ISSN 1929-7726 (Online / En ligne)

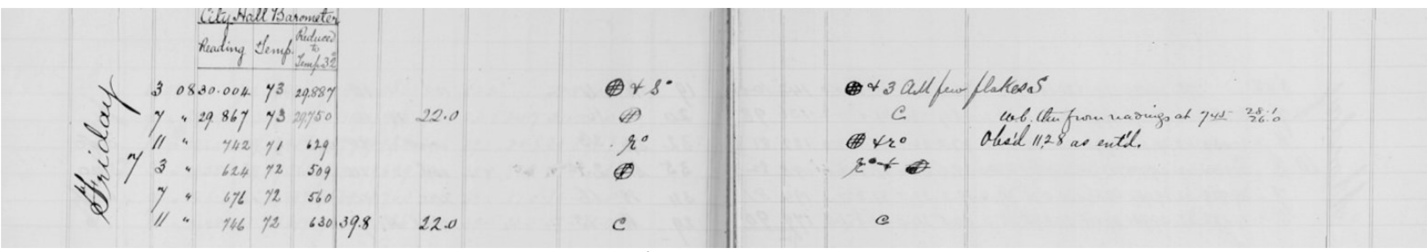
CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

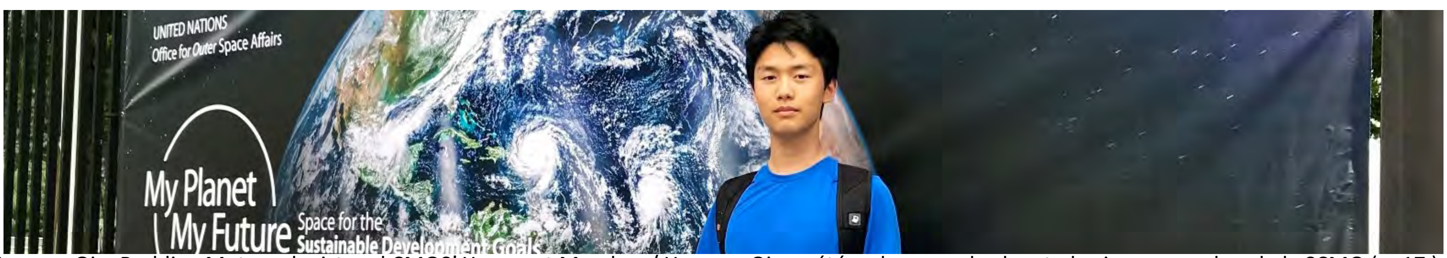
La Société canadienne de météorologie et d'océanographie

August / août 2019 Vol. 47 No. 4

Updated CMOS Position on Climate Change / Énoncé de position de la SCMO sur les changements climatiques (p.7)



Historical Weather Data Rescue with McGill's DRAW / Sauvetage de données météorologiques historiques avec l'initiative SAM (p. 11)



Haowen Qin, Budding Meteorologist and CMOS' Youngest Member / Haowen Qin, météorologue en herbe et plus jeune membre de la SCMO (p. 17)

Working for Our Members, So They Can Work for Science / Travailler pour nos membres pour qu'ils se consacrent à la science (p.4)

Climate in the Age of Empire: Weather Observers in Colonial Canada (p. 29) and Verner Suomi: the Life and Work of the Founder of Satellite Meteorology (p. 27)

CMOS Bulletin SCMO
Volume 47 No. 4
August 2019 - août 2019

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.: 613-990-0077
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

Working for Our Members, So They Can Work for Science

The news is awash with stories of ongoing, climate-related disasters from the tropics to the Arctic. On the date that I write this, the Amazon rainforest is seeing wildfires raging at a rate well beyond normal. With the dry season running until October, there is no immediate end in sight, and global concern is rising daily. Meanwhile, just a few weeks ago, the US National Snow and Ice Data Center reported record-breaking melting of the Greenland ice sheet, with total melt runoff estimated at 55 billion tons, enough to fill 22 million Olympic-sized swimming pools with water.

At times like these, societies like CMOS are more important than ever. With a scientific membership numbering more than 700, CMOS brings together weather, atmosphere, ocean and climate scientists from across Canada.

Incoming and outgoing CMOS Presidents Kimberly Strong (centre) and Paul Kushner (standing, right) with University of Toronto graduate students and postdoctoral fellows at the 2019 CMOS Banquet. Photo credit: Marek Stastna

And surely, there is vital work that needs to be done right now within the scientific community to support our changing world. As CMOS President, one of my jobs is to ensure that we support our members in the best way possible, to do their best work for our environment and for our nation. I would like to take this opportunity to share with you some recent progress on CMOS activities related to the three themes that I plan to focus on over the next year.

CMOS Outreach and Visibility

As a scientific society whose members include many internationally recognized experts in atmospheric, oceanographic, and climate science, CMOS is uniquely positioned to provide objective scientific information about climate change to Canadians. We have recently released a new position statement on the science and implications of climate change. The full text can be found in this issue of the CMOS Bulletin and at https://www.cmos.ca/site/ps_pos_statements, along with previous position statements. I encourage you to read it and to make use of it when communicating with Canadians about climate change.

Our sister society, the Australian Meteorological and Oceanographic Society has also recently released a Supplementary Statement on the IPCC Special Report on Global Warming of 1.5°C. This statement is supplementary to our CMOS Statement on the IPCC Special Report on Global Warming of 1.5°C released in November 2018, which AMOS endorsed earlier this year. Also on this topic, you may also be interested in having a look at the American Meteorological Society's recently updated Information Statement on Climate Change.

To remain relevant, CMOS must be active and visible on issues related to atmospheric and oceanic sciences and related environmental disciplines. To this end, CMOS, along with CGU and JPDL Inc. hosted the IUGG General Assembly in Montreal from July 8-18. The conference was a great success, with approximately 3000 talks and 2000 posters from more than 50 countries. I thank the Montreal Centre and all CMOS members who helped organize and run this year's IUGG General Assembly, particularly Dominique Paquin, who did a splendid job as CMOS Liaison for the conference. Congratulations to all who were involved!

CMOS Membership and Student Involvement

New members are essential to the future of CMOS, and to this end, we are working on clearly articulating the role and relevance of the society, as well as the benefits and responsibilities of membership. We have also set up an ad hoc working group to oversee the redesign of the CMOS website over the coming year – if you have thoughts on how we can improve our website, please send them along to me.

A recent analysis has shown that free membership for students, implemented in 2017, has had a positive impact, resulting in student membership almost doubling that year. As a percentage of the total membership, students comprised 14% in 2016, increasing to 25% in 2017 and 23% now.

Words from the President / Mot du présidente

In late July, I met with our new National Student Representative, Ellen Gute, to talk about student engagement in CMOS. Ellen has some great ideas and to help her implement them, we need an active Student Committee. Ellen is the Chair of this committee, which should have one student member from each CMOS Centre. If you'd like to get involved, please contact me.

CMOS Education and Mentorship

There are a number of areas where I wan to strengthen CMOS activities related to education, particularly through revitalizing the School and Public Education Committee (SPEC) and the University and Professional Education Committee (UPEC), and increasing mentorship opportunities, possibly in partnership with our Private Sector Committee (PSC).

One long-standing CMOS activity is supporting the participation of K-12 science teachers in Project Atmosphere and Project Maury, two summer workshops offered by the American Meteorological Society. While Project Maury is co-sponsored by the Canadian National Committee for the Scientific Committee on Oceanic Research (CNC/SCOR), we are seeking a new partner to join CMOS in supporting the future participation of teachers in Project Atmosphere – I welcome any suggestions!

In closing, I thank you for the honour of having been invited to serve as CMOS President this year, and I invite you to get in touch (president@cmos.ca) if you would like to discuss CMOS activities.

Best wishes,

Kim

Kimberly Strong, Professor & Chair, Department of Physics, University of Toronto and Incoming CMOS President
Email: president@cmos.ca

Travailler pour nos membres pour qu'ils se consacrent à la science

Les actualités sont continuellement inondées d'histoires de désastres liés au climat, des tropiques à l'Arctique. Au moment où j'écris ces lignes, la forêt amazonienne, « poumon de notre planète », est la proie d'incendies qui la ravagent à un taux bien supérieur à la normale. Comme la saison sèche s'étend jusqu'en octobre, il y a peu d'espoir d'une fin immédiate, et les préoccupations du monde entier augmentent de jour en jour. En outre, il y a quelques semaines à peine, le National Snow and Ice Data Center des États-Unis a signalé une fonte record de l'inlandsis du Groenland. L'écoulement de l'eau de fonte est estimé à 55 milliards de tonnes, soit le volume de 22 millions de piscines olympiques.

Dans ces moments, des sociétés comme la SCMO s'avèrent plus importantes que jamais. Comptant plus de 700 membres scientifiques, la SCMO réunit des spécialistes de la météorologie, de l'atmosphère, de l'océan et du climat, de partout au Canada.

Et il y a assurément un travail vital à entreprendre dès maintenant au sein de la communauté scientifique afin de soutenir notre monde en mutation. En tant que présidente de la SCMO, l'une de mes tâches consiste à m'assurer que nous appuyons nos membres de la meilleure façon possible, afin qu'ils travaillent pleinement pour notre environnement et notre pays. Je profite de l'occasion pour vous faire part des progrès récents concernant les activités de la SCMO liées aux trois thèmes sur lesquels je compte me concentrer au cours de la prochaine année.

La sensibilisation et la visibilité de la SCMO

En tant que société scientifique dont les membres comprennent de nombreux experts de renommée internationale en sciences de l'atmosphère, de l'océan et du climat, la SCMO est particulièrement bien placée pour fournir aux Canadiens de l'information scientifique objective sur les changements climatiques. Nous avons récemment publié un nouvel énoncé de position sur la science et les répercussions des changements climatiques. Le texte intégral se trouve dans ce numéro du Bulletin de la SCMO et à l'adresse https://www.cmos.ca/site/ps_pos_statements?language=fr_FR&, où paraissent aussi les énoncés précédents. Je vous encourage à le lire et à vous y référer lorsque vous communiquez avec les Canadiens au sujet des changements climatiques.

Words from the President / Mot du présidente

Notre société sœur, l'Australian Meteorological and Oceanographic Society, a aussi récemment publié une déclaration supplémentaire sur le Rapport spécial du GIEC sur le réchauffement planétaire de 1,5 °C (Supplementary Statement on the IPCC Special Report on Global Warming of 1.5 °C). Cette déclaration s'ajoute à la Position de la SCMO sur le rapport spécial du GIEC sur le réchauffement planétaire de 1,5 °C, publié en novembre 2018 et que l'AMOS a appuyé plus tôt cette année. Dans le même ordre d'idée, vous pouvez également consulter le document d'information sur les changements climatiques (Information Statement on Climate Change) récemment mis à jour par l'American Meteorological Society.

Pour demeurer pertinente, la SCMO doit être active et visible quant aux enjeux relatifs aux sciences atmosphériques et océaniques et aux disciplines environnementales connexes. En ce sens, la SCMO, de concert avec l'UGC et JPDL inc., a accueilli à Montréal l'Assemblée générale de l'UGGI, du 8 au 18 juillet. La conférence a été un grand succès, avec environ 3000 présentations et 2000 affiches provenant de plus de 50 pays. Je remercie le centre de Montréal et tous les membres de la SCMO qui ont participé à l'organisation et à la gestion de l'Assemblée générale de l'UGGI, en particulier Dominique Paquin, qui a effectué un excellent travail de liaison entre la SCMO et l'Assemblée. Félicitations pour votre travail!

L'adhésion à la SCMO et la participation des étudiants

Les nouveaux membres sont essentiels à l'avenir de la SCMO et, à cette fin, nous travaillons à formuler clairement la fonction et la pertinence de la société, ainsi que les avantages et les responsabilités des membres. Nous avons également mis sur pied un groupe de travail spécial qui supervisera la refonte du site Web de la SCMO au cours de la prochaine année. Si vous avez des suggestions sur la façon d'améliorer le site Web, n'hésitez pas à m'en faire part.

Une analyse récente a montré que l'adhésion gratuite pour les étudiants, mise en œuvre en 2017, a eu un effet positif et a permis de presque doubler le nombre d'étudiants cette année-là. Les étudiants représentaient 14 % de l'effectif en 2016 et 25 % en 2017. Maintenant, les étudiants comptent pour 23 % des membres.

À la fin de juillet, j'ai rencontré notre nouvelle représentante nationale des étudiants, Ellen Gute, afin de parler de la participation des étudiants à la SCMO. Ellen a d'excellentes idées, et pour lui permettre de les mettre en œuvre nous avons besoin d'un comité étudiant dynamique. Ellen préside ce comité qui devrait se composer d'un membre étudiant issu de chaque centre de la SCMO. Si vous souhaitez faire partie du comité, n'hésitez pas à communiquer avec moi.

L'éducation et le mentorat au sein de la SCMO

Je souhaite renforcer les activités de la SCMO relativement à un certain nombre de thèmes éducatifs, notamment en revitalisant le comité d'éducation publique et scolaire (CEPS) et le comité d'éducation professionnelle et universitaire (CEPU), et en augmentant les occasions de mentorat, peut-être en partenariat avec notre comité du secteur privé (CSP).

La SCMO soutient depuis longtemps la participation d'enseignants en sciences, de la maternelle à la 5e secondaire, au Projet atmosphère et au projet Maury, deux ateliers d'été qu'offre l'American Meteorological Society. Tandis que le projet Maury est cofinancé par le Comité national canadien pour le Comité scientifique pour les recherches océaniques (CNC pour le SCOR), nous sommes à la recherche d'un nouveau partenaire pour financer la participation future des enseignants au Projet atmosphère… je suis ouverte à toute suggestion!

En terminant, je vous remercie de l'honneur que vous m'avez accordé en me confiant cette année la présidence de la SCMO, et je vous invite à communiquer avec moi (president@scmo.ca) si vous souhaitez discuter des activités de la Société.

