A joint project of Scientific Committee on Oceanic Research and Intergovernmental Oceanographic Commission of UNESCO and an affiliate program of the Global Carbon Project

The IOCCP Conveyor No. 36, October 2016

A Word from the Editor

Dear Ocean Carbon & Biogeochemistry Community,

In this issue of the Conveyor we update you on a number of activities which will directly and indirectly influence all our work in the near and not-so-near future: strong networking movements amongst African colleagues spawned by the GOA-ON efforts, breakthrough developments in the sensors world and explicit written support of the Global Ocean Observing System by the G7. None of these involved IOCCP directly but all of these will enhance our efforts. We also update you on the latest status of SOCAT and the work towards globally inter-comparable nutrients measurements. Finally we continue our introductions with a profile of Björn Fiedler, the IOCCP SSG expert for time series activities.

As we are all well engaged in the usual September-October buzz of tasks, activities, events and deadlines, I am sure that there will be a lot to report on early next year. Until that time, I wish you all enough stamina, motivation and time to achieve your professional and personal goals.

I hope that you will find this issue useful.

Maciej Telszewski

Report from the IOCCP-JAMSTEC 2015 inter-laboratory calibration exercise for nutrients in seawater

In June this year IOCCP and JAMSTEC (Japan Agency for Marine-Earth Science and Technology) made a significant contribution towards increased consistency in ocean nutrient data through the publication of the "IOCCP-JAMSTEC 2015 Inter-laboratory Calibration Exercise of a Certified Reference Material for Nutrients in Seawater" report. The results of this exercise identify biases in a global network of nutrient measurements, thus enabling further scrutiny of analytical procedures and elimination of reason(s) for these biases.

Observation of the natural variability and trends in nutrients and inorganic carbon in the ocean is of fundamental importance for oceanographic research, particularly for studies of global climate change. However, attaining this knowledge is hampered by the presence of biases and imprecision in nutrient measurements, reasons for which are difficult to identify by a single investigator. Despite of the fact that the oceanographic community has engaged in three international inter-laboratory comparison studies since 2003, and the development of nutrient reference materials (RMs), adequate comparability and traceability of nutrient data has not yet been achieved.

The 2015 IOCCP-JAMSTEC co-organized inter-laboratory comparison study presented an opportunity to move a step forward thanks to the fact that Certified Reference Materials (CRMs) for nutrients (nitrate, nitrite, silicate and phosphate) in seawater, covering a wide range of nutrient concentrations, became available in 2014. The exercise was also strongly supported by the formal coming together of nutrient analysts as part of the SCOR Working Group 147: COMPONUT (Towards comparability of global oceanic nutrient data; http://www.scor-int.org/SCOR_WGs_WG147.htm).

The 2015 Inter-laboratory comparison study was conducted with the use of:

- four lots of recently certified RMs prepared by KANSO, Japan (Fig 1);
- three CRMs by National Metrology Institute of Japan;
- one recently developed RM from the Korea Institute of Science and Technology (KIOST), and
- the silicate stock solution provided by the Royal Netherlands Institute for Sea Research (NIOZ).

Fig 1. Four lots of CRM samples provided by KANSO.

A set of samples was distributed to all 71 participating laboratories from 28 countries from around the globe. Eventually results from 59 participating laboratories were collected.

The results indicate that non-linearity of the calibration curves for nutrient analysis is a significant source of decreased comparability of nutrient data. This implies that CRMs covering the whole range of measurable nutrient concentrations are needed to maintain comparability among a global collection of samples. Moreover, consensus standard deviations for all nutrients are an order of magnitude larger than the homogeneity of the distributed CRMs, and are approximately double the measurement precision reported by laboratories. These results indicated that future use of CRMs should greatly enhance the comparability of nutrient data among the laboratories of the world. Detailed results from this study are described in the report, available for online viewing and PDF download from our website HERE.

