SOLAS into the Future:
Designing the next phase of the Surface Ocean-Lower Atmosphere Study

A change in the landscape of Global Change science coordination: the future of SOLAS

- **A change in the landscape of Global Change science coordination**

- **IGBP is winding down in 2015 and Future Earth research for Global sustainability started in 2013**

- **SOLAS decided that it will transition from IGBP to Future Earth in the first half of 2014.**

- **In this new landscape, SOLAS 2015-2025 will have more emphasis on the human relevance of SOLAS science (e.g. geoengineering and environmental services)**

…. towards Future Earth

Transition statement addressed to Future Earth in November 2014,
Future Earth reply provided last April , responses to referees comments sent to Future Earth end of May,

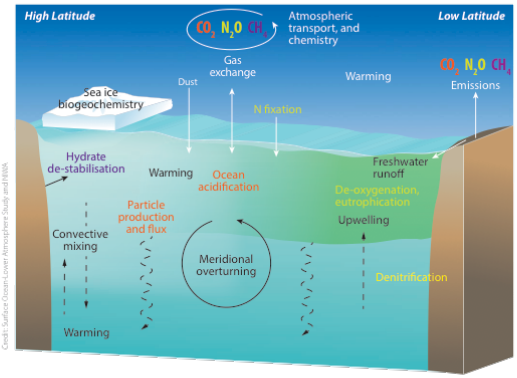
SOLAS Science Plan 2015-2015 sent to Future Earth December 2014,

ECS Ocean Governance, socio-economists and SOLAS Scientist Workshop, June 2015, Kiel,
Christa Marandino, Erik van Doorn, Ulrike Kronfeld-Goharani, Sarah Gahlen

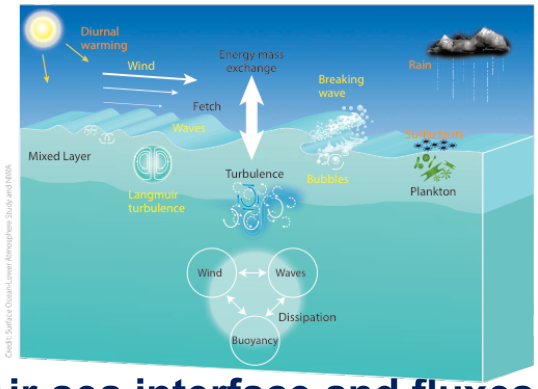
OSC Kiel 2015: Plenary on SOLAS Science and Society, September 2015, Kiel
Hans Joachim Schellnhuber (Germany), Lucia Fanning (Canada), Phil Boyd (Australia), David Turner (Sweden)

