



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

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OCEAN SCIENCE NEWS

This section of your newsletter provides an opportunity to highlight your research programs to the Ocean Science Community.

*Your are invited to send contributions to David Greenberg,
david.greenberg@dfo-mpo.gc.ca*

Mettez en valeur vos programmes de recherche en publiant un article dans cette première section de votre bulletin.

*Faites parvenir vos contributions à David Greenberg,
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NATLocean - A high resolution ocean model product for the North Atlantic Ocean

**Blair Greenan, Tobias Spears, Zeliang Wang
and Dave Brickman**

Fisheries and Oceans Canada
Bedford Institute of Oceanography

1. Basin scale ocean modelling at Bedford Institute of Oceanography

The basin-scale modelling group at BIO (Bedford Institute of Oceanography) has been working on global and basin scales modelling since early 2000s. Beginning in 2005, the group has been using the NEMO ocean model (detailed in the following section) to study variations of oceans and their driving mechanisms (Holloway and Wang, 2009; Wang et al, 2010; Holloway et al., 2011; Wang et al., 2011; Wang and Greenan, 2014; Brickman et al, 2015; Wang et al., 2015). Recently, the group produced a GIS-compatible ocean product (NATLocean) for the North Atlantic Ocean using the data generated by a 1/12° resolution North Atlantic model. NATLocean consists of a set of geospatial web services used to portray and enable access to data from this model, along with an on-line, interactive viewer to enable internet visitors to access and use the data.

2. The NATLocean model

The model is based on NEMO (Nucleus for European Modelling of the Ocean) which includes an ocean component OPA (Madec et al., 1998) and the sea ice module LIM (Fichefet and Morales Maqueda, 1997). It has a nominal resolution of 1/12° (model domain shown in Figure 1). The latitudes range from 8°N to 76°N with the whole Baltic Sea included in the model domain, and most of the Mediterranean Sea. There is a maximum of 50 levels in the

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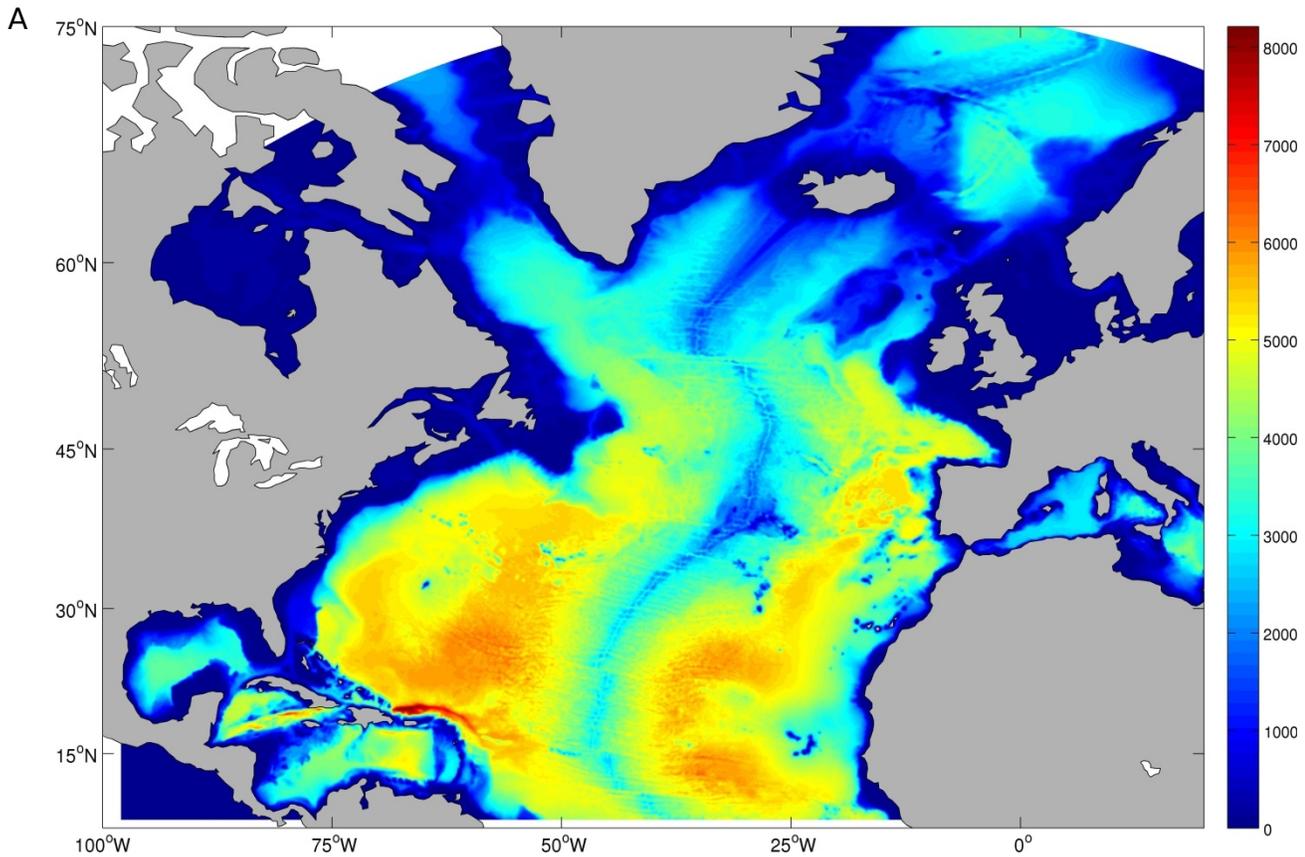
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The Canadian National Committee of the Scientific Committee for Oceanic Research (CNC-SCOR) fosters and facilitates international cooperation. It is a non-governmental body that reflects the multi-disciplinary nature of ocean science and marine technology.

