Canadian National Committee for SCOR
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OCEAN SCIENCE PROGRAMS

Operational atmosphere-ocean-ice prediction systems in Canada: Providing decision-enabling marine environmental information to end users

Submitted by Fraser Davidson[1], Gregory Smith[2], Youyu Lu[1], and Susan Woodbury[1]

Operational oceanography is an emerging discipline that provides environmental information services for a variety of management and end user needs in marine environments. These services inform applications ranging from real-time decision making (e.g., oil spills), to historical review of ocean conditions and strategic planning. Herein we describe a Canadian government initiative to develop core ocean information services.

In looking to improve its weather forecasts, Environment Canada (EC) developed a prototype coupled ice-ocean forecast system for the Gulf of St. Lawrence in conjunction with Fisheries and Oceans Canada (DFO). This project was partly motivated by DFO's need for ocean analysis and forecasts in response to its mandate to provide services in the marine environment such as search and rescue, oil spill response and to ensure safe and navigable waterways. Additionally, DFO wished to describe and understand the state of the ocean for marine ecosystem management.

The need for teamwork within Canada to develop operational atmosphere-ocean-ice forecast systems motivated the formation of an initiative called CONCEPTS (Canadian Operational Network for Coupled Environmental PredicTion Systems). This initiative was formalized in a Memorandum of Understanding (MOU) signed in 2009 by EC, DFO and the Department of National Defence (DND).

DND is an integral partner in CONCEPTS and provides an embedded user to help focus activities toward user-oriented needs. CONCEPTS activities enhance the Canadian Government's effort to provide Canadians with the best available operational forecasts and analyses of atmosphere, ocean and sea-ice states, with lead times from days to months.

[1] Fisheries and Oceans Canada
[2] Environment Canada

It was recognized early on that Canadian expertise was not sufficient on its own to develop an ocean forecasting capability in Canada. Collaboration with Mercator-Océan, the French ocean forecasting group, was pursued through scientific exchanges. Formal signed agreements between CONCEPTS and Mercator-Océan are now well underway.

The systems developed under CONCEPTS provide atmosphere, ocean and sea-ice analyses through "statistical blending" of models with available observations. The atmospheric module of the forecasting systems is based on the Global Environmental Multi-scale (GEM) atmospheric model and variational data assimilation technology, both of which have been in development for several decades at EC. Currently, the ocean module for the global and regional (ocean basins and shelf seas) is based on the Nucleus for European Modelling of the Ocean (NEMO) adopted from Europe and the SAM2 ocean data assimilation system provided by Mercator-Océan. The sea-ice module is in transition from the LIM2 model developed in Europe to the CICE model developed in USA and the sea-ice data analysis and assimilation technology developed at EC.

Two major systems are being developed: CONCEPTS global and CONCEPTS regional.

CONCEPTS global provides ocean forecasts on a global grid with 15-35 km horizontal resolution. This system is a twin of MERCATOR's global PSY3 ocean forecast system with a few changes such as the use of Canadian GEM wind forcing and the assimilation of a sea surface temperature analysis and a sea ice analysis. The objective of the Global systems is to track large scale changes in the ocean, and have these taken in account by the weather forecast systems. In time, CONCEPTS global will also provide monthly-to-seasonal coupled predictions of the coupled atmosphere-ocean-ice system.

CONCEPTS regional has a finer resolution from 3-8 km with highest resolution in the Canadian Arctic. The regional system also provides 10 day forecasts, but its purpose is to provide marine environmental information to operational activities such as search and rescue, oil spill drift prediction, marine routing through ice covered areas and better marine wind forecasts. The forecasting products can be used for a wide range of applications including transportation, energy exploration, environmental disaster response (e.g., oil spill), fishery management and recreation. These products can be applied for environmental assessment to support oil and gas exploration and fishery management.

The global and regional systems naturally link to each other because the former provides the latter with the forcing at the lateral boundaries.

Figure 1 shows the schematic of a regional forecasting system covering Canada, the Arctic and North Atlantic Oceans. When the system is in pre-operation in 2015, the spatial resolutions will be 10 km for the atmospheric component and 3-8 km for the ocean and sea-ice components. Funding for the development of this system comes mainly from the EC METAREAs project, the Beaufort Regional Environmental Assessment (BREA), the Program of Energy Research and Development (PERD) and the Environmental Studies Research Funds (ESRF). The development of standardized validation and visualisation protocols plays an essential part in allowing scientists and end users to evaluate forecast performance. This follows the successful implementation of the Gulf of St Lawrence system (http://ogsl.ca/en.html), a precursor of CONCEPTS.

