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CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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Photo: Dan Weaver

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CMOS Bulletin SCMO
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CMOS Bulletin SCMO
"at the service of its members / au service de ses membres"

Editor / Rédactrice: Sarah Knight
Director of Publications / Directeur des publications: Douw Steyn

Canadian Meteorological and Oceanographic Society / Société canadienne de météorologie et d’océanographie
E-mail: bulletin@cmos.ca
Courriel: bulletin@scmo.ca

CMOS Office / Bureau de la SCMO

P.O. Box 3211, Station D
Ottawa, Ontario, Canada, K1P 6H7
Homepage: http://www.cmos.ca
Page d’accueil: http://www.scmo.ca

Gordon Griffith, Ing., P. Eng., FEC
Executive Director - Directeur général
Tel/Tél.: 613-990-0300
E-mail/Courriel: cmos@cmos.ca

Ms. Qing Liao
Office Manager - Chef de bureau
Tel/Tél.: 613-990-0196
E-mail/Courriel: accounts@cmos.ca

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.

Words from the President

Dear Friends and Colleagues –

New Year's Eve is fast approaching and the holiday season is upon us as I write this message. Here in Ottawa, Parliament has recessed and another year has gone by with very little real headway on increasing the funding and good management of science across the federal government. The world is exhibiting the significant spasms of instability we have wrought upon the planetary atmospheric and ocean systems through our ineffectual attempts to moderate climate change. Polar ice is retreating, fires are raging, floods are rampant.

But life goes on - and CMOS members continue to do their part in improving our environment and in creating and providing the tools to manage our day-to-day activities and the long-term health of our atmosphere and oceans. Through our new electronic Bulletin, we will be able focus our message on the positive and important scientific and operational work of our members. I would also like now to highlight some of our other activities in working to bridge the gaps between science, policy and society.

Over the past year we have supported organizations such as Evidence for Democracy (E4D). E4D emerged in 2012 in response to the attack on government science by the Harper government. E4D has become a leading fact-driven, non-partisan, not-for-profit organization promoting the transparent use of evidence in government decision-making in Canada. Their issue-based campaigns tackle emerging issues affecting science and evidence -based public policy in Canada. They work with national and local partners to organize events, raise awareness, and engage the public directly with policy-makers.

For many years, CMOS has been an active participant in the Partnership Group for Science and Engineering (PAGSE). PAGSE is an umbrella group of 25 + science and engineering organizations operating under the auspices of the Royal Society, and is supported by NSERC. Over the years, PAGSE has held scientific symposia and has provided submissions to Parliamentary Committees on science issues, particularly submissions to the pre-budget process with the House of Commons Standing Committee on Finance. For well over a decade, PAGSE has delivered the Bacon and Eggheads Breakfast seminars on Parliament Hill. This flagship series brings Parliamentarians together with experts in science and engineering, showcasing outstanding Canadian research accomplishments. Its purpose is to provide unbiased insight into topical scientific issues, within a non-partisan forum. This prestigious forum represents an ongoing and unique opportunity for scientists to communicate important findings to a distinguished and influential audience and CMOS has provided its share of speakers and topics.

Let's Talk Science is an award-winning, national, charitable organization that creates and delivers a number of unique learning programs and services that engage children, youth and educators in science, technology, engineering and mathematics (STEM). For example, the Annual Challenge is a team-based, competitive, enrichment event offered for Grade 6-8 students. This free, fun-filled program gives students the opportunity to build their team skills, interact with relevant role models and test their abilities against peers. Approximately 3,000 students participate annually. Our Executive Director, Gordon Griffith has been working with the organization to promote the science and profession of meteorology in the 2018 Challenge Guideline documentation. David Sills, a severe weather scientist with Environment and Climate Change Canada (ECCC) will be highlighted, as well as the Southern Ontario Lightning Mapping Array (SOLMA) technology from David's group in ECCC.

As we start the New Year, I would like all members to think about your stories, photos and videos and examples of the technologies that you use. Let's show our student members how we use the field work and course work that we did as undergrads and post grads in our daily work lives. Let's show Canadian taxpayers how important their financial resources are in improving their lives through our national and international scientific enterprise.

I urge all members to get involved with any of these communication and education initiatives. Please do subscribe to the new electronic Bulletin, where you can read and share the important work of your colleagues, and consider how you can work with us to share the stories of the work that you do with people around the world. Our future is formed by the actions of today.

All the best in 2018!

Wayne Richardson, P.Eng.
CMOS President

Mot du président

Chers amis et collègues,

Au moment d'écrire ces lignes, je sens le temps des fêtes à nos portes et le jour de l'An qui approche à grands pas. Ici, à Ottawa, la Chambre s'est ajournée et une autre année s'est écoulée avec très peu de progrès réels en ce qui concerne l'augmentation du financement et la bonne gestion des sciences dans l'ensemble du gouvernement fédéral. Le monde subit les spasmes d'instabilité que nous avons causés aux systèmes atmosphériques et océaniques planétaires par nos tentatives inefficaces de modérer les changements climatiques. La glace polaire se retire, des incendies font rage et les inondations sont omniprésentes.

Mais la vie continue! Et les membres de la SCMO s'affairent à améliorer l'environnement ainsi qu'à créer et à fournir les outils nécessaires à la gestion de nos activités quotidiennes et à la santé à long terme de l'atmosphère et des océans. Grâce à notre nouveau bulletin électronique, nous pourrons mettre en lumière les importants travaux scientifiques et opérationnels tangibles de nos membres. J'aimerais également souligner certaines de nos autres activités visant à combler les écarts entre la science, les politiques et la société.

Au cours de la dernière année, nous avons soutenu des organisations comme Évidence pour la démocratie. Ce groupe est apparu en 2012 en réaction à l'attaque qu'avait lancée le gouvernement Harper contre la science gouvernementale. Il est maintenant un organisme sans but lucratif et non partisan de premier plan, qui se fonde sur des faits et fait la promotion de l'utilisation transparente de données probantes pour étayer la prise de décisions au sein du gouvernement du Canada. Ses campagnes visant des enjeux précis abordent les nouvelles menaces qui touchent la science et les politiques publiques canadiennes fondées sur des preuves solides. Évidence pour la démocratie collabore avec des partenaires nationaux et locaux afin d'organiser des événements, de sensibiliser le public et de le faire interagir directement avec les décideurs.

La SCMO est une participante active du Partenariat en faveur des sciences et de la technologie (PFST) depuis de nombreuses années. Le PFST chapeaute plus de 25 organisations vouées à la science et au génie. Il relève de la Société royale du Canada et il est financé par le CRSNG. Au fil des ans, le PFST a tenu des colloques scientifiques et présenté des mémoires aux comités parlementaires sur des questions scientifiques, notamment dans le cadre de consultations prébudgétaires du Comité permanent des finances de la Chambre des communes. Depuis plus d'une dizaine année, le PFST organise les « déjeuners avec des têtes à Papineau » sur la colline du Parlement. Cet événement phare réunit des parlementaires et des experts en sciences et en génie, qui mettent en valeur des recherches scientifiques canadiennes exceptionnelles. Il vise à fournir des informations impartiales sur des questions scientifiques d'actualité, dans le cadre d'un forum non partisan. Ce forum prestigieux représente une occasion unique et continue pour les scientifiques de communiquer leurs résultats importants à un auditoire exceptionnel et influent, et la SCMO a proposé sa part de conférenciers et de sujets.

Let's Talk Science (parlons sciences) est un organisme de bienfaisance national primé, qui met sur pied et offre un certain nombre de programmes et de services d'apprentissage uniques, qui mobilisent les enfants, les jeunes et les éducateurs en matière de sciences, de technologie, de génie et de mathématiques. Par exemple, leur défi annuel, un événement d'enrichissement axé sur la compétition et l'esprit d'équipe, est offert aux élèves de 11 à 13 ans. Ce programme gratuit et amusant donne aux élèves l'occasion de développer leur esprit d'équipe, d'interagir avec des modèles auxquels s'identifier et de tester leurs aptitudes par rapport à leurs pairs. Environ 3000 élèves y participent annuellement. Notre directeur général Gordon Griffith a travaillé avec cet organisme afin de promouvoir les sciences météorologiques et la profession de météorologue dans le document d'orientation du défi de 2018. David Sills, un spécialiste du temps violent à Environnement et Changement climatique Canada (ECCC), y sera en vedette, tout comme la technologie du réseau cartographique de la foudre du sud de l'Ontario, émanant du groupe où travaille David à ECCC.

Au seuil de la nouvelle année, j'aimerais que tous les membres se penchent sur leurs histoires, photos, vidéos et exemples de technologies qu'ils utilisent. Montrons à nos membres étudiants comment nous utilisons, dans notre vie professionnelle quotidienne, les travaux sur le terrain et les cours auxquels nous avons participé comme étudiants, du baccalauréat aux études postdoctorales. Montrons aux contribuables canadiens l'importance de leur apport financiers pour améliorer leur propre vie grâce à notre entreprise scientifique nationale et internationale.

Je prie ardemment tous les membres de participer à ces initiatives de communication et d'éducation. N'oubliez pas de vous abonner au nouveau *Bulletin* électronique, dans lequel vous pourrez prendre connaissance des importants travaux de vos collègues pour ensuite les partager. Pensez aussi à partager, par le biais de la SCMO, les histoires professionnelles que vous vivez avec des gens du monde entier. Notre avenir repose sur les gestes que nos posons aujourd'hui.

Mes meilleurs vœux pour 2018!

Wayne Richardson, ing.
Président de la SCMO

PEARL at the Pole: An Update on Canada's Polar Environment Atmospheric Research Laboratory

The PAHA Team*

The Polar Environment Atmospheric Research Laboratory (PEARL) at Eureka, Nunavut is Canada's "PEARL near the Pole" – a scientific station fully equipped for specialised atmospheric measurements and situated in Canada's far North only 1,100 km from the Pole.

The original building that houses PEARL was constructed in the early 1990s by what is now Environment and Climate Change Canada, primarily as a location to study ozone, and was named the Arctic Stratospheric Ozone Observatory (ASTRO). Changing priorities at the turn of the century effectively mothballed the facility, but a university and government consortium called the "Canadian Network for the Detection of Atmospheric Change" (CANDAC) pin-pointed measurements of the atmosphere in the Extremely High Arctic as a priority measurement globally, since there are so few measurements at that high a latitude. They also recognized that Canada could provide such a set of measurements to the global community using the Eureka building as a base. Thus was born the idea of PEARL.

With support from numerous funding agencies, including the Canadian Foundation for Climate and Atmospheric Science (CFCAS), Environment Canada, the Canadian Space Agency (CSA), the Natural Sciences and Engineering Research Council (NSERC), and the Canada Foundation for Innovation (CFI), equipment was purchased, and operating funds obtained to focus on improving our knowledge of atmospheric composition and dynamics relevant to global change issues. PEARL was officially opened in 2006 and by 2007 PEARL had become a major contributor to high profile programs such as the International Polar Year (IPY).

When CFCAS funding was not renewed, it looked as though PEARL was destined to close in 2013, but new funds were found in a one-time program from NSERC – the Canadian Climate and Atmospheric Research (CCAR) program, which funded PEARL through the Probing the Atmosphere of the High Arctic (PAHA) network along with six other major environmental networks in the 2013-2018 time frame. However, in 2018, all these networks come to the end of their funding and, despite a highly positive review of the program and requests by NSERC to the government, there is at present no successor program.

