REPORT OF THE SECTION ON *CARBON AND CLIMATE*

The meeting of the Section on *Carbon and Climate* (CC-S) was held from 09:00–17:00 on October 26, 2007 at PICES XVII in Dalian, China. The meeting was attended by 9 members and 11 observers, with Drs. James Christian (Canada) and Toshiro Saino (Japan) acting as the meeting Co-Chairmen (*CC-S Endnote 1*). The agenda was adopted unanimously (*CC-S Endnote 2*).

AGENDA ITEM 2
Membership

A new member from China, Dr. Xiuren Ning, was introduced to the group. Dr. Liqi Chen is also a new member from China but did not attend. Appointment of additional new members from Japan was discussed. The appointment of Dr. Masao Ishii and Dr. Ahihiko Murata was recommended and subsequently approved by Governing Council. Dr. Shuichi Watanabe (Japan) has since resigned from membership in CC-S.

AGENDA ITEM 3
Journal of Oceanography special section

Results from Topic Session (S2) on "*Decadal changes in carbon biogeochemistry in the North Pacific*" convened by CC-S at PICES XVI in Victoria, Canada, are being published as a special section of the *Journal of Oceanography*. Submission deadline was August 31, 2008. To date, four manuscripts have been received and are under review. Publication is expected in early 2009.

AGENDA ITEM 3
Methods manual distribution and translation

Dr. Christian and Dr. Alex Kozyr gave an update on the distribution of the Guide to Best Practices for Ocean CO_2 Measurements, published just after the last meeting. Fifty copies have been distributed to national coordinators in Canada, China, Korea, and Russia. Drs. Kozyr (U.S.A.) and Toru Suzuki (Japan) are responsible for distribution of hardcopies in non-PICES countries. The manual is also freely available in electronic form from CDIAC.

One Standard Operating Procedure (SOP 8) has been translated into Spanish, which is now available at CDIAC. Dr. Tongsup Lee (Korea) has been coordinating translation of the guide into Korean, which is more than half completed.

AGENDA ITEM 4
Reports of collaborating organizations and agencies

Reports were given on several national and international programs relevant to the mandate of CC-S, including IOCCP (Kozyr), SOLAS (Uematsu), JP-GEOTRACES (Saino), and CarboOcean (Kozyr). Drs. Saino, Ishii, and Akira Nakadate reported on recent activities at JAMSTEC and JMA.

AGENDA ITEM 5
Report on "Oceans in a high-CO_2 world" Symposium

Dr. Ishii gave a brief report on the Second International Symposium on the "*Ocean in a high CO_2 world*", held in Monaco on October 6–9, 2008. A number of CC-S members who could not come to Dalian met there and discussed the Implementation Plan for CO_2 data synthesis (see Agenda Item 6 and *CC-S Endnote 4*).

AGENDA ITEM 6
Data synthesis

A final version of the Implementation Plan for data synthesis was presented and extensively discussed, revised, and approved by the membership (see *CC-S Endnote 4*). It had also been previously discussed in Monaco with several members unable to attend the meeting in Dalian. The date for closure of data submission in January 2009 was left unchanged. a second level QA/QC will begin at that time. A 1½-day carbon data synthesis workshop will be held at PICES-2009. The request for meeting room space and travel support for one scientist was requested and subsequently approved. There will also likely be an "unofficial" workshop held in March 2009 in Japan.

AGENDA ITEM 7
Future activities

A Topic Session will be held at PICES-2009 (see *CC-S Endnote 3*). A detailed proposal for the session description was presented and discussed by the members. The final version was presented at the POC and BIO meetings and subsequently approved by Science Board and Governing Council.

AGENDA ITEM 8
Consideration of latest draft Science Plan for FUTURE and the CC-S role in it

Dr. Hiroaki Saito from the FUTURE Science Plan Writing Team made a brief presentation of the current status of the Science Plan. The CC-S Terms of Reference were revised at PICES XVI and the members believe that these revisions are complementary to FUTURE goals. The beginning of FUTURE is expected to overlap the renewal of CC-S at the 5-year point of its existence and further revisions to the Terms of Reference will be considered at that time.