Amicalement,

Kim

Kimberly Strong, Présidente de la SCMO, professeure au département de physique de l'Université de Toronto
Courriel : president@scmo.ca

Updated CMOS Position on Climate Change

The process of revising the CMOS position statement on climate change:

In August 2019, the CMOS Council approved a revised position statement on climate change. The previous statement dated from 2014 and important developments in the science of climate change had occurred in the intervening years. In particular, the 2018 release of the Intergovernmental Panel on Climate Change's Special Report on 1.5 C and the 2019 release of Canada's Change Climate Report (CCCR). CMOS members made important contributions to these assessment reports, and they have important implications for Canadian society. The revised statement (below, and on the CMOS website) is designed to highlight these and communicate the basic physical science of climate change.

The CMOS Scientific Committee undertook the revision in spring 2019, after CCCR was published. The committee surveyed the climate change statements of other professional societies. There was a consensus that the shorter statements were more effective to communicate to the public and policymakers: less is more. The committee established a goal of an approximately two-page statement in the form of a list of bullet points. The latter choice was inspired by the Canada's Changing Climate Report "Headline Statements", an excellent distillation of the lengthy underlying report. To make explicit that the CMOS statement on climate change builds on extensive national and international assessment reports, which include the references to underlying peer-reviewed publications, there are links to the web addresses of four reports.

After the Scientific Committee co-chairs Timothy Merlis and Clark Richards produced a draft statement, the majority of Scientific Committee members and several CMOS Councilors offered suggestions for revision to ensure the statement was clear and precise. This drew on the broad scientific expertise of the Scientific Committee and the experience of the past Scientific Committee chair Adam Monahan, who led the writing of the previous statement. In the process of producing a shorter, hopefully more effective statement, some existing material was removed. This is a delicate balance and subsequent statements may be longer to include new developments or science that become prominent in public discourse. At the moment, our view is that the highest priority for CMOS is to effectively communicate the basic science of anthropogenic climate change and its impacts on Canada.

[This position statement was authored by the Scientific Committee of CMOS, and approved by CMOS Council on August 26, 2019.]

The Canadian Meteorological and Oceanographic Society (CMOS) is a national society of individuals and organizations dedicated to advancing atmospheric and oceanic sciences, as well as related environmental disciplines. CMOS has more than 700 members from Canada's major research centres, universities, private corporations, and government institutes. CMOS is uniquely positioned to provide scientific information to Canadians on the science of climate change. Many of its members are internationally recognized scientists who are extensively involved in comprehensive assessments of the current state of knowledge with respect to this complex issue. Such assessments require atmospheric and ocean scientists working together with scientists in related environmental, social, and economic disciplines to advise policymakers and the public on climate change.

This statement on the science and implications of climate change draws on national and international assessment reports, such as Canada's Changing Climate Report (2019), the World Meteorological Organization Statement on the state of the global climate in 2018 (2019), the United Nations Intergovernmental Panel on Climate Change Special Report Global Warming of 1.5° C (2018), and the United Nations Intergovernmental Panel on Climate Change Fifth Assessment Report (2013). These reports include references to underlying peer-reviewed scientific literature upon which this statement is based.

- Earth's climate—arising from the interaction of the atmosphere, ocean, ice, land surface, and living things—undergoes changes from both human activity and natural causes.
- Knowledge of climate change is based on observations of the climate and scientific understanding of physical, chemical, and biological processes.
- Humans influence the climate through changing the atmosphere's composition, primarily through emissions of greenhouse gases as a result of combustion of fossil fuels and deforestation. Carbon dioxide (CO2) is the dominant human-emitted greenhouse gas. The current CO2 concentration is approximately 50% above the

Updated CMOS Position on Climate Change

- Human activity has been the main cause of the observed increase in temperature since the middle of the 20th century. The four recent years (2015-2018) have been the warmest years on record for global surface temperature. A long-term warming will continue in the 21st century, although individual months or years will also be affected by natural climate variations.
- Changes in climate result in responses in average and extreme temperature and precipitation, as well as in wind, sea level, snow and ice cover. There are also numerous other responses, such as ocean acidification and deoxygenation. Many of these responses, including those attributed to human activity, have already been observed and are predicted to continue in the future.
- Change has both global (e.g., increasing surface temperature) and regional (e.g., reduction of Arctic sea ice) effects. Important effects specific to Canada, drawing on Canada's Changing Climate Report 2019 include the following:
  - Warming in Canada is, on average, about double the magnitude of global warming. Northern Canada has warmed and will continue to warm at more than double the global rate.
  - The effects of warming in Canada include more extreme heat, less extreme cold, longer growing seasons, increased precipitation in most areas, increased wildfire risk, shorter snow and ice cover seasons, earlier spring peak streamflow, thinning glaciers, thawing permafrost, increased coastal erosion, rising sea level, and more frequent coastal flooding.
  - Canadian areas of the Arctic and Atlantic Oceans have experienced longer and more widespread sea ice -free conditions. Canadian Arctic marine areas, including the Beaufort Sea and Baffin Bay, are projected to have extensive ice-free periods during summer by mid-century. The last area in the entire Arctic with summer sea ice is projected to be north of the Canadian Arctic Archipelago.
  - Because some further warming is unavoidable as a result of past and present emissions, these trends will continue over the next century.
- Future climate projections are based on scientific understanding of physical, chemical, and biological processes that affect climate and estimates of future human activity. There is uncertainty in projections that results from both incomplete scientific understanding and uncertain future human activity. Reducing the uncertainty that arises from incomplete scientific understanding of climate change and quantitatively assessing natural climate variations are core professional goals of many CMOS members.
- A range of future human greenhouse gas emission scenarios are used to inform climate change impact assessment, climate risk management, and policy development. Important climate change effects associated with various emission scenarios are summarized below.
  - With current emission reduction plans and commitments, the future temperature and sea level changes are likely to result in averaged surface temperature increases of 4-6 °C for Canada (even higher for northern regions) and coastal sea level rises approaching 1 metre for some populated parts of Canada by the end of the century.
  - High emissions scenarios, which closely mirror today's business as usual emissions, will have substantially more future climate change effects than this.
  - Scenarios with limited warming will only occur if Canada and the rest of the world reduce net carbon dioxide emissions to near zero early in the second half of the century and reduce emissions of other greenhouse gases substantially. To limit global warming to 1.5°C by 2100, projections indicate we must achieve net zero emissions globally by approximately 2050.

CMOS strongly endorses the results of the recent Government of Canada's Changing Climate Report, and, in collaboration with researchers, citizens, governments and industry, stands ready to work collectively toward rapid decarbonization of the economy and investment in renewable energy sources. CMOS is also committed to assisting Canadians learn how to adapt to the climate changes to which we are already committed, for both present and future generations.

Link to this, and other, CMOS position statements: https://cmos.ca/site/ps_pos_statements

Énoncé de position de la SCMO sur les changements climatiques

---

Le processus de révision de la déclaration de position de la SCMO sur le changement climatique

En août 2019, le Conseil de la SCMO a approuvé une déclaration de position révisée sur le changement climatique. La déclaration précédente datait de 2014 et des développements importants dans la science du changement climatique avaient eu lieu dans l'intervalle. En particulier, la publication en 2018 du rapport spécial du Groupe d'experts intergouvernemental sur l'évolution du climat sur le 1,5 C et la publication en 2019 du Rapport sur le climat de changement du Canada (RCCC). Les membres de la SCMO ont grandement contribué à ces rapports d'évaluation, ce qui a des conséquences importantes pour la société canadienne. La déclaration révisée est conçue pour mettre en évidence celles-ci et communiquer la science physique fondamentale du changement climatique.

Le comité scientifique de la SCMO a entrepris la révision au printemps 2019, après la publication du RCCC. Le comité a examiné les déclarations sur le changement climatique d'autres sociétés professionnelles. Il y avait un consensus sur le fait que les déclarations plus courtes étaient plus efficaces pour communiquer avec le public et les décideurs: moins c'est plus. Le comité s'est fixé comme objectif une déclaration d'environ deux pages sous la forme d'une liste de points. Ce dernier choix a été inspiré par le rapport intitulé "Énoncés principaux" du Rapport sur le climat changeant du Canada, un excellent résumé du long rapport sous-jacent. Pour expliquer que la déclaration de la SCMO sur les changements climatiques s'appuie sur de nombreux rapports d'évaluation nationaux et internationaux, qui incluent les références aux publications sous-jacentes revues par des pairs, des liens vers les adresses Internet de quatre rapports sont disponibles.

Après que les coprésidents du comité scientifique, Timothy Merlis et Clark Richards, eurent rédigé un projet de déclaration, la majorité des membres du comité scientifique et plusieurs conseillers de la SCMO ont proposé des suggestions de révision pour garantir que la déclaration soit claire et précise. Cela s'appuie sur la vaste expertise scientifique du Comité scientifique et sur l'expérience de l'ancien président du Comité scientifique, Adam Monahan, qui a dirigé la rédaction de la déclaration précédente. Dans le processus de production d'une déclaration plus courte, espérons-le plus efficace, certains éléments existants ont été supprimés. Il s'agit d'un équilibre délicat et les déclarations ultérieures risquent d'être plus longues pour inclure de nouveaux développements ou de nouvelles données scientifiques qui occuperont une place prépondérante dans le discours public. À l'heure actuelle, nous estimons que la principale priorité de la SCMO est de communiquer efficacement les connaissances scientifiques de base sur les changements climatiques anthropiques et leurs répercussions sur le Canada.

[Cet énoncé de position a été rédigé par le comité scientifique de la SCMO et approuvé par son conseil d'administration le 26 août 2019.]

La Société canadienne de météorologie et d'océanographie (SCMO) est une société nationale de particuliers et d'organismes dévoués à l'avancement des sciences atmosphériques et océaniques, et d'autres sciences de l'environnement connexes. La SCMO compte plus de 700 membres, provenant de centres de recherche majeurs, d'universités, d'entreprises privées et d'organismes gouvernementaux canadiens. Elle reste la mieux placée pour fournir aux Canadiens de l'information scientifique en matière de changements climatiques. Bon nombre de ses membres jouissent d'une reconnaissance internationale dans leur domaine d'expertise scientifique. Ils participent activement aux évaluations approfondies établissant l'état actuel des connaissances, en ce qui concerne cet enjeu complexe. Ces évaluations nécessitent une étroite collaboration entre les scientifiques étudiant l'atmosphère et l'océan, et les spécialistes de l'environnement, de la société et de l'économie, afin de conseiller les décideurs et le public en matière de changements climatiques.

Cet énoncé sur la science et les incidences des changements climatiques s'appuie sur des rapports d'évaluation nationaux et internationaux, comme le Rapport sur le climat changeant du Canada 2019 , la Déclaration de l'Organisation météorologique mondiale sur l'état du climat mondial en 2018, le Rapport spécial sur le réchuffement planétaire de 1,5 °C issu du Groupe d'experts intergouvernemental sur l'évolution du climat relevant de l'Organisation des Nations Unies (2018) et le Cinquième Rapport d'évaluation du Groupe d'experts intergouvernemental sur l'évolution du climat (2013). Ces rapports contiennent des références à de la documentation scientifique sous-jacente évaluée par des pairs, sur laquelle se fonde cet énoncé.

- Le climat de la Terre, que régissent les interactions entre l'atmosphère, l'océan, la glace, la surface terrestre et les êtres vivants, évolue à la fois sous l'action d'activités humaines et de causes naturelles.
- Les connaissances en matière d'évolution du climat sont fondées sur l'observation du climat et la compréhension scientifique des processus physiques, chimiques et biologiques.
- Les humains influent sur le climat en modifiant la composition de l'atmosphère, principalement par l'émission de gaz à effet de serre émanant de combustibles fossiles et par la déforestation. Le dioxyde de carbone (CO2) est le principal gaz à effet de serre qu'émettent les humains. La concentration actuelle de CO2 est d'environ 50 %

