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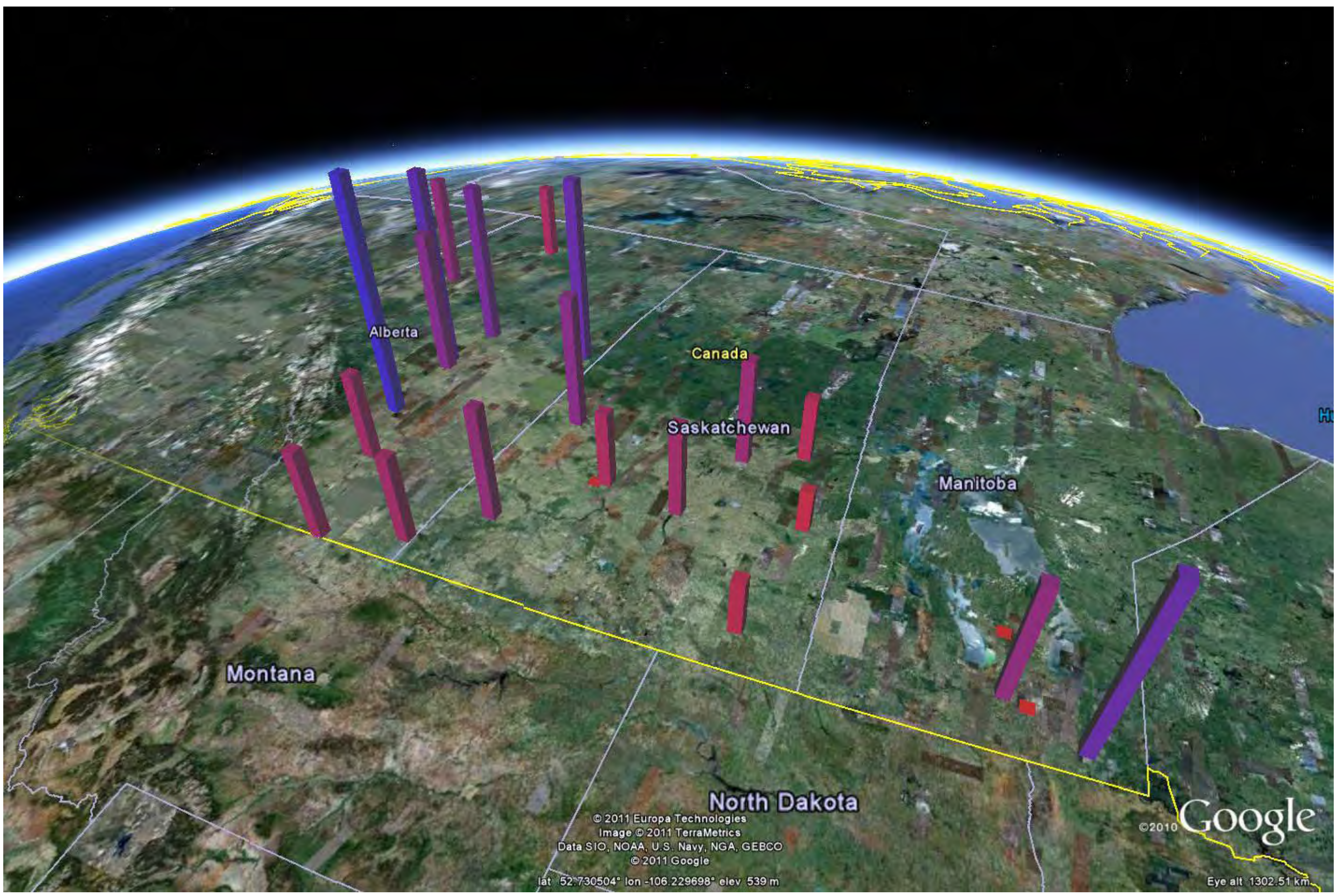
SCMO

Canadian Meteorological and Oceanographic Society

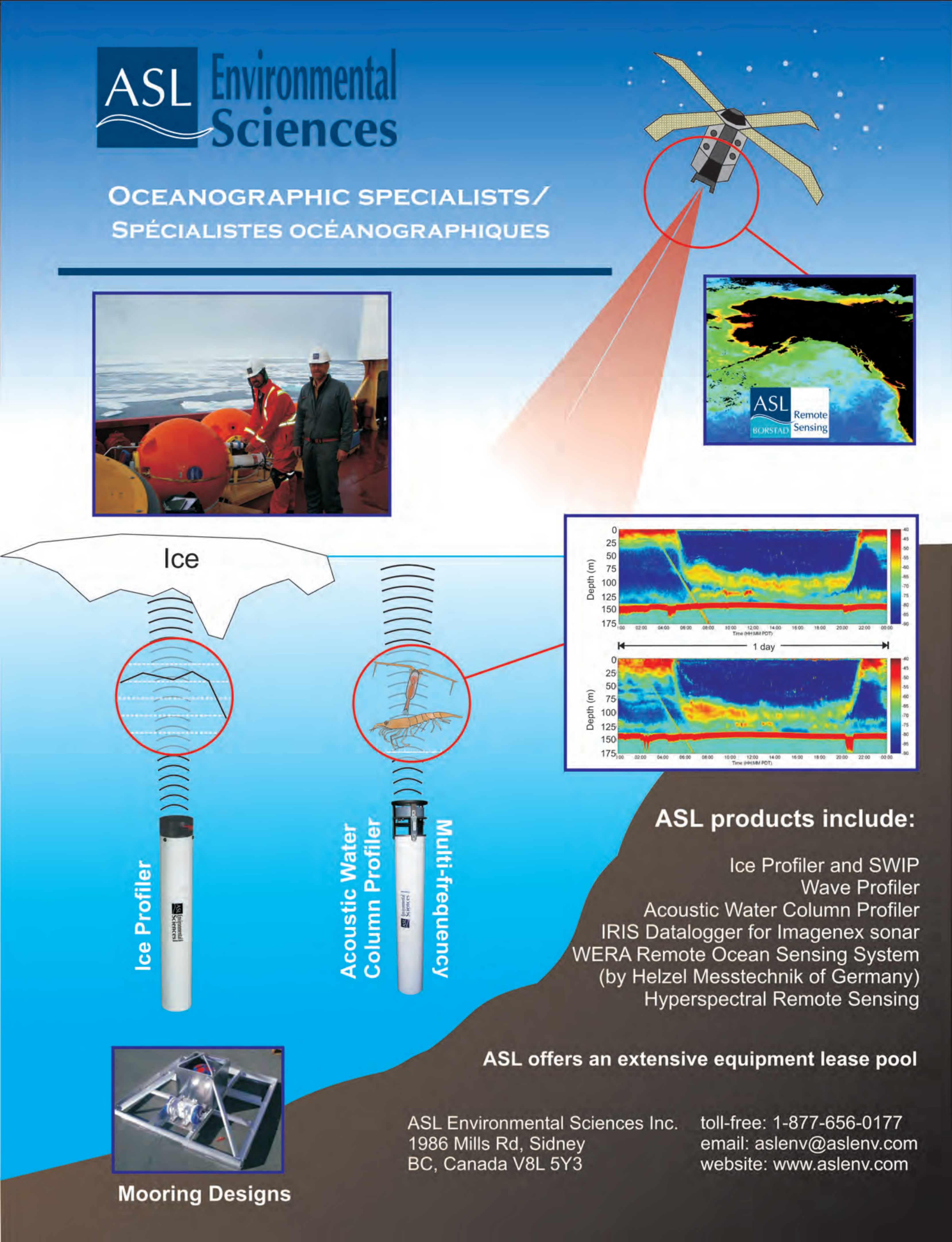
La Société canadienne de météorologie et d'océanographie