CC-S Endnote 1

CC-S participation list

Members	Observers
Andrey Andreev (Russia)	Alex Bychkov (PICES)
James Christian (Canada, Co-Chairman)	Rongshuo Cai (China)
Masao Ishii (Japan, appointed to membership November 2008)	Fei Chai (U.S.A.)
Alex Kozyr (U.S.A.)	Michael Dagg (U.S.A.)
Tongsup Lee (Korea)	Skip McKinnell (PICES)
Xiuren Ning (China)	Akira Nakadate (Japan)
Tsuneo Ono (Japan)	Hiroaki Saito (Japan)
Toshiro Saino (Japan, Co-Chairman)	Nobuo Tsurushima (Japan)
Toru Suzuki (Japan)	Mitsuo Uematsu (Japan)
	Elena Ustinova (Russia)
	Xiuhua Yan (China)

CC-S Endnote 2

CC-S meeting agenda

1. Review and adopt agenda, aims of the workshop
2. Discussion of CC-S membership, introduction of new members
3. CC-S activity report: integrated dataset, JO special volume, distribution of methods manual
4. Information exchange: IOCCP/GCP, SOLAS, JP-GEOTRACES, CarboOcean, JMA repeat hydrography activities, new JAMSTEC activities
5. Report from "Oceans in a high-CO_2 world" Symposium
6. Implementation Plan for data synthesis
7. Discussion of future activities: Publication of JO special volume, topic session for PICES-2009
8. Consideration of latest draft Science Plan for FUTURE and CC-S role in it?

CC-S Endnote 3

Proposal for a POC/BIO Topic Session at PICES-2009 on
"***Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific***"

Convenors: Toshiro Saino and James Christian

Accumulation of anthropogenic carbon and associated changes in ocean chemistry ("ocean acidification") affect all of the world's oceans. Anthropogenic CO_2 has multiple feedbacks to ocean chemistry and biology, such as reduction of calcification, shifts in phytoplankton species composition, and dissolution of particulate or sedimentary carbonates. The carbon system can also be affected by other anthropogenic factors such as changes in river flow and aeolian dust deposition. Carbon and nutrient biogeochemistry will be affected both directly and indirectly by ocean acidification. This session invites papers that address the biogeochemistry of anthropogenic carbon (processes controlling its distribution, processes by which it alters ocean chemistry), other anthropogenic impacts on carbon and nutrient cycles, acidification impacts on marine biota, and feedbacks among these.

Suggested invited speakers: Richard Zeebe, University of Hawaii, U.S.A.; Yoshihisa Shirayama, Kyoto University, Japan; Ken Caldeira, Stanford University, U.S.A.

CC-S Endnote 4

The Pacific Water Column CO_2 Data Synthesis Implementation Plan for 2008–2009

Overall goals
- To bring together research groups that measure water-column CO_2-related parameters in the Pacific;
- To provide a forum for working groups for data collection and analysis;
- To create a synthesized database of water-column CO_2-related parameters for the Pacific that has gone through a 2nd-level quality assessment (2nd-level QA), *i.e.*, an activity to correct for the offset in parameters among cruises or stations by way of cross-over analysis, MLR analyses, internal consistency among carbon parameters, *etc*.;
- To estimate anthropogenic CO_2, acidification, and natural variability in the Pacific from regional to basin scales.

Targeted areas
- The North Pacific, the equatorial Pacific, the South Pacific, and their marginal seas.

Datasets to be collected
- First priority is given to the datasets of post-WOCE cruises that include high-quality discrete hydrographic and chemical data including dissolved inorganic carbon (DIC), total alkalinity (TA), pH, partial pressure of CO_2 (pCO_2), dissolved oxygen (DO), nutrients (nitrate + nitrite, phosphate, silicic acid), dissolved organic carbon (DOC), ^{13}C and ^{14}C of DIC, and transient tracers such as CFCs, CCl_4, SF_6, *etc*.;
- Historical datasets that include these parameters;
- Metadata such as methods of analysis, information on quality assurance, and list of related publications.