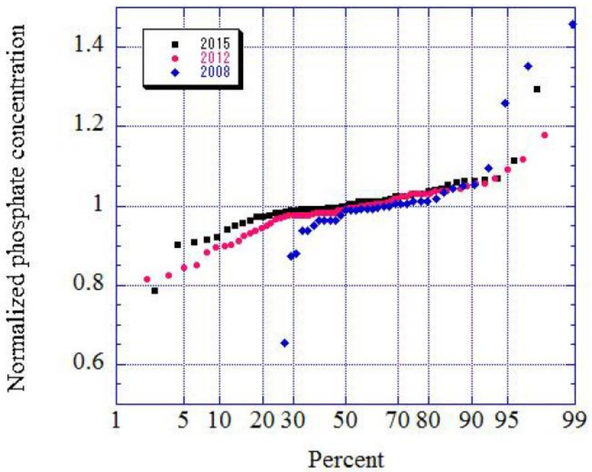

Fig 2. Cumulative distribution of reported phosphate concentrations in 2008, 2012 and 2015 I/C studies. Fig. 7 in the report.

The 2015 Inter-laboratory comparison exercise is certainly not the last one in its series. Realizing that consistent nutrient data is key to understanding changes in ocean biogeochemistry in the Anthropocene, IOCCP will look forward to further supporting this endeavor.

Artur Palacz

New IOCCP SSG member profile: Björn Fiedler

This article is the second of a series of new IOCCP SSG member profiles. In this issue we want to introduce Dr. Björn Fiedler who has taken over from Laura Lorenzoni the responsibility for coordination of biogeochemical Time Series Efforts at IOCCP.

Björn, a German national, first obtained a degree in Chemistry and then a PhD in Marine Chemistry from the University of Kiel and GEOMAR. His dissertation title was: "CO_2 and O_2 Dynamics and Ocean-Atmosphere Fluxes in the Eastern Tropical North Atlantic."

Currently, Björn is a postdoc fellow at the GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany and a Scientific Coordinator of GEOMAR's Cape Verde Ocean Observatory (CVOO, cvoo.geomar.de). From the very beginning of his doctoral degree Björn got involved in the establishment of the CVOO time-series program in West Africa. His work focused on combining autonomous biogeochemical sensors placed on a variety of mobile or fixed-point platforms with classical shipborne time-series observations in the eastern tropical North Atlantic. His most valuable expertise, from IOCCP's perspective, lies in his experience in integrating these platforms into one local observing system and hence thoughtfully improving the spatio-temporal observing coverage – an approach which allows for deeper understanding of the processes triggering biogeochemical variabilities under investigation.

His scientific motivation for sensor and platform development and sustaining long-term observations lies mainly in carbon, oxygen and nitrogen cycles and specifically in investigating CO_2/O_2 air-sea gas exchange in the eastern tropical North Atlantic and examining the impact of mesoscale eddies on carbon and nitrogen cycling in the same region.

Besides classical ship-based operations as the backbone of time series observations at CVOO, Björn utilizes homogenous sensor packages on a set of mobile platforms including profiling floats, Wave Glider and underwater winch/profiler systems. As each platform has its own requirements on pay-loaded sensors and thereby making data processing more complicated he works towards a more uniform data processing protocols for existing sensor technologies. This endeavor would be highly beneficial to the global community and IOCCP could play an important role in homogenizing approaches of a very scattered and often disconnected time-series community.

Furthermore, based on his experience in establishing time series observations in a developing country, Björn is aware of the challenges and difficulties local partners are facing to operate and maintain high quality time series observations. Better connecting these national time series efforts from developing countries with the international research community is an endeavor he wants to push forward.

Fig 3. Field work in Mindelo, Cape Verde: Björn regularly spends a few weeks per year in Cape Verde to conduct field work together with local partners.

Björn participated in and cooperated with several national and international research projects (SOPRAN, CarboChange, FixO3, OCB, Eddy-Hunt) which makes him a recognized partner in the community and gives him the essential knowledge on the personal and institutional structure of the community.

We welcome Björn on board IOCCP and look forward to working closely with him towards strengthening IOCCP's coordination of biogeochemical time series efforts.

