Intergovernmental Oceanographic Commission

Workshop Report No. 222

Surface Ocean CO$_2$ Atlas Project Atlantic and Southern Oceans Regional Meeting

Norwich, UK
25-26 June, 2009

IOCCP Report Number 13

UNESCO

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Abstract:
The SOCAT Atlantic and Southern Oceans Regional Groups met at the University of East Anglia in Norwich, UK from 25-26 June 2009. The workshop was chaired by Ute Schuster and attended by twenty-eight scientists from seven different countries. The Atlantic and Southern Oceans regional group met with the developers of the Live-Access Server tools to learn how LAS can be used in the QC effort for SOCAT. The participants installed the tools and software on their computers, downloaded the data files for their regions, set up the shared QC environment, and worked through several exercises to demonstrate the system. The groups began working through the data sets for their region (flagging, determining which 2nd level QC tests may be applied, testing those, etc.)

SOCAT Atlantic & Southern Oceans Regional Meeting

25 and 26 June 2009,

School of Environmental Sciences,

University of East Anglia, Norwich, UK

Table of Contents

INTRODUCTION

WELCOME

Bakker welcomed the participants, introduced the local participants and thanked the sponsors of the meeting, notably SCOR (for IOCCP and IMBER) and the European Union COST (for SOLAS). Bakker introduced the new IOCCP Coordinator (Tedesco). Bakker provided some housekeeping information. Tedesco, Jones (Elizabeth) and Telszewski kept minutes during the meeting. Jones, Jones, Telszewski and Krijnen helped with meeting logistics.

AIMS OF SOCAT AND STATE OF THE SOCAT DATA SET

Schuster reminded the participants of the two main aims of Surface Ocean CO_2 Atlas (SOCAT). These are to establish as:

- 2nd level quality controlled (QC) global surface ocean fCO_2 data set
- Gridded global SOCAT product of monthly surface water fCO_2 means, with no temporal or spatial interpolation (i.e. bin averages).

These data products will be made publicly available, as discussed at the 2007 SOCOVV meeting in Paris (meeting report on http://www.ioccp.org/).

Initially the meeting at UEA was intended for the Atlantic, Indian, and Southern Ocean groups. However, no discussions took place on the Indian Ocean, in the absence of its regional group leader. The name of the meeting has been adjusted to reflect this.

The aims of the meeting of the Atlantic and Southern Ocean groups were to introduce the participants of SOCAT on the Live Access Server (LAS), to start 2nd level data quality control for these regions, to set a time table for 2nd level QC for these regions and to discuss scientific outcomes from SOCAT.

Pfeil gave an update on the state of the SOCAT dataset. The current version of SOCAT is version 1.3 (to be released by mid-2010), which contains data from 2175 voyages, with 10.5 million sea surface temperature values and 7.6 million recalculated fCO_2 values, covering a time frame from 1968 to 2007.

Metzl asked for a more detailed description of the temporal data distribution, specified for the SOCAT regions (for future presentations).