surface ocean solas lower atmosphere study

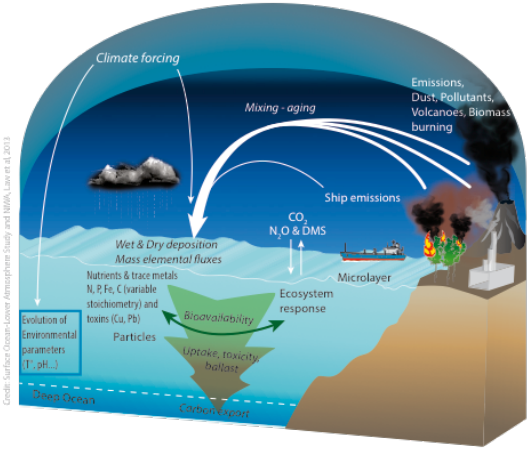
SOLAS 2015-2025 core themes



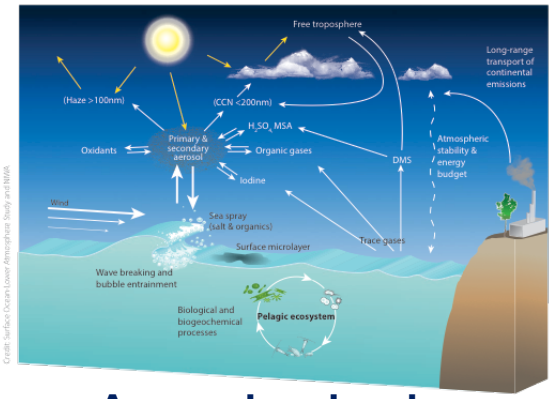
Greenhouse gases and the oceans



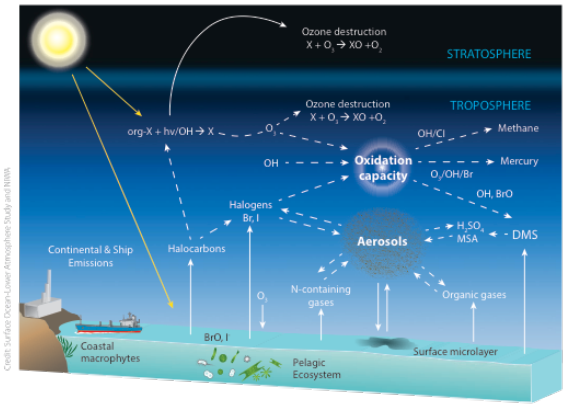
Air-sea interface and fluxes of mass and energy



Atmospheric deposition and ocean biogeochemistry



Aerosols, clouds, and ecosystems



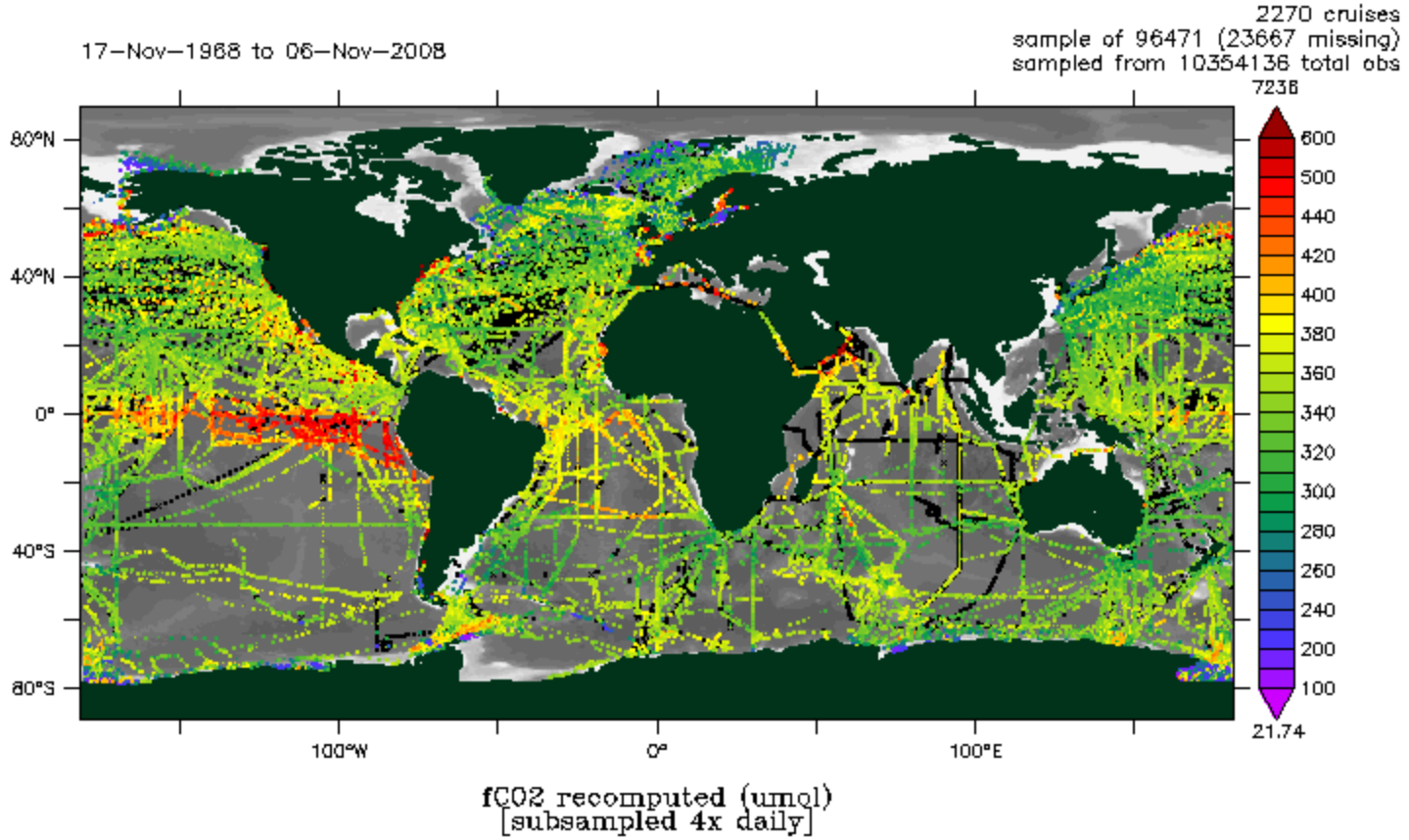
Ocean biogeochemical controls on atmospheric chemistry

