REPORT OF THE SECTION ON CARBON AND CLIMATE

The meeting of the Section on *Carbon and climate* (hereafter CC-S) was held from 09:00–17:00 hours on October 14 and October 15, 2006. Drs. James Christian and Toshiro Saino, Co-Chairmen of CC-S, opened the meeting and welcomed members and observers (*CC-S Endnote 1*). The draft agenda was reviewed and adopted unanimously (*CC-S Endnote 2*).

Methods manual (Agenda item 2)

Dr. Christian gave an update on the progress of the "*Guide to best practices for oceanic CO_2 measurements and data reporting*" that remains as unfinished business of WG 17. He has worked with Drs. Andrew Dickson and Christopher Sabine and PICES staff (Ms. Rosalie Rutka) to transfer the chapters to a Microsoft Word/MathType format for more accessible editing by the community, and several chapters have already been extensively edited and re-written. A list of chapters was presented and volunteers were solicited to review the scientific content. These chapters are to be posted on the web for community input, as decided at the November 2005 CC-S meeting. Dr. Alex Kozyr agreed to host the interactive review web page on his servers at CDIAC. (Update: As of December 2006, almost all chapters have been converted to the Word format and posted on the CDIAC website for review.)

Reports of collaborating organizations and agencies (Agenda item 3)

Reports were given on several national and international programs relevant to the mandate of CC-S, and of individual agencies within PICES member countries. From Japan, separate reports were received from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC, Shuichi Watanabe), the Japan Fisheries Agency (JFA, Tsuneo Ono), the Centre for Global Environmental Research (CGER, Yukihiro Nojiri), and the Japan Meteorological Agency (JMA, Masao Ishii). All have ongoing observational programs which will contribute data to the North Pacific carbon data synthesis. Dr. Saino (Nagoya University) reported on a new moored profiling system for daily *in situ* measurements of primary productivity. The instrument has operated successfully at Station K2, which is also regularly occupied by JAMSTEC.

Other ocean carbon programs represented included: CLIVAR/Repeat hydrography (Richard A. Feely), SOLAS (Mitsuo Uematsu), IMBER (Hiroaki Saito) and CARBO-OCEAN (R. Feely and A. Kozyr). GEOTRACES was briefly discussed, but was not represented at the meeting. CLIVAR is funded until 2012 in the United States, and the current decadal survey is about 40% complete. SOLAS and IMBER have published a joint plan on carbon cycle research. SOLAS-Japan has been funded until 2010. IMBER-Japan expects funding for field work in the western North Pacific over the next 6 years (2007-2012).

CARBO-OCEAN is an Atlantic-centric program scheduled from 2005 to 2009. While doing extensive field surveys, they also had the first meeting on synthesizing carbon data from the Atlantic, Arctic and Southern Oceans in June 2006, in Iceland. Two CC-S members, Drs. Feely and Kozyr, are on the CARBO-OCEAN Scientific Steering Committee, and Drs. Steven Emerson, Kitack Lee and Toshiro Saino, all CC-S members, are on its International Advisory Panel. The initial 2 years' results will be presented at an upcoming workshop in the Canary Islands in December 2006.

The most recent IOCCP progress report (May 2006) was briefly discussed. The report indicated that PICES WG 17 had disbanded, but its authors did not seem to be aware of the formation of CC-S. The Section will inform IOCCP of this, and of progress on the methods

manual. IOCCP and the SOLAS/IMBER Carbon Group will be holding a workshop in Paris, France, in April 2007. Drs. Feely and Lee are on the workshop Organizing Committee.

NOAA-PMEL hosted a workshop on carbon fluxes along the North American Continental Margins (NACM) on October 10–11, 2006. The workshop declared as an objective a compilation of all historic measurements out to ~300 km from shore. The current estimate of net C uptake by NACM is 1.9 Pg/y (±100%). Lower latitudes tend to be a carbon source, and higher latitudes (>30°N) tend to be a sink. There are too few data to state definitively whether the system as a whole is a source or a sink. There are few data from the Gulf Coast, or from the Canadian and Mexican parts of the Pacific coast. Future goals of NACM are (1) to integrate with fisheries and coastal management to get carbon observations on as many programs as possible, (2) to integrate numerous existing programs, and (3) to improve remote sensing and in water autonomous technologies and promote broader implementation of existing technologies. These activities are closely related to CC-S objectives.

CC-S will ask participants to provide updates at future CC-S meetings, and may ask PICES to co-sponsor future joint workshops.

Data integration for synthesis: Why do we need the integrated dataset? (Agenda Item 4)

Synthesis of carbon data for the North Pacific was extensively discussed. A similar undertaking in the Atlantic Ocean is underway under CARBO-OCEAN. PICES is clearly responsible for the North Pacific in this respect. It was suggested that the GLODAP (Global Ocean Data Analysis Project) synthesis could serve as a model. GLODAP is still collecting data, and has developed a consistent system for QA/QC. The person principally responsible for this is Dr. Robert Key (Princeton University, U.S.A.). Dr. Feely is a Principal Investigator on the NOAA grant that funds this work, and he offered some of his time to this effort. Dr Key also works closely with Dr. Kozyr of CDIAC. The present GLODAP data set in the North Pacific (2004) has very limited temporal coverage (89% of DIC data north of 20°S were collected in the years 1991–1994).

