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CMOS

BULLETIN

SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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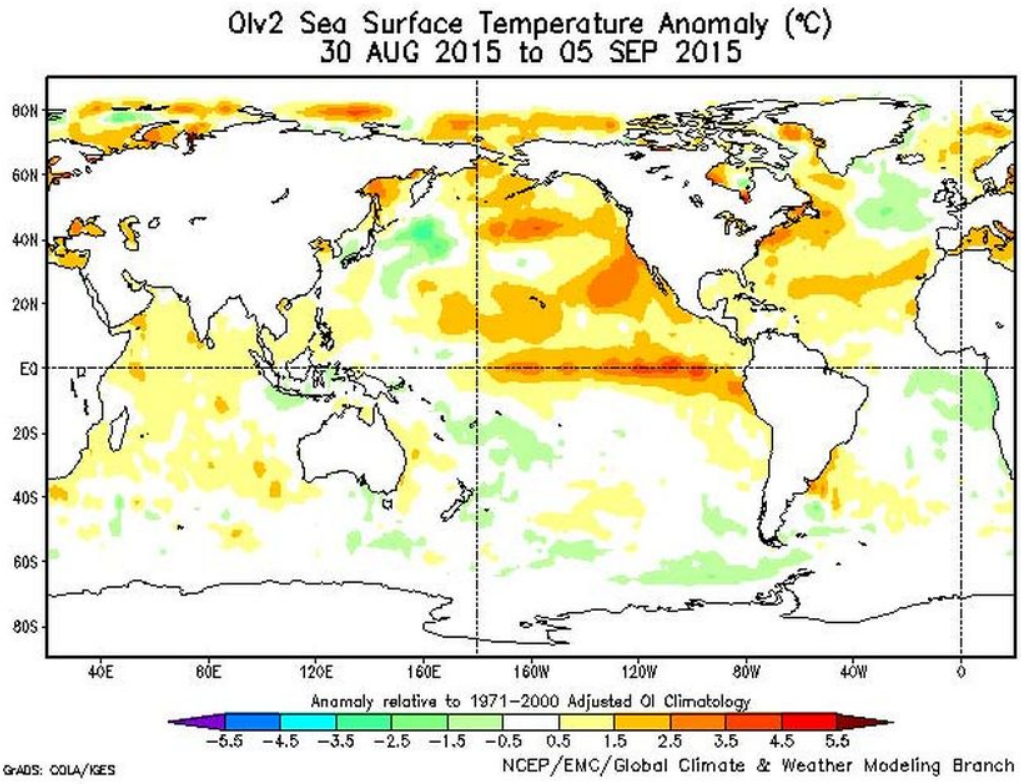
Global Sea Surface Temperature Anomaly during 30 August - 5 September 2015



Anomalies de température de la mer en surface, du 30 août au 5 septembre 2015

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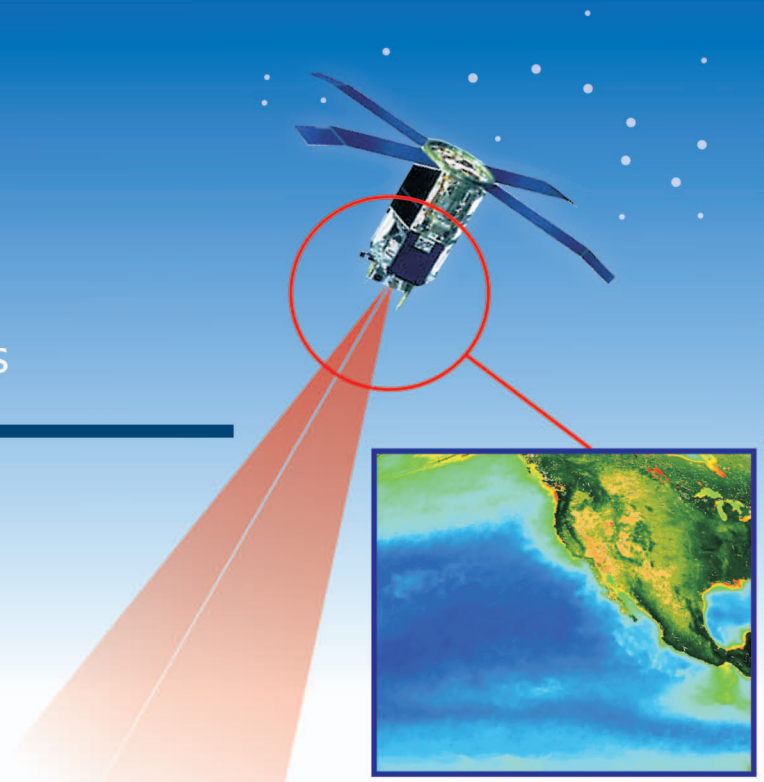
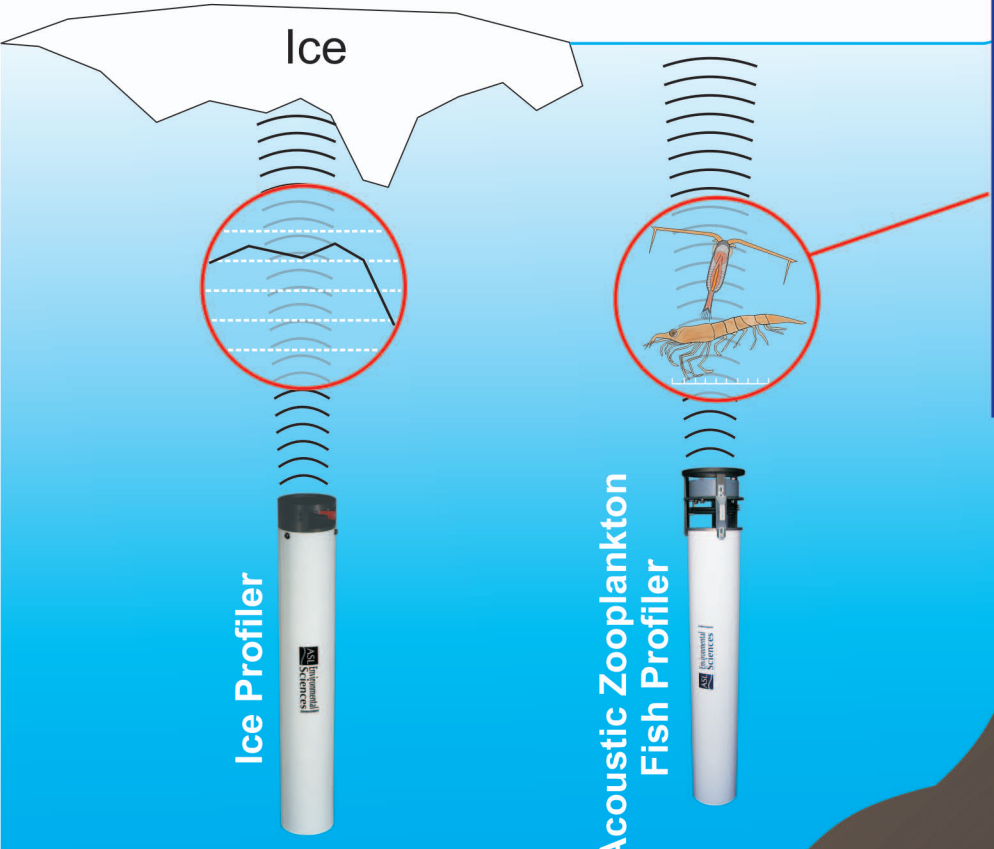
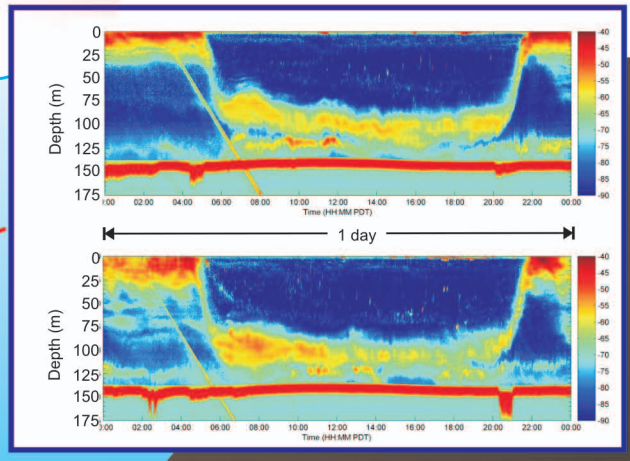


Ocean colours are chlorophyll concentrations and land colours are NDVI





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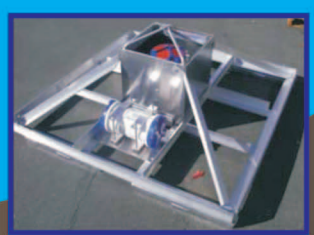

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.... Words from the President

Friends and Colleagues:

Martha Anderson
CMOS President
Présidente de la SCMO

We are very excited that CMOS has a new association with the *Canadian Weather Trivia Calendar*, which has been a popular item for many years. **David Phillips** compiles the calendar on his own time, and he is offering the royalties of the 2016 edition to CMOS. We are extremely grateful for this generous offer that will bring financial benefit to CMOS, and also for the widespread recognition it will bring to CMOS. The annual sales are over 15 thousand copies per year, and the back cover will carry the CMOS logo. We hope this is the beginning of a long term relationship.

At the national CMOS office we have recently experienced a major change, with the departure of the Executive Director **Dr. Andrew Bell**. The CMOS Council members, congress organizers, and the office staff will greatly miss his guidance and dedication to our society. On behalf of our CMOS community, I want to publicly thank Andrew for the two years he has spent with us. At time of writing, his replacement has not been named.

Another departure to acknowledge is **Sheila Bourque** stepping down from being our national Director, Education and Outreach. Sheila has vast knowledge and experience in these areas and her involvement will certainly be missed. Her duties coordinating the Project Maury and Project Atmosphere participation by Canadian school teachers who travel to the US for teacher summer workshops have been passed to **Denis Bourque**, the CMOS Awards Coordinator. The newly reinvigorated School and Public Education Committee will also help fill the gaps left by Sheila's departure.

[Continued on page 154]

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.

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Inside / En Bref

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

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Cover page: The Global Sea Surface Temperature Anomaly map (30 August - 5 September 2015) illustrated on cover page clearly shows the warming of the equatorial Pacific region, indicating the return of El Niño. To learn more, please read William Hsieh's article on **page 161.** Image courtesy of National Oceanic and Atmospheric Administration (NOAA) / National Centres for Environmental Prediction website.

Page couverture: En page couverture, la carte mondiale des anomalies de température de la mer en surface (du 30 août au 5 septembre 2015) montre sans équivoque le réchauffement du Pacifique équatorial, indiquant le retour d'El Niño. Pour en connaître plus, prière de lire l'article de William Hsieh en **page 161**. Image reproduite à partir du site web des "National Centres for Environmental Prediction" de la "National Oceanic and Atmospheric Administration" (NOAA).

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

The Arctic continues to receive attention. Polar Knowledge Canada was established as a new federal agency on June 1, 2015. The government's goal is to provide a pan-northern Science and Technology (S&T) program. Also, planning is underway for the Year of Polar Prediction (YOPP), which is one of the key elements of the Polar Prediction Project of the World Meteorological Organization (WMO). YOPP is scheduled to take place from mid-2017 to mid-2019, centred on the year 2018. For our members with an interest in the Arctic, you can join the Arctic Special Interest Group (SIG) of CMOS, who are planning future events and have regular newsletters.

As you read this, the 2015 Paris Climate Conference (COP21) will be increasingly discussed in the media and set to begin in late November. CMOS has a recent policy statement on climate change on our website under `Activities`. We encourage our members to make themselves available to the media to share their scientific expertise on this topic as the public discourse on climate change heats up.

I welcome your ideas and concerns about CMOS, and I appreciate the efforts of all our volunteers. As you each plan your fall and winter activities, please consider if you have time to organize a local CMOS event, or contribute an article to the *Bulletin*. These individual contributions combine to give us a vibrant and interesting CMOS community.

Martha Anderson, CMOS President

.... Allocution de la présidente

Chers amis et collègues,

Nous sommes heureux d'annoncer notre nouvelle association avec l'*Almanach météorologique du Canada*, un calendrier jouissant d'une grande popularité depuis des années. David Phillips compile bénévolement les données de l'almanach et il offrira les redevances de l'édition 2016 à la SCMO. Nous lui sommes extrêmement reconnaissants de cette offre généreuse. La Société profitera ainsi d'un gain financier et d'une visibilité accrue. Les ventes annuelles s'élèvent à plus de quinze mille exemplaires, de plus le logo de la SCMO figurera au dos du calendrier. Nous espérons qu'il s'agit là du début d'une longue association.

Le bureau national de la SCMO a dû composer avec un événement majeur, le départ du directeur général Andrew Bell. Son dévouement envers la Société et ses conseils judicieux manqueront aux membres du conseil d'administration, aux organisateurs des congrès et aux employés du bureau. Au nom de tous les membres de la SCMO, je remercie publiquement Andrew Bell d'avoir travaillé avec nous pendant ces deux années. Au moment d'écrire ces lignes, nous n'avons pas encore désigné son successeur.

