Canadian National Committee for SCOR
Comité national canadien pour SCOR

Scientific Committee on Oceanic Research

CANADIAN OCEAN SCIENCE NEWSLETTER
LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

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International and Intergovernmental Organizations in Ocean Science

Report by Allyn Clarke; ClarkeA@mar.dfo-mpo.gc.ca

An oceanographer venturing outside of Canada's territorial waters, soon encounters a jungle of international and intergovernmental organizations. This article is intended as a brief summary of their principal interests and activities.

The International Council for the Exploration of the Sea (ICES) is the oldest of these organizations, founded as an intergovernmental organization in 1902 to co-ordinate oceanographic research and observations in the Northeast Atlantic in support of the fisheries (http://www.ices.dk/). Jens Smed (2007) has just published an interesting paper on the national and inter-personal politics in the years leading up to its foundation. Not much different from the issues that we dealt with over the recent past in the organization and implementation of the global climate research programs such as the World Ocean Circulation Experiment (WOCE) and the Global Ocean Observing System (GOOS).

From its beginning, ICES had both a secretariat and a laboratory located in Copenhagen and hence does real scientific work on behalf of its members. ICES was for many years the international organization that set the standard for oceanographic observations, establishing methods and protocols through its committees and working groups and producing standards like "Copenhagen Water", the standard from salinity determinations for many years. It publishes a journal as well as special publications nad sponsors working groups and workshops on scientific issues. ICES also coordinated many of the early multi-institutional investigations of the North Atlantic and its marginal seas. Canadian biological, chemical, fisheries and physical oceanographers working in the Atlantic continue to be active in ICES activities.

The **North Pacific Marine Science Organization (PICES)**, an intergovernmental scientific organization, was established in 1992 to promote and coordinate marine research in the northern North Pacific and adjacent seas. (http://www.pices.int/default.aspx) It is modelled on ICES; however, its international staff is restricted to a small secretariat housed at IOS, Pat Bay. It supports working groups, co-ordinates observations and research projects across the North Pacific and publishes special publications related to the activities of its working groups and projects.

The **North Atlantic Fisheries Organization (NAFO)** is an intergovernmental organization established in 1979 to manage and conserve the fisheries of the North-west Atlantic. (http://www.nafo.int/) It replaced the **International Commission of the Northwest Atlantic Fisheries (ICNAF)** (1949-1978) at the time when Canada along with other coastal states claimed exclusive fishing rights over their continental shelves. NAFO's scientific council assesses both the environment and the marine ecosystem of the NW Atlantic from scientific reports presented by marine scientists from the member countries. It sponsors workshops and publishes a journal.

The **Intergovernmental Oceanographic Commission (IOC) of UNESCO** was established in 1960. (http://ioc.unesco.org/iocweb/index.php) It is the organization responsible for the coordination of intergovernmental issues associated with the ocean. The IOC is working with the World Meteorological Organization (WMO) to establish operational ocean observing and

information systems globally. This is co-ordinated by the Joint WMO-IOC Commission on Oceanography and Marine Meteorology (JCOMM) and the Global Ocean Observing System (GOOS). The IOC also co-ordinates global ocean data management. The IOC supports a number of regional organizations to assist in regional co-ordination of ocean science as well as training local expertise.

The **International Association for the Physical Sciences of the Oceans (IAPSO)** is one of the seven scientific unions of the **International Union of Geodesy and Geophysics (IUGG)**. (http://iapso.sweweb.net/) Oceanography has been a part of the IUGG since its founding in 1922 and until the establishment of the IOC in 1960, IAPSO was the principal global oceanographic organization. During the International Geophysical Year (1957), IAPSO established the World Oceanographic Data Centres. Its commissions established the early protocols and standards for the oceanographic parameters. IAPSO still remains responsible for overseeing the production and delivery of the standard water which remains the standard for salinity observations at sea. IAPSO has very limited funds. It does occasionally establish working groups on particular oceanographic issues; these working groups are often co-sponsored by other international organizations and programs. Its principal activity is the organization of large international scientific assemblies every two years.. Every 4 years, these assemblies are held as part of the IUGG General Assembly; an the alternate years these are joint assemblies with one or two of its sister IUGG associations. Meetings. The next IAPSO meeting will be held in Montreal, 19-29 July 2009 in partnership with the atmosphere (IAMAS) and the cryosphere (IACS). IAPSO also awards the Prince Albert I medal to an outstanding physical oceanographer every 2 years. Professor Lawrence Mysak of McGill is the current president of IAPSO.