Énoncé de position de la SCMO sur les changements climatiques

- L'activité humaine s'avère la principale cause de l'augmentation de la température observée depuis le milieu du XXe siècle. Les quatre dernières années (2015 à 2018) ont été les plus chaudes jamais enregistrées en ce qui concerne la température en surface mondiale. Un réchauffement à long terme se poursuivra au XXIe siècle, même si certains mois ou années suivent aussi la variabilité naturelle du climat.
- Les changements climatiques entraînent des réactions sur le plan des températures et des précipitations moyennes et extrêmes, et quant au vent, au niveau de la mer, à la neige et à la glace. D'autres réactions se feront sentir, comme l'acidification et la désoxygénation des océans. Bon nombre de ces réactions, y compris celles que produit l'activité humaine, ont déjà été observées et elles devraient se poursuivre dans le temps.
- L'évolution du climat génère des effets mondiaux (p. ex. l'augmentation de la température en surface) et régionaux (p. ex. la réduction de la glace de mer arctique). Les effets importants propres au Canada, tirés du Rapport sur le climat changeant du Canada 2019 comprennent ce qui suit:
  - En moyenne, au Canada, le réchauffement est environ deux fois plus élevé que le réchauffement planétaire. Le Nord du Canada s'est réchauffé et continuera de le faire deux fois plus rapidement que le taux mondial.
  - Les effets du réchauffement au Canada comprennent des chaleurs plus intenses, moins de froid extrême, des saisons de croissance allongées, des précipitations accrues dans la plupart des régions, un risque supérieur d'incendies de forêt, des périodes plus courtes avec couvertures de neige et de glace, un débit de pointe printanier précoce, l'amincissement des glaciers, la fonte du pergélisol, une érosion côtière accrue, une hausse du niveau de la mer et des crues côtières plus fréquentes.
  - Les zones canadiennes de l'océan Arctique et de l'océan Atlantique sont restées plus longtemps et plus largement libres de glace de mer. On prévoit que les zones marines de l'Arctique canadien, y compris la mer de Beaufort et la baie de Baffin, connaîtront de longues périodes estivales libres de glace, d'ici le milieu du siècle. La dernière zone arctique où l'on retrouvera de la glace de mer en été se situera vraisemblablement au nord de l'archipel Arctique canadien.
  - Étant donné qu'un réchauffement supplémentaire est inévitable en raison des émissions passées et présentes, ces tendances se poursuivront au cours du prochain siècle.
- Les projections climatologiques se fondent sur la compréhension scientifique des processus physiques, chimiques et biologiques qui régissent le climat et sur des estimations de l'activité humaine future. Ces projections sont sujettes à une certaine incertitude en raison d'une compréhension scientifique incomplète et d'une activité humaine future plus ou moins prévisible. Réduire l'incertitude qui découle d'une compréhension scientifique incomplète de l'évolution du climat et évaluer quantitativement les variations climatiques naturelles sont les objectifs professionnels de nombreux membres de la SCMO.
- Une série de scénarios d'émission de gaz à effet de serre est à la base de l'évaluation de l'impact des changements climatiques, de la gestion des risques dus au climat et de la planification des politiques. Les effets importants des changements climatiques selon divers scénarios d'émission sont résumés ci-dessous.
  - Selon les plans et les engagements actuels de réduction des émissions, l'évolution de la température et du niveau de la mer se traduira probablement par des augmentations moyennes de la température en surface de 4 à 6 °C pour le Canada (et plus encore dans les régions nordiques) et par une élévation du niveau de la mer de près de 1 mètre, le long de certains littoraux habités du Canada, d'ici la fin du siècle.
  - Les scénarios d'émission élevée, qui reflètent les émissions actuelles, produiront davantage d'effets découlant de l'évolution future du climat.
  - Les scénarios engendrant un réchauffement limité ne se réaliseront que si le Canada et le reste du monde réduisent leur émission nette de dioxyde de carbone à près de zéro dès la seconde moitié du siècle et diminuent considérablement les émissions d'autres gaz à effet de serre. Pour limiter le réchauffement de la planète à 1,5 °C d'ici 2100, nous devons, selon les projections, atteindre mondialement l'objectif d'émission nette zéro, d'ici environ 2050.

La SCMO appuie fortement les résultats du récent rapport du gouvernement du Canada sur le climat changeant du pays et, en collaboration avec les chercheurs, les citoyens, les gouvernements et l'industrie, se tient prête à travailler à la décarbonation rapide de l'économie et à l'investissement dans les sources d'énergie renouvelables. La SCMO s'est également engagée à aider les Canadiens des générations actuelles et futures à s'adapter aux changements climatiques.

Lien vers ceci, et d'autres, énoncés de position CMOS : https://cmos.ca/site/ps_pos_statements

Historical Weather Data Rescue with McGill's DRAW (Data Rescue: Archives and Weather), in Canada and around the world

By Victoria Slonosky, McGill University, Montreal, Canada

To know how the climate is changing, we need to know what the climate was like in the past. Historical weather records are the best and most detailed source of information about climatic changes and extreme weather events over past decades and centuries.

Abstract

In Canada, we are fortunate to have a wealth of historical weather records going back over three centuries. Many of these records, however, still exist only in paper format, and so are unavailable for scientific use. "Data rescue" is the process of locating and transforming historical records into machine readable format, with groups around the world in many areas of geoscience working to transform billions of past observations into usable data. McGill's ***DRAW (Data Rescue: Archives and Weather) project*** *aims to rescue the weather observations from the McGill Observatory (1864-1963). With millions of observations recorded on thousands of pages for a century, the task is an enormous one. DRAW is turning for help to crowdsourcing by building a citizen science website where volunteers can go to learn about our scientific heritage and help save our historical weather observations.*

Some results using historical data from the Saint Lawrence Valley region suggest increased climatic volatility in the early 19th century, with a high number of heat waves as well as cold spells in the first few decades of the 19th century. Very preliminary results from some DRAW data suggest an intriguing possibility of high levels of atmospheric particulates or pollution in the late 19th century. Finally, as weather observers also recorded descriptive observations along with instrumental readings, it's possible to look at how changes in specific weather conditions, such as blowing snow, have changed over time. These results suggest that while observations by human observers are broadly comparable over time, recent changes to observing practices involving automatic weather stations or processing of data may make more recent data incompatible with hundreds of years of past records.

CALLING ALL CITIZEN SCIENTISTS! DRAW NEEDS YOU!

What is DRAW?

DRAW (Data Rescue: Archives and Weather) is a Canadian web-based crowdsourced site to get the public involved in Canada's weather history and help rescue the McGill Observatory's one hundred year long weather records.

Why are we doing this?

Climate change is a topic on everyone's mind at the moment.

But..how exactly has it changed? What has it changed from? How do we know what the climate was like before? How has it changed in the past?

These are questions that can only be answered by looking back in time.

We are incredibly fortunate (and can thank our scientific predecessors!) that historical records exist, and that with these records, we can find answers to our questions. But many historical records still only exist as numbers written down on paper sheets. To analyse the millions of historical climatic observations we have going back over hundreds of years, they need first to be transformed into machine readable digital formats.

How can you get involved?

Log on to our website at https://citsci.geog.mcgill.ca/, choose the English or French option, set up an account and go through our orientation tutorial.

The records are sometimes complex, and we find it usually takes about 15 minutes to get the hang of using the transcription app. Then start transcribing historical weather data!

We designed the transcription tool, so that the data you type in goes directly to our database. Even if you don't finish an entire page, as you soon you hit the "save" button on the transcription bar, the data you've entered is saved in our database, a few numbers or observations at a time. This helps break up an enormous task into small chunks. Don't worry too much about making mistakes or if you can't read something." The data is all checked at a later stage (and we're hoping to get some checking built in soon, so you can check as you go), so mistakes will be caught, and we've found that so far the data entered by volunteers is remarkably accurate.

Whatever large or small part in this project you can play will help!

APPEL À TOUS LES CITOYENS SCIENTIFIQUES! SAM compte sur vous!

Qu'est-ce que l'initiative SAM?

SAM (Sauvetage d'archives météorologiques ou DRAW en anglais) est un site Web canadien qui permet au public de participer à l'histoire météorologique du Canada et de sauver les archives météorologiques centenaires de l'Observatoire de McGill.

Pourquoi est-ce important?

Les changements climatiques sont le sujet de l'heure.

Mais en quoi le climat a-t-il changé? Quel était le climat passé? Comment savons-nous ce qu'était le climat passé? Quelle a été son évolution jadis?

Ces questions ne trouveront réponse que si nous remontons dans le temps.

Nous sommes incroyablement chanceux (grâce aux scientifiques d'antan!) qu'il existe des relevés historiques et qu'à partir de ceux-ci nous puissions trouver des réponses à nos questions. Mais nombre de ces relevés ne se présentent que sous forme papier, où sont consignées à la main les données qui nous intéressent. Pour analyser les millions d'observations climatologiques remontant à des centaines d'années, il faut d'abord les transformer en information numérique lisible par machine.

Comment participer?

Visitez notre site Web à l'adresse https://citsci.geog.mcgill.ca/, choisissez Anglais ou Français, créez un compte, suivez le tutoriel d'orientation (les relevés sont parfois complexes, il faut donc une quinzaine de minutes pour s'habituer à l'application de transcription) et finalement commencez à transcrire les données météorologiques historiques!

Nous avons conçu l'outil de transcription de façon que les données que vous saisissez soient directement enregistrées dans notre base de données. Même si vous ne terminez pas une page, en cliquant sur le bouton « Sauvegarder » de la fenêtre de transcription, les données que vous avez saisies seront sauvegardées dans la base de données, et ce, quelques données ou observations à la fois. Cela permet de fragmenter une tâche énorme en petites parties. Ne vous inquiétez pas outre mesure des erreurs que vous puissiez commettre ou si vous ne pouvez lire une information. Les données sont toutes vérifiées ultérieurement de sorte que nous détecterons les incohérences. En outre, nous espérons que des mécanismes seront bientôt en place pour que vous puissiez vérifier vos saisies au fur et à mesure. Toutefois, jusqu'à maintenant, nous constatons que les volontaires saisissent les données avec une remarquable exactitude.

Toute contribution compte!

Article: Data Rescue: Archives and Weather (DRAW)

As we continue learning about our weather and climate, and perhaps especially as we learn what we don't yet know, the importance of real-world data and observations becomes ever more apparent. Astonishing feats of physics, mathematics and computing go into modelling of various kinds, including data synthesis, understanding of processes, and short-and long-term forecasting, but science progresses only by holding a constant conversation between theoretical models and observations. Climate, meteorology and the geosciences are largely historical rather than experimental sciences, in the sense that events occur only once in real time on our actual planet. We observe the weather as it happens, and these measurements provide us with our weather and climate data. These observations are then used to further our understanding of extreme events, weather hazards and climatic variability and change. Historical data are thus extremely important, in that they provide us with our only record of actual weather and climate.

At the **2019 IUGG** and concomitant CMOS annual meeting in Montreal this past July, the Joint Session "Old Data for New Knowledge, " organized by Josep Batllo (Institut Cartogràfic i Geològic de Catalunya Spain), and chaired by both him and Kristine Harper (University of Florida), brought together researchers across the geosciences, showing how historical data and records are being used in disciplines across the geosciences to better our understanding of past and current events, from the everyday to the extremely hazardous. Measurements and descriptions of solar magnetic storms capable of disrupting modern communications and infrastructures, community destroying medieval floods, and devasting volcanoes and earthquakes are all locked in mainly paper sources such as technical scientific literature, ships' logs, written documents (including tax accounts and other official records) , and instrumental records such as seismograms. Many of these date back centuries. What they all have in common is that, in Prof. Batllo's definition of historical data, the data they contain "are not available in present form for immediate use."

In the field of weather and climate, researchers around the world have been working to recover and analyse weather observations from historical documents (Figure 1). Those working in this field range from national meteorological services and university researchers and groups to dedicated individuals and even charitable organizations (Fig.1c). Volunteers also play a large role in weather data rescue, from small groups meeting together (Fig 1d) to thousands of people going online to type in weather observations in crowdsourced citizen science projects. Once a year, historical weather and climate data researchers meet either in person or over the web at annual ACRE (Atmospheric Circulation Reconstructions over the Earth; Allan et al 2011) meetings. ACRE, led by Rob Allan from the UK Met Office, serves as an umbrella organization for data rescue efforts around the globe.

Figure 1: International examples of old weather data and data rescue volunteers: a) a weather journal from Boston, Massachusetts, courtesy of Cary Mock, University of South Carolina*, b) printed weather reports from Arkangelsk, Russia, courtesy of Juerg Luterbacher, University of Giessen, c) data from the international citizen science rescue project IEDRO: International Environmental Data Rescue Organization, courtesy of Rick Crouthamel d) volunteers from the MERIT project, Australian Bureau of Meteorology, courtesy of Mac Benoy.

Article: Data Rescue: Archives and Weather (DRAW)

Here in Canada, systematic weather observations from the St Lawrence Valley region go back to the mid 18th century and were made digitally readable in an earlier citizen science project supported by CMOS volunteers (see the October 2011 issue). Historical weather data rescue and analysis for locations across the country is supported by a blend of sponsored and volunteer, citizen-science based research. Support from Environment and Climate Change Canada has recently gone towards locating and cataloging 4475 digital images of weather observations, from 46 different locations (Figure 2), with up to 21 variables observed two or three times a day. More sporadic weather observations also exist for the Hudson Bay area from the mid 18th century onwards (K Devine, C Wilson pers. comm), while ships' logs and explorers' diaries also provided sources of early instrumental weather data (C. Mock, R. Allen pers. comm).

The challenge of turning millions of 19th and early 20th century handwritten meteorological observations into machine-readable bytes that can be used for scientific analysis is a formidable one. At McGill University, an interdisciplinary team comprised of archivists, information specialists, geographers and citizen engagement analysts, software developers, meteorologists and historical climatologists founded the citizen science project DRAW (Data Rescue: Archives and Weather) to find a way to get the historical records of the McGill Observatory transcribed into digital data.

The McGill Observatory was founded in 1863 by Dr Charles Smallwood and was formally incorporated into the Meteorological Service of Canada in 1874. Professors, students and later formal observers recorded anywhere from 40 observations nine time a day in the 1880 to 55 observations twice a day by the 1930s. Although this adds up to a potential of nine and half million unique weather observations, not all the variables on the printed sheet were regularly recorded while others, such as rain or snow, were left blank when there was no precipitation. The actual number of observations to transcribe is likely less than six million. It's still a huge number, one far beyond the capacity of an enthusiastic but small and time-pressed band of historical weather data aficionados at McGill.