Autre départ à considérer, Sheila Bourque n'occupera plus le poste de directrice nationale pour l'éducation et la sensibilisation. Sheila possède une grande connaissance et une grande expérience de ces domaines, sa contribution nous manquera considérablement. Denis Bourque, le coordonnateur des récompenses, se chargera de coordonner la participation d'enseignants canadiens qui suivent, dans le cadre des projets Maury et Atmosphère, des ateliers estivaux de formation aux États-Unis. L'aide du comité d'éducation publique et scolaire, nouvellement remis sur pied, permettra de combler les lacunes qu'engendre le départ de Sheila.

L'Arctique continue de susciter l'attention. Savoir polaire Canada, une nouvelle agence fédérale, a été créée le 1er juin 2015. L'objectif du gouvernement est d'établir un programme de sciences et technologies couvrant tout le Nord. En outre, la planification de l'Année de prédiction polaire (YOPP) va bon train. Elle représente l'un des principaux éléments du projet de prévision polaire relevant de l'Organisation météorologique mondiale (OMM). Centrées sur 2018, les activités de l'Année de prédiction polaire s'étendront néanmoins de mi-2017 à mi-2019. Les membres s'intéressant à l'Arctique peuvent se joindre au groupe d'intérêts spéciaux pour l'Arctique de la SCMO. Ce groupe organise des événements et publie régulièrement un bulletin de nouvelles.

De plus en plus citée dans les médias, la Conférence des parties sur les changements climatiques de 2015 (COP21) se tiendra à Paris à la fin de novembre. Vous trouverez la plus récente prise de position de la SCMO sur les changements climatiques sur notre site Web sous l'onglet « Activités ». Nous encourageons les membres à répondre aux demandes d'information des médias, afin de partager leur expertise scientifique sur ce sujet, à mesure que les débats publics sur les changements climatiques s'animeront.

Je suis reconnaissante des efforts que déploient nos bénévoles. En outre, n'hésitez pas à me communiquer vos idées et vos préoccupations à propos de la SCMO. Tandis que vous planifiez vos activités automnales et hivernales, pourquoi ne pas inclure l'organisation d'un événement local de la SCMO ou la rédaction d'un article pour le *Bulletin*? Ces contributions individuelles s'allient pour faire de la SCMO une communauté dynamique et engageante.

Martha Anderson, Présidente de la SCMO

Executive Director CMOS

CMOS/SCMO seeks applicants for the position of Executive Director.

Responsibilities

Provision of strategic advice and recommendation to the CMOS council on the achievement of the goals of the society, on its governance, its programs, and its operations.

Foster good relationships with related scientific societies within Canada and with other national meteorological and oceanographic societies.

Representing CMOS as a member of umbrella organizations such as the Partnership Group for Science and Engineering (PAGSE) and Canadian Consortium for Research (CCR).

Fostering public visibility of CMOS and its programs through the issuance of position statements, open letters to public officials, news releases, publicity brochures, participation in meetings with public officials etc.

Supervising the national office and support staff for national programs including membership, committees, publications, the annual congresses, education and outreach, prizes and awards, scholarships, certification, maintaining records of the society's operations and all the general business and financial affairs.

Acting as signing authority on behalf of society for contracts, grants, and agreements and for reporting on the same.

Required Competencies

- Dedication to the goals of CMOS and its success as an organization.
- Leadership and communication skills.
- General knowledge of science and scientific societies.
- Ability to formulate objectives, strategies, and action plans and to motivate others.
- Ability to self - motivate and work independently.
- Fluency in English.
- Understanding of financial analysis, planning, budgeting, and reporting.

Assets

- A person willing to work in the Ottawa office for two days per week.
- It is preferred that the candidate have skills in the use of HTML code and the J-Query command set to aid with management of the society database, website, and organisation of the society's annual congress.
- Familiarity with standard office software tools.
- Being bilingual is viewed as being a significant advantage.
- Understanding of not-for-profit / charity organizations.

Remuneration

This is a part time position requiring on average two days per week physical presence in CMOS offices in Ottawa. It is a one-year renewable contract without benefits. The Executive Director is expected to function as an independent consultant not as an employee. Compensation to be negotiated.

Please apply via e-mail to council@cmos.ca

Articles

The Data Utilization and Applications Plan for the RADARSAT Constellation Mission[1]

by William Perrie[2]

Following the success of the RADARSAT-1 & 2 missions , the Canadian Space Agency's RADARSAT Constellation Mission (RCM), planned for 2018, has objectives to provide greatly improved operational capability, and to add new applications. With three satellites, RCM will provide more frequent observations of Canada's territory and waters day and night under any weather conditions in support of national sovereignty and security, environmental monitoring, natural resources management, and other government priorities. With daily coverage and fast revisit capability, RCM will significantly increase synthetic aperture radar (SAR) data acquisition, compared to current RADARSAT utilization by government departments. The Data Utilization and Applications Plan (DUAP) is the framework to provide technical and financial assistance to federal departments in preparation for the new anticipated RCM capabilities. RADARSAT-1 gave 5000 images/year with data access via CDs, RADARSAT-2 gives 30,000 images/year, and RCM is expected to give possibly 300,000 images/year.

One focus of DUAP is the project "Winds from SAR RCM Readiness Proposal" led by Environment Canada (EC), with Department of Fisheries and Oceans (DFO) providing R & D support. The objective of this project is to *transition* the operational "National SAR Winds (NSW) Program" from RADARSAT-2 to RCM, to *integrate* the new capabilities offered by RCM, involving new radar beam modes, and higher geospatial coverage, and put new established wind speed algorithms into EC's operational production system. DFO is a supporting partner to this initiative, working with EC to *transitioning* DFO SAR-wind methodologies and models to the anticipated RCM data stream, *integrating* new RCM beam mode capabilities, and *optimizing* and *formatting* our SAR models, so that they can be specifically *implemented* within EC's NSW program.

For RADARSAT-2, recent studies show that the cross polarization synthetic aperture radar (SAR) data have promising ability for wind field monitoring, particularly for high-wind-speeds such as occur in hurricanes (Zhang and Perrie, 2012). The quad-polarization data allows a tremendous simplification in the wind retrieval model. For example, Figure 1a shows the family of curves that represent the normalized radar cross section (NRCS) as a function of wind speed from the *single – polarization data*. Not only are these curves a function of incidence angles, but they also saturate as winds reach about 30 m/s or so – that is they flatten out; for higher winds, NRCS starts to decrease, becoming double valued.

Moreover, Figure 1b shows the results for the cross-polarization data (HV); the relation is not only essentially independent of incidence angle, but it is almost linear. Thus, the retrieval model to get wind speed from NRCS; this is a simple linear relation to invert. And it does not appear to 'saturate' – that is, it does not appear to flatten out, or become double valued, for high winds.
More details are presented by Zhang and Perrie (2012). There, as a test of our wind retrieval model, we show images from hurricane Earl (2010). Not only do we present a better representation of the overall wind field for Earl, but we verify that our wind retrieval method is better than the CMOD5.N model, in comparisons with high resolution aircraft data collected by stepped-frequency microwave radar (SFMR).

Moreover, analysis of the symmetry characteristics of the co- and cross- polarization channels respect to the wind direction, in comparison to NRCS for quad-polarization SAR images, allows determination of wind directions. Thus, fully polarimetric SAR measurements can provide high resolution vector ocean surface wind fields. An example is given in Figure 2.

Motivated by these results dual-polarization (dual-pol) geophysical model functions (GMFs) were established by Shen *et al*. (2013). Similar to the quad-polarization results of Zhang and Perrie (2012), the results of Shen *et al*. (2013) are important because of their simplicity, and the ease with which winds can be inverted; they are simple functional relationships.

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[1] First published in *Canadian Ocean Science Newsletter*, No.83, July 2015; reproduced here with the authorization of the editor and author.

[2] Bedford Institute of Oceanography, Department of Fisheries and Oceans, Dartmouth, NS

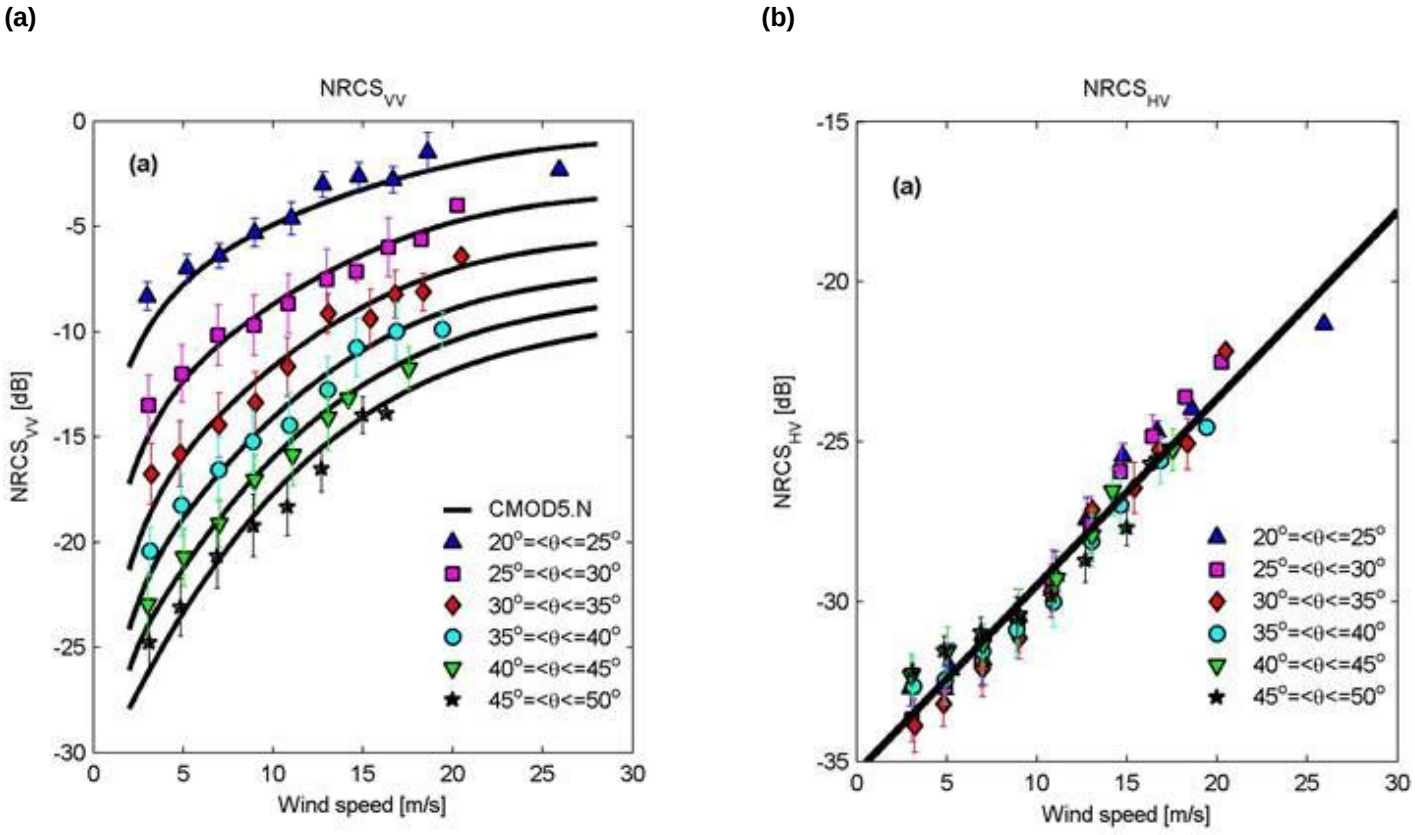

Figure 1. NRCS versus wind speed, for six 5° incidence angle bins between 20° and 50° for HH polarizations, as indicated. The black lines represent the CMOD5.N model for relating NRCS to wind speed, which is the previous state-of-the-art model for retrievals of wind speeds. Figure 1b is for HV polarization, and the black line is a linear fit with correlation coefficient 0.97. From Zhang *et al*. (2011).

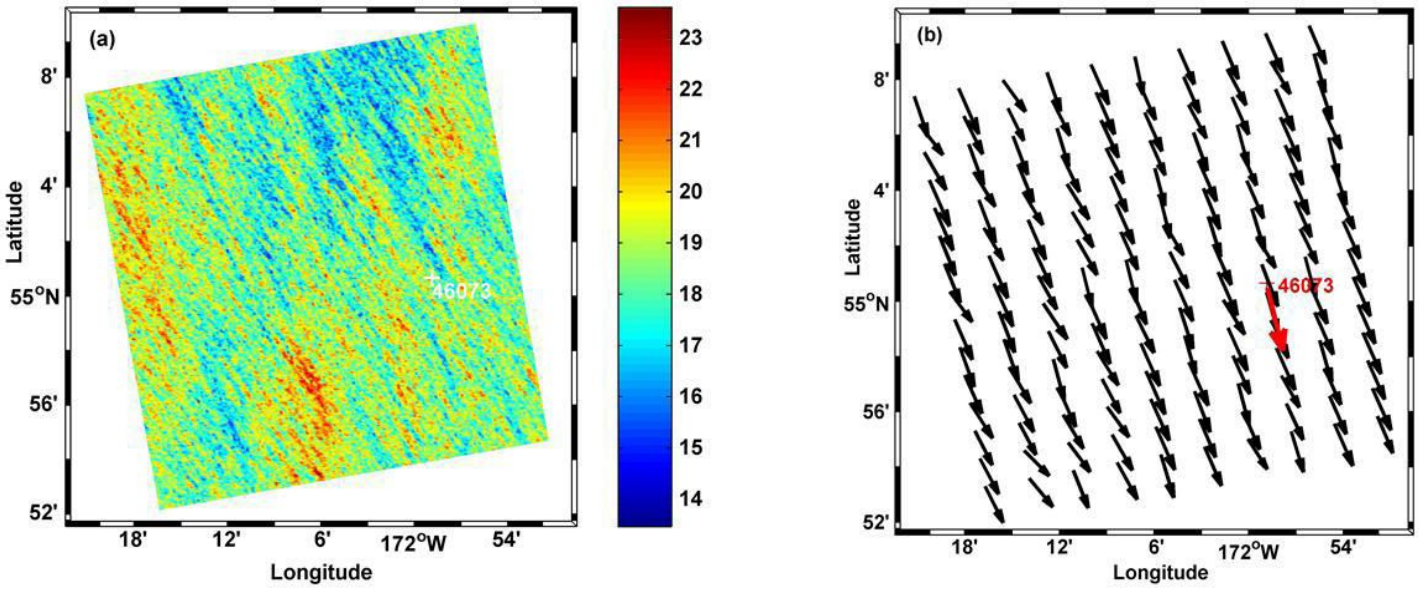

Figure 2. SAR-retrieved wind speeds from a VH-polarized SAR image without any external wind direction or radar incidence angle inputs, and (b) SAR-retrieved wind directions without ambiguities. From Zhang *et al.* (2012).