Le Comité national canadien du Comité scientifique de la recherche océanographique (SCOR) favorise et facilite la coopération internationale. Il reflète la nature multidisciplinaire de la science océanique et de la technologie marine.

vertical, with level thickness increasing from 1 m at the surface to 200 m at a depth of 1250 m and reaching the maximum value of 460 m at the bottom of the deep basins. The maximum depth represented in the model is 5730 m.



There are two open boundaries in this model configuration, the northern and southern boundaries. The northern open boundary includes 3 segments, Fury and Hecla Strait which connects Hudson Bay with the Arctic, the Baffin Bay segment which receives Arctic water from the Canadian Arctic Archipelago and transports a portion of the West Greenland Current water mass out of the region, and the Barents Sea segment - a key part for the water mass exchange between Arctic and North Atlantic. The southern open boundary is set at 8°N, which was intended to include as much as the subtropical gyre within the available computer resources. Open boundary data are climatological monthly data compiled from GLORYS reanalysis product (Global Ocean Reanalyses and Simulations; Ferry et al., 2010) which includes data assimilation. Normal velocity, temperature and salinity, and sea surface height are specified at the open boundaries; the Flather methodology is used for the open boundary treatment. The runoff of the major rivers is specified according to a monthly climatology compiled for the DRAKKAR project (Barnier et al., 2006). No surface restoring to sea surface temperature is applied. However, the

model's sea surface salinity is restored to its monthly climatology with a 60-day restoring time scale.

For the 1990-2007 period, the CORE forcing (Griffies et al., 2009) was used to drive the model. For the 2008 to 2014 period, the NCEP surface forcing was used. The CORE forcing is based on the NECP reanalysis, and the turbulent air-sea fluxes have been bias-corrected on the basis of comparison with more reliable satellite and in-situ data. When we started the modelling in 2010, the CORE forcing was only available up to the year of 2007. For the years following the 1990-2007 period, we switched to NCEP forcing since the CORE product was not available for that period. We acknowledge that there could be a potential discontinuity in the model results between the CORE and NCEP periods, and users should be aware of this issue when using this product for the entire 1990 - 2014 period. The 10-year spin up simulation was driven by climatological CORE forcing - CORE Normal Year forcing. The model was driven by CORE and NECP subsequently.

In order to keep consistency of the surface forcing, and to represent tides and inter-annual variations of river discharges, a simulation using the NCEP forcing from 1999 to 2014 with tides and observed river discharges has been carried out. We have been working on validating this new product. After the validation process is completed, this new product will be also available.

3. Description of NATLocean

The monthly data are available from 1990 to 2014. Variables include zonal and meridional velocities, temperature and salinity.

Here we demonstrate part of the validation of NATLocean. More details can be found in Wang and Greenan [2014], Brickman et al. [2015], Wang et al. [2016].

3.1 SST - A comparison with $\frac{1}{4}$ degree GLORYS model data

To validate the modelled sea surface temperature, the mean SST from GLORYS is obtained by averaging over the 1993 - 2011 period, and the mean SST from the model is produced for the same period for comparison. Figure 2 shows the SST from the two sources. The modeled SST is consistent with that from the GLORYS.