The **Scientific Committee for Oceanic Research (SCOR)** is a scientific committee of the IUGG. (http://www.scor-int.org/) It was established in 1957 in order to serve the multidisciplinary needs of oceanic research. SCOR assists in the coordination of oceanic research through its working groups, through sponsorship of international research programs and through its moral support of its affiliated programs. Over the years, SCOR working groups have created a number of timely monographs summarizing and reviewing active and developing areas of oceanic research and setting both a foundation and a vision for future research in that field. SCOR has also created task groups, working groups and scientific steering groups to initiate, plan and co-ordinate large scale ocean research programs.

References: Smed, Jens, 2007. Fridtjof Nansen's Role In The Foundation Of Ices. History of Oceanography, 19, 15-31

Ocean Climate Variability Studies on the Outer Halifax Line

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Variability in the production and modification of water masses in the Labrador Sea is an important influence on the ocean climate of the shelf and slope waters off Atlantic Canada, and on the North Atlantic's "ocean conveyor belt" which is an integral component of the global climate system. Scientists at the Bedford Institute of Oceanography (BIO) have been carrying out observational studies of the Labrador Sea and other parts of the North Atlantic's subpolar gyre since the 1960s. In 1990 an annual survey of hydrographic and chemical properties on a

section across the Labrador Sea was initiated as a contribution to the international World Ocean Circulation Experiment (WOCE). A biological component was added in 1994 as a contribution to the international Joint Global Flux Study (JGOFS). This Labrador Sea Monitoring Program is now an important DFO and Canadian contribution to the Global Climate Observation System (GCOS) of the World Climate Research Program. Significant changes in the properties of the deep "overflow" waters originating in the Northeast Atlantic and of the locally-formed mid-depth Labrador Sea Water (which together form the lower limb of the conveyor belt) are being observed, with apparent influences from both natural variability and climate change.

The properties and transport of these subsurface waters as they move southward in the North Atlantic are the subject of a coordinated international research program in the United States (USA) and United Kingdom (UK), aimed at determining whether the conveyor belt is changing (such as the potential slow-down projected in some climate change scenarios). A significant portion of these waters flow along the lower Scotian Slope and Rise, near the outer end (2700-m isobath) of the Halifax Line of DFO's Atlantic Zone Monitoring Program (AZMP). In recent years the Ocean Sciences and Ecosystem Research Divisions at BIO have undertaken a physical-biological-chemical survey of this line on the CCGS Hudson's June return trip from the annual Labrador Sea expedition, as part of AZMP. Since 2006, three or four deep-water stations have been added to the June survey of the line to sample the physical, chemical and biological properties of the deep overflow waters (often referred to as the Deep Western Boundary Current) out to the 4300-m isobath. This expanded survey also provides improved sampling of the Labrador and Warm Slope Waters whose variability and on-shelf intrusions can have large effects on the entire Scotia-Maine region, and thereby complements the core AZMP. The signatures of Labrador Sea Water and the Deep Western Boundary Current can be clearly seen in the data from the 2006 and 2007 surveys.

Sampling on the "extended" Halifax Line is also being coordinated with the UK Rapid Climate Change (RAPID) program, a 12-year research initiative which is entering its second 6-year phase. Since 2004, OSD has been collaborating with the UK's Proudman Oceanographic Laboratory (POL) in the deployment of moorings to monitor the currents and water mass properties over the Scotian Slope/Rise off Halifax, funded by the Panel for Energy Research and Development (PERD) and UK RAPID. RAPID has also been contributing to the physical and chemical sampling on the extended Halifax Line, in an evolving and mutually-beneficial cooperation between BIO and POL.. A further collaboration is being planned as part of the 2008-13 RAPID-WATCH program, involving the deployment of moored current meters, and temperature-salinity and bottom pressure recorders between the 1000- and 4300-m isobaths on the line, together with profiles of hydrographic and chemical properties including tracers. This collaboration will provide a small and opportunistic additional DFO contribution to international climate change research programs in the North Atlantic, complementing both the Labrador Sea Monitoring Program and joint UK-USA programs making measurements on a line ("W") south of Woods Hole and another across the Atlantic along 26.5^{o}N. Through these collaborations with international programs sampling the Scotian Slope/Rise and adjacent regions, DFO is collecting valuable information on how the ocean conveyor belt and slope waters are changing off Atlantic Canada.

Observing and Modelling Ocean Heat and Freshwater Budgets and Transports

Report by Igor Yashayaev, YashayaevI@mar.dfo-mpo.gc.ca

A Special Issue of Progress in Oceanography (see citation below) has recently been published with Dr. Igor Yashayaev of Ocean Sciences Division (OSD) of the Bedford Institute of Oceanography as the Guest Editor. The issue has a collection of papers on observations and analyses of oceanic inventories of heat and freshwater which have recently provided convincing evidence of systematic global-scale changes. The papers are intended to provide an overview of recent advances in our knowledge of large-scale heat and freshwater changes, and of questions requiring further research. Several of the advances have contributed to the *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC). Five of the articles were authored or co-authored by Canadian scientists, with a focus on the northwest North Atlantic.