Action item: Produce temporal distribution plots for each SOCAT region (Pfeil).
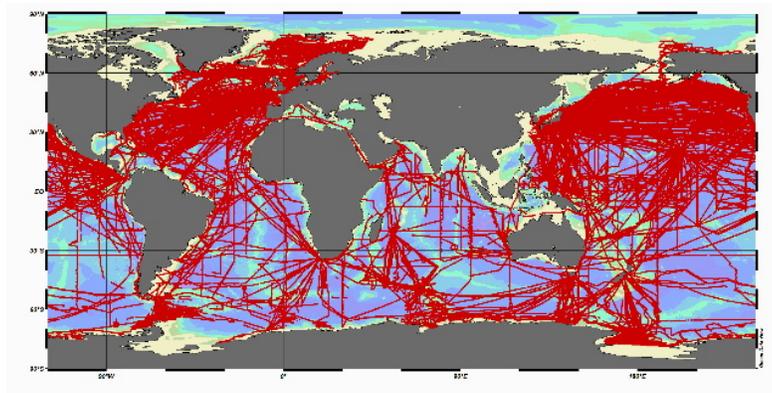
Figure 1. The distribution of cruises in SOCAT v1.3 (Pfeil).
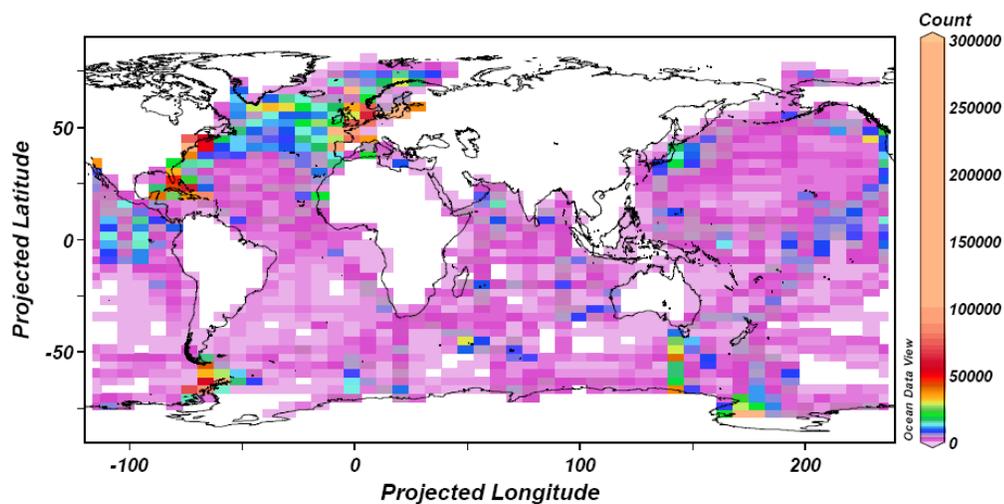
Figure 2. The spatial distribution of data in SOCAT version 1.3 with the number of observations (color scale) binned in 4˚ by 5˚ degree grids (Pfeil)
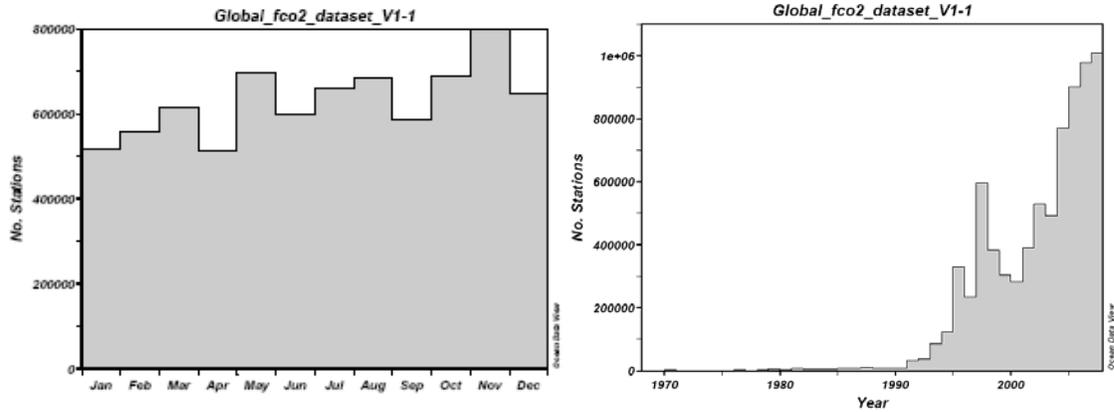
Figure 3. The temporal distribution of data in SOCAT version v1.3 by a) month and b) year (Pfeil).

REPORTS FROM PREVIOUS MEETINGS AND WORKSHOPS

REPORT FROM THE SOCAT COASTAL GROUP MEETING, JANUARY 2009

Schuster presented a summary of the meeting of the SOCAT Coastal Group in January 2009 in Kiel, Germany (meeting report to be posted on http://www.ioccp.org/), focusing on decisions made with regards to QC (quality control) procedures:

- Check metadata;
- Check data;
- Check outliers of a voyage, e.g. in SSS (sea surface salinity), SST (sea surface temperature), fCO_2, position, date/time;
- Autocorrelation analysis to determine grid box for QC;
- Cross-over analysis (decisions should be made manually, rather than automated);
- Property/property plots are extremely useful (e.g. fCO_2 versus SSS, fCO_2 versus SST);
- Collapsing data into one year, adjusting seawater fCO_2 for the change in atmospheric fCO_2 (climatology);
- Variance of monthly mean and median.

The coastal group divided the coastal regions according to the scientific interests of the PIs (see Annex III).

The participants discussed the coastal regions in the Southern Ocean. Tilbrook suggested that the 2nd level QC of the coastal regions in the Southern Ocean will be done by the Southern Ocean group.

Metzl asked whether the climatology planned by the coastal group will have weekly or monthly resolution. Schuster responded that lack of data will probably not allow weekly resolution. Schuster stated that in the coastal region the spatial resolution in any gridded product or climatology must be higher than in the open ocean regions.

The participants welcomed the suggestion by the coastal group that the median and the mean should be used for the gridded SOCAT product (therefore 2 gridded products). Olsen asked how the

median is going to be computed, and Hankin mentioned that some vessels will measure much more frequently than others and therefore the median might be biased. The consensus was reached to calculate the monthly mean for data from each vessel in a certain grid box prior to calculating the "box-wide" median and mean.

Feely pointed out that climate oscillations should not be "ignored" in climatology calculations. The ENSO and NAO have to be taken into account when calculating climatologies. The coastal group had not decided how this should be accounted for. Wanninkhof reminded the participants that for example the Takahashi climatology does not use data from ENSO years.

Action item: Include coastal data in the Southern Ocean in Southern Ocean QC (Southern Ocean group).