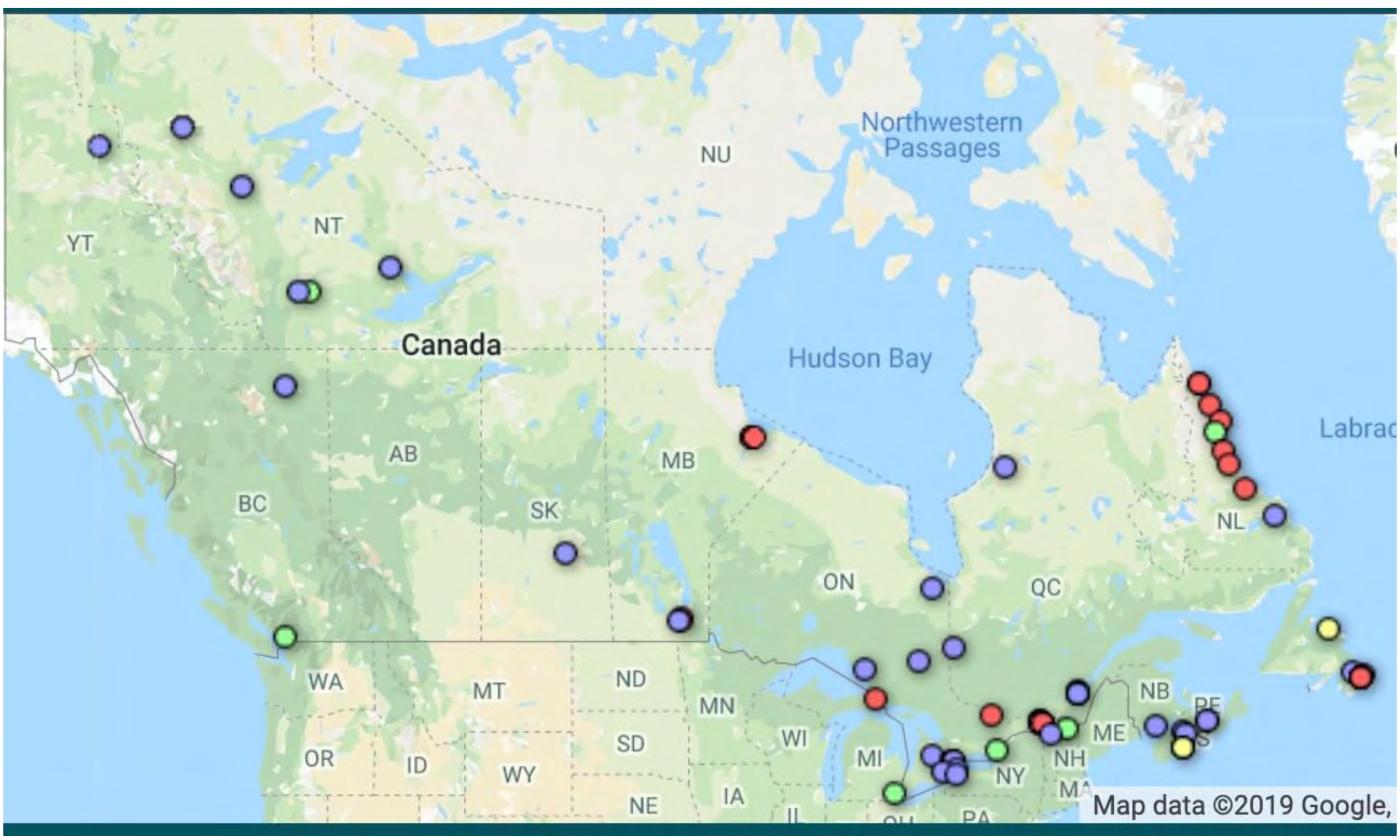


Figure 2: locations of historical (pre 1874) sub-daily Canadian weather data.

Instead, we turn to citizen science, not only for help in getting McGill's historical weather data turned into a usable format for scientific analysis, but also to make Montrealers and indeed, all Canadians, aware of our amazing scientific heritage.

For the McGill DRAW project, we are asking volunteers to log on to our website at https://citsci.geog.mcgill.ca/, choose the English or French option, go through our orientation tutorial and then start transcribing historical weather data directly into our web app using our user interface, the transcription tool.

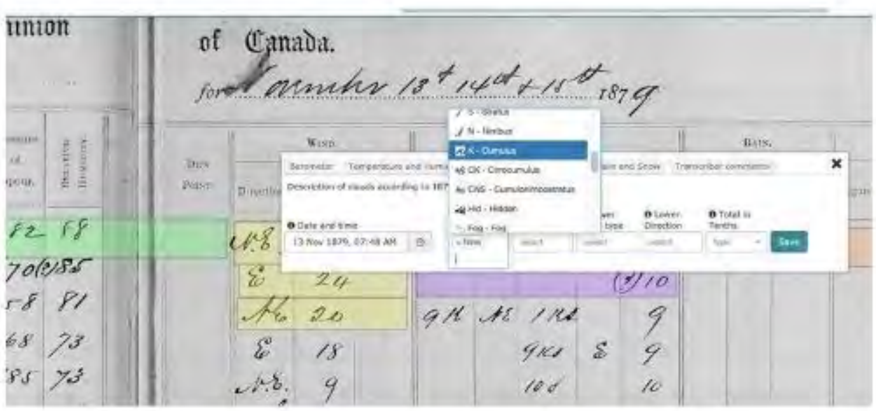


Figure 3 (left): A page from the McGill Observatory weather register, showing some of the complexity of capturing the data recorded. The weather (centre column) was recorded as hand-drawn symbols, even when written in short descriptive sentences in the "Remarks" (right) column. As the anemometer readings (left) were recorded in a separate logbook, the observers instead recorded a second barometer reading taken at Montreal's City Hall in the anemometer columns.

Figure 4 (right): A screenshot of the DRAW web app showing the transcription tool, with a drop-down menu to select cloud type.

We're aware that the McGill Observatory data set is complex. Not only are the variables observed technical and in archaic units, such as "Barometric pressure reduced to 32·F" or "hygrometer" rather than everyday terms such as air temperature and humidity, but there are variables such as cloud type abbreviations (CuST for CumuloStratus) obscure weather symbols which can't be reproduced on a keyboard (Figure 3). We've spent considerable effort in making the transcription environment as easy to use as possible, with drop down selection menus to match cloud types (Figure 4), wind directions and weather symbol types, hover pop-ups with extra information, and FAQs, tutorials supporting blogs. So far, we have over 1100 pages partially or completely transcribed, with over 250 000 unique observations, including cloud type, captured so far (Figure 5).

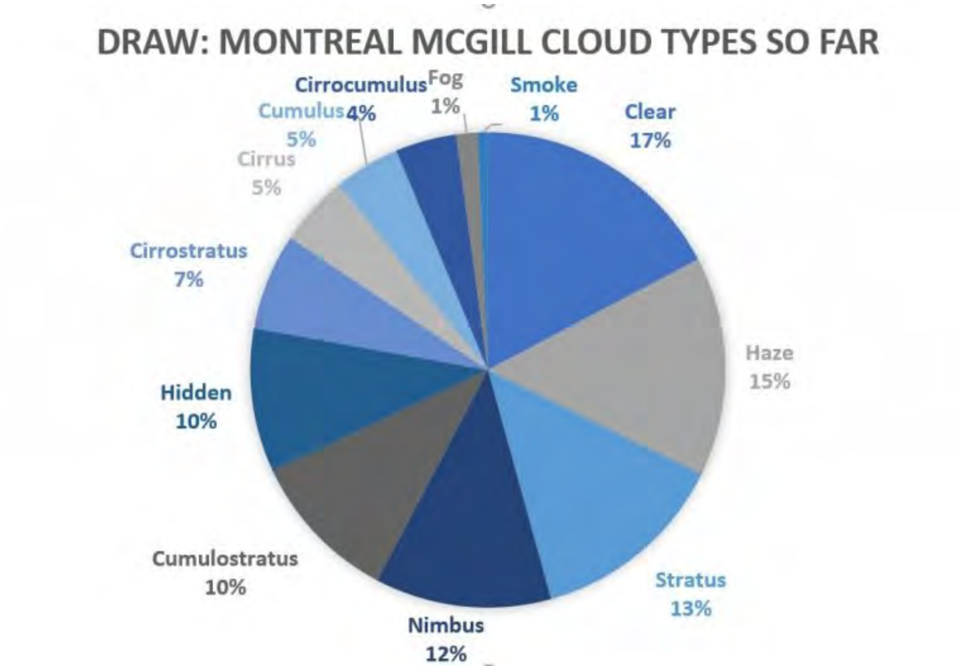


Figure 5: Chart showing the distribution of different cloud types transcribed to date from the McGill observatory records. Note the high proportion of "haze" and "hidden", which suggest high levels of atmospheric particles or pollution.

What happens to the data once it's typed up? One of the principal aims of ACRE is to understand the atmospheric circulation variations that drive climatic variability, change and extreme events. All of the surface pressure data captured by historical data rescue, including the Canadian volunteer projects, form part of the International Surface Pressure Databank (ISPD, Cram et al., 2015), which in turn is one of the major sources of initial data assimilation for the NOAA-CIRES Twentieth Century Reanalysis (20CR) dataset (Compo et al., 2011). The latest version of 20CR, version 3, is being released this summer and covers 1836-2015 (Slivinski et al., 2019). Data from the Canadian north and west are particularly valuable to help improve 20CR estimates over North America. Historical data are also being consolidated in international databanks as described by Thorne et al (2017).

Digitized historical weather data are also used to examine climate variability and change at local and regional levels. Temperature data from the earlier Canadian volunteer data rescue for the St Lawrence Valley were analyzed and an attempt was made to consolidate the disparate individual diaries into a regional temperature record going back (with gaps) to 1742. As the original weather diaries were sub-daily, it's possible to examine in great detail short term events such as heat waves and cold spells. Below are estimates of heat waves and cold spells for the Saint Lawrence Valley region, centred on Montreal. Here, as in Slonosky (2015), by definition a cold spell count starts with three consecutive days when the minimum temperature was less than -25ºC or the maximum temperature was less than -15ºC. If a fourth consecutive day fulfilled these criteria, the count incremented by one and so on. For heat waves, the conditions were maximum temperatures above 32ºC or minimum temperatures above 21ºC for three consecutive days, incremented as for cold spells.

It's surprising to see the concentrated density of heat wave counts in the early 19th century; 1807 and 1808, as attested by Alexander Spark, and 1820, as attested by Thomas and John Samuel McCord and Alexander Skakel were years with both high average summer temperatures and repeated heat waves (Figure 6). The heat waves of 1807 and 1808 are reflected in European records (H. Bergström, pers comm), suggesting highly meridional flow with periods allowing southerly flow in both eastern Canada and western to central Europe as a potential cause. The heat waves seen in the Montreal records of 1820 are also reflected in those New England records (L.A. Dupigny-Giroux, pers. comm) which have data going back that far.

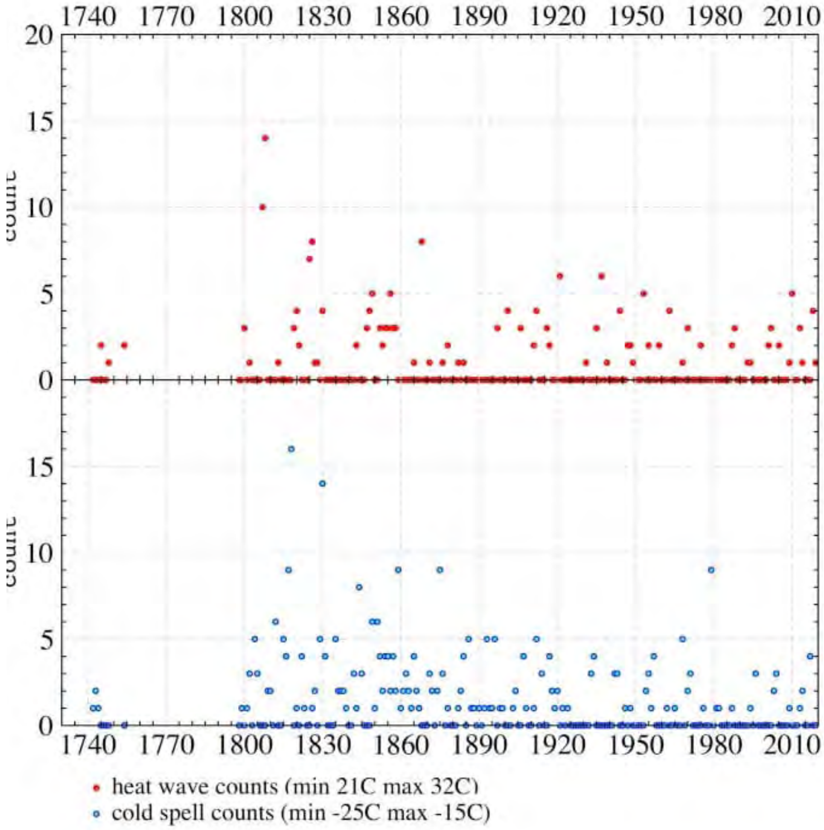


Figure 6: Heat waves and cold spells in the St Lawrence Valley, 1742- July 2019.

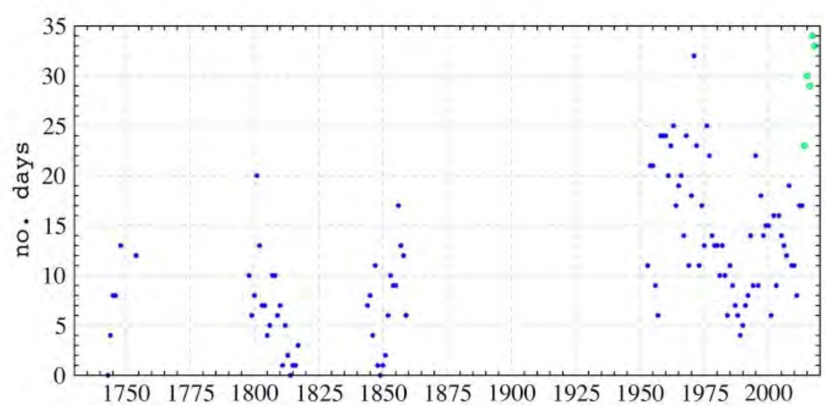


Figure 7 Number of days per year of blowing snow reported at Quebec City, 1742-2018. While the number of days reported by professional teams of observers at the airport between 1953-2013 is higher than that reported by the individual observers in the 18th and 19th centuries (blue dots), they are generally within similar ranges. Since 2014 (green dots), however, the number of days of reported blowing snow at the airport is consistently much higher than at any time in the past two centuries, suggesting an incompatibility in observing methods. Similar results (not shown) are seen for Montreal. Figure adapted form Slonosky (2019). Filling in the blank spaces is a major impetus behind projects like DRAW.