Thus, in late 2017 PEARL again faced closure. Some of you will have seen some of the press coverage that flowed from that announcement and the realisation that not only was PEARL ending, but so were the six other

LEFT: PEARL has a full-time internet connection through the Telesat Anik F2 satellite. Eureka is probably the site of the most northerly geostationary communications links on the planet and the technology and operational strategies to keep them running are themselves a research problem. PEARL is connected through a C-band link and we have experimented with Ka-band in collaboration with the Canadian Space Agency (photo credit: Jim Drummond).

CENTRE: The PEARL Ridge Laboratory from the air on a rare summer day with no snow visible. The Ridge Laboratory is owned and maintained by Environment and Climate Change Canada. (photo credit: Paul Loewen)

RIGHT: Inside the PEARL facility it feels like a regular laboratory. Here one of the PEARL operators is using one of the many computers used to monitor instruments, collect data and send them south for processing and archiving (photo credit: Pierre Fogal)

major environmental projects of CCAR. NSERC described this as eliminating: "..one of the only sources of public funding for research on climate change and atmospheric processes" (http://www.nserc-crsng.gc.ca/_doc/CCAREvaluation_e.pdf)

On November 8, 2017 the government announced additional funding for PEARL in the amount of $1.6M to carry the facility to the Fall of 2019, by which time we hope that further funding will have been found.

Why is PEARL at Eureka so important? After all, it is in the very far North of Canada over 400 km north of Grise Fiord, which itself is the most northerly community in Canada. It is only accessible by charter plane and has no landlines or fiber for communications. The answer to this question has several facets which we will outline briefly.

Firstly, the atmosphere at these very high latitudes is highly sensitive to the prolonged polar night which lasts from mid-October to mid-February and sets up atmospheric physical and chemical conditions that are extremely different from those at more southerly latitudes. The study of the Polar atmosphere stretches our understanding of the atmosphere in unique ways.

Secondly, PEARL is situated in the Canadian Arctic which itself is changing due to a confluence of several factors linked to natural and anthropogenic activities. PEARL regularly records particulate and chemical intrusions from forest fires, smelters and volcanoes. PEARL also carries out measurements of ozone-related gases and is one of the few High Arctic contributors to the global Network for the Detection of Atmospheric Change (NDACC) network of similar stations.

Thirdly, we know that climate change is occurring faster in the Arctic than in other regions of the planet and again the atmosphere at PEARL is sufficiently different that it merits both research study as well as long-term monitoring of the changes that are occurring. PEARL is one of the few High Arctic contributors to the Total Carbon Column Observing Network which, like NDACC, has stations all over the world but it also an integral part of the calibration systems for the satellites in orbit measuring carbon dioxide over the planet.

Carbon measurements are not the only satellite measurements validated at PEARL, as it is ideally located for overpasses by polar-orbiting satellites. Many of the major atmospheric satellites pass over PEARL frequently, including Scisat and Odin, which carry Canadian instruments optimised for measurements of ozone-related compounds. Every year in February-March there is an intensive campaign at PEARL to make measurements to validate the data from these missions.

PEARL-related research has resulted in more than 25 MSc and PhD theses, with about a dozen others in progress, and more than 125 refereed papers, 340 conference presentations, and 270 workshop presentations. In 2011, PEARL captured the largest ozone depletion event ever seen in the Arctic. This occurred exactly over PEARL, with about 40% of the ozone column destroyed due to the stable vortex and very low temperatures. Measurements by spectrometers and lidar were combined with data from sites in other countries and satellite observations to assemble a comprehensive picture of this phenomenon. Cristen Adams was awarded the CMOS 2012 Roger Daley Post-Doctoral Publication Award and Rodica Lindenmaier the CMOS 2011 Tertia Hughes Memorial Prize for work related to this event. In addition, in 2012 Emily McCullough was awarded the Northern Scientific Training Program Malcolm Ramsay Memorial Award for her lidar work.

PEARL is also invaluable for training young scientists. When you are doing research at PEARL, you are on your own. The nearest Canadian Tire is over 2,000km away and so you need to plan for all contingencies. It promotes self-reliance and a deep understanding of how equipment works. A side benefit is that if there are senior scientists on the site there is a captive mentorship program in the dining hall, and many conversations have gone deep into the night.

PEARL is a collaborative effort. The support of ECCC through the weather station staff and management should be particularly noted, but also the support of the multiple funding agencies that have provided funding in the past – and hopefully will continue to do so into the future.

We also thank the many people who have built equipment for PEARL, operated equipment at PEARL, performed research at PEARL and then gone on to write papers and theses on the research. Many of these people have gone on to research careers in government, academia and industry in Canada and around the

world. We also acknowledge all of those who have brought their work to the public through our CANDAC/ PAHA education and outreach program, including presentations to more than 2,000 students in over 80 classrooms in Nunavut and southern Canada.

So concludes our short snapshot of our “PEARL at the Pole”. Thanks to funding from the federal government, we will be continuing the journey for another couple of years and we all earnestly hope that the research will continue for many years further. The science questions associated with the impacts of climate change and similar phenomena are not addressed by a project based on a single funding cycle or a few years of measurements; but must be carried out over many decades both as a responsibility of Canada as an Arctic nation and to safeguard Canada’s northern resources.

About the Authors

The PAHA team, at the CANDAC workshop held in May 2017. (Photo credit: Yan Tsehtik)

The Probing the Atmosphere of the High Arctic (PAHA) team consists of:
Jim Drummond, Dalhousie University, Principal Investigator
Kimberly Strong, University of Toronto, Deputy Principal Investigator
Robert Sica, University of Western Ontario
Alan Manson, University of Saskatchewan
Rachel Chang, Dalhousie University
Patrick Hayes, Université de Montréal
Jean-Pierre Blanchet, Université du Québec à Montréal
Kaley Walker, University of Toronto
Norman O’Neill, Université de Sherbrooke

PHOTO STORY: “A Day in the Life” at PEARL

Arctic Hare along Slidre Fjord, near Eureka, Nunavut.

Sunrise over Eureka, Nunavut.

PHOTO STORY: “A Day in the Life” at PEARL

PEARL researchers open the dome of a sun tracking instrument on the roof of the Ridge Lab to perform maintenance.

The dome of the PEARL Ridge Lab Brewer spectrophotometer, which measures ozone, in the foreground and the Sun Photo Spectrometer (SPS) instrument in the background on the Ridge Lab roof.

PHOTO STORY: “A Day in the Life” at PEARL

Researcher checks up on the satellite dishes outside the PEARL Ridge Lab.

High Arctic landscape between Eureka and Resolute, Nunavut.

PHOTO STORY: “A Day in the Life” at PEARL

The CANDAC Raman Lidar (CRL) at the Zero-altitude PEARL Auxiliary Laboratory (0PAL) taking nighttime measurements of the high Arctic atmosphere (e.g. temperature, H2O).

PEARL researcher walks north from the Ridge Lab during a break from a busy fieldwork campaign.

About the Photographer:

Dan Weaver is a PhD candidate at the University of Toronto researching water vapour measurement techniques at PEARL. He is also an educator and photographer. Highlights of his photography can be found on his website, www.danweaver.ca and on Instagram, www.instagram.com/danweaver_ca.

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Canada Needs Sustained Climate Research Funding

Jon Abbatt, Jim Drummond, Roger François, Paul Kushner, Paul Myers, Kimberly Strong, Laxmi Sushama, Phillipe Tortell

TOP: Photo from 2014 NETCARE field campaign in the Canadian Arctic exploring relationships between ocean emissions, aerosol particles, and clouds. CCAR-funded scientists are on board both the CGCS Amundsen icebreaker and the AWI POLAR6 aircraft. Photo credit: Maurice Levasseur

MIDDLE: This glider was deployed on 4 July 2014 from the Coast Guard Ship Hudson (in the background), on the Northeast Newfoundland Shelf. This deployment was part of the Ventilation Integration Transport Across the Labrador Sea (VITALS) project, with the glider aiming to look at physical and biogeochemical property exchange into the Labrador Sea from the boundary current. Photo credit: Robin Mathews

BOTTOM: Water column sampling in the Arctic Ocean during the 2015 Canadian GEOTRACES field campaign. A rosette specifically designed to eliminate metal contamination during sampling was used to accurately measure the concentration and isotopic composition of a large number of trace elements in seawater, and better understand their sources, biogeochemical cycling and ultimate fate in a rapidly changing Arctic Ocean. Photo credit: Glenn Toldi

As members of a community that works with climate-related measurements and models on a day-to-day basis, we know from first-hand experience that our understanding of the fundamental science that goes into atmospheric and climate model predictions is not complete.

Of course, enormous progress has been made but the complexity of the Earth system still limits the accuracy of our climate and air quality projections, especially on regional scales. And we don't yet know what surprises of unforeseen behavior in our Earth system — which includes the atmosphere, ocean, land, cryosphere, biosphere and the couplings between them — await us as the global environment responds to increased greenhouse gas radiative forcing and other forms of pollution. The critical importance of weather, climate, and air quality research to Canada and Canadians is documented in the White Paper on Atmosphere-Related Research in Canadian Universities (ARRCU, http://www.arrcu.ca/).

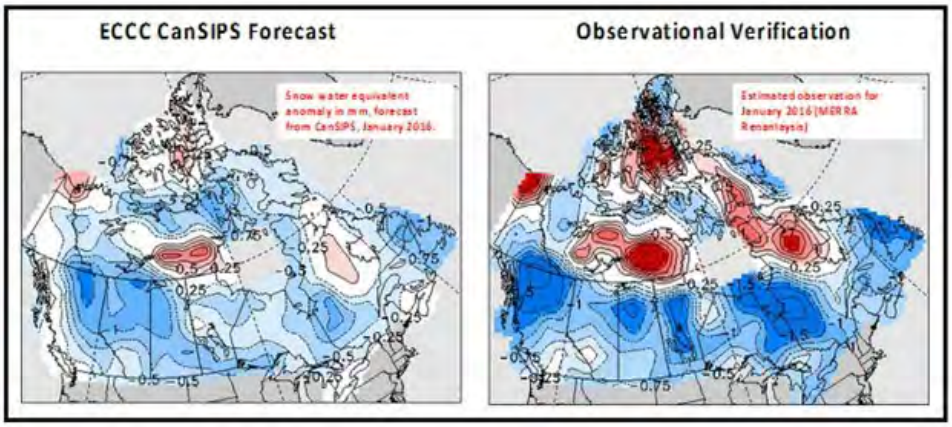
It is for these reasons that the CMOS community has long been lobbying for the continuation of dedicated federal funding in the climate and atmospheric science fields. Starting in 2000 and operating for just over a decade, the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) funded both small investigator-led projects and also larger research networks in disciplines from air quality to climate to severe weather. When CFCAS was not renewed, there was sufficient groundswell of support for climate science that the federal government created in 2013 the Climate Change and Atmospheric Research (CCAR) program, administered by NSERC. With $35M in funding spread over five years, seven large research networks have been addressing large-scale questions related to atmospheric aerosols and clouds, the biogeochemistry of the Arctic ocean, atmosphere of the high Arctic, seasonal snow cover and sea ice prediction, regional -scale weather and climate processes and prediction, cold region hydrology, and coupling between the ocean and atmosphere.