REPORT FROM THE SOCAT PACIFIC GROUP MEETING, TSUKUBA, JAPAN

- Hankin presented a summary on the Pacific regional group meeting in Tsukuba in March 2009 (meeting report to be posted on http://www.ioccp.org/). The meeting was chaired by Nojiri and Hankin. Aim of the meeting was to introduce the Pacific group to LAS and to begin secondary QC for the SOCAT Pacific region. The participants looked at SOCAT version 1.2. There were several talks on data in the Pacific region and on a neural network technique. The bulk of the time was spent with hands-on using of the LAS system and evaluating cruises. The most important conclusion of the meeting was that SOCAT still had a variety of level 1 QC problems that needed to be addressed. This implied changes to the data itself. There was a discussion of how to handle problematic datasets for which the responsible PI is unresponsive (retired, or other). The Pacific participants agreed that such data sets need to be fixed, but without setting out a pathway for doing so. The participants suggested that the SOCAT time table (with a public data release in late 2009) needed to be adjusted. Many ideas were put forward for enhancing the LAS system – a list too long to address in the time since the Tsukuba meeting. Hankin and Malczyk prioritized the items based upon a rough cost/benefit assessment and addressed what was possible. Those changes were part of the LAS system that was used in June 2009. The changes include the following:
- :Increase the speed of the LAS;
- Additional sub-sampling levels (Done: extra 10 and 20 minute subsampling);
- Quick access to email address of PIs responsible for cruises;
- Add new QC "status" flags. (Done: Suspend and Exclude);
- Allow entering a comment-only without setting a QC flag (Done);
- LAS Table of Cruises to show one line per cruise for each relevant region (Done);
- More digits of precision in the quick "Property-property Values" output;
- Data Downloads button should always give full resolution data (Done);
- Linkages to documents with more detailed QC discussions than the short comment field;
- Community-editable FAQ;
- Visualization tools to show where data are "missing";
- Side-by side comparisons of property-property plots to help explore the relationship between more than 2 variables;
- Include Expocodes in the Table of Cruises.

REPORT FROM THE 2009 INTERCOMPARISON, KAMISU CITY, JAPAN

Bakker gave a short presentation on the 2009 Intercomparison of underway and buoy mounted pCO$_2$ systems sent by Simone Alin from PMEL. The intercomparison took place from 24 February to 6 March 2009 Kamisu City, Ibaraki, Japan. A summary of the experiment can be found in the SOCAT Pacific Regional Group Workshop Report posted at www.ioccp.org.

The participants of the Atlantic and Southern Ocean meeting expressed a general appreciation for the hard work and funds that the Japanese organizers, i.e. Nojiri and his team, put into the organization of the experiment. Feely commented that 5 ppm precision for moored platforms is not sufficient to constrain global ocean fluxes to 0.2 Pg C yr^{-1}. Also, the participants strongly encouraged the publication of the results from the intercomparison experiments in 2003 and 2009. As a minimum, recommendations for the improvement of instruments and protocols, based on the outcome of the experiments, need to be made widely available shortly after such an experiment. Watson suggested that future intercomparison experiments should be included in funding proposals.

THE LIVE-ACCESS SERVER (LAS)

OVERVIEW OF LAS

Hankin introduced the participants to LAS (Live Access Server) and Malczyk introduced the participants to using LAS via the internet. A copy of the presentation by Hankin will be made available on the LAS server.

Currently the QC is done on version 1.3, which will remain frozen during data QC. New data will be added to version 1.4, which will then also go through 2nd level QC.

The correction and exclusion of suspicious data was discussed. Schuster and Wanninkhof stated that any changes/corrections of data should only be done by the data-generator, where possible. The group confirmed that the PI for missing/erroneous data should be contacted and Pfeil should be kept in the loop. Telszewski reminded the participants that during the SOCAT Pacific group meeting, the agreed recommendation was to contact the PI in the first instance. If that fails, the leader of the regional group (to which the questionable data belongs) should make the executive decision.

Hankin has added two "status" flags to the QC (besides A to F): 'X' for exclude and 'S' for suspend. Excluded voyages may include double cruise entries. Suspended voyages, which need serious attention, remain in the version 1.3 dataset, yet are not visible to a LAS user. Such voyages can then be corrected, if possible, and will return in version 1.4. (Note that in a later part of the meeting [QC tools to be used] an additional suggestion was made. In view of the large number of files that seem to require level 1 QC it should be possible to flag individual fCO2rec data points as being rejected from the SOCAT collection.)

The manner in which the Coastal Group has divided the analyses of data has introduced a number of new sub-regions that are not defined in the SOCAT database. The question was raised whether LAS and the database should explicitly support these subregions, allowing the coastal group members to select sub-regions by name. Hankin said that it is currently possible to zoom into the sub-regions only by constraining to a particular lat-long box for Coastal Region data only. A list of crossovers has been added to LAS, ranked by the closest approach or "pseudo-distance" between voyages, where the pseudo-distance holds 1 day of time to be equivalent to 30 kilometers. The calculation was carried out to a maximum of 100 km of pseudo-distance, implying a maximum temporal separation of

about 3 days. The participants suggested that a column with the region-name should be added to the crossover table.

