

2022 Report of the Section on *Carbon and Climate*

A virtual meeting of the Section on *Carbon and Climate* (S-CC) was held virtually from 17:00–20:00 on August 23, 2022 (US/Canada Pacific time). Drs. Alex Kozyr and Tsuneo Ono acted as meeting co-chairs. Ten members were present, representing Canada, China Japan, Korea, and the US (*S-CC Endnote 1*).

AGENDA ITEM 1

Confirmation of member exchange and adoption of agenda

Dr. Ono introduced new member, Dr. Masahide Wakita (Japan), who was formally appointed to S-CC in January 2022, replacing Dr. Akihiko Murata. The meeting agenda was slightly modified and adopted by the members (*S-CC Endnote 2*).

AGENDA ITEM 2

Progress report of “inventory table” for coastal OA/deoxygenation monitoring sites

Dr. Ono reported progress on the construction of an inventory table of domestic OA/deoxygenation monitoring sites in each PICES member country, a program launched in 2020 as one of S-CC’s new activities. Information on coastal monitoring sites, including carbon parameters and oxygen in the US, Canada, Japan and Korea has been properly uploaded to the PICES TCODE catalog homepage¹. Chinese members, Drs. Zhongyong Gao and Xianghui Guo, reported that they are now consulting with other Chinese scientists for submission of their $p\text{CO}_2$ and oxygen data along the Chinese coast for next year’s meeting.

AGENDA ITEM 3

Reports from collaborating organizations and agencies

Dr. Ono presented a report on the Surface Ocean CO_2 Atlas (SOCAT) that was prepared by Dr. Shin-ichiro Nakaoka, who, unfortunately, could not attend the meeting. SOCAT v.2022 was published on June 14. The new version includes 33.7 million $f\text{CO}_2$ data obtained from 1957 to 2021 with accuracy of $< 5 \mu\text{atm}$ were included, as well as 6.4 million measurements with an accuracy of $< 10 \mu\text{atm}$. Although, $f\text{CO}_2$ observations are sparse in some regions, especially in the eastern South Pacific, both the North Pacific and North Atlantic regions are now generally filled with measurements. Members discussed possible collaboration between the BGC Argo group and SOCAT to fill the geographical gap of data coverage in the South Pacific.

Dr. Kozyr reported on the recent release of GLODAPv2.2022 which contains 1.4 million water samples collected on 1085 cruises, of which data from 96 new cruises were added. Many S-CC members have contributed to GLODAPv2.2022: Alin, Feely, Ishii, Kozyr, and Suzuki are the co-authors of a paper describing GLODAPv2.2022, submitted to the journal *Earth System Science Data*. Dr. Kozyr also introduced the recent release of CODAP-NA: An integrated database of discrete carbon measurements in the coastal area of the North American continent. Four S-CC members: Alin, Feely, Hales, and Kozyr contributed to the construction and release of this database. This new coastal database contains 3,391 profiles at present, and the CODAP group is aiming to increase the numbers further in the planned next release of the dataset in 2023.

¹ <http://tcode.tinro.ru/geonetwork/srv/eng/catalog.search#/home>

Dr. Masao Ishii introduced recent progress of Integrated Ocean Carbon Research (IOC-R). Possible collaboration between IOC-R and the DOOS group was discussed.

Finally, Dr. Ono provided follow-up information on the ISO/DIS “5667-26 “Guidance on sampling for the parameters of the oceanic carbon dioxide system”, in which a different protocol from that of PICES Special Publication 3 “Guide to Best Practices for Ocean CO₂ Measurements” was adopted for the poisoning of the water samples. The scientific review of this new draft of international standard (DIS) has finished, and a final draft (FDIS: <https://www.iso.org/standard/78376.html>) was released for the public in November 2022. S-CC will follow the community’s response to this new water sampling standard as well as the traditional one (PICES Special Publication 3).

AGENDA ITEM 4

Deep Ocean Observing Strategy (DOOS)

Project Director, Dr. Leslie Smith, introduced the Deep Ocean Observing Strategy (DOOS), a UN-decade endorsed international program that coordinates deep ocean observing and modeling to understand the current deep ocean status and its responses to climate change. They are now operating several working groups, including the definition of essential ocean variables for deep ocean observation in coordination with GOOS, development of shared best practices, standards, and cross-calibration procedures in coordination with Ocean Practices, construction of coordinated models for observing system assessment and design, and assessment of observational gaps for understanding climate change in deep ocean. Possible future collaboration between PICES and DOOS was discussed. Inclusion of methane measurement in GO-SHIP cruises was pointed as the most effective approach, and several ideas for its implementation were suggested by the members. It was also pointed out that PICES and DOOS could collaborate in the areas of sea-mount ecosystem studies, as well as the continental slope ecosystem survey.