Finally, because many historical weather observers kept records of weather conditions as well as instrumental measurements, it's also possible to get a sense of how much certain types of weather conditions have changed over the centuries. While frequencies of snowstorms or blowing snow are fairly comparable over time when observed by humans, the arrival of automatic weather stations or other recent changed in observing practices make some recent data incompatible with records kept for centuries (see Figure 7).

Canada has a wealth of historical weather documents, a scientific legacy that is only beginning to be unlocked. One of ACRE's overall goals is to transcribe and make available for scientific analysis the estimated billion historical weather observations currently locked in paper archives. This data will then made used to further understanding of climate change, climatic variability, extreme events, weather hazards and their impacts. Canada has tens of millions of potential observations to contribute to this goal. McGill's DRAW citizen science project is attempting to take this challenge online. DRAW is also being integrated into the classroom at the college (CEGEP) and plans are being made to integrate DRAW into high schools as well. If the DRAW project is successful in transcribing the McGill Observatory records, similar projects could be set up to transcribed historical data from across the country.

Analysis of the historical records has already revealed some surprises, such as the heat waves in the St Lawrence Valley during the early 19th century. Combined with the high number of cold spells, it suggests this was a time of increased climatic volatility. Scrutiny of descriptive weather conditions also highlights the importance of continuity in record keeping over time if we want to be able to compare historical and modern observations to evaluate climate change.

Acknowledgments

Many thanks are due to all the volunteers and citizen scientists, who have made it possible to analyze the historical weather data shown here, especially Gilles Paquette, Ray Couture, Pat Fortin, Rose Dlhopolsky, Carolyn Verduzco, Jennifer Dowker, Kristin Davoli, Alana Cameron, Kyle Hipwell, Dan Manweiler, Lisa Woodward, Nancy Hagen, Jason Ferguson, Jean-Paul Hacot, Federico Ponari, Hervé Hacot, Josée Lapointe and Louis Schwalm. Thanks to Xiaolan Wang for support from ECCC, and the DRAW team at McGill University: Renée Sieber, Rob Smith, Gordon Burr, Frederic Fabry, Drew Bush, Rachel Black, Sara Allan, Lori Podolsky, Eun Park, Yves Lapointe, Frederic Guiliano, Marissa Stimpson and all the DRAW students. Geoff Pearce and his students at Dawson College have also been dedicated DRAW contributors who are exploring the uses of historical weather data. Thanks to Cary Mock, Juerg Luterbacher, Rick Crouthamel and Mac Benoy for the use of their images, and to Lesley-Ann Dupigny-Giroux, Nancy Westcott, Hans Bergstrom, Ken Devine, Cynthia Wilson and the late Morley Thomas for sharing data and data sources.

About the Author

Victoria Slonosky studied climatology at McGill University and earned a PhD in historical climatology from the Climatic Research Unit in Norwich, UK and spent time in France on post-doctoral studies. On returning to Canada she investigated climatic change and variability in Canada from historical records dating back to the 1740s. She currently works with McGill University's citizen science DRAW (Data Rescue: Archives and Weather) project to engage the public in rescuing Canada's scientific heritage. Her book **Climate in the Age of Empire: Weather Observers in Colonial Canada** was recently published by the American Meteorological Society.

References

Allan, R., Brohan, P., Compo, G. P., Stone, R., Luterbacher, J., & Brönnimann, S. (2011). The International Atmospheric Circulation Reconstructions over the Earth (ACRE) Initiative. Bulletin of the American Meteorological Society, 92(11), 1421–1425. https://doi.org/10.1175/2011BAMS3218.1

Cram, T. A., Compo, G. P., Yin, X., Allan, R. J., Mccoll, C., Vose, S., … Worley, S. J. (2015). The International Surface Pressure Databank version 2. https://doi.org/10.1002/gdj3.25

Compo, G. P., Whitaker, J. S., Sardeshmukh, P., Matsui, N., Allan, R. J., Yin, X., … Worley, S. J. (2011). The Twentieth Century Reanalysis Project (Vol. 137). https://doi.org/10.1002/qj.776

Slivinski, L. C., Compo, G. P., Whitaker, J. S., Sardeshmukh, P. D., Giese, B. S., McColl, C., … Wyszyn'ski, P. (2019). Towards a more reliable historical reanalysis: Improvements for version 3 of the Twentieth Century Reanalysis system. Quarterly Journal of the Royal Meteorological Society, qj.3598. https://doi.org/10.1002/qj.3598

Slonosky, V. C. (2015). Daily minimum and maximum temperature in the St-Lawrence Valley, Quebec: Two centuries of climatic observations from Canada. International Journal of Climatology, 35(7), 1662–1681. https://doi.org/10.1002/joc.4085

Slonosky Victoria C. (2019). Hazardous weather events in the St Lawrence Valley, from the French regime to Confederation: Examination of descriptive content in historical weather diaries from Quebec City and Montreal over the period 1742 to 1869. Natural Hazards. https://doi.org/10.1007/s11069-019-03612-5

Thorne, P. W., Allan, R. J., Ashcroft, L., Brohan, P., Dunn, R. J. H., Menne, M. J., … Worley, S. J. (2017). Toward an integrated set of surface meteorological observations for climate science and applications. Bulletin of the American Meteorological Society, 98(12). https://doi.org/10.1175/BAMS-D-16-0165.1

An Interview with Haowen Qin, Budding Meteorologist and CMOS' Youngest Member

By Sarah Knight, CMOS Bulletin Editor

At 17-years old, Haowen Qin is an incredibly passionate and knowledgeable budding meteorologist, and is CMOS' youngest member to date. I recently had the opportunity to interview Haowen, at the urgings of our very own Prof. Douw Steyn who has been mentoring this young man and has seen what his curiosity, intelligence and drive are capable of. Read the quite remarkable story of Haowen's relationship with meteorology, and why we are quite privileged to be in a position to support him and others like him – the next generation of atmospheric and ocean scientists, at a time when the world most certainly needs them.

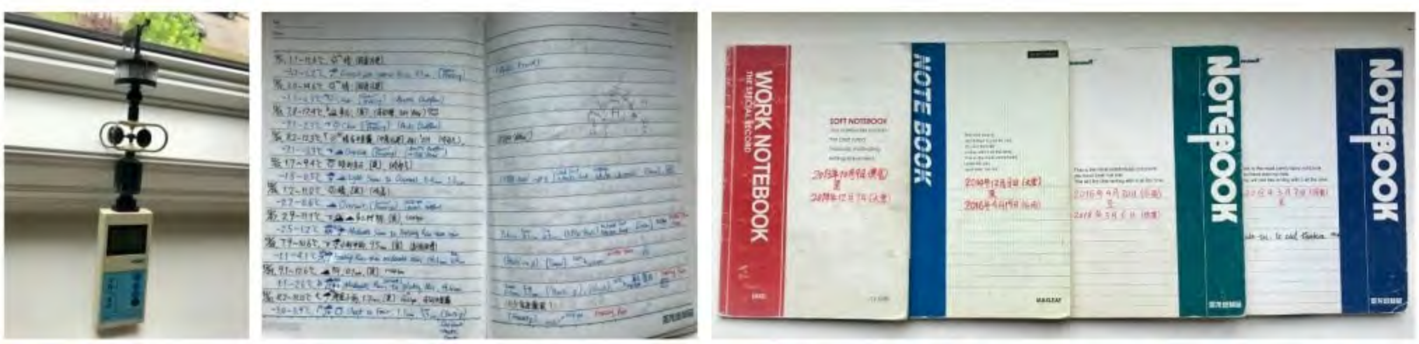
Sarah Knight, CMOS Bulletin Editor

Q: Tell me a bit about yourself, and how you became interested in Meteorology?

I am 17 years old and will be starting grade 12 in September at St. George's School, in Vancouver. I was always interested in math, and always curious about how things worked in general. I like to think! My parents say I spend a lot of time wondering in the realm of things that I don't really understand!

In grade 4 I read about a Chinese meteorologist **Coching Chu** in a textbook. He was the founder of East Asian meteorology. At that time China didn't have any meteorological devices, anywhere, so he just started recording weather data, every single day, for 60 years. The text said that even on the last day of his life, his trembling hand held a pencil as he recorded his measurements. His dedication really inspired me, and ever since then I have been recording weather data, every day, for 8 years now. First in Shanghai where I was living, and now I record data for both Vancouver and Shanghai. I have notebooks full of my measurements and observations.

Another factor that compelled me to pursue a path in meteorology was that in 2012, the year I started weather recording, Arctic sea ice reached a historic minimal and climate change became a really big topic. I realized that observing weather and learning about it would be really meaningful.



From left: Haowen's hand-held weather device; a page of Haowen's weather recordings; Haowen's log books from 2012 to present.

Q: How do you take your measurements and what do you record?

In grade 8, I moved to Vancouver from Shanghai, and I set up a weather station in my school with my science teacher. Pretty soon after I moved here, my interest in weather became known, and within a month people were calling me the "Weatherman"! My science teacher heard about this and approached me to say that we had some spare money in the school and asked if would I help set up a weather station. It is still going in the school now.

I also use the official **YVR site** and I have some devices at home.

I usually start with just looking out my window and noticing the surroundings. Then I make notes on things like the first and last frost dates, the day of the first leaf on the Maple tree outside, as well as when the cherry blossoms first appear and when the trees lose all the leaves. At my school, I notice and record when dozens of Canadian geese flock to the rugby fields in front of the campus. In Shanghai, I recorded when the pond in my neighborhood froze. Here I watch the snow line creeping down on the mountains north of Vancouver as winter sets in. I appreciate those things. Being aware of nature makes me feel connected to the Earth, as a living part of it.

I also record the standard stuff like daily high and low temperature, precipitation, wind speed and direction, and barometric pressure.

The view from Haowen’s window, across the seasons.

Q: What do you get out of doing this?

People sometimes ask me “How is it possible that you can be fascinated about such a mundane thing like the weather?” I notice that other people see the weather as the same thing that happens every day, but I see it as a different thing every day, and I appreciate it. I always come back to the numbers. I like to look at my data and see what patterns are appearing. What is the relationship between whether the snow comes early or late, and how early or late the flowers first appear in the spring? And sometimes really interesting patterns appear! For example, I looked at the first frost and last frost in Vancouver for the last three years, and even though the dates are different (by as much as a month) each year, there were respectively 176, 175, and 176 days between the first and the last, almost the same length!

I have also noticed how the weather in Shanghai and the weather in Vancouver are connected. One on the west side of the Pacific, the other on the east. I have learned it is called “teleconnection.” Sometimes I look at a satellite picture and follow low-pressure systems from Shanghai across the ocean. In summer, the systems generally get deflected towards Alaska because of the high pressure ridge that sits over Vancouver. In fall, I often experience storms in Vancouver which visited Shanghai a week ago!

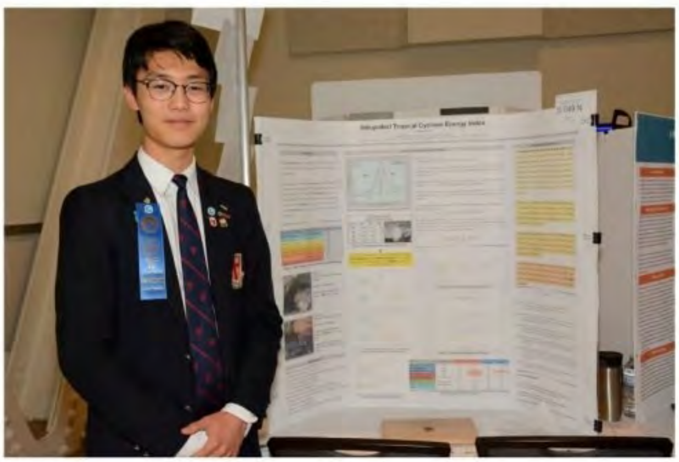
Once, in grade 9, I was out on a camping trip on Vancouver Island, and I kayaked through a Western Pacific Typhoon that I had been watching over Shanghai! It had crossed the Pacific, transforming into an extra-tropical cyclone, before it hit the BC coastline.

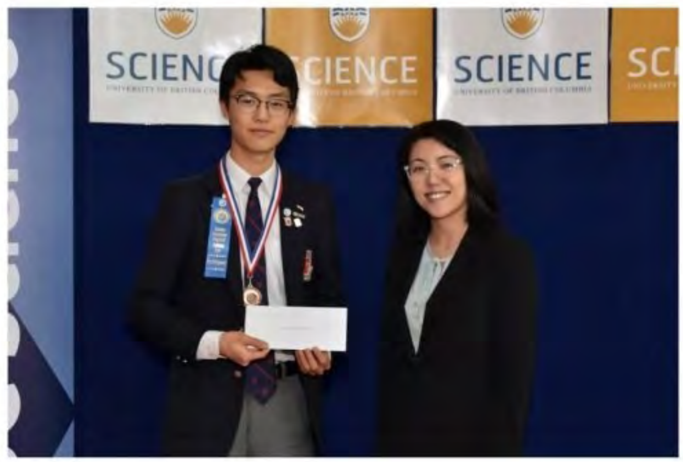
Q: I hear you recently won an award for your science project on meteorology, can you tell me about it?

My project was awarded a Bronze Medal and SFU Faculty of Science Award at the 2019 **Greater Vancouver Regional Science Fair**. The project "Integrated Tropical Cyclone Energy" showed how cyclones are categorized today, only by wind speed, and also how my approach of using "integrated energy" might be a better way to understand the actual potential impact of a hurricane on humans. I included measures of damages such as financial loss and fatalities. In that project I analyzed 97 tropical cyclones that made landfall in Canada, China, Japan, the Philippines, and the United States, with over 1000 data points!