Many applications of ocean forecasting require resolutions finer than 1 km in near-shore regions. Hence CONCEPTS is planning to adopt un-structured finite volume (FVCOM) models for such applications. A major initiative in planning is the Complementary Measures project for the area surrounding Kitimat, British Columbia to support planned oil tanker traffic. This is a specific demonstration of how ocean services are infrastructure assets that supports the Canadian economy.

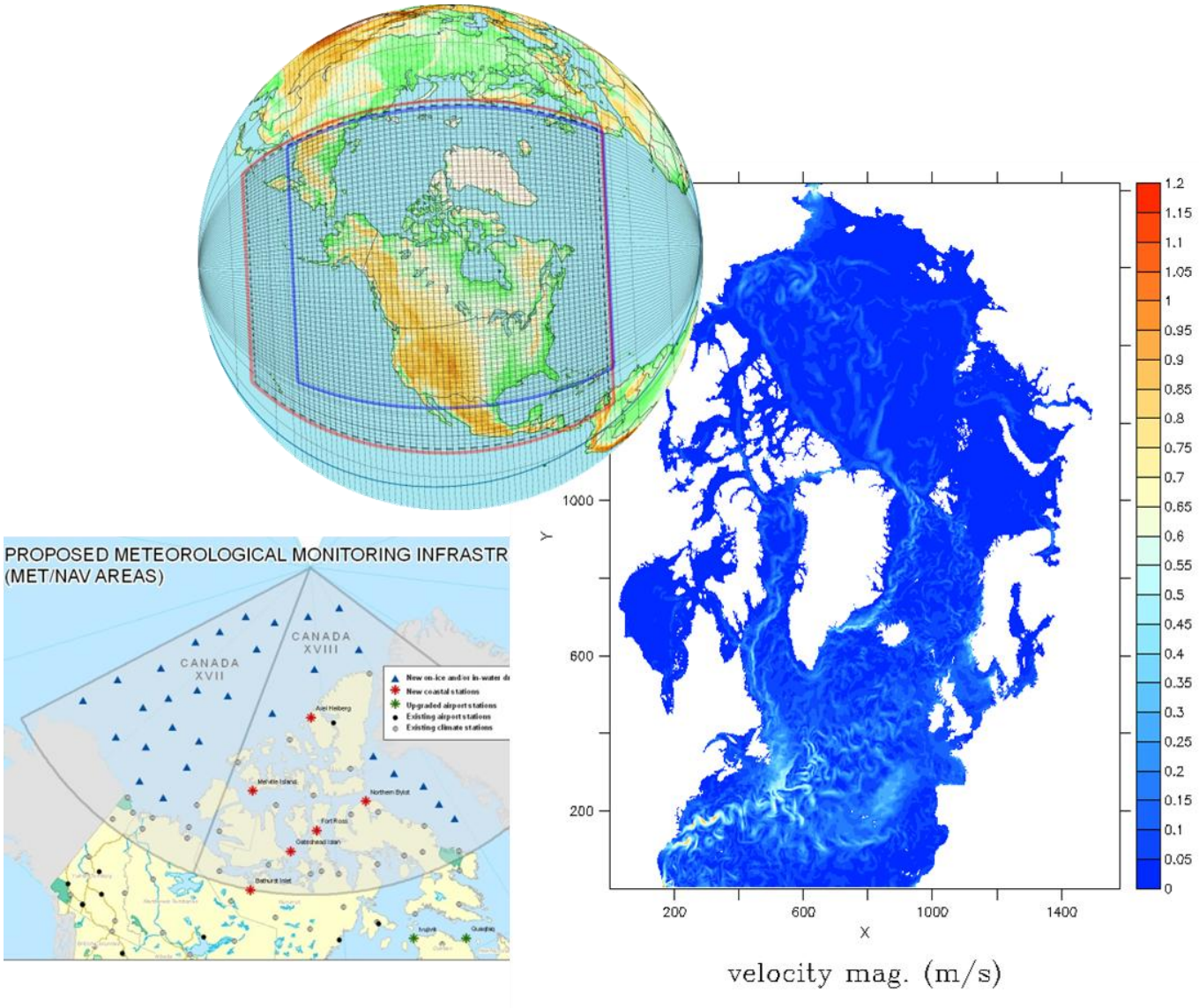

Figure 1 Schematic of the CONCEPTS Arctic-North Atlantic regional forecasting system under development, showing the grids of the Canadian weather forecasting model GEM (top middle), a snapshot of surface current from the NEMO ocean and sea-ice module (right), and the target areas of marine forecasting applications (bottom left).

