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CMOS

BULLETIN

SCMO

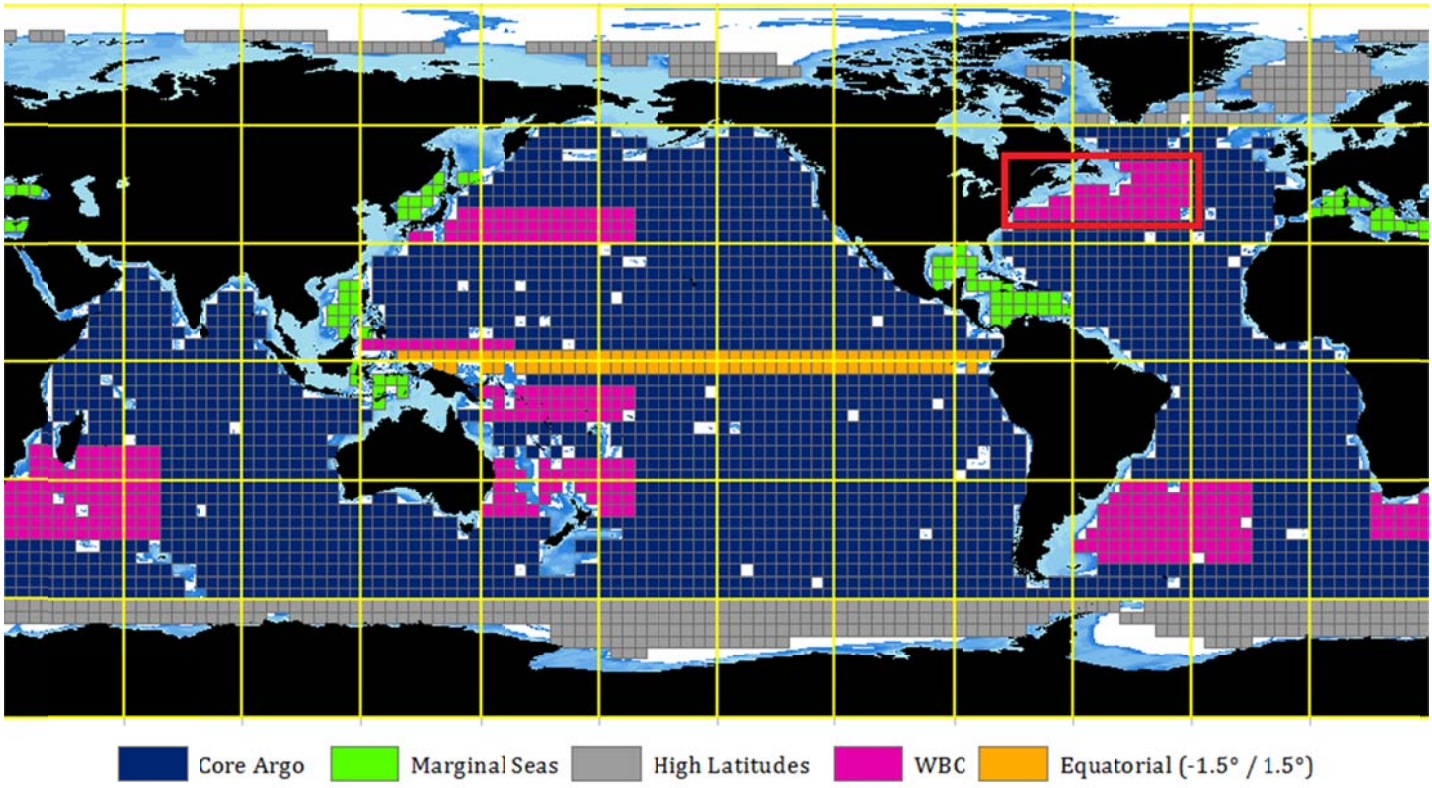
Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

December / décembre 2014 Vol.42 No.6

Proposed regional enhancements to the Argo profiling float array

Modifications régionales proposées au réseau Argo de flotteurs profilants



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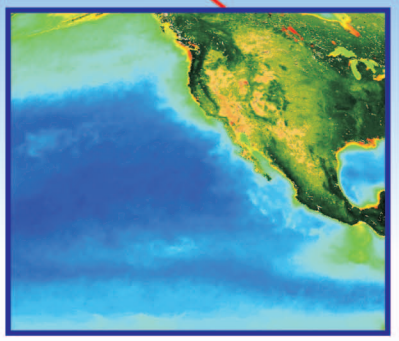
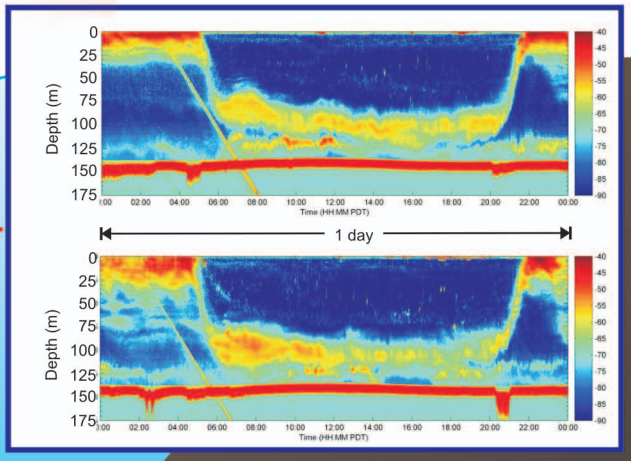
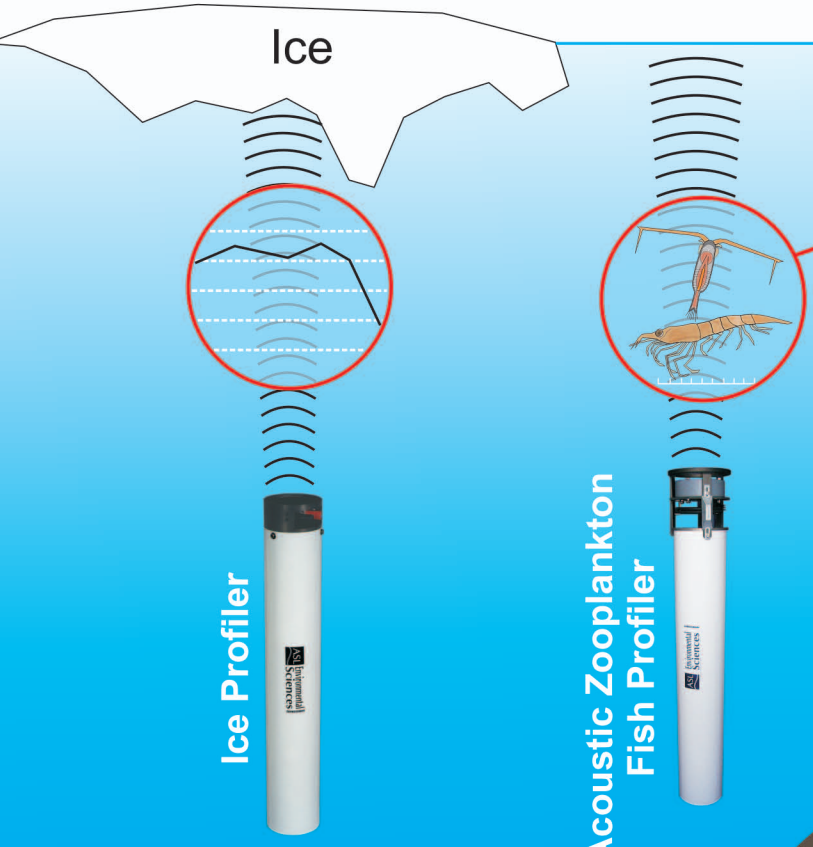


Ocean colours are chlorophyll concentrations and land colours are NDVI





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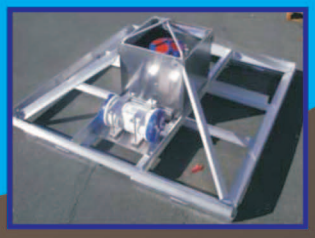

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.... Words from the President

Friends and Colleagues:

Harinder Ahluwalia
CMOS President
Président de la SCMO

CMOS is in a state of transition to provide various additional services and activities. However, that is possible only if we get volunteers to implement those new services and activities.

We have signed an MOU (Memorandum of Understanding) with AMS (American Meteorological Society) which provides mutual benefits to the two organizations and its members. We encourage CMOS management and members to study the benefits of this relationship and take full advantage of it. We are discussing potential bilateral relationships with other International Societies to leverage the strength of each other for mutual benefit – one such society which has approached us is the Indian Meteorological Society and we plan to follow this up, also for mutual benefit.

We will be starting webinars in December 2014 and members are encouraged to suggest new topics and speakers.

Many of our students and young professionals need mentoring to channel their careers. We encourage our senior and experienced members and well-wishers to offer to be mentors. We believe that this activity helps both sides and also provides a lot of satisfaction to mentors.

CMOS is nothing but a confluence of its various Centres across the country. Therefore, we urge Centre Chairs to ***increase the membership*** of their Centres and their activities as much as possible. We understand that most of us are doing our duties for CMOS on a volunteer basis and we have a full day-job to earn our living; therefore, we need to involve more people and divide our roles to achieve greater success.

In recent surveys, our members and potential members have overwhelmingly shown their preference for CMOS to be a scientific as well as a professional society. We need to involve large users of meteorology from various sectors such as power, aviation, agriculture, etc. and provincial governments which are also users of meteorology. We need to implement a value proposition of interest to them. One of the ways we believe they could be attracted is by having Special Interest Groups (SIGs) in each of those fields.

[Continued on page 179]

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Cover page: World map showing the proposed regional enhancements to the Argo profiling float array at the 4th Argo Science workshop in Venice, Italy in 2012. On this Mercator projection map, each colored square represents an area of 3° latitude x 3° longitude. The original Argo core mission is indicated in blue, and regional enhancements are presented with other colours. WBC = Western Boundary Current. To learn more, please read Denis Gilbert's article on **page 183**.

Page couverture: carte du monde montrant les modifications régionales visant à améliorer le réseau Argo de flotteurs profilants, comme proposées au Quatrième atelier scientifique Argo, tenu à Venise (Italie), en 2012. Sur cette projection de Mercator, chaque carré représente une surface de 3° de latitude sur 3° de longitude. La mission de base originale Argo apparaît en bleu. Les autres couleurs représentent les améliorations régionales. WBC = courant de bord ouest. Pour en savoir plus, prière de lire l'article de Denis Gilbert en **page 183**.

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Société canadienne de météorologie et d'océanographie (SCMO)

Council / Conseil d'administration

.... Words from the President [Continued / Suite]

Our effort to create those SIGs is under way; however, the success of this effort is dependent upon interest shown by our current members and potential members. Please volunteer your help in creating and operating these SIGs. Similarly, media, government, and public relations is an important part of the CMOS mandate. We need to strengthen this by taking required actions which is on our agenda during the next three months.

In the WWOSC (World Weather Open Science Conference) in Montreal in August 2014, leaders of the Weather Enterprise from public, private, and university sectors as well as meteorological societies participated in three panels. It was concluded that the future of the "Weather Enterprise" lies in full collaboration between the three sectors which needs to be facilitated by meteorological societies. We need to gear ourselves for that role.

In order to achieve success in our efforts, we need volunteers and we need to recruit large users to get some sponsorship to enhance the image and activities of CMOS. Let's all pitch in to achieve results of which we all can be proud of.

Please offer yourself as a volunteer for any of the activities mentioned above. Your strong involvement would be highly appreciated.

Harinder Ahluwalia
CMOS President

CMOS exists for the advancement of meteorology and oceanography in Canada.

Le but de la SCMO est de promouvoir l'avancement de la météorologie et l'océanographie au Canada.

.... Allocution du Président

Chers amis et collègues,

La Société canadienne de météorologie et d'océanographie est en transition, afin d'offrir des services et des activités supplémentaires. Toutefois, ces améliorations ne verront le jour que si nous mobilisons des bénévoles pour les mettre en œuvre.

Nous avons signé avec l'American Meteorological Society (AMS) une entente qui profitera aux deux organisations et à leurs membres. Nous encourageons les dirigeants et les membres de la SCMO à examiner les avantages de cette collaboration et à en retirer le maximum. Nous discutons actuellement avec d'autres sociétés étrangères au sujet de collaborations bilatérales, afin d'exploiter nos forces respectives et d'en profiter mutuellement. L'Indian Meteorological Society a communiqué avec nous en ce sens et nous planifions prendre en considération les avantages éventuels d'une telle relation.

Nous commencerons les webinaires en décembre 2014 et encourageons les membres à suggérer de nouveaux thèmes et conférenciers.

Nos étudiants et jeunes professionnels recherchent des mentors pour orienter leur carrière. Nous encourageons nos membres chevronnés et ceux de longue date à servir de mentor. Nous croyons que cette activité présente des avantages pour les deux parties et que le mentor en retire une réelle satisfaction.

La SCMO s'articule autour de ses centres situés partout au pays. Ainsi, nous prions les présidents des centres d'***augmenter le plus possible leur nombre de membres*** et leurs activités. Nous comprenons que la plupart d'entre nous travaillons pour la SCMO sur une base bénévole. Nous exerçons un emploi à temps plein pour gagner notre vie. Pour atteindre nos objectifs, nous devrons donc nous partager la tâche, et ce, en recrutant des bénévoles supplémentaires.

Les sondages récents montrent que nos membres et membres potentiels préfèrent nettement que la SCMO soit à la fois une société scientifique et professionnelle. Nous devons mobiliser les grands utilisateurs de météorologie des divers secteurs : électricité, aviation, agriculture, etc., ainsi que les gouvernements provinciaux, qui comptent aussi sur les services météorologiques. Nous devons mettre en place un programme qui les intéresse. Nous croyons que la création de groupes d'intérêts spéciaux dans chacun de leur domaine s'avérerait une façon de les attirer.

Nous nous efforçons présentement de créer ces groupes. Toutefois, leur succès dépendra de l'intérêt que démontreront les membres actuels et potentiels. Je vous prie instamment de participer à la création et à la gestion de

ces groupes d'intérêts spéciaux. En outre, les relations avec les médias, les gouvernements et le public constituent une part importante du mandat de la SCMO. Nous devons les renforcer en prenant les mesures qui s'imposent et qui figurent à notre programme des trois prochains mois.

Durant la Conférence scientifique publique mondiale sur la météorologie, tenue à Montréal, en août 2014, les chefs de file en météorologie, venant des secteurs public, privé et universitaire, ainsi que des sociétés météorologiques, ont participé à trois groupes de discussion publics. Ses conclusions confirment que le futur de la météorologie dépend de la collaboration complète entre les trois secteurs visés et que les sociétés météorologiques devraient faciliter cette collaboration. Nous devons donc nous préparer à assumer cette fonction.

Pour réussir, nous devons attirer des bénévoles et nous devons mobiliser les grands utilisateurs, pour que ceux-ci financent la consolidation de l'image de la SCMO et ses activités. Retroussons nos manches et obtenons des résultats qui nous rendront fiers.

N'hésitez pas à offrir vos services pour mener à bien l'une des activités mentionnées précédemment. Votre participation active ne passera pas inaperçue.