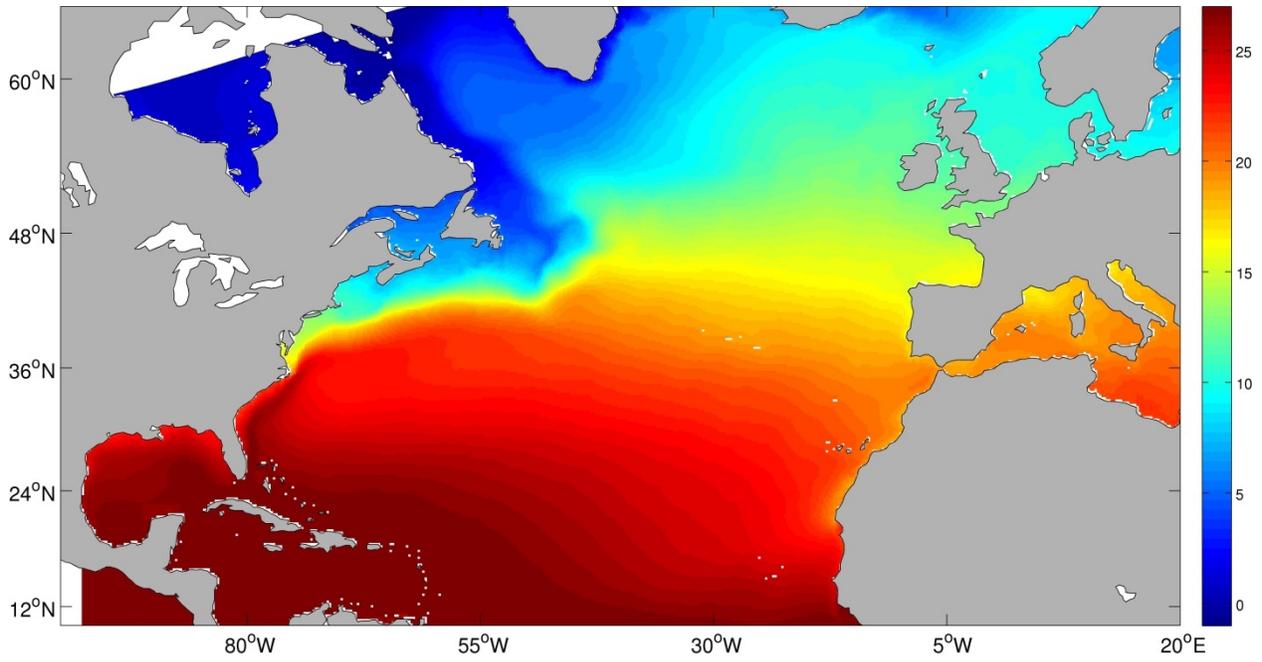


Figure 2a.

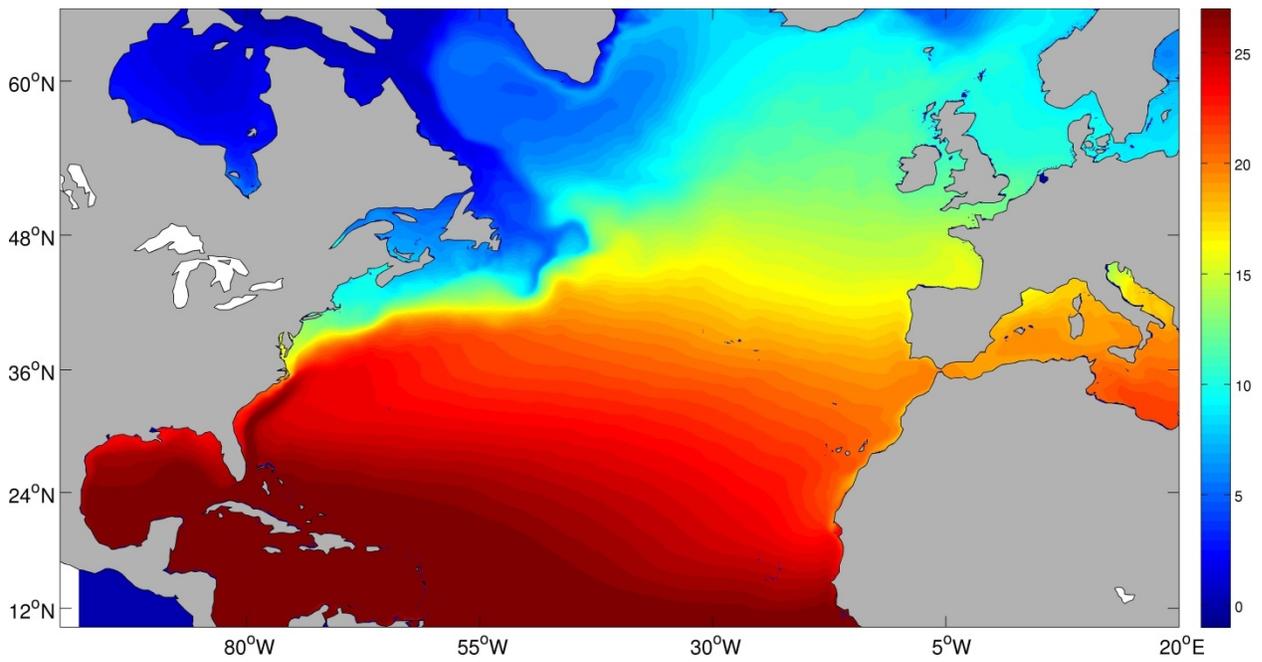


Figure 2b. The averaged SST from GLORYS (2a); averaged SST from the NA model (2b).

