

Report for the year 2016 and future activities

SOLAS Norway

compiled by: Siv K. Lauvset

PART 1 - Activities from January 2016 to Jan/Feb 2017

1. Scientific highlight

Omar et al.(2016) determined, for the first time, the seasonal changes and controlling processes of ocean acidification parameters across western Norwegian fjords, based on data obtained mainly with sensors on board a commercial ship, M/S *Trans Carrier*, in 2005–2009. The study fills an important gap in our knowledge on ocean acidification in western Norwegian fjords, which are important ecosystems: important recreation areas, marine pathways, and spawning grounds for different fish species.

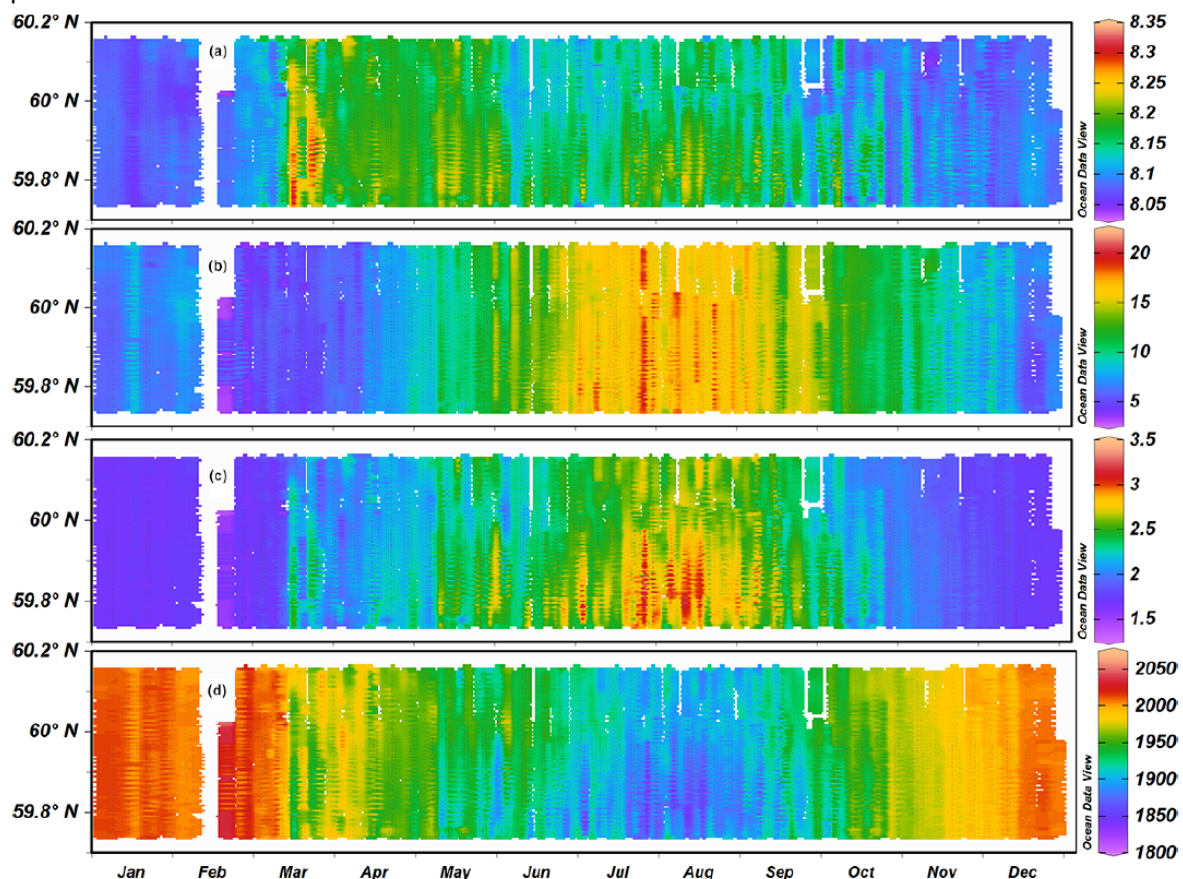


Figure1. a) estimated pH, b) SST, c) estimated Ω_{Ar} , d) estimated $DIC_{S=30.5}$. All data from 2005-2009 have been condensed into one virtual year.

Reference: Omar, A. M., I. Skjelvan, S.R. Erga and A. Olsen, 2016: Aragonite saturation states and pH in western Norway fjords: seasonal cycles and controlling factors, 2005-2009, *Ocean Sci.*, 12, 937-951, 2016. doi:10.5194/os-12-937-2016.

A determination of possible ocean carbon cycle parameter changes under glacial low CO₂

conditions (including alterations in rain ratio, Redfield ratio, solubility of CO₂, dust input, and circulation changes) was carried out with a combination of forward and inverse modelling and a comprehensive data base of paleoceanographic data. Reference: Christoph Heinze, Babette A. A. Hoogakker, and Arne Winguth, Ocean carbon cycling during the past 130000 years – a pilot study on inverse palaeoclimate record modelling *Clim. Past*, 12, 1949–1978, 2016, www.clim-past.net/12/1949/2016/ doi:10.5194/cp-12-1949-2016.

2. Activities/main accomplishments in 2016 (projects, field campaigns, events, model and data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, etc.)

In 2016, the Research Council of Norway funded ICOS-Norway (the Norwegian branch of the European research infrastructure ICOS RI) and the European central facility Ocean Thematic Centre (OTC) with a generous grant to (i) upgrade the Norwegian research infrastructure for observing carbon uptake in the ocean, on land, and in the atmosphere, and (ii) establish and coordinate OTC on a European scale.