April / avril 2011 Vol.39 No.2

Groundwater Level Data in 3D Google Earth Visualization



Données du niveau de la nappe phréatique utilisant la représentation 3D de «Google Earth»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....from the President's Desk

Friends and colleagues:

A much higher percentage of Canadians than Americans believe that climate change is real, according to a recent polling study carried out by Sustainable Prosperity, a research and policy network at the University of Ottawa (see http://www.sustainableprosperity.ca/article911). The findings of this study include:

David Fissel
CMOS President
Président de la SCMO

1) In Canada, 80 per cent believe in the science behind climate change, compared with 58 per cent in the United States;

2) Canadians expressed a higher degree of willingness to pay for increased production of renewable energy resources than their American counterparts;

3) While most Americans do not support such policy options as cap and trade and carbon taxes, a majority of Canadians indicated that they would support such policy options even if this imposed increased costs of up to $50 per month in energy expenses.

These results are encouraging for CMOS, and our nearly one thousand members, who provide understandings and forecasts in meteorology and oceanography for all Canadians. Just prior to the December 2009 Copenhagen international forum, the CMOS Council endorsed a press release and a letter to all Members of Parliament on the urgency of action on climate change. In June of last year, an important outcome of the 2010 CMOS-CGU Joint Congress was the Statement of Concerns on Climate Change issued by scientists attending the meeting, based on the timely scientific results provided in many papers presented at the Congress.

(Continued on page 43 / Suite à la page 43)

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

Le but de la SCMO est de stimuler l'intérêt pour la météorologie et l'océanographie au Canada.

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Inside / En Bref

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Cover page: The figure on the cover page is of a 3D visualization of groundwater levels in Google Earth. The unaffected shallow observation wells show the annual change in water table for the period of June 1, 2001 to May 31, 2002 [ranges between a decline of 50 cm (short/red) to an increase of 50 cm (tall/blue)]. Google Earth was a tool used by the Drought Research Initiative (DRI) to integrate and present research results. To learn more please read the article by Harder et al. on **page 45**.

Page couverture: L'image en page couverture représente une visualisation en 3D des niveaux de la nappe phréatique utilisant "Google Earth". Les puits d'observation peu profonds montrent le changement annuel dans le niveau de la nappe pour la période du 1^er^ juin 2001 au 31 mai 2002 [écarts entre un déclin de 50 cm (court/rouge) à une augmentation de 50 cm (haute/bleue)]. "Google Earth" est un outil utilisé par l'Initiative de recherche sur la sécheresse (DRI) pour intégrer et présenter les résultats de leur recherche. Pour en apprendre plus, prière de lire l'article de Harder et coll. en **page 45**.

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....from the President's Desk (Continued / Suite)

At present, Dr. Tom Pedersen, Executive Director of the Pacific Institute for Climate Solutions, has been addressing the issues of climate change as the 2011 CMOS Tour Speaker through public lectures across Canada. Dr Pedersen has been emphasizing that "global warming caused by human activities is happening, it is scientifically well understood and, it presents a serious challenge to human societies." Along with this profound challenge, Dr. Pedersen is identifying opportunities for us to do things better, through more creativity in our stewardship of our natural environment, and to revitalize our economy while engaging in new, cleaner industrial activities.

CMOS must continue to take a leadership role in raising and explaining the issues of climate change as part of our overall mandate to advance meteorology and oceanography in Canada.

Finally, in the spirit of National Volunteer Week in Canada (April 10-16, 2011), I would like to pay tribute to the hundreds of CMOS members who give their time and energy to advance and promote meteorology and oceanography. CMOS volunteers make up the CMOS Executive and Council, the many CMOS Committees, the many volunteers who organize and operate our Annual Congresses, CMOS members who participate in national and international scientific committees and the executives of local CMOS Centres across Canada. The work of our CMOS volunteers is essential and enriches all of us within CMOS and the larger communities that we serve. Thank you!

David Fissel
CMOS President
Président de la SCMO

Highlights of the January and February CMOS Executive Meetings

Congresses

Victoria, June 5-9, 2011
The abstract submission deadline has passed. 478 abstracts have been received, which falls in between the numbers submitted to the Halifax and Ottawa Congresses. There were ~ 100 requests to give posters, which is higher than usual, possibly because the organizers highlighted that there would be plenty of space for posters and three poster prizes. The icebreaker will be held at the Royal BC Museum. There are confirmed sponsors for the icebreaker and a pre-banquet reception. About half of the exhibitor booths have been sold. All the exhibitor information has been translated into French and is available online. There will be a video camera in the main plenary room, in case of overflow out of the room. Oceans Day (June 8th) falls during Congress this year. Volunteer recruitment is under way.