Harinder Ahluwalia
Président de la SCMO

ARTICLES

How the Intergovernmental Oceanographic Commission works with its Member States to address Climate Change

by Dr. Albert Fischer, Head, Ocean Observation Section,
and by Dr. Wendy Watson-Wright, Executive Secretary,
Intergovernmental Oceanographic Commission of UNESCO[1]

Near the beginning of his mandate, Ban-Ki Moon, Secretary-General of the United Nations, called climate change a "defining issue of our era." For the ocean, climate change is increasing temperatures, leading to reduced sea ice, increasing its acidity, growing low oxygen areas, and increasing sea levels. The ocean is a key player in the climate system, involved in the storage and transport of heat, evaporation and rainfall, carbon and nutrients. Human life on this planet depends on many ocean ecosystem services, through food provision, carbon storage, coastal protection, coastal livelihoods and economies, tourism and recreation, and biodiversity.

The Intergovernmental Oceanographic Commission (IOC) of UNESCO is a UN specialized mechanism for cooperation among Member States on oceanographic research, observations, data exchange, and services. Its Executive Secretary is Wendy Watson-Wright, a Canadian.

IOC Member States, who now number 147, have recently adopted an eight-year strategy which has as its vision *"Strong scientific understanding and systematic observations of the changing world climate and ocean ecosystems shall underpin global governance for a healthy ocean, and global, regional and national management of risks and opportunities from the ocean."* Supporting this vision are four high-level objectives for IOC Member States to collectively achieve:

1. Healthy **ocean ecosystems** and sustained ecosystem services,
2. Effective **early warning systems** and preparedness for tsunamis and ocean-related hazards,
3. Increased resiliency to **climate** change and variability through scientifically-founded **services, adaptation, and mitigation** strategies, and
4. Enhanced knowledge of **emerging ocean science issues.**

Functionally, IOC programs contribute to these high-level objectives through:

- the building of scientific knowledge in ocean research and observing systems and data management systems,

- application of that scientific knowledge for societal benefit in early warning and ocean information services and in scientific assessments and information for policy, and

- improving governance and sustainable management in improving science/policy interfaces.

Underpinning all of these programs are efforts to build scientific capacity to address these challenges, and to develop individual and institutional capacity so that all Member States can achieve IOC's high-level objectives.

Dr. Wendy Watson-Wright
Executive Secretary, IOC

In ocean research, IOC addresses climate change in partnership with the World Meteorological Organization (WMO) and the International Council for Science (ICSU) through the World Climate Research Programme (WCRP), which has as its mission to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit, and value to society. WCRP's Climate Variability and Predictability Project (CLIVAR) has a particular focus on understanding the dynamics, the interaction, and the predictability of the coupled ocean-atmosphere system. It facilitates observations, analysis, and predictions of changes in the Earth's climate system, enabling better understanding of climate variability and dynamics, predictability, and change, to the benefit of society and the environment in which we live.

[1] 7 Place de Fontenoy
75007 Paris, France

IOC has additional ocean research activities related to the ocean's carbon sources and sinks and ocean acidification. The ocean has absorbed about 50% of the greenhouse gases that humans have emitted since the start of the Industrial Revolution, which fortunately for us has reduced the amount of atmospheric warming. On the other hand, carbon in the ocean makes it more acidic - it has become 30% more acid. Many ocean animals including corals and pteropods ('ocean butterflies' or zooplankton) require more energy to construct their carbonate shells in acidic water, and may be impacted. Given that corals house an estimated 25% of oceanic biodiversity and that pteropods are the base of the food chain in many polar regions, marine ecosystems are sure to change.


Dr. Albert Fischer, Head Ocean Observation Section

In ocean observations and data management, four IOC programmes (a number of them in partnership with WMO, the United Nations Environment Programme [UNEP], and/or International Council for Science) address the collection of oceanic information for climate monitoring, research, projections, and developing climate services. These are the Global Ocean Observing System (GOOS), the Global Climate Observing System (GCOS), the Joint IOC-WMO Technical Commission for Oceanography and Marine Meteorology (JCOMM), and the International Oceanographic Data and Information Exchange (IODE). Collectively these programmes ensure that: 1) we are making the right observations to be able to answer societal issues related to climate change, 2) that the observations are well-coordinated, to common standards and using best practices shared among all Member States, and 3) that data and information about ocean climate flow freely to the benefit of all.

The requirements for ocean observations for climate are expressed as the oceanic Essential Climate Variables (ECVs) or climate Essential Ocean Variables (EOVs). We know that the ocean has absorbed about 90% of the excess heat in the climate system, and that oceanic transport is key to modifying patterns of drought and extremes around the globe. The ECVs have therefore been largely physical up until now. But as we learn more about how the ocean reacts to climate change, there is growing understanding that marine chemistry and biology will be impacted - and in turn this could change ocean ecosystem services upon which we as humans depend. As such, an increasing number of biogeochemical and biological EOVs are being seen as essential to observe in order to address climate change - to prepare for it, adapt, and to mitigate its consequences.

The JCOMM Observing Platform Support Centre (JCOMMOPS) provides key technical coordination to *in situ* observing networks such as Argo profiling floats, surface drifters, moorings, and time series stations. It is a key driver of integration in the observing system, promoting and developing cooperation between individual networks.

In the area of scientific assessment, IOC is engaged in adding to the work of the Intergovernmental Panel for Climate Change (IPCC) through a number of complementary assessment activities. It has published summaries for policymakers on ocean acidification and ocean fertilization. With funding from the Global Environment Facility, IOC will publish in early 2015 two complementary marine assessments focused on Large Marine Ecosystems and the Open Ocean under a Transboundary Waters Assessment Program (TWAP). Climate is a major theme of the assessment, along with its impact on coastal populations through sea level rise, and its impact on marine ecosystems and the services they provide. And the IOC is one of the two UN organizations providing essential technical support to the first UN World Ocean Assessment, due to be published in 2015.

Scientific information can provide societal benefit in the case of climate change only through good interfaces between policy and science. IOC addresses climate and policy through programs in Integrated Coastal Area Management, which incorporate oceanographic, social, and economic information in support of good decision-making for the coastal zone.

Finally, IOC is pushing efforts to have the ocean fully incorporated in UN environmental and sustainable development agendas, including in the UN Framework Convention for Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and through UN processes in developing Sustainable Development Goals which are presently being set for the period beyond 2015.

From a Member State perspective, participating in the IOC carries a small amount of overhead through the cost of attending meetings and staff time volunteering for IOC projects, but the benefits are vast. Canada has been one of the countries that has played a leadership role in Climate Change Programmes and has been quite successful in leveraging and influencing the work of IOC Member States and other international organizations in research, observations, data management, early warning, services, and science-policy interfaces. Gordon McBean, current President of the International Council for Science, Savi Narayanan, past Vice-Chair of IOC and past Co-President of JCOMM, Geoff Holland, past Chairman of IOC, David Grimes, current President of WMO, and many Canadian scientists leading and contributing to understanding, documenting, and increasing public awareness, are examples of Canadian leadership in Ocean Sciences and in particular Climate Change.

Enhancements to the Argo array

by Denis Gilbert[1]

In 1999, the original design goal of the Argo array was to deploy Argo floats as uniformly as possible in the ice-free global ocean between 60°S and 60°N in waters deeper than 2000 m, in such a way that on average, we would have one Argo float per 3° latitude x 3° longitude "square" of the ocean, excluding marginal seas. The Argo community now refers to this original sampling design as its core mission, which corresponds to a total number of close to 3000 floats.

During the fourth Argo Science Workshop (ASW4), held in Venice in September 2012, various enhancements to the Argo array were proposed. Some of the proposed enhancements focused on the measurements *per se*, such as introducing float models capable of profiling deeper than 2000m, or making temperature and salinity measurements between 4 m and the sea surface to aid in the calibration of satellite-derived surface temperature and salinity data. Another set of enhancements were proposed for specific geographical regions (Figure 1 shown on next page), and this is what I briefly report on in this note.

The equatorial Pacific Ocean plays a disproportionally important role in shaping weather patterns around the globe through its irregular and difficult to predict flips from El-Niño conditions to La Niña conditions. But unfortunately, degradation in the TAO (Tropical Atmosphere Ocean) array in recent years has diminished our ability to predict the future evolution of physical oceanographic conditions in the equatorial and tropical Pacific. To partially offset these data losses from the TAO array, the Argo program was asked to increase its float coverage by 50% in a narrow band extending from 1.5°S to 1.5°N in the equatorial Pacific. Good progress towards that goal is being made thanks mainly to float deployment efforts by the USA.

Marginal seas were also targeted as potential areas of Argo float deployments with a float coverage that would be on average twice denser than the core Argo mission. This goal has already been attained in the East/Japan Sea. Good progress is also being made in the Mediterranean and South China Seas. However, things are progressing at a much slower pace in the Caribbean Sea and Gulf of Mexico regions.

In the seasonally or permanently ice-covered regions of the ocean north of 60°N or south of 60°S, ASW4 attendees had set the ambitious goal of achieving a coverage density similar to core Argo. We still remain very far from achieving that goal, mostly due to the more expansive and demanding logistics of field work activities in ice-covered regions. In Canada, our main effort in this direction is being led by the Takuvik group at Université Laval. They are planning to deploy several profiling floats in Baffin Bay in 2015 and 2016 and will be testing new sensors and algorithms for ice avoidance. The Department of Fisheries and Oceans (DFO) and Environment Canada (EC) are also conducting a small pilot experiment with the deployment of ice-anchored profilers in the Beaufort Sea.

Finally, recognizing the major role of western boundary currents in global ocean circulation, ASW4 participants proposed a doubling of Argo float density in currents such as the Gulf Stream, Kuroshio, Agulhas and their extension regions. I am glad to report that Canada recently made significant contributions towards increasing float coverage density in the Gulf Stream region. After deploying four Canadian floats in the Gulf Stream's northern recirculation gyre in April 2014, Bedford Institute of Oceanography personnel aboard *CCGS Hudson* deployed an additional five floats from Germany and four U.S. floats during September 2014. Residence time of floats in the Gulf Stream system can be expected to be lower than average due to high advection speeds carrying the floats away. Maintaining denser float coverage in this region will therefore require float deployments on a repeated basis in future years. Rather than an independent and competing effort, the Gulf Stream floats, once dispersed, can seamlessly be merged with the floats of the "core" Argo mission. In the Kuroshio extension region, much progress towards a denser Argo array was made in recent years thanks to Japan.

[1] Institut Maurice-Lamontagne, Mont-Joli, Québec, Canada

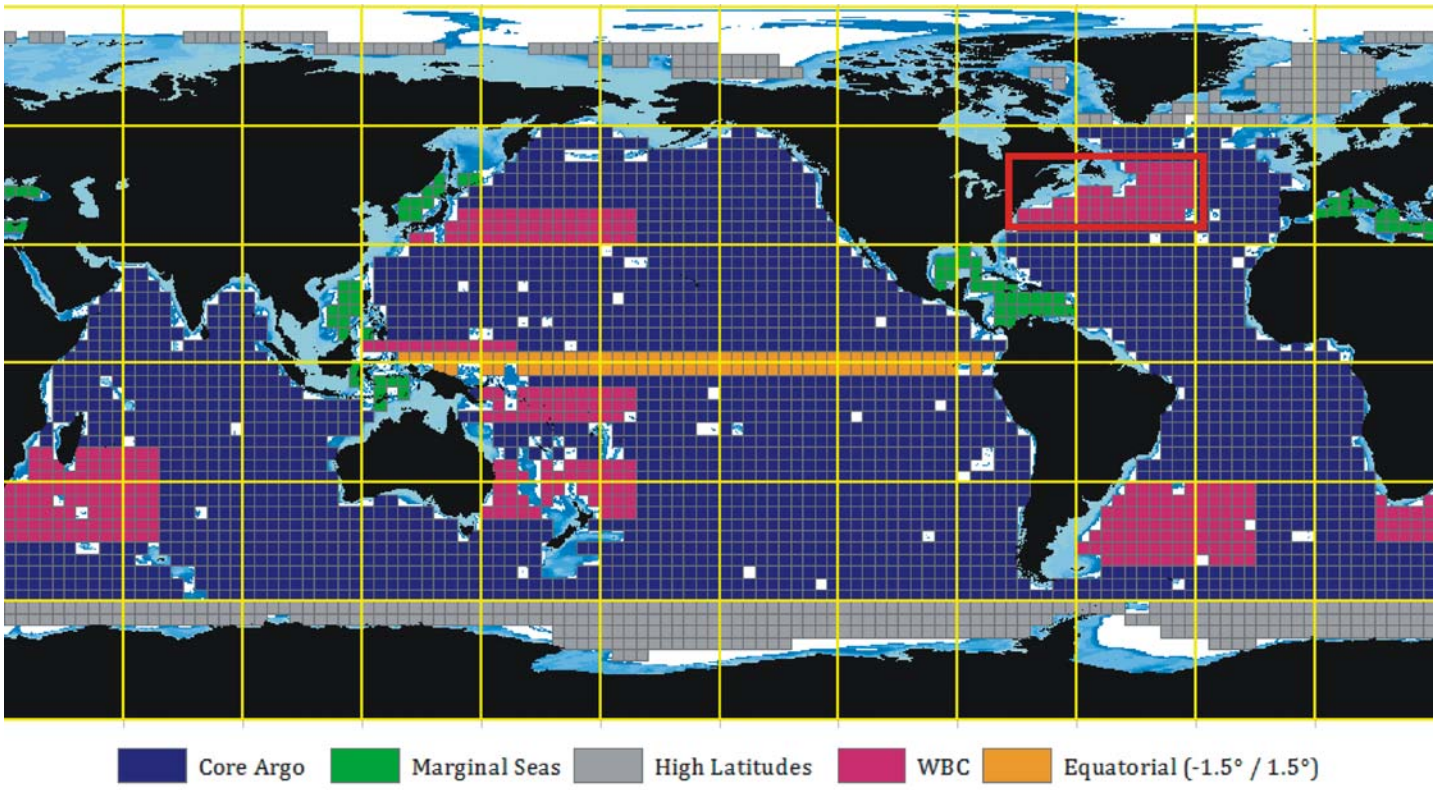


Figure 1: Regional enhancements proposed to the Argo array in 2012 at the 4th Argo Science workshop in Venice, Italy. On this Mercator projection map, each colored square represents an area of 3° latitude x 3° longitude. The original Argo core mission is indicated in blue. The largest marginal seas are shown in green, oceanic regions north of 60°N or south of 60°S are grey, and WBC = Western Boundary Currents.

Development of a 1/4 m deep surface tracker for emergency response and potentially oceanographic measurements

by Tamás Juhász and Charles Hannah[2]

A team of researchers at the Institute of Ocean Sciences, (IOS), headed by Dr. Charles Hannah, and Tamás Juhász, senior technologist, are developing and testing a unique drifter that fills the gap between the "wind drifter", (drift cards, floating toys, and running shoes), and currently accepted oceanographic drifters, such as the 1-2m deep Davis drifter, and the even deeper drogued holey sock Surface Velocity Program/Global drifter. The initial goal is to provide ocean surface tracking for the purposes of modelling the currents in coastal waters, and then as an emergency response tool for spills and similar disasters.