It is about developing and applying a new tropical cyclone categorization system, after seeing the Saffir-Simpson Wind Scale sometimes misrepresents a cyclone's destructiveness: a cyclone might not have a particularly fast wind speed, but it can cause a lot of damage because it is so large. For example, last year's Hurricane Michael was a Category 5 at landfall while Florence was a Category 1, but they both caused about the same amount of (nominal) damage. Hurricane Florence picked up so much moisture, but this was not reflected in wind speed, which was how the hurricane was categorized.

The project was actually the successor of my science project in grade 9. Then I hadn't yet learned any hard core physics, so what I did wasn't really scientifically sound, but I wanted to try to show a different understanding of hurricanes. Using my experience in tracking typhoons online and discussing with other amateurs, I plotted the cloud temperatures, eye temperatures, wind speed, and radius of a cyclone on a chart. From a traditional science point of view, they aren't necessarily connected, but it helped me understand the different factors. I entered this into the Greater Vancouver Regional Science Fair and won an honorable mention.





Haowen Qin with his winning poster (on left) and receiving his award at the 2019 Greater Vancouver Regional Science Fair (on right).

Q: How did you meet Prof. Steyn?

Shortly after that, I encountered Prof. Douw Steyn, and he became a great help to me! When I was in grade 9, a grade 12 student from another school heard that I was known as the "Weatherman," and he asked me to provide data assistance to his project on climate change (International Baccalaureate final project). His project group then invited me to join them when they were interviewing some atmospheric scientists from the University of British Columbia. Prof. Steyn was one of them. We quickly connected when he realized how much knowledge I had about the language of meteorology. We met up again and he offered to help me with my project, by giving me some guidance on the scientific approach to using the data that I had to understand hurricanes. I remember at the time that Prof. Steyn said that my project was "legitimate and interesting". These words meant I was on the right track! He also told me that when I learned more in math and physics I would understand how to solve the problem of relating my data, myself. The great thing was, he was right! On my very first day of learning integration in my Grade 11 AP Calculus class, I went home that night and applied what I had learned to my project. It was indeed the right approach!

Article: CMOS' Youngest Member

Q: How did you get to be a member of CMOS?

In the summer of 2017 when I was moving in to grade 10, Prof. Steyn advocated for me to join CMOS, and I learned that I was the youngest member ever. I felt that there was a mission for me in that, and I became even more excited to do things related to weather.

I've already gotten so much from CMOS members. Other than Douw Steyn, Rich Pawlowicz, Cindy Yu, and Ken Kwok have been really helpful.

Q: What is next for you?

Environmental issues and climate change are a big problem, and I think awareness and action are a big part of the solution. Addressing both science and policy factors is important. Prof. Steyn showed me an article from the Globe and Mail on Canadian Research in the Arctic, and how it is under threat because the federal funding for research in the Arctic is just not enough. I see how policy plays a big role in whether or not science can happen, and it is so important that we **advocate for science, and action, and communicating science** in a way that everyone can understand is crucial.

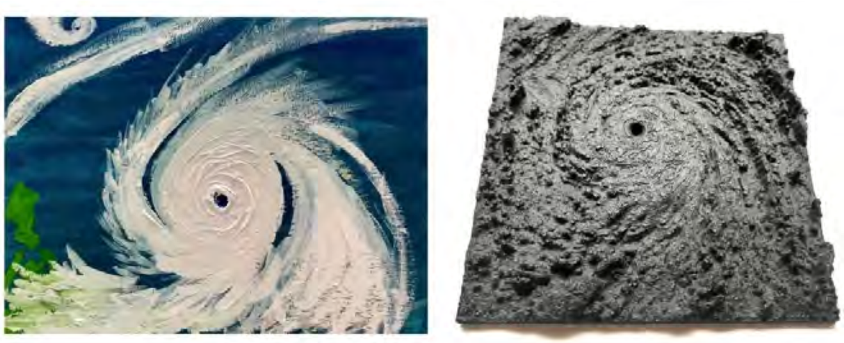
> **In Praise of Mentoring**
>
> All societies grow in stature and depth through the transfer of knowledge, skills and culture between generations. One particular way this transfer occurs is through the practise commonly know as mentoring, in which a senior, experienced person guides a younger, less experienced person through the early stages of their development. In the best of circumstances, mentoring provides benefits to both mentor and mentee. The former drawing satisfaction from seeing a young person develop skills and knowledge, and the latter benefiting from the acquired experience and skill.
>
> These truisms hold in societies at all scales, including scientific societies such as CMOS. Scientific mentorship generally occurs in an informal, unorganized way, but in some societies and organizations, can be fostered through the development of a loosely structured mentoring network. Past President Harinder Aluwalia proposed such a network in CMOS, and while the idea was not formalized, mentoring continues to exist in CMOS, to the benefit of all.
>
> *Prof. Douw Steyn*

Right now at school assemblies, I often go up and talk about our weather and our changing seasons, to help people stay better informed in what is happening around us. I am also a part of my school's environmental stewardship program, and as a part of that I was curious about our environmental audit. I read the one that had last been completed, in 2013, in which they said they would do another one in 5 years. I advocated for this to happen, and I managed to convince the school's administration to set aside the money to do another audit. It is happening right now! I lobbied the principal and it worked!

Now, I get younger students coming up to me and telling me that they are interested in weather too. I feel a real passion to help students get more engaged with meteorology, so if more students are interested in this field, or in related fields, more people will understand climate change and its impacts, more people will go into important research, and we will start finding more solutions.

My dream is to someday work for the WMO, where I see that science and policy really meet. In 2018 I met Ken Kwok, and he invited me to visit Environment Canada's office in Vancouver. On the tour he showed me the seat where David Grimes used to sit. It is really inspiring for me to know of people like him, who are making such a difference in using science to inform policy. I hope to attend the **CMOS congress in Ottawa in 2020** and learn from David Grimes, and so many other experts.

In the meantime I am always happy to talk about meteorology and get any input that I can into my project! **If anyone from CMOS has ideas for me I would love to hear them.**



Painting of a typhoon (on left) and 3-D printing of Hurricane Katrina (on right), both by Haowen.

CMOS SCMO

54th CONGRESS / 54e CONGRÈS

Canadian Meteorological and Oceanographic Society (CMOS) Annual Congress

Congrès annuel de la Société canadienne de météorologie et d'océanographie (SCMO)

BUILDING SOCIETAL RESILIENCE to Changing Weather, Climate, Oceans and Environment

BÂTIR UNE RÉSILIENCE SOCIÉTALE face aux changements de la météo, du climat, des océans et de l'environnement

Sunday May 24, 2020 to Thursday May 28, 2020 at the Delta Hotel, 101 Lyon St., Ottawa
Dimanche le 24 mai 2020 au jeudi le 28 mai 2020 à l'hôtel Delta, 101, rue Lyon, Ottawa

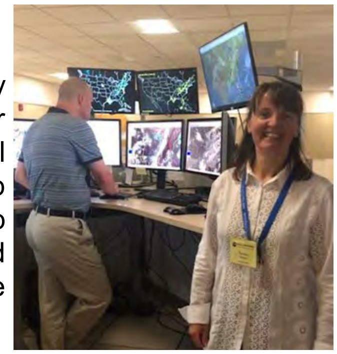
cmos.ca / scmo.ca

Report: Project Atmosphere 2019

Report for CMOS on Project Atmosphere, 2019

By Canadian Participant Bugosia Gierus (Calgary, AB)

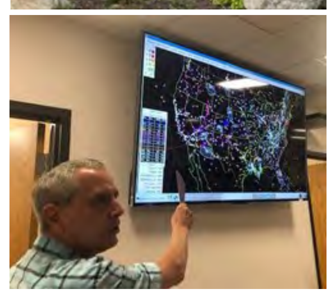
Overview



This year I was selected by the Canadian Meteorological and Oceanographic Society as the Canadian participant of Project Atmosphere. Project Atmosphere is a Summer Teacher's Workshop offered by the American Meteorological Society at the National Weather Service Training Center in Kansas City, Missouri. This year, the workshop was one week on-site in Kansas City, Missouri, with several pre and post workshop coursework modules. Finally, as an alumni of this workshop, I am to prepare and present a training session for teachers in my school division and/or area based on the activities we learned during this program.

Twenty four teachers from all over the US and one Canadian (me) participated in this professional development workshop designed for us to teach atmospheric content to students from K-12. The workshop was held at the National Weather Service Training Center (NWSTC). Having the workshop in this meteorological training facility allowed us to have access to a large assortment of computerized weather information systems as well as to see first-hand the equipment used in forecasting such as the Automated Surface Observing System (ASOS) and surface stations. The Aviation Weather Center, responsible for aviation forecasting, is also in the building, allowing us to see real-world applications of weather forecasting.

Before the workshop



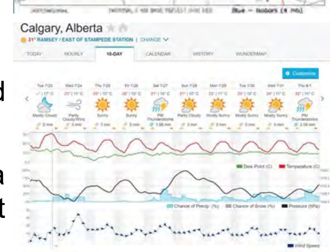
During the pre-workshop coursework, we were exposed to three very challenging MetEd Modules designed originally for forecasters and/or students of meteorology:

- Basics of Visible and Infrared Remote Sensing,
- Weather Radar Fundamentals
- GOES-R Geostationary Lightning Mapper (GLM)

Although these modules were extremely difficult for a beginner such as myself, but I learned a lot of meteorological terms and concepts that were invaluable for the workshop itself as well as for applications in teaching physics.

We also had a chance to see and learn through two very hands-on modules for teaching some challenging and important meteorology topics:

- Air-Sea interaction module
- Coriolis Effect module



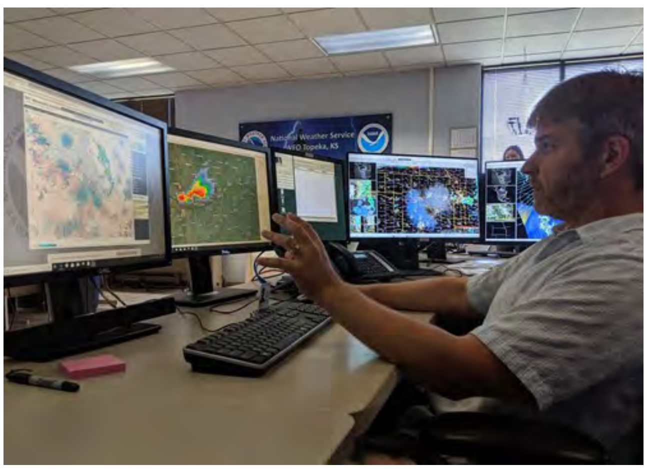
These two modules were very self-explanatory, well thought-out for K-12 students and I could see using them in my day-to-day teaching.

Finally, we had to write journal entries (blog) on weather parameters and clouds over a three week period. This reflection was meant to ignite our process of thinking about weather and how some factors, such as temperature, pressure, wind, dew point, and fronts are connected to each other. This was an excellent introduction to meteorology and made me observe natural weather phenomena in a completely new way. This also reminded me how important writing in a journal or blog for students to reflect on their own learning. I have decided to implement a blog for my students similar to this process.

On-Site Workshop - Kansas City

During the week on-site workshop, we learned from experts in the field, were taught weather and climate concepts by professors, and were given modules to apply the knowledge in the classroom. Topics such as satellite and RADAR imagery interpretation, thunderstorms and severe storms, and weather forecasting were addressed by experts in their fields.

One evening, we had a field trip to the National Weather Service (NWS) Topeka weather station to launch a weather balloon. We learned from the front-line meteorologists who are in charge of detecting tornadoes and any severe weather in the neighbouring area. We visited their tornado shelter and launched a weather balloon. The next day when we were able to take the raw data collected by the balloon and analyze it.



Throughout the week we had many impressive presentations by notable individuals:

- Dr. Louis Uccellini - director of NWSTC
- Ken Graham - DIrector, National Hurricane Center (NHC)
- Andy Bailey - Presentation on RADAR
- Kim Runk - Satellite Workshop
- Sarah Atkins & Tim Brice - How to request a video "Ask a Meteorologist" chat
- Barb Boustead - Presentation on Climate
- Lori Schultz - NASA Presentation
- Bill Bunting - Presentation from the Storm Prediction Center (SPC)
- John Mclaughlin - NOAA Education presentation

All of the presenters were extremely passionate about what they do and seemed very knowledgeable about in their domain. Their presentations were engaging and highly professional.

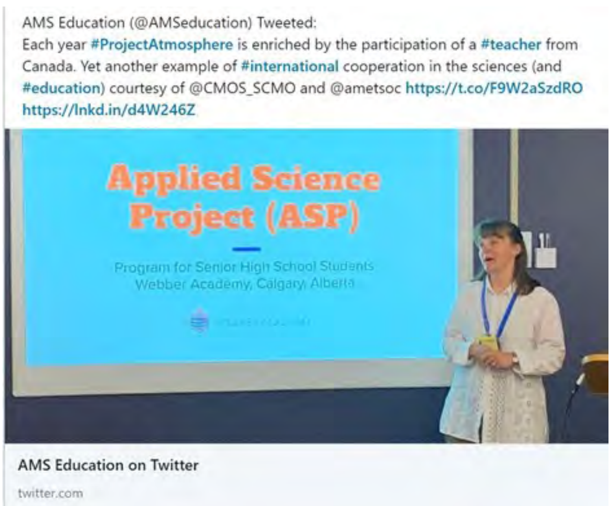
My favourite parts of the week were all the hands-on activities (modules) that we were introduced to. These activities were specifically designed for K-12 students and could be adapted for any grade level - I could see myself (and any of the science teachers) using these activities directly in my classroom. For instance, we learned about pressure highs and lows with the Hand Twist activity, the Extra-Tropical Cyclone slider activity, and the cloud-in-a-bottle activity.

Report: Project Atmosphere 2019

Each day we also had a weather briefing with Jerry Griffin, Master Instructor in the Forecast Operations Programs, at the NWSTC. During these briefings, we observed RADAR and satellite imagery and learned to interpret surface station data and 500-millibar charts. We also followed storm systems as they moved near Hawaii and near Florida and explored many great online resources that we can use to forecast weather with our students.