3.2 Surface currents - A comparison with surface drifter data

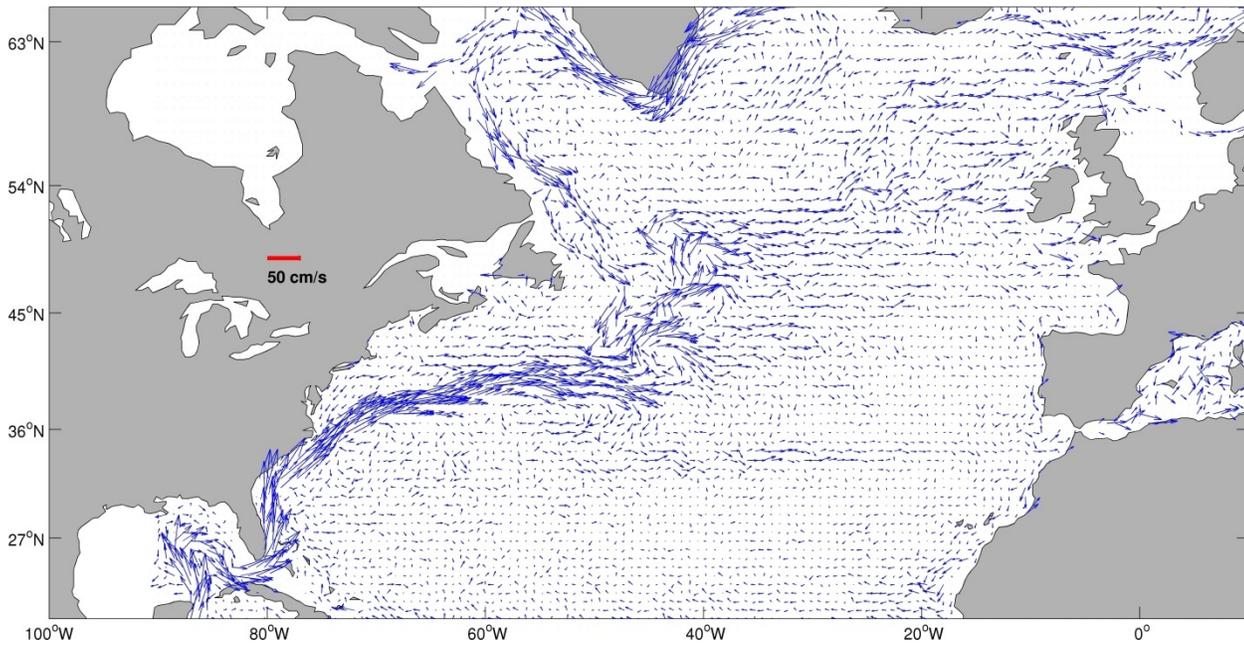


Figure 3a.