In the DUAP project on marine winds with EC, "Winds from SAR RCM Readiness Proposal", DFO will first need to address the difference between dual-pol, quad-pol radar returns with respect to wind speed, and the necessity and methodology to *transition* present GMFs to new class of GMFs for new beam modes such as Compact Polarimetric (CP) images, available for RCM, for remote sensing of mesoscale wind processes, including severe storms such as hurricanes. This activity will involve an *evaluation* of new radar beam mode capabilities available from RCM.

Moreover, for compact polarized data, RCM enables three satellites working together, which means that the traditional SAR technical issue related to knowing wind directions *a priori*, before wind speed can be retrieved, could possibly be immediately solved. The new algorithm and SAR-wind model is to be deployed to retrieve wind vectors from RCM SAR directly.

A successful algorithm for wind retrieval, for RCM SAR, should have characteristics such as: *optimized* for efficient application, and *monotonic* increasing dependence on wind speed. We hope scatter will not be a problem, particularly for high winds. Signal *saturation* can also be a problem; for quad-pol and dual-pol imagery, GMF formulations for high-wind-speed retrievals, for SAR imagery, for hurricanes, have not exhibited notable signal saturation or the speed ambiguity problems. These results are important for the potential future application of RCM SAR images for implementation of routine operational wind retrievals, in EC's NSW program.

References:

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El Niño is back!

by William W. Hsieh[1]

For researchers interested in the El Niño phenomenon, the world was very exciting in 1997-98, when the biggest warm episode in a century hit. Since then, life has been rather uneventful until 2015, when once again the big one arrived. Figure 1 shows the the equatorial Pacific monthly sea surface temperature (SST) anomaly (from National Centers for Environmental Prediction [NCEP], National Oceanic and Atmospheric Administration [NOAA]) in the Niño 3.4 region (5°N-5°S and 120°W-170°W) for 2015 and for 1997-98. The warming in 2015 started earlier than in 1997, thanks to an aborted El Niño in 2014.

Around May-June 2014, a major El Niño arriving in 2014 was widely heralded in the news media: e.g.

https://www.newscientist.com/article/mg22229682-400-world-is-unprepared-for-major-le-nino-later-this-year/

and

http://www.theguardian.com/environment/2014/jun/11/-sp-le-nino-weather-2014

The SST did rise for a while in 2014, then stopped increasing, hence 2015 started somewhat warm in the Niño 3.4 region. The SST anomaly finally took off in spring 2015, and in August 2015, the Niño 3.4 SST anomaly was 2.06°C, marginally above the August 1997 value (Fig.1).

Regardless of how the current El Niño will evolve -- even if it does not reach the peak value of 2.69°C attained in Dec.1997 -- it will be a major El Niño. It will also be in time to influence Canada's climate during the winter of 2015-16 via atmospheric teleconnection. During the winter of an El Niño, the air temperature tends to be warm over most of Canada, with the greatest warming centred around Manitoba-western Ontario, where a temperature anomaly of up to +3°C can be found (Shabbar and Khandekar, 1996; Hoerling *et al*., 1997). Southern Canada also tends to be drier during an El Niño winter (Shabbar *et al*., 1997) and southern British Columbia tends to receive less snow (Hsieh and Tang, 2001).

The global SST anomaly map (30 Aug.-5 Sep. 2015) from NCEP (Figure 2 shown on next page) clearly shows the El Niño warming in the equatorial Pacific. What is not typical is the presence of large patches of warm water ("blobs") in

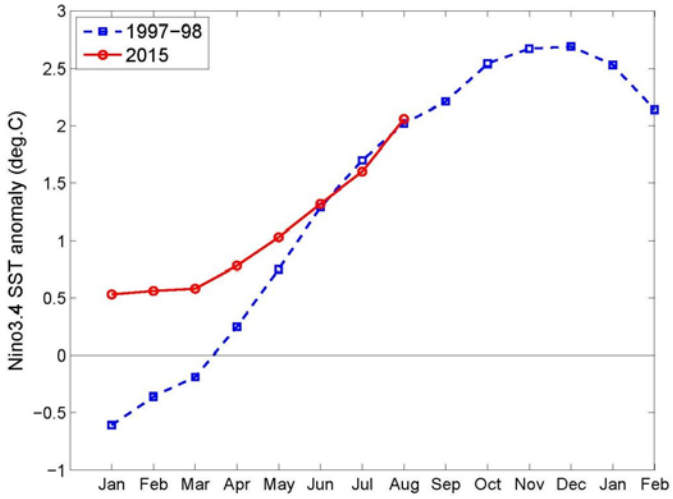

Figure 1: Nino 3.4 SST Anomaly: 2015 versus 1997-98

the extratropical North Pacific, which developed in late 2013, and has a great impact on the marine food web http://www.nwfsc.noaa.gov/news/features/food_chain/index.cfm. While the warm blobs do not fit the classic pattern of the warm phase of the Pacific Decadal Oscillation (PDO), where warm water is present in the eastern extratropical North Pacific and cool water to the west, they did help to flip the PDO index from negative to positive in Jan. 2014. Hence, we are having a major El Niño on top of a PDO warm phase.

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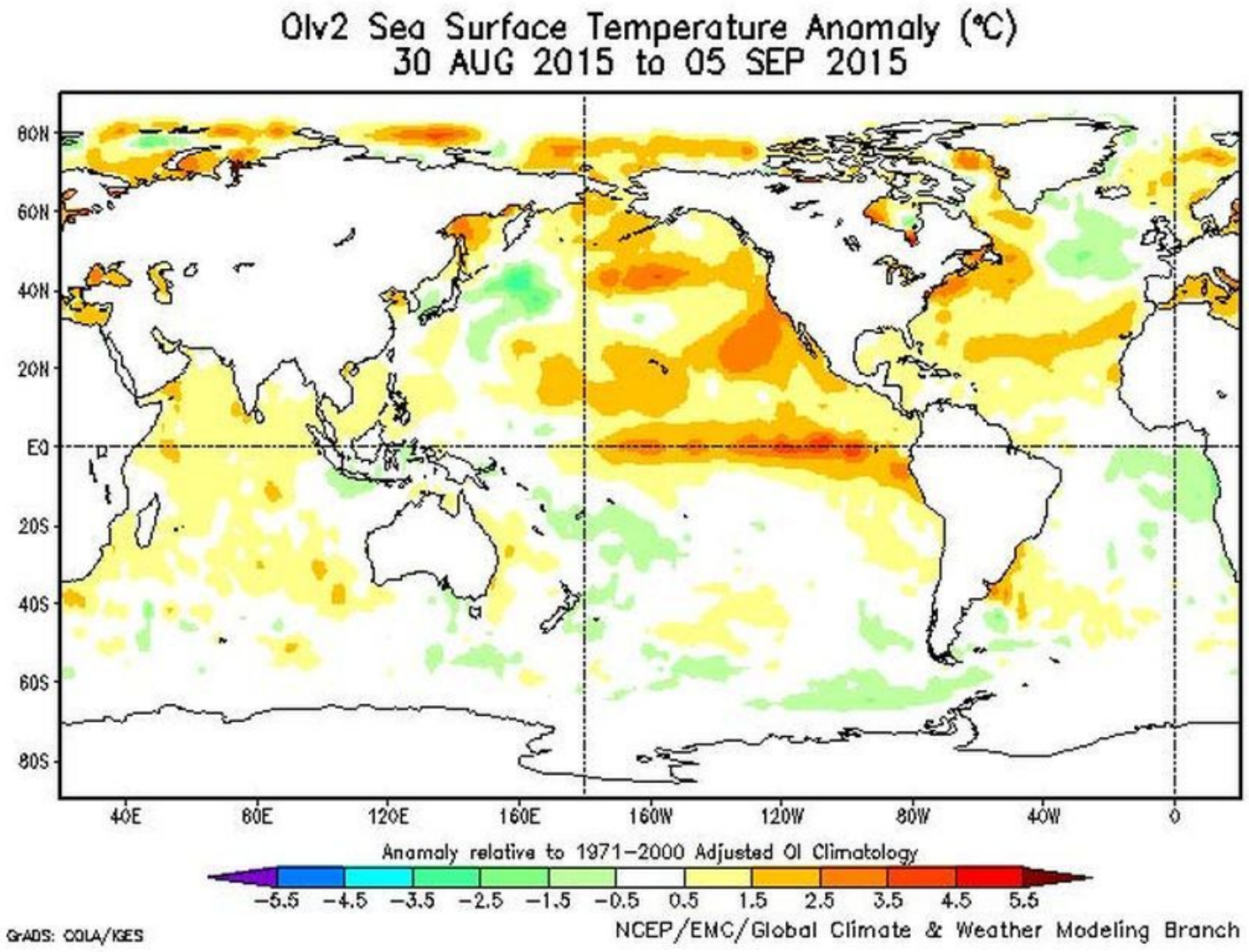

Figure 2: Global Sea Surface Temperature Anomaly during 30 August - 5 September 2015

Directeur général de la SCMO

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Fournir des conseils stratégiques et des recommandations au Conseil de la SCMO sur la façon d'atteindre les objectifs de la Société, sur sa gouvernance, ses programmes et son fonctionnement.

Entretenir de bonnes relations avec des sociétés scientifiques canadiennes semblables et d'autres organismes nationaux des secteurs de la météorologie et de l'océanographie.

Représenter la SCMO au sein d'organismes-cadres comme le Partenariat en faveur des sciences et de la technologie (PFST) et le Consortium canadien pour la recherche (CCR).

Renforcer la notoriété publique de la SCMO et de ses programmes grâce à la diffusion de déclarations de position, de lettres ouvertes aux hauts fonctionnaires, de communiqués de presse, de brochures publicitaires, de présentations auprès de comités parlementaires et de participations à des réunions avec des fonctionnaires, etc.

Administrer le bureau national de la SCMO, y compris la supervision des adhésions, des comités, des publications, des congrès annuels, de l'éducation et de la sensibilisation, des prix et des bourses, de la certification, de la gestion des documents, et des affaires générales et financières liés au fonctionnement de la Société.

Agir comme signataire autorisé de la Société, en ce qui concerne les contrats, les subventions et les ententes, et en faire rapport.

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Coupled Environmental Prediction within Canada: The CONCEPTS Initiative and the Year of Polar Prediction (2017-19)[2]

by Gregory C. Smith[3], Harold Ritchie[4], Fraser Davidson,[5] and Youyu Lu[6]

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With increased refinement of numerical weather prediction systems, describing the interactions across the air-ice-ocean interface is becoming more important. This leads to a need for a new generation of fully-integrated environmental prediction systems composed of atmosphere, ice, ocean, and wave modeling and analysis systems. Such systems are in increasing demand as the utility of marine information products (e.g. for emergency response) becomes more widely recognized. This is particularly relevant in polar regions, as small-scale features of the sea ice cover (leads, ridges, melt ponds) can strongly modulate heat, moisture and momentum fluxes between the atmosphere and the ocean.

The World Weather Research Program has initiated a Polar Prediction Project (PPP; www.polarprediction.net) to promote cooperative international research enabling the development of improved weather and environmental prediction services for the polar regions on time scales from hourly to seasonal. A key activity of the PPP is the Year of Polar Prediction (YOPP) planned for 2017-19 (Jung *et al*., 2014; Smith *et al*., 2015a). The objective of YOPP is to enable a significant improvement in environmental prediction capabilities for the Polar Regions and beyond, by coordinating a period of intensive observing, modelling, verification, user-engagement and education activities.

Within Canada, this need for new and enhanced environmental products and services is being addressed in part through a government initiative called the Canadian Operational Network of Coupled Environmental PredicTion Systems (CONCEPTS), among Environment Canada, Fisheries and Ocean Canada and National Defence (Davidson *et al*., 2013; Smith *et al*., 2013a). CONCEPTS is developing a hierarchy of coupled forecasting systems to provide new and improved forecast products on global and regional spatial scales, and timescales from hours to seasons.