During the development, testing, and implementation of the IOS drifters, a number of previously unknown, definitely unexpected, observations of movement of the upper (less than 1/2m) of the ocean are being observed.

This new approach is made possible through the arrival of mass produced low cost, "asset tracking" devices, real-time monitoring, and the LEO satellite systems, i.e., Globalstar.

[2] Institute of Ocean Sciences
Fisheries and Oceans Canada
Sidney, British Columbia
Canada

Low Cost Drifter developed at IOS

At IOS the Trace1 model asset tracker made by SPOT Inc. forms the core of our buoy. Some of the salient features are:

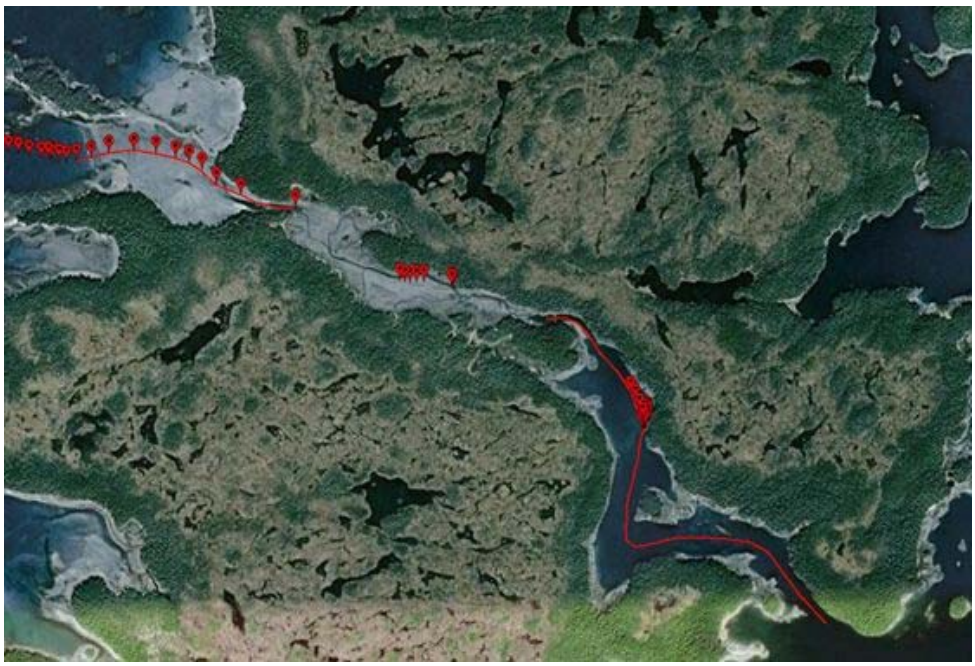
- GPS time/date/location data available real-time over internet and WiFi;
- low cost; buoys have produced data as low as $0.04 - $0.10 per point;
- low weight, small size; the Trace1 has negative buoyancy of only 90 gr of electronics, plastic, and battery combined;
- operating life 1 – 2 months, at the currently set 5 min. interval;
- biodegradable construction of cedar, wood fibre cellulose sponge, and metals common in nature;
- the use of sponge for the platform allows the "traditional buoy" and "traditional drogue" to be combined into one unit;
- currently the above water profile, to submerged profile, is 1:16;
- approximates density of the water it occupies; when dry, the sponge is 95% air, when immersed it is 95% full of the fresh or salt water it occupies,

We are reasonably assured that this new buoy is a good emergency response tool.

Further development will be aimed at increased data return, more sophisticated data dissemination and display, simpler and more robust construction, increased ratio of above/below surface profiles to approach 1:40, air deployment, fabrication in quantity, ease of program delivery into the field, and community outreach and collaboration.


Drifters ready to be deployed sitting on ship deck


Deployment of a drifter at sea



Sample Drift Track crossing a tide flat

Sample Drift Track in open water

SeaDataNet

by Robert Keeley[1]

Introduction

SeaDataNet (www.seadatanet.org) is the pan-European infrastructure for ocean and marine data management as developed and operated by National Oceanographic Data Centres and other marine data centres in countries around the European seas, with co-funding from the European Commission (EC). The first steps were undertaken in the Sea-Search project (2002 – 2005), which was succeeded in 2006 with the five-year SeaDataNet project and continued in 2011 for another four years with the SeaDataNet II project. The EU (European Union) had adopted or was poised to adopt a number of directives that require the accessibility of a wide variety of marine data and information that was being collected. At the same time, the EC recognized the wide diversity of capabilities for managing data in the EU. The SeaDataNet infrastructure and its standards and services are meeting these requirements. There are 55 partner institutions [including the Intergovernmental Oceanographic Commission (IOC), the International Council for the Exploration of the Seas (ICES), and the EU Joint Research Centre (EU-JRC)] in the SeaDataNet II project coming from 35 countries. Partner institutions are responsible for assembling the variety of marine data and information collected within their nation (shared responsibilities are arranged when two or more institutions cooperate in the data collection). The project began with targeting physical oceanographic data, but that has expanded now to include biological, geological, bathymetric, and chemical data and information from moored platforms, autonomous vehicles, and ships. As part of building the pan-European infrastructure, SeaDataNet partners are active in disseminating their approach. That is resulting in the adoption of SeaDataNet protocols, infrastructure, and tools by other EU projects and projects outside of Europe. In addition to assembling, processing, and distributing data and information, there is also a component within SeaDataNet to generate products.

Components and Technologies

SeaDataNet has a great variety of component developments. Most of them focus on standardizing the assembly, treatment, archiving, and dissemination of marine data and information. Other components are concerned with product development, communications, and exploring options for sustainability including seeking continued EU co-funding after the end of SeaDataNet II. The SeaDataNet activities have greatly enlarged and harmonized the European capacity for marine data management. The SeaDataNet infrastructure has expanded beyond the SeaDataNet consortium partners to include other marine data centres. This is reflected in a pan-European infrastructure which at present is connecting more than 100 data centres from 35 countries and which is used by many institutes and projects at national, regional, and EU scales. Altogether SeaDataNet handles data sets from more than 500 organizations.

SeaDataNet does not contribute to data acquisition. However, one of the first responsibilities of SeaDataNet partners is to be sure that what is collected is reported in a standard form called a Cruise Summary Report (CSR). This report has been around for many years, but SeaDataNet has built software standardized on ISO-19115 - 19139, to streamline the reporting requirements and allow for cruise track maps to be included. The German Data Centre is responsible within the project for acquiring CSRs from national SeaDataNet partners and has constructed a database containing them. This is supported by a number of other standardized catalogues that are maintained and managed by SeaDataNet. These include lists of projects underway or completed, European organizations, descriptions of data set collections, descriptions of monitoring activities and networks, and controlled vocabularies. The various catalogues are interrelated and each is managed at the European level by one of the SeaDataNet partners while individual project partners are responsible for ensuring their national entries are correct. These catalogues and vocabularies are used to ensure a common naming convention for all data collected. CSRs enter the SeaDataNet realm even before the data do.

Once data and information arrive at a SeaDataNet partner institution, a metadata record is created in a common structure called the Common Data Index (CDI). This is a centralized facility operated within the SeaDataNet project by the Marine Information Service in the Netherlands (MARIS). The format of the CDI is an ISO 19115 - 19139 profile and each partner is responsible for creating records using software tools developed by IFREMER (French Research Institute for Exploitation of the Sea) in France, another SeaDataNet partner. Through software and network connectivity to the various data centres contributing to the project, MARIS harvests CDI entries and updates an on-line catalogue of holdings. This catalogue is the point of entry for users wanting to identify data of interest and for requesting access to the data sets that are managed at each of the connected data centres.

[1] Retired oceanographer; formerly with the Marine Environmental Data Service of the Department of Fisheries and Oceans, Ottawa, Ontario, Canada

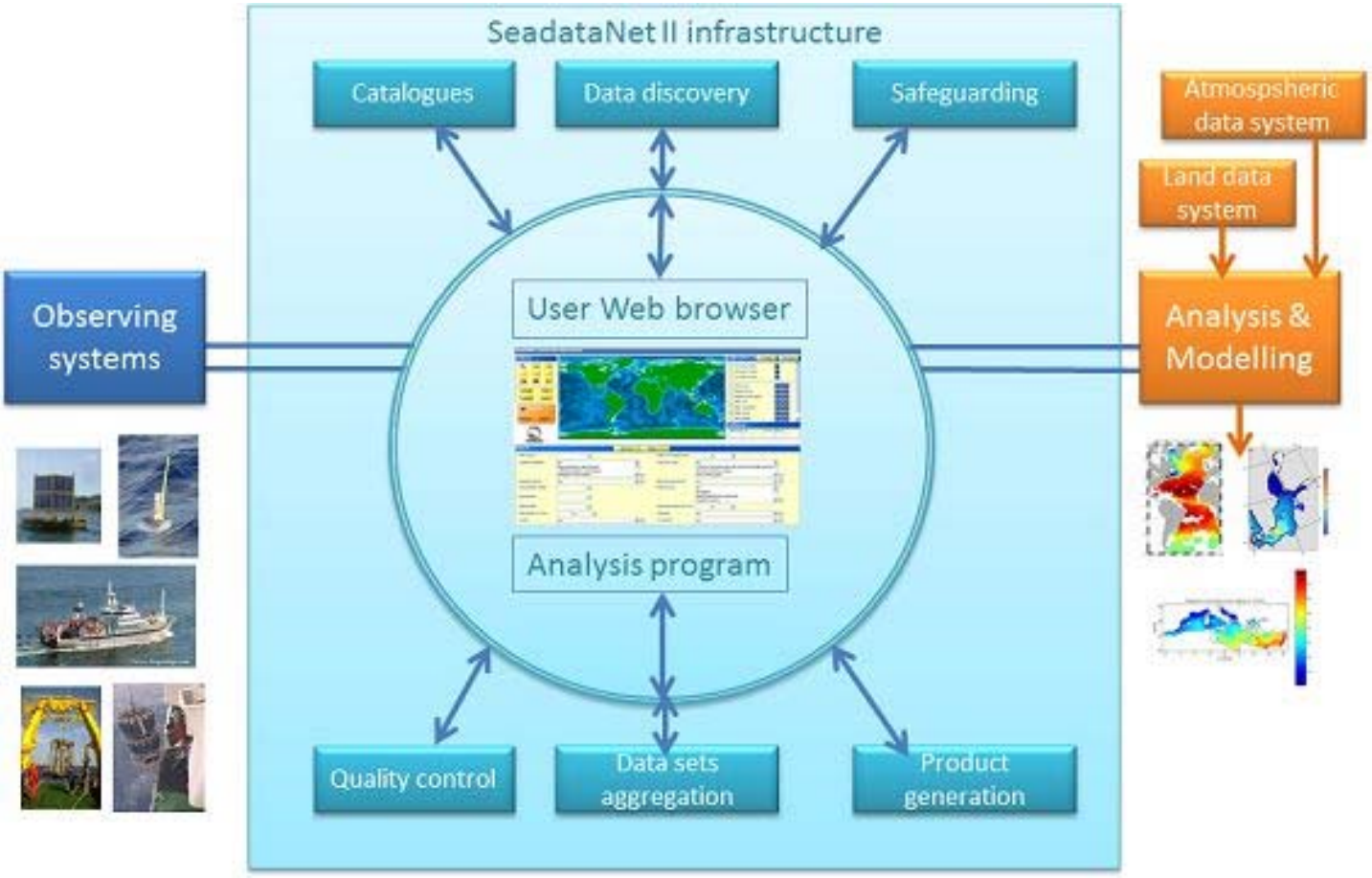


Figure 1: A schematic of the SeaDataNet infrastructure

A single CDI entry is quite detailed. For example, a single CTD cast, a single drifting buoy location, a single time series, a single biological observation all generate single CDIs. This makes for many, many entries in the CDI, but allows for a very precise search capability. All data, whether available with no restrictions or with some distribution restrictions, are recorded in the CDI.

When data arrive at SeaDataNet partners, each uses a common software tool to check the quality of the data. This tool has been built by greatly extending the software application called Ocean Data View (ODV) developed by Reiner Schlitzer of the Alfred Wegener Institute in Germany. He wrote the original software to provide a means of data visualization for himself. As part of SeaDataNet, he has extended this tool so that it now handles a variety of data types, allows for quality control operations, checks for data duplications, permits the inclusion of detailed metadata such as the SeaDataNet CDI and records data processing history within ODV.

All of these tools already mentioned and others are tied together by a common vocabulary. This is maintained by the British Oceanographic Data Centre (BODC) in the UK. It began as an effort to standardize naming of ocean variables and units of measurement. It has evolved into a full fledged vocabulary server using modern technology that allows machine-to-machine interactions. This means that software that is constructing a CDI in one country can consult the vocabulary server to check that the name used for a particular variable is known and well described. BODC has built a community of experts to help extend and improve a combined SeaDataNet and MarineXML Vocabulary Content Governance Group (SeaVoX). More information about SeaVox can be found at https://www.bodc.ac.uk/data/codes_and_formats/seavox/.

Data Access

The user interface to the CDI catalogue was built by MARIS and uses standard Web Map Service technologies to display information. The user can search in a variety of ways such as by type of data, area, time frame, etc. Once data of interest are identified, a request to receive the data can be launched.

Access to the CDI is freely available (see above SeaDataNet link). However, a request for data download requires user registration. The registration is so that SeaDataNet can know who is in their user community and facilitates tracking requests. Also, although a large fraction

of the data made available through the CDI is open to all, there are some that require consultations with data originators before they may be released. Obtaining release may involve communication with the user, hence the need for registration. The SeaDataNet Data Policy is easily found under the "Data Access" tab on the SeaDataNet web pages.

Data within SeaDataNet are maintained by the connected data centres and in their own institutions. Once a query for access to data has been formulated through the on-line interface, a request manager tool distributes the request to all of the institutions holding the data. Software tools built through SeaDataNet and installed at partner institutions receive the request and assemble the data that they hold. A user can monitor the progress of data assembly. When the request is completed, the user is notified. Data are delivered in the SeaDataNet ODV ASCII format and soon also in a netCDF-CF (Common Data Format-Climate and Forecast) compliant format.

SeaDataNet has developed tools to monitor the state of network connections among partners. The capabilities of this software are quite sophisticated and it allows for the careful scrutiny of accessibility of partner operations. The monitoring of all services and data centre connections supports the objective to provide a robust and operational infrastructure.

Products

The main product currently under development is a set of climatologies for waters surrounding Europe. It is being created using the DIVA (Data-Interpolating Variational Analysis) software developed by the University of Liège. The software is free and available through the SeaDataNet link provided on the previous page.

Collaborations

SeaDataNet has collaborations with institutions such as ICES (International Council for the Exploration of the Sea) to ensure common naming of ships used in ocean research. IOC/IODE (Intergovernmental Oceanographic Commission/International Oceanographic Data and Information Exchange) provides training facilities at its offices in Belgium. The EU-JRC is leading an activity to analyze legal models for sustaining SeaDataNet as a legal entity. SeaDataNet has contributed ideas to the European Marine Observation and Data Network (EMODnet) initiative which was started in 2008 by the EU. SeaDataNet infrastructure and standards have been adopted by EMODnet projects for physics, chemistry, and bathymetry, and they are also contributing to biology and geology projects. This engagement has extended the types of data that SeaDataNet can manage and deliver. Moreover it has resulted in more data centres connecting to the SeaDataNet infrastructure and making their data available through the SeaDataNet CDI service. More recently, a collaboration with USA and Australia data centres within the Ocean Data Interoperability Platform (ODIP) has seen the adoption of many of the vocabularies and a recognition of the usability of software tools.