But, once again, just as occurred with the funding gap at the end of CFCAS, with the non-renewal of the CCAR program we are heading into a period of uncertainty with no dedicated funding for research in the fundamental science of global change. Of course, research is still continuing via individual NSERC Discovery Grants, but other federally funded programs are more focused on climate change adaption and mitigation, or links to resource development, with a noticeable absence of funds addressing the funda-mental science. In particular, there are no federal programs via which large-scale field measurement or modeling efforts can be mounted (see a recent op-ed in the Globe and Mail from the CMOS Executive at https://tgam.ca/2uPI1kn and

articles in Physics Today at DOI:10.1063/PT.6.2.20171127a and at https://doi.org/10.1063/PT.3.3689). The complex field of climate science requires an interdisciplinary, national-scale, collaborative funding approach which is inherently costly to implement, and not conducive to single-investigator Discovery Grant research alone. Moreover, the funding should be sustained. With a funding gap upon us, highly trained personnel are leaving the CCAR research networks, often to other countries or disciplines. This is leading to outcomes in direct contradiction to the stated goals of our governments to promote the development of highly qualified personnel.

Within this context, it was heartening to hear that the federal government has recently given eighteen months of additional funding to one of the CCAR projects, specifically to the PEARL facility located at Eureka, NU. PEARL is a highly valuable high-latitude atmospheric observatory. However, the community needs sustained funding, not stop-gap measures of this nature. Nor should climate funding be restricted to Arctic science only. While the Arctic is a bellwether of climate change and Canada should undoubtedly play a leading role in Arctic science, a more holistic climate funding program is needed, one that does not focus exclusively on the Arctic nor one that relies on short-term funding measures.

As principal investigators of CCAR projects, it has been truly amazing to see the growth in our fields that arose with CCAR funding. The highly collaborative nature of the networks excited and engaged a new generation of young scientists (according to NSERC, over 370 personnel were trained in the CCAR networks), and leveraged immense resources from our government and international collaborators. The impact of our science was recognized by the international science community. We also know that there is a wealth of untapped scientific talent in our community – from recent faculty hires, from established researchers not funded under CCAR, and from young scientists eager to move into this field. What better way to take advantage of Canadian strengths in this area than to have a sustained source of peer-reviewed funding available in a field that underpins our ability to formulate wise policy decisions?

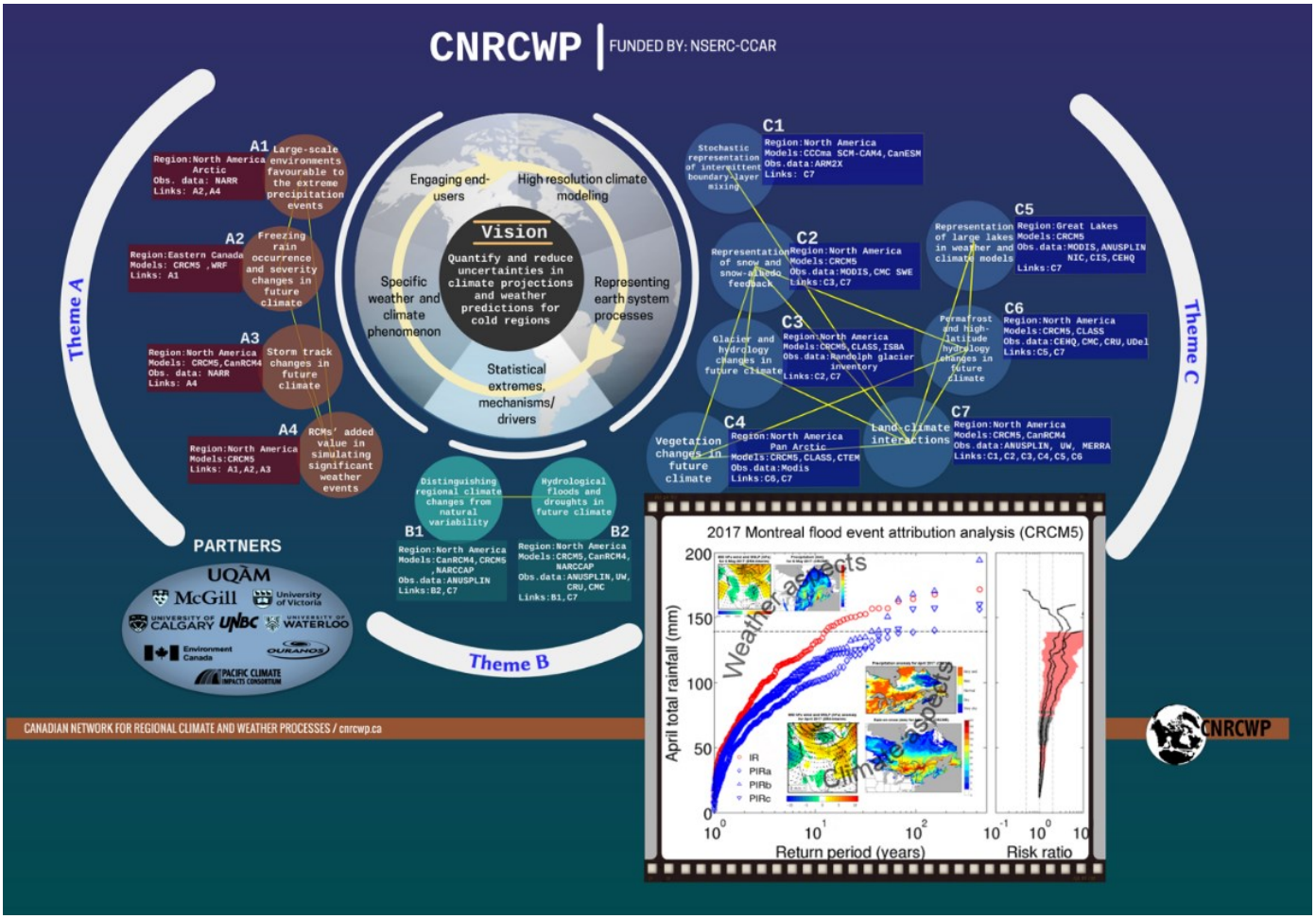


LEFT:Adjusting a Brewer ozone spectrophotometer on the roof of the PEARL Ridge laboratory. PEARL is situated beneath the Polar vortex in winter and that makes it ideal for studying Arctic ozone changes at Polar sunrise, such as the large depletion event seen in Spring of 2011. Photo Credit: Pierre Fogal

RIGHT: Caption: This forecast for snow water equivalent (shown for January 2016) is an example of a new snow forecast product developed by William Merryfield and collaborators of Environment and Climate Change Canada as a result of research by the Canadian Sea Ice and Snow Evolution Network (CanSISE). Figure courtesy of Dr. Merryfield, from Kushner et al. in review, https://doi.org/10.5194/tc-2017-157

The Minister of Science has referred to CCAR as a “one-off” solution to climate science research. It would not be so if the government had refunded the program, or returned to the CFCAS model of funding for both large networks and smaller, single-investigator-led projects. Indeed, NSERC recommended that “The federal government continues to fund fundamental research in climate change and atmospheric processes through NSERC’s CCAR initiative, as long as these areas remain priorities for the federal government.” (www.nserc-crsng.gc.ca/_doc/CCAREvaluation_e.pdf). We encourage you to write to the Ministers of Science and Environment, and to your local member of parliament, stating your thoughts on this issue.

Article: Canada Needs Sustained Climate Research Funding



Summary diagram of the Canadian Network for Regional Climate and Weather Processes, showing diverse research themes and projects. Lower right: analysis of weather and climate factors contributing to the 2017 Montreal flood, performed with the fifth generation Canadian Regional Climate Model (CRCM5). Credit: CNRCWP.

About the Authors

Jon Abbatt, FRSC, Professor, Department of Chemistry, University of Toronto, Principal Investigator for NETCARE (Network on Climate and Aerosols: Addressing Fundamental Uncertainties in Remote Canadian Environments)
Jim Drummond, FRSC, Professor, Department of Physics and Atmospheric Science, Dalhousie University, Principal Investigator for PAHA (Probing the Atmosphere of the High Arctic)
Roger Francois, FRSC, Professor, Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, co-Principal Investigator for the Canadian Arctic GEOTRACES Program (Biogeochemical and Tracer Study of a Rapidly Changing Arctic Ocean)
Paul Kushner, Professor, Department of Physics, University of Toronto, Principal Investigator for CanSISE (Canadian Sea Ice and Snow Evolution Network)
Paul Myers, Professor, Department of Earth and Atmospheric Sciences, University of Alberta, Principal Investigator for VITALS (Ventilation Interactions Transports Across the Labrador Sea)
Kimberly Strong, Professor, Department of Physics and Director of the School of the Environment, University of Toronto, Deputy Principal Investigator for PAHA (Probing the Atmosphere of the High Arctic)
Laxmi Sushama, Professor, Department of Civil Engineering, Trottier Chair in Sustainability in Engineering and Design, McGill University; Adjunct Professor, Department of Earth and Atmospheric Sciences, University of Quebec at Montreal; Principal Investigator of CNRCWP (Canadian Network for Regional Climate and Weather Processes – Network Vision: Quantifying and reducing uncertainties in climate projections and weather predictions for Canada's northern and Arctic regions)
Philippe Tortell, Professor, Department of Earth, Ocean, and Atmospheric Sciences, and Department of Botany, University of British Columbia, co-Principal Investigator for the Canadian Arctic GEOTRACES Program (Biogeochemical and Tracer Study of a Rapidly Changing Arctic Ocean)

Environment and Climate Change Canada | Environnement et Changement climatique Canada

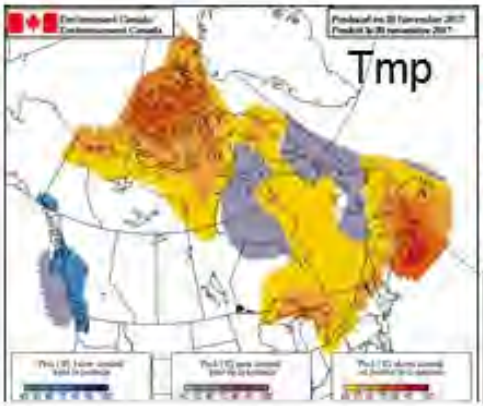
Canada

Seasonal Outlook for the winter 2017/18 (DJF) based on the official CanSIPS forecast issued on the 30th Nov. 2017

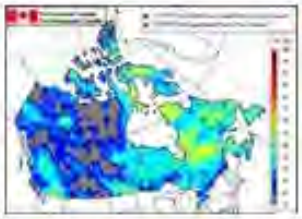
Marko Markovic and Kevin Gauthier, CMC, Montreal.

Above normal temperature winter is expected across eastern Canada. The highest probabilities (60% and +) for such a forecast are in the Maritimes, over the Great Lakes region and over northern Canada. Central prairies and continental BC have equal probability chances. Coastal BC have ~40 probability for below than normal temperature winter.