Saskatoon, 2013
Hotel contracts are nearly complete. Three quarters of LAC populated; only three more members are required. The agreement to co-host with the Canadian Geophysical Union is in progress.

Other General Issues
The Canadian Foundation for Climate and Atmospheric Science (CFCAS) is continuing to build a business case for refunding. The nominating committee has been actively looking for another Environment Canada Board member.

David Fissel is in discussion with the Presidents of the Canadian Geophysical Union and Canadian Society of Soil Scientists about the expansion of the Canadian Society of Geophysical Sciences.

CMOS Membership continues to grow this year. We are about 5% ahead of last year in renewals. Student memberships are up by about 20%. Members now have access to *Atmosphere-Ocean* online, so long as their membership is current. This is the end of membership renewal season. Members are left on the active list until the end of March, after which they go into the lapsed file. Lapsed members can renew for the next two years, after which they have to reapply to rejoin.

Tom Pedersen's CMOS Speaking Tour is under way. His presentations in eastern Canada have received positive media attention.

CMOS members are encouraged to submit their work for publication in *Atmosphere-Ocean*, our own journal.

Sophia Johannessen,
Recording Secretary / Secrétaire d'assemblée

Correspondance / Correspondence

From: Denis Gilbert
Maurice-Lamontagne Institute

To: Canadians interested in temperature and salinity data from Argo profiling floats.

Date: February 16, 2011

Subject: 2010 Argo Report

You will find in this issue of the *CMOS Bulletin SCMO*, (on page 57) the 2010 Argo Canada report that I recently submitted in preparation for the 12th meeting of the international Argo Steering Team (AST-12).

In the last message that I sent to this distribution list (May 2010), I had advertised the Argo Canada Townhall meeting that took place on June 3rd at the 2010 CMOS congress in Ottawa. The main objectives of this Townhall meeting were to touch base with Canadian users of Argo temperature and salinity data, and discuss ways of strengthening financial support to Argo Canada in the future. If you wish to know more about the present status of funding and human resources devoted to Argo Canada, the relevant information appears in section 2 of the attached 2010 report.

The Argo Canada Townhall meeting was well attended with about 40 participants from government and academia. A number of interesting suggestions were made, but I only mention two here for brevity. 1) Seek funding from the CFI (Canada Foundation for Innovation) for the purchase of Argo profiling floats. This would require champions from the academic sector. And to keep with Argo's open data-sharing policy, the data from these floats would have to be made publicly available in real-time. 2) Since Argo temperature and salinity data are presently being assimilated in real-time in operational ocean and atmospheric models, we should seek financial support for the collection of Argo data. In particular, the interdepartmental initiative CONCEPTS (Canadian Operational Network of Coupled Environmental PredicTion Systems) involving DFO, EC and DND would seem to be a promising avenue for the operational use (and funding?) of Argo data.

While these ideas may bear fruit in the long term, I need to remind you that in the short term, we have not yet found a stable source of funding for Argo Canada satellite communications costs, which total about 65 000 dollars per year. This remains our most immediate financial concern. If you have some leftover money at the end of the fiscal year, we welcome all contributions. Just email or phone me and I will let you know how you may help with maintaining afloat our CLS America satellite communications account.

STOP PRESS !!!

New CMOS Undergraduate Scholarship in Memory of Dr. Dan Wright

Dr. Daniel G Wright

A new CMOS undergraduate scholarship has been created in memory of Dr. Dan Wright, who passed away suddenly in July 2010. Dr. Wright was a senior research scientist at DFO's Bedford Institute of Oceanography, as well as an Adjunct Professor at Dalhousie University, for many years prior to his passing. In his outstanding career as an eminent physical oceanographer, Dr. Wright was highly productive, a generous and respected scientist, and an advisor, colleague and friend to many in the oceanographic and atmospheric research communities. In particular, he cherished the opportunity to interact with students and young scientists, which is the motivation for honouring his memory through an Undergraduate Scholarship. A complete summary of his many accomplishments and honours appeared in the *CMOS Bulletin SCMO* (vol. 38, No. 4) in August 2010.

The new CMOS Undergraduate Scholarship named in honour of Dan Wright, in the amount of $1,000, will be awarded to a Canadian undergraduate student entering his/her final year of a B.Sc. Honours program in Mathematics and/or Physics, or a related discipline, at a Canadian university. The successful candidate will be selected on the basis of: his/her academic standing; a demonstrated interest in pursuing graduate studies in physical oceanography or a related field of study; and the ability and interest to communicate and share his/her knowledge with others, as indicated in his/her resume and/or letter(s) of reference. CMOS intends to offer this new undergraduate scholarship for at least the next five years, or longer as donations allow. Donations for the new CMOS Undergraduate Scholarship in Dan Wright's memory can be made to the Scholarship Fund of the Canadian Meteorological and Oceanographic Society (CMOS). A donation form can be found on the CMOS website.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **June 2011.** Please send your articles, notes, workshop reports or news items before **May 6, 2011** to the address given on page 42. We have an URGENT need for your written contributions.

ARTICLES

Experiences in the Management, Archiving and Visualization of Data for Drought Research in DRI

by Phillip Harder[1], Patrice Constanza[2], Christian Saad[2], Rick Lawford[1], Ronald Stewart[1]

Abstract: Data management was an integral part in facilitating the research of the Drought Research Initiative (DRI) which studied the 1999-2005 drought over the Canadian Prairies (Stewart et al., 2008). DRI was established to better understand the physical characteristics and processes influencing Canadian Prairie droughts, and to contribute to their better prediction, through a focus on the recent severe drought that began in 1999 and largely ended in 2005. This work was funded through the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) and conducted research from 2005-2011. A significant challenge of this network was that the data and information necessary to conduct this analysis was primarily collected by agencies external to DRI before the formal research program began. Challenges and hurdles were faced in collecting, managing, integrating and archiving various data from global to local domains. The experiences of this endeavour were valuable and resulted in systems and data collections which facilitated the activities of the network as well as providing a stepping stone for future drought research in Canada.