Several technical and organizational issues relating to metadata were raised. Dr. Kozyr stated that use of the CDIAC data-submission webform is not mandatory, and that they will accept user metadata in plain text, Word or PDF format. CDIAC needs information from individual investigators that cannot necessarily be obtained from other data centers. JODC, for example, does not handle metadata. CDIAC also requires English metadata, which can create bottlenecks due to the expense of translation.

The group decided that PICES will create a working synthetic data set, open within the group but not public domain, as we did for the 2004 Seattle workshop (http://cdiac.ornl.gov/oceans/NOAA_Workshop/Data.html), using GLODAP as a model. The ocean will be divided into 4 regions: Northwest Pacific, Northeast Pacific, Tropical Pacific and South Pacific. Marginal seas will be initially excluded. The data set will include all nutrient and oxygen measurements as well as carbon system measurements, but will not include cruises where no carbon measurements were made. Investigators responsible for each region are: Drs. Nobuo Tsurushima (Northwest Pacific), Sabine (Northeast Pacific), Feely and Masao Ishii (Tropical Pacific) and Key (South Pacific). Drs. Key and Kozyr will serve as overall project coordinators.

Science topic presentations (Agenda Item 5)

Presentations were given by several CC-S members and observers (see *CC-S Endnote 2*). Topics ranged from biogeochemistry of a northwest Pacific estuary to estimating surface ocean pCO_2 at basin-scale from satellite data.

Topic Session at PICES XVI (Agenda Item 6)

The description of a 1-day BIO/POC Topic Session proposed to Science Board at the April 2006 inter-sessional meeting was submitted to the membership. Some revisions were made to the text, and possible invited speakers discussed.

The revised description (*CC-S Endnote 3*) was submitted to POC and BIO on October 18, and to Science Board on October 21. Financial support for 2 invited speakers was requested.

CC-S Endnote 1

Participation list

Members

Andrey Andreev (Russia)
James Christian (Canada, Co-Chairman)
Richard A. Feely (U.S.A.)
Hernan Garcia (U.S.A.)
Alex Kozyr (U.S.A.)
Tsuneo Ono (Japan)
Toshiro Saino (Japan, Co-Chairman)
Toru Suzuki (Japan)
Shuichi Watanabe (Japan)
Pavel Tischenko (Russia)

Observers

Norio Baba (Japan)
Alexander Bychkov (PICES)
Rongshuo Cai (China)
Fei Chai (U.S.A.)
Michael Dagg (U.S.A.)
Makio Honda (Japan)
Akio Ishida (Japan)
Masao Ishii (Japan)
Michio Kawamiya (Japan)
Mingkui Li (China)
Akihiko Murata (Japan)
Xiuren Ning (China)
Jun Nishioka (Japan)
Yukihiro Nojiri (Japan)
Keith Rodgers (U.S.A.)
Fangli Qiao (China)
Hiroaki Saito (Japan)
Vedula V.S.S. Sarma (Japan)
Zhenya Song (China)
Hiroya Sugisaki (Japan)
Nobuo Tsurushima (Japan)
Mitsuo Uematsu (Japan)

CC-S Endnote 2

CC-S meeting agenda

1. Welcome, introductions, approval of agenda
2. Methods manual for CO_2 measurements
3. Reports of collaborating organizations and agencies
4. Data integration for synthesis: Why do we need the integrated dataset?
5. Science topic presentations:
   a. Richard Feely: *Decadal changes in the aragonite saturation horizon*
   b. Vedula Sarma: *Satellite algorithm for pCO_2 in the North Pacific*
   c. Andrey Andreev: *Excess pH in the subarctic North Pacific*
   d. Pavel Tischenko: *Hydrochemical study of the Amur River estuary*
   e. Makio Honda: *JAMSTEC K2 time series*
6. Topic Session at PICES XVI in Victoria

CC-S Endnote 3

Proposal for a 1-day BIO/POC Topic Session at PICES XVI on
Decadal changes in carbon biogeochemistry in the North Pacific"

This session will be the first effort by the PICES Section on *Carbon and Climate* (CC-S) to synthesize the current understanding on inter-relationship between the carbon cycle and climate in the Pacific. Emphasis will be placed on decadal change in carbon cycling, *e.g*., anthropogenic carbon, air–sea exchange of CO_2, the biological pump, impacts of increasing levels of carbon dioxide on carbonate chemistry and marine biota, and possible feedbacks to atmospheric greenhouse gases. We expect that the session will enable us to update our understanding of the relationships between the carbon cycle, marine biota, and climate in the Pacific, and to identify gaps in our knowledge for future research in areas of importance for the PICES Section on *Carbon and Climate*.

Recommended convenors: James Christian (Canada) and Toshiro Saino (Japan).

Potential invited speakers: Taro Takahashi (U.S.A.), James Orr (France), Ichiro Yasuda and Makio Honda (Japan)