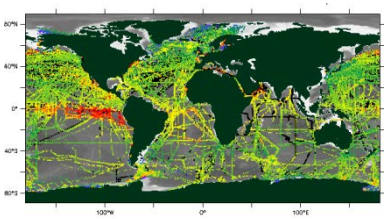
-Integrated Topics : Regional process studies in high sensitivity systems

-SOLAS and Geoengineering

-SOLAS and Society

Surface Ocean CO_2 Atlas (SOCAT)





SOCAT articles

SOCAT highlight – Science News or EOS, .. (Bakker et al.)

ESSD technical article(s) - The more the better!

- Technical global paper on the uniform data and QC (Olsen, Pfeil, Bakker et al.), draft available at public release, main reference for SOCAT data set;
- Technical paper on LAS (Hankin, Koyuk, Malczyk?);
- Technical paper on the gridding (Chris?);
- Regional technical papers ?

Scientific articles – THINK articles!

- At least 1 high flying paper;
- Special Issue?
- Some papers in time for IPCC AR5.

Surface Ocean CO_2 Atlas

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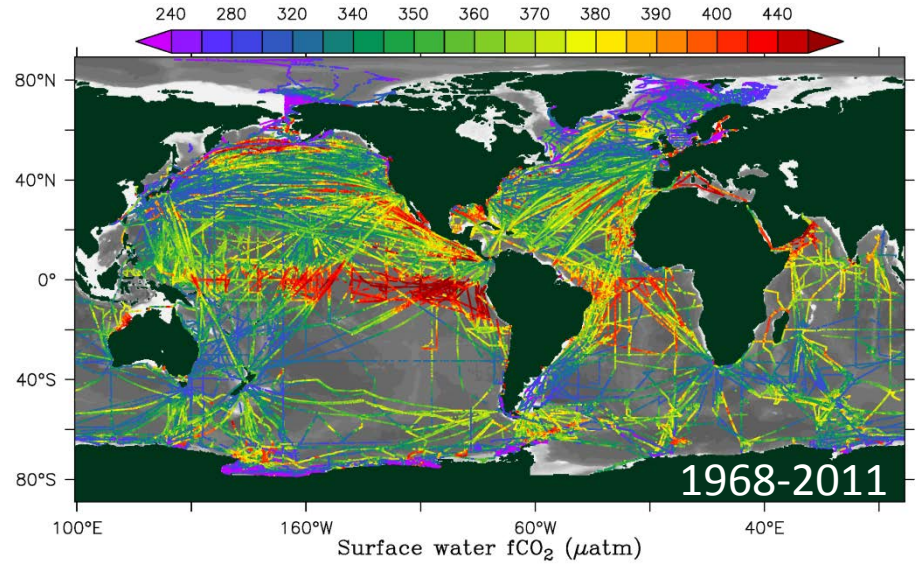

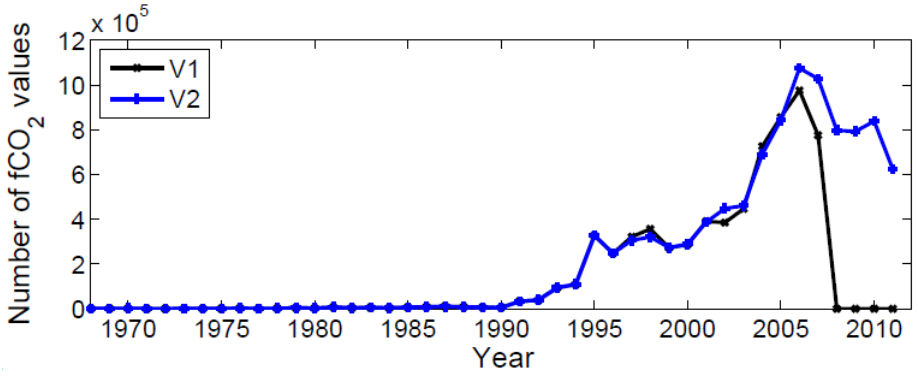

SOCAT: Surface ocean fCO_2 (fugacity of CO_2) in uniform format with quality control;
2011: Version 1: 1968-2007, 6.3 million fCO_2, 1851 cruises;
2013: Version 2: 1968-2011, 10.1 million fCO_2, 2660 data sets;