At the end of the workshop, all the teacher-participants went out to tour Kansas City and socialize for the last time.

During the workshop teachers were able to share their teaching experiences with the other teachers in so-called “sharing sessions”. I was the first teacher to share during one of these sessions. I discussed the Applied Science Project program which we offer at our school. I was also able to learn a lot about what is offered at other schools around the US and the very interesting science programs other teachers offer to their students. I was also able to connect with other AP Physics teachers, and we were able to share resources and their interesting teaching methodology.



After the workshop

The post-Kansas City coursework was another set of modules:

- The Weather Cycler Module
- The El-Nino / La-Nina Module
- Upper Air Weather Module

Once again, these modules were extremely well prepared for adults and students K-12. The modules lead students independently through a set of activities that progressively explain these difficult concepts.

As part of the post-workshop coursework, we were also asked to do a weather briefing (similar to ones we saw Jerry Griffin do each day) to remind ourselves of the amazing online tools and sites that were used during the briefings.

Finally, all the teacher-participants are expected to present a local workshop training for other teachers in their school or district. I plan to do this local workshop coming up in the fall of this year. Since I am a teacher at a K-12 school, I will be able to apply all the information I learned and have an in-school workshop for all the science teachers during one of our professional development days / meetings.

Acknowledgment

A huge thank-you goes out to our hosts and leaders, Wendy Abshire, Elizabeth Baugher, and Chad Kauffman, who did an amazing job of sharing their knowledge with us, keeping us organized and getting us ready to share what we’ve learned with other teachers. Also, I would like to thank the Canadian Meteorological and Oceanographic Society for continuing to support Canadian participation in this workshop.

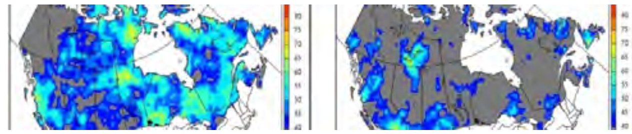
MORE ON CMOS TEACHER SUMMER WORKSHOPS HERE: https://cmos.ca/site/summerworkshops

In case you missed it...

From CMOS Bulletin Volume 47, Number 3:

Women in Meteorology: The Early Days
by Rebecca Milo

Seasonal Forecast for Summer 2019
by Marko Markovic et al.

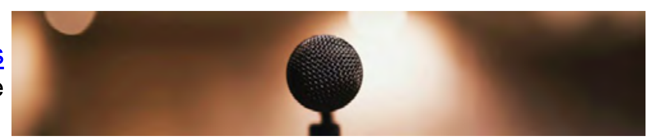


Changing of the Guard: Paul Kushner Hands Over CMOS Presidency to Kimberly Strong

CMOS at the Upcoming IUGG General Assembly

Book Review: Ice at the End of the World
Review by Phil Chadwick

Members Updates
Meeting Notifications, Books for Review, and more



These articles, and more, in the new, online CMOS BULLETIN.

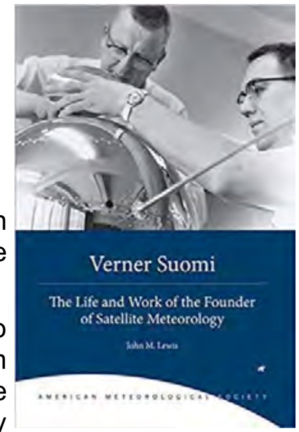
http://bulletin.cmos.ca (english)
http://bulletin.scmo.ca (français)

Subscribe here to receive your bi-monthly e-update.

Book Review

Verner Suomi – The life and work of the founder of satellite meteorology

Review by Lewis Poulin



By John M. Lewis
Published by the American Meteorological Society
Paperback, 168 pages, $30.00 (USD)
ISBN 9781944970222

– *"Processing satellite data is like taking a drink from a fire hose"* – **Verner Suomi –**

I was looking forward to doing this review. I love biographies and I'm working now with GOES-16/17 data which has been made possible by Verner Suomi's early work in satellite meteorology.

The book's first 146 pages are presented in 5 sections each with a subset of short easy to read chapters. Part I: The Winding road to Meteorology, Part II: Earth's Heat Budget from Space, Part III: Space Science and Engineering Center: An Institute for Satellite Meteorology, Part IV: Notable Research Themes: Their Past, Present and Future and finally Part V: Suomi's uniqueness. A final section offers insights about Suomi from those who worked closely with him.

Verner grew up in Eveleth Minnesota where their superb schools with a variety of hands-on workshops were great training for using your hands to get things done – an approach which stuck with Suomi afterwards. After completing Junior College and teacher's college he worked for four years as a science teacher and earned a pilot's license where ground school introduced him to meteorology.

Suomi heard a radio broadcast by C.G. Rossby, then at U. of Chicago, for a cadet program for college graduates interested in meteorology. Suomi was accepted and was fortunate to have great professors like Rossby and T. Bergeron. The course sparked Verner's interest in the observation side of meteorology.

Suomi was good at designing and building instruments. His first remote sensing project was the redesign of a bulky mobile radiosonde system so that it could fit into a suitcase instead of a truck.

His second project was developing a sonic anemometer after hearing how acoustic measurements in the atmosphere could be used to measure wind velocity and his was apparently the first such instrument used in a field experiment to measure turbulence near the ground.

This led to an invitation to Iowa State Agricultural College (ISAC) to see if his device could derive estimates of turbulent heat and moisture fluxes over corn crop canopies.

His work was so timely it generated two job offers – one from ISAC and one from the University of Wisconsin (UW) – Madison. He chose UW – Madison.

At UW-Madison he started a fruitful collaboration with the brilliant electrical engineer Robert Parent which would lead to many scientific innovations. While Suomi had a constant stream of new ideas, Parent was able to successfully build the 20% or so of Suomi's ideas that were excellent.

Suomi remained interested in agricultural meteorology. He began an experiment to calculate the heat budget over a crop field using an evaporimeter he designed using a water tank to measure latent heat flux. The mass of water that evaporated over time multiplied by the latent heat of vaporization of water gave the latent heat flux from the tank. Suomi then floated a container of soil with corn stalks on the surface of the water and poured oil on the surface surrounding this container so that evaporation would occur only from the container with soil and corn stalks. Evaporation of water from the soil and stalks reduced the weight of the inner container and Archimedes principle could be used to calculate the mass of evaporated water allowing to complete the calculation of latent heat flux for soil and stalks. Over several hours this method gave accurate measurements.

Suomi was encouraged to present the crop experiment as his PhD project and did so, passing his doctoral exam in front of an illustrious review panel. A key insight during the thesis defense came from a question from Herbert Riehl who asked Suomi – "Now that you've examined the heat budget over a corn field, how would you go about examining the heat budget for the Earth and it's atmosphere?" This question was timely in light of the upcoming Earth Radiation Budget Experiments and IGY.

Riehl's question was an epiphany for Suomi who realized that from space one could indeed measure the dominant radiative processes in the Earth Atmosphere system.

Though late in the planning calendar for the upcoming (1957-58) IGY, the heat budget experiment did get accepted with the support of key scientists. The challenge now for Suomi and Parent was to design the instrument that could operate from a rotating space-based platform.

It's fascinating to read how Suomi and Parent had prototyped a new instrument and the had to convince Werner Von Braun to add their prototype "ping pong radiometer" as it was known on an upcoming satellite launch. Von Braun had just had two launch failures and he was not going to let Suomi and Parent's instrument with its "rabbit ears" type antennas jeopardize a third launch. It was a last-minute idea Suomi had with an orange and a mirror in his hotel room that saved the day allowing them to instead use hemispheric radiometers on flat plates (bolometers). They got a green light from Von Braun. The rush was on to get the instrument built and figure out the telemetry required to download the data.

The above examples seem to summarize Suomi's and Parent's skills and approach which served them well throughout their careers. They were constantly working with new ideas and challenges, and were able to successfully solve, through hard work and creativity, scientific and technical challenges, get the job done on time, collect good data, present it and move on to the next challenge.

The book includes a brief description of how they went about designing the instrument that would allow them to calculate the Earth's energy balance. Choice of materials and the Stefan Boltzmann law served as the basis for their six heat transfer equations with six unknowns that could then be solved. This and experiments to follow provided a steady stream of data for Earth Radiation Budget (ERB) studies providing insights over many years into the Earth's planetary albedo, the important role of clouds, and how weather patterns influenced energy exchanges to space.

The rest as they say is history.

The book chronicles in an easy to follow manner the series of satellite experiments over many years that kept collecting ground breaking data. The low earth orbit of early experiments meant the satellite was moving relative to the earth and its weather patterns. Inspired by the use of replays in sports broadcasts, Suomi had the idea that if the satellite could stay still and have the weather move – they could see produce weather movies and see the weather move instead of the satellite. Suomi and Parent developed their spin-scan camera which used several scans of the earth to then generate full images of the earth that allowed weather patterns to be tracked and studied which then stimulated weather forecast research and innovation in many areas. Interest grew in using this data in data assimilation and NWP which was emerging at that time. From this data satellite derived winds were calculated (thanks in part to a very bright coder under Suomi) which were then available for data assimilation systems and NWP.

As ideas for experiments kept growing Suomi needed more and more resources. He lobbied for a formal multidisciplinary institute to specialise in satellite remote sensing. In 1968 the Space Science and Engineering Center (SSEC) came into existence.

The book's information is supported by a great number of quotes from those who worked with Suomi. This help to get a broader picture of Suomi from many perspectives and how he greatly influenced so many people. His teaching style was very hands on with graduate students – over coffee they would discuss a research problem that students would pursue together over a term often resulting in publications. He had a knack for explaining complex science in simple terms. Even late in his career he still enjoyed teaching an introduction to Science class to non science students. Suomi excelled at designing and developing sensors that could withstand harsh environments like the sea or space. As a result, he helped train a slew of scientists and engineers.

The book does provide in great detail the many accomplishments in the wide range of fields Suomi contributed in. From his satellite work to measure poleward heat transport by the oceans, to boundary layer experiments on board ships, to his participation in planetary atmosphere explorations and many other areas.

Footnotes in the book offer links to interesting documents. One link I tested had a verbatim account of a press conference Suomi describing why his satellite heat budget experiment was relevant. There is also the Suomi website at U. Madison at http://library.ssec.wisc.edu/SuomiWebsite and its subdirectory /SuomiImages where more photographs and documents are available. The book has a comprehensive list of references to offer additional supporting information.

The book's 189 pages offer an easy read for those working in meteorology, oceanography, data assimilation, NPW, agriculture and remote sensing in general. Reading about how others like Suomi confronted their technical and scientific challenges in creative ways was helpful. It's also insightful to read how team leaders like Suomi were successful team leaders.

The book did not indicate if Suomi worked directly with Canadian Scientists. Those involved in early planning for Global Atmospheric Research Program (GARP) likely interacted with Suomi who lead this group. Page 70 has a group picture from the October 1971 meeting in Downsview of GARP's Joint Organizing Committee (JOC) in which Warren Godson also appears.

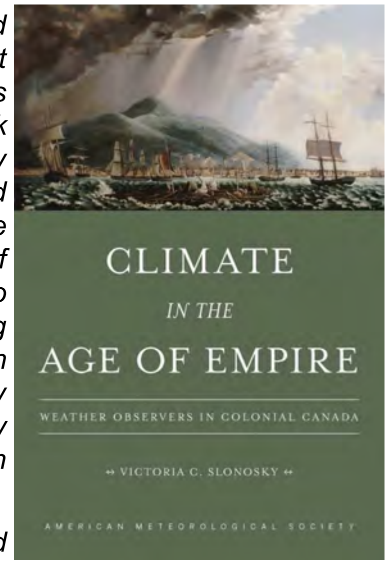
With the latest GOES satellites now in space, the book is timely and provides a chance to read about Suomi and the role he and his teams played in developing satellite meteorology.

Book Review

Climate in the Age of Empire: Weather Observers in Colonial Canada

Review by Richard Leduc, Ph.D., AirMet Science Inc

By Victoria C. Slonosky
Published by the American Meteorological Society
Paperback, 288 pages, $45.00
ISBN 9781944970208



The material in this book is abundant. I have read many sections of the book and each is very detailed and contains many anecdotes, facts, and examples that supplement the topics covered and are tied to historical facts. Dr. J. F. Gaultier's contribution to the early days of the colony is impressive, and Slonosky's book shines in highlighting it, and the contribution of Smallwood, McCord and many others. The author also introduces the issue of climate change that preoccupied these pioneers, namely the "improvement" of climate following deforestation. The final chapters address derived observations and specific seasons, and are full of information (agronomic indicators, frost dates, ship's arrival) and details that go back to the colony. The work required must have been colossal. Adding biographical data was an excellent idea and it shows these people's contribution in a wide scientific and historical context. The illustrations, all interesting, are mostly found in the middle of the book (figures of the last two chapters excepted). They include maps, document excerpts, portrait paintings, sketches, photos, notes. In examining them carefully, one can appreciate their many details.

The main conclusion: this book is a remarkable piece of work. The subject is treated skilfully and the documentation is very detailed, all done within a fascinating historical context. Moreover, any book published by the AMS immediately vouches for the very high quality of its content.

I have felt, throughout her work, the author's appreciation of all those who were there before us and whose efforts have helped build Canadian meteorology to what it is today. A sequel to this chronicle would certainly be welcome.

Débutons tout suite par le constat principal: cet ouvrage est magnifique. Quel magnifique travail, un sujet traité de main de maître, une documentation des plus fouillée, le tout dans un contexte historique fascinant. En plus, une monographie publiée par l'AMS assure d'emblée la très haute qualité du contenu.