Résumé: La gestion des données a été partie intégrante pour favoriser la recherche au réseau DRI (Drought Research Initiative – Initiative de recherche sur la sécheresse) qui a étudié de 1999 à 2005 la sécheresse sur les Prairies canadiennes (Stewart et al., 2008). En raison d'une sécheresse exceptionnelle prolongée de 1999 à 2005, le réseau DRI a été mis en place pour mieux comprendre les caractéristiques physiques et les processus qui influencent les sécheresses sur les Prairies canadiennes, et aussi pour contribuer à une meilleure prédiction de tels événements. Ce projet a été financé par la Fondation Canadienne pour les Sciences du Climat et de l'Atmosphère (FCSCA) et a mené à une recherche de 2005 à 2011. Un défi important de ce réseau, pour mener à bien l'analyse des données et des informations, a été principalement de les recueillir d'agences externes au réseau DRI avant le début du programme de recherche formel. On a dû faire face à des défis et des obstacles dans la collecte, la gestion, l'intégration et l'archivage de différentes données appartenant autant au domaine global que local. Les travaux, dans lesquels on a mis beaucoup d'effort, ont été d'un grand intérêt et ont produit des systèmes et des cueillettes des données, ce qui a favorisé les activités du réseau tout en fournissant un point de départ pour la recherche future sur la sécheresse au Canada.

1. Introduction

1.1 Rationale

The scientific process in the information age has evolved as information processing and storage capabilities have made extraordinary advances regardless of discipline. Systematic planning and management is required to realize the full potential of the emerging data-science infrastructure which scientists must employ to remain relevant (Arzberger et al, 2004). DRI responded with the development and resourcing of a Data Management (henceforth DM) component within the DRI Secretariat.

1.2 Data Challenges

Challenges encountered by DRI, in regard to data needed to fulfill the research objectives and mandate of DRI, included issues of data-sharing policies, data access, data formats, data discontinuities and data stewardship.

Photo taken near Consul, Saskatchewan in April 2002. Photo courtesy of Ted Banks, Agriculture and Agri-Food Canada.

[1] University of Manitoba, Winnipeg, MB, Canada

[2] McGill University, Montreal, QC, Canada

Archive	Datasets
Data Access Integration (DAI)	• NARR • EC Observation Station Data • Regional Claimate Models [CRCM and ARPEGE] • Global Climate Models [CGMC2, CGMC3, HadCM3 and ECHAM4] • NDVI
Investigator Archives	• Field Data [St. Denis (SK), West Nose Creek (AB), Kenaston Soil Moisture Mesonet (SK), Assiniboine Delta Aquifer (MB), and Crop Agro-Meteorology (SK and MB)] • Observational Data [steamflow, upper air, meteorological, lightning, snow cover/surveys, soil moisture, groundwater, wetlands, soils and sea surface temperatures] • Gridded Meteorological Data [CRU TS 2.1, ANUSPLIN and CanGRD] • Indices [SPI, PDSI, CMI and Teleconnections] • Model Simulations [VIC, CRHM, PAMII, SABAE, GEM, MESH and CLASS] • Satellite Data [GRACE, MODIS and AVHRR] • Water/Energy Budgets • South Saskatchewan River Basin Project Datasets • Environment Canada Weather Radar • Canadian Precipitation Analysis [CaPA] • CPC Merged Analysis of Precipitation • GPS derived Precipitable Water • Surface Radiation Budget (SRB) Cloud Data • And Others
DRI Website	• 1km Land Surface Grid • AB/SK/MB Groundwater Data • Hourly Environment Canada Meteorological Data • Alberta Agriculture Meteorological Data • Environment Canada Adjusted and Harmonized Canadian Climate Data
DRI Data Legacy	• Prairie Radar Data • 1960-2006 Hourly Meteorological Data at selected Prairie Locations • PAM II Model input and output • VIC Model input, output and derived SMAPI • VIC Model output over the Upper Churchill • Gridded SPI and PDSI • Kenaston Soil Moisture Mesonet • Census Ag Region Yield Deviation • Growing Season NDVI • Prairie Groundwater Data • Gridded Land Surface Dataset • West Nose Creek, AB Station Data • St. Denis Station Data • Modelled Prairie and Wetland Hydrology • Grace Satellite Data • Eddy Correlation Data • SABAE-HW v 1.5 Model Code • And Others