Individual data set files / Global synthesis product / Global gridded products;
Public access to regular releases via http://www.socat.info/;
Interactive online viewers (LAS); Downloadable (text, NetCDF, ODV, Matlab);
Documented in 3 ESSD articles (68 citations in peer-reviewed publications);

Documentation and data policy

www.socat.info

Earth Syst. Sci. Data, 5, 125–143, 2013
www.earth-syst-sci-data.net/5/125/2013/
doi:10.5194/essd-5-125-2013

40 citations

A uniform, quality controlled Surface Ocean CO_2 Atlas (SOCAT)

B. Pfeil[1,2,3], A. Olsen[1,2,4,5], D. C. E. Bakker[6], S. Hankin[7], H. Koyuk[8], A. Kozyr[9], J. Malczyk[10], A. Manke[7], N. Metzl[11], C. L. Sabine[7], J. Akl[12,13], S. R. Alin[7], N. Bates[14], R. G. J. Bellerby[15,16,2], A. Borges[17], J. Boutin[11], P. J. Brown[6,18], W.-J. Cai[19], F. P. Chavez[20], A. Chen[21], C. Cosca[7], A. J. Fassbender[22], R. A. Feely[7], M. González-Dávila[23], C. Goyet[24], B. Hales[25], N. Hardman-Mountford[26,*], C. Heinze[1,2,5,16], M. Hood[27], M. Hoppema[28], C. W. Hunt[29], D. Hydes[30], M. Ishii[31], T. Johannessen[1,2], S. D. Jones[32], R. M. Key[33], A. Körtzinger[34], P. Landschützer[6], S. K. Lauvset[1,2], N. Lefèvre[11], A. Lenton[12], A. Lourantou[11], L. Merlivat[11], T. Midorikawa[35], L. Mintrop[36], C. Miyazaki[37], A. Murata[38], A. Nakadate[39], Y. Nakano[38], S. Nakaoka[40], Y. Nojiri[40], A. M. Omar[5,16], X. A. Padin[41], G.-H. Park[42], K. Paterson[12,13], F. F. Perez[41], D. Pierrot[42], A. Poisson[24], A. F. Ríos[41], J. M. Santana-Casiano[23], J. Salisbury[29], V. V. S. S. Sarma[43], R. Schlitzer[28], B. Schneider[44], U. Schuster[6], R. Sieger[28], I. Skjelvan[1,2,16], T. Steinhoff[34], T. Suzuki[45], T. Takahashi[46], K. Tedesco[47,**], M. Telszewski[48,**], H. Thomas[49], B. Tilbrook[12,13,50], J. Tjiputra[1,2], D. Vandemark[29], T. Veness[12,13], R. Wanninkhof[51], A. J. Watson[6], R. Weiss[52], C. S. Wong[53], and H. Yoshikawa-Inoue[38]

13 citations

Surface Ocean CO_2 Atlas (SOCAT) gridded data products

C. L. Sabine[1], S. Hankin[1], H. Koyuk[1,2], D. C. E. Bakker[3], B. Pfeil[4,5,6], A. Olsen[7,8], N. Metzl[9], A. Kozyr[10], A. Fassbender[1,20], A. Manke[1,2], J. Malczyk[11], J. Akl[12,13], S. R. Alin[1], R. G. J. Bellerby[14,4,*], A. Borges[15], J. Boutin[9], P. J. Brown[3,16], W.-J. Cai[17], F. P. Chavez[18], A. Chen[19], C. Cosca[1], R. A. Feely[1], M. González-Dávila[21], C. Goyet[22], N. Hardman-Mountford[23,**], C. Heinze[4,5,8,14], M. Hoppema[24], C. W. Hunt[25], D. Hydes[26], M. Ishii[27], T. Johannessen[4,5], R. M. Key[28], A. Körtzinger[29], P. Landschützer[3], S. K. Lauvset[4,5], N. Lefèvre[6], A. Lenton[13], A. Lourantou[9], L. Merlivat[9], T. Midorikawa[30], L. Mintrop[31], C. Miyazaki[32], A. Murata[33], A. Nakadate[34], Y. Nakano[33], S. Nakaoka[35], Y. Nojiri[35], A. M. Omar[8,14], X. A. Padin[36], G.-H. Park[37], K. Paterson[12,13], F. F. Perez[36], D. Pierrot[37], A. Poisson[22], A. F. Ríos[36], J. Salisbury[25], J. M. Santana-Casiano[21], V. V. S. S. Sarma[38], R. Schlitzer[28], B. Schneider[39], U. Schuster[3], R. Sieger[24], I. Skjelvan[5,14,4], T. Steinhoff[29], T. Suzuki[40], T. Takahashi[41], K. Tedesco[42,***], M. Telszewski[43,***], H. Thomas[44], B. Tilbrook[12,13,45], D. Vandemark[25], T. Veness[13], A. J. Watson[3], R. Weiss[46], C. S. Wong[47], and H. Yoshikawa-Inoue[33]