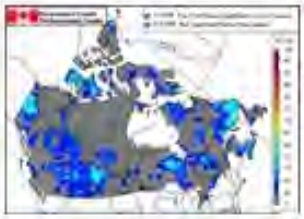
Elevated chance of above normal precipitation over certain regions of Canada?
There is >40% probability for this outcome around southern and central AB, southern SK and the most southern parts of ON. Some parts of Newfoundland and Labrador are also expecting ~40% of above than normal precipitation.

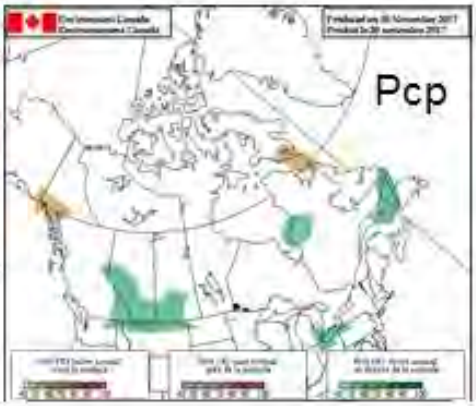


Historical Skill, Tmp



Historical Skill, Pcp





CanSIPS DJF17/18 forecasted Indices:
Nino3.4 = - 1.0 (moderate La Nina)
PDO = - 0.5 (weak negative phase)

What will influence the next season? We are currently experiencing mild **La Nina** condition (just around -0.5°C) in the central equatorial Pacific. However, ECCC predicts moderate La Nina conditions (-1.0 °C) to develop this winter and to persist in the following spring. According to the longer lead seasonal forecast issued by International Research Institute (IRI), there is a probability of above than 70% that **La Nina condition** will prevail this winter and of ~45% to continue in spring. **PDO** index is expected to become negative this winter, with North Pacific colder waters approaching the west coast. According to the ECCC seasonal forecast, La Nina will probably have impact on the coastal BC regions.
Weak ***NAO*** is forecasted for DJF17, mainly in December, after which skill is low.
PNA index will likely stay positive (until the end of December, according to the CPC).

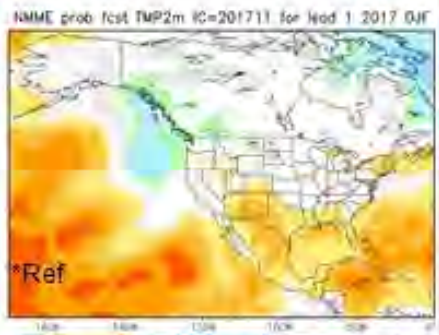
SON17 Obs. Categories

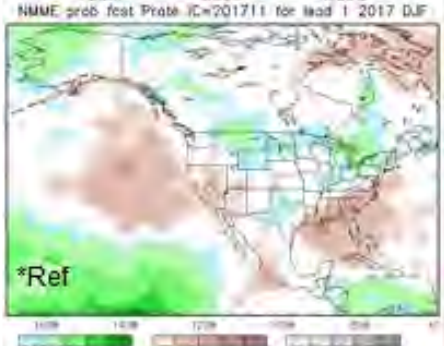
SON17 CanSIPS Catgs.

Verification SON17, Based on 88 observational days
Percent Correct, Temperature: for all model grid points over Canada: ~50%. Above normal values over Canadian prairies are responsible for the halfway score.

Seasonal forecast by other centers: Temperature: There is a difference between CanSIPS and longer lead forecast from NMME (upper figure), especially in the Maritime region, eastern Canada and over the Great Lakes where NMME forecasts near normal and equal chances for all possible outcomes. Over central Canadian prairies and coastal BC, both systems are in accord for equal-chance and below normal temperature values respectively. Longer lead seasonal forecast from IRI is in accord with CanSIPS with respect to the temperature forecast this winter.

Precipitation: There is a difference between CanSIPS and NMME (lower figure), especially in eastern Canada Over these regions NMME is forecasting ~40% probability of above than normal precipitation. Similarly to CanSIPS, NNME and IRI are forecasting above normal precipitation over the Great Lakes and southern central Prairies.





*Ref: http://www.cpc.ncep.noaa.gov/products/NMME/

Environment and Climate Change Canada | Environnement et Changement climatique Canada

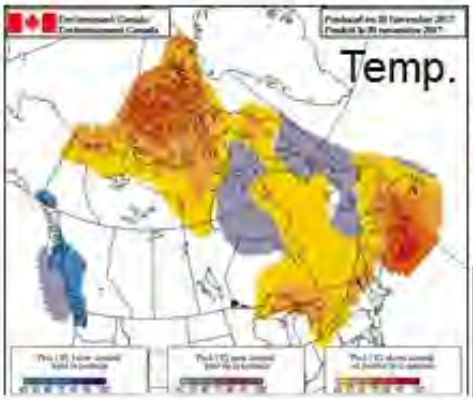
Canada

Prévision saisonnière pour l'hiver 2017/18 (DJF) par le système SPISCan, produite le 30 novembre 2017

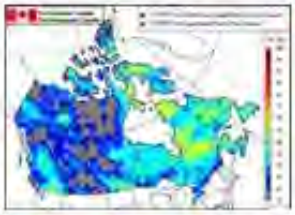
Marko Markovic et Kevin Gauthier, CMC, Montréal.

Un hiver plus chaud que la normale est anticipé pour l'est du Canada.
Les probabilités les plus élevées (60% et +) sont anticipées, pour les prévisions au-dessus de la normale, dans les Maritimes, la région des Grands Lacs et dans le nord du Canada. Les prairies centrales et la C.-B. continentale ont des chances égales de probabilité. La côte de la C.-B. a une probabilité de ~40% pour des températures sous la normale.

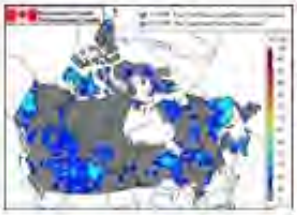
Probabilité élevée de précipitations au-dessus de la normale dans certaines régions du Canada?
Il y a une probabilité >40% pour des précipitations au-dessus de la normale autour du sud et du centre de l'AB, du sud de la SK et pour la majorité du sud de l'ON. Certaines régions de Terre-Neuve-et-Labrador prévoient également des précipitations au-dessus de la normale de ~40%.

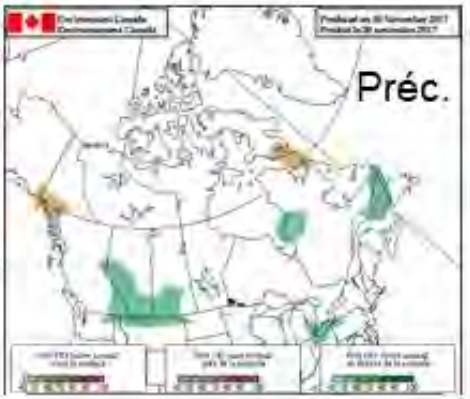


Habileté historique, temp



Habileté historique, préc





Les indices climatiques prévus par le SIPSCan pour DJF17/18:
Nino3.4 = - 1.0 (La Nina modéré)
PDO = - 0.5 (phase faiblement négative)

Qu'est-ce qui influencera le climat la saison prochaine?
Un faible **La Nina** (autour de -0.5°C) est attendu dans le Pacifique équatorial central. Cependant, ECCC prévoit que des conditions modérées de La Nina (-1.0°C) se développeront cet hiver et persisteront au printemps prochain. Selon la prévision à plus longue échéance du International Research Institute (IRI), il y a une probabilité plus grande que 70% que la **condition de La Nina** se prolonge cet hiver, et une probabilité de ~45% qu'elle continue au printemps.
L'indice **PDO** devrait devenir négatif cet hiver, grâce aux eaux froides du Pacifique Nord approchant la côte ouest. Selon les prévisions saisonnières d'ECCC, La Nina aura probablement un impact sur les régions côtières de la C.-B.
Un faible **NAO** est prévu pour DJF17/18, principalement en décembre, après quoi l'habileté à prévoir est faible.
L'indice **PNA** restera probablement positif (jusqu'à la fin du mois de décembre, selon le CPC).

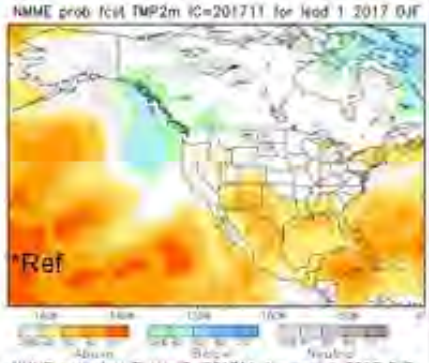
SON17 Obs. Catégories

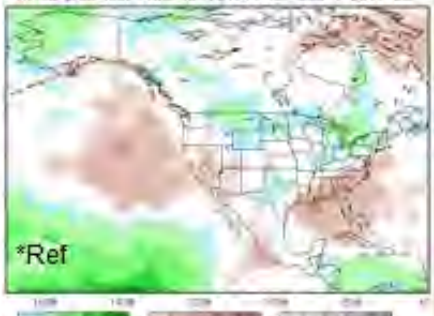
SON17 SIPSCan Catgs.

Vérification de SON17, basé sur 88 jours d'observations
Pourcentage correct, Température: Pour tous les points de grille du modèle au Canada: ~50%. Les valeurs au-dessus de la normale dans les Prairies canadiennes sont responsables de ce score.

Prévisions saisonnières d'autre centre: Température:
Il y a une différence entre SPISCan et les prévisions à long terme du NMME (figure du haut), surtout dans la région des Maritimes, l'est du Canada et les Grands Lacs où NMME prévoit des températures près de la normale et des chances égales pour tous les résultats possibles. Dans les prairies du centre du Canada et sur la côte de la C.-B., les deux système sont en accord et prévoient respectivement des chances égales et des températures sous la normale. La prévision à plus longue échéance du IRI est en accord avec SIPSCan pour la prévision de température cette hiver.

Précipitation: Il y a une différence entre SPISCan et NMME (figure du bas), particulièrement dans l'est du Canada. Pour ces régions le NMME prévoit une probabilité de ~40% de précipitations au-dessus de la normale. Comme pour SPISCan, le NMME et l'IRI prévoient des précipitations au-dessus de la normale sur les grands Lacs et le centre-sud des Prairies.





*Ref: http://www.cpc.ncep.noaa.gov/products/NMME/

In case you missed it...

From CMOS Bulletin Volume 45, Number 5:

Wind-Driven Upwelling and Seawater Chemistry in British Columbia's Shellfish Aquaculture Capital
by Ben Moore-Maley, University of British Columbia

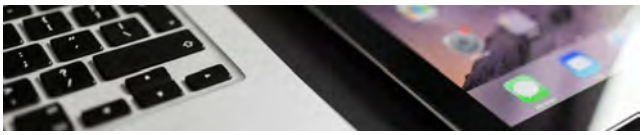
A New Option for at Sea Canadian Ocean Science?
by Donald Reid and Douglas Bancroft, Canadian Scientific Submersible Facility (CSSF)

Adaptation to Global Warming Inevitable, Prepare Now
by John Hollins

Book Review: Convenient Mistruths, A Novel of Intrigue, Danger and Global Warming. A Novel by Geoff Strong.
Review by Edward Lozowski

A Piece of History: The Canadian Chronometric Radiosonde
by Kenneth A. Devine

CMOS Founding Member Dick Morgan Turns 100
by David Nowell, Elizabeth Marshall and Veronica Leonard



Message from the CMOS President: Why has the Bulletin moved to an online format?