Table 1: DRI Data Holdings

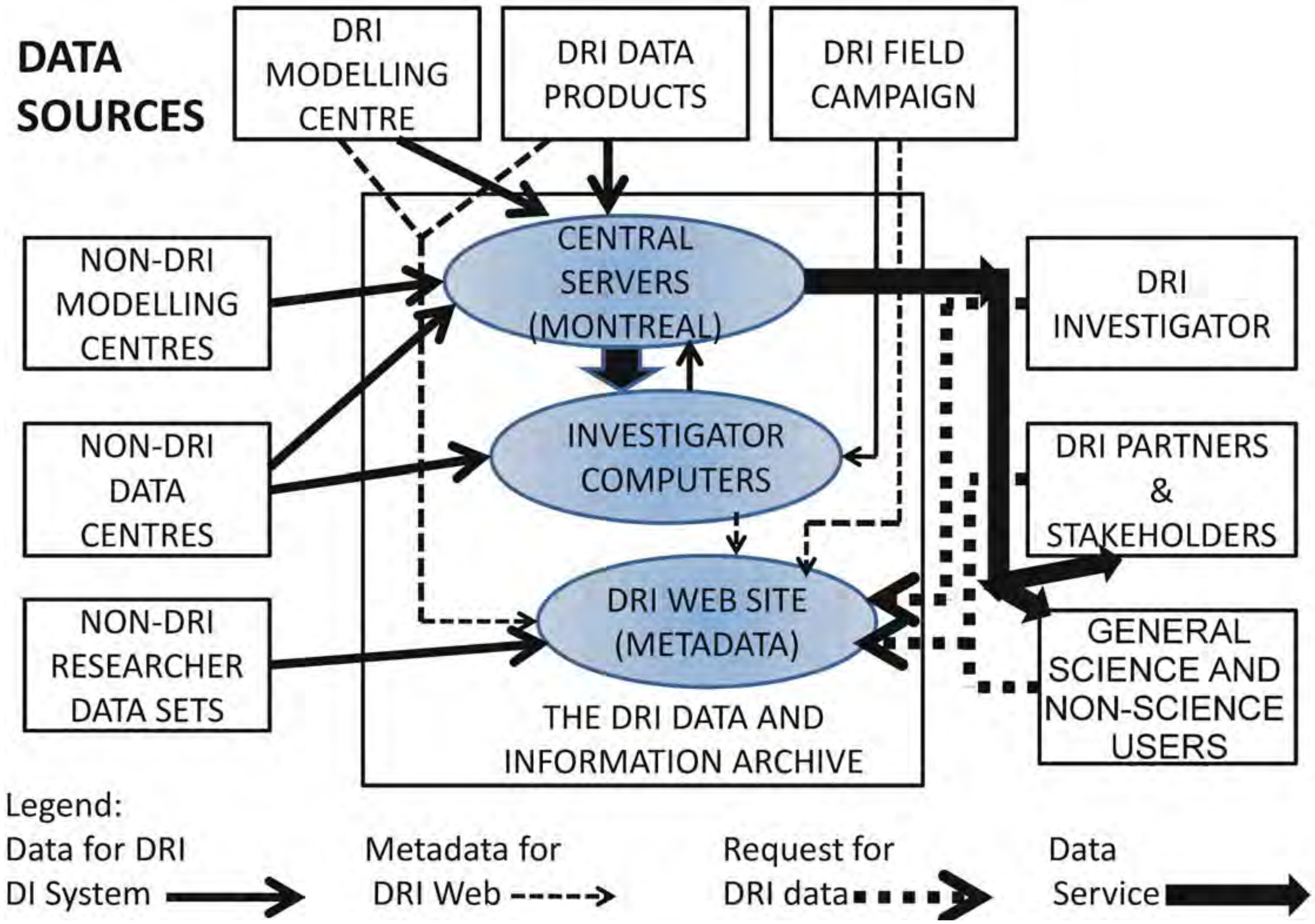

Figure 1: The DRI Data and Information System (Lawford, 2009)

1.3 Data Sharing

Data sharing policies can often have a far greater role in how data is handled than any technical constraints. Perspectives on data vary which have implications for data management relating to aspects such as ownership, proprietary rights, defining user access and sharing. Differences of perspective can largely be divided into two major schools of thought in this regard - one advocating open transparent access; the other advocating closed or selective policies built around strictly enforced copyrights and intellectual property rights (Muray-Rust, 2008). DRI typically encountered semi-open perspectives as use was generally governed by either formal or informal licences that allowed distributors to make data available under certain conditions. The reasoning is that economic and academic environments are competitive and an advantage can be gained by restricting the sharing of data. Sharing is only done under the agreement that the data is not to be distributed further which may undermine those advantages. These perspectives create challenges that must be dealt with when advocating for open access within DRI; data management in the case of DRI was as much management of social mechanisms, i.e. sharing policies, as it was a technical exercise.

1.4 Data Access

Data access is often just as important as a datasets data-sharing policy to a potential user. While a dataset may be freely available, if users cannot easily find or access it, it is of little use. The large amount of information available can further restrict access as data can become easily buried. Without easily accessible data, users are inhibited in their work while a data provider's work is not being fully utilized. Additionally, online networks, essentially the only medium through which data is made accessible presently, can be dynamic and maintaining static linkages is difficult.

1.5 Data Format

Data can be available and accessible but issues relating to its formatting can directly impact its usage. If the format is unfamiliar or beyond the capabilities of a researcher, the effort needed to utilize it may involve an unjustifiable investment of time, energy and resources. Additionally, formats can become unsupported over time as software and

IT systems advance. Standardization of the data to simple and relatively stable and supported formats is often the best way to address this issue.

1.6 Data Discontinuities

A major challenge of DRI in achieving its research outcomes adequately is linked with data discontinuities. An example of this is the limited amount of quality data spanning the Canadian-American border. The emphasis of DRI's research is on the Canadian Prairies which is directly adjacent to this discontinuity. The full extent of the drought as such is often assessed without input of the processes occurring to the south. The discontinuity in data is due to each nation's separate archives and varying network densities, methodologies, standards and units of measurement. This is a long term challenge that DRI was unable to address but other initiatives (such as the GEO bilateral working groups (USGS, 2008)) are carrying out testbed studies to address this issue.

1.7 Long Term Stewardship

Long term stewardship of datasets beyond the lifetime of the research projects producing them can be problematic. Funding agencies are not set up to ensure data stewardship, as that is not their mandate, and, in some cases, have limited interest in addressing this problem. The most valuable legacy of many projects is their data, as the theories and assumptions involved are dynamic whereas the data are a permanent record of the past that can be used in other research environments. The value of historic datasets while often recognized is not enough to prevent them from being neglected as the intellectual and technical infrastructure and resources are currently inadequate in Canada to facilitate the achievement of these goals.

To address the challenges of data in the 21st century there are two components commonly employed; one dealing with the discovery, access and management of datasets for ongoing research programs and the other dealing with the archiving and annotation of datasets for future research programs. The DRI DM strategy, with its own unique challenges, addressed both components.