The Future

The SeaDataNet II project has one year to complete its agreed deliverables. There are still many things to do. The objective of formulating Sensor Web Enablement (SWE) standards and implementing these for selected instruments and platforms is well underway. The suite of climatologies building upon the SeaDataNet data collections is making good progress but the final and public version remains to be constructed. Some data centres have yet to contribute additional descriptions of their data holdings and must install and configure upgraded versions of the software tools built by the project.

In September 2015, the SeaDataNet II project will officially end. A final report will be delivered to the EC some months later. It will include comprehensive documentation of the project's accomplishments. They are extensive, and have gone beyond the original objectives in a number of areas. There is little doubt that the experience gained in unifying the handling of the many types of data collected in the marine environment, the software tools that draw on the standardized vocabularies, the adoption of ISO standards for these tools and the quality control, duplicate detection and visualization tools will impact ocean data management throughout the world. This will be promoted further by the SeaDataNet consortium that will continue the operation of the SeaDataNet infrastructure for at least another three years as part of a SeaDataNet exploitation agreement. The National Oceanographic Data Centres in Europe and most other connected marine data centres are also actively engaged in the EMODnet projects and other EU projects which are making use of the SeaDataNet infrastructure, standards, tools, and services. On top of that, SeaDataNet is starting an active lobby towards their national authorities and the EU for another phase of the SeaDataNet research and technical developments. There are many new challenges for ocean and marine data management, considering new instruments and platforms, new data types, big data, cloud processes, visualization techniques, and societal questions which demand further development and maintenance of standards, services, and integrated capacities. It is hoped that the EU will recognize the importance to support the continued collaboration, use of the expertise, mass and momentum gained by SeaDataNet as a pan-European approach rather than by fragmented national developments.

Note from the Co-Editor: Dick Schaap (dick@maris.nl) and Michele Fichaut (Michele.Fichaut@ifremer.fr), co-chairs of SeaDataNet, provided comments and changes to the original text. Stephen Miller (Emeritus scientist at Scripps Institution of Oceanography), Margarita Gregg (Director of the US National Oceanographic Data Center), Hans Dahlin (formerly at the Swedish Meteorological and Hydrological Institute), and Robert Keeley constitute the Advisory Board to the SeaDataNet project.

Reports / Rapports

2013 Patterson Medal Award Presentation

The Patterson Distinguished Service Medal, first presented in 1954, is considered the pre-eminent award recognizing outstanding work in meteorology by residents of Canada. This award is named in honour of Dr. John Patterson, a meteorologist who was Director and Controller of the Meteorological Service of Canada from 1929 to 1946, a crucial period in the development of Canada's weather service.


Dr. William W. Hsieh

In Rimouski, on June 3rd, David Grimes, Assistant Deputy Minister, Meteorological Service of Canada and President of the World Meteorological Organization (WMO), presented the medal to **Dr. William Hsieh** as a recognition for his outstanding meteorological and climate research, his dedicated graduate student supervision, and his generous volunteer service to CMOS.

William W. Hsieh is Professor Emeritus in the Department of Earth, Ocean and Atmospheric Sciences at the University of British Columbia. His research specialty is in developing nonlinear machine learning methods from the field of artificial intelligence and applying them to the environmental sciences. He has over 90 refereed journal publications covering areas of climate variability and prediction, machine learning, atmospheric science, oceanography, hydrology, and agricultural science. He is the author of "*Machine Learning Methods in the Environmental Sciences*", published by Cambridge University Press in 2009. He is a Fellow of the Canadian Meteorological and Oceanographic Society and a winner of the CMOS President's prize (1999), and has served as an editor in chief of *Atmosphere-Ocean*. Among his numerous graduate students, three have won the Tertia M.C. Hughes memorial graduate student prize, and one the prestigious WMO Research Award for Young Scientists. He has a B.Sc. in Combined Honours Mathematics and Physics, an M.Sc. in Physics and a Ph.D. in Physical Oceanography, all from the University of British Columbia, and was post-doctoral fellow at the University of Cambridge and the University of New South Wales.

Congratulations to **Dr. William Hsieh** from all the CMOS community and particularly from the Publications Committee on which he served for many years.

Note from the Co-Editor: Dr. William Hsieh was not present for the Rimouski medal presentation. The Patterson Medal will be presented to William at a later date.

Présentation du prix de la médaille Patterson 2013

La médaille Patterson pour service méritoire, qui a été remise pour la première fois en 1954, est considérée comme un prestigieux prix visant à souligner le travail remarquable des Canadiens en météorologie. Ce prix a été nommé en l'honneur de M. John Patterson, Ph.D., météorologue qui a été directeur et contrôleur du Service météorologique du Canada de 1929 à 1946. Il s'agit d'une période cruciale dans le développement du service météorologique du Canada.

Le 3 juin, à Rimouski, David Grimes, sous-ministre adjoint du Service météorologique du Canada et président de l'Organisation météorologique mondiale (OMM), a présenté cette médaille à William Hsieh (Ph.D.), en reconnaissance de ses travaux de recherche en météorologie et en climatologie, de son dévouement envers ses étudiants diplômés et de son généreux bénévolat au sein de la SCMO.

William W. Hsieh est professeur émérite au département des sciences de la Terre, des océans et de l'atmosphère de l'Université de la Colombie-Britannique. Il se spécialise dans le développement de méthodes non linéaires d'apprentissage automatique relatives à l'intelligence artificielle et applique celles-ci aux sciences environnementales. Il a publié plus de 90 articles évalués par des pairs, portant sur la variabilité et la prévision du climat, l'apprentissage automatique, les sciences atmosphériques, l'océanographie, l'hydrologie et l'agronomie. Il a rédigé *Machine Learning Methods in the Environmental Sciences*, publié par Cambridge University Press, en 2009. Il est membre émérite de la Société canadienne de météorologie et d'océanographie et lauréat du Prix du président de la SCMO (1999). Il a aussi occupé le poste de rédacteur en chef d'*Atmosphere-Ocean*. Trois de ses nombreux étudiants diplômés ont gagné le prix commémoratif Tertia M.C. Hughes. Un autre a reçu le prestigieux Prix de l'OMM destiné à récompenser de jeunes chercheurs. M. Hsieh détient un baccalauréat avec double spécialisation en mathématiques et en physique, une

maîtrise en physique et un doctorat en océanographie physique, tous obtenus à l'Université de la Colombie-Britannique. Il a été boursier de recherche postdoctorale à l'Université de Cambridge et à l'Université de New South Wales.

Félicitations à William Hsieh de la part de tous les membres de la SCMO et particulièrement du comité des publications, au sein duquel il a servi pendant plusieurs années.

Remarque du corédacteur: William Hsieh était absent, lors de la présentation de la médaille Patterson, à Rimouski. Celle-ci lui sera remise à une date ultérieure.

2014 Recipient of the Timothy R. Parsons Medal - Dr. Paul J. Harrison

On June 3rd, 2014 at the annual Congress of the Canadian Meteorological and Oceanographic Society in Rimouski, the 2014 Parsons Medal for excellence in multidisciplinary ocean sciences from Fisheries and Oceans Canada was announced by Denis Hains, Director-General of Canadian Hydrographic Service and Ocean Science. Dr. Paul J. Harrison, Professor Emeritus at University of British Columbia, was this year's recipient. Unfortunately, Dr. Harrison was not able to attend and the medal was awarded at a special ceremony in his honor on October 15, 2014 in Vancouver, British Columbia.

The Timothy R. Parsons Medal was established by Fisheries and Oceans Canada to recognize achievement in ocean sciences. It honours the outstanding contributions of Dr. Timothy R. Parsons to the field of ocean sciences, who was the first recipient of the medal. It is awarded for:

- distinguished accomplishments in multidisciplinary facets of ocean sciences while working for Canadian institutions or for the benefit of Canadian science;

- excellence during the lifetime of the recipient or for a recent outstanding achievement, both being equally eligible.

Dr. Harrison received his Bachelor's degree in General Science from the University of Toronto, a Master's degree in Botany and Ecology from Guelph, and a Ph.D. in Biological Oceanography from the University of Washington in Seattle. From 1975 to 2002, Dr. Harrison was a Professor at the University of British Columbia in Vancouver, and from 2002 to 2010 he was the Director of the Atmospheric & Marine Science Program at the Hong Kong University of Science & Technology.

Dr. Paul Harrison, Dr. Timothy Parsons and Dr. Curtis Suttle (2011 Medal recipient)

A specialist of phytoplankton ecology and physiology, Dr. Harrison has authored and co-authored over 300 refereed publications on subjects ranging from the physiological ecology of marine algae to nutrient uptake and assimilation by phytoplankton and seaweeds. His work has been cited over 16,000 times in scientific publications, with almost 6,000 citations since 2009. He has also written three textbooks.

Dr. Harrison is a Fellow of the Royal Society of Canada, has won awards for his teaching and international awards for his research. He has also been a Principle Investigator on three large multi-disciplinary Canadian programs: JGOFS (Joint Global Ocean Flux Study), GLOBEC (Global Ocean Ecosystem Dynamics), and SOLAS (Safety of Life at Sea). He has assumed leadership roles as the President of the Western Canadian University Marine Biology Society, and a member of the Advisory Board of the National Research Council of Canada (Institute for Marine Biosciences) and Venus and Neptune Networks.

Numerous letters of support were received from both across Canada and abroad, which highlight a variety of reasons why Dr. Harrison is highly deserving of this award. They spoke of his work on numerous committees across the world, the number of students that he has supervised throughout his career, and the editorial responsibilities which he has assumed over the years. Three separate letters noted that one of Dr. Harrison's key contributions are his laboratory cultures that form the groundwork of our understanding of the photosynthesis, nutrient uptake, growth, sinking, and competition of phytoplankton in nature, and how difficult these are to perform - his lab, for example, is one of the few capable of growing key oceanic species that exhibit Fe limitation. They also noted that he went beyond the lab, designing observations and experiments in the field to complement his findings. Another letter

discussed how Dr. Harrison just "knows bugs"; which should be considered the highest level of praise to understand how it all fits together, from oceanographic forcing to physiological and biochemical mechanisms.

Récipiendaire 2014 de la médaille Timothy R. Parsons : Paul J. Harrison (Ph.D.)

Le 3 juin 2014, à Rimouski, Denis Hains, directeur général du Service hydrographique du Canada et sciences des océans, a annoncé, lors du Congrès annuel de la Société canadienne de météorologie et d'océanographie, le nom du récipiendaire de la médaille Parsons de 2014, remise par Pêches et Océans Canada, pour souligner l'excellence en recherches océanographiques multidisciplinaires. Monsieur Paul J. Harrison (Ph.D), professeur émérite à l'Université de la Colombie-Britannique, en est le récipiendaire. Malheureusement, M. Harrison n'a pu assister à ce congrès et la médaille lui a été remise lors d'une cérémonie en son honneur, le 15 octobre 2014, à Vancouver (Colombie-Britannique).

Pêches et Océans Canada a créé la médaille Timothy R. Parsons pour souligner les réalisations liées aux sciences océaniques. La médaille marque la contribution exceptionnelle de Timothy R. Parsons (Ph.D.) à l'étude des océans. Il a été le premier à recevoir cette distinction. La médaille est décernée pour :

- souligner des réalisations multidisciplinaires remarquables dans le domaine des sciences océaniques, menées pour des organismes canadiens ou au profit de la science au Canada;

- souligner l'excellence démontrée au cours de la vie du récipiendaire ou, au même titre, pour une réalisation exceptionnelle récente.

M. Harrison a obtenu un baccalauréat en sciences générales de l'Université de Toronto, une maîtrise en botanique et écologie de l'Université de Guelph et un doctorat en océanographie biologique de l'Université de Washington à Seattle. De 1975 à 2002, M. Harrison a été professeur à l'Université de la Colombie-Britannique, à Vancouver. De 2002 à 2010, il a occupé le poste de directeur du programme de sciences atmosphériques et marines à la Hong Kong University of Science & Technology.

Spécialiste de l'écologie et de la physiologie des phytoplanctons, M. Harrison a rédigé et corédigé plus de 300 articles évalués par des pairs, sur des sujets allant de l'écologie physiologique des algues marines à l'absorption et à l'assimilation de nutriments par les phytoplanctons et les algues. Ses travaux ont été cités plus de 16 000 fois dans des publications scientifiques, y compris près de 6000 citations depuis 2009. Il a de plus écrit trois manuels.

M. Harrison est membre de la Société royale du Canada. Il a reçu des prix qui le récompensaient pour son enseignement et des prix internationaux pour ses travaux de recherche. Il a aussi assumé la fonction de chercheur principal au sein de trois grands programmes canadiens multidisciplinaires : JGOFS (Étude conjointe sur les flux océaniques mondiaux), GLOBEC (Dynamique des écosystèmes océaniques mondiaux) et SOLAS (Étude sur la couche troposphérique à la surface de l'océan). Il a occupé des postes de premier plan en tant que président de la Western Canadian Universities Marine Biological Society, comme membre du conseil consultatif de l'Institut des biosciences marines du Conseil national de recherches du Canada, ainsi qu'au sein des réseaux VENUS et NEPTUNE.

De nombreuses lettres de soutien sont venues de partout au Canada et de l'étranger pour justifier l'octroi, à M. Harrison, de cette médaille hautement méritée. Elles relatent sa participation à plusieurs comités partout dans le monde, et mentionnent qu'il a guidé de nombreux étudiants au cours de sa carrière et qu'il a assumé des responsabilités éditoriales au fil des ans. Trois lettres mentionnent qu'une des contributions majeures de M. Harrison comprend ses cultures en laboratoire. Celles-ci s'avèrent la pierre d'assise de notre compréhension de la photosynthèse, de l'absorption de nutriments, de la croissance et de l'enfoncement des phytoplanctons, ainsi que de la compétition qui les oppose dans la nature, et comment il est difficile de les observer. Son laboratoire est, par exemple, un des seuls en mesure de faire croître des espèces océaniques clefs, limitées par le fer. Ces lettres notent aussi qu'il va au-delà des expériences en laboratoire, et conçoit des méthodes d'observation et d'expérimentation sur le terrain, afin de valider ses résultats. Une autre lettre encore insiste sur le fait que ces «petites bêtes» ne recèlent plus de secrets pour Paul Harrison : une des meilleures façons de le complimenter sur sa compréhension globale du sujet, qui va des forçages océanographiques aux mécanismes physiologiques et biochimiques.