A fully coupled atmosphere-ice-ocean forecasting system for the Gulf of St. Lawrence (GSL) has been developed (Faucher *et al.*, 2010) and has been running operationally since June 2011. This system demonstrated the strong impacts that a dynamic sea ice cover can have on 48hr atmospheric forecasts leading to large changes in surface air temperature (up to 10°C), low-level cloud cover, and precipitation (Pellerin *et al*., 2004).

The CONCEPTS regional coupled prediction system builds on the experience of the coupled GSL system and extends the domain to cover Canadian ice-infested waters. This system will serve as the preparation service to provide marine information products as part of the Global Marine Distress and Safety Service (GMDSS) for the new Arctic METAREAs 17 & 18.

A particular challenge is the development of an accurate sea ice forecasting system in areas of rapidly evolving ice cover to meet the needs of marine traffic through the Canadian Arctic Archipelago (CAA). This requires kilometer-scale resolution models and analyses able to resolve narrow channels and bays in the CAA as well as details of the ice edge in the marginal ice zone (MIZ). Sea ice models have been primarily developed for climate applications and their use at such high resolution requires innovations to sea ice rheologies (formation of ridges and leads, landfast ice; Lemieux *et al*., 2015a) and numerical algorithms. Work is currently underway in both these areas as part of the Regional Ice Prediction System (RIPS; Lemieux *et al.*, 2015b). A first version of RIPS is running experimentally at CMC (Centre Météorologique Canadien) producing four 48hr forecasts per day on a 5km resolution grid. Development of an improved version of RIPS using regional coupled NEMO-CICE ice-ocean model at 2-8km resolution is nearly complete. Multi-annual simulations and forecast trials have shown improvements following the inclusion of tides and modifications made to the surface flux formulations and the turbulent mixing parameterization (Dupont *et al.*, 2015; Roy *et al*., 2015). A higher-resolution ocean configuration is also being tested over the Grand Banks (Zhai *et al*., 2015) and will be used in the CONCEPTS regional system in the future.

[2] First published in *ARCICSIGnal*, Volume 2, Issue 01, May 2015. Updated version reproduced here with authorization of the authors and publisher.

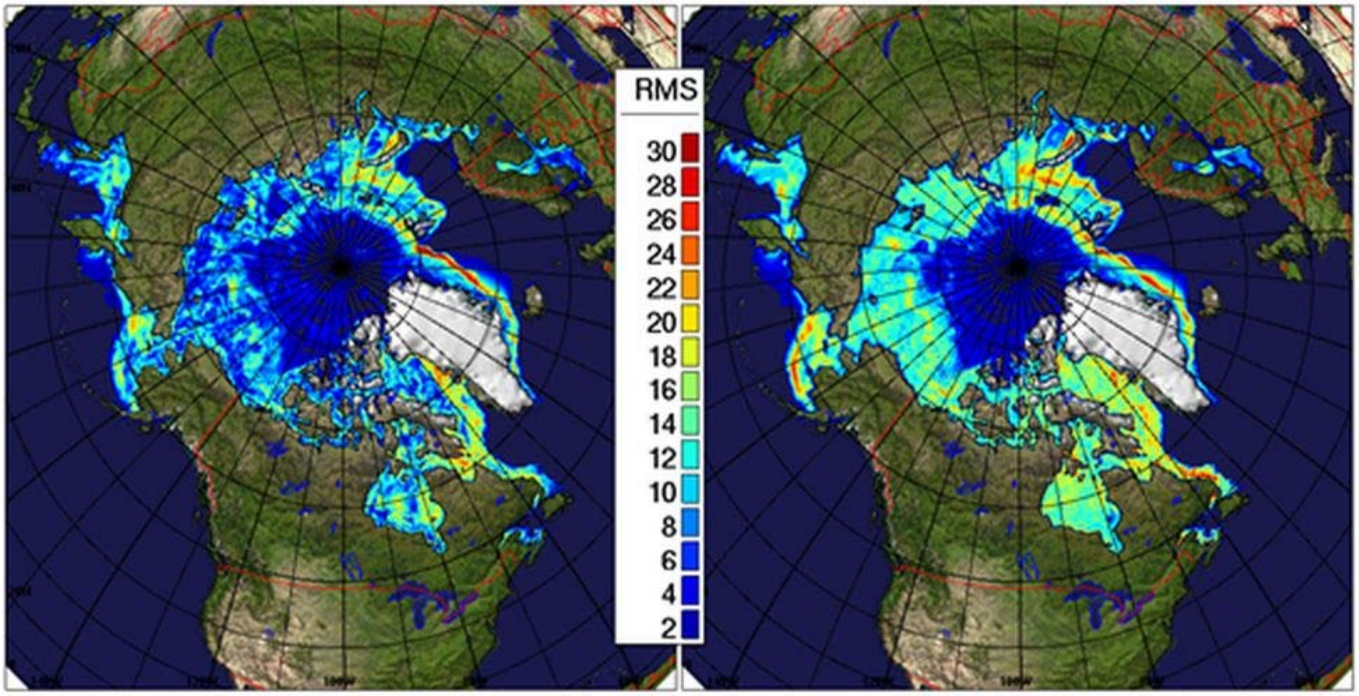

Figure 1: Verification of sea ice forecasting skill for the Global Ice Ocean Prediction System (GIOPS). Colours indicate the root-mean-squared (RMS) 7 day forecast error evaluated over the year 2011 for GIOPS (left) as compared to persistence (right). Figure reproduced from Smith *et al*. (2015b).

In addition, an accurate representation of the MIZ requires coupling of ice and wave models as waves can penetrate tens of kilometers into the pack breaking ice floes. Moreover, the sea state can have a strong impact on surface fluxes between the atmosphere and ocean. As a result, development of improved wave guidance has become a priority, and work is underway to couple the sea ice model to the WWIII wave model.

Longer timescale forecasting of polar regions is being supported by the Global Ice Ocean Prediction System (GIOPS) now running operationally at CMC (Smith *et al*., 2015b) since August 20, 2015. Figure 1 shows an example of the skill of GIOPS in producing sea ice forecasts. GIOPS provides global ice and ocean analyses and 10 day forecasts daily, valid at 00GMT on a 1/4° resolution grid. GIOPS includes a multivariate ocean data assimilation system that combines satellite observations of sea level anomaly and sea surface temperature (SST) together with in situ observations of temperature and salinity. In situ observations are obtained from a variety of sources including: the Argo network of autonomous profiling floats, moorings, ships of opportunity, marine mammals and research cruises. Ocean analyses are blended with sea ice analyses produced by the operational global ice analysis system running at CMC.

Efforts are underway to couple GIOPS to global atmospheric forecasting systems at CMC. Initial results are promising (Smith *et al*., 2013b) and highlight the potential benefits of coupling for environmental prediction. A particular focus in the coming years for CONCEPTS is the preparation and participation in YOPP (2017-2019). YOPP provides a number of opportunities for the Government of Canada, in terms of improving core weather and environmental prediction services as well as providing visibility for the world class systems and services currently being provided. This is especially relevant given EC's role as the Preparation and Issuing Service for METAREAs 17 & 18 in the Canadian Arctic.

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À l'attention de tous les photographes (de nuages)!

Êtes-vous un photographe passionné par les nuages? Voici maintenant votre chance de devenir mondialement célèbre et riche! OK, peut-être juste célèbre!

L'Organisation météorologique mondiale (OMM) met à jour l'Atlas international des nuages (AIN) et cherche actuellement de nouvelles images couleur de bonne qualité et de haute résolution de tous les types de nuages et d'autres météores avec les métadonnées qui les accompagnent. Les images de nuages et de météores plus rares sont susceptibles d'être choisies pour publication.

L'AIN a été publié la première fois en 1939. Son édition la plus récente (1987) renferme plus de 200 images des 150 classifications et plus de types de nuages et de météores.

Les images et les métadonnées qui seront prises en considération par l'équipe d'experts d'observation des nuages doivent être soumises sur le site Web de l'OMM à l'adresse suivante : http://wmoica.org/index.php/en/. On peut trouver sur ce site plus de détails et de conditions, y compris une liste des « plus recherchés ». Les photos de nuages seront acceptées jusqu'en **décembre 2015** au moins. Pour plus d'information, veuillez communiquer avec Shannon deGraaf à Shannon.degraaf@ec.gc.ca ou au numéro 905 315-5235.

REPORT / RAPPORT

Communicating Uncertainty to Users of Weather Forecasts

by Brad Snyder[1] and Rebecca Schneider[2]

Background

The workshop on *Communicating Uncertainty to Users of Weather Forecasts* was held on May 31st, prior to the 2015 CMOS Congress in Whistler. It was a continuation of talks from the 2014 Western Canada Weather Workshop where uncertainty was a central theme. The themes for the 2015 workshop centered around using forecast uncertainty to aid in decision making; the use of Ensemble Prediction Systems to communicate uncertainty; and sources and scales of uncertainty. Over 40 attendees registered for the workshop. Table 1 lists the affiliation of these attendees.

Affiliation	Number
Forecasters	16
Academia	12
Media	4
Partners	8
Other	2

Table 1: The affiliation of the participants at the workshop

The expected outcomes of the workshop were:

1. A better understanding of how uncertainty is currently used in the field of weather forecasting;

2. Examples of communication approaches that work and those that do not;

3. Recommendations for operationalizing existing knowledge within the Meteorological Service of Canada (MSC);

4. Identifying key knowledge gaps to guide future research efforts.

There were five plenary talks, two shorter talks, and an afternoon exercise involving all the attendees. The talks are summarized as follows:

- the case of the non-blizzard in New York City and how it was used to exemplify the role that uncertainty can play in a major weather scenario;

- how the public understands uncertainty and the best ways for communicating uncertainty;

- how meteorological organizations attempt to convey probability and uncertainty in their forecasts;

- lessons and pitfalls of communicating uncertainty to sophisticated users;

- converting Ensemble Prediction System information into probabilistic forecasts.

Highlights

The highlight for many participants was the presentation by Dr. Susan Joslyn from the University of Washington. Dr. Joslyn is a cognitive psychologist who has spent many years studying how people make weather-related decisions based on uncertainty. She dispelled many myths and misunderstandings about the public's perceptions of uncertainty. Here is an excerpt from an abstract for her talk:

Although previous research suggests that we are not very good at reasoning with uncertainty, the research program described in this talk is far more encouraging. Unlike earlier work that compares peoples' decisions to a rational standard, these experiments compared decisions made by people with uncertainty information to decisions made by people without uncertainty information. The results suggest that including specific numeric uncertainty estimates in weather forecasts leads to better decisions, reducing both risk-seeking and risk-averse errors. Uncertainty estimates give people a better idea of what to expect both in terms of the range of possible outcomes as well as the amount of uncertainty in the particular situation, all of which benefits precautionary decisions. In addition, forecasts with uncertainty estimates receive high trust ratings, suggesting that acknowledging the uncertainty up front makes the forecast seem more credible.

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Her argument is not whether people make rational decisions with uncertainty but whether they make *better* decisions. She found that the general public may not have a theoretical understanding of uncertainty but they have a *practical* understanding of uncertainty. Some of the more provocative results from her research are highlighted below:

1. Can people understand expressions of uncertainty? **YES**!

- Via threshold probabilities, predictive intervals, and odds ratios.

2. Do people make good decisions with uncertainty information? **YES**!

- Better able to distinguish situations that require precautionary action.

3. Does uncertainty information increase trust? **YES!**

- People know predictions involve uncertainty.
- Forecasts that acknowledge uncertainty seem less wrong when a single value forecast fails to verify.
- Counteracts the effect of false alarms.
- Increases compliance with warnings.

4. What is the best way to communicate uncertainty information?

- Numeric expressions are more precise.
- Include information that can be directly applied to decision at hand.
- Explanation matches user expectations.

Afternoon exercise

Participants were given one of two scenarios and a 'role'. The four roles were: academia, forecaster, media, and partner. Partners were defined as decision-makers at a high level in an organization. Examples could include a manager in an Emergency Management Organization or the Provincial Ministry of Transportation.

The following is one of the scenarios used in the exercise:

It is a Monday morning in late September in a metropolitan city that usually sees its first snowfall in November or later.

Last Friday forecasters were predicting, with a high level of confidence, a major snow storm. The major snow storm failed to materialize.

Now, forecasters are predicting another major snow storm to strike Thursday evening at rush hour, again with a high level of confidence. (This would make it the first snow storm of the season.)

The questions asked of each group or role included the following:

Academia:

a) What types of information about the upcoming possible event do you want to know, as a weather information user (member of the general public)?

b) How do you think this information should be relayed to the public to ensure it is understood, acted on, and taken seriously?

c) How would you recommend mitigating or explaining last week's missed forecast?

Response:

Their biggest issue is lack of confidence, and that the forecast authority needs to rebuild trust via an analysis of the previous storm. They would want to know what went wrong last time and how this event differs. They suggested that graphics and numbers should be used, such as a return period for the upcoming storm. They would also want to see probabilities and stressed that there should be a sole authority delivering the message.

Forecasters:

a) What services and/or products would you initiate?

b) How would you manage incoming media requests regarding last week's missed forecast?

Response:

The forecasters would consider a blog to communicate uncertainty and indicate a trend as the event approached. They would have a tendency to be conservative with the amounts, taking into consideration last week's missed forecast.

Media:

a) Would you share this information with your audiences? If not, why not? If yes, answer *b* & *c*.

b) What type of information from the forecasters would be most useful to you?

c) How would you best transmit this information to the public?