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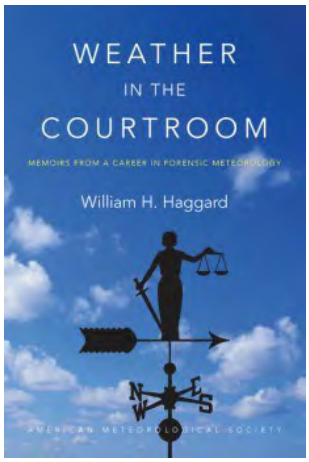
Book Review: Weather in the Courtroom

Weather in the Courtroom

Review by Daryl O'Dowd MSC ACM CO, Consulting Industrial Meteorologist (odowd@weatherdyne.com)



Book by William H. Haggard
Published by the American Meteorological Society
Paperback, 201 pages, ISBN 978-1-940033-95-2, $30.00

For fans of the television series Law and Order, this is the weather book for you. Start with a weather-related crime (or accident), follow it with the gathering of evidence, a jury trial – often with combative lawyers and breath-holding evidence, and then wrap it all up with a verdict. Add in the twist that the gumshoe detective collecting evidence isn't a brash badge-wearing Sergeant Friday, but instead a conscientious details-oriented meteorologist, often helicoptering into the scene months later, sniffing the wind and then tunnelling through tomes of weather data. All together you get a very different take on classic courtroom drama. Here the weather is brought inside and put on the stand.

The 96 year old author – whose meteorological career stretches back to World War Two – picks a wide variety of cases covering his 26 years of practice after retirement from NOAA. To his credit he includes cases that didn't always go his way (or rather the way his client would have preferred). Each chapter deals with an accident or crime associated with a different weather phenomena, starting with the 1972 loss of a light aircraft in Alaska carry two Congressmen – an investigation which brought the author into the business – and then covers everything from fog-induced road accidents to counting the number of tornadoes at a ski lodge (with Ted Fujita's help).

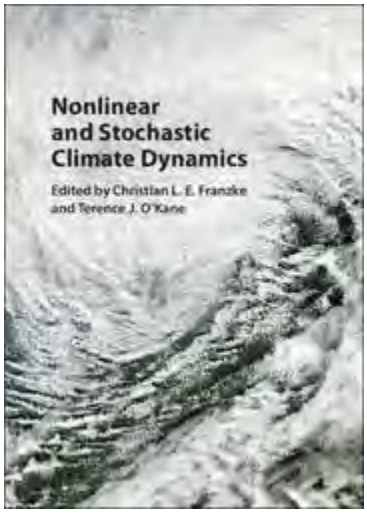
Two especially interesting chapters further help illustrate the scope of the author's practice. Chapter 2 is titled "The Secret Test That Killed" and details biological warfare testing over San Francisco in the 1950's. Chapter 13 is titled "Christmas Overboard" and deals with the loss of 388 shipping containers due to a North Pacific storm that overtook the container ship APL China in 1998, with more than $100 million in lawsuits filed.

On a practical level, forget the idea of reading this as a How To Book on forensic weather. The cases span 1972 – 2001 so the content isn't exactly recent. Further, it's definitely written in the parlance of the US justice system, where general damages (pain and suffering) and punitive damages (a court assigned penalty) can be spectacularly large, and the courtroom environment tense and combative. This is alluded to in the last case in the book – a 2001 murder investigation in North Carolina – where the author describes the defence attorney engaging in "a vigorous attack questioning my credentials…" and later a "belligerent and vigorous cross-examination." Clearly forensic meteorology isn't for shrinking violets.

Overall this professionally written 15 chapter softcover is an easy read for any meteorologist, although the non-expert weather enthusiast might find the humidity of the prose a bit low (quite dry and technical in places). It has an adequate number of author-produced illustrations (somewhat inconveniently grouped in the centre of the book) and the font, layout, use of white space plus reference section are all good.

Nonlinear and Stochastic Climate Dynamics

Review by André April, Canadian Ice Service, Ottawa



Edited by Christian L. E. Franzke and Terence J. O`Kane
Cambridge University Press 2017
Hardcover, 432 pages, ISBN 9781107118140, $177.95

Nonlinear multiscale processes drive the climate system, where memory effects or stochastic forcing interact to shape the behaviour of climate regimes. Prompted by the current difficulties in understanding the climate system and its modelling, this book presents the latest developments and recent issues on the subject of nonlinear stochastic climate dynamics. Around 30 researchers in the fields of mathematics, physics and climate science teamed up to solve the problems and the specific challenges of mathematical geoscience. This book will prove very useful to climate and applied mathematics specialists as it presents the latest development and recent issues in mathematical geoscience. Study applications are listed at the end of each chapter and will at times be of great help in better understanding the chapter material. The book also aptly suggests research orientations and further research ideas in the field of dynamic climatology.

Le système climatique est gouverné par des processus non-linéaires, multi-échelles, où des effets de mémoire ou des forçages stochastiques viennent interagir sur le comportement des régimes climatiques. Motivé par les présentes difficultés à comprendre le système climatique et sa modélisation, ce livre présente les derniers développements et les questions récentes dans le domaine de la dynamique climatique non-linéaire et stochastique. Près de 30 chercheur(e)s des domaines des mathématiques, de la physique et de la science climatique, s'unissent afin de résoudre les problèmes et défis particuliers des géosciences mathématiques. Ce livre permettra aux étudiant(e)s gradué(e)s et chercheur(e)s d'obtenir un large éventail du système climatique physique, ainsi qu'une grande introduction aux méthodes d'analyse et de modélisation pour les scientifiques de la climatologie et les mathématiciens appliqués. Voici un aperçu du contenu des chapitres de ce livre.

Le livre commence avec le chapitre de Crucifix et al. (U catholique de Louvain) en discutant du « comment » la non-linéarité intervient dans la prédiction du climat, particulièrement dans l'évènement de l'Âge glaciaire. L'Âge glaciaire, caractérisé par l'évolution du climat dans le Quaternaire, fait suite partiellement à l'insolation due aux changements d'orbite de la Terre, de la calotte glaciaire, et la dynamique de l'océan et du cycle du carbone. Les interactions de la dynamique lente du climat et les modes de variabilité plus rapides, millénaires et centenaires, sont alors adressés à différents types de modèles. On peut consulter sur ce sujet, les travaux plus près de nous de W.R. Peltier de l'U de Toronto.

Le second chapitre de Ditlevsen (Niels Bohr Institute) introduit la notion de point de bascule (Tipping Points) dans le système climatique, qui est une série de changements abrupts dus à des effets non-linéaires causés par des forçages externes ou des fluctuations stochastiques internes. Le système climatique perd sa stabilité lorsque des paramètres de contrôle (gaz à effet de serre, retournement océanique, balance de masse de la calotte glaciaire, etc.) force une bifurcation. Livina et Lenton (2013) ont tenté d'expliquer la faible superficie de la glace de mer dans l'arctique en 2007 par une bascule du climat, mais les résultats d'une bifurcation semblent incertains. Feldstein (Pennsylvania U) et Franzke (U of Hambourg) nous présentent dans le chapitre suivant les caractéristiques spatiales et temporelles des téléconnections climatiques, incluant leurs histoires et leurs mécanismes physiques. On retrouve au site web du climate prediction center (National Weather Service) les diverses téléconnections discutées dans ce chapitre.

Le chapitre 4 de Straus et al. (George Mason U) analyse les régimes climatiques récurrents tel le NAO au niveau 500 hPa en utilisant un index scalaire et où la fonction de distribution de probabilité résultante est non-gaussienne. Les auteurs étendent la méthode à plusieurs dimensions en utilisant la méthode d'analyse des fonctions empiriques orthogonales (EOF) et la méthode d'analyse de regroupement (cluster). L'auteur spécifie que le régime climatique tel le NAO peut être étudié par différentes méthodes étant donné que ce régime est mieux connu. Il peut cependant s'avérer plus critique pour d'autres régions, puisque les résultats sont probablement dépendants de la méthode. Le chapitre suivant de Nadiga et O'Kane (Los Alamos National Lab.) et (CSIRO Ocean and Atmosphere) nous conduit dans l'étude de la prédictibilité d'un écoulement, à l'aide d'un

modèle de tourbillon barotrope qui permet des régimes de transitions à basses fréquences entre les états zonaux et dipolaires. Il démontre notamment que la prédiction d'ensemble qui utilise les vecteurs breds perturbés (bred vectors) est plus robuste en terme d'écarts d'erreurs que lorsque l'on utilise les vecteurs Lyapunov perturbés (voir aussi Kalnay et al. 'are bred vectors the same as lyapunov vectors?'). On en conclue que le système est plus prédictible en mode zonal (1) et le fait que l'horizon de prédictibilité est trop court pour que l'on puisse prédire ces régimes de transitions (2). L'intérêt de cette étude réside dans le fait que, comme dans l'étude atmosphère océan, le système basse fréquence peut être attribué à l'océan et que l'atmosphère agit comme source de stochasticité, (1) et que l'évolution de structure à petite échelle pourrait jouer également un rôle en initialisant des régimes de transitions pour des structures de plus grande échelle (2). Par la suite on s'intéresse à la théorie de réseau complexe pour étudier la structure statistique des interrelations entre multiples séries temporelles. Ce chapitre fait un résumé des fondations théoriques ainsi que de récentes applications dans le domaine de l'analyse de réseau climatique, fait à l'aide d'une boite à outil python nommée pyunicorn disponible gratuitement par Donges et al. (2005) (Posdam Institute for Climate Impact Research).

Le chapitre 7 de Horenko et al. (U della Svizzera Italiana, Suisse) présente l'inférence (déduction) et la validation des relations de causalité dans les téléconnections du climat. Ces chercheurs ont développé un model multi-échelle d'inférence et de causalité, afin d'extraire les relations bayésiennes les plus significatives entre les données historiques et les séries temporelles de téléconnection, afin de quantifier leur impacts sur les situations synoptiques. Par exemple, il a été possible de démontrer la prédictibilité bayésienne des modes climatiques dans l'hémisphère sud sur l'échelle mensuelle. Le chapitre 8 de Gottwald et al. (U of Sydney), le cœur de ce livre, fait une revue de la théorie stochastique du climat. A l'aide de l'équation dynamique de Mori-Zwanzig contenant un terme Markovien, un terme mémoire et un terme bruit stochastique, on simplifie, et alors il est possible de faire une prédiction d'un régime basse fréquence du climat, en utilisant des données observationnelles. On s'intéresse ici à la théorie et sa dérivation mathématique; les études appliquées sont seulement citées et référencées à la fin du chapitre. Frederiksen et al. (CSIRO, Australia) poursuit avec la modélisation géophysique stochastique sous-grille et la turbulence tridimensionnelle. On développe une paramétérisation pour un LES (large eddy simulation), en tenant compte du drainage de la viscosité et la rétrodiffusion stochastique. On compare la consistance des résultats avec les statistiques d'un DNS (direct numerical simulation). La paramétérisation pourrait être applicable à des processus barocliniques et convectifs.