2. The Drought Research Initiative

The DRI network can be considered a test bed for scientific data management in a Canadian research network. In order for DRI to fulfill its research objectives in an efficient, coordinated and timely manner, DM was required. There were four identified goals for DRI DM. Firstly, DRI DM was to support the research network by providing the necessary infrastructure for the Investigators to perform their work. Such infrastructure provided data access, data management, and data archiving. Secondly, DRI DM was to provide the expertise on a wide range of data Investigators needed but lacked the time to develop. This expertise gave investigators more time for the analysis and interpretation of the data. Thirdly, DRI DM was to help the Investigators to integrate their results in a more user friendly way with the use of visualization tools such as Google Earth. Lastly, DRI DM was to facilitate the long term storage of DRI related datasets. All of the DRI data and associated systems discussed in this report can be accessed by visiting the DRI website data page at www.drinetwork.ca.

DRI DM's goals were met by the development of two systems. The DRI Data and Information System was the operational system and focussed on acquiring and managing datasets for the benefits of the investigators and directly contributing to the scientific program of the network. The DRI Data Legacy System was developed to organize and archive the datasets used and produced by the investigators for long term public access following the completion of DRI. DRI operational and legacy data holdings were quite diverse and a brief summary can be found in Table 1 shown above.

2.1 DRI Data and Information System

The DRI Data and Information System acted as an interface facilitating the interaction between DRI data users and the data. The focus of the research endeavour was on the 1999-2005 drought and, as a result of DRI only beginning in 2005, the data necessary to study the drought came from many non-DRI sources. The data system envisioned by DRI DM provides a range of services for accessing the data using various platforms. It is based on the following five principles. Firstly, DRI, through its research efforts, sought to develop and disseminate information about drought and to enable stakeholders to provide better drought monitoring, drought prediction and guidance to the public. Secondly, the DRI Data and Information System was the central element in DRI's services to stakeholders. Thirdly, the DRI data policy advocated open access for all data but also respected the right of those investigators who collect field data to have time for the quality control and analysis of these data before making them open to the broader research and applications communities. The DRI data policy also respected the restrictions that data suppliers may have placed on their data. Fourthly, all users of DRI data sets respected the effort that goes into collecting and processing these data and properly referenced the source of the data and the DRI project. Lastly, as a Canadian project, DRI fully cooperated with Group on Earth Observations (GEO) and viewed itself as a prototype for how GEO could interface with research projects in the future. To meet these principal requirements the conceptualized Data and Information System was distributed over a variety of platforms (Figure 1). The DRI vision for the Data and Information System was integrated central servers, investigators' local computer systems and a website to deliver integrated services to the investigators, the drought community and the public.

Data Access Interface (http://loki.qc.ec.gc.ca/DAI/): The Data Access Interface (DAI) functions as the central servers for the DRI network and contains many large datasets. The data holdings on this system include model outputs from Canadian, US, British and French regional and global climate models, Environment Canada observational data and remote sensing data from the Canadian Centre for Remote Sensing. The number of data sets on this system continues to increase. Other than the Canadian Regional Climate Model (CRCM), access to the data is limited to registered users from the partner organizations which funded DAI's development. Due to space restrictions on the DRI web server two datasets were placed on the DAI servers, in a dedicated DRI directory, and were only accessible through the DRI website. These datasets were assembled specifically for DRI and included groundwater observation wells for the Prairie Provinces and gridded Canadian land surface data.

Local Computer Systems
All investigators had their own systems and many produced value-added datasets. Metadata for these products were developed and placed on the web site.

DRI Web Site (www.drinetwork.ca)
The DRI web site provided a user-friendly entry point to the different data sources within the DRI data system and elsewhere on the internet. In relation to DAI which handled large complex datasets the DRI website focussed in connecting users with smaller more specialized datasets. In relation to DAI, the DRI website did not have the infrastructure or space necessary to handle anything other than simple datasets. A restricted directory, accessible only to investigators, contained most data on the DRI website. Data included Environment Canada meteorological station data (hourly data from the GRP interface as well as adjusted historical datasets for the Prairie Provinces) and Alberta Environment meteorological station data. These datasets ultimate owners were the contributing agencies and the conditions under which DRI obtained the data limited the use of the data to DRI participants only. In addition to a selection of data on the DRI website an extensive list of datasets, organizations and projects related to drought on the prairies and globally was created. This list's objective was to provide the investigators of DRI with a one-stop shop to find drought-related data and information. The list progressed from a simple PDF document, to a HTML list and finally a searchable MYSQL database during the course of DRI. This resource was populated primarily by internet searches, and participant suggestions.

Data Management
The nature of DRI meant that the data were collected and managed by external parties and DRI DM acted as an intermediary. The consequence is that DRI DM did not undertake QA/QC procedures on the data nor did it maintain real-time datasets. The responsibility of quality control of the data was left with the investigators so the DRI system tended to be a "collect and forget" setup from a data management perspective in this regard. The data were received from the providers, who were responsible for their own QA/QC, and DRI DM merely facilitated the storage and exchange of information. An effort was undertaken to ensure documentation was made available but actual data manipulation beyond organizing the data into a logical format was limited.

Data Sharing
The DRI data access policy outlined the access to the datasets DRI collected and managed during its active phase. Access was unrestricted for members of the network and to outside users on a case-by-case basis. The data policy was formulated by the DM, recommended by the Science Committee and approved by the Board of Directors which made it obligatory for DRI investigators to follow. This data policy committed DRI to the establishment, maintenance, validation, description, accessibility, and distribution of high-quality, long-term data sets. Full and open sharing of the full suite of data sets was expected. The data archives needed to include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data. The data would be provided at the lowest possible cost to DRI researchers in the interest of full and open data access. Finally, all data would be made openly available beyond an initial period for quality control judged to be reasonable by the DM and the DRI investigator. These policies dictated the terms by which DRI approached data-sharing within and outside the network over the course of the project.

2.2 DRI Data Legacy
DRI collected and generated a large amount of data that relate to drought but without a centralized data service they are not readily available to potential users. In order to meet the needs of users of drought data as well as in response to a funding condition of CFCAS, an integrated data system for consolidating regional information about drought was developed. The DRI Data Legacy was formally integrated into the 2009-2011 GEO work plan under Task WA-06-02b and was accepted as a Type 3 Initiative in response to a GEO Call For Participation (CFP) for Earth Observations in Decision Support (GEO, 2010). The DRI Data Legacy System not only serves the needs of the research community but it provides governments and the public with better access to information about the drought phenomenon.