Submission and use of QC flags were discussed. No password protection is implemented for submission of QC flags and comments. This can be added if the SOCAT community requests it. The participants did not see a need for additional password protection. The participants decided that when a reviewer submits a QC flag and comment, an email is automatically sent to the reviewer and to Pfeil. There needs to be a way of looking at the QC flags for a region (e.g. sortable by time). It was stated that it would help if the community names their voyages using Expocodes, as this helps handling the data set.

Hankin suggested to built a tool allowing to create climatologies "on the fly" by selecting the preferable suite of variables. This way several versions of a climatology could be computed by the user depending on the input data. Watson expressed reservations about this suggestion, worrying that the community might abuse this tool by creating climatologies which fit their purposes. Hankin suggested that this could be addressed by ensuring that all outputs from such a system would be automatically self-documented with the choices that had gone into the analysis. Olsen asked for the possibility of additional files (e.g. graphs showing crossover results) being uploaded at the time of flagging a cruise and Malczyk agreed.

<u>**Action item**</u>: A copy of the presentation by Hankin will be made available on the LAS server (Hankin).

USE OF QC AND LAS

The participants split into three regional groups: North Atlantic, Tropical Atlantic, and Southern Ocean and spent several hours during the first and second day implementing QC procedures. Subsequently decisions were made on:

<u>**Action item**</u>: Generation of email to reviewer and Pfeil upon submission of data QC flags and data QC comments (Malczyk, Hankin).

<u>**Action item**</u>: If suspicious fCO_2rec data, data directly involved in calculating fCO_2rec or data relating to time and position of fCO2rec are found, the PI needs to be contacted, while keeping Pfeil in the communication loop (all). If the PI is not available (retired, unresponsive, etc.), the regional group leader needs to make a decision on correcting/excluding such data (all, regional group leaders).

<u>**Action item**</u>: Addition of possibility for uploading additional files during data QC with a direct link to the cruise of interest (Malzcyk, Hankin).

<u>**Action item**</u>: Suggestion to submit data files with voyages named according to EXPO codes (all future data generators for v1.4 and later).

<u>**Action item:**</u> In the cross-over table, add a column for the SOCAT region where the closest approach point occurs (Hankin, Malczyk).

<u>**Action item**</u>: Suggestion to be able to upload arbitrary files into the SOCAT (Hankin)

<u>**Action item**</u>: For the coastal group, add the capability to easily select the individual, named sub-regions (see maps in the Annex III). (Hankin, Malczyk)

Action item: Make data rows invisible when no fCO$_2$ recomputed are not present (Hankin, Malczyk).

Action item: QC flags should not be added due to suspicious salinity data since this community is not able to judge quality of salinity (all)

Action item: Produce a data set of atmospheric CO$_2$ data measured by 2010 (Pfeil).

Action item: Create a SOCAT gridded product of the variance of monthly means and medians for QC purposes (Hankin, Malczyk).

DEFINITION OF METHODS USED FOR MEASUREMENTS

The group discussed criteria for analytical methods that need to be met for a voyage to be given flag "A" or "B". 'Following methods criteria' equates to an overall accuracy of 2 μatm. It was decided that to achieve an overall accuracy of 2 μatm, the fCO$_2$ data collection would need to have met these criteria:
- Continuous measurements, not discrete;
- Based on xCO$_2$ analysis, not fCO$_2$ calculated from other carbon parameters;
- Detection based on an equilibrator and IR (infrared)/ GC (gas chromatograph);
- The calibration included at least 2 non-zero gas standards, traceable to WMO standards;
- The equilibrator temperature was measured to within 0.05 ^{o}C;
- The seawater temperature was measured to within 0.05 ^{o}C;
- The equilibrator pressure was measured to within 0.5 hPa;
- The barometric pressure was measured to within 0.1 hPa.

These criteria follow the recommendations from the 2002 Miami workshop http://www.aoml.noaa.gov/ocd/gcc/uwpco2/workshops/, also see http://ioc3.unesco.org/ioccp/Tsukuba2004Results_files/Tsukuba2004Results.htm#WG3