Le chapitre 10 par Harlim (Pennsylvania State U) fournis différentes perspectives mathématiques sur un aspect important de l'assimilation des données : l'erreur du modèle. Deux types de méthodes sont discutés afin de limiter l'erreur du modèle; la méthode statistique, qui estime les erreurs statistiques de faible ordre et la paramétérisation stochastique, qui estime implicitement toutes les statistiques par l'imposition de modèle stochastique. Ce chapitre a été écrit en espérant une plus grande collaboration entre utilisateurs des modèles et théoriciens. Par la suite, Bunde et Ludesher (U of Giessen, Germany) nous introduisent à la mémoire long terme (LTM) dans le climat. On y apprend que, d'un point de vue statistique, lorsqu'une série temporelle est caractérisée par un LTM, sa fonction d'autocorrélation ne décroit pas exponentiellement, mais plutôt comme une décroissance de type loi de puissance. Au-dessus des océans, la température est caractérisée par un fort LTM, au-dessus des régions côtières par un LTM un peu plus faible, et à l'intérieur des continents un LTM faible. Une application étudiant des températures mensuelles de station dans l'antarctique vient confirmer cette hypothèse. Le chapitre 12 de Watkins (London School of Economics and Political Science, England) fait une synthèse des séries temporelles où la probabilité de distribution augmente pour les grands événements (heavy-tailed), ainsi que les phénomènes où les fluctuations sont lentes et longues dans les systèmes physiques. On fait référence au mode des finances ainsi qu`à l'ouvrage de D. Sornette, Critical Phenomena in Natural Sciences : Chaos, Fractals, Selforganization and Disorder (2004). Par la suite, Ribatet (U de Montpellier) nous introduit à la théorie de la modélisation spatiale des extrêmes en utilisant le processus max-stable qui est une généralisation de la théorie des valeurs univariées extrêmes, appliquée au cas spatial multivarié. Des applications de la cartographie des chutes extrêmes de neige dans les Alpes sont présentées. Pour terminer, Bodai (U Hambourg) fait un sommaire de la théorie des valeurs extrêmes pour des variables aléatoires et d'un système dynamique déterministe. Il démontre que le diagnostic de la modélisation des données de valeurs extrêmes par la distribution généralisée de valeurs extrêmes (GEVD) est nécessaire, mais pas toujours suffisante.

Comme vous pourrez le constater ce livre sera fort utile pour les scientifiques de la climatologie et les mathématiciens appliqués en présentant les derniers développements et les questions récentes des géosciences mathématiques. Les applications de ces études sont citées à la fin de chaque chapitre, et s'avéreront parfois indispensables pour une meilleure compréhension d'un chapitre. On retrouve dans ce livre de bonnes suggestions de recherches et d'approfondissements possibles dans le domaine la climatologie dynamique.

In Memoriam: Dick Morgan

Dick Morgan

July 14th 2917 - December 14th, 2017

MORGAN, Cdr. Maurice Richard 'Dick' - R.N., R.C.N. - It is with great sadness that the family of Maurice “Dick” Morgan announces his passing on Thursday, December 14, 2017 at the Belmont Long Term Care Facility, Belleville at the age of 100.

Dick was a retired Meteorologist & Oceanographer, Ph. D. from Exeter University (at age: 83), Member of the Naval Officers' Association and a Member of the Canadian Meteorological and Oceanographic Society.

Dick’s ashes will be returned home to Cornwall, England, where they will be scattered at sea. Donations in Dick’s memory can be directed to the Heart & Stroke Foundation, Hospice Quinte, or to a charity of choice.

The CMOS Bulletin recently published an article on Dick, as he celebrated his 100th birthday just 5 months ago. That article is reprinted in part here, below, and can be found in full at http://bulletin.cmos.ca/cmos-founding-member-dick-morgan-turns-100/

The full obituary can be found at: http://www.canadianobituaries.com/hastings/80465-cdr-maurice-richard-morgan-december-14-2017.html

CMOS Founding Member Dick Morgan Turns 100

November 10, 2017

By David Nowell, Elizabeth Marshall and Veronica Leonard

A member of CMOS and its predecessor, the Canadian Branch of the Royal Meteorological Society, for over 50 years, CDR/Dr Maurice Richard (Dick) Morgan recently celebrated his 100th birthday. A party to honour the occasion was held the following day at the home of his eldest daughter Liz Marshall in Belleville, Ontario.

Dick Morgan was born on 14 July 1917 at Saltash, Cornwall in the United Kingdom. Following university graduation he was commissioned in the Royal Navy as an Instructor Lieutenant shortly before the start of World War II. At the time of the attack on Pearl Harbour, he was serving in the cruiser HMS Diomede which was then assigned to the West Indies Squadron and operating in the eastern Pacific.

After the war, he qualified as a Royal Navy meteorologist. Subsequent appointments included a 1946-49 posting to the Naval Weather Service Centre in Simonstown, South Africa where he helped organize the whaling fleet in taking weather observations when operating in data sparse areas of the Antarctic. On his return to the UK, he worked for three years on the staff of the Naval Weather Service in London. This was followed by a three year posting as Assistant Director of Meteorology in the newly established NATO SACLANT Headquarters in Norfolk, Virginia with the rank of Commander. He returned to the UK in 1956 and was posted as Officer-in-Charge of the Weather Office at the Abbotsinch Naval Air Station in Scotland.

Continue reading here http://bulletin.cmos.ca/cmos-founding-member-dick-morgan-turns-100/ or refer to CMOS Bulletin Volume 45, Issue 5, page 24.

Pictured here with former CMOS President, Neil Campbell, at the CMOS Annual Congress in Halifax in 2009.

Dick receiving his PhD from the University of Exeter.

Dick with long time friend, colleague and CMOS member, David Nowell and his wife Ann, in July 2017.

Arctic Science Events in Canada and Beyond

Compiled by Helen Joseph, CMOS Arctic SIG and HCJ Consulting

The Arctic is experiencing unprecedented change of its ocean and terrestrial ice, permafrost and ecosystems under the triple pressures of climate change, industrialization and modernization. The impacts of these pressures can be seen on food and energy security, shipping, sovereignty, northern community health and well-being, sustainable development and resource exploitation. All these issues have brought the Arctic to the forefront of national and international agendas.

Circumpolar nations face an increased demand to enhance the observational capacity and understanding of this region to ensure that the best information possible is available to support evidence-based policy and decision-making. Science and knowledge mobilization play a pivotal role in this process.

Building on the success of its previous Annual Scientific Meetings, the ArcticNet Network of Centres of Excellence and its national and international partners welcomed the international Arctic research community to the International Arctic Change 2017 Conference in, Québec, Canada from December 11 – 15, 2017.

With over 1500 participants, the Arctic Change 2017 conference was one of the largest trans-sectoral international Arctic research conferences ever held in Canada. The conference brought together leading Arctic researchers, graduate students, Northern community representatives, government and industry partners and stakeholders from all fields. As in previous years, the CMOS Arctic Special Interest Group assisted ArcticNet in judging the over 150 student marine science posters.

As we move into the coming year, 2018, there will continue to be a global focus on the changes occurring in the global Arctic. Listed below are a few highlighted events in the first six months of 2018 but please refer to the ARCUS website (https://www.arcus.org/events/arctic-calendar) for an up-to-date listing of Arctic science events.

Fifth International Symposium on Arctic Research (ISAR-5)

Tokyo, Japan, January 15 – 18, 2018, http://www.jcar.org/isar-5

This symposium entitled “The Changing Arctic and its Regional to Global Impact: From Information to Knowledge and Action” will be comprised of discussions on environmental changes in the Arctic and their regional and global implications. Additional international scientific collaboration is being sought in this area by gathering, synthesizing, and sharing information related to these changes occurring in the Arctic. Arctic change has impacts on the global climate, as well as ecosystems and human societies in higher-middle latitudes. A better understanding of these processes is needed so that improved information can be given to society and stakeholders, particularly decision makers. Special emphasis will be placed on the fields of the social sciences and humanities, which have not been included in previous ISARs.

The general sessions include the fields of atmosphere; ocean and sea ice; rivers, lakes, permafrost and snow cover; ice sheets, glaciers and ice cores; terrestrial ecosystems; marine ecosystems; geospace; policies and economy; and, social and cultural dimensions.

Arctic Frontiers 2018

Tromso, Norway, January 21 – 26, 2018, http://www.arcticfrontiers.com

In 2018, the Arctic Frontiers Policy program will have five main sessions with the following tentative working titles: State of the Arctic, Technology and connectivity, Resilient Arctic societies and business development, Healthy and productive oceans, Industry and environment. The Arctic Frontiers Science program will address the following topics: Aquaculture in the High North in times of change; the New Arctic in the Global Context; Resilient Arctic Societies and Industrial Development; and Circumpolar Safety, Search and Rescue Collaboration.

Northern Lights 2018

Ottawa, Canada, January 28 – February 3, 2018, https://www.northernlights.events/

Northern Lights is a biannual event that was created to showcase Canada’s unique northern arts, culture and heritage, and strengthen partnerships between Canada’s northern and southern key businesses and government stakeholders.

CMOS Congress

Halifax, Canada, June 10 – 14, 2018, http://congress.cmos.ca/

The CMOS Arctic Special Interest Group is working with the 2018 Scientific Program Committee to ensure that Arctic science is profiled at the Congress, including scientific sessions on the Year of Polar Prediction and The Changing Arctic from the Perspective of its Oceanography, Meteorology, Interdisciplinary Studies and Policy Implications.

POLAR 2018 – A joint SCAR, ISAC and ASSW conference

Davos, Switzerland, June 15 – 26, 2018, http://www.polar2018.org

POLAR 2018 is a joint event from the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC). The SCAR meetings, the Arctic Science Summit Week and the Open Science Conference (OSC) will take place in Switzerland.

The goal of POLAR 2018 is to bring together excellent research from both poles, as well as from high altitude areas, focusing on the similar challenges those regions face. The program features 65 different sessions, structured into 12 categories. In addition to the parallel sessions, central elements of the OSC will be keynote presentations, mini-symposia, extended poster sessions, and exhibitions. The annual COMNAP symposium will be held during the OSC, as well as a plenary lecture from the 2018 Arctic Observing Summit as an opening to this biennial summit immediately after the OSC.

Arctic Observing Summit 2018

Davos, Switzerland, June 24-26, 2018, http://www.arcticobservingsummit.org/aos-2018

The Arctic Observing Summit (AOS) is a high-level biennial summit that provides a platform to address urgent and broadly recognized needs of Arctic observing across all components of the Arctic system. AOS 2018 will focus on pressing issues in the implementation and support of sustained observations that can be addressed through a business-case lens. To that end, short submissions are requested that address any and all aspects of the overarching theme and sub-themes.

ArcticNet Annual Science Meeting

Ottawa, Canada, December 10 – 14, 2018, http://www.arcticnet.ulaval.ca/

Details will be forthcoming over the coming months.