Structure
A modest attempt was made to integrate the datasets and metadata in the data legacy. The DRI Data Legacy (Figure 2) includes a metadata database that is coupled with a user friendly web interface which utilizes Google Map technology to add a spatial component to searches and results. This centralized metadata database links to centralized service

available through DAI and distributed data on other computer systems. The goal of these services is that users can find relevant drought data that can be tailored to their location of choice. In this manner both the centrally archived datasets and distributed datasets are accessible from a common portal. Optional conditions to narrow results include text search, spatial bounding, temporal extent, keywords and data source. Data that are being made available (at the time of this article submission) are identified in Table 1 shown above.

Metadata

The cornerstone of the DRI Data Legacy was metadata and at a minimum the core components of the ISO 19115 metadata specification were collected. This standard was selected due to its current broad acceptance at many levels, its inter-operability with other standards and its emerging presence as the global standard. This attribute allows for DRI metadata to be potentially inter-operable with global data discovery systems. The metadata were collected through an online form allowing all contributors to submit their metadata directly to the DRI DM in a standardized manner. The raw metadata underwent a validation stage that utilized the open-source program CatMDEdit which produced validated ISO 19115 metadata in XML and HTML.

Data

Data that were used or produced through DRI-funded research were collected from the investigators for inclusion in the data legacy. The data cover a wide array of formats, sizes and variables which made the development of a systematic data storage system challenging with the resources available. In addition, the potential amount of data available was reduced due to the restrictive data-sharing policies of several original data providers. In such situations, efforts were made to either establish connections to these datasets through the investigators or original data providers, and to include them as part of this distributed archive. Access to these datasets was granted on a case-by-case basis by the data custodian.

Data Legacy Policy

The data legacy required a different data policy than the operational system as it needed to be a stand-alone system with no maintenance required. This policy was designed to define the contents of the data legacy and how it would be designed and operated for public access. The most important part of the legacy policy is the data-sharing policy. It is a non restrictive policy of licensed use as the majority of the data available is provided to DRI under a data sources own licensed use policies. No data were made available in the legacy if its source data policy would be violated in this manner. By downloading the data, the user is agreeing to acknowledge and cite DRI and the original data sources as the source of the data in any work. This conforms to current standard sharing practices.

Long Term Stewardship

Data hosting for the data legacy relies on external partners as DRI's mandate does not include operation and maintenance of servers beyond its time frame. The data legacy would not be possible without these relationships. Two locations were made available for the hosting of the data. DAI facilitated the provision of a directory in their existing system for the data legacy. This directory was externally accessible and simple hyperlinks facilitated the connection of the metadata database and the datasets. NCAR provided a similar space, though larger, that was able to handle the size of the large radar data archive (~1.3 TB). The metadata database and the datasets were also connected by simple hyperlinks.

3. Google Earth Data Visualization

The difficulty in data visualization is that the many different formats of geospatially referenced scientific data such as NetCDF, GriB and ASCII have little in common. Different possibilities to overcome the many data visualization problems exist and experience using Google Earth to present geo-scientific data in an integrated manner was gained during DRI. Some of the reasons to use Google Earth include its user-friendliness, the ease with which files can be shared, its cost (free), the internet accessibility, the inclusion of spatial and temporal referencing and its GIS compatibility.

Google Earth can be obtained free of charge from www.earth.google.com and is a four-dimensional interface that uses the Keyhole Markup Language (KML) to simplify the conversion of data coming from different data formats to the specific format of Google Earth to visualize them. KML displays geographic data in an Earth browser such as Google Earth using a tag-based structure based on the XML standard. Conceptually, Google Earth is a blank sphere on top of which geographically referenced layers can be overlaid. Google Earth uses the 1984 World Geodetic System (WGS84) with a simple cylindrical projection to geographically reference its various components. The latter system can be of vector or raster format.

One of the big advantages in choosing Google Earth as a common way to visualize data is the fact that it has a very active online community that has developed extensive resources relating to the access, manipulation and applications of Google Earth and KML files. This has helped to stimulate the creation of new applications and technologies dedicated to Google Earth.