Response:

Considering social media, this group declared they would have no choice but to share with their audience. They would also want to explain why the forecast was missed last time.

Partners:

a) What types of information about the upcoming possible event do you want to know?

b) How do you want the forecasters to transmit this information to you?

c) What decisions are you making based on this type of information?

d) How often do you want to be updated as the possible event nears?

Response:

This group would want to know what happened last time. And, what is different between this week's potential event and last week's? They would also want to know about the weather following the storm (not just *during*), as impacts happen post event. They want to be updated in person or via webinar. They do not want conference calls but would accept pushed information.

At the end of the day, the question was posed to all:

What can the Meteorological Service of Canada (MSC) do now to advance the communication of uncertainty to various users?

Multiple participants agreed that the MSC needs a new vehicle, such as a blog, or perhaps more than one vehicle to express uncertainty, especially in the long range. The participants also agreed that the public needs more education on everyday expressions used in weather forecasts such as what a *60 percent chance of showers* means. There was also agreement for a larger 'media' team or more staff that excel in communication.

Survey Summary

To assess the success of the workshop, a survey was given to attendees after the workshop. Of the 42 who attended almost 80% responded. The following is a distillation of the more important results.

What did you like or dislike?

- gathering of different domains of expertise;
- interdisciplinary approach;
- time for discussion and brainstorming;
- too short;
- do this on a more regular basis.

What can the MSC do now to advance the communication of uncertainty?

- collaborative research with cognitive scientists;
- more use of social media;
- more discussion to augment the public forecast, more weather discussion, synopsis;
- provide a product that actually communicates uncertainty;
- strengthen the relationship between local forecasts offices and the media;
- educate the users; train those who interact with media and decision makers;
- a collective vision is needed, moving forward … including uncertainty is a must.

Attendees were asked whether the workshop addressed the four objectives:

1. A better understanding of how uncertainty is currently used in the field of weather forecasting,

2. Examples of communication approaches that work and those that do not,

3. Recommendations for operationalizing existing knowledge within MSC,

4. Identifying key knowledge gaps to guide future research efforts.

Figure 1 (see next page) summarizes the results. Clearly, attendees felt that they had a better understanding of uncertainty after the workshop and had an idea of best practices for communicating uncertainty. There was no consensus however on recommendations for operationalizing existing knowledge (although suggestions were made). Nor was there consensus on whether knowledge gaps have been identified.

Summary and Recommendations

The workshop successfully brought various sectors of the meteorological community together to share knowledge and experience related to communicating uncertainty. Figure 2 (see next page) illustrates a process for improving the use of uncertainty within the meteorological community. We start with models which simulate atmospheric behaviour; forecasters interpret this guidance and create various products and services; users take this information to help make decisions. The process is enhanced by knowledge sharing and feedback amongst the three groups.

The workshop was a successful application of this process, particularly from the user/partner and forecaster perspective. By almost all accounts, attendees stated that they came away with a better understanding of uncertainty with respect to weather forecasts along with steps we can take to better communicate this to users. Indeed, users of weather information including the general public can and do use uncertainty information (if given) in their decision making.

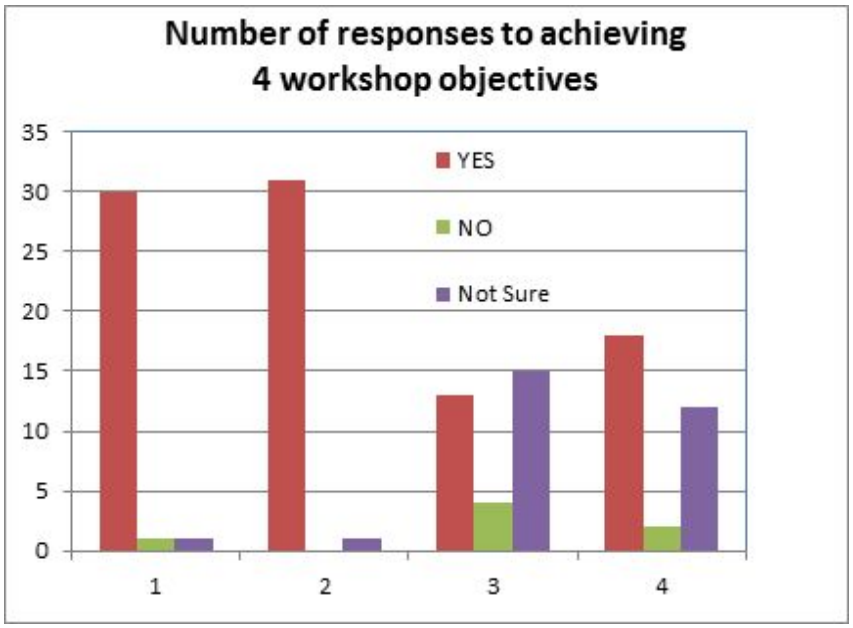

Figure 1: Summary of responses to whether each of the four workshop objectives was met.

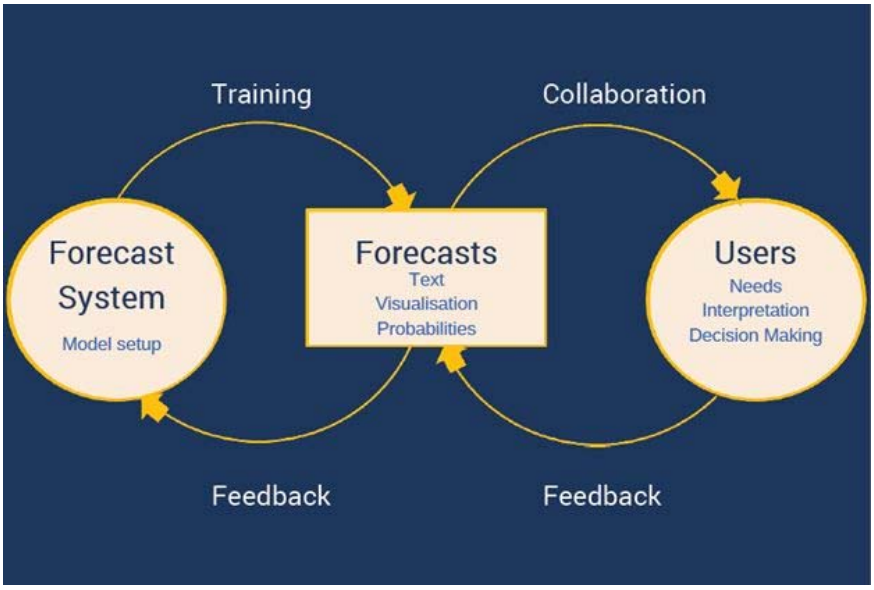

Figure 2: Schematic representation of the process of communicating uncertainty amongst the modelling, forecasting, and user communities (adapted from Ramos et al 2010).

The discussions during the workshop show that there is an appetite for more communication of uncertainty. The message from those that were in attendance is that the MSC needs to offer a product (or service) that allows forecasters to convey uncertainty. We also need to find other ways to communicate (e.g., social media) and educate.

The recorded sessions for those who could not attend the workshop will be found in the future on the CMOS website.

The Training and Career Development Division would like to thank the CMOS Local Arrangements Committee for their assistance in making the workshop a success.

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CMOS BUSINESS / AFFAIRES DE LA SCMO

Andrew Bell is leaving us

After serving close to two years as Executive Director of the Canadian Meteorological and Oceanographic Society, Dr. Andrew Bell is moving to new challenges and new skies. At the time you will read this particular *CMOS Bulletin SCMO* issue, he would have already started in his new endeavour with Airbus Defence and Space (the largest such company in Europe) in Munich, Germany. Andrew will be an Optical Systems Architect at their Centre of Excellence for Earth Observations, working on new instruments for the European MetOp polar orbiting satellites, space-based LIDAR, and other new technologies. Among the projects in which Andrew will be involved with Airbus there are two who might be of interest to the CMOS community. These two are: 1) METOP - second generation (the updated European polar orbiter meteorological mission supporting their geostationnary observations; and, 2) MERLIN, a German-French collaboration on a space borne methane concentration mapping Lidar.

Dr. Andrew Bell

Andrew took up the Executive Director position on October 1, 2013 and right at the beginning he has been working with Ian Rutherford on the transition. Presidents of CMOS come and go but the Executive Director remains and keeps our organization on track. After being on the job for a few months and have grasped quickly the various regular tasks of our Society, Andrew was involved with the purchase of an association management software to support the business processes of members. He also continued the work already started by Ian in getting adopted the new By-Laws of the Society. Andrew was involved in the planning and preparation of the Rimouski and Whistler congresses.

Andrew has 25 years of experience in the remote sensing space industry split between time in Europe and North America. He is an energetic professional facilitator of measurements important to understanding the environment and climate change, having championed the design and development of scientific instruments for different types of atmospheric soundings as well as earth and ocean surface sensing. These projects have flown on ERS2[1], ENVISAT[2], MSG & SCISAT[3]. He has a decade of experience leading major Canadian studies for spaceborne hyperspectral imaging and meteorological instrumentation. He has also made significant contributions to several space astronomy projects including the XMM[4], FUSE[5] and James Webb Observatories.

His academic qualifications, all from the UK, include a Doctorate in Atmospheric Physics from the University of Manchester, a Masters in Satellite Remote Sensing from University & Imperial Colleges of London and a double major Bachelors in Physical Electronics and Astrophysics & Astronomy from the University of St Andrews.

As shown above, Andrew has had a long and successful career, in space instrumentation engineering. He came to Canada to pursue this career but became stranded when the Canadian space industry lost its government funding (familiar story for many environmental scientists). His job at CMOS was a way to keep active and maintain contacts with remote sensor users, but did not fulfill his professional goals nor make use of his specialized skills.

Andrew sees above the daily problems and is able to outline the big picture. He used this ability to steer CMOS and make valuable recommendations to the Society. Although his Scottish temper shows from time to time, he's fairly easy to work with and entertaining to hang out with, full of stories of his youth in Scotland, studies in one of the best universities in the world, and work in the aerospace industry.

All those who had the occasion to work with Andrew have been able to appreciate his talents in all domains, his reasoned commentaries and advice, his commitment to the Society and to everything that concerns atmospheric and oceanographic sciences, all rounded up in a friendly personality. His calm demeanor and competent grasp of the Society's business will be missed by all.

The CMOS community certainly wish him all the best for his new and challenging career.

Endnote

1) ERS-2: European Remote Sensing Satellite - 2
2) ENVISAT: ENVIronmental SATtellite
3) SCISAT: studies the complex chemical reactions occurring in the middle atmosphere that affect ozone
4) XMM: European Space Agency X-Ray Multi Mirror Mission
5) FUSE: Far Ultraviolet Spectroscopic Explorer

In collaboration with Martha Anderson, David Huard, Bob Jones, and Paul-André Bolduc

Départ d'Andrew Bell

Après presque deux ans au poste de directeur général de la Société canadienne de météorologie et d'océanographie, Andrew Bell entreprendra maintenant de nouveaux défis sous un nouveau ciel. Quand vous lirez ce bulletin, il aura déjà commencé sa carrière chez Airbus Defence and Space (la plus grande entreprise de cette catégorie en Europe), à Munich (Allemagne). Andrew occupera le poste d'architecte de systèmes optiques à leur Centre d'excellence pour les observations de la Terre. Il travaillera sur de nouveaux instruments pour les satellites météorologiques opérationnels européens à orbite polaire, sur des lidars spatiaux et d'autres nouvelles technologies. Deux des projets auxquels participera Andrew chez Airbus pourraient s'avérer d'intérêt pour les membres de la SCMO : 1) METOP - 2e génération (la plus récente mission européenne sur l'utilisation de satellites à orbite polaire en soutien aux observations géostationnaires); 2) MERLIN - une collaboration Allemagne-France visant à mettre au point un lidar capable de cartographier la concentration de méthane à partir de l'espace.

Andrew a accepté le poste de directeur général le 1er octobre 2013 et, dès le départ, il a planifié la transition à l'aide d'Ian Rutherford. Les présidents de la SCMO vont et viennent, mais le directeur général demeure et assure la permanence de l'organisation. Après quelques mois, Andrew avait rapidement compris le fonctionnement de notre Société et il a participé à l'achat d'un logiciel de gestion destiné aux associations, afin de faciliter les processus administratifs liés aux membres. Il a aussi poursuivi les travaux qu'avait commencés Ian en faisant adopter le nouveau règlement de la Société. Andrew a participé à la planification et à la préparation des congrès de Rimouski et de Whistler.

Andrew compte 25 années d'expérience en télédétection au sein de l'industrie spatiale. Il a partagé son temps entre l'Europe et l'Amérique du Nord. C'est un professionnel dynamique qui contribue à l'observation de phénomènes importants pour la compréhension de l'environnement et des changements climatiques. Il a soutenu la conception et la mise au point d'instruments scientifiques capables de divers types de sondages atmosphériques, ainsi que de mesures de la surface de la terre et de la mer. Ces projets ont été embarqués à bord des satellites ERS-2[1], ENVISAT[2], MSG et SCISAT[3]. Il a passé une dizaine d'années à diriger des études canadiennes majeures liées à la spectroradiométrie imageante spatiale et à l'instrumentation météorologique. Il a aussi contribué notablement à nombre de projets d'astronomie, y compris les observatoires spatiaux XMM[4], FUSE[5] et James Webb.

