differences with current flags.)

Flag	Criteria
A (11)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than 2 µatm; (2) A high-quality cross-over with another data set is available.
B (12)	(1) Accuracy of calculated fCO_{2w} (at SST) is better than 2 µatm; (2) Followed approved methods/SOP criteria.
C (13)	**(1) Accuracy of calculated fCO_{2w} (at SST) is better than 5 µatm;** (2) Did or did not follow 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 µatm;** (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 µatm;** **(2) Did not follow approved methods/SOP criteria;** **(3) Metadata documentation complete;** **(4) Dataset QC was deemed acceptable.**
F (15)	(1) Does not meet A through E criteria listed above.
S (Suspend)	(1) More information is needed for dataset before flag can be assigned; (2) Dataset QC revealed non-acceptable data; (3) Data are being updated (part or the entire cruise).
X (Exclude)	The cruise (data set) duplicates another cruise (data set) in SOCAT.
NA…NF	**Flags prior to independent quality control, as indicated by the "N". The NA though NF flags provided by the data contributor.**