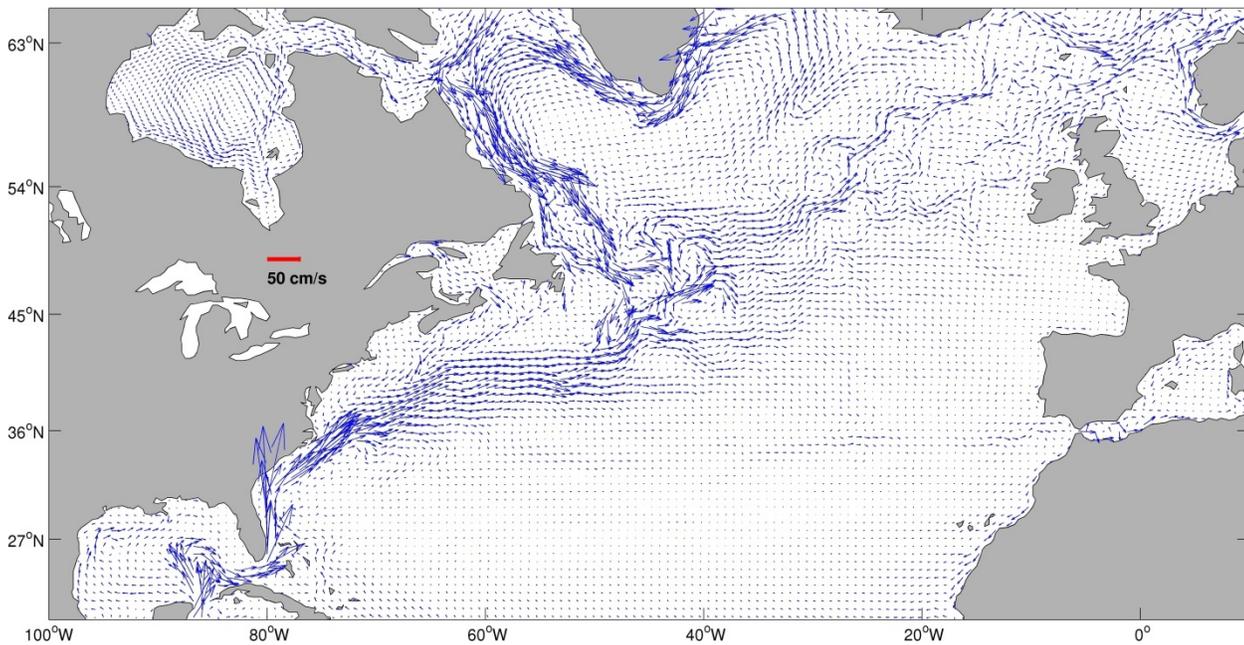


Figure 3b. Mean surface currents from drifter data (3a) and model results (3b).

The Global Drifter Program is an array of satellite tracked surface-drifting buoys designed to provide observations of mixed layer currents and sea surface temperature [[NOAA/AOML Global Lagrangian Drifting Buoy Database](#)]. The first large-scale deployments occurred in 1988, and the array achieved the target of 1250 drifters (an average 5° spacing) in 2005. The buoys are of various designs but mostly comprise a surface float attached to a drogue at 15 m depth. Data are transmitted via the ARGOS satellite system, with the drifter position inferred from the Doppler shift of its transmission as the satellite passes over. The data are quality controlled by the Drifter Data Assembly Center and are interpolated to a regular 14 day interval. We use the drifter data to compute the mean surface current for the region.

The model demonstrates a good skill in obtaining the flow patterns for the whole North Atlantic Ocean, and the magnitude of the currents are also presented in the model in general (Figure 3). Here, we give details for a region with energetic interactions between the Gulf Stream extension and the Labrador Current. The off-shore Labrador Current trifurcates at the northeast corner of Newfoundland Shelf, one branch flowing southward through Flemish Pass, one flowing southeastward over Flemish Cap, and another one continuing eastward at the northern flank of the Flemish Cap, then turning southward at eastern flank of the Cap. The North Atlantic Current meanders northward to the east of Grand Banks and Flemish Cap before turning eastward at Orphan Knoll area. The modelled North Atlantic Current tends to move further north before turning east. Note: the number of drifters in this Northwest corner area is far less than that in the adjacent areas, which could make the derived current from those drifters biased due to eddy variability.

4. NATLocean publication

To make NATLocean available to end-users, the Ocean Data and Information Section (ODIS) at BIO developed a methodology to make it accessible on-line via an ArcGIS Server (seven of 50 depth levels) adhering to native ESRI REST services and Open Geospatial Consortium Web Map Services (WMS) and Web Feature Services (WFS). The full netCDF data compilation will be downloadable via FTP or other protocols through infrastructure supported by DFO Information Management & Information Technology Services Branch (IM&TS). The data compilation and web services will be published externally for access outside the Government of Canada and advertised through the Federal Geospatial Platform and Government of Canada Open Data Portal. Metadata will comply with ISO 19115: Harmonized North American Profile adopted by the Government of Canada and directed for implementation by all departments. These provide platforms for users to view and choose the data they need.

The NATLocean set of geospatial web services can portray and enable access to data from the NEMO 1/12° North Atlantic model. The on-line, interactive viewer allows internet visitors to access and use the data. It is hoped that the website will be activated by late June and the web coordinates will be announced at that time. As alluded to above, more of the model output will become available over time.