Time for Change?
Climate Science Reconsidered

The Report of the UCL Policy Commission on Communicating Climate Science

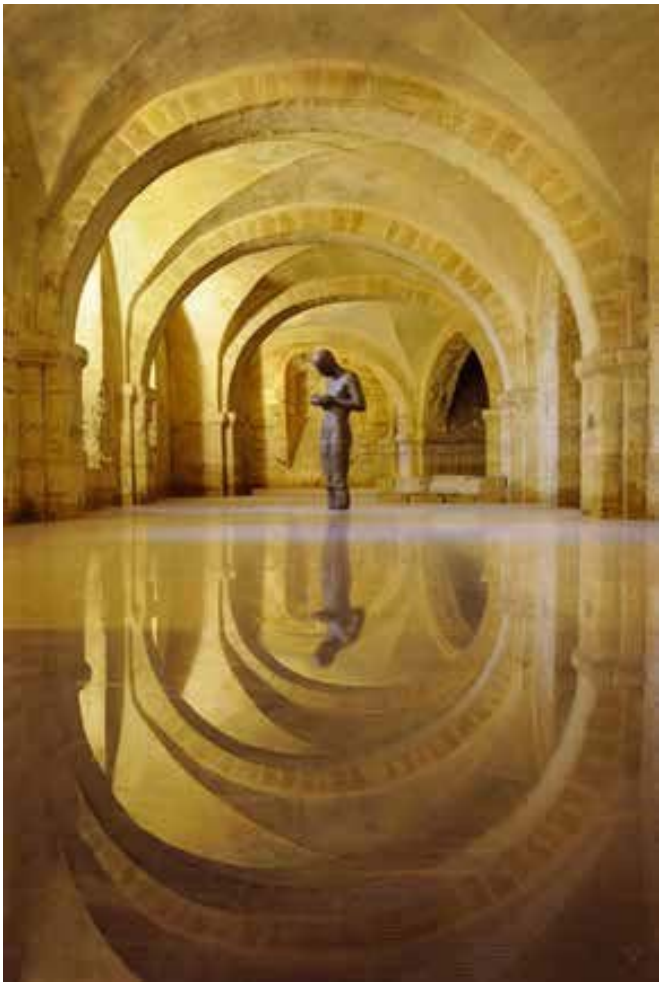
University College London, 2014

Reviewed by Prof. John Stone[1]

If science were sufficient to stimulate our serious tackling of climate change we would likely already see emissions declining. The science of climate change is after all not new; it can be traced back to the work of Joseph Fourier and Svante Arrhenius more than a century ago. Nor is the threat of climate change new; the Toronto Conference on The Changing Atmosphere in 1988 was a significant event in putting the issue on the political agenda.

Regrettably, what we have seen are emissions continuing to grow, and at an accelerating rate, rather than seeing them peak and then decline. Clearly, despite the Enlightenment view of a rational, evidence-based paradigm to which we as scientists hold on to, something is missing. To seek solutions University College London (UCL) established a Policy Commission on Communicating Climate Science. The Commission was an examination of the successes and failures in communicating climate change science. The study was led by Chris Rapley who some may remember from the time he ran the International Geosphere-Biosphere Programme (IGBP). The Commission brought together a mix of experts from the physical and cognitive sciences – even from ophthalmology. Although the report is embedded in the context of science in the United Kingdom the lessons learned are relevant to us in Canada.

In contrast to communicating solid science, what seems to have worked is the cherry-picking of data, the challenging of hypotheses and the general misrepresentation of science by the climate change nay-sayers. By sowing doubt they have undermined the growing confidence in the scientific consensus and convinced policy-makers and the public that we still don't know enough to act. The nay-sayers' methods have been well exposed in Naomi Oreskes' book *Merchants of Doubt* and Jim Hoggan's *Climate Cover-Up*.



Sir Antony Gormley's *Sound II*, installed in the crypt of Winchester Cathedral. Photograph by Joe Low; this magnificient photograph is reproduced here from the on-line report [See link on next page]

The nay-sayers have understood only too well the barriers to action determined by human psychology, what Stephen Schneider called the "five horsemen of the environmental apocalypse: ignorance, greed, denial, tribalism, and short-term thinking". Trying to understand how these human traits affect decision-making forms one of the threads of this UCL report. It may be that success in addressing the threat of climate change does not lie in further understanding the remaining uncertainties of the climate system but rather in finding ways of overcoming these barriers and engaging those who are convinced by arguments of doubt.

Another thread of the report looks at how scientists as individuals and as a community behave. The findings are not always pleasant. Some idea of the problems was provided by the Climategate incident. This involved several

[1] Adjunct Research Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, ON, Canada. Lead author of the 4th Report (Polar Regions) for the IPCC Fifth Assessment Report.

scientists who had been involved in preparing reports for the Intergovernmental Panel on Climate Change (IPCC). Allegations included suggesting that the scientists had not complied fully with the spirit of freedom of information, had subverted the peer review process, and colluded in improperly influencing the process of evidence-based policy making. In other words it was alleged that these individuals had behaved in an unprofessional scientific manner. The scientists were eventually exonerated, and the science shown to be solid. However, the e-mail messages exchanged between some of the scientists did suggest some arrogance and a rather tribalist behaviour.

Understanding better the barriers to effective communication takes us inevitably into considerations of values, prejudices, ideologies, and dogma which for most of us are outside our normal comfort zones as physical scientists. The report also suggests that we need to have some degree of humility, that we must be open to the possibility that sometimes we might be wrong. One facet the report does not consider is that from time to time we might have to stand up to defend the science and not be silenced or choose to remain silent.

Ultimately, the public discussion of climate change is, as the authors suggest, as much about what sort of world we wish to live in, and hence about ethics and values, as it is about the potential impacts of climate change. Establishing such a discussion requires that we understand that people's backgrounds, beliefs, and world views strongly influence the way in which they receive and process information. This is complicated because these factors may not always be explicitly recognized. Some climate change nay-sayers may be driven by vested interests, for example if they have financial holding in fossil fuel companies which they see threatened by a shift to lower carbon energy sources. Others may see in tackling climate change a greater intrusion of government and regulations affecting the free market. Arguing against such world views with scientific facts is a recipe for frustration.

Some of the barriers we come across though are as a result of the nature of the threat of climate change. Humans respond most urgently to threats that are present, concrete, and definite but climate change is gradual, insidious, hard to observe and indefinite For the most part climate change occurs slowly and the impacts are likely to be felt most acutely in future generations or in parts of the world very distant from ourselves. Furthermore, addressing climate change requires making sacrifices now in order to prevent unclear costs in the distant future. In addition many presentations of climate change leave the audience in a state of helplessness compounded by a feeling of guilt. An extensive examination of these issues is contained in a recently released book by George Marshall called "*Don't Even Think about It: Why our Brains are Wired to Ignore Climate Change*".

Part of the UCL exercise was one of self-reflection, to look into the mind of a scientist, how we as scientists think and act, in order to minimize the possibility of unwitting bias, faulty reasoning, and to maximize the effectiveness of our efforts to communicate science; to warn yet not to impose our own values. This exercise might have been more valuable if there had been something of a sounding board. As it was the Commission members and the External Reviewers were all from academia – an example of Schneider's tribalism behaviour.

The report suggests there are several roles for a scientist in addition to expanding the boundaries of knowledge. These include being a science communicator, not just to the ranks of students but also to other elements of society including the policy-makers. The report expands this engagement with the policy realm by adding the role of an unbiased interpreter of the evidence, being clear about what we know and don't know and admitting to the possibility of different interpretations of the science.

Polls continue to suggest that scientists are amongst the most credible in society. However, to maintain this credibility it would seem imperative for scientists to remain as objective as possible. As Dr. Pachauri, the current Chairman of the IPCC has said: "Scientists must continually earn the public's trust or we risk descending into a new Dark Ages where ideology trumps reason". However, not imposing one's values seems to be inconsistent with the report's suggestion that scientists should be issue advocates.

Not unsurprisingly, the report ends with some recommendations. These include the obvious ones such as the suggestion that climate scientists should participate actively in the "co-production" of policy formulation and decision-making processes. But it would seem to go too far in recommending the establishment of a professional body to represent scientists, to set appropriate norms and practices, and to facilitate interactions with experts on public engagement and communications (which risks the danger of spin trumping substance).

This report is not designed as a textbook. It was written with the idea of recommending its findings for consideration by the community of scientists. It is not a voluminous report and can be accessed on the Internet:

http://www.ucl.ac.uk/public-policy/policy_commissions/Communication-climate-science/Communication-climate-science-report/TIME_FOR_CHANGE_Final_Proof.pdf

As this review suggests there are lessons from the Commission's deliberations that are pertinent to Canada where a national debate on climate change leaves much to be desired.

2014 Project Atmosphere Report

by Zach Vanthournout

Anglophone School District East
Hillsborough, New Brunswick

Weather Sensing Analyzing and Forecasting

Many years ago I read an article by a journalist Joel Garreau, titled *The Nine Nations of North America* (1981). I use this article in my geography classes to help students understand the basic unit of measure for a geographer: the region. In his article, Garreau uses a regionalizing tool to divide North America into what he calls the Nine Nations. These nations were regionalized using metrics such as resources, population, culture, political power, weather and climate, and finally, future potential. In developing his Nine Nations Garreau makes an extremely strong argument for the Bread Basket, or the central United States, as being one of the most powerful and having the most potential of all the regions – since reading that article I had always wanted to go there!

My trip to the Bread Basket was a four-day (eight-day round trip) driving expedition to Project Atmosphere in Kansas City at the National Training Center for the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration (NOAA). Funded jointly by NOAA and the American Meteorological Society (AMS), Project Atmosphere has been an annual event since 1984 — save for last year due to the American budget sequestration. For me, this was by far one of the best teacher training institutes and initiatives I have been privileged to be part of.

Our two weeks of training, from July 13–25, 2014, had me learning alongside American colleagues who were just as interested in the "Canadian paradigm" as I was in their world of standardized testing and the No Child Left Behind Act. The days were a fantastic mixture of in-class theory and discussion combined with learning activities I could share with my students and peers here in Canada. The instructors were absolute experts in their respective fields and employed by the NWS or the AMS; all held graduate degrees in meteorology, and most had doctorates. Content varied from cloud formation basics, to hurricanes and storms, and their associated hands-on activities. Big-picture speakers, such as Dr. Lou Uccellini, head of the NWS, and Dr. Bill Lapenta, were vibrant and informative in their roles, explaining the development of a "weather ready nation."

There were two official field trips; one included a site visit to a weather station in Topeka, Kansas and a weather balloon launch, as well as a guided tour of the Aviation Weather Center housed within the NWS Training Center in Kansas City. Daily weather briefings were provided by NWS. These extremely informative sessions used satellite information and other data-gathering tools (such as one conducted by a senior meteorologist using radiosonde telemetry and airport weather data) to extrapolate future weather events.

Currently their mainframe can complete 200 trillion calculations per second, based on three million different weather observations per minute. Their new mainframe will handle over 600 trillion calculations per second, which will allow events, like the "left hook" Hurricane Sandy made, to be predicted four days in advance.

As a foreign national, a few extra hoops had to be jumped through, for obvious security reasons, and I was not allowed to take pictures within the NWS Training Center or the Aviation Weather Center. However, my American colleagues quickly set up a social network site and shared their photos with me. A third and optional field trip for participants was arranged for our Saturday in Kansas City when we were given a tour of local geologic formations as well as an underground storage facility called Subtropolis. Subtropolis was a limestone mine and the vast cavern left in its wake is now the world's largest climate-controlled storage facility...we drove our tour bus through it—it is over 4.5 km^2 and has over 5 million m^3 of storage space!

As reported, Project Atmosphere was an amazing educational and professional learning experience. I need to extend my greatest gratitude to the Canadian Geographic Education of the Royal Canadian Geographical Society and the Canadian Meteorological and Oceanographic Society for their support. This amazing learning opportunity for pre-college teachers, along with other programs provided by the AMS has seen over 18,000 educators receive training in areas from oceanography (Project Maury) to weather and climate in Project Atmosphere. I consider myself to be a singularly lucky Canuck who benefitted from the extreme hard work and dedication of others and I believe a model that could easily be developed here in Canada.

2014 Project Maury Report

by Daryl Rideout

Macdonald Drive Elementary School
St. John's, Newfoundland

There are many opportunities for teachers to participate in local, national, and international professional development programs. I have been involved in many over the years with the most recent being The Maury Project, an exceptional learning experience in the area of science, which was held at the United States Naval Academy in Annapolis, Maryland, from July 6 to 18, 2014.

The Maury Project is a teacher enhancement program of the American Meteorological Society (AMS) in cooperation with the US Naval Academy, and is supported by the Canadian Meteorological and Oceanographic Society (CMOS) and the Canadian National Committee/Scientific Committee on Ocean Research (CNC/SCOR), who sponsored me as the only Canadian participant in this program.

The Maury Project focused on oceanography and consisted of presentations, lectures, and field trips in and around the Annapolis area including Washington, D.C. All lectures were held at the US Naval Academy and facilitated by educators from the academy. Each lecture was informative and very interesting. Some of the topics covered included ocean tides, El Niño, La Niña, deep and shallow water waves, currents, and estuaries. Field trips included a visit to the National Oceanic and Atmospheric Administration (NOAA), the National Aquarium in Baltimore, and the Center for Weather Climate Prediction in College Park, Maryland. We met meteorologists who described their work processes when issuing national forecasts and when monitoring weather warnings for tornadoes, tsunamis, hurricanes, forest fires, and volcanic eruptions worldwide. We also had an opportunity to do a beach study in Annapolis where we looked at erosion and its effects.

The program was not all classroom and field trips though. For one afternoon, we boarded the navy research vessel YP640 from the US Naval Academy and gained hands-on experience working onboard with partners to perform experiments and ocean assessments involving ocean tides and currents, deep ocean assessment, and deep and shallow ocean waves. This was one of the highlights of the program for me.

Twenty-four teachers attended Project Maury and most were high school science teachers. I was one of two elementary teachers, and we worked with partners for the workshops and experiments making modifications when necessary to fit the grade six curriculum.

The Maury Project was both interesting and informative, and it was an honour to have been invited to attend. I would like to thank the Newfoundland and Labrador Teachers' Association (NLTA), CMOS, and CNC/SCOR for their support. Progressive organizations such as these make it possible for teachers to participate in professional development programs such as The Maury Project, and to gain knowledge and instructional resources that can in turn be adapted to enhance classroom learning and to hopefully install a lifelong interest in oceanography in students.

Atmosphere-Ocean 52-5 Paper Order

Applied Research / Recherche appliquée

AO-2013-0062
Climate Station Analysis and Fitness for Purpose Assessment of 3053600 Kananaskis, Alberta
Paul H. Whitfield

AO-2013-0035
Modelling of Ocean Shallow Convection under Fast Ice in the Arctic
André April

AO-2014-0003
Trends in Canadian Short-Duration Extreme Rainfall: Including an Intensity–Duration–Frequency Perspective
Mark W. Shephard, Eva Mekis, Robert J. Morris, Yang Feng, Xuebin Zhang, Karen Kilcup and Rick Fleetwood

Fundamental Research / Recherche fondamentale

AO-2013-0051
Sea-Ice Concentration Multivariate Assimilation for the Canadian East Coast in a Coupled Sea Ice–Ocean Model
Anna Katavouta and Paul G. Myers

AO-2014-0018
Mechanism of an Abrupt Decrease in Sea-Ice Cover in the Pacific Sector of the Arctic during the Late 1980s
Jianfen Wei and Jie Su

New CMOS Website

Most of you will have already noticed that the CMOS website sports a new look. Not only was the site completely redesigned, but the administrative tools of the back office benefitted as well from the upgrade. The system is easy enough to use. The volunteers, and committee and local centre leads, can manage the contents on their own. Many are now familiarising themselves with the new system in order to take advantage of its recently added features.