Dataset sources
- Open datasets that are available from various data centers such as CCHDO, CDIAC, WDCGG, NODC, and websites of research organizations and programs. Original PIs should be informed of the use of datasets and invited to participate in this work.
- As yet unopened high-quality datasets from PIs who agree to submit them to this database and to participate in this data synthesis. By submitting data, PIs agree that data will be opened at end of 2nd level QC.

Data archives
- MIRC and/or CDIAC
- Toru Suzuki (MIRC) and Alex Kozyr (CDIAC) are responsible for cruise and data inventory

Access to the datasets
- Original and processed datasets stored in MIRC and/or CDIAC will be accessible only to the PIs who submitted data and members of the data synthesis working group.
- Modelers and other potential data users will be invited into the process towards the end of 2nd-level QA. A statement of cooperation will be available for them to sign, pledging proper use of the data and crediting of original PIs.

Data processing (2nd-level QA and offset correction)
- A processed database (PICES carbon database) that has gone through the 2nd-level QA and offset-corrections is created. It will be disseminated in a readable electronic format, preferably WHP exchange format, with quality flags and version (update) information. Details of the data format will be decided by working group members in consultation with CARINA group members such as Dr. Robert Key (Princeton University).

2nd-level QA will be performed for the following CO_2-related parameters:
- DIC analyzed using CRM for quality control (QC),
- TA analyzed using CRM for QC,
- pH,
- Dissolved Oxygen (DO),
- Nutrients (nitrate + nitrite, phosphate, silicic acid).

For DIC, TA, DO and nutrients, sub(regional) working groups are to be established to perform cross-over analysis for 2nd-level QA. Candidates are:
- Repeated lines on 137ºE (P9) and 165ºE (P13): Masao Ishii (JMA/MRI) and personnel in JMA;
- Repeated lines on 155ºE and 175ºE, and stations KNOT and K2: Nobuo Tsurushima (AIST) and personnel in JAMSTEC/MIO;
- A-line : Tsuneo Ono (HNF)
- Station Papa and Line P: James Christian and Lisa A. Miller (DFO);
- Station ALOHA : Christopher Sabine and Richard A. Feely (NOAA/PMEL);
- Other cross-overs in the North Pacific: Akihiko Murata (JAMSTEC), Christopher Sabine (NOAA/PMEL), and Toru Suzuki (MIRC);
- Equatorial Pacific: Masao Ishii (JMA/MRI) and Richard A. Feely (NOAA/PMEL);
- South Pacific: Akihiko Murata (JAMSTEC) and Richard A. Feely (NOAA/PMEL);
- Sub-group members need to closely communicate with each other and with the original PIs. The results of the cross-over analysis should be shared with all working group members;
- For pH, the number of data is expected to be smaller than for DIC and TA. Whether there are many cross-over stations is unclear at present, but will be investigated in early 2009. If any exist, a sub-working group will perform cross-over analysis for all areas after, or in parallel with, the evaluation of offsets in DIC and TA among cruises;
- For other parameters, such as CFCs, DOC, ^{13}C and ^{14}C, their 2nd-level QA are consigned to the experts on these parameters;
- Information on the 2nd-level QA, such as offset tables, is to be documented, and included in the final report.

Processed data policy
- The PICES carbon database will be open to the public through participating data centers, *i.e.*, MIRC, CDIAC, NODC. Other data centers (*e.g.*, of PIs organizations) may stage the data but there will be a "version of record";
- Credit will be given to all PIs who submitted or processed datasets;
- Publishing the datasets in a data publishing journal "Earth System Science Data (ESSD)" published by Copernicus Publications (http://www.earth-system-science-data.net/) is to be considered.

Action items
- Target date to compile the original datasets is the end of January 2009;
- A small meeting will be held in Tokyo in March 2009 to assess the status of data collection;
- A data-synthesis workshop will be held at the PICES Annual Meeting in Jeju in October 2009. Meeting room space at PICES-2009 was requested via the PICES POC and BIO committees.