

## Report of the Section on *Carbon and Climate*

The meeting of the Section on *Carbon and Climate* (S-CC) was held from 14:00-18:00 on October 19, 2019 at the PICES Annual Meeting in Victoria, Canada. Drs. James Christian and Tsuneo Ono acted as the meeting Chairs. Six members were present, representing Canada, Japan, Korea and the US (*S-CC Endnote 1*). The meeting agenda was adjusted to involve discussion of a proposed new working group (*S-CC Endnote 2*).

### AGENDA ITEM 2

#### **Presentation of PICES Special Publication 5**

[PICES Special Publication 5](#) on “*Ocean Acidification and Deoxygenation in the North Pacific Ocean*” was published on September 12, 2019. Outreach to other science communities as well as effective use within the PICES community were discussed. S-CC made a presentation about this publication at the GOA-ON international workshop Hangzhou in April 2019 (see Agenda Item 3), and posted a brief notice on this publication to IOCCP and SOLAS. Ocean Carbon and Biogeochemistry (OCB) and Future Earth were indicated as additional targets of advertisement. S-CC will send brief notices to their newsletters. Since this publication includes information on acidification data inventories in several PICES member countries, some scientists have started personal data exchange based on this information. S-CC will support such activities by mediating among data holders.

### AGENDA ITEM 3

#### **Progress on sensor intercomparison activities**

Dr. Ono gave a brief report on planned and ongoing activities regarding intercalibration of pH and  $p\text{CO}_2$  sensors, which were outlined in the [S-CC 2017 Annual Report](#). Attempts to obtain funding for a sensor intercomparison experiment have so far been unsuccessful. A new proposal will be submitted this year, mainly to cover travel costs of scientists within Japan. A request for funds for foreign scientists will be submitted in 2020, and the first experiment will be conducted in 2021 if these applications are successful.

A report on the workshop hosted by Ocean Networks Canada in Victoria, Canada, in February 2018 (see [S-CC 2018 Annual Report](#)) has been accepted for publication in *Frontiers in Marine Science*. Four S-CC members attended and are co-authors on the publication. The full citation is Sastri, A.R., J.R. Christian, E.P. Achterberg, D. Atamanchuk, J.J.H. Buck, P. Bresnahan, P.J. Duke, W. Evans, S.F. Gonski, B. Johnson, S.K. Juniper, S. Mihaly, L.A. Miller, M. Morley, D. Murphy, S.-I. Nakaoka, T. Ono, G. Parker, K. Simpson, and T. Tsunoda, 2019. Perspectives on *in situ* sensors for ocean acidification research. *Front. Mar. Sci.* doi:10.3389/fmars.2019.00653; the paper is available at <https://www.frontiersin.org/articles/10.3389/fmars.2019.00653/full>.

### AGENDA ITEM 4

#### **Review of activities over previous year**

An International Symposium on “Ocean Acidification - Dialogues between Scientists and Stakeholders” was held by the Ocean Policy Research Institute (OPRI), Japan, on the day after the S-CC meeting at the 2018 Annual Meeting (October 28, 2018). Four S-CC members participated as invited speakers or panelists. Although the details of this symposium have already been described in the S-CC 2018 Annual Report, Dr. Christian gave a brief report on this symposium for the benefit of those who were not present.

Dr. Ono gave a brief report on 4<sup>th</sup> Global Ocean Acidification Observing Network (GOA-ON) International Workshop held April 14–17, 2019 in Hangzhou, China (see [pp. 7–10](#) in PICES Press 2019, Vol. 27, No. 2). PICES co-sponsored this symposium, supporting travel costs of two young scientists from Canada and China. Dr. Ono attended this symposium and made a presentation about the forthcoming PICES Special Publication on ocean acidification and deoxygenation (Agenda Item 2). Discussions of personal ocean acidification data exchange among PICES member countries also took place at this symposium.