The observational section of the issue is led by a comprehensive summation of Arctic and Subarctic freshwater flux and budget studies (*Dickson et al.*). This overview is followed by four papers on ocean currents and water masses. Spanning geographically from the Nordic Seas (*Jonsson*) to Antarctica (*Cunningham and Pavic*), these papers demonstrate unique instrumental records and discuss variability in regional ocean transports and water mass properties (*Yashayaev*; *Johnson and Gruber*). The two papers closing the observational section discuss sea surface salinity changes (*Reverdin et al.*; *Myers et al.*) in complementary spatial domains, using similar approaches in constructing time series of regional precipitation minus evaporation. The time periods covered in these four studies are very similar, allowing a link to be established between the oceanic changes and their potential sources.

The modelling section of the special issue starts with results of experiments investigating how the global ocean conveyor is controlled by varying freshwater disparities or salinity differences between major ocean basins (*Haupt and Seidov*). Three other studies presented in this special issue analyze hydrographic changes in the North Atlantic simulated by coupled (*Wu et al.*; *Hu et al.*) and ocean (*Lu et al.*) models. All three models show freshening of the subpolar basins through the 1980s and 1990s. *Hu et al.* build a detailed account of various sources, which contribute to the changing fresh water budget. Freshening of the deep ocean forced by different scenarios of the planetary climate change is explored by *Wu et al*. Finally, *Lu et al.* simulate the response of the deep Labrador Sea reservoir to realistic atmospheric forcing and explore the contribution of different factors to the varying production of Labrador Sea Water and subpolar ocean circulation.

Changes in the North Atlantic heat and freshwater storages and transports are central to the special issue. From the introductory article the intermediate and deep water masses of the subpolar region became notably fresher between the 1960s and 1990s accounting for the oceanic freshwater storage change that is equivalent to dumping (mixing) a ~3.9 m layer of freshwater into the water column of the 1960s (*Figure*). The leading role of the Labrador Sea Water (LSW, a product of deep convection in the Labrador Sea) in such a massive freshwater gain is also acknowledged in several other studies presented in the issue.