The transition is however far from over. Some parts of the site need more work before fully meeting expectations. Many people are working towards a better site and your comments, inputs, and general help are all welcome. I invite you to browse the site and send us your ideas at webmaster@cmos.ca

I take this opportunity to mention that our blog editor, Laura Gillard, is looking for occasional bloggers wishing to write about their experience or thoughts on science. Our Twitter editor, Kevin Bowley, invites you to follow the CMOS Twitter feed for news from the Society and the atmospheric and oceanic sciences fields.

David Huard, CMOS Webmaster

Nouveau site Web de la SCMO

Comme la plupart d'entre vous l'auront probablement remarqué, la SCMO s'est doté d'un nouveau site Web. Non seulement la façade a été complètement revue, mais les outils administratifs en arrière-plan ont également profité de cette refonte. Le système est suffisamment simple d'utilisation pour que les volontaires et responsables des comités et centres locaux puissent gérer eux-mêmes leur contenu. Plusieurs d'entre eux se familiarisent dès maintenant avec le nouveau système afin d'en exploiter les nouvelles possibilités.

La transition est toutefois loin d'être complète et plusieurs sections du site demandent encore du travail avant d'être à la hauteur des attentes. De nombreuses personnes travaillent à l'amélioration du site et vos commentaires, suggestions et coup de main sont évidemment les bienvenus. Je vous invite donc à parcourir le site et nous faire part de vos idées à webmaster@cmos.ca.

J'en profite pour mentionner que notre éditrice blog, Laura Gillard, est à la recherche de bloggeurs occasionnels tentés de faire connaître leurs expériences et réflexions sur la science, et que notre curateur twitter Kevin Bowley vous invite à suivre le fil twitter de la SCMO pour recevoir les nouvelles de la société et des sciences atmosphériques et océaniques.

David Huard, Webmestre de la SCMO

New CMOS Archivist

In October, Bob Jones stepped down after 17 years as the CMOS webmaster. The new webmaster is David Huard, presently on Council as recording Secretary. Coincident with this change was the launch of the new website platform. Bob will continue to support CMOS by helping with its archives. The previous Society Archivist was Morley Thomas who stepped down in 2006.

Bob will help initially with the major transition to the new website by ensuring nothing is lost that was formerly available on the old website.

For a while the entire old website can be found under the "Archives" drop down menu, but only archival items like photos and historical publications and information will be updated. Following this transition, Bob will continue work to digitize the remaining Society publications, streamline the Archives part of the website, and then see what can be done with many unopened boxes of material which were sent to the CMOS office by Mr. Thomas.

Bob will also remain involved in helping the Ottawa Centre with membership and its meeting notices.

Bob Jones, CMOS Archivist

Nouvel archiviste de la SCMO

En octobre, Bob Jones a quitté la fonction de webmestre de la SCMO, qu'il exerçait depuis 17 ans. David Huard, le nouveau webmestre, occupe actuellement le poste de secrétaire d'assemblée au sein du conseil d'administration. Parallèlement à ce changement de garde, le nouveau site Web a été mis en ligne. Bob continuera d'apporter son soutien à la SCMO en s'occupant des archives. L'archiviste précédent, Morley Thomas, s'est retiré en 2006.

Bob gérera tout d'abord la transition majeure vers le nouveau site Web, s'assurant que tout ce qui était offert sur l'ancien site restera en ligne. Pendant encore quelque temps, l'ancien site Web demeurera consultable au complet sous le menu déroulant « Archives ». Toutefois, seulement les photos, et les publications et informations historiques seront mis à jour. Après cette transition, Bob continuera de numériser le reste des publications de la Société et d'améliorer la section « Archives » du site, puis il s'attaquera aux boîtes de documents scellées, que M. Thomas a envoyées au bureau de la SCMO.

Bob aidera aussi le centre d'Ottawa relativement aux avis de réunion et au recrutement.

Bob Jones, Archiviste de la SCMO


Dr. Savithri Narayanan

New *CMOS Bulletin SCMO* Co-Editor

With the December 2014 issue, Savi Narayanan is joining the Editorial Team of the *CMOS Bulletin SCMO*.

Dr. Savithri (Savi) Narayanan received her Ph.D. from Harvard University in Applied Mathematics (Physical Oceanography), and subsequently moved to Canada to work, first in Victoria as an oceanographic consultant, later as a scientist and a faculty member at the Memorial University of Newfoundland in St. John's, and then with the Federal Department of Fisheries and Oceans. In DFO, she was a research scientist and section head of Physical Oceanography in St. John's until she became the Director of Marine Environmental Data Service in Ottawa, and finally the Dominion Hydrographer and the Director General of Ocean Sciences-Canadian Hydrographic Service.

Internationally, she was the vice-chairman of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, chairman of Arctic Ocean Science Board, chairman of the Arctic Regional Hydrographic Commission, and the co-president of the WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology.

Nouveau responsable du compte Twitter de la SCMO

Kevin Bowley, étudiant au doctorat au département de sciences atmosphériques et océaniques de l'Université McGill, est maintenant responsable du compte Twitter de la SCMO.

Kevin publiera sur Twitter les événements et les nouvelles touchant notre communauté. Si vous souhaitez lui transmettre des suggestions sur un article intéressant, par exemple, ou à propos du début d'une campagne sur le terrain, d'un événement météorologique, de nouvelles données ou du déploiement d'instruments, ou d'un congrès, veuillez envoyer vos messages à tweet@cmos.ca ou directement au compte Twitter @CMOS_SCMO

Le fil peut être consulté à l'adresse https://twitter.com/CMOS_SCMO et s'affiche aussi sur la page d'accueil de notre nouveau site Web.

New CMOS Twitter Editor

Kevin Bowley, Ph.D. student at McGill in the Atmospheric and Oceanic Sciences department has agreed to take on the role of twitter editor for CMOS.

Kevin will tweet about events and news in our community. If you want to make suggestions to Kevin, e.g. an interesting paper, the start of a field campaign, a meteorological event, new data or deployment of instruments, a congress, please send those to tweet@cmos.ca or tweet to @CMOS_SCMO

The feed can be seen on https://twitter.com/CMOS_SCMO and is also shown on the home page of the new web site.

Nouvelle corédactrice du *CMOS Bulletin SCMO*

À partir du numéro de décembre 2014, Savi Narayanan se joint à l'équipe éditoriale du *CMOS Bulletin SCMO*.


Savithri Narayanan, Ph.D.

Savithri (Savi) Narayanan a obtenu son doctorat de l'Université Harvard en mathématiques appliquées (océanographie physique). Elle a ensuite déménagé pour travailler au Canada, d'abord à Victoria comme consultante en océanographie, ensuite comme chercheuse-enseignante à l'Université Memorial de Terre-Neuve (St. John's), puis au ministère des Pêches et des Océans. Au sein du MPO, elle occupait le poste de chercheuse et chef de l'océanographie physique à St. John's, jusqu'à ce qu'elle soit nommée directrice du Service des données sur le milieu marin, à Ottawa. Et, finalement, elle a été promue hydrographe fédérale et directrice générale du Service hydrographique du Canada, Secteur des sciences.

Sur le plan international, elle a été vice-présidente de la Commission océanographique intergouvernementale (COI) de l'UNESCO, présidente de l'Arctic Ocean Sciences Board, présidente de la Commission hydrographique régionale de l'Arctique et coprésidente de la Commission technique mixte OMM/COI d'océanographie et de météorologie maritime.

New MOU between CMOS and AMS

Canadian Meteorological and Oceanographic Society

La Société Canadienne de Météorologie et d'Océanographie

The Canadian Meteorological and Oceanographic Society (CMOS) and the American Meteorological Society (AMS) have signed a Memorandum of Understanding (MOU) for mutually beneficial interaction. On October 31, the MOU was signed by both Presidents, **Dr. Harinder P. S. Ahluwalia** of CMOS and **Dr. William B. Gail** of AMS.

This MOU will allow CMOS members to join AMS as "Affiliate Members" and with benefits provided to Affiliate Members as outlined on the AMS website, including, but not limited to a subscription to the digital version of the *Bulletin of the American Meteorological Society* (BAMS), member rates on all journals, books, and other products of the AMS, and member registration rate for all AMS meetings. The dues rate for Affiliate Members will be set at the time of this MOU as $65 (US), which is approximately 66% of the normal AMS member rate. It is subject to inflationary increases over time at the discretion of the AMS. CMOS members may apply for Affiliate Members status directly with AMS, and AMS will handle all aspects of the application and annual renewal process. Members of CMOS will be asked to provide their CMOS membership number (or other appropriate identification) that can be confirmed with CMOS at the discretion of AMS.

AMS members will receive reciprocal benefits. Several other benefits to both Societies are listed in the MOU. For a full description, please consult CMOS website.

Nouvelle entente entre la SCMO et l'AMS

La Société canadienne de météorologie et d'océanographie (SCMO) et l'American Meteorological Society (AMS) ont signé une entente de collaboration mutuellement avantageuse. Le 31 octobre, le président de la SCMO, **Harinder P. S. Ahluwalia (Ph.D.),** et celui de l'AMS, **William B. Gail (Ph.D.)**, ont signé cette entente.

Celle-ci permettra aux membres de la SCMO d'adhérer à l'AMS en tant que « membres affiliés » et de profiter des avantages octroyés à ce type de membre. Tel que le mentionne le site de l'AMS, ces avantages comprennent, mais sans s'y limiter, un abonnement à la version numérique du *Bulletin of the American Meteorological Society* (BAMS), l'accès au tarif des membres pour toutes les revues, tous les livres et tous les autres produits de l'AMS, ainsi que l'accès au tarif d'inscription réservé aux membres pour toutes les réunions de l'AMS. Les frais d'adhésion des membres affiliés ont été fixés à 65 dollars américains à la signature de l'entente. Ce qui équivaut à 66 % des frais d'adhésion habituels de l'AMS. L'AMS se réserve le droit d'augmenter ce tarif en raison de l'inflation. Les membres de la SCMO peuvent s'adresser directement à l'AMS pour obtenir le statut de membre affilié. L'AMS administrera tous les aspects de l'adhésion et du processus annuel de renouvellement. Les membres de la SCMO devront fournir leur numéro de membre de la SCMO (ou une autre preuve d'adhésion), que pourra confirmer la SCMO, à la discrétion de l'AMS.

Canadian Meteorological and Oceanographic Society

La Société Canadienne de Météorologie et d'Océanographie

Les membres de l'AMS disposeront des mêmes privilèges. L'entente énumère plusieurs autres mesures profitant aux deux sociétés. Pour une description complète de l'entente, veuillez consulter le site Web de la SCMO.

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Couvertures intérieures ou pages centrales	400$	non disponible	non disponible	
Pages intérieures	300$	200$	150$	50$ (pour l'année)

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* Le matériel inséré dans les publications de la SCMO doit être spécialement approuvé par la SCMO auparavant. La SCMO recommande les annonces bilingues, et s'engage à faire la traduction de courts textes gratuitement, s'il y a lieu. Des frais additionnels s'appliquent si de la mise en page, traduction appréciable, dessin, photographie ou photocopie sont nécessaires.

BOOK REVIEW / REVUE de LITTÉRATURE

Sea-Level Science: Understanding Tides, Surges, Tsunamis and Sea-Level Surges

by David Pugh and Philip Woodworth

Cambridge University Press, ISBN 978-1-107-02819-7
2014, Hardback, xii + 395 pages, $90

and

Essentials of the Earth's Climate System

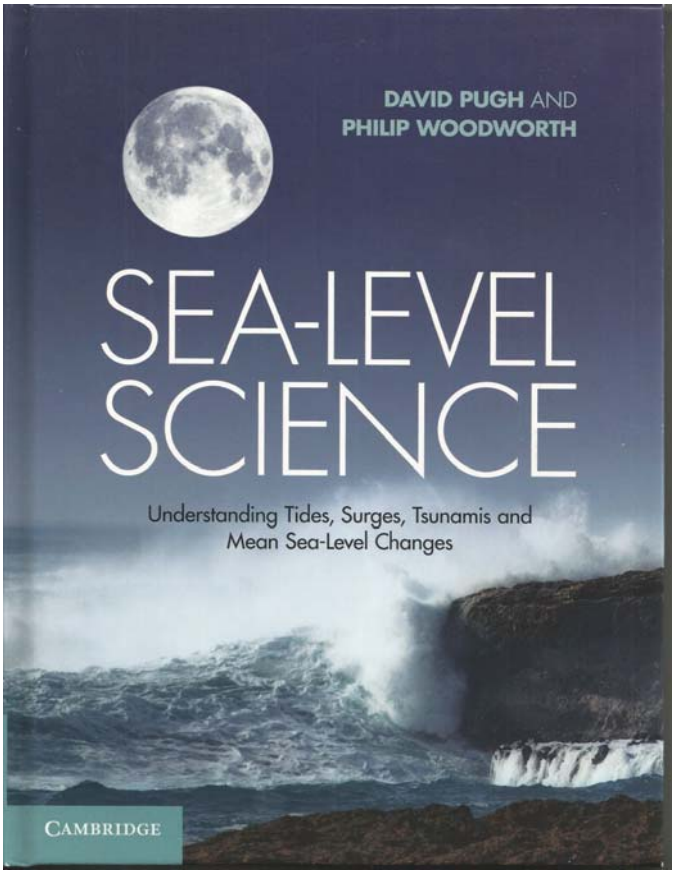
by Roger G. Barry and Eileen A. Hall-McKim

Cambridge University Press, ISBN 978-01-107-62049-0
2014, Paperback, xii + 259 pages, $68

Books reviewed by J.J.P. Smith[1]

The abiding scientific issue of our time – an era now firmly accepted as the Anthropocene – is that of the effect of human activity on the Earth's climate system. No other global environmental concern has been so persistent and apparently irremediable. Other world-scale problems of the past half century (for example the depletion of stratospheric ozone, chemical pollution transport, and ocean fisheries conservation) have not been as significant in their impact, or controversial, or posed risks for the long-term future. Climate change most readily manifests itself in two observed physical phenomena: unusual (atypical) weather patterns and events, and changes in sea level. (Also recalling the emerging research about chemical changes from increased atmospheric carbon dioxide levels, such as ocean acidification.) These two publications on the subject of the earth's ocean and atmosphere systems, ***Sea-Level Science*** and ***Essentials of the Earth's Climate System***, are timely additions to the literature for the understanding, researching, and teaching of climate change.

David Pugh and Philip Woodworth, the authors of ***Sea-Level Science***, are widely recognized (and honoured) oceanographers from the United Kingdom. Pugh is also known to Canadian oceanographers from his 2003-07 term as President of the Intergovernmental Oceanographic Commission. He was the author of the 1987 forerunner of the present book, *Tides, Surges and Mean Sea-Level: A Handbook for Engineers and Scientists* which has been the



singular resource on the subject. *Sea-Level Science* is more or less entirely new, clearly up-to-date in method, data, the presentation of scientific advances, and use of terminology.