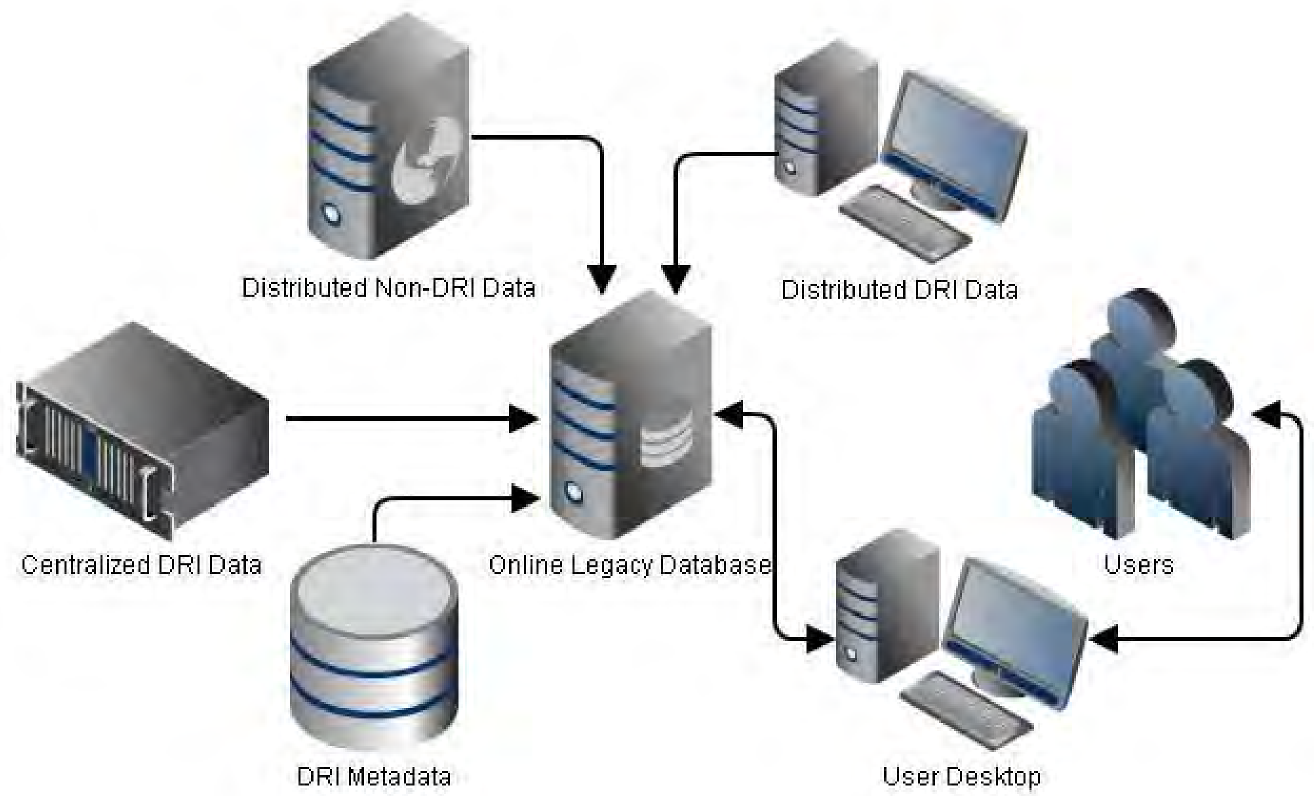

Figure 2: DRI Drought Data Legacy (adapted from Harder, 2010)

KML is simply a derived version of the XML language which facilitates the portability of KML and Google Earth as it can be read and understood by any type of web-browser over the Internet. KML uses XML tags to assign specific parameters such as spatial, time and description characteristics. KML is very flexible and allows for visualization of data in the form of points, lines, polygons, image overlays (see Fig. 4) and 3D models (see Fig. 3) all of which additionally can have added height, time, colour and descriptive attributes.

During the project, DRI DM researched and tested the different plausible and relevant ways to visualize drought related datasets with Google Earth. An outreach component of DRI, the DEWS (Drought Early Warning System) pilot project, utilized Google Earth to present data in a visually appealing and standardized manner. The KMZ file (compressed KML) of the DEWS example can be found at www.drinetwork.ca/dews. This pilot project showed the flexibility and integrative abilities of Google Earth when presenting geospatial data.

There is an ever expanding suite of tools that range from simple, free and open scripts to commercially developed and expensive fully featured programs. As KML is now an established standard of the Open Geospatial Consortium (OGC), commercial software developers such as ESRI are building KML functionality into their programs. For a more detailed discussion of the integration of data with Google Earth please visit the DAI website

http://loki.qc.ec.gc.ca/DAI/Google_Earth_what_is-e.html

where examples, tutorials and tools are available for generating various types of KML files.

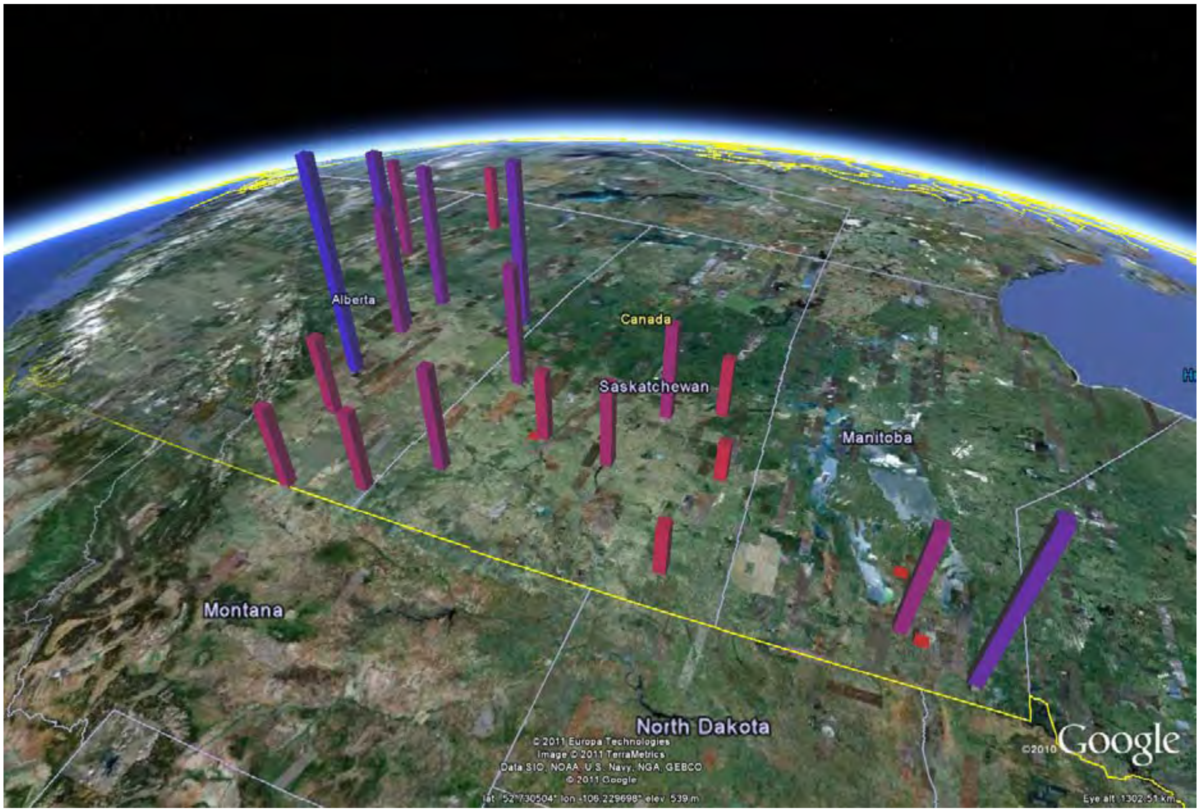