The development of Ocean Services in Canada demands teamwork for which CONCEPTS activities follow a few established strategies that include the adoption of common software structure and codes, common validation approaches as well as agreed upon visualisation protocols for the results. The creation of a common framework approach to ocean services will allow CONCEPTS partners to collaborate effectively with Canadian university research initiatives such as the Marine Environmental Observation Prediction and Response Network (MEOPAR). The framework approach is further supported by participating in international forums related to Ocean Services such as the International Oceanographic Commission and World Meteorological Organization's JCOMM Expert Team on Ocean Forecasting, the Global Ocean Data Assimilation Experiment OceanView and the European Global Monitoring for Environment and Security program which includes the MyOcean project.

As ocean service products in Canada become more prevalent, it is important to continue a team effort in further developing these core services as well as supporting new end uses of this enhanced marine environmental information.

MEETINGS

CNC-SCOR Annual Meeting, 26 May, Saskatoon, SK

CNC-SCOR will hold its annual business meeting on the first day of the 1st Joint Congress of the CMOS, CGU and CWRA, 26 May 2013. The Committee will meet in the Kendal room, on the second floor of the Hilton Garden Inn, Saskatoon. Among the topics discussed will be the proposals for new SCOR Working Groups.

PICES 2013 Annual Meeting, 11-20 October, Nanaimo, BC

The North Pacific Marine Science Organization (PICES) has announced its 2013 Annual Meeting to be held October 11–20, 2013, at the Vancouver Island Conference Centre, Nanaimo, British Columbia. The meeting is hosted by the Government of Canada, Department of Fisheries and Oceans in coordination with the PICES Secretariat. Local arrangements are made by the Department of Fisheries and Oceans, Science Branch, Pacific Region.

Deadlines and further information on the meeting including the scientific program can be found here (click)

ArcticNet Annual Science Meeting, 9-13 December 2013, Halifax, NS

The 9th ArcticNet Annual Scientific Meeting (ASM2013) will be held from 9 to 13 December 2013 at the World Trade and Convention Centre WTCC in Halifax, Nova Scotia.

As the largest annual Arctic research gathering held in Canada, the annual meeting is the ideal venue to present results from all fields of Arctic research and stimulate networking and partnership activities.

Building on the success of previous ASMs, the 2013 meeting welcomes researchers, students, policy makers, stakeholders and the media to address the global challenges and opportunities brought by climate change and modernization in the Arctic.

Detailed information on the meeting, registration, call for abstracts and sponsor/exhibitor opportunities will be available soon.

Réunion scientifique annuelle d'ArcticNet , 9-13 décembre 2013, Halifax, N-É

La neuvième réunion scientifique annuelle d'ArcticNet (ASM2013) se tiendra du 09 au 13 décembre 2013 au World Trade and Convention Centre WTCC à Halifax, Nouvelle-Écosse.

Étant la plus importante réunion annuelle sur la science arctique au Canada, l'ASM est le moment idéal pour présenter les résultats de recherche et pour stimuler le réseautage et le partenariat.

Suite au succès des réunions scientifiques annuelles précédentes, l'ASM2013 invite les chercheurs, les étudiants, les décideurs, les représentants d'organisations gouvernementales et privées à aborder les défis et les opportunités amenés par les changements climatiques et la modernisation dans l'Arctique.

Plus de détails sur la réunion, les modalités d'inscription, les différentes possibilités pour commanditaires et exposants ainsi que l'appel aux conférenciers seront disponibles prochainement.

PERSONNEL

Charles Hannah

Dr. Charles Hannah is taking over as Head, State of the Ocean Section in the Ocean Sciences Division at DFO's Institute of Ocean Sciences. Charles comes to IOS from the Ocean Sciences Division at the Bedford Institute of Oceanography, where he has held several positions as Research Scientist, Section Head and Acting Division Manager.

Charles is a native of British Columbia, having grown up on the coast and doing his university/post-graduate education at UBC. As a PhD student Charles worked on the circulation of BC north coast before he headed east to start a most productive 20-year career at BIO.