Ses études, toutes entreprises au Royaume-Uni, incluent un doctorat en physique atmosphérique de l'Université de Manchester, une maîtrise en télédétection par satellites du University College et de l'Imperial College de Londres, ainsi qu'un double baccalauréat en physique électronique et en astrophysique et astronomie de l'Université de St Andrews.


Andrew Bell, PhD

Comme on le voit ci-dessus, Andrew compte une longue et fructueuse carrière en ingénierie de l'instrumentation spatiale. Il est venu au Canada afin de poursuivre cette carrière, mais s'est retrouvé en situation précaire quand l'industrie spatiale canadienne a perdu ses subventions gouvernementales (un refrain connu des scientifiques en environnement). Le poste de directeur de la SCMO lui a permis de rester actif et de maintenir ses contacts avec les utilisateurs de télédétection, mais n'a pas su répondre à ses objectifs professionnels ni lui permettre de faire bon usage de ses compétences spécialisées.

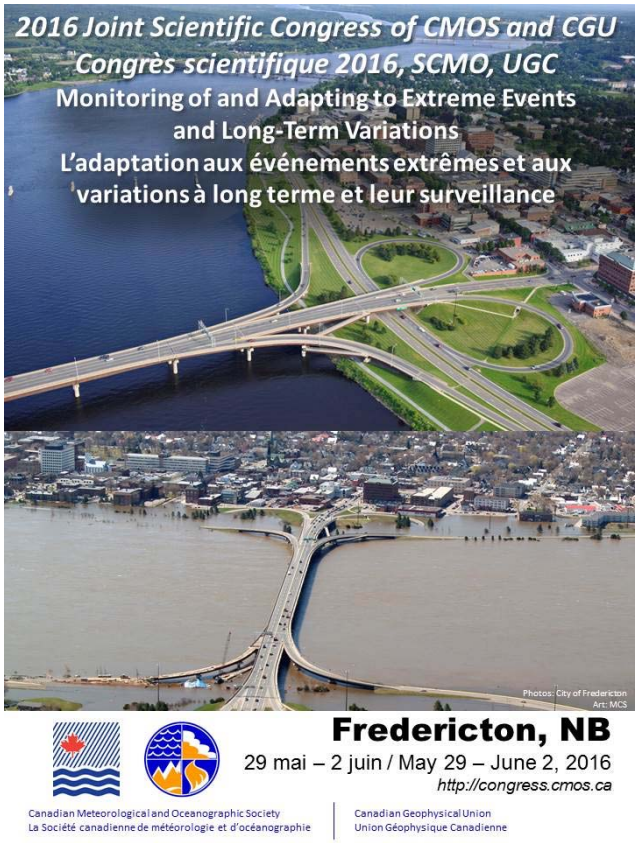
Andrew possède la faculté de voir la situation globalement, au-delà des problèmes quotidiens. Il a mis cette aptitude au service de la SCMO et a proposé des recommandations utiles à la Société. Il est plutôt facile de travailler avec lui, bien que son tempérament écossais fasse à l'occasion surface. Il est d'un naturel divertissant, comme en témoignent ses récits de jeunesse en Écosse, ses études dans l'une des meilleures universités et son travail au sein de l'industrie aérospatiale.

Tous ceux qui ont eu l'occasion de travailler avec Andrew ont pu apprécier son talent dans tous les domaines, ses commentaires et avis sensés, ainsi que son dévouement à la Société et à tout ce qui concerne les sciences atmosphériques et océanographiques, le tout soudé par une personnalité amicale. Son calme et sa compréhension des affaires de la SCMO nous manqueront à tous.

Les membres de la SCMO lui souhaitent du succès dans le cadre de cette nouvelle et stimulante carrière.

Notes
1) ERS-2 : European Remote Sensing Satellite - 2
2) ENVISAT : ENVIronmental SATtellite
3) SCISAT : étudie les réactions chimiques complexes qui touchent l'ozone dans la moyenne atmosphère.
4) XMM : mission de l'observatoire spatial X-Ray Multi Mirror de l'Agence spatiale européenne
5) FUSE: Far Ultraviolet Spectroscopic Explorer

En collaboration avec Martha Anderson, David Huard, Bob Jones, et Paul-André Bolduc



Next CMOS Congress in 2016

The 50th CMOS Congress will be held in Fredericton, New Brunswick, from May 29 to June 2, 2016. This congress will be held jointly with Canadian Geophysical Union (CGU). The theme of this joint conference is: ***Monitoring of and Adapting to Extreme Events and Long-Term Variations.*** The organizing committee is putting together an exciting program both inside and outside of the congress. We hope to see you all at the Fredericton congress next year!

Prochain Congrès de la SCMO en 2016

Le 50e congrès de la SCMO se tiendra du 29 mai au 2 juin 2016 dans la ville de Frédéricton, Nouveau-Brunswick. Ce congrès se tiendra en même temps que le congrès de l'Union géophysique canadienne (UGC). Le thème choisi de cette conférence conjointe est ***L'adaptation aux événements extrêmes et aux variations à long terme et leur surveillance***. Le comité organisateur local met présentement en place un programme tant scientifique que social. Nous espérons tous vous voir au congrès de Frédéricton l'an prochain.

Atmosphere-Ocean 53-4 Paper Order

Applied Research / Recherche appliquée

AO-2013-0049
Conversion of Pressure to Depth for Moored Instruments using a Reference Bottom Mounted Pressure Sensor
Junde Li, Chujin Liang, Changming Dong, Weifang Jin, Guanghong Liao, Beifeng Zhou, Tao Ding, Xiaodong Lu, and Xiangming Zhang

AO-2015-0021
Observed Trends in Severe Weather Conditions Based on Humidex, Wind Chill, and Heavy Rainfall Events in Canada for 1953–2012
Éva Mekis, Lucie A. Vincent, Mark W. Shephard, and Xuebin Zhang

Fundamental Research / Recherche fondamentale

AO-2014-0043
Estimation and Projection of Non-Linear Relative Sea-Level Rise in the Seto Inland Sea, Japan
Han Soo Lee, and Arata Kaneko

AO-2014-0070
Quantifying Changes in Extreme Weather Events in Response to Global Temperature Increases
Travis R. Moore, H. Damon Matthews, Christopher Simmons, and Martin Leduc

AO-2015-0014
Comparison of Wintertime North American climate Impacts Associated with Multiple ENSO Indices
Bin Yu, Xuebin Zhang, Hai Lin, and Jin-Yi Yu

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **December 2015.** Please send your articles, notes, workshop reports or news items before **November 6th, 2015** to the electronic address given at the top of page 154. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **décembre 2015.** Prière de nous faire parvenir avant le **6 novembre 2015** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse électronique indiquée au haut de la page 154. Nous avons un besoin URGENT de vos contributions écrites.

BOOK REVIEW / REVUE de LITTÉRATURE

Climate Conundrums
What the Climate Debate Reveals About Us

by William B. Gail

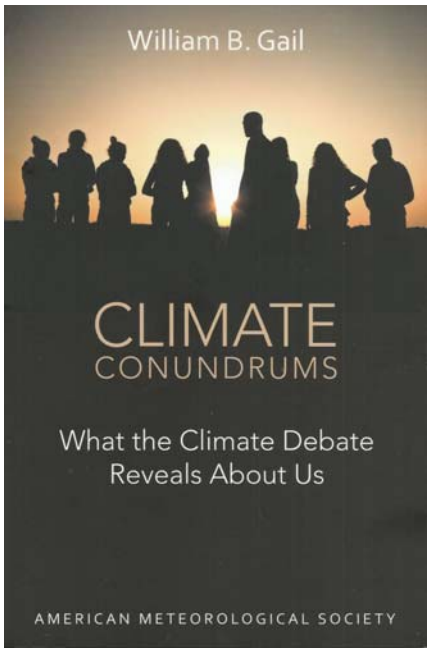
Published by American Meteorological Society and
distributed by University of Chicago Press, 2014
ISBN 978-1-935704-74-4
Paperback, 235 pages, US$30.

Book reviewed by John Stone[1]

What is the 2014 President of the American Meteorological Society doing writing a book about ethics, religion, and cognitive processes? The reason is that he believes that solving the threat of climate change cannot be achieved through simply further strengthening the scientific basis but requires "enhancing the very core of human thought". Such matters raise deep philosophical questions that have engaged minds since the days of the Greeks in the 3rd century BC (particularly Aristotle) and includes the "father" of modern scientific thinking, René Descartes (Je pense, donc je suis) - none of whom get much mention in this book.

The author, William B. Gail, is the co-founder of Global Weather Corporation and a lifetime national member of the US National Research Council. He has degrees in physics and electrical engineering and previously was a director with Microsoft Corporation. This book would seem to represent a considerable intellectual excursion from his previous experience. The book rehearses (but doesn't make much reference to) arguments that have appeared recently in several other books that set out to explore why we haven't made much progress in practical actions to tackle climate change such as George Marshall's: *Don't Even Think About It – Why Our Brains are Hardwired to Ignore Climate Change*. Furthermore, the arguments made by the author are not always rigorous and the references are often to popularized books on contemporary science and economics.

The book is organized around a series of what the author calls "conundrums", with titles such as: "Could science and religion reconcile"? and "What will become of us"? Each chapter explores one of these conundrums but produces more questions and rarely concrete solutions. It uses the challenge of climate change to illustrate these conundrums but the scope is far broader. His deep concern is that we have reached a stage in human evolution where we are no longer able to manage our advances in science and technology. Examples include the threats of nuclear power, genetically modified organisms, biomimicry, artificial intelligence, stratospheric ozone depletion as well as climate change. He makes reference to global-scale, human-originated issues that are affecting nature and society in complex ways, characterized by information that is rapidly evolving and ambiguous, producing unexpected outcomes that are beyond the realm of previous experience and not readily resolved with existing tools. Many of these are factors that characterize the ecological systems explored by C. S. (Buzz) Holling in his work on resilience and by Frances Westley in her book: "*Getting to Maybe*". Neither is referred to in this book.



The book starts with a chapter on: "Are humans distinct from Nature"? The very formulation of this first conundrum belies the rather anthropocentric manner in which we tend to look at the World in which we live. Gail claims that our efforts to segregate human influences from Nature, a goal which he asserts has driven the environmental movement, have failed. The author's view is that making a clear distinction between humans and Nature makes no more sense than "dividing up California". Coincidentally with reviewing this book Pope Francis issued his encyclical: "*Laudato Si*" which

[1] Retired Meteorologist and Adjunct Research, Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, Ontario

discusses the same question but in greater depth and authority.

The author of this book argues that we have put distance between ourselves and Nature in order to better focus our energies and knowledge initially on our survival and later our own and society's advancement. In so doing the author suggests we have begun to rely less on our instincts and reduced our personal awareness of Nature. In its place science, which Francis Bacon saw as being "for the glory of God and the relief of Man's estate" has now, in the view of the author, given us the means to irreversibly change Nature. A means we seem incapable of resisting and increasingly unable to manage with our present tools. Or, to put it as a question, is human purpose, despite our amazing progress in understanding Nature and being able to predict the future, better than Nature's indifference (Nature will survive regardless of our actions; it just may look very different).

In what I found to be one of the most provocative chapters, the author's third conundrum poses the question: "Is nature sustainable". We tend to use the term sustainable development as though it were one word. Gail argues that sustainable implies a future as good as the past whereas development suggests this is not enough and that we strive for a future that is better. This poses a dilemma – can we both preserve and improve the world? This is relevant to the second part of Article 2 of the UN Framework Convention on Climate Change – the "ultimate objective" – that we should stabilize atmospheric concentrations of greenhouse gases at a level that would avoid dangerous interference with the climate system and at a rate *that enables economic development to proceed in a sustainable manner.*

This leads the author to raise a tantalizing question; if we are able to achieve this ultimate objective would we be content with the new climate. Having demonstrated that we can manipulate the climate, what is to stop any nation, or company for that matter, altering the climate to suit its own ends? Our one atmosphere is a global commons. This is central to the debate on climate engineering, such as modifying the climate by injecting aerosols into the atmosphere. Who knows what we might unleash, what may be the unintended consequences.

The author uses the later half of the book to think through possible solutions in the belief that we do have an obligation to future generations. This is where the relevance to climate change is most obvious as it will undoubtedly have greater impacts on future society than at present even if we start aggressively reducing our emissions. The question is, how much do we care, how much are we willing to do, how much do we have to do? Our ability to imagine a World even only 2 ^{o}C warmer, let alone a potential 4 ^{o}C, is limited by our lack of any previous experience; we have only our models to help us explore the full boundaries of phase space. He quotes Winston Churchill who said: "The empires of the future are the empires of the mind".

Gail's basic thesis is that we have to learn from Nature and the constant tension between change and stability in order to achieve a resilient system. He also makes an occasional reference to the notion of Gaia introduced by James Lovelock – the idea that Nature is a dynamic, self-governing system. And, in passing, argues that globalization is taking us in the wrong direction by reducing our options. In his view we have to change the way in which we think including the way in which we measure progress (not necessarily by the resources we consume). He notes that human progress, just like natural evolution, has not been linear and he is searching for that disruptive idea that will take us in a new direction. He uses the metaphor of a phase change such as water changing to ice as we pass the tipping point of 0 ^{o}C.