The objectives of the OTC are:

- Provide comprehensive coordination of the ICOS marine carbon cycle observing network by providing technical support for observations and data management
- Set and maintain the quality standards of CO₂ measurements in marine ICOS through labelling of stations, training, and data quality control
- Collaborate with the Carbon Portal for uniform data handling, quality control, and storage in line with standards established across the international community
- Collaborate with members of the ICOS Research Infrastructure to produce monthly, seasonal, and interannual maps of CO₂ sources and sinks in Europe and the adjacent seas
- Collaborate with the Central Analytical Laboratory to analyse flask samples
- Ensure high quality calibrations of gas standards for oceanic measurements in collaboration with the Central Analytical Laboratory

Objectives of ICOS-NORWAY is to:

- Implement a long-term research infrastructure that will provide accurate data on, and integrated assessments of, the Norwegian carbon balance at regional scale, and across land, ocean and atmosphere.
- Be an integral part of pan European ICOS RI.

For further info visit the project web webpages:

<https://otc.icos-cp.eu>

<https://no.icos-cp.eu>

Research cruise to the Greenland Sea, 75°N (2-13 August) with full-depth sampling of hydrography, inorganic carbon (DIC and TA), oxygen, transient tracers (CFC-12 and SF₆), and δC¹³. In addition underway surface measurements of pCO₂ and O₂/Ar.

3. Top 5 publications in 2016 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Fröb, F., Olsen, A., Våge, K., Moore, G.W.K., Yashayaev, I., Jeansson, E., Rajasakaren, B., 2016. Irminger Sea deep convection injects oxygen and anthropogenic carbon to the ocean interior. *Nature Communications* 7, 13244, doi: 10.1038/ncomms13244.

Christoph Heinze, Babette A. A. Hoogakker, and Arne Winguth, Ocean carbon cycling during the past 130000 years – a pilot study on inverse palaeoclimate record modelling *Clim. Past*, 12, 1949–1978, 2016, www.clim-past.net/12/1949/2016/ doi:10.5194/cp-12-1949-2016

Omar, A. M., I. Skjelvan, S.R. Erga and A. Olsen, 2016: Aragonite saturation states and pH in western Norway fjords: seasonal cycles and controlling factors, 2005-2009, *Ocean Sci.*, 12, 937-951, 2016. doi:10.5194/os-12-937-2016

Schwinger, Jörg; Goris, Nadine; Tjiputra, Jerry; Kriest, Iris; Bentsen, Mats; Bethke, Ingo; Ilicak,

Mehmet; Assmann, Karen Margarete; Heinze, Christoph Evaluation of NorESM-OC (versions 1 and 1.2), the ocean carbon-cycle stand-alone configuration of the Norwegian Earth System Model (NorESM1). [Geoscientific Model Development](#) 2016 ; Volume 9 (8). s. 2589-2622, doi:10.5194/gmd-9-2589-2016

Gharamti, M. E., J. Tjiputra, I. Bethke, A. Samuelsen, I. Skjelvan, M. Bentsen, and L. Bertino (2017), Ensemble data assimilation for ocean biogeochemical state and parameter estimation at different sites, *Ocean Model.*, 112, 65-89, doi:<http://dx.doi.org/10.1016/j.ocemod.2017.02.006>.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2016? If yes, who? How did you engage?

Christoph Heinze participated in the Workshop on the Development of an Integrated Ocean Research Network. Venue: Kiel, Germany. Dates: 4-5 December 2016. He co-lead a breakout group (Group #3 Oceanic thresholds and save operating spaces, Thorsten Blenckner; Christoph Heinze).

PART 2 - Planned activities from 2017/2018 and 2019

1. Planned major field studies and collaborative laboratory and modelling studies, national and international (incl. all information possible, dates, locations, teams, work, etc.)

Participation in a research cruise to the Greenland and Iceland Seas in Spring 2018 (coordinated by WHOI; Bob Pickart).

Intercalibration activity of pCO₂ and related sensors (details in development). Coordinated within the ICOS Ocean Thematic Centre network.

2. Events like conferences, workshops, meetings, schools, capacity building etc. (incl. all information possible)

Christoph Heinze is member of the Scientific Steering Committee for the 10th International Carbon Dioxide Conference to be held in Interlaken, Switzerland, 21-25 August 2017
<http://www.icdc10.unibe.ch/>

Our collaboration with and capacity building at the Red Sea University in Port Sudan, Sudan continues (funded by EU through SEACRIFROG). This will include field work in the Red Sea in 2018 (plans are being developed).

3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 Science Plan and Organisation (downloadable from the SOLAS website) the activity topics relate – including the core themes and the cross cutting ones)

ICOS Norway and OTC (see part 1) (Themes 1 and 2).

RINGO: Readiness of ICOS for Necessities of Integrated Global Observations. An EU Horizon 2020 project aiming to further develop and foster sustainability of the ICOS RI and the ICOS ERIC (Themes 1 and 2).

SEACRIFROG: Supporting EU-African Cooperation on Research Infrastructures for Food Security and Greenhouse Gas Observations. An EU Horizon 2020 project where UNI and UiB (both in Bergen, Norway) are responsible for Task 4.3: "Harmonization of data collection and quality control"

EXPECT – Exploring the Potential and Side Effects of Climate Engineering ('Geoengineering theme') – ends mid-2017

INTAROS - Integrated Arctic Observing System (Themes 1 and 2)

**4. Plans / ideas for future projects, programmes, proposals national or international etc.
(please precise to which funding agencies and a timing for submission is any)**

5. Engagements with other international projects, organisations, programmes etc.

Siv K. Lauvset was chosen as a new member of the IOCCP scientific steering committee.

Comments

No input was given from other groups in Norway, so the above report summarize the activities of the research community in Bergen only.