CANADIAN JOBS

Instructor, Department of Oceanography, Dalhousie University

Dalhousie University is seeking applicants for an Instructor position within the Department of Oceanography, Faculty of Science. This is a 12-month position. Applicants require a minimum M.Sc. in Oceanography, with extensive interdisciplinary experience in oceanographic sampling tools and techniques, and in teaching at the undergraduate level. The successful applicant will be responsible for the organization, coordination and instruction of two sections of a 2nd-year, laboratory-based, full-year (1 credit) course ("Tools and Concepts in Oceanography") offered in Fall and Winter semesters, and of two sections of a 2-week, intensive field course (0.5 credit) offered in Summer semester. Further teaching in relevant subject areas will be required.

Click here for more details.

Anticipated appointment date is 1 July 2013. Consideration of candidates will begin in May 2013 and continue until the position is filled.

Staff Scientists - 2 positions, Ocean Networks Canada: Deep-Sea Benthic Ecology, and Plankton Dynamics/Ocean Biogeochemistry

Ocean Networks Canada (ONC) is seeking a Staff Scientist with specific research area background in deep-sea benthic ecology and a Staff Scientist with specific research area background in plankton dynamics and ocean biogeochemistry. The staff scientists will work with external users and internal departments to drive and integrate advances in interdisciplinary science, IT capability, and multivariate earth-ocean informatics. The Staff Scientist position is key in achieving ONC's mandate to serve users of the complex data that ONC's instruments and sensors produce.

The Staff Scientist interacts with and provides support to a diverse international user community, with the goal of increasing the number of scientific publications, the number and breadth of users accessing the facility, broadening the awareness and utility of the observatories in the science community, and encouraging its use by an ever-widening community of interdisciplinary users and research topics.

A PhD in Science with at least 2 years of relevant post-doctoral experience in an observational or experimental marine science field is required.

Experience in the following areas is required:

- Demonstrated background, knowledge, and qualifications in Deep-Sea Benthic Ecology (1st position) or in plankton dynamics and ocean biogeochemistry (2nd position)
- Oceanographic mission experience, including collecting, processing, and analyzing samples at sea
- Experience facilitating and coordinating interdisciplinary scientific programs and teams
- Significant experience using multi-dimensional numerical databases
- Significant experience in quantitative multivariate data analysis and display using high-level data analysis languages such as Matlab, R, and/or IDL
- Experience in producing accurate scientific communications, including peer-reviewed publications, conference abstracts and presentations, and summaries for broader audiences (public outreach and education)
- Strong problem-solving abilities and interpersonal skills in a team environment
- Proven ability to take research projects from conception to completion, with an understanding of instrument specification and configuration, data quality and analysis, and scientific interpretation

For more details on the Deep-Sea Benthic Ecology position, please click here. For more details on the Plankton Dynamics/Ocean Biogeochemistry position, please click here.

Applications must be submitted by 30 April 2013.

Looking for work? Try the CMOS site (click)

GENERAL

Arctic Observing Summit - White Papers Available for Public Comment

The Arctic Observing Summit (AOS) is a high-level, biennial summit that aims to provide community-driven, science-based guidance for the design, implementation, coordination and sustained long-term (decades) operation of an international network of arctic observing systems. The AOS will provide a platform to address urgent and broadly recognized needs of arctic observing across all components of the arctic system, including the human component. It will foster international communication and coordination of long-term observations aimed at improving understanding and responding to system-scale arctic change. The AOS will be an international forum for optimizing resource allocation through coordination and exchange among researchers, funding agencies, and others involved or interested in long-term observing activities, while minimizing duplication and gaps. The white papers and guidance for comments are available on the web site (click).

AOS 2013 will be in Vancouver, 30 April - 2 May. For more information on the AOS , click here.

The AOS is a contribution to the Sustaining Arctic Observing Network (SAON) initiative.

New RADARSAT-1 images available on the Polar Data Catalog

The Polar Data Catalogue is a database of metadata and data that describes, indexes and provides access to diverse data sets generated by Arctic and Antarctic researchers. The records follow *Federal Geographic Data Committee* (FGDC) standard format to provide metadata exchange with other data centres. The records cover a wide range of disciplines from natural sciences and policy, to health and social sciences. This geospatial search tool is available to the public and researchers alike and allows searching data using a mapping interface or other parameters.

There are now over 20,000 new RADARSAT-1 images from the Canadian Ice Service available in the Polar Data Catalog. These images cover all Canadian waters, from 1997 to 2006. Click here to the access the Data Catalog.

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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 #71 will be distributed on *15 June* 2013. Please send contributions to Michel Mitchell, michel.mitchell@dfo-mpo.gc.ca
Bulletin #71 sera distribué le *15 juin* 2013. Veuillez faire parvenir vos contributions à michel.mitchell@dfo-mpo.gc.ca

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