QC TOOLS TO BE USED

The group discussed which QC checks should be carried out by all groups prior to assigning a quality flag. These QC checks were decided upon:
- Check metadata of each voyage;
- Check if a PI is listed for each voyage;
- Check for duplicate voyages and get a decision on which voyage to remove;
- Decide on a grid box size that should be used to compare data from different cruises (by an educated decision or autocorrelation analysis for QC in an area of minimum natural variability);
- Check outliers of a voyage, e.g. in SSS, SST, fCO$_2$rec, barometric pressure, position, date/time;
- Property / property plots for these parameters:
    - SST vs. equilibrator temperature (outlier if a value spikes to > 3 ^{o}C);
    - fCO$_2$ vs. SST;
    - fCO$_2$ vs. SSS (no quality flag to be added to salinity);
    - barometric pressure vs. time;
    - SST-normalised fCO$_2$ vs. time;
    - Calculated ship speed vs. time;
    - Latitude vs. Longitude.
- Cross-over analysis, once LAS criteria are widened to 10 days and 210 km
    Additional recommended 2nd level QC checks:

- Calculate variance of monthly mean and monthly median for a grid box
- Variance of SST-normalised fCO_2
- MLR (multiple linear regression)

The group agreed that voyages without any fCO_2 data should be deleted from SOCAT.
Grid box sizes should be proposed by every sub-group based on the autocorrelation analysis.

During the 2008 Paris SOCAT meeting (meeting report on http://ioc3.unesco.org/ioccp/Docs/SOCAT2_Final2.pdf), it was decided that atmospheric CO_2 can be used as a QC parameter. The Atlantic/Southern Ocean participants decided to postpone a check against atmospheric CO_2 until a later stage of the project, as it would require a lot of work by Pfeil to implement atmospheric CO_2 in SOCAT.

The discussion developed around the visualizations of the gridded product, which should be ultimately available via LAS. Hankin suggested that the choice of visualizations should be decided by the most interested participants (PI's, regional leaders etc.) via email, so the sample products can be distributed and commented on.

MLR (multiple linear regression) could be done on a box-by-box basis. The algorithm developed can be then applied to individual cruises within a box and the offset cruises can be potentially identified. Olsen has utilized such a procedure in the past (using SST only which makes it LR rather than MLR). MLR code (Matlab) should be available via LAS, so all the groups use the same software. Olsen, Hankin, and Schuster will liaise on the issue to set this up for all regional groups.

Wanninkhof suggested QC'ing on a data-point level. Consensus has been achieved and the discussion developed on how to achieve this technically. Hankin reminded the participants the QC was decided to be performed strictly on a per voyage level during the 2008 Paris SOCAT meeting. By overwriting this agreement we make an executive decision without projects quorum present.

Action item: Discussion on the addition of QC flags for each fCO_{2rec} data point in a voyage, set to zero initially. WOCE QC flags (2,3,4,9) should then be used during the SOCAT QC procedure (Wanninkhof, Olsen, Bakker, regional group leaders, Hankin.

Action item: Carry out all QC procedures decided upon prior to assigning QC flags (all).

Action item: Prepare and test Matlab routines for MLR (Pierrot, Olsen).

Action item: Update other regional groups on the outcome of the SOCAT Atlantic and Southern Ocean group meeting (Bakker, Metzl, Olsen).

THE FUTURE

RELEASE OF SOCAT VERSION 1.3

It was decided that the public release of the SOCAT version 1.3 dataset should be delayed to mid-2010.

SCIENTIFIC STUDIES / PUBLICATIONS

Feely emphasised that the group should decide what happens beyond the fCO_2 atlas. The scientific output should be presented by the SOCAT scientists in order to highlight its full impact on the scientific community. Watson suggested that much more science can be done with this data set than with Takahashi data set, but that timely completion is essential. Feely compared the impact of potential scientific articles on SOCAT to post-WOCE articles (e.g. Sabine et al 2004).

Schuster assembled an "open" list of potential publications. As a minimum technical descriptions of SOCAT should be published for each region, one for global SOCAT, one for the data set in a uniform format and one for LAS. Feely added that the lead authors of major global and regional synthesis papers should be agreed upon on soon.

Technical papers:
- Regional 'technical' papers (mid-2010)
- 1 summary global 'technical' paper (mid-2010)
- 1 technical paper on the uniform SOCAT data set (mid-2010)
- 1 technical paper on LAS (mid-2010)
- ……

Scientific articles:
- 1 global SOCAT synthesis paper, change in global oceanic CO_2 uptake
- Regional papers on long-term trends
- 1 global paper on long-term trends
- Regional papers on seasonal variability
- 1 global paper on seasonal variability
- Ice-edge processes
- Frontal processes
- Effects of climate indices
- Global neural networks, creation of fCO2 maps
- Algorithms using remotely sensed data
- Coastal/tidal processes
- -……

A special issue should be prepared for all scientific publications based on the SOCAT dataset. The SOCAT group might also consider a special issue in Earth System Science Data for the technical publications.

MEETINGS

Possible future meetings for the presentation of SOCAT and SOCAT science include:

- ICDC8 2009 (Jena, September 2009)
- OceanObs09 (Venice, September 2009)
- CarboOcean 2009 (Bergen, October 2009)
- SOLAS (Barcelona, November 2009)
- AGU-ASLO-TOS Ocean Sciences (Portland, February 2010)
- EGU (Vienna, May 2010)
- ASLO (Santa Fe, June 2010)
- a SOCAT science meeting in summer 2011
- Regional group workshops, as required. The tropical Atlantic team will meet at the SOLAS 2009 meeting. The Southern Ocean group plans a meeting in March/April 2010 in Hobart.