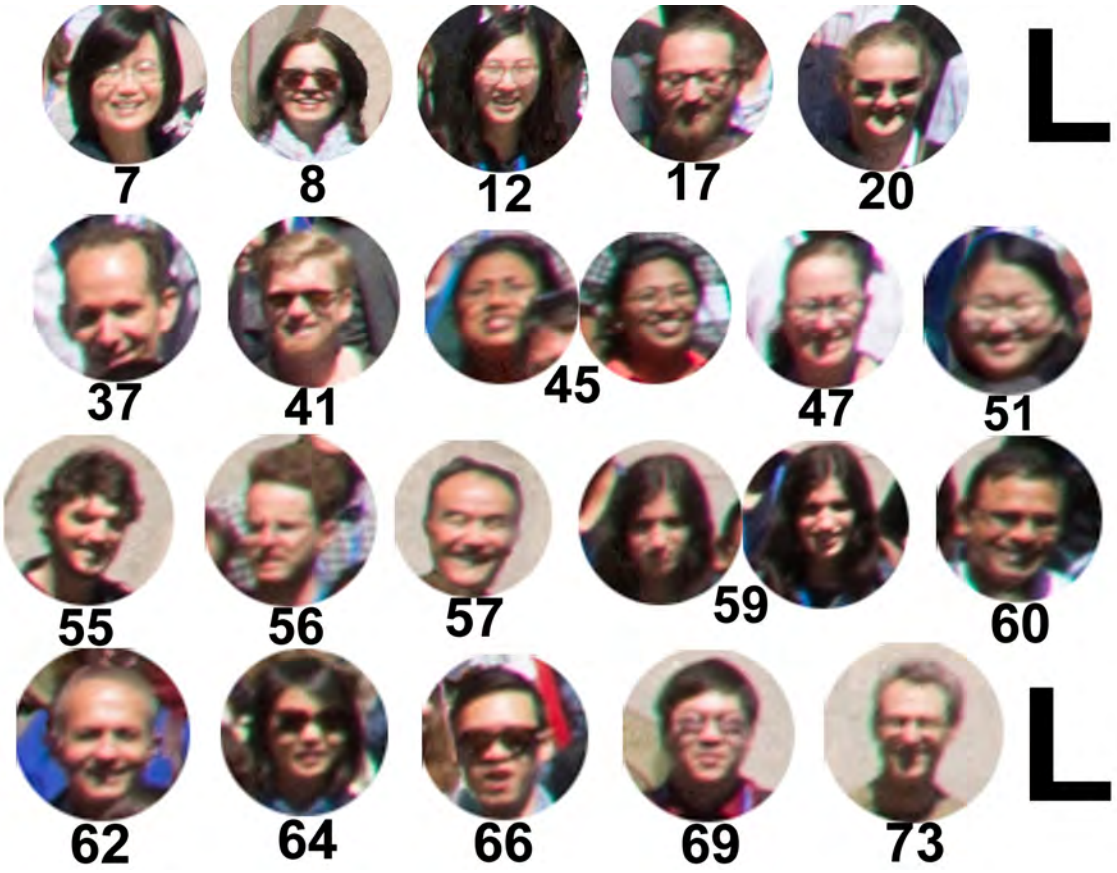
CMOS News: Congress Photo Group ID'ing

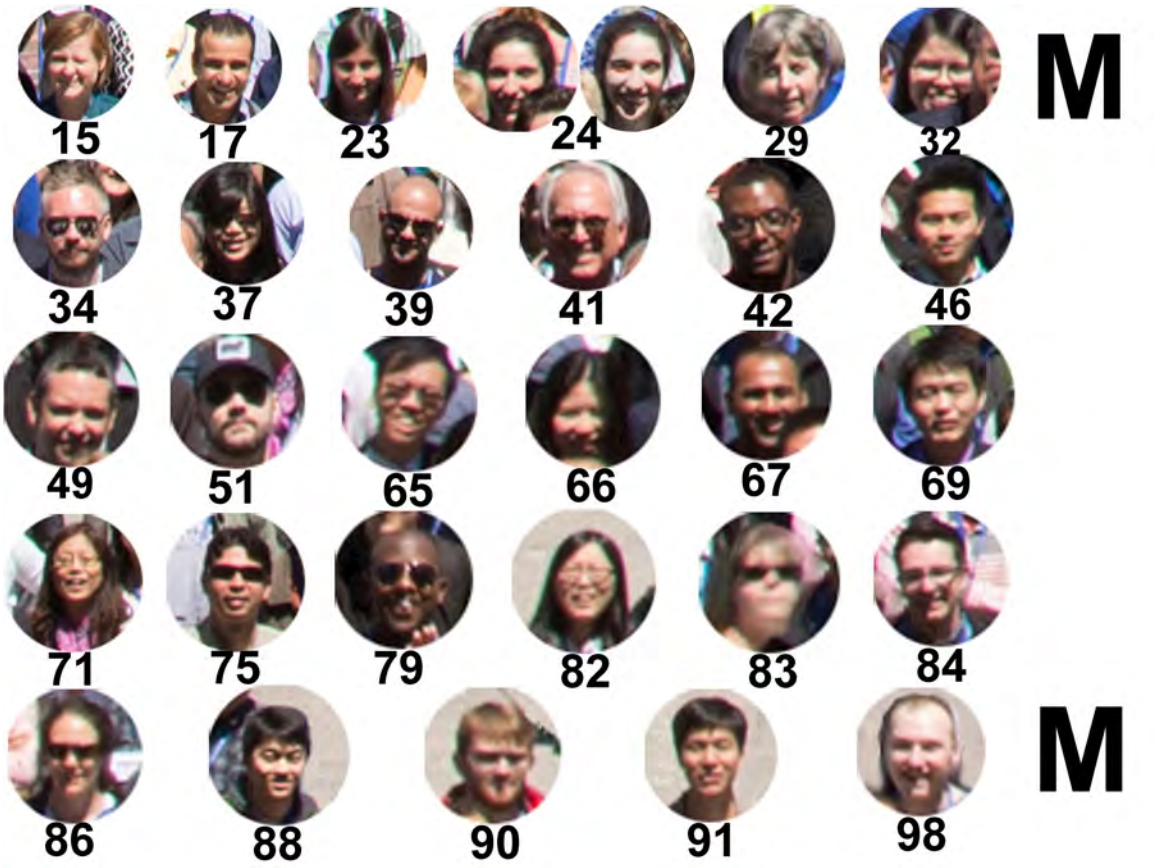
If you attended the 2016 CMOS Congress in Toronto, then you likely were corralled in to Nathan Phillips Square for the group photo. Since then, CMOS archivist Bob Jones has been working hard to identify all of the 245 faces in the photograph, and he is nearly there.

But now, he needs your help!

There are still 62 people who have yet to be identified. Please have a look at the photo below, and the two on the following page, and if you spot a face you know contact Bob. Thank you!

jonesb@ncf.ca

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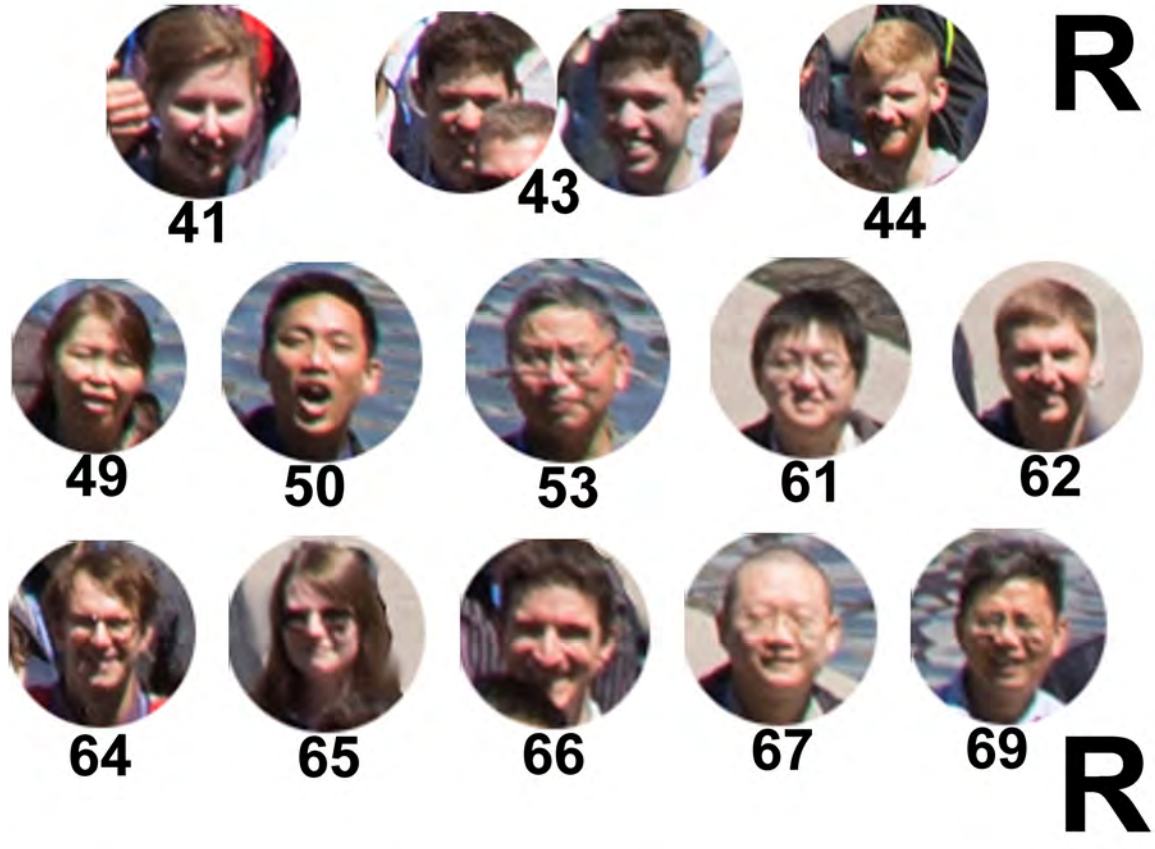
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It's time again for nominations for the CMOS annual awards

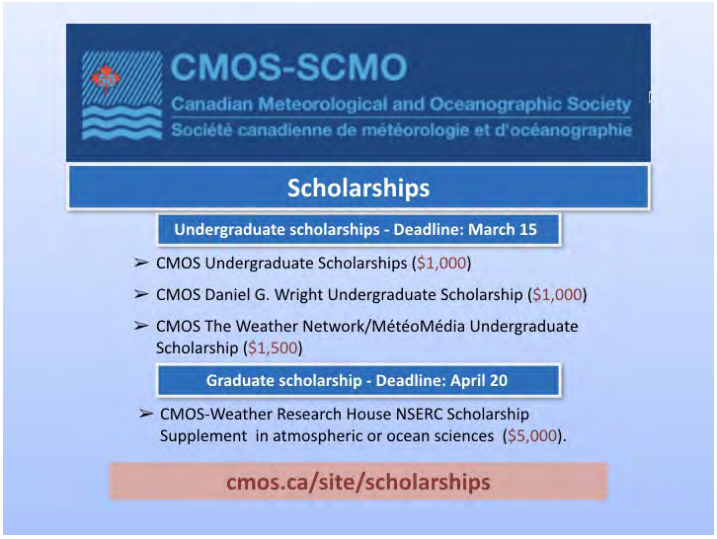
Each year, the Society recognizes significant achievements with prestigious awards and prizes. This tradition started with three prizes during the inaugural Congress of the Society in 1967. Today, there are eight awards, highlighting everything from recent research to life-time achievements. Four awards are restricted to Members of the Society. However, the other four awards are open to members and non-members alike.