Artur Palacz

Launch of ApHRICA: "OceAn pH Research Integration and Collaboration in Africa"

A new pilot called "OceAn pH Research Integration and Collaboration in Africa – ApHRICA" was officially launched during the kick-off workshop at the end of July 2016. The project aims to install and operate ocean sensors on platforms operated by colleagues in Mauritius, Mozambique, the Seychelles and South Africa to study ocean acidification in East Africa. The launch of ApHRICA will not only enhance local ocean monitoring efforts in East Africa but will also facilitate connections to global efforts such as the Global Ocean Acidification Network (GOA-ON).

ApHRICA is a public-private partnership launched jointly by the U.S. Department of State, the Ocean Foundation, the Heising-Simons Foundation, Schmidt Marine Technology Partners, and the XPRIZE Foundation. ApHRICA has been years in the making, starting with developing ocean pH sensor tools, engaging leading experts and raising the funds to bring passionate people and new technologies together to take action and fill much-needed ocean data gaps.

The project was announced at the 2015 Our Ocean Conference in Chile, and was recently officially launched with ApHRICA's regional capacity building workshop held July 26-30, 2016, in Mauritius. The workshop welcomed ocean scientists from African countries to learn how to operate new ocean acidification (OA) monitoring technology and to connect to global efforts such as GOA-ON.

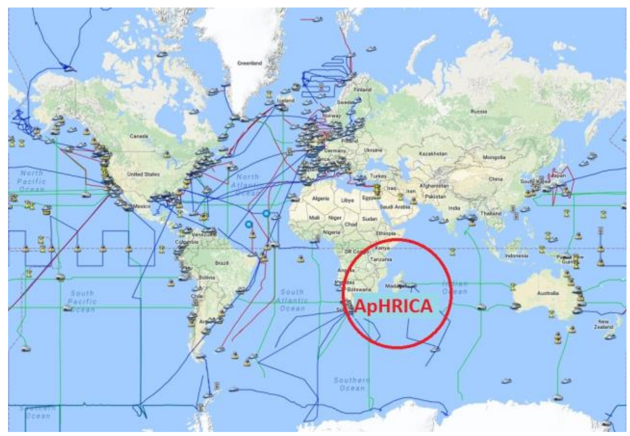

Fig 4. A snapshot from the GOAN-ON data portal Explorer, showing the distribution of different observing platforms used to collect the data.

Among the speakers at the workshop were: White House Science Envoy for Ocean, Dr. Jane Lubchenco, Dr. Roshan Ramessur at the University of Mauritius, and ocean sensor trainers and scientists Dr. Andrew Dickson of University of California San Diego, USA, Dr. Sam Dupont of University of Gothenburg, Sweden, and James Beck, CEO of Sunburst Sensors – a company that will provide their newly developed ocean pH sensor for this project.

The first ApHRICA workshop was a critical step in increasing the worldwide coverage of the GOA-ON and training monitors and managers to better understand the impacts of OA. This is particularly important in East Africa that has such a strong reliance on marine resources but lacks the capacity to monitor OA in all marine environments, from estuarine areas to open ocean. The hope is that ApHRICA will strengthen the resiliency of coastal communities, improve oceanographic collaboration in the region, and that the newly-gathered data will contribute significantly to GOA-ON, filling a major data gap in the notoriously mysterious Indian Ocean.

The project does not yet have a dedicated website, but if you want to obtain further information about ApHRICA, please contact Esther Bell (U.S. Department of State) by email at BellEF@state.gov.

Artur Palacz

The SenseOCEAN project successfully deploys a truly multi-parameter insitu sensor

The SenseOCEAN project, www.senseocean.eu, is a project funded by the EC under the FP7 Oceans of Tomorrow call. The project has a goal of making a multi-parameter sensor for insitu marine use, for a number of key biogeochemical parameters, including pH, nutrients and trace contaminants. Now in its third year the SenseOCEAN team have made significant advances at the individual sensor level and are moving towards a de facto standard for true 'plug and play' multifunctional sensor development and operation; through a shared system of data management, power and resource management and communication both with the individual sensors on the sensor package and the wider world using standardized data output via the Iridium system.