15 citations

An update to the Surface Ocean CO_2 Atlas (SOCAT version 2)

D. C. E. Bakker[1], B. Pfeil[2,3], K. Smith[4,5], S. Hankin[4], A. Olsen[2,3,6], S. R. Alin[4], C. Cosca[4], S. Harasawa[7], A. Kozyr[8], Y. Nojiri[7], K. M. O'Brien[4,5], U. Schuster[9,*], M. Telszewski[10], B. Tilbrook[11,12], C. Wada[7], J. Akl[11], L. Barbero[13], N. R. Bates[14], J. Boutin[15], Y. Bozec[16,17], W.-J. Cai[18], R. D. Castle[19], F. P. Chavez[20], L. Chen[21,22], M. Chierici[23,24], K. Currie[25], H. J. W. de Baar[26], W. Evans[4,27], R. A. Feely[4], A. Fransson[28], Z. Gao[21], B. Hales[29], N. J. Hardman-Mountford[30], M. Hoppema[31], W.-J. Huang[18], C. W. Hunt[32], B. Huss[19], T. Ichikawa[33], T. Johannessen[2,3,6], E. M. Jones[31], S. D. Jones[34], S. Jutterström[35], V. Kitidis[36], A. Körtzinger[37], P. Landschützer[1], S. K. Lauvset[2,3], N. Lefèvre[38,39], A. B. Manke[4], J. T. Mathis[4], L. Merlivat[15], N. Metzl[15], A. Murata[40], T. Newberger[41], A. M. Omar[6,3,2], T. Ono[33], G.-H. Park[42], K. Paterson[11], D. Pierrot[13], A. F. Ríos[43], C. L. Sabine[4], S. Saito[44], J. Salisbury[32], V. V. S. S. Sarma[45], R. Schlitzer[31], R. Sieger[31], I. Skjelvan[6,2,3], T. Steinhoff[37], K. F. Sullivan[13], H. Sun[21], A. J. Sutton[4,5], T. Suzuki[46], C. Sweeney[41], T. Takahashi[47], J. Tjiputra[6,3], N. Tsurushima[48], S. M. A. C. van Heuven[49], D. Vandemark[32], P. Vlahos[50], D. W. R. Wallace[51], R. Wanninkhof[19], and A. J. Watson[9,*]

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EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

VOLUME 93 NUMBER 12
20 MARCH 2012
PAGES 125–132

Global Data Products Help Assess Changes to Ocean Carbon Sink

PAGES 125–126

Net oceanic uptake of the greenhouse gas carbon dioxide (CO_2) reduces global warming but also leads to ocean acidifi-

managers have generously donated their time and expertise to SOCAT. These participants were organized into seven regional groups and a global coordina-

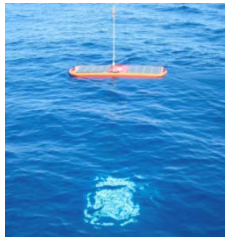
oceans and coastal seas. The data originate from 1851 voyages by research vessels, commercial ships, and moored as well as drifting platforms. Two SOCAT products have been created: (1) a global data set of surface ocean fCO_2 from 1968 to 2007 (Figure 1) recalculated using a uniform procedure and subject to QC checks and (2) a global, gridded, monthly mean surface water fCO_2 data product

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.