J'ai plusieurs livres sur l'histoire de la météorologie dans ma bibliothèque, comme par exemple celui de Khrgian (des plus étonnants), celui du regretté Morley Thomas (personnage impressionnant que j'ai connu à mes débuts) avec son " The Beginnings of Canadian Meteorology ", Fiero, Frisinger, Middeleton et plusieurs autres touchant des aspects sociaux ou culturels de la météorologie et du climat au Québec. Je ne suis pas un historien mais je crois que l'ouvrage de Mme. Slonosky est un ajout significatif dans l'historique du développement de la météorologie au Canada.

La couverture, une peinture illustrant une vue de Montréal autour de 1840, puis la première page qui est une carte de la ville de Québec vers 1822 et finalement les dernières pages qui sont une carte de la ville de Montréal de 1853 nous ramènent dans ce passé historique. Le ton est donné.

L'ouvrage comprend deux parties. La première s'intitule "The Landscape: Scientists, Practices and Theories" avec les chapitres suivant 1: "Territory, Networks, and Tools", 2: "Dr. Jean-François Gaultier: New France's Climatologist", 3: "Clearing and Cultivation: Eighteenth-Century Climate Improvement Theory", 4: "British-American Weather Observers to 1830", 5: "McCord and the Montreal Natural History Society", 6: "Nineteenth-Century Scientists Question Climate Amelioration"; pour la seconde partie "Meteorology Takes Shape" on a 7: "Meteorology and the Military", 8: "The Magnetic Cruisade and the Founding of the Toronto Observatory", 9: "Medical Meteorology", 10: "The Establishment of the Meteorological Service of Canada", 11: "The McGill Observatory and the Professionnalization of Meteorology", 12: "What Do Three Centuries of Observations Tell US?", 13: "Extraordinary Seasons", et finalement une section "Biographical Sketches" et un index. À la fin de chaque chapitre on retrouve une liste de références qui me semble exhaustive. Au début, outre la Table des matières, il y a une liste des illustrations, une Préface et des Remerciements. Le tout est documenté dans les moindres détails.

Les illustrations, toutes intéressantes, sont regroupées au centre du livre (outre les figures des deux derniers chapitres); il y a des cartes, des extraits de documents, des portraits (peinture), croquis, photos, notes et il est des plus intéressant de les examiner avec soin pour y retrouver nombre de détails. J'ai bien aimé les photos de A. Spark, du Dr. Smallwod et autres, de l'intérieur de l'Observatoire de McGill et de la bâtisse qui l'abritait et la photo des étudiants de McLeod. On y trouve aussi un manuscrit de J.-F. Gaultier.

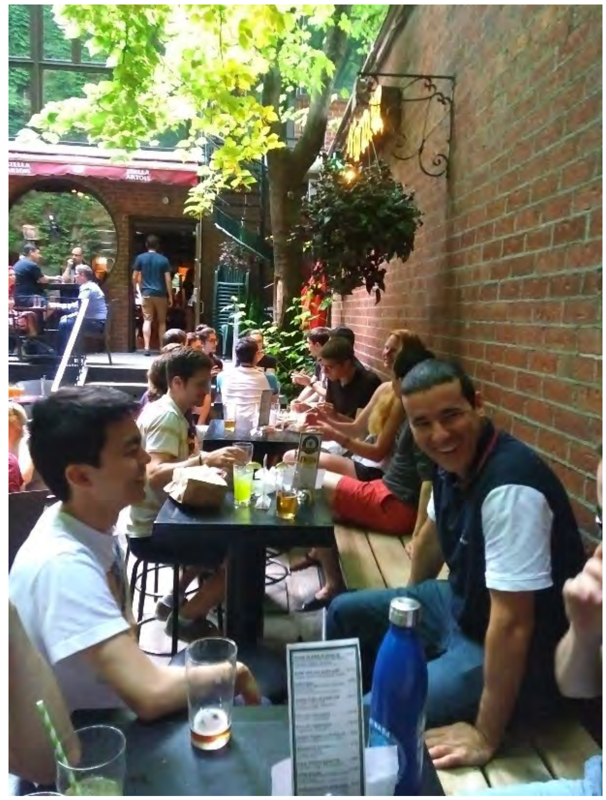
La matière est abondante. J'ai lu de nombreuses sections et chacune d'entre elle est des plus détaillée et contient de nombreuses anecdotes, faits, exemples qui viennent documenter les sujets traités et le tout, relié à des faits historiques. La contribution du Dr J.-F. Gaultier au début de la colonie est impressionnante et l'ouvrage de Mme. Slonosky a le grand mérite de la faire connaître, tout comme celle de Smallwood et de McCord et de nombreux autres aussi. Elle nous fait aussi connaître la question des changements climatiques qui préoccupaient ces pionniers, soit "l'amélioration" du climat suite à la déforestation. J'ignorais aussi l'intérêt et la contribution de Smallwood à la question médicale (propagation des maladies) et l'importance que ce sujet avait à cet époque. Les derniers chapitres sur les observations dérivées et la description de saisons particulières fourmillent d'informations (indicateurs agronomiques, dates de gel, arrivée des bateaux) et de détails qui remontent à la colonie. J'imagine que le travail nécessaire à leur réalisation fut colossal. L'idée d'ajouter une section sur les biographies est excellente et permet de situer la contribution des personnages dans un contexte scientifique et historique plus global.

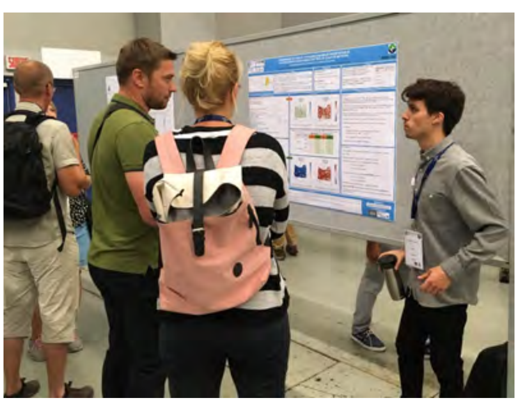
J'ai senti comment, tout le long de son œuvre, l'auteure est reconnaissante envers tous ceux qui nous ont précédé et dont les efforts ont contribué à bâtir la météorologie canadienne d'aujourd'hui. La suite de cette épopée serait la bienvenue.

Merci Mme Slonosky de nous avoir fait cadeau de ce magnifique volume.

CMOS at the IUGG General Assembly, 2019

The 53rd CMOS Conference was held in Montreal at the Palais des congrès as an integral part of the General Assembly of the International Union of Geodesy Geophysics, from July 8 to 18, 2019. Of the 4000 participants, 200 attended identified as CMOS members and were able to present the results of their research to colleagues around the world. More than 4900 oral presentations or posters were held throughout the conference. It should be noted that presentations and activities of areas of interest for CMOS took place during the first days of the conference. Some activities reserved for CMOS members were held, especially for students (icebreaker at Ste-Élisabeth pub on July 8th and food & drink on July 10th at Chez Chili restaurant). About 100 people from CMOS participated in the traditional CMOS banquet (and award ceremony) held on July 11th.





Clockwise from top left: CMOS banquet crowd; Laughter at the Student Icebreaker; Sisi Chen, one of this year's recipients of the Tertia M.C. Hughes Memorial Graduate Student Prize with Past-President Paul Kushner; CMOS LAC Chair Dominique Paquin hands the task over to Gordon McBean and next year's CMOS LAC for the 2020 Congress in Ottawa; Gabriel Gobeil presenting his poster; "Lunch 'n Learn" networking event for students.

MORE PHOTOS from the CMOS Congress at the IUGG General Assembly:
http://cmosarchives.ca/CongressPhotos/collage2019congress.html

RSC Fellowship for CMOS President Kim Strong

CMOS President Kim Strong has been elected a Fellow of the Royal Society of Canada (RSC). She is not only President of CMOS, but also chair of the Physics Department at U of T and a lead for PEARL science and operation.

The official RSC announcement states:

"Kimberly Strong is an internationally eminent atmospheric physicist who employs an array of spectroscopic techniques to probe the composition of the atmosphere. She has developed novel experimental methodologies and analysis tools, and established long-term observing capabilities in the Canadian Arctic and elsewhere. Her research has provided new insights into the physical and chemical processes that drive atmospheric change, furthering our understanding of ozone depletion, air quality, and climate."

Congratulations Kim!

Ninety-three new Fellows in the Academies of Arts and Humanities, Social Sciences, and Science have been elected by their peers for their outstanding scholarly, scientific and artistic achievement. Recognition by the RSC is the highest honour an individual can achieve in the Arts, Social Sciences and Sciences.

"The Royal Society of Canada is extremely fortunate to welcome these exceptionally talented scholars, artists and scientists as new Members of the Society. They have made outstanding contributions to their fields and to Canada's intellectual and artistic breadth, and are making a tremendously positive impact on the world. We recognize them for all that they have done, and indeed will continue to do, to advance scholarly and public life in Canada and around the world," says RSC President Chad Gaffield.

The 2019 Fellows and Members will be welcomed into the RSC this November, in Ottawa, during the RSC's Celebration of Excellence and Engagement. The presentation of RSC Medals and Awards, will also take place along with multiple opportunities to learn about and discuss the latest research results.

Source: https://rsc-src.ca/en/press-release-rsc-presents-class-2019

Michel Jean awarded 2018 Patterson Medal

On July 11, the 2018 Patterson Distinguished Service Medal was awarded to Michel Jean, DG of the Canadian Centre for Meteorological and Environmental Prediction Directorate (CCMEPD). The Patterson Medal is the Meteorological Service of Canada's most prestigious award and has been presented annually since 1954.

Mr. Jean is being recognized for his exceptional contributions to the operationalization of meteorological science, advancement in environmental applications of numerical weather predictions and for exemplary work in representing Canada on the world stage.

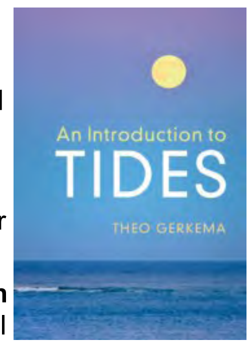
Michel's passion for computing, science, and the environment resulted in exceptional achievements. He has played a leading role in transferring advances in meteorological research and development into operational services both at the national and international level. His leadership on the international stage, through the World Meteorological Organization, has allowed Canada to influence the evolution of the world's weather infrastructure and leverage investments and knowledge from other countries.

Please join us in congratulating Michel Jean for his dedicated service and distinctive contributions to meteorology in Canada and around the world.

David Grimes, Assistant Deputy Minister, Meteorological Service of Canada

Diane Campbell, Associate Assistant Deputy Minister, Meteorological Service of Canada

Books Available for Review



An Introduction to Tides, 2019. By Theo Gerkema, Cambridge University Press, ISBN 978-1-108-46405-5 (Paperback), 211 pages, $51.95 USD (2019-3)

Other recent titles still available for review by a CMOS member:

- **18 Miles: The Epic Drama of Our Atmosphere and Its Weather,** 2018. By Christopher Dewdney, ECW Press, ISBN 978-1-77041-346-7 (Paperback), 251 page, $21.95. (2019-1)
- **A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow**, 2019. By Joshua S. Goldstein and Staffan A. Qvist, Hachette Book Group, ISBNs 978-I-5417-241O-5 (hardcover), 978-1-5417-2409-9 (e-book), 288 pages, $34.00. (2018-9)
- **Trends and Changes in Hydroclimatic Variables: Links to Climate Variability and Change**, 2019. Edited by Ramesh Teegavarapu, Elsevier Inc., ISBN 978-0-12-810985-4, 400 pages, US$127 (2017-10)
- **Tropical Extremes: Natural Variabilities and Trends**, 2019. Edited by V. Venugopal, Jai Sukhatme, Raghu Murtugudde, Remy Roca, Elsevier Inc. ISBN 978-0-12.809248-4, 333 pages, US$110 (2018-11)
- **World Seas, An Environmental Evaluation. VOLUME III: Ecological Issues and Environmental Impacts**, Second Edition, 2019. Edited by Charles Sheppard, Elsevier Inc. ISBN 978-0-12-805052-1, 633 pages, US$250. (2018-12)
- **Synoptic Analysis and Forecasting, An Introductory Toolkit**, 2017. By Shawn Milrad, Elsevier, ISBN 9780128092477, 246 pages, US$125.00 (2018-1)
- **Ice Caves**, 2017. Edited by Aurel Persoiu, Elsevier, ISBN 9780128117392, 752 pages, $225.00 (2018-2)
- **Rainbows: Nature and Culture**, 2018. By Daniel MacCannell, The University of Chicago Press and Reaktion Books Ltd, ISBN 9781780239200, 208 pages, US$24.95 (2018-4)
- **The Deep Pull: A Major Advance in the Science of Ocean Tides**, 2018. By Walter Hayduk, FriesenPress, ISBN 9781525518706 (hardcover) $35.49, 9781525518713 (softcover) $27.49, 9781525517820 (eBook) $11.99, 251 pages. (2018-7)

Never reviewed a book before? No problem! Check out some of these past reviews for ideas: Ice: Nature and Culture; Weather in the Courtroom; Convenient Mistruths: A Novel of Intrigue, Danger and Global Warming; Weather, A Very Short Introduction; Nonlinear and Stochastic Climate Dynamics.

If you a review a book it is yours to keep! Contact the Editor to get involved.

Council / Conseil d'administration

CMOS Bulletin SCMO @ bulletin.cmos.ca

This publication is produced under the authority of the Canadian Meteorological and Oceanographic Society. Except where explicitly stated, opinions expressed in this publication are those of the authors and are not necessarily endorsed by the Society.

CMOS Bulletin SCMO @ bulletin.scmo.ca

Cette publication est produite sous la responsabilité de la Société canadienne de météorologie et d'océanographie. À moins d'avis contraire, les opinions exprimées sont celles des auteurs et ne reflètent pas nécessairement celles de la Société.

Thank you to Bob Jones for his continued editorial assistance and guidance.