The team has continued to push the sensors along the technology readiness level, with the aim to make the sensors commercially available as soon as possible. They have developed electrochemical sensors for nitrous oxide, phosphate, oxygen and silicate. New optodes for pH, CO_2, O_2 and ammonia have also been developed and in a significant step, a multi-analyte optode system has been designed.

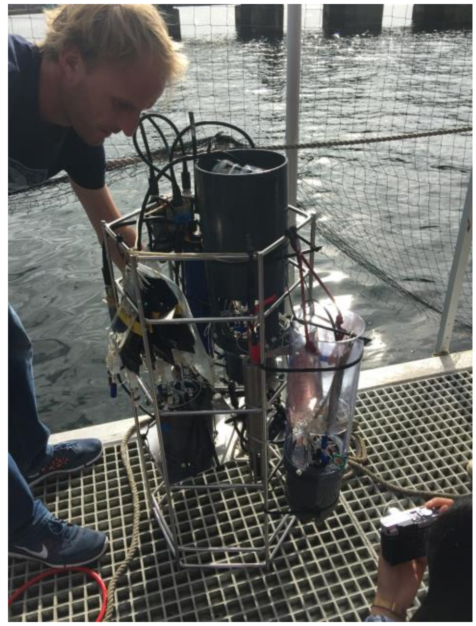

Fig 5. The fully integrated system as deployed on the pontoon in Kiel Harbour

There have been significant advances in the development of the suite of lab on chip (LOC) sensors, both in the range of analytes, (NO_3, NO_2, pH, Fe^{2+}, Fe^{3+} and PO_4) the sensitivity of the sensors and the miniaturization along with cost savings in their manufacture.

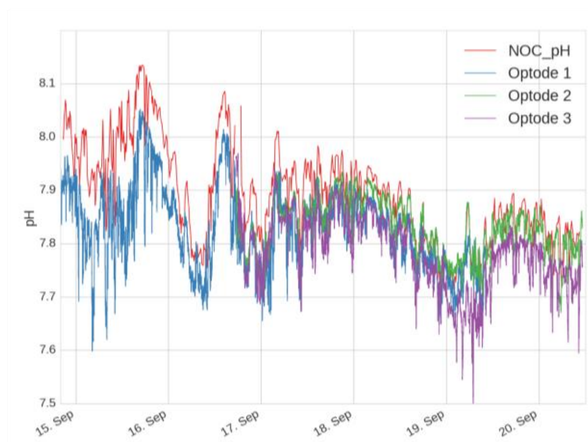

Fig 6. The unprocessed data from a seven-day deployment of 4 optodes and one LOC sensor for pH, the initial numbers of sensors deployed was increased of the testing period.

The team has just completed a wide-ranging testing exercise in Kiel, using a shore side pontoon and in the deeper waters of the Kiel fjord from research ship F.K. Littorina. This was the first test of a fully integrated multi-parameter sensor and the field results were extremely encouraging. A total of 7 sensors fully integrated into a single package (LOC - NO_3, PO_4, pH;

optode – pH, CO_2, O_2, NH_3 and Na) were tested along with stand alone sensors for silicate and nitrous oxide. The unprocessed data can be seen in Fig 6, showing pH measurements using 4 separate optodes and a LOC sensor. This data has not been corrected for environmental variables such as temperature and time offsets with the LOC system. In the final year of the project the project team has test deployments planned for Argo floats and a deep-sea observatory, along with gliders and further ship deployments.

Douglas Connelly

The Rationale, Design and Implementation Plan for Biogeochemical-Argo

The development of the Biogeochemical-Argo has been the topic of interest for the lion's share of our community. Therefore, we were happy to report a few months ago that a new draft document **'The Rationale, Design and Implementation Plan for Biogeochemical-Argo'** was released for community consultation. For those of you less familiar, Biogeochemical-Argo is an expansion of the Argo array of profiling floats by adding additional floats that are equipped with biogeochemical sensors for pH, oxygen, nitrate, chlorophyll, suspended particles, and downwelling irradiance.