GENERAL ACTION ITEM ON LIASING WITH OTHER SOCAT GROUPS

Action item: Define a way forward for the Indian Ocean group (Sarma).

ANNEXES

ANNEX I
PARTICIPANTS

Dorothee Bakker (UEA, UK)
Emily Brévière (SOLAS, UK)
Richard Feely (NOAA-PMEL, USA)
Nathalie Lefèvre (LOCEAN, France)
Melchor González-Dávila (Las Palmas, Spain)
Steve Hankin (NOAA-PMEL, USA)
Nick Hardman-Mountford (Plymouth, UK)
Mario Hoppema (AWI, Germany)
David Hydes (Southampton, UK)
Truls Johannessen (Univ. Bergen, Norway)
Elizabeth Jones (UEA, UK)
Steve Jones (UEA, UK)
Alex Kozyr (CDIAC, USA)
Justin Krijnen (UEA, UK)
Jeremy Malczyk (NOAA-PMEL, USA)
Nicolas Metzl (L'OCEAN, France)
Are Olsen (Univ. Bergen, Norway)
Toni Padin (Vigo, Spain)
Benjamin Pfeil (Univ. Bergen, Norway)
Denis Pierrot (NOAA-AOML, USA)
Aida Rios (Vigo, Spain)
Magdalena Santana-Casiano (Las Palmas, Spain)
Ute Schuster (UEA, UK)
Kathy Tedesco (IOCCP, France)
Maciej Telszewski (UEA, UK)
Bronte Tilbrook (CSIRO, Australia)
Rik Wanninkhof (NOAA-AOML, USA)
Andrew Watson (UEA, UK)

Unable to attend:
Nick Bates (BIOS, Bermuda)
Richard Bellerby (Univ. Bergen, Norway)
Alberto Borges (ULG, Belgium)
Catherine Goyet (Univ. Perpignan , France)
Arne Körtzinger (IFM-GEOMAR, Germany)
Dileep Kumar (NIO, India)
Andrew Lenton (Univ. Pierre and Marie Curie, France)
Jon Olafsson (Univ. Iceland, Iceland)
Abdirahman Omar (Univ. Bergen, Norway)
Fiz Perez (Vigo, Spain)
Tobias Steinhoff (IFM-GEOMAR, Germany)
VVVV Sarma (NIO, India)
Colm Sweeney (Univ. Colorado, USA)
Taro Takahashi (LDEO, USA)
Doug Wallace (IFM-GEOMAR, Germany)

ANNEX II

AGENDA

Thursday 25 June	
09:00 to 10:15	Introductions and reviews (Lab D)
09:00 to 09:15	Welcome, Introduction and House Keeping (Bakker, Tedesco)
09:15 to 09:30	Status of SOCAT and aim of this meeting (Pfeil, Schuster; 5 min plus discussion)
09:30 to 09:45	Summary of SOCAT's Coastal meeting (Schuster; 5 min plus discussion)
09:45 to 10:00	Summary of SOCAT's Pacific meeting (Hankin; 5 min plus discussion)
10:00 to 10:15	Summary of 2009 Tsukuba Intercomparison (TBA)
10:15 to 10:45	Coffee (LGMAC coffee room)
10:45 to 11:00	Group photo
11:00 to 12:30	Overview of LAS (Lab D, Hankin and Malczyk) • How to download data • Visualization and assessment tools that are available through LAS • How to do QC and upload QC evaluations • How SOCAT scientists can utilize their own tools (Matlab, Excel, ...) • What to do about the "coast"
12:30 13:30	Sandwich Lunch (LGMAC coffee room)
13:30 to 15:00	LAS and QC in practice (Lab D, leading: Hankin and Malczyk on 6 computers)
13:30 to 14:00	Setup of LAS and necessary procedures on 6 computers (Hankin, Malczyk)
14:00 to 14:15	Summary of QC procedures decided upon (Schuster)
14:15 to 15:00	First data QCs
15:00 to 15:30	Tea (LGMAC coffee room)
15:30 to 16:30	LAS and QC in practice (Lab D, All) Carry out data QC (in groups around 6 computers)
16:30 to 17:30	Update and future of EU ICOS (Lab D) (Mainly EU participants plus anybody interested/involved)
18:00 to 19:00	Leave for dinner in town Dinner at the Library Restaurant and Grill