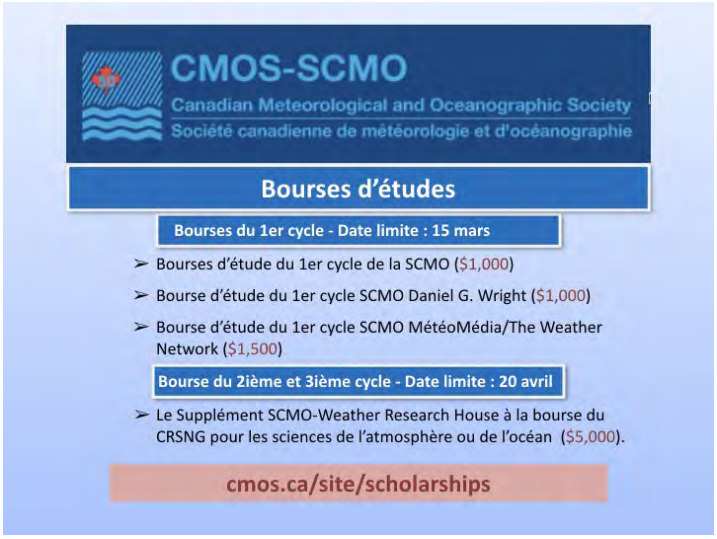
However, the Selection Committee can only work on the basis of nominations submitted. The Committee does not nominate anyone. That is where you, the reader, become important. Please take a moment to think of your colleagues because, as the Awards Co-ordinator, Denis Bourque notes: "regrettably, there are many deserving persons who go unrecognised because we are too busy to prepare a nomination."

The deadline for nominations for the eight awards is February 15. Please take a moment to visit http://www.cmos.ca/site/awards for a list and description of the eight awards, and for instructions on how to make a nomination. A list of past recipients can be found at http://cmosarchives.ca/pastaw.html .

Any inquiries and all nominations are to be forwarded to the CMOS Awards Coordinator, Denis Bourque, at awards-coord@cmos.ca .

Paul-André Bolduc (left) receiving the 2016 Neil J. Campbell Medal for Exceptional Volunteer Service for President Martin Taillefer during the Toronto Congress (June 2017).





Other CMOS News

Books in search of a Reviewer*:

(2016-2) *Heliophysics: Active Stars, their Astrospheres, and Impacts on Planetary Environments*, 2016. Edited by Carolus J. Schrijver, Frances Bagenal, and Jan J. Sojka, Cambridge University Press, ISBN 978-1-107-09047-7, Hardback, 406 pages, $68.95

(2017-3) *Eustasy, High-Frequency Sea-Level Cycles and Habitat Heterogeneity*, 2017. By Mu Ramkumar and David Menier, Elsevier Inc, ISBN 978-0-12-812720-9, Paperback, 102 pages, $60 US

(2017-4) *Minding the Weather: How Expert Forecasters Think*, 2017. By Robert R. Hoffman, Daphne S. LaDue, H. Michael Mogil, Paul J. Roebber, and Gregory Trafton, The MIT Press, ISBN 978-0-262-03606-1, Hardcover, 469 pages, $66.69

(2017-5) *Risk Modelling for Hazards and Disasters*, 2017. By Gero Michel, Elsevier, ISBN 9780128040713, paperback, 338 pages, US$100.00

(2017-6) *Introduction to Satellite Remote Sensing; Atmosphere, Ocean and Land Applications*, 2017. By William Emery and Adriano Camps, Elsevier, ISBN 9780128092545, 860 pages, US$130.00

(2017-7) *Remote Sensing of Aerosols, Clouds and Precipitation*, 2017. By Tanvir Islam, Yongxiang Hu, Alexander Kokhanovsky and Jun Wang, Elsevier, ISBN 9780128104378, 364 pages, US$120.00

(2017-8) *Mixed-Phase Clouds: Observations and Modeling*, 2017. By Constantin Andronache, Elsevier, ISBN 9780128105498, 300 pages, US$89.95

You review it, yours to keep!

A 2017 update of the World Meteorological Organization (WMO) publication WMO-No.574 'Sea Ice Information Services in the World' has now been released.

The World Meteorological Organization (WMO) publication 'Sea Ice Information Services in the World' (WMO-No.574) is intended to provide to mariners and other users information on best practices in sea-ice services available world-wide and by this is formally extending the two WMO publications No.9, Volume D – Information for Shipping and No.558 – Manual on Marine Meteorological Services (WMO-No. 558).

The 2017 update of this comprehensive document has now been released by the Joint World Meteorological Organization/Intergovernmental Oceanographic Commission Technical Commission for Oceanography and Marine Meteorology (WMO-IOC JCOMM) Expert Team on Sea Ice (ETSI). The document reflects new types of sea ice and icebergs information, forms of collaboration and delivery of the products through August 2017. Areas that have seen substantial progress over the last seven years are the complementation of classical ice services by sea-ice forecasts based on numerical models and Southern Ocean sea ice and icebergs analysis, which are reflected by corresponding additions to the document by numerous ice services. The document greatly facilitates getting an overview on current sea-ice services - just in time for the Year of Polar Prediction (YOPP) research community which is currently ramping up concerted efforts to improve our capabilities to forecast weather, climate, and sea ice in the polar regions.

The document and future updates can be obtained from 'WMO-IOC JCOMM Sea-Ice Regulatory Documents', subsection 'Sea-Ice Information Services in the World' - http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=9607. Additional requests on JCOMM sea-ice regulatory material may be also forwarded to ETSI chair Dr Vasily Smolyanitsky (vms(at)aari.aq).

DATA, MODELS AND ANALYSIS

The Highest Impact Articles in *Atmosphere-Ocean*

CMOS SCMO

Edited by

GUOQI HAN, HAI LIN and DOUW STEYN

ROUTLEDGE

Council / Conseil d'administration

CMOS Bulletin SCMO @ bulletin.cmos.ca

The CMOS Bulletin has moved on-line to http://bulletin.cmos.ca. Please continue to send articles, notes, workshop reports and news items to bulletin@cmos.ca. We will be accepting, reviewing, and publishing content on an on-going basis.

CMOS Bulletin SCMO @ bulletin.scmo.ca

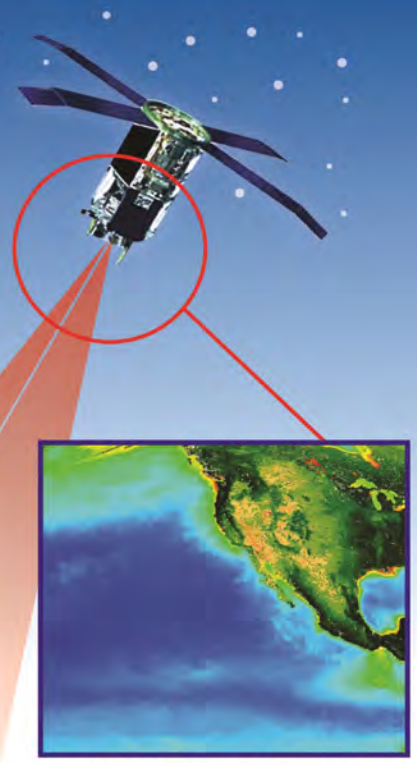
Le *Bulletin de la SCMO* se trouve maintenant en ligne à http://bulletin.scmo.ca/. N'hésitez pas à soumettre notes, rapports d'atelier et nouvelles à l'adresse bulletin@scmo.ca. Nous accepterons, réviserons et publierons vos contenus sur une base continue.

Thank you to Bob Jones and Paul-André Bolduc, for their continued editorial assistance and guidance.

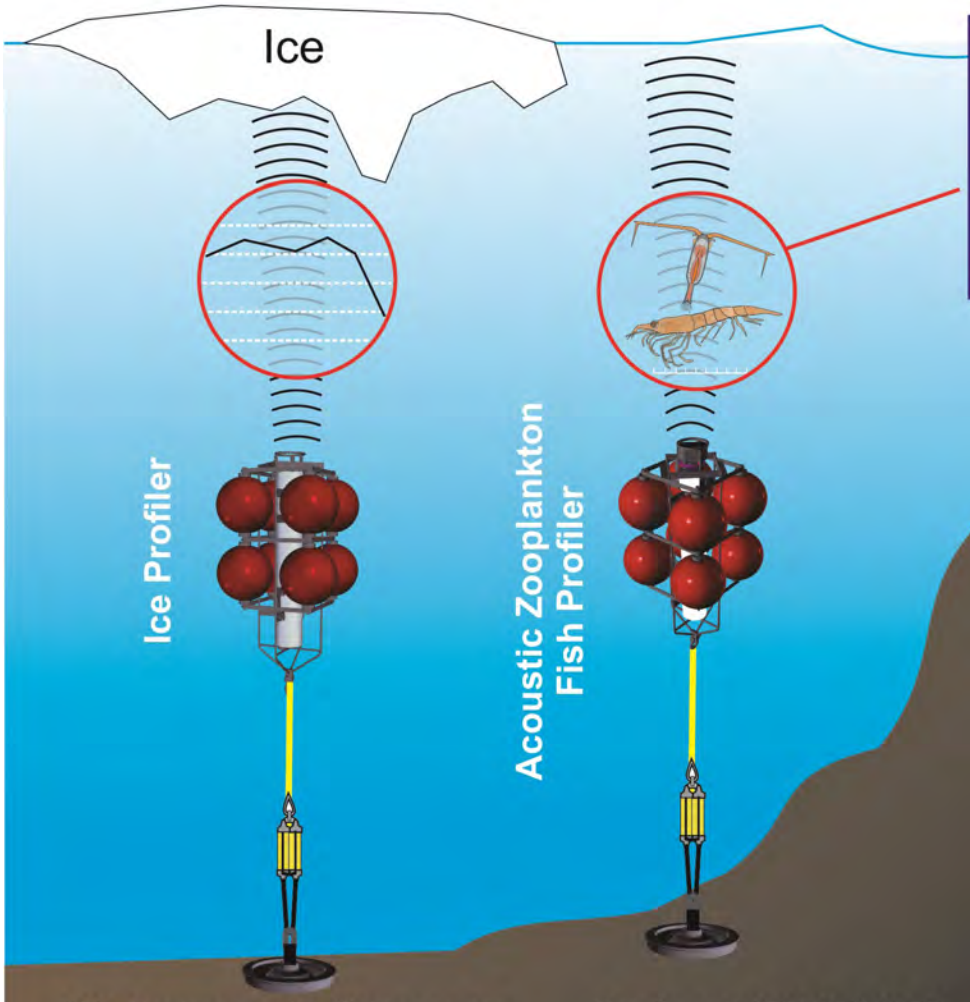
ASL Environmental Sciences

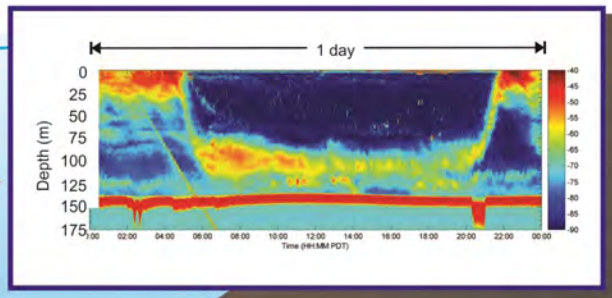
40 YEARS
1977-2017

Oceanographic specialists/
Spécialistes océanographiques



Ocean colours are chlorophyll concentrations and land colours are NDVI





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website: www.aslenv.com