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Impact of SOCAT

Citations by ≥ 68 peer-reviewed, scientific publications
(2015–1; 2014-29; 2013-21; 2012-5; 2011-3; 2010-8; 2009–1),
2014 CBD and 2013 IPCC reports, 4 book chapters, ≥ 1 PhD thesis;
Used by 2013, 2014 Global Carbon Budgets,
≥ 2 data-products, SOCOM, NASA and ESA projects

Scientific application	Number (of 59)
Reference to SOCAT and/or fCO_2 data	**30**
Use of SOCAT tools	**1**
Figure of fCO_2 data distribution	**5**
fCO_2 in process studies, e.g. ocean acidification and genomics	**4**
Coastal and ocean CO_2 sink estimates	**12**
Model validation	**6**
Regional pH trends	**1**

Ocean carbon sink estimates

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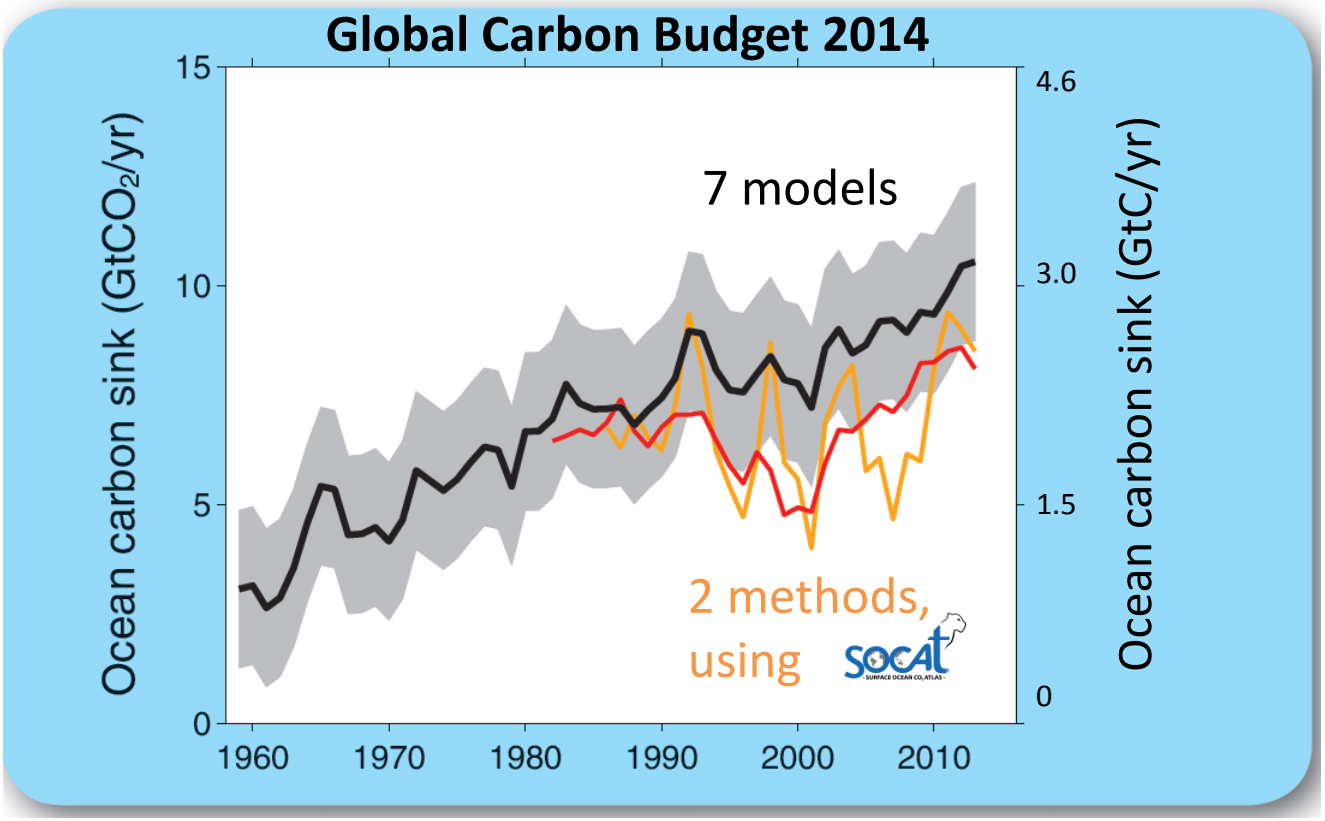