The draft plan stems from the discussions held at a workshop on 11-13 January 2016, at the Laboratoire d'Océanographie de Villefranche, France. It has been prepared and reviewed by attendees of the Villefranche workshop and supported by the Argo Steering Team. It proposes tentatively to deploy 1,000 floats in the global oceans as the target size for a Biogeochemical-Argo array.

A summary of the report has also been presented at a variety of scientific meetings including:

- Global Climate Observing System Science Meeting, Amsterdam, 2-4 March 2016
- Argo Steering Team, Yokohama, 22-24 March 2016
- US OCB Summer Meeting, Woods Hole, 25-28 July 2016

A session at the US OCB Summer Meeting also reported on work being done in the Southern Ocean Carbon and Climate Observations and Modeling program (SOCCOM), which is one of several regional float arrays being operated around the globe. In many regards, these regional arrays serve as prototypes for a global array of profiling floats with biogeochemical sensors.

Comments on the Biogeochemical-Argo draft document were collected from wider community through the month of August by Ken Johnson (MBARI, US) and Hervé Claustre (LOV, France), and are now being considered for implementation.

The final document will be soon posted at the web site: http://biogeochemical-argo.org/.

Masao Ishii & Artur Palacz

G7 support for enhancement of multidisciplinary sustained global ocean observing system

The Science and Technology Ministers of the G7 (Canada, France, Germany, Italy, Japan, UK, US) and the European Commissioner for Research, Science and Innovation, met in Tsukuba City, Japan on May 15-17 to discuss science, technology and innovation aspects across global challenges such as health, energy, agriculture and the environment. In their communiqué, the G7 ministers support the enhancement of multidisciplinary sustained global ocean observing system, promote open data sharing infrastructure and call for an enhanced system of ocean assessments.

The G7 ministers acknowledged that the health of the oceans had rightly been recognized as a crucial economic development issue and thus included as the United Nations sustainable developments goal 14 (SDG 14): “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”. Therefore, to help achieve SDG 14, as well as other relevant goals of related conventions, the G7 ministers support taking the following actions:

- Support the development of an initiative for enhanced global sea and ocean observation required to monitor inter alia climate change and marine biodiversity, e.g. through the Global Argo Network and other observation platforms, while fully sustaining and coordinating with ongoing observation;
- Support an enhanced system of ocean assessment through the UN Regular Process to develop a consensus view on the state of the oceans, working to a regular timescale which would enable sustainable management strategies to be developed and implemented across the G7 group and beyond;
- Promote open science and the improvement of the global data sharing infrastructure to ensure the discoverability, accessibility, and interoperability of a wide range of ocean and marine data;
- Strengthen collaborative approaches to encourage the development of regional observing capabilities and knowledge networks in a coordinated and coherent way, including supporting the capacity building of developing countries; and
- Promote increased G7 political - cooperation by identifying additional actions needed to enhance future routine ocean observations.

The full Tsukuba Communiqué is available HERE.

In the attachment to the Tsukuba Communiqué, the G7 provides a series of recommendations based on the G7 expert workshop on Future of the Oceans and Seas. These recommendations are built on the Global Ocean Observing System approach with specific mention of individual observing networks like profiling floats, ships, moorings or gliders, the need to develop new observing technologies to support the implementation of the Essential Ocean Variables, and the need for more effective use of marine information gathered through observations. Furthermore, to advance G7 actions in this domain, the G7 ministers agreed to maintain the expert group as a future Working Group.

The full text of Attachment 2 to Tsukuba Communiqué is available HERE.

In response to the recommendations voiced by the G7 ministers, individual observing programs like GO-SHIP and non-governmental organizations like IAPSO, IUGG and SCOR provided their perspective on the research and monitoring needs related to issues outlined in the G7 communique. Such input is hoped to be considered by the G7 governments during follow-up actions in this domain.

Maciej Telszewski & Artur Palacz

Update on SOCAT Activities

SOCAT version 4 released!