PICES also sponsored the SOLAS Open Science Conference held in Sapporo April 21–25, 2019. Dr. Lisa Miller outlined several major themes and accomplishments. It was recognized that atmospheric deposition makes a considerable contribution to biological production in the North Pacific. To address this topic further, SOLAS will propose a topic session on “Atmospheric nutrient deposition” at PICES-2020. S-CC will express strong support for this session in the parent committees.

#### AGENDA ITEM 5

##### **Discussion on new working group “Ocean Negative Carbon Emissions”**

Dr. Rui Zhang presented an outline for a proposed new working group on “Ocean Negative Carbon Emissions (ONCE),” to be submitted to Science Board for approval. This working group is proposed as a successor to the PICES/ICES Working Group (WG 33) on *Climate Change and Biologically-driven Ocean Carbon Sequestration*, focusing on the contribution of the “microbial carbon pump” as well as carbon sequestration in coastal areas caused by terrestrial nutrient sources. This WG (like WG 33) would be joint between PICES and ICES; the proposal has already been approved by ICES. It was generally agreed that this working group, like WG 33, could be an effective complement to S-CC, as it focuses on processes in the ocean that S-CC has little expertise in. Some S-CC members expressed concern that the proposed terms of reference (TOR) were too broad, and that it was difficult to understand what the specific goals are. Especially, it was suggested that the proponents of the new working group clarify that their focus is “biologically-based” negative carbon emissions, and that non-biological processes (*e.g.*, CO<sub>2</sub> absorption by the ocean as a consequence of local change in circulation) are not within its scope. The proponents agreed to modify the proposed TOR following these suggestions before submitting the official proposal.

#### AGENDA ITEM 6

##### **Reports of collaborating organizations and agencies**

Dr. Miller gave a brief update on SOLAS, including the SOLAS Open Science Conference in 2019 and a topic session proposal for PICES-2020 (see Agenda Item 4). At the Open Science Conference, a 1-day workshop was held on geoengineering where potential benefits and risks of several geoengineering technologies were examined. Such discussions will become more widespread in the future, and PICES can perhaps address this topic via new working groups such as ONCE (see Agenda Item 5).

Dr. Alexander Kozyr presented an update on the Carbon Dioxide Information and Analysis Center (CDIAC) data transfer to NOAA/NCEI’s new Ocean Carbon Data System (OCADS) Project. All data formerly archived in CDIAC have been successfully transferred to OCADS. Dr. Kozyr reconstructed essentially the same web site that was at CDIAC that is now open to the public at [OCADS](#).

The International Ocean Carbon Coordination Project (IOCCP) has created a study group for regular updating of GLODAPv2. Several S-CC members are involved in GLODAP (Global Ocean Data Analysis Project) updates (Drs. Richard Feely, Masao Ishii, Alexander Kozyr, Akihiko Murata and Toru Suzuki). They made the first update of GLODAPv2 as [GLODAPv2.2019](#) that was published by the Ocean Carbon Data System (OCADS) in September 2019. GLODAPv2.2019 contains 116 new cruises not included in the previous

version, and extends time coverage from 2013 to 2017. The adjustment table for all core variables was updated in GLODAPv2.2019 to include these new cruises. As a result, some adjustments in GLODAPv2.2019 differ from those in the Pacific Ocean Interior Carbon Database (PACIFICA). The potential impact of the modification of the adjustment table was discussed by S-CC. It was suggested that the basin-scale view of horizontal nutrient distribution (especially silicate) in deep waters might be different between GLODAP2/PACIFICA and GLODAPv2.2019.

Dr. Ono presented an update on SOCAT (Surface Ocean CO<sub>2</sub> Atlas) based on materials provided by Dr. Shin-ichiro Nakaoka. SOCAT v2019 was released in June 2019. Around 25.7 million *f*CO<sub>2</sub> data points with accuracy less than 5  $\mu$ atm were collected, covering years from 1957 to 2019. An additional 1.7 million data points with accuracy less than 10  $\mu$ atm, mostly collected by sensors, were also included. Data submission for the next version (SOCAT v2020) will close on January 15, 2020. SOCAT was cited by over 260 peer-reviewed papers in 2019.