Acknowledgements:

Dr. Youyu Lu was involved in the discussion for the model setup, and provided helpful suggestions. Brendan Detracy prepared the surface forcing for the recent years (2013 -2014). Brian Bower helped with the publication of NATLocean. Andrea Segovia, with the

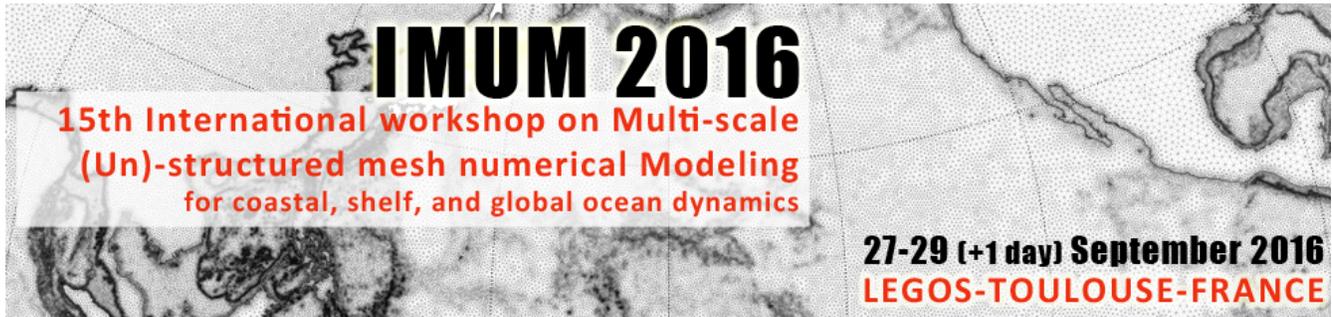
High Performance Computing Solutions group at Shared Service Canada, provided essential support for the model runs on the BIO HPC02 cluster, a 64 node cluster with 80TB of dedicated storage running Red Hat Linux. We appreciate the help from Dr. Dave Greenberg for the publication of this article.

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MEETINGS

IMUM 2016, Sept 27-30, Toulouse, France.



The **15th International Workshop on Multi-scale (Un)-structured mesh numerical Modeling** for coastal, shelf, and global ocean dynamic will be held in Toulouse, France, from September 27th to 30th, 2016. It will be hosted by the Midi-Pyrénées Observatory and LEGOS Ocean Science Laboratory.

The IMUM annual workshops have become a premier forum to report on, and advance, the state-of-the-art of unstructured-mesh modeling of the ocean, at multiple scales and in its interactions with freshwater and/or the atmosphere. The workshops have an informal and interactive style, and seek to balance high quality presentations with discussions on leading edge development, benchmarking and application of models.

In addition to the scientific program, we wish to dedicate the last day of the workshop to provide facilities for software demos and/or numerical tools exchanges between participants. In what could be thought as a software market place, participants will be encouraged to share software and experiences about mesh/grid generation (triangular/quadrangular unstructured grids, non-orthogonal structured grids), database processing (DTMs, initial conditions, ...), graphical user interface, etc..

Dates to remember:

Abstract deadline: **June 10, 2016.**

Early Registration deadline: **July 15, 2016.**

More information can be found at <https://imum2016.sciencesconf.org/>.

ICES/PICES Symposium on Drivers of dynamics of small pelagic fish resources, March 6-11, 2017, Victoria, Canada.



The goal of the 2017 symposium is to revitalize global international cooperation on investigations of small pelagic fish (SPF) and to identify, discuss and develop a framework to address unanswered questions such as the impact of climate and/or fishing pressure on the resilience of small pelagic populations using a comparative approach. Because of the importance of environmental and anthropogenic drivers on small pelagic resources, the participation of experts in physical oceanography, climate, and socio-economics is essential.

Themes:

- Environmental control of productivity and distribution
- Early life history and recruitment processes
- Trophodynamic role between plankton and top predators in different ecosystems
- Mechanisms of teleconnection and synchrony
- Management and economics

*An important deadline: **October 1, 2016*** - Early registration, Abstract submission, Financial support application.

Details can be found on the conference website:

<http://meetings.pices.int/meetings/international/2017/pelagic/>

ICHA 17 Conference on Harmful Algae, October 9-14 2016, Florianópolis, Santa Catarina, Brazil.

[The 17 International Conference on Harmful Algae](#) will take place from 9 - 14 October 2016 in Florianopolis, Brazil. It is the first ICHA in South America. A major goal of the 2016 conference is to connect the science on harmful algae with the beneficiaries of this research. The scientific program will range from Harmful Algae Biology and Toxins to Surveillance and Management of Harmful Algal Blooms.

For some countries visa may be required. Please check visa regulations well in advance (the process may take several months) with your local Brazilian Consulate for official instructions on the specific visa regulations and application procedures.



*Noctiluca bloom in Vietnam
(photo:Nguyen Ngo)*

As the major host of the conference, ISSHA will support the event with various activities: Travel awards to students and post-docs, ISSHA auction, and several achievement awards.