In September the Surface Ocean CO_2 Atlas (SOCAT; www.socat.info) – a synthesis activity by the international marine carbon research community with more than 100 contributors - released its Version 4 product. SOCATv4 has 18.5 million quality-controlled, surface ocean fCO_2 (fugacity of carbon dioxide) observations with an accuracy of better than 5 µatm from 1957 to 2015 for the global oceans and coastal seas. It is also the first annual release using automated data upload.

Automation of data upload and initial data checks speeds up data submission and allows annual releases of SOCAT from version 4 onwards (Fig 7).

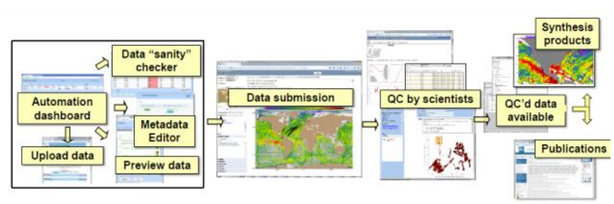

Fig 7. Data flow upon SOCAT automation from data upload, via submission to quality control and release of synthesis products. Source: www.ioccp.org/images/04aSynthSur/SOCAT_v4_release_poster.pdf

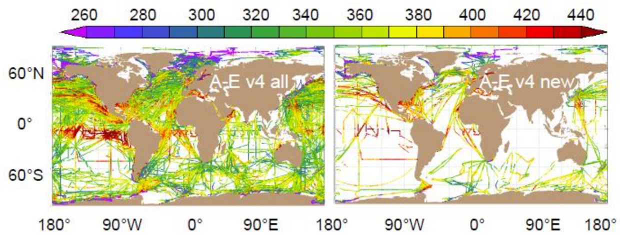

Fig 8. a) All and b) newly added quality controlled, surface water fCO_2 observations (μatm) in version 4.

Some key features of SOCATv4 are:

- Synthesis and gridded, quality controlled, observational products of surface ocean fCO_2 for the global oceans and coastal seas, (Fig 8),
  - V4 (2016): 18.5 million fCO_2, 1957 -2015,
  - V3 (2015): 14.5 million fCO_2, 1957 -2014,
  - V2 (2013): 10.1 million fCO_2, 1968 -2011,
  - V1 (2011): 6.3 million fCO_2, 1968 -2007,
  - with an accuracy for fCO_2< 5 μatm (flags of A-D, WOCE 2),
- Calibrated sensor data also available (<10 μatm, flag of E),
- During quality control (QC), scientists assign a flag to each data set (see Table 1 below) and WOCE flags of 2 (good), 3 (questionable) and 4 (bad) to fCO_2 values.
- QC criteria in v4 are similar to v3.
- Sea surface temp. and salinity not QC-ed.
- Atmospheric CO_2 measurements accepted (no QC yet);
- Additional surface water parameters accepted (no QC),
- There is no sustained funding for SOCAT

Table 1. Data set quality control flags in versions 3 and 4. All criteria need to be met for assigning a flag of A to E. A flag of E is mainly for alternative sensor data with adequate calibration. Other data set flags are S (suspend) and X (exclude).

	A	B	C	D	E
Accuracy of fCO_2 values (μatm)	<2	<2	<5	<5	<10
High-quality cross-over	yes	no	(no)	(no)	no
Followed approved methods / Standard Operation Procedures	yes	yes	yes/ no	yes/ no	no
Metadata complete	yes	yes	yes	no	yes
Data quality control acceptable	yes	yes	yes	yes	yes

Source: www.ioccp.org/images/04aSynthSur/SOCAT_v4_release_poster.pdf

SOCAT enables quantification of the ocean carbon sink and ocean acidification and evaluation of ocean biogeochemical models. SOCAT represents a milestone in research coordination, data access, biogeochemical and climate research and in informing policy.

To download the synthesis and gridded products of SOCATv4, please navigate to the 4th button on the left hand side of www.socat.info site. Access to the online viewers for version 4 is now also enabled.