AGENDA ITEM 5

Travel support for 2023 GOOD-OARS summer school

A financial support request sent to PICES for a Global Ocean Oxygen Decade–Global Acidification Research for Sustainability (GOOD-OARS) international summer school was discussed by S-CC members. S-CC recommends PICES to support this summer school.

AGENDA ITEM 6

Plans for 2022–2023

S-CC had proposed a topic session for the Fifth Symposium on “*Effects of Climate Change on the World’s Ocean*” (ECCWO5, April 17–21, 2023, Bergen, Norway) regarding ocean acidification and ocean deoxygenation next year. This proposal was synthesized into two ECCWO5 sessions for ocean acidification (Session 19) and ocean deoxygenation (session 11) in conjunction with several other acidification- and deoxygenation- related proposals. S-CC also submitted a topic session proposal for PICES-2023 titled “Ocean acidification and deoxygenation in ocean margin: its multiple causes and consequences for ecosystems and fisheries” (*S-CC Endnote 3*) to its parent committees (POC and BIO), which was approved by Science Board.

S-CC Endnote 1**S-CC participation list**Members

Alexander Kozyr (USA, Co-Chair)
 Tsuneo Ono (Japan, Co-Chair)
 James Christian (Canada)
 Zhongyong Gao (China)
 Xianghui Guo (China)
 Masao Ishii (Japan)
 Masahide Wakita (Japan)
 Toru Suzuki (Japan)
 Geun-Ha Park (Korea)
 Samantha Siedlecki (USA)

Members unable to attend

Canada: Wiley Evans
 China: Liqi Chen, Liyang Zhan, Yumei Zhao
 Japan: Shin-ichiro Nakaoka
 Korea : Kitack Lee, Jeong Hee Shim
 Russia: Andrey Andreev, Pavel Ya. Tishchenko
 USA: Simone Alin, Andrew Dickson, Richard A. Feely, Hernan Eduardo Garcia, Burke Hales

Observer

Leslie Smith (DOOS)

S-CC Endnote 2**S-CC meeting agenda**

17:00 – 2000 Aug. 23 in US/Canada Pacific time, held on virtually

1. Confirmation of member exchange and adoption of agenda
2. Progress report of “inventory table” for coastal OA/deoxygenation monitoring sites (Ono)
3. Reports from collaborating organizations and agencies
 - GLODAP (Kozyr)
 - CODAP-NA (Kozyr)
 - SOCAT (Ono in place of Nakaoka)
 - IOC-R & IPCC IR6 (Ishii)
 - ISO/DIS 567-26 (Christian)
4. Introduction of Deep Ocean Observing Strategy (DOOS) with discussion for possible collaboration (Smith)
5. Discussion for travel support for 2023 GOOD-OARS summer school
6. Discussion for 2022–2023 section business plans
 - High CO₂ World symposium
 - Fifth symposium on Effects of Climate Change on the World’s Ocean (ECCWO5)
 - New session in PICES-2023

S-CC Endnote 3

**Proposal for a Topic Session on
“*Ocean acidification and deoxygenation in ocean margin:
its multiple causes and consequences for ecosystems and fisheries*”
at PICES-2023**

Convenors: Tsuneo Ono, Japan, Alexander Kozyr, USA,

Duration: 1 day

Ocean acidification and deoxygenation are well documented in open ocean waters, but also affect ocean margins including coastal waters. The causes of these changes, however, are far more complex than in open ocean waters. Interaction of open ocean waters and coastal waters along ocean margins creates further complex variations, most of which have not been well documented by current ocean monitoring. Responses of ocean margin ecosystems to acidification and deoxygenation can also be different from the open ocean because species in ocean margin ecosystems are adapted to a wide range of natural pH/oxygen variation. Complex water-mass dynamics along ocean margins can also generate locally-specific pH/oxygen environments, that can either act as refuges or as areas of enhanced impact. This session aims to gather information on observed or projected changes in pH and oxygen concentration on ocean margins including coastal areas, its causes and interaction with the open ocean, biological responses, and consequences to fisheries.