The author is convinced of the power of engineering. Given his professional background this is perhaps not entirely surprising. However, he has a broad interpretation of engineering as "a tool we use to extend our intellectual capabilities", an "amplifier of human thought". He broadens this to examine the power of nature to engineer itself, which raises the everlasting question of why is the universe the way it is (the anthropic principle), which brings us back to the Pope's encyclical. Gail argues that science and religion are complementary; that science provides the best explanations when information is relatively complete and religion's core strength is its ability to enable thought where empiricism fails. As Stephen J. Gould wrote: they address non-overlapping domains.

Although this book raises all sorts of interesting and indeed important questions (my copy is full of notes in the margin), it is somewhat regrettable that it doesn't provide concrete solutions – the sort that you could bring to a Minister. While the book is a long way from Navier-Stokes equations, it is worth reading as it discusses the climate change issue from an interesting perspective.

Hurricane Pioneer: Memoirs of Bob Simpson

by Robert H. Simpson with Neal M. Dorst

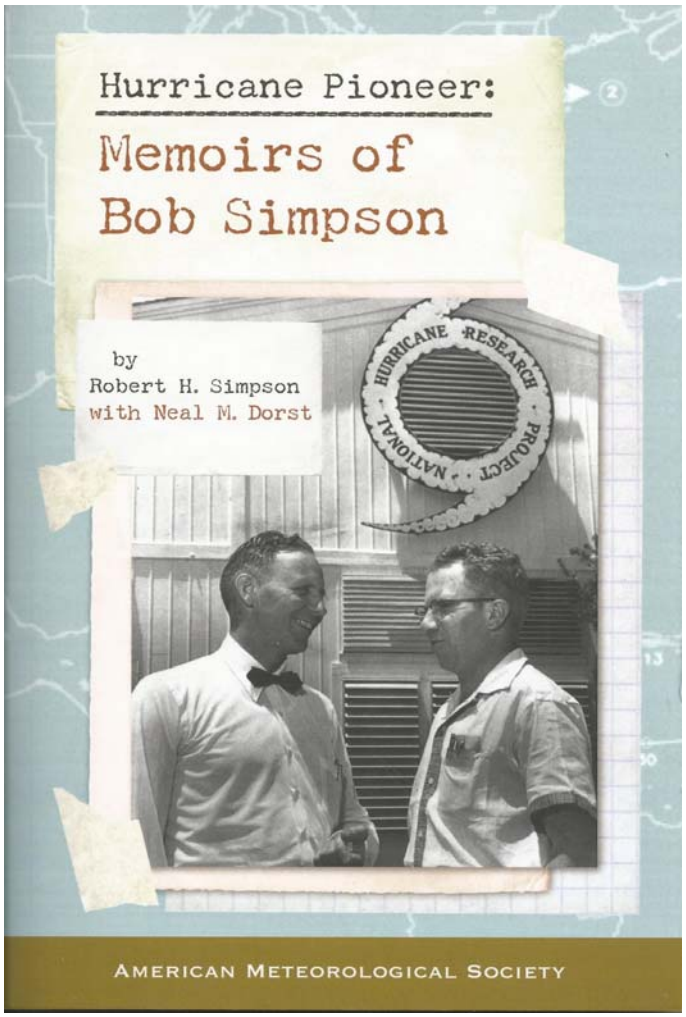
American Meteorological Society (AMS),
2015, paperback,
142 pp.
US $25.00 from the AMS on-line bookstore
Also available from University of Chicago Press and Amazon (paper only)
ISBN: 978-1-935704-75-1

Book reviewed by Bob Jones[2]

When I was asked to review this short book, I checked Oxford for the difference between Memoirs and Autobiography. *Memoirs* is a written account of one's memory of certain events or people, while an *autobiography* is an account of a person's life written by that person. This book is both, a life story, by the author, to be published after his death which occurred in 2014 at age 102. Bob Simpson had much to record and he presents us with an organized description of his life, personal and professional, covering many decades. Indeed after I finished the first read, my thoughts went to the elusive *American Dream.* It was wonderful to read of a fellow meteorologist who lived that dream.

In this review, I will present Canadian connections and parallels. Because hurricanes in our part of this hemisphere are mainly a USA and Caribbean / Pacific concern, the book includes one direct Canadian reference, but describes many events which are similar to the Canadian meteorological experience. In 1957, Simpson presented findings at a meeting of the Royal Canadian Institute – probably about Hurricane *Hazel* (see more about *Hazel* below).

The book is a very easy read and, if you like biographies, is hard to put down. It is recommended for all audiences. Bob Simpson organized his Memoirs to cover his childhood life, education, early career and postings with the US Weather Bureau, finding his niche in hurricane studies and research projects, finally getting his doctorate and concluding like so many successful meteorologists by setting up a consulting firm to continue his work. Nine chapters cover everything in his life including three marriages and their influence on his career. The



appendices include some photos, career positions, and a long list of publications and technical reports. I always eagerly look for photos in any biography and would have preferred to see more. The only other flaw in this book is lack of an index.

Bob Simpson lived 102 years. In the CMOS Archives is a list of our deceased colleagues. Many Canadian pioneering meteorologists reached the mid-90s. Like a lot of us, Simpson started his career as a met technician. His first posting was to remote Swan Island in the Caribbean Sea – much like those of us who spent early years in the north. Always studying theoretical meteorology, he was finally posted in 1942 to New Orleans as a junior forecaster. New Orleans had a wide variety of responsibilities which attracted Simpson and aided his further studies. Interestingly, that weather office was located in the Post Office building, like the Atlantic Weather Centre – which also had a variety of

[2] CMOS Archivist, Ottawa

responsibilities and interesting weather. In 1943, following a quick transfer to forecasting in Miami, he joined other Weather Bureau forecasters for masters training at the University of Chicago. Carl Rossby led the meteorological faculty and Simpson brought his three-front model to later offices where he worked. Course graduates went through the same pre-posting trauma as we did in Canada. Preferences were submitted and results were usually much different. Simpson was posted to Panama in 1944 where he was able to conduct hurricane research while doing instructional duties at a military school of meteorology.

Francis Reichelderfer became a mentor for Bob Simpson during his early Weather Bureau career. Reichelderfer was head of the US Weather Bureau from 1938 to 1963, and the Memoirs describe him as a hands-on Director who met and encouraged his promising employees. The Canadian comparison is Andy Thomson who was head of Meteorological Service of Canada (MSC) from 1946 to 1959. After the war, Reichelderfer posted Simpson to the Washington head office to help train new meteorologists. Fortunately his office was close to Reichelderfer's and in after hours they discussed research needs and directions to improve forecasts. A 1948 four-year posting to Hawaii stressed Bob Simpson's first marriage which ended then. In Hawaii, Simpson was involved in two important events. He was on an Air Force aircraft which flew for the first time directly into the eye of a nearby typhoon. Secondly he convinced Hawaiian scientists to build a permanent observatory at Mauna Loa – which now provides the longest and most complete CO_2 database.

In 1952, he returned to Weather Bureau HQs under Reichelderfer. The 1954 hurricane season, which included *Hazel*, was also bad for coastal USA with much damage and loss of life. This provided the impetus for Reichelderfer to assign Simpson to design research projects to describe all aspects of hurricanes. Data gathering included flights into the eyes of hurricanes and typhoons, and Simpson was on those flights. Being single he had time to devote to what would become his "niche" area of expertise. Excellent Canadian meteorologists who found their "niche" include Godson in atmospheric research, Markham in ice, Thomas in climatology, Phillips in media presentation and Robertson (also over 100!) in agrometeorology, to mention just a few. Realizing that a doctorate was necessary to continue research, supported by Reichelderfer, Simpson spent 1960 and 1961 at University of Chicago when he obtained the coveted PhD and then returned to research in Washington.

The early "hurricane hunter" flights provided not only position and strength information but also many data sets which Simpson and others would use later to better understand tropical cyclones. Bob White succeeded Reichelderfer in 1964 and he was soon immersed in the type of resource politics and reorganizations, common also in Canada. The venerable US Weather Bureau became ESSA and then NOAA just like MSC became Atmospheric Environment Service (AES), and then back to MSC. Hurricane research continued but struggled for funding in quiet seasons. However, Bob soon began collaborations with another researcher, Joanne Malkus, who was investigating cumulus clouds and their role in hurricanes. In the early 1960s, their studies led to *Project Stormfury* which was a storm "seeding" effort to try to alter and diminish powerful hurricanes before they hit populated areas. These experiments coincided in time with MSC's efforts to seed storms (with silver iodide) in Northern Ontario – Quebec border area. In both countries, politics got in the way, false information was disseminated by the media and, after significant effort and many flights, results from both were inconclusive, ending these projects. Far more successful was the 45-year marriage to Joanne, which began in 1965.

In 1968, the Simpsons moved again to Miami where Bob was appointed Head of the National Hurricane Centre (NHC). There he reorganized, continued research and remained until retirement from government service. During his time at NHC, he and colleague Herb Saffir developed the enduring hurricane classification system, called the ***Saffir-Simpson Scale***, which is like the *Fujita* (or F category scale) for tornados. This scale is Bob Simpson's enduring legacy.

In retirement, Bob and Joanne continued to consult and do research, both with their own company and at various universities. They also travelled extensively and helped with World Meteorological Organization (WMO) projects GARP and GATE, both well known to many *Bulletin* readers. Finally, it is worth noting that Bob Simpson's main mentor, Francis Reichelderfer, became the first President of WMO (1951-1955). This is the same position now occupied by MSC's David Grimes who is starting a second four-year term.

Undefined acronyms:
GARP - Global Atmospheric Research Project
GATE - GARP Atlantic Tropical Experiment
NOAA - National Oceanic and Atmospheric Administration
ESSA - The Environmental Science Services Administration (part of NOAA)

Global Warming: The Complete Briefing Fifth Edition

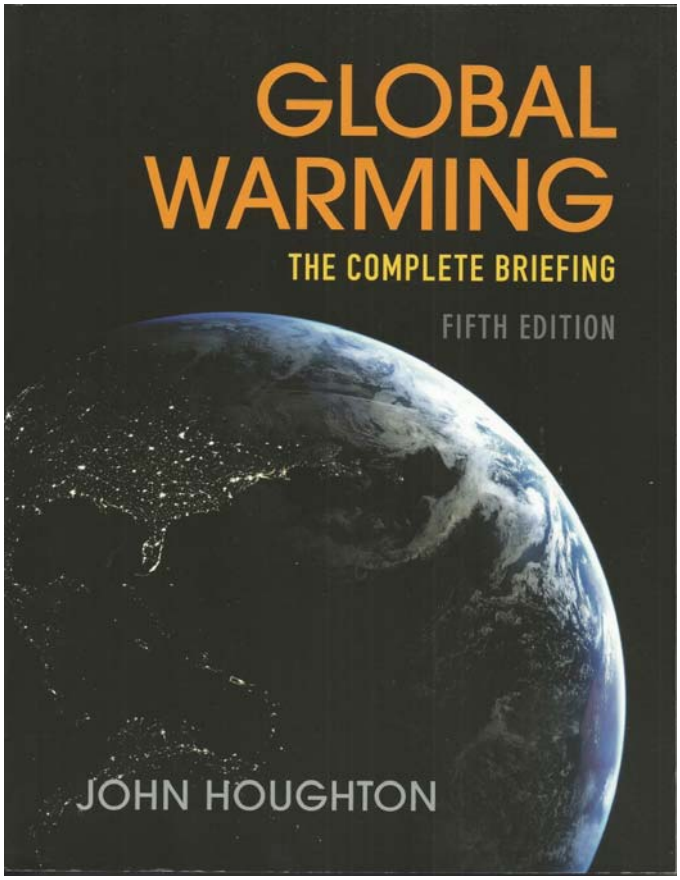
by John Houghton

Cambridge University Press, 978-1-107-46379-0, 2015
Paperback, 380 pages, $59.95

Book reviewed by John Stone[3]

Sir John Houghton has just had published the fifth edition of his much, and deservedly, acclaimed book, *Global Warming: The Complete Briefing*. This brings earlier versions up to date with the material in the 5th Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Sir John was co-chair of IPCC's Science Working Group for the first three Assessment Reports and earlier editions of his book clearly benefitted from his extensive familiarity with the science of climate change. The latest two editions (2009 and 2015) are enhanced by the IPCC's 4th and 5th Assessment Reports (2007, 2014). It is interesting to follow the development of some elements of the science as reflected in Sir John's book.

In the final stages of the preparation of the IPCC's 4th Assessment Report (AR4) there were two especially difficult topics: sea-level rise and tropical cyclones. Sea level rise is critically important because of the threat to much of the world's coastal urban development. The AR4 was criticized at the time for being too conservative on estimates of future sea-level rise because of the uncertainties in the many processes involved, particularly involving the Greenland and Antarctic ice-sheets. The AR4 found that these ice-sheets had *very likely* contributed to sea-level rise but (like the 3rd Assessment Report TAR) the sum of the climate contributions identified at the time was estimated to be smaller than the observed. The AR5 is more exhaustive in identifying the climate contributions. The two largest contributions since 1993 are ocean thermal expansion (1.1 mm per year) and changes in land glaciers (0.76 mm per year) followed by the two major ice-sheets (together 0.6 mm per year) and land water storage (0.38 mm per year). Sir John, in his book, maintains that while contributions from the ice-sheets have been relatively small (the increase in snowfall and melting being in rough balance), beyond the 21st century both ice-sheets may pass tipping points which could lead to significant sea-level rise. However, according to the AR5 there is currently no consensus in the scientific community on such conclusions based as they are on semi-empirical models.