The book is organized around presenting the physics of ocean surface movement: "*an integrated account of sea level and why it is endlessly changing*." Almost half addresses tidal dynamics, the remainder other manifestations of sea level disturbance phenomena including storm surges, tsunamis, and spatial and temporal variations of the ocean's surface. Two chapters of the application of science to such things as coastal flood defences and the biological aspects of ocean tides, together with five appendices of equations and supporting materials round out *Sea-Level Science*. The currency of the book can be seen in the extensive references for each chapter, averaging more than 50, with very recent journal articles as well as time-tested monographs such as A.E. Gill's 1982 *Atmosphere-Ocean Dynamics* and Gabriel Godin's 1972 *The Analysis of Tides*. The book's glossary is comprehensive and the index obviously well prepared. The modern art of the academic reference and text is what might be called *visual accessibility*, and *Sea-Level Science* reflects this, with an engaging lay-out of narrative text, formulae, and colour illustrations. This will ensure the book has a readership beyond the academic-research community.

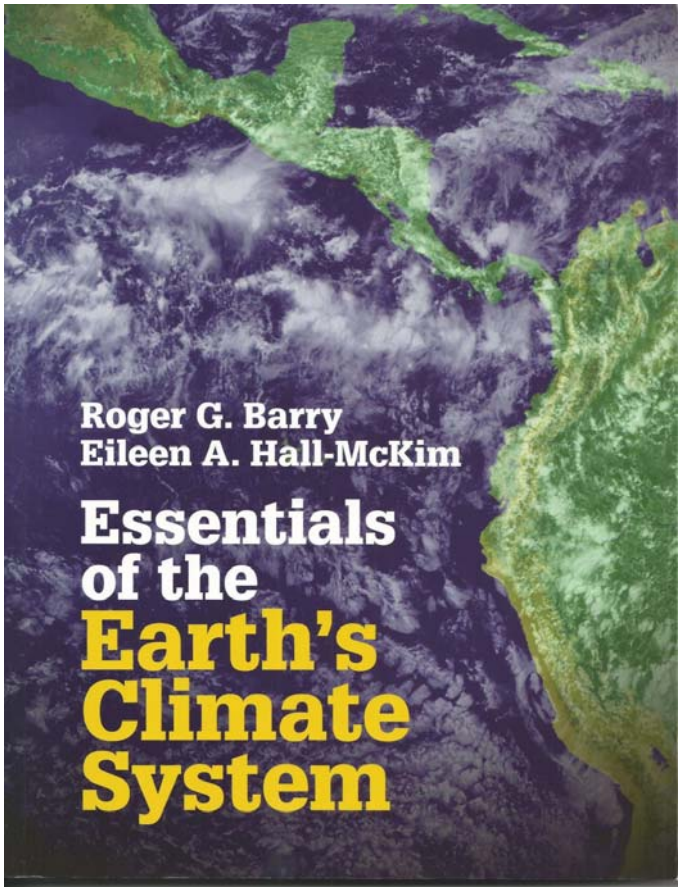
[1] McGill and Carleton Universities, and the government of the Saharawi Arab Democratic Republic.

The core chapters about tidal forces (Chapter 3) and tidal analysis (Chapters 4 and 5) are not overly demanding of mathematical ability, containing the necessary equations to explain tidal mechanisms (usefully supplemented by elementary hydrostatic, hydrodynamic, and current equations in the appendices). The second half of *Sea-Level Science*, which addresses manifestations of tidal phenomena – surges, tsunamis, and long-term changes – is qualitative, readable, and a superb summary of scientific understanding to date. Parts of these chapters are valuable references for specific events, such as the 2004 and 2011 seismically-induced tsunamis in Indonesia (Sumatra) and Japan (Tohoku). Chapter 10 addresses possible future sea level changes. The discussion here about climate change induced variability is outstanding, with a nuanced presentation of projections issued by the Intergovernmental Panel on Climate Change (the IPCC) from 1990 through 2014. Chapters 11 and 12 offer contemporary insights into the effect of sea level on "the solid earth", that is, vertical land movement, and flood and surge defences in coastal areas, respectively.

Few useful criticisms can be made of *Sea-Level Science*. While the authors are English with examples across chapters drawn from the United Kingdom, the book's reach is global (*e.g.* the description of seiches in Port Stanley Harbour at page 167 and the discussion of shelf tides at pages 113 *et seq*.). Appendix E, *"Legal definitions in the coastal zone*", while a useful summary of national definitions of the legal coastline (low and high water marks) could have had a fuller discussion of seaward zones of jurisdiction under the 1982 United Nations *Convention on the Law of the Sea* and the crucial implications of sea level for determining the baselines of maritime claims and boundaries.

Essentials of the Earth's Climate System is, similarly, intended primarily to be a text. The book's lead author, the eminent climatologist Roger G. Barry, notes that "*[i]t is designed to serve as an introductory course in climatology, suitable for students in environmental sciences, geography, meteorology, and related disciplines*." Although qualitative in its discussion of climate and atmospheric circulation, its descriptions of complex phenomena are excellent. This is the result of arranging subjects progressively by chapter, and a clarity of narrative, together with a superb layout that includes well-chosen illustrations, summaries, and explanatory inset boxes.

The authors take an innovative approach to framing the underlying mechanisms of the global climate: descriptions of *energy* and of *moisture*. The discussion begins with insolation and its limits, and how that manifests itself in temperature. The descriptive survey of moisture is somewhat fragmented, the building blocks to understand later chapters. Chapter 3 is, in effect, a synopsis of what makes for weather, from "pressure and winds" to air masses and frontal zones, storms, thunderstorms, and finally



mesoscale convective systems. The description of cyclone formation is outstanding, although case studies of recent large-scale events (*e.g*. Cyclone Nargis in 2008) could have been useful. The balance of the book is about climatology (and not, it should be recalled, about meteorology, or ocean-atmosphere physics). Chapter 4, a nicely written summary of local and microclimate classification, is the pivot point for the substantive presentations that follow: general atmospheric circulation (Chapter 5), circulation modes (Chapter 6), synoptic climatology (chapter 7), ocean-atmosphere circulation (Chapter 8), major climatic types on land (Chapter 9), past climates (Chapter 10), future climate (Chapter 11) and applied climatology (Chapter 12). The survey of climatic types in Chapter 9 is outstanding, comprehensive, and unique in the literature. The discussions here about climate processes on ice tundras (Greenland and Antarctica) and of monsoons are – typical of much of the book – interesting in their own right. The authors give a useful and credible summary of future climate developments in the closing chapters. The discussion of climate change in the present Anthropocene (at pages 186 *et seq*.) is well handled, a useful historical survey of the past century and of where we now find ourselves in a time of climate change. The closing parts of *Essentials of the Earth's Climate System* are consistently well prepared: appendices of units of measurement and web links, a glossary, a comprehensive bibliography, and an index.

Essentials of the Earth's Climate System should have a readership wider than that of a student text. It is a welcome addition to the classic literature on the subject, including Roger Barry's 2010 *Atmosphere, Weather and Climate* (in its ninth edition) and Wilfrid G. Kendrew's mid-20th century mainstay, *The Climates of the Continents*. The only criticism which can be leveled at this fine book is that it might usefully have included a summary appendix on the principles of atmospheric physics, and perhaps (as a substantive discussion or in the form of an exemplary case study) a passage about the impacts on climate from the atmospheric transport of chemical pollutants. *Essentials of the Earth's Climate System* deserves a place with meteorologists, oceanographers looking for insights into climate classification, and those working in interdisciplinary social sciences and policy fields. It should also be on the shelves of university and public libraries in Canada.

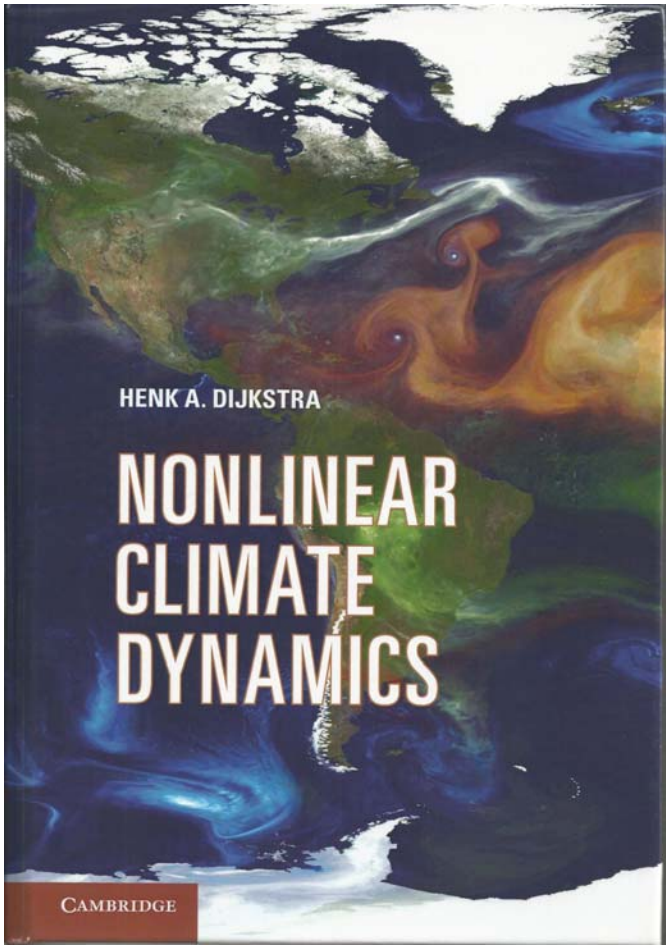
Nonlinear Climate Dynamics

by Henk Dijkstra

Cambridge University Press, ISBN 978-0-521-87917-0, 2013, Hardback, $76.95, 357 pages

Book Reviewed by Marek Stastna[2]

Nonlinear Climate Dynamics is a graduate level monograph/text that presents a stochastic dynamical system point of view on the dynamics of various climate phenomena to a graduate or researcher level audience. As such, it stakes out a unique patch of climate science ground from its inception. Modern climate science is heavily dominated by proxy based climate reconstruction and climate modelling, and as such the author has set out for himself two tasks. The first is to introduce the topic to an audience of students already committed to a Ph.D. in the area, and in this task the book certainly succeeds. The second is the rather difficult task of convincing an audience that his point of view on climate dynamics is both tractable and profitable. The effort made to accomplish this second task is admirable, with well polished text, a pleasant typeset and ample, well constructed figures (with colour plates occupying a central section as is common practice for Cambridge University Press). There are no problems or exercises in the text, though reproducing any one of the figures would keep a graduate student busy for some time.



While I both respect the author's voluminous record in terms of past contributions, and applaud the effort made in this book, I feel the book only partially succeeds in its second aim.

The book consists of an introductory chapter, four chapters outlining the necessary theoretical developments, a transitional chapter (which is a real gem) that outlines the climate modelling hierarchy, and six largely self-contained chapters of applications to particular climate phenomena. Both the introductory chapter and the transitional chapter on climate modelling are clearly the work of a polished and experienced researcher. The latter especially is something I can imagine assigning to graduate students not only as background reading, but as an example of how to write an overview of a topic for a general audience. The background material assumes quite a bit of the reader, especially given the shift away from a mathematics/physics background in North American geosciences programs. As an applied mathematician, I found it both intriguing and infuriating. It is clear that the author has a tremendous level of knowledge, and an understanding that much of the notation and machinery of modern applied mathematics is more an impediment, than an advantage to the scientist wishing to use it. As such a deep level of understanding by the author is drawn upon to select a compendium of terms, important

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results, and examples that span modern dynamical systems theory and its extension to stochastic differential equations. I enjoyed a considerable portion of these chapters, and felt I gained a fair amount of insight. However, the level of detail presented often conveyed only the surface layers of a given topic (perhaps by necessity) and I had the distinct impression that a student could get lost quite easily. Here exercises really would have helped. Nevertheless, the quality of the graphics, and the presentation is high and I suspect almost anyone who is willing to dedicate some time to these chapters will come away with new knowledge. I did find the reliance on numerical codes maintained by authors not connected to the book somewhat annoying. One never knows if a given project will continue to be supported and an archive of codes in a commonly used language like Matlab could easily be maintained by the publisher (as is the case with other Cambridge University Press books).

The applications chapters span standard topics in theoretical climate science, such as ENSO (El Niño/Southern Oscillation), variability of the thermohaline circulation, glacial climate variability and predictability. It is likely that any one of these topics could have an entire monograph dedicated to it, and indeed quite a few of them do. The point of view is consistent with the theoretical development, and thus the work put in by a reader in mastering the first part of the book is put to good utility in the second half of the book. The success of the techniques adopted by the author varies by topic with some impressive and impressively coherent results (e.g. for ENSO). Again I felt like I learned, or in some cases relearned, interesting aspects of each phenomenon, and many topics introduced literature I was not familiar with for further reading. However, I did feel that at times the literature discussion slipped to a summary of work by the "usual suspects", with contributions by those outside of a core group largely ignored. At a few points, I noted omissions that, while understandable for a textbook, were glaring for a monograph. I also felt that the results of EMICS (or earth system models of intermediate complexity) were largely taken at face value, even though the use of such models is largely an artifact of a lack of available computational resources in the past. Moreover, the details and omissions of the models were not discussed in the text. Some of the discussion, quite rightly, draws on the author's own work, and here some rather obscure literature building on the author's work was discussed and for a reader who really wanted to delve into the details this might be appreciated.

Overall, *Nonlinear Climate Dynamics* is an imperfect book, though one that I can imagine recommending to graduate students as supplementary reading, wherein they focus on a portion of the book. Given the changing habits of students with respect to reading this means the book is likely a worthwhile purchase for a wide variety of climate scientists. I can also imagine using it as the basis of a Ph.D. level topics course, though assembling an audience with the required prerequisites and interests may prove difficult. For a true expert in a given topic I feel the discussion as presented in the book, should be supplemented by other sources. Finally, if a second edition is published, the book really ought to come with a set of numerical routines to carry out some of the analyses discussed in the text.

Father Benito Viñes – The 19th-Century Life and Contributions of a Cuban Hurricane Observer and Scientist

by Luis E. Ramos Guadalupe
(translated by Oswaldo Garcia)

American Meteorological Society (AMS) paperback, 2014, 171 pages, about C$20 from the AMS on-line bookstore or Amazon **ISBN:** 9781935704621

Book reviewed by Bob Jones[3]

Our *CMOS Bulletin SCMO* Co-Editor must have had a sixth sense when he asked me to review this book. It is an archival biography which includes the beginnings of the Cuban Weather Service. There is a strong parallel with the establishment of the Canadian Meteorological Service, described in many papers and books by Morley Thomas. As a young meteorologist, I too did a lot of forecasting in the Caribbean (happily not in Hurricane season). Finally, the Co-Editor knew of my recent trips to Cuba. He did not know we visited Matanzas, a city devastated by a hurricane in 1870 and, in Havana, that one tour took us to Fr. Viñes final resting place, the famous Cólon Necrópolis (Cemetery).