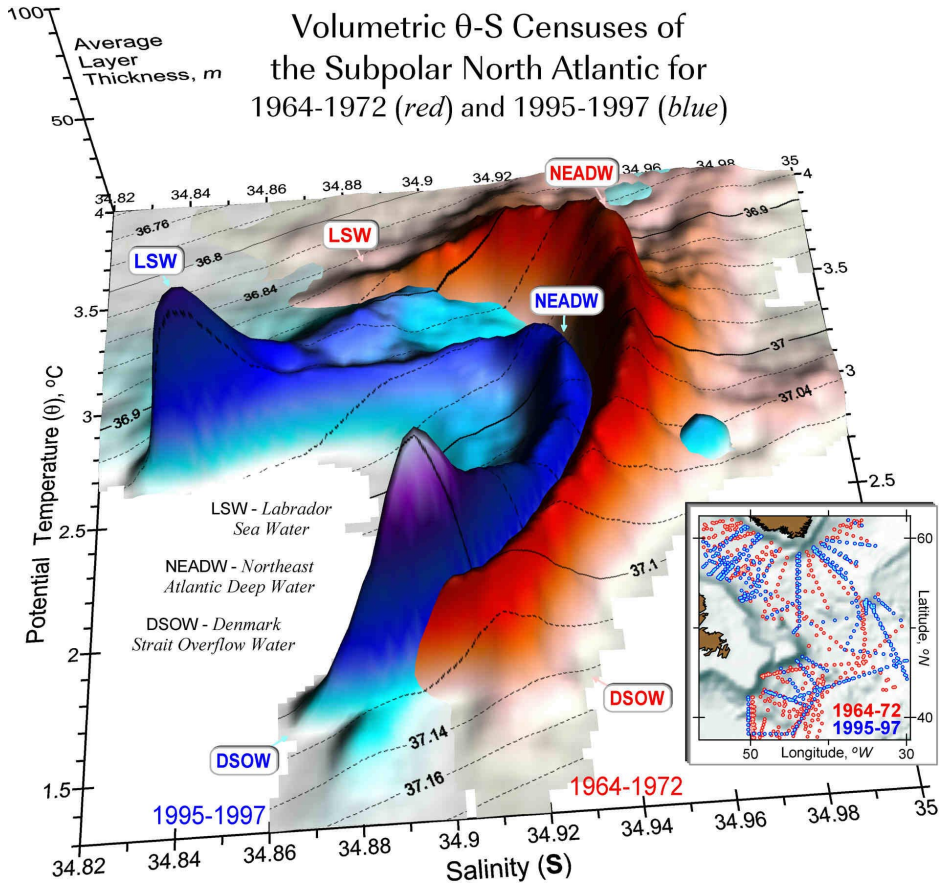

Figure from *Changing freshwater content: Insights from the subpolar North Atlantic and new oceanographic challenges* by *Igor Yashayaev*.
Volumetric potential temperature–salinity censuses of the subpolar North Atlantic for 1964–1972 (red) and 1995–1997 (blue). The values represent thickness of 0.1°C×0.01 (temperature×salinity) layers in meters. The insert map shows the locations of the hydrographic profiles in the 1960s' and 1990s' compilations. Labrador Sea Water (LSW), Northeast Atlantic Deep Water (NEADW) and Denmark Strait Overflow (DSOW) experienced large changes in their temperature, salinity and associated heat and freshwater storages between these two periods. The sources, signatures and effects of these and some other ocean changes are discussed in the special issue.

Citation: 2007. Observing and modelling ocean heat and freshwater budgets and transports. *Progress in Oceanography 73* (3-4): 203-426.
http://www.sciencedirect.com/science?_ob=PublicationURL&_cdi=5838&_pubType=J&_auth=y&_acct=C000056891&_version=1&_urlVersion=0&_userid=2322943&md5=2819d71d4de3af66d4026ee657a6ecfd&jchunk=73#73

CMOS Congress "Water, Weather, Climate: Science Informing Decisions"
May 25 to May 29, 2008
at the Grand Okanagan Lakefront Resort and Conference Centre, Kelowna, BC
Conference Web site: http://www.cmos2008.ca/

Plenary Speakers:

Michael Glantz
Climate, Water and Weather Affairs: "Selling" Science to Society

Humfrey Melling
An Observer's View of a Changing Marine Arctic

David W. Schindler
Climate Change, Human Endeavor and Water Supplies in Western Canada

Kathryn A. Kelly
Atmosphere-Ocean Interactions in the Western North Atlantic Ocean: Weather and Climate Implications

Pierre Yves Le Traon
Observing and forecasting the ocean: 10 years of achievements

David Hughes
The Energy Sustainability Dilemma: Powering the Future in a Finite World

Roland Stull
Tricks and Traps on Using Fine-scale Numerical Weather Forecasts for Western Canada

Peter Taylor
The NASA Phoenix Mars mission

Peter D. Killworth

Peter D. Killworth of the National Oceanography Centre at the University of Southampton in the UK. Peter died after a long battle with "motor neuron disease". Peter was an outstanding physical oceanographer who made many important contributions to dynamical oceanography in numerous areas. He was also the founder and later editor of the journal "Ocean Modelling."

In a statement, friends at the University of Southampton said: "Peter will be remembered for his unbridled enthusiasm for science, his dedication to work, and his selfless and generous nature that fostered and encouraged the scientific development of the numerous colleagues he worked with. "Peter will be sorely missed by the many people who knew him and worked with him. His outstanding contribution to oceanography will live on through his published papers, and in the hearts and minds of those who knew him."

Ocean Science Theses

Using 2000 as a starting point, the CNC/SCOR has complied and posted listings of Canadian university PhD and MSc theses in ocean sciences. Additions for 2007 have been posted at http://www.cmos.ca/scor/thesesdirectory.html. Listings include those for University of Victoria, University of British Columbia, University of Alberta, University of Manitoba, McGill University, Québec-Océan (which includes theses listings from Université Laval, Université du Québec à Rimouski (UQAR), Université du Québec à Chicoutimi (UQAC), Institut national de la recherche scientifique (INRS), McGill University) and Dalhousie University.

SCOR Newsletter No. 11, April 2008

The latest newsletter from international SCOR may be found on its web site at http://www.scor-int.org/ Amongst other things it provides information on the SCOR 50th Anniversary Symposium (see https://www.confmanager.com/main.cfm?cid=1285); SCOR XXIXth General Meeting; SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater; SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf; SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling; SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems; SCOR Capacity-building Activities; POGO Cruise Database; Large-Scale Ocean Research Projects (GEOTRACES, GLOBEC, IMBER, SOLAS, GEOHAB); SCOR Panel on New Technologies for Observing Marine Life; Second Symposium on The Ocean in a High-CO_2 World (see http://www.confmanager.com/main.cfm?cid=975); SCOR/GESAMP Statement on Deliberate Nutrient Additions to the Ocean; SCOR Publications; and SCOR Annual Meetings

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Previous newsletters may be found on the CNC/SCOR web site.
Les bulletins antérieurs se retrouvent sur le site web du CNC/SCOR.

Newsletter #37 will be distributed on June 27, 2008. Please send contributions to dick.stoddart@sympatico.ca
Bulletin #37 sera distribué le 27 juin 2008. Veuillez faire parvenir vos contributions à dick.stoddart@sympatico.ca

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