Friday 26 June	
09:00 to 10:30	LAS and QC in practice (Lab D, All)
09:00 to 09:30	Review of LAS and QC of previous day (Schuster, Tilbrook and/or Lefevre, 10 min + discussion) • What has been done; what works and what does not work • What other QC procedures do we need • How to keep QC decisions consistent across regions
09:30 to 10:30	Continue data QC
10:30 to 11:00	Coffee (LMAC coffee room)
11:00 to 12:30	LAS and QC in practice (Lab D, All) Continue data QC
12:30 to 13:30	Sandwich lunch (LGMAC coffee room)
13:30 to 15:30	LAS and QC in practice and summary (Lab D, All)
13:30 to 14:30	Final data QC
14:30 to 15:30	Summary of meeting's QC and decisions on the future (Schuster, Lefevre, Tilbrook, Bakker) • What has been achieved • What is missing • What is still needed to make QCs consistent across regions • Who is doing what by when • Possible publications • ……………..
15:30 to 16:00	Tea (LGMAC coffee room)
16:00	Adjourn

ANNEX III

SUBDIVISIONS OF SOCAT REGIONS

1.1.1   Coastal group
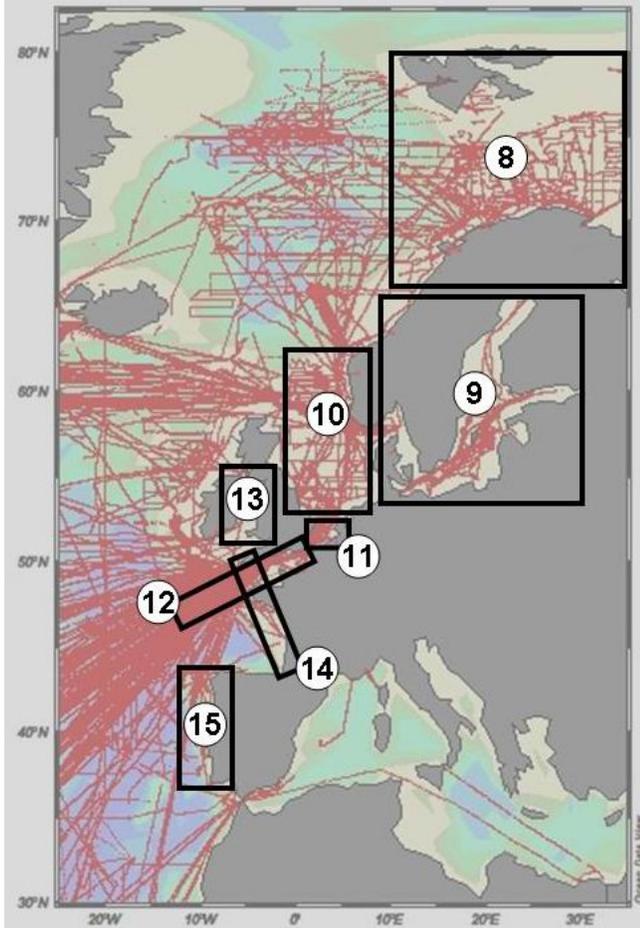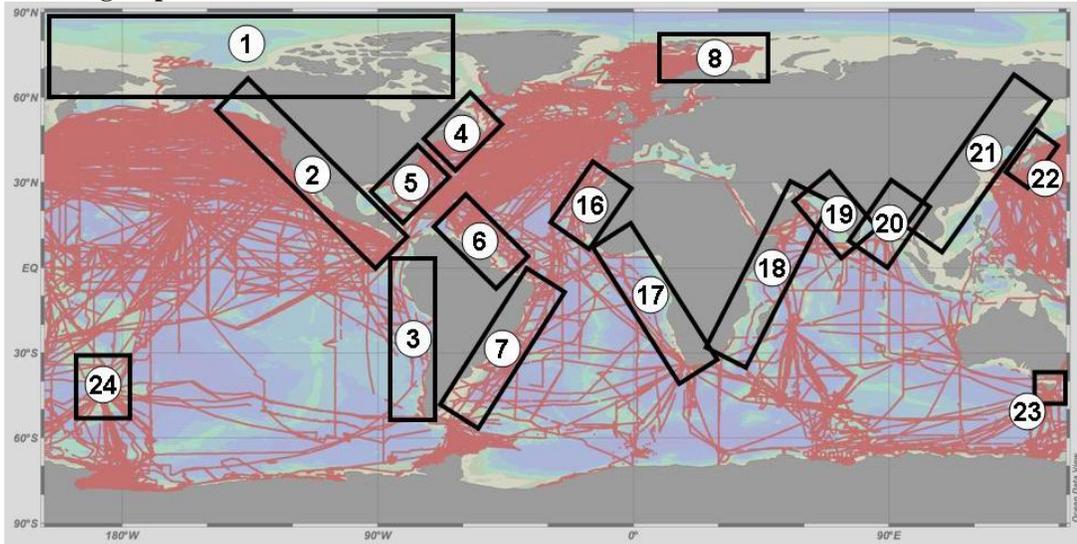
Table 1. PIs of the SOCAT Coastal Regional Group