*Abstract deadline: **June 3, 2016.***

<i>Please send meeting announcements to David Greenberg, david.greenberg@dfo-mpo.gc.ca</i>	<i>SVP faites parvenir vos annonces de réunion à David Greenberg, david.greenberg@dfo-mpo.gc.ca</i>
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CANADIAN JOBS and TRAINING

Fisheries and Oceans Canada to hire 135 scientists

On May 11, the Canadian Department of Fisheries and Oceans [announced](#) it would be hiring 135 scientists with job postings starting to appear online in the very near future. This is the most significant hiring in DFO for decades. Given that the department now can replace retiring employees and there could be more job openings associated with expected announcements of future ocean-science related programs, it is hard to overestimate the significance to the Canadian ocean-science job market. People interested in applying for Government of Canada positions should become familiar with the hiring process as found in <http://emplois-jobs.gc.ca/>. There they can register to create an account so that a profile can be entered with a CV. Depending on the urgency of the work to be done, some competitions may remain open for just short periods of time. The site should be checked often, or people can chose to be notified automatically when positions in which they might be interested become available. Note that frequently, qualified candidates for one position are used as a pool for other positions with the same job requirements without opening the competition to further applicants. It is anticipated that generic pools will be used to fill multiple vacancies. Thus, to establish eligibility for all such positions, candidates might consider applying to any position that matches their skill set.



<i>Looking for work? Try the CMOS site (click).</i>	<i>Vous recherchez un emploi? Visitez le site SCMO (click).</i>
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GENERAL

The Martin Bergmann Medal for Excellence in Arctic Leadership and Science

Established by the Royal Canadian Geographical Society in 2012, the medal recognizes achievement for “excellence in Arctic leadership and science”. It celebrates “Marty” Bergmann, a public servant with an outstanding talent for networking that led him to connect scientists with resources and technology, to inspire business leaders, explorers and innovators towards new goals and to consider and attempt to meet the challenges inherent in opening up the Arctic.



Candidates will be evaluated on their qualifications in the following five categories, based on information presented in the nomination package:

- Significance of contributions to Arctic leadership or science;
- Contribution to outreach and awareness of the value of the Arctic to the Canadian public;
- Contribution with a lasting impact on or for a significant group (e.g. community, demographic group, scientific discipline, mass media);
- Leadership through teaching/mentoring;
- Significant contributions to disciplinary and interdisciplinary science activities; outreach activities; inspiration and influence on policy directions and discovery initiatives.

All nominations must be made on-line. Nominations can be made by Canadian Citizens or Permanent Residents of Canada. Details can be found at:

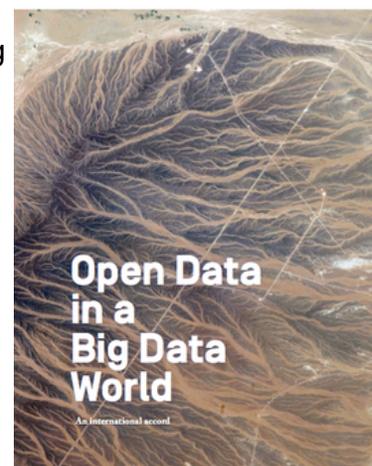
http://www.rcgs.org/awards/bergmann_medal/nominations.asp

Nomination deadline: June 30, 2016.

“Open Data in a Big Data World”

The 2015 edition of Science International has developed an international accord on the values of open data in the emerging scientific culture of big data. The Accord recognises the need for an international framework of principles on “Open Data in a Big Data World” and proposes a comprehensive set of principles.

These principles provide a guiding framework for an African data science capacity mobilization initiative spearheaded by CoDATA-ICSU and supported by other Science International partners. The initiative puts forward a comprehensive capacity mobilization plan, to be co-designed and delivered with key partners in Africa. It proposes the establishment of an African Open Data Platform, which will coordinate a series of actions at different levels of national science systems in the region.

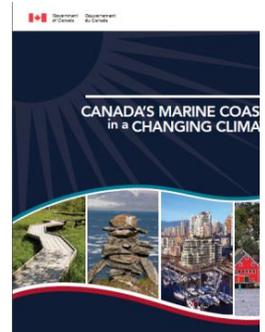


Two versions of the Accord are [available for download](#), a short four-pager giving an overview of the key issues, and a long version describing in detail a proposed international framework for open data in a big data world.

If you are an organization wishing to endorse the principles laid out in this accord, please fill in [this endorsement form](#).

Canada's Marine Coasts in a Changing Climate

Recently released, Canada's Marine Coasts in a Changing Climate assesses climate change sensitivity, risks and adaptation along Canada's marine coasts. The report includes overviews of regional climate change impacts, risks and opportunities along Canada's three marine coasts, case studies demonstrating action, and discussion of adaptation approaches. Led by Natural Resources Canada, the development of this report involved over 60 authors and 70 expert reviewers, and synthesized over 1300 recent publications.