In 1870, following several devastating hurricanes, the then Spanish colonial rulers of Cuba decided that a properly equipped "observatory" should be set up in Havana to help predict these storms. In their wisdom, they chose Father Benito Viñes who arrived in Havana that spring and took over a poorly maintained observatory in Bélen College. A few months later, Fr. Viñes reported to the newspapers on the Matanzas storm, but this early in his time as head of the observatory, no attempt at prediction was possible.

The cover photo of Father Viñes shows a thin frail looking priest of the Jesuit Order. He arrived in Cuba at age 33, and died there, a young 56. The Jesuits have a strong mission to educate people in more than religion and they run many colleges and universities throughout the world. Pierre Trudeau received an important part of his education from the Jesuits. Readers of this book will not find much religious activity by Fr. Viñes, but it records that he did say Mass daily and reported to his Rector at Bélen College.

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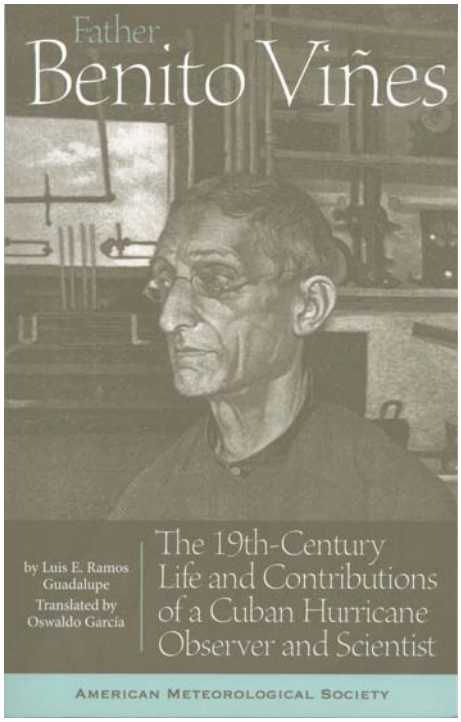
[3] CMOS Archivist, Ottawa, Ontario, Canada



Leaving the review for a moment, it is interesting to compare with what was happening in Canada at that time. An observatory situated on the University of Toronto campus, had been operating precariously for many years before 1871, but it took Prof. G. T. Kingston, formerly a British naval officer, to make the changes needed to found the Canadian Meteorological Service at this location. Storm warnings were started in 1876, about the same time that Fr. Viñes began issuing hurricane warnings for Cuba. Both forecasts were based on gradually expanding telegraphed observations. In 1870, the US National Weather Service was born, also utilizing an expanding network of telegraphed observations but in their case, the Army Signal Service ran the meteorological service.

The small book is organized into four parts, three of which chronicle Fr. Viñes' 23 years in Cuba. It covers the science of the time, is very readable by everyone, and will be of interest to atmospheric scientists interested in history and who love biographies of those who went before. The second chapter deals with the pre-Cuba period of Fr. Viñes, birth in Spain, education, entry into the Jesuits, etc. My main criticism of this book is that the order of things jumps around a bit. The second chapter belongs first, but we can see the wisdom of the AMS in beginning the book by describing some serious hurricanes. The latter two chapters deal with the development of his science to forecast the hurricanes, followed by the last chapter where Fr. Viñes totally immersed himself in trying to improve his science while continuing to provide his warnings to the Cubans. Acknowledgements, introduction, epilogue, and index complete the book.

A few words are needed about the science behind Fr. Viñes' forecasts. Imagine forecasting hurricanes without using computers, satellites or Doppler radar. Upon his arrival in Cuba, after getting the observatory in shape with improved instruments, etc., he set forth to devise a climatology of seasonal hurricane paths. Some of his charts looked very much like the spaghetti-like tracks we see today. Early on, he recognized the "typical" track of the West Indies storms which plague Cuba, that is they usually come from the easternmost or Lesser Antilles islands, and move westward towards Hispaniola and Cuba, then curve northwest and / or north towards the US mainland. This climatology, combined with another amazing tool, served him well for 90% of the storms he predicted and the Havana newspapers eagerly awaited his forecasts so their readers would be able to take life-saving actions.

Fr. Viñes recognized the circular form of large rotating storms and that well-developed hurricanes cast a very wide cloak of different types of cirrus cloud over much of the Caribbean. Using plotting boards and other observing and navigational instruments of the time, he was able to determine accurately the motion of these cirrus layers. With simple geometry he could then pinpoint the location of the eye (then called the vortex) of a distant hurricane, days in advance of its appearance near Cuba. Repeating such observations would give him a track, and then it was a relatively easy matter to forecast any Cuban landfall, or how far away from the coast the storm would pass.

No book on meteorology would be complete without mention of a bad (called a "bust") forecast and Fr. Viñes experienced a serious one in 1888. By this time, his methods were well established and in early September of that year he detected and forecast that a large hurricane would track through the Florida Straits with its vortex passing near Key West. He predicted serious winds and weather for the Cuban north coast but no direct hit. Unfortunately as the storm neared, an unusually strong high pressure area over the southern USA deflected the track of this storm from Fr. Viñes' predicted track. It actually crossed Cuba lengthwise causing serious damage and loss of life. This exception caused some Havana newspapers to lose faith in Fr. Viñes' forecasts, but most recognized his excellent record both before and after this incident.

In the early 1890s, Fr. Viñes had several bouts of illness which prevented him from fully carrying out his duties at the observatory. In 1893, the organizers of the International Meteorological Congress (predecessor to WMO) invited him to present his results to the theoretical meteorology session at the Chicago World Fair. The brightest atmospheric scientists from many countries would be in attendance. Fr. Viñes used his last reservoir of strength to finish his paper and arrange to send one of his forecasting instruments for display at the Fair, but due to illness, he was unable to travel to Chicago. Knowing of his deteriorating health, Spain named two Philippine meteorologists to present Fr. Viñes' findings. He died shortly after completing the paper. The title was *Investigations Relating to the Circulation and Cyclonic Translation of Hurricanes of the Antilles* and it summarized all the work he had accomplished during his 23 years in Cuba. It was published posthumously by the United States Weather Bureau.

In summary, ***Father Benito Viñes*** is a fascinating look at the life of a man who worked on the cutting edge of 19th century weather science. With notes that put his life into modern context, this book shines a spotlight on a figure who played a crucial role in making our lives safer.

Books in search of a Reviewer (Partial list)
Livres en quête d'un critique (Liste partielle)

Latest Books received / Derniers livres reçus

2014-1) *Biogeochemical Dynamics at Major River-Coastal Interfaces, Linkages with Global Change*, 2014, Edited by Thomas S. Bianchi, Mead A. Allison, Wei-Jun Cai, Cambridge University Press, 978-1-107-02257-7, Hardback, 658 pages, $146,95.

2014-5) *An Introduction to Ocean Remote Sensing*, by Seelye Martin, 2nd Edition, 2014, Cambridge University Press, 978-1-107-01938-6, Hardback, 496 pages, $88,95.

2014-6) *Electromagnetic Scattering by Particles and Particle Groups, An Introduction*, by Michael I. Mishchenko, 2014, Cambridge University Press, 978-0-521-51992-2, Hardback, 435 pages, $73,95.

2014-10) *The Thinking Person's Guide to Climate Change*, by Robert Henson, 2014, Published by American Meteorological Society and distributed by the University of Chicago Press, ISBN 978-1-935-70473-7, 171 pages, Paperback, US$30,00.

2014-11) *The Arctic Climate System*, (2nd edition), by Mark C. Serreze and Roger G. Barry, 2014, Cambridge University Press (Cambridge Atmospheric and Space Science Series), 978-1-107-03717-5, Hardback, 404 pages, $130,95.

Best Wishes

It is with great pleasure that the *CMOS Bulletin SCMO* Editorial team (Savithri Narayanan, Lise Harvey, Qing Liao, Douw Steyn, Andrew Bell, and Paul-André Bolduc) offers this last issue for Volume forty-two (42) of *CMOS Bulletin SCMO*. At the same time, we take this opportunity to wish all CMOS Members a joyous holiday season and a very Happy New Year 2015.

Next Issue *CMOS Bulletin SCMO*

Next *CMOS Bulletin SCMO* issue will be published in **February 2015.** Please send your articles, notes, workshop reports or news items before **January 2, 2015** to the electronic address given at the top of page 178. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **février 2015.** Prière de nous faire parvenir avant le **2 janvier 2015** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse électronique indiquée au haut de la page 178. Nous avons un besoin URGENT de vos contributions écrites.

BRIEF NEWS / NOUVELLES BRÈVES

Naomi Klein wins 2014 Hilary Weston Prize

According to CBC Books, Canadian activist and author Naomi Klein has won the $60,000 Hilary Weston Writers' Trust Prize for Nonfiction for her "groundbreaking" book about climate change **"*This Changes Everything: Capitalism vs The Climate***". The prize is the most lucrative literary award for a nonfiction book published in Canada.

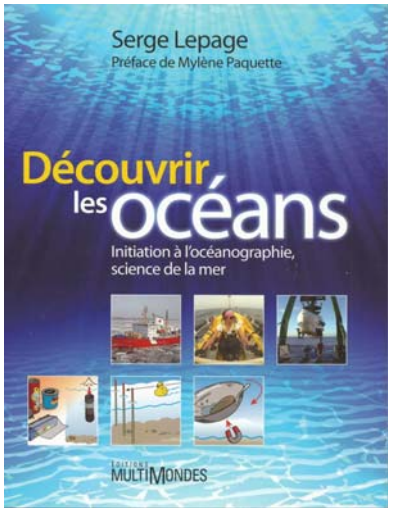
When her name was called, an emotional Klein took to the stage. She praised the other "wonderful" books on the shortlist and said her win was not "supposed to happen." Still, she has been encouraged by the reception to her book and believes "there is a deep desire for change in this country".

In a post-ceremony interview with CBC Books, Klein said that winning the prestigious Hilary Weston Prize may help her book reach different audiences. "*Maybe even people who disagree with my politics might engage with it ... For me, I want the book to stimulate debate, I don't just want the book to entrench people's positions*," she said. *"I think we really need to air this out*".

The jury, which included past Hilary Weston Prize winner Charles Foran, writers Priscila Uppal, Merrily Weisbord, CBC News' Peter Mansbridge, and filmmaker Deepa Mehta, lauded Klein's book for its "*fresh insights*" into the climate crisis. "[Her] *urgency and outrage is balanced by meticulous documentation and passionate argument*," the jury said in its citation. "*Heart and mind go hand in hand in this magisterial response to a present crisis*."

Reference:
http://www.cbc.ca/books/2014/10/naomi-klein-wins-2014-hilary-weston-prize.html

Vient de paraître en 2014!



Pour tous ceux ou celles qui cherchent encore un cadeau éducatif à donner à leurs enfants ou petits-enfants en ce temps des Fêtes, *Découvrir les Océans* de Serge Lepage pourrait s'avérer le cadeau idéal.

Ce livre, dont Mylène Paquette a écrit la préface, (celle qui a traversé l'Atlantique à la rame), se destine aux jeunes amoureux de la mer. Livre d'initiation à l'océanographie, le premier chapitre fait découvrir les océans en présentant la formation des bassins océaniques, les propriétés physiques et chimiques de l'eau de mer, les mouvements des masses d'eau océaniques et la vie dans les océans.

Puis le livre offre un chapitre audacieux en décrivant pour les jeunes lecteurs ce qu'est la profession d'océanographe, le but étant de susciter de nouvelles vocations!

Les outils utilisés par les océanographes pour effectuer leurs mesures sont décrits en détail dans le chapitre suivant en passant par les navires océanographiques, les instruments de mesure et de collecte des échantillons, la plongée sous-marine et les sous-marins d'exploration, les satellites d'observation, les balises Argo, les modèles numériques et les laboratoires dans les différents instituts de recherche au pays.

Ce livre innove en présentant plusieurs expériences que peuvent effectuer les jeunes amoureux de la mer en utilisant les moyens du bord comme des boîtes de chips ou des vieux contenants à peinture!

L'auteur termine son livre en offrant quelques idées sur l'avenir, parfois sombre, des océans. Abondamment illustré en couleur, ce livre couvre un large éventail des sciences de la mer.

Écrit à la première personne du singulier, ce livre est très personnel et saura sans aucun doute capter l'intérêt des jeunes lecteurs pour les sciences de la mer.

Découvrir les Océans, Initiation à l'océanographie, science de la mer, Serge Lepage, ISBN 2-89544-472-5, Éditions Multimondes.

Highly Diluted Fukushima Radioactivity Becomes an Ocean Tracer, Providing New Insights into Ocean Circulation

There are a variety of ways to study ocean circulation — most are planned though some are occasionally unplanned, as in the case of a tracer that accidentally ended up in the Pacific Ocean on March 11, 2011. That was the day a severe, undersea earthquake off the northeast coast of Japan triggered a tsunami, causing extensive damage to a nuclear power plant in Fukushima, Japan. The natural disaster resulted in the release of radioactive cesium-137 (^{137}Cs) and cesium-134 (^{134}Cs) — common products of nuclear fission — directly into the western North Pacific Ocean.

The plume of radioactive cesium eventually flowed northeast, swept along in the offshore Kuroshio Current. Computer modelling of ocean transport predicted that the radioactivity would take several years to approach the Canadian coastline.

In a future issue of the *CMOS Bulletin SCMO*, the Editorial team plans to present the full story on this new interesting topic.

Reference: *XNCR Science Bulletin,* distributed by Department of Fisheries and Oceans, November 12, 2014.

La radioactivité très diluée de la centrale nucléaire de Fukushima devient un traceur océanique, offrant de nouvelles perspectives en matière de circulation océanique

Il existe diverses méthodes pour étudier la circulation océanique; la majorité d'entre elles sont planifiées, toutefois, il peut arriver que certaines ne le soient pas comme c'est le cas pour un traceur qui a accidentellement fini dans l'océan Pacifique le 11 mars 2011. Ce jour-là un tremblement de terre sous-marin au large de la côte nord-est du Japon a déclenché un tsunami, causant des dommages considérables à une centrale nucléaire à Fukushima au Japon. Cette catastrophe naturelle a entraîné un rejet de césium 137 (^{137}Cs) et de césium 134 (^{134}Cs) radioactifs, qui sont des produits courants de la fission nucléaire, directement dans le nord-ouest de l'océan Pacifique.

Le panache de césium radioactif s'est finalement propagé vers le nord-est, notamment dans le courant du Kuroshio. La modélisation informatique du transport océanique prédisait que la radioactivité prendrait plusieurs années pour se rapprocher de la ligne de côte canadienne.

Dans un prochain numéro du *CMOS Bulletin SCMO*, l'équipe éditoriale planifie présenter un article complet sur ce nouveau sujet fort intéressant.

Référence: *XNCR Science Bulletin,* distribué par le ministère des Pêches et Océans le12 novembre 2014.

Meilleurs Souhaits

C'est avec un grand plaisir que l'équipe éditoriale du *CMOS Bulletin SCMO* (Savithri Narayanan, Lise Harvey, Qing Liao, Douw Steyn, Andrew Bell et Paul-André Bolduc) complète ce dernier numéro du volume quarante-deux (42) du *CMOS Bulletin SCMO*. Nous profitons également de l'occasion pour souhaiter à tous les membres de la SCMO de très joyeuses fêtes et une très Bonne et Heureuse Année 2015.

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