The SOCAT Team kindly requests that you follow the SOCAT Fair Data Use Statement by generously acknowledging the contribution of SOCAT scientists by invitation to co-authorship, especially for data providers in regional studies.

Below are also the key dates for the next annual release:

- Submission of data for version 5 ends 15 January 2017.
- Quality control for version 5 ends 31 March 2017.

A new article highlights the wide scientific impact of SOCAT

Also in September we saw the publication of the SOCAT version 3 article in the Earth System Science Data (ESSD; open-access journal) entitled: “A multi-decade record of high-quality fCO_2 data in version 3 of the Surface Ocean CO_2 Atlas (SOCAT).”

This ESSD "living data" publication documents the methods and data sets used for the assembly of SOCATv3 data collection and compares these with those used for earlier versions of the data collection (Pfeil et al., 2013; Sabine et al., 2013; Bakker et al., 2014).

This paper also discusses the importance of SOCAT by highlighting its citation in three categories of high-impact reports (Fig 9), notably:

- reports on ocean observing systems,
- assessments of climate change and global carbon budgeting, including carbon observing strategies, and
- ocean acidification studies.

Moreover, SOCAT is used for a variety of scientific applications, some of which suggest a wider relevance for SOCAT data products than foreseen during the project’s creation (IOCCP, 2007). These include:

- figures of surface ocean CO_2 observations;
- use of SOCAT tools and protocols;
- use of surface ocean fCO_2 in diverse environmental studies;
- model–data comparison, model evaluation and data assimilation;
- detection of ocean acidification trends;
- regional process studies of surface ocean fCO_2;
- quantification of coastal ocean carbon sinks and sources;
- quantification of the ocean carbon sink and its variation;
- quantification of the land carbon sink.

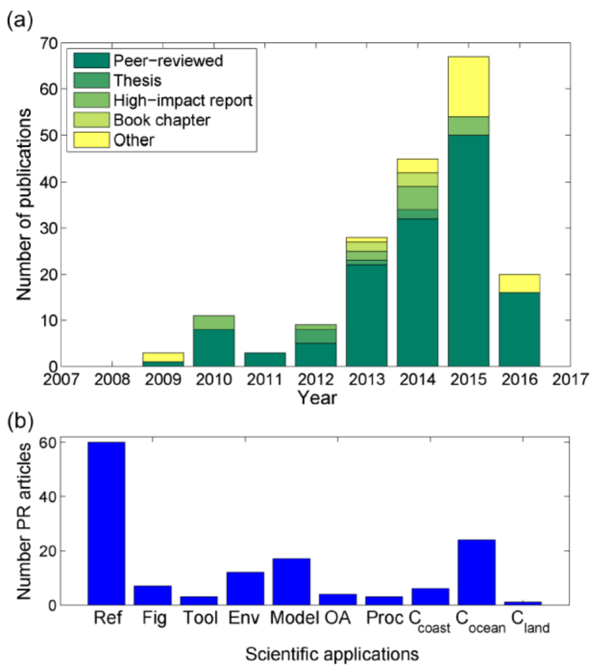

Fig 9. Number of publications citing or naming SOCAT per year by type of publication and (b) scientific applications of SOCAT in peer-reviewed, scientific articles. The number of publications in 2016 only includes publications before 22 April 2016. From: Bakker et al. (2016).

Types of publications included in the analysis are peer-reviewed, scientific articles, PhD and MSc theses, high-impact reports, book chapters and all other publications. Scientific applications in peer-reviewed, scientific articles are grouped as reference (only) to the SOCAT data synthesis; use of figures or tools based on SOCAT; use of surface ocean fCO_2 values for various environmental studies; modelling; trend analysis in ocean acidification studies; fCO_2 process studies; and carbon budgeting of coastal seas, open ocean and land systems. A list of publications citing or naming SOCAT is available on from: www.socat.info/publications.html.