During the S-CC meeting at PICES-2018, Drs. Ishii and Miller had reported on a new carbon-focused international “Think Tank”. A new IOC working group was established, entitled the Working Group on Integrated Ocean Carbon Research, with several S-CC members among its proposed membership.

The Tropical Pacific Observing System 2020 (TPOS2020) is an international project sponsored by the Global Ocean Observing Network (GOOS) to develop effective and sustainable observation systems in the tropical ocean. Several S-CC members (Drs. Feely, Ishii, Kitack Lee, and Murata) are involved in its Biogeochemistry Task Team. In May 2019, TPOS released its second report, updating information on biogeochemical and ecosystem observations in the TPOS region. Although the TPOS region does not overlap with the core region of PICES (north of 30°N), S-CC will maintain contact via liaison members.

#### AGENDA ITEM 7

##### **Further discussion of Section business**

Dr. James Christian (Canada) has stepped down as Co-Chair of S-CC, having served since 2005. Dr. Alexander Kozyr (USA) was elected as a new S-CC Co-Chair. Dr. Ono will continue as Co-Chair to the end of his second term, in 2020.

Several other changes in membership were reported. Drs. Lisa Miller and Sophia Johannessen stepped down as members of S-CC in June 2019, so Dr. Christian is the only member from Canada at this moment. Drs. Minhan Dai also expressed his desire to step down from S-CC, and suggested appointment of Dr. Xianghui Guo (Xiamen University). This suggestion will be forwarded to China Governing Council representatives. Further possible membership turnover was discussed and will be continued at the next Annual Meeting, together with discussion of the future plans of S-CC.

S-CC has held topic sessions on ocean acidification approximately every other year, most recently in 2018. However, members opted not to propose a session for 2020. We will consider a session proposal for 2021 at PICES-2020.

PICES proposed a theme session entitled “Taking stock of ocean acidification research for provision of future efforts” at its ASC 2020 (September 7–10, 2020, Copenhagen, Denmark) and has requested that PICES co-convene this session. S-CC will recommend to its parent committees travel support for a convenor and an early career scientist to attend.

***S-CC Endnote 1***

**S-CC participation list**

Members

James Christian (Canada, Co-Chair)  
Tsuneo Ono (Japan, Co-Chair)  
Andrei Andreev (Russia)  
Alexander Kozyr (USA)  
Kitack Lee (Korea)  
Toru Suzuki (Japan)

Observers

Lisa Ann Miller (SOLAS)  
Rui Zhang (China)

Members unable to attend

China: Liqi Chen, Minhan Dai, Zhongyong Gao, Liyang Zhan, Yumei Zhao  
Japan: Masao Ishii, Akihiko Murata, Shin-ichiro Nakaoka  
Korea: Dong-Jin Kang, Jeong Hee Shim  
Russia: Pavel Ya. Tishchenko  
USA: Andrew Dickson, Richard A. Feely, Hernan Eduardo Garcia, Burke Hales

***S-CC Endnote 2***

**S-CC meeting agenda**

1. Opening, review and adopt agenda (Christian, Ono)
2. Presentation of PICES Special Publication 5 (Christian, Ono)
3. Progress on sensor intercomparison activities (Ono, Nakaoka, Christian)
4. Review activities over previous year (GOA-ON workshop in Hangzhou, OPRI International Symposium on Ocean Acidification, new IOC “Carbon Think Tank”, TPOS)
5. Discussion on new working group “Ocean Negative Carbon Emissions”
6. Reports of collaborating organizations and agencies
  - SOLAS (Miller)
  - OCADS (Kozyr)
  - GLODAPv2\_2019 (Kozyr)
  - SOCAT (Ono)
7. Further discussion of Section business (Membership, publications, future activities)
8. Adjourn