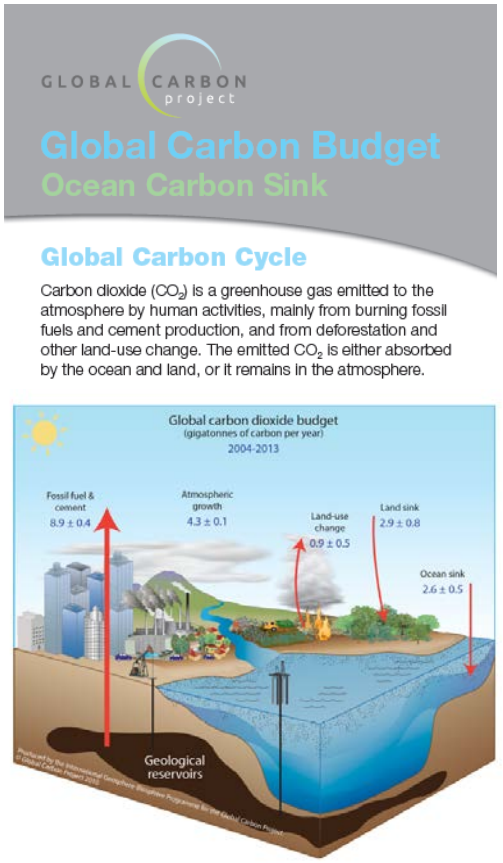

Data-based methods estimate different year-to-year and long term variation in the ocean carbon sink.

(Figures: Le Quéré et al., 2014; Landschützer et al., 2014; Rödenbeck et al., 2014)

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Conclusions

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

Applications include:

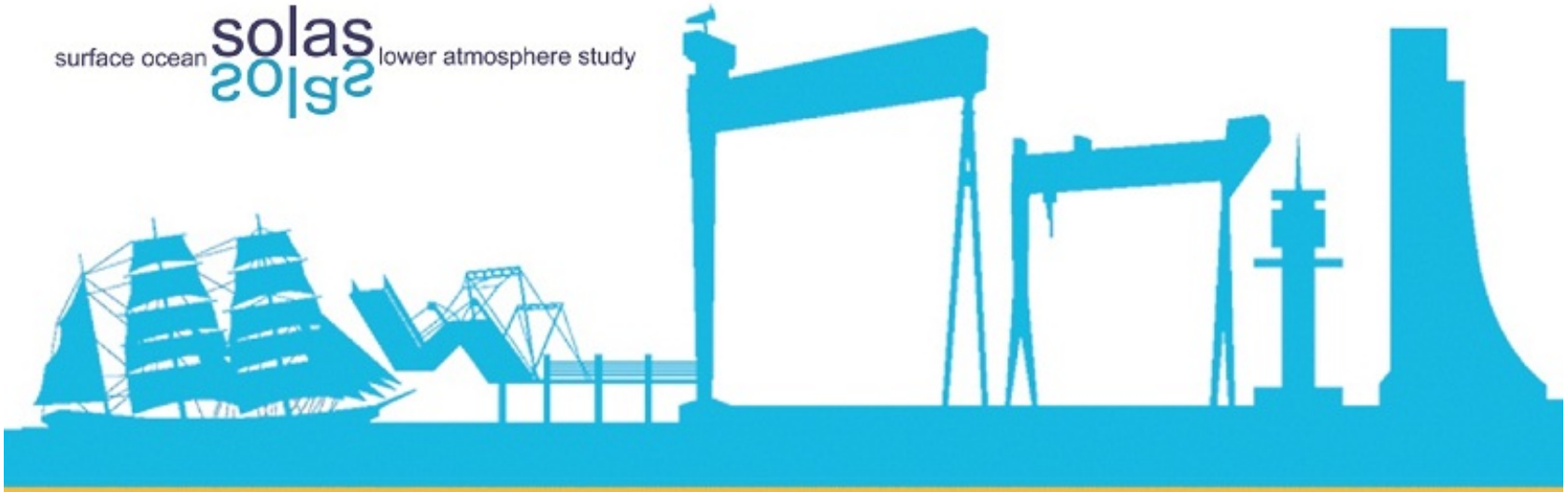
- Quantification of the ocean CO_2 sink (e.g. Global Carbon Budget, SOCOM);
- Assessments of ocean acidification;
- Validation of ocean biogeochemical models.

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**.

SOCAT is a community activity!

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

Upcoming event



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