The ESSD article can be downloaded as PDF from: http://www.earth-syst-sci-data.net/8/383/2016/essd-8-383-2016.pdf

Please cite the paper as:

Bakker, D. C. E., Pfeil, B., Landa, C. S., Metzl, N., O'Brien, K. M., Olsen, A., Smith, K., Cosca, C., Harasawa, S., Jones, S. D., Nakaoka, S.-I., Nojiri, Y., Schuster, U., Steinhoff, T., Sweeney, C., Takahashi, T., Tilbrook, B., Wada, C., Wanninkhof, R., Alin, S. R., Balestrini, C. F., Barbero, L., Bates, N. R., Bianchi, A. A., Bonou, F., Boutin, J., Bozec, Y., Burger, E. F., Cai, W.-J., Castle, R. D., Chen, L., Chierici, M., Currie, K., Evans, W., Featherstone, C., Feely, R. A., Fransson, A., Goyet, C., Greenwood, N., Gregor, L., Hankin, S., Hardman-Mountford, N. J., Harlay, J., Hauck, J., Hoppema, M., Humphreys, M. P., Hunt, C. W., Huss, B., Ibánhez, J. S. P., Johannessen, T., Keeling, R., Kitidis, V., Körtzinger, A., Kozyr, A., Krasakopoulou, E., Kuwata, A., Landschützer, P., Lauvset, S. K., Lefèvre, N., Lo Monaco, C., Manke, A., Mathis, J. T., Merlivat, L., Millero, F. J., Monteiro, P. M. S., Munro, D. R., Murata, A., Newberger, T., Omar, A. M., Ono, T., Paterson, K., Pearce, D., Pierrot, D., Robbins, L. L., Saito, S., Salisbury, J., Schlitzer, R., Schneider, B., Schweitzer, R., Sieger, R., Skjelvan, I., Sullivan, K. F., Sutherland, S. C., Sutton, A. J., Tadokoro, K., Telszewski, M., Tuma, M., van Heuven, S. M. A. C., Vandemark, D., Ward, B., Watson, A. J., and Xu, S.: A multi-decade record of high-quality fCO_2 data in version 3 of the Surface Ocean CO_2 Atlas (SOCAT), Earth Syst. Sci. Data, 8, 383-413, doi:10.5194/essd-8-383-2016, 2016.

Artur Palacz & the SOCAT Team

Upcoming Events

- Ocean Optics XXIII, 23-28 October 2016, Victoria, BC, Canada; https://tosmc.memberclicks.net/ooxxiii-home; abstract submission closed.
- Pan Ocean Remote Sensing Conference (PORSEC), 3-11 November 2016, Fortaleza, Brazil, http://porsec2016.virtual.ufc.br/; abstract submission closed.
- North Pacific Marine Science Organization (PICES) 25th Annual Meeting, November 2-13, 2016, San Diego, CA, USA,

http://meetings.pices.int/meetings/annual/2016/pices/scope; abstract submission closed.

- Setting Targets for Biogeochemical Observing System in the Atlantic – H2020 AtlantOS workshop, 29 Nov. – 1 Dec. 2016, Sopot, Poland; website; by invitation only.

- AGU Fall Meeting 2016, 12-16 December 2016, San Francisco, CA, US; http://fallmeeting.agu.org/2016/; abstract submission closed.

- 12th Session of the IOCCP SSG, 6-7 February 2017, Miami, FL, USA; by invitation only.

- Implementation of Multi-Disciplinary Sustained Ocean Observations (IMSOO) workshop, 8-10 February 2017, Miami, FL, US; website; by invitation only.

- ASLO 2017 Aquatic Sciences Meeting: Mountains to the Sea; 26 Feb – 3 Mar 2017, Honolulu, Hawaii, US; https://www.sgmeet.com/aslo/honolulu2017/default.asp; abstract submission closed.

- 10th International Carbon Dioxide Conference, 21-25 August 2017, Interlaken, Switzerland; http://www.icdc10.unibe.ch/; Abstract submission deadline: **28 February 2017**.

The IOCCP Conveyor is edited by Maciej Telszewski (m.telszewski@ioccp.org) and Artur Palacz (a.palacz@ioccp.org)