The web-accessible report is available in its full version and by chapter at: <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2016/18388>

This report follows from the 2014 update of Canada's second national science assessment on climate change impacts and adaptation, entitled Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation. Also led by Natural Resources Canada, it involved over 90 authors and 115 expert reviewers, synthesized over 1500 recent publications, and is available at:

<http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>

The Outgoing Secretary for CNC/SCOR

After years of dedicated service to CNC/SCOR, Michel Mitchell left the post of Secretary this past Autumn. CNC/SCOR is grateful to Michel for his relentless efforts that have been key to the continued success of the organization.



Michel Mitchell at the 48th CMOS Congress in Rimouski.

The Incoming Secretary of CNC/SCOR

David Greenberg is an emeritus research scientist working at the Bedford Institute of Oceanography (BIO) in Fisheries and Oceans Canada. He retired in 2013. David can still be found at BIO 4 days a week, spends one day a week at Dalhousie University and an occasional day at Acadia University, working on model [development and application](#). He continues an active collaboration with LEGOS (Laboratoire d'études en géophysique et océanographie spatiales) in Toulouse, France. He is proud to have spent his career in science avoiding administrative duties mostly through demonstrated incompetence. Incompetence has proven to be an insufficient excuse in "retirement" as he finds himself leading the BIO seminar committee and is now secretary of CNC/SCOR, worrying that replacing Michel Mitchell will be a difficult task.



New SCOR Working Group Proposals

Eleven working group proposals have been submitted to SCOR for review:

1. Atmosphere-waves-current interactions and oceanic extremes (EXTREMES)
2. Climate-Change Impacts of Ocean Carbon Chemistry/Synergism with Other Stressors: How can Seamount Deep-Sea Coral Ecosystems respond to ASH/CSH Shoaling/Ocean Acidification? (IBDIOCC)
3. Iron Model Intercomparison Project (FeMIP)
4. Measuring Essential Climate Variables in Sea Ice (ECVice)
5. Building a coral reef marine biodiversity observation network (CoralMBON)
6. Global Assessment of Nutrient Export Through Submarine Groundwater Discharge (NEX SGD)
7. The dynamic ecogeomorphic evolution of mangrove and salt marsh coastlines (DEMASCO)
8. Towards strategic observatories for regional ocean-atmosphere interactions in the Eastern Boundary Upwelling Systems (cOCtEAU)
9. Towards the science-based jellyfish observing system (JOS)
10. Eastern Boundary Upwelling Ecosystems (EBUE): inter-comparisons, variability and forecasting responses to climate and global change
11. Carbon Hot Spot: Drivers and Sensitivities of Large Carbon Uptake in Western Boundary Currents

The proposals can be accessed here (http://www.scor-int.org/Annual%20Meetings/2016GM/SCOR_GM_2016.html). One to three of these will be funded at the Annual SCOR meeting in September. Comments from any interested scientist are welcomed. Comments can be sent to CNC-SCOR, either via the Chair (Paul Myers, pmyers@ualberta.ca) or the Secretary (David Greenberg, david.greenberg@dfo-mpo.gc.ca). The deadline for comments for this year is July 4, 2016.

**CANADIAN OCEAN SCIENCE NEWSLETTER
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<p>Previous newsletters may be found on the CNC/SCOR web site.</p> <p>Newsletter #89 will be distributed in July 2016. Please send contributions to David Greenberg david.greenberg@dfo-mpo.gc.ca</p> <p>If you wish to subscribe to this newsletter, please send an email to listserv@lists.mcgill.ca with the following message: SUBSCRIBE OCEAN-NEWSLETTER</p> <p>If you wish to cancel your subscription, please send an email to listserv@lists.mcgill.ca with the following message: SIGNOFF OCEAN-NEWSLETTER</p>	<p>Les bulletins antérieurs se retrouvent sur le site web du CNC/SCOR.</p> <p>Le Bulletin #89 sera distribué en Juillet 2016. Veuillez faire parvenir vos contributions à David Greenberg, david.greenberg@dfo-mpo.gc.ca</p> <p>Si vous désirez vous abonner à bulletin, veuillez envoyer un courriel à listserv@lists.mcgill.ca avec le message suivant: SUBSCRIBE OCEAN-NEWSLETTER</p> <p>Si vous désirez annuler votre abonnement, veuillez envoyer un courriel à listserv@lists.mcgill.ca avec le message suivant: SIGNOFF OCEAN-NEWSLETTER</p>
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