Tropical cyclones are not only scientifically interesting as powerful physical phenomenon but, as hurricanes Katrina and Sandy showed, they can cause devastation and social disruption. At the time of the AR4 there was a very lively debate within the climate science community regarding tropical cyclones; the observational evidence was limited and the mechanics of their formation and development was not well understood. The AR4 concluded that there was no clear trend in the annual number of tropical cyclones (with the exception of the North Atlantic since 1970). Seven years later the AR5 still put low confidence on long-term observed changes but strengthened the conclusion regarding the North Atlantic. The AR5 also downgraded confidence in conclusions regarding human contribution to past trends. As far as future occurrences, the AR4 concluded that globally it is

[3] Retired Meteorologist and Adjunct Research, Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, Ontario

likely tropical cyclones will increase in intensity but are expected to be less frequent. The AR5 basically confirmed these conclusions for the 21st century. Sir John in his book adds very little to these IPCC findings except to discuss the role of regional-scale models in making projections of what is a relatively small-scale phenomenon.

This is a book for students and laymen; each chapter containing questions for the reader, suggestions for further reading, and extensive end-notes. It is a pity, however, that Sir John didn't take the opportunity to give some sense of the scientific debate regarding these two controversial aspects of climate change. Such a discussion would provide useful (and encouraging) insight into how science evolves and scientists operate. It is also disappointing that Sir John doesn't discuss the controversy regarding the "hiatus" in the global atmosphere temperature trend over the past couple of decades. This prompted climate change nay-sayers to declare that climate change was over (if it ever existed). The controversy occurred during the drafting of the AR5. This meant that the Report could not take into account the latest scientific publications. Thus the AR5's only comment is that due to natural variability trends based on short records do not in general reflect long-term climate trends. The consensus view now is that 90% of the warming has gone into the oceans leaving less to go into the atmosphere. However, more recently it has been argued that the temperature record was actually in error and so perhaps there was no hiatus after all. Such illustrations of how science progresses would immeasurably increase the value of Sir John's book.

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

Latest Books received / Derniers livres reçus

2015-3) *An Observer's Guide to Clouds and Weather, A Northern Primer on Prediction*, by Tony Carlson, Paul Knight, and Celia Wyckoff, American Meteorological Society and distributed by the University of Chicago Press, ISBN 978-1-935-70458-4, Paperback, 210 pages, US$30.00.

2015-4) *Thermodynamics, Kinetics, and Microphysics of Clouds*, by Vitaly I. Khvorostyanov and Judith A. Curry, Cambridge University Press, 978-1-107-01603-3, Hardback, 782 pages, $108.95.

2015-6) Applied Thermodynamics for Meteorologists, by Sam Miller, Cambridge University Press, 978-1-107-10071-8, Hardback, 385 pages, $92.95.

Note from the Co-Editor: CMOS *Bulletin* readers may refer to the review also writen by John Stone of the fourth edition of John Houghton's book *"Global Warming: The Complete Briefing*" in *CMOS Bulletin SCMO*, Vol.37, No,5, pages 170-171. Dov Richard Bensimon also wrote a review of the same book in the same issue of the *Bulletin* on page 172.

COMING SOON!

Special Issue on Meteorology and Oceanography in the Arctic

The Arctic Special Interest Group, known as the **ArcticSIG**, is celebrating its second year by producing a special issue of the CMOS Bulletin. It will focus on meteorology and oceanography in the Arctic, but may have some linked information about living carbon clusters (ie creatures) as well.

Please contact the Chair of the ArcticSIG, **Helen Joseph** (helen@hcjconsulting.ca), or the special issue coordinator, **Ann McMillan** (mcmillan@storm.ca), with articles and notices of interest in this context. Note the deadline for input is **November 6, 2015**.

BIENTÔT!

Numéro spécial sur la météorologie et l'océanographie dans l'Arctique

Le groupe d'intérêts spéciaux pour l'Arctique, connu sous le sigle **ArcticSIG**, célèbre son deuxième anniversaire en publiant un numéro spécial du *CMOS Bulletin SCMO*. Celui-ci portera sur la météorologie et l'océanographie dans l'Arctique, mais pourra aussi comporter des informations connexes sur des organismes vivants.

Veuillez communiquer avec la présidente du groupe pour l'Arctique, **Helen Joseph** (helen@hcjconsulting.ca), ou avec la coordonnatrice du numéro spécial, **Ann McMillan** (mcmillan@storm.ca), pour soumettre un article ou un avis d'intérêt pertinents. Notez que la date de tombée est le **6 novembre 2015**.

BRIEF NEWS / NOUVELLES BRÈVES

Professor Mysak honoured at the IUGG Meeting in Prague

Professor Lawrence Mysak

At the close of the 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), in Prague, on July 1, 2015, Canada Steamship Lines Emeritus **Professor Lawrence Mysak** was elected an inaugural Fellow of IUGG for "*exceptional research contributions and international cooperation*".

Also at the same General Assembly, the President of IAPSO (International Association for the Physical Sciences of the Oceans) presented to **Professor Mysak** a certificate of appreciation "*for providing outstanding leadership to IAPSO, especially during his term as President, 2007-2011*".

John Gyakum, Chair of Department of Atmospheric and Oceanic Sciences, McGill University

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University of British Columbia Alumni Award of Distinction for 2015

Former Assistant Deputy Minister for Atmospheric Environment Service, Environment Canada, **Professor Gordon McBean,** has been awarded the University of British Columbia (UBC) Alumni Award of Distinction for 2015. Professor McBean is an internationally recognized Canadian climate scientist and climate change expert. He has been elected President of the International Council for Science (ICSU). See *CMOS Bulletin SCMO*, Vol.42, No.5, page 171, October 2014.

The award will be presented to Professor McBean at the alumni UBC Achievement Awards celebration on October 27, 2015.

Professor McBean was born and educated in Canada, and obtained a PhD in physics (1970) from the University of British Colombia, Vancouver. After an academic and research career that included serving as Professor of Atmospheric and Oceanographic Sciences at UBC, he was appointed Assistant Deputy Minister in Environment Canada, and was, from 1994 to 2000, responsible for

Professor Gordon McBean delivering his Presidential address at the ICSU meeting in Auckland, New Zealand, in September 2014

climate, weather, and air quality sciences and services in the federal government. He currently holds chairs in the Departments of Geography and Political Science at the University of Western Ontario, London, Canada, and is Director of Policy Studies at the Institute for Catastrophic Loss Reduction there. His research interests are in atmospheric and climate sciences, ranging in scope from natural phenomena, and the hazards they generate, to the policies of governments and responses of people to them.

A leader in climate science, Dr. Gordon McBean has led global efforts to raise awareness about climate change impacts and played a key role in the development of the Intergovernmental Panel on Climate Change (IPCC) and in 2007, with his IPCC colleagues and Al Gore, was awarded the Nobel Peace Prize.

Dr. Philip Boyd
2015 A. G. Huntsman Award Recipient

The A.G. Huntsman Foundation is pleased to announce that the 2015 A.G. Huntsman Award will be presented to **Dr. Philip Boyd** of the University of Tasmania. The award ceremony will take place at 2PM on Friday 11 December 2015 at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Following the ceremony, Dr. Boyd

will present a distinguished lecture entitled "*Ocean Global Change Biology – unravelling a Gordian Knot*".

The A.G. Huntsman Award Medal

The Royal Society of Canada will present the 2015 A.G. Huntsman Award to Dr. Boyd to recognize his research contributions to marine science, which include his remarkable ability to conceive and lead trans-disciplinary projects that have resulted in a more realistic understanding of a wide range of inextricably linked ocean processes. Dr. Boyd is a leading world expert on a range of topics including: iron biogeochemistry and ocean iron fertilization; the ocean biological pump and organic matter export; and climate change impacts on ocean planktonic ecosystems.

The A.G. Huntsman Award was established by the Bedford Institute of Oceanography in 1980 to recognize excellence of research in, and outstanding contribution to, the marine sciences. The award honours those men and women, of any nationality, who have had, and continue to have, a significant influence on the course of marine scientific thought. The award was created to honour the memory of Archibald Gowanlock Huntsman (1883–1972), pioneer Canadian oceanographer and fishery biologist.

Participate in the Joint Assembly of IAPSO-IAMAS-IAGA in Cape Town, South Africa, 27 August - 1 September, 2017. See http://www.iapso-iamas-iaga2017.com

STOP PRESS

IN MEMORIAM

Edgar Cormier (MT 26)


M. Edgar Cormier

À Lachine, le 8 septembre 2015, à l'âge de 70 ans, s'est éteint Edgar Cormier. Il laisse dans le deuil Gloria (Godin), son épouse depuis 47 ans, sa fille Lyne (Patrick), son fils Martin (Anne), ses petites-filles Roxane et Gabrielle, son père Cuthbert, ses frères Jean (Nicole), Denis (Aurella), Roméo (Marie-Cécile), Serge, Wilbert (Diane), ses sœurs, Marguerite (Bernard), Gracienne et Yolaine, ses beaux-frères Léonard Godin (Raymonde) et Robert McGouey (Doreen), sa belle-sœur Evelyne Malik (Aijaz), ainsi que de nombreux neveux, nièces et amis.

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2016 Joint Scientific Congress of CMOS and CGU
Congrès scientifique 2016, SCMO, UGC

Monitoring of and Adapting to Extreme Events and Long-Term Variations

L'adaptation aux événements extrêmes et aux variations à long terme et leur surveillance

Photos: City of Fredericton
Art: MCS

Fredericton, NB

29 mai – 2 juin / May 29 – June 2, 2016

http://congress.cmos.ca

Canadian Meteorological and Oceanographic Society
La Société canadienne de météorologie et d'océanographie

Canadian Geophysical Union
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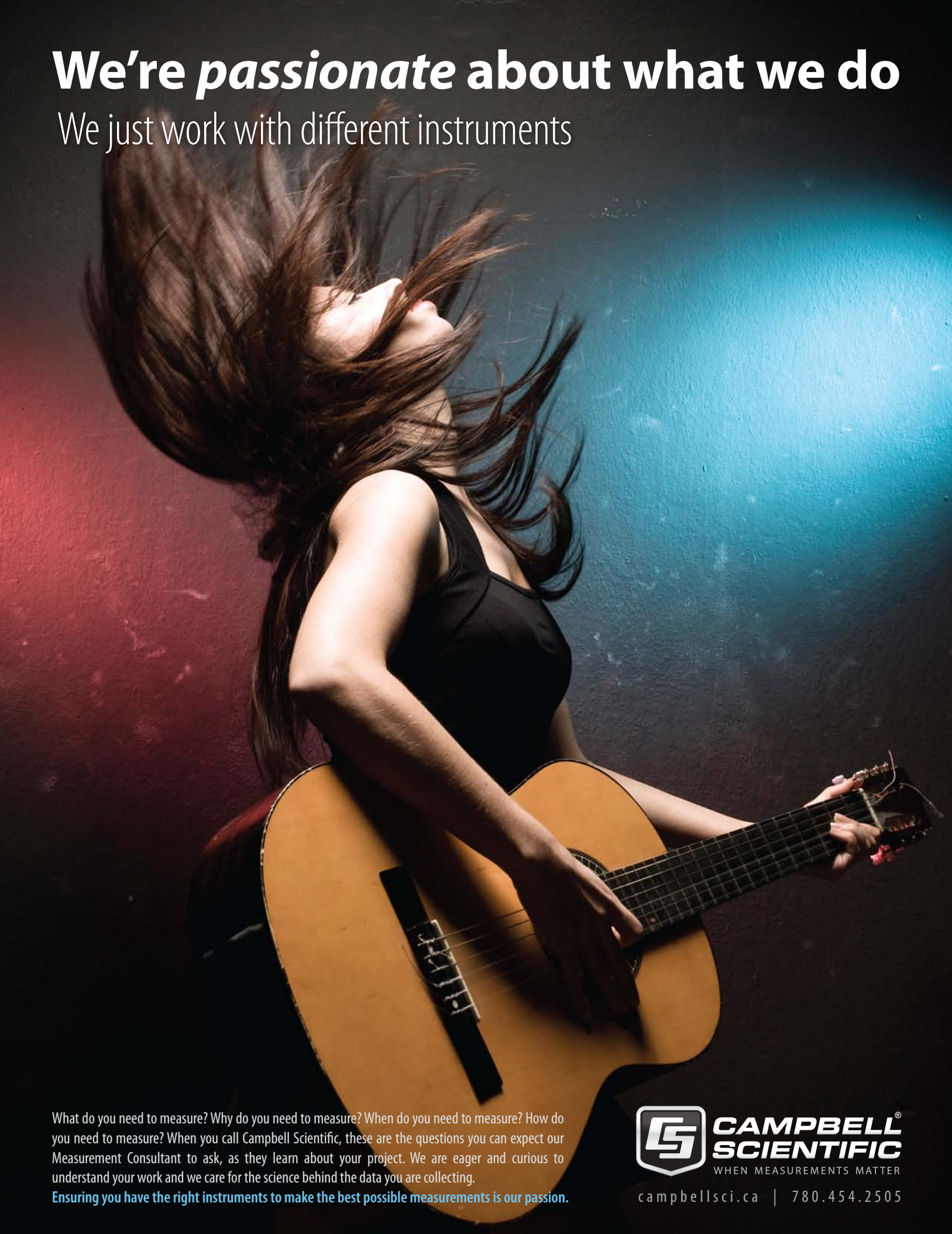

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