ID N° (Fig.1)	Area	PIs
1	U.S. & Canadian Arctic	H. Thomas, N. Bates
2&3	U.S. & South American western coasts	F. Chavez, B. Hales, S. Alin
4	Northern U.S. East coast	J. Salisbury, H. Thomas
5	Southern U.S. East coast	W.J. Cai
6&7	South American East coast	S. Alin
8	European Nordic seas	B. Pfeil, A. Olsen, A. Omar
9	Baltic Sea	B. Schneider
10	North Sea	A. Omar, H. Thomas
11	S.B. of the North Sea	A.V. Borges
12	English Channel & Celtic Sea	U. Shuster
13	Irish Sea	N. Hardman-Mountford
14	Bay of Biscay (French coast)	D. Hydes, A. Padin
15	Iberian coast	A. Padin
16&17	African West coast	M. Santana-Casiano, M. González-Dávila, P. Monteiro, F. Chavez, B. Hales, A. Körtzinger, T. Steinhoff
18,19 & 20	Indian ocean coasts	V.V.S.S. Sarma
21	China Seas	M. Dai, A. Chen
22	Japan coastal	A.V. Borges (if no-one else)
23	Tasman shelf	A.V. Borges
24	New Zeeland coastal	A.V. Borges, K. Currie

1.1.2   North Atlantic group
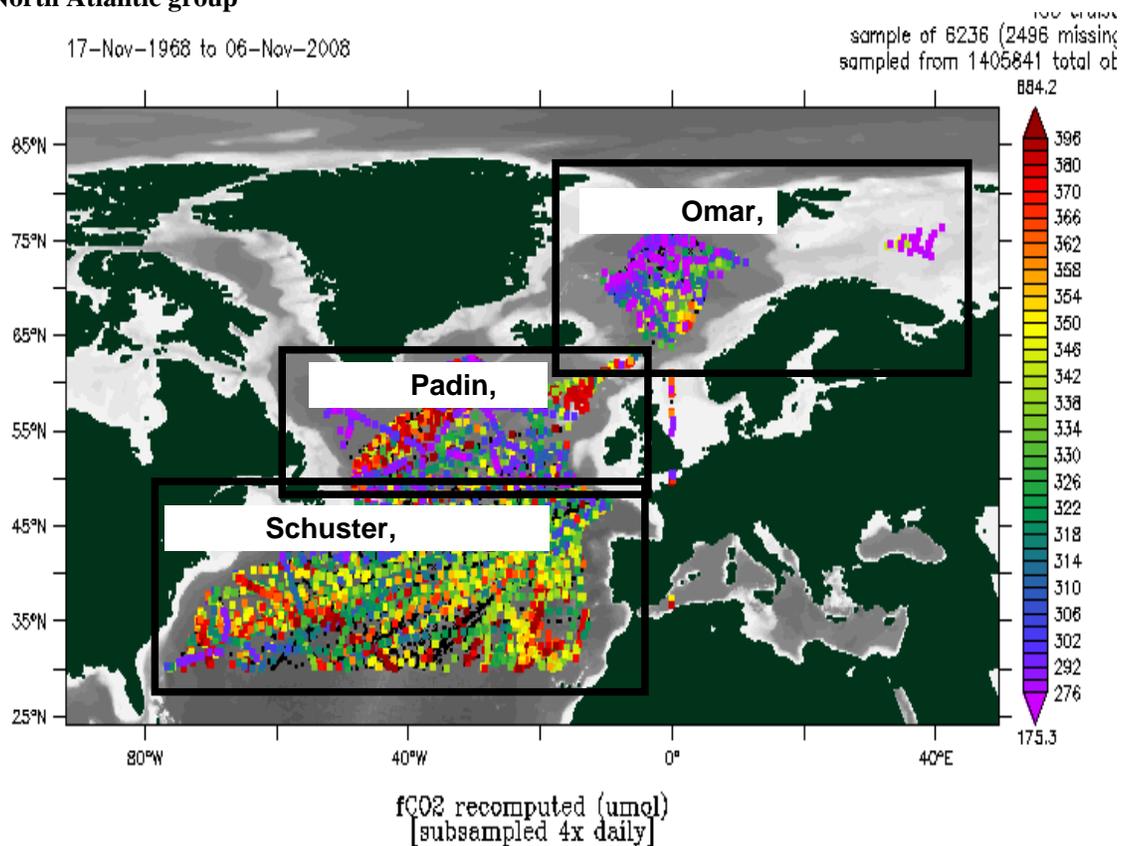
Tropical Atlantic group

The Tropical Atlantic has decided to stay together as one group, i.e. no subdivision.

Southern Ocean group

PIs of the Southern Ocean Regional Group for performing 2nd Level QC:

Indian sector	(10°E-120°E)	Metzl
Pacific sector	(120°E-70°W)	Tilbrook
Atlantic sector	(70°W-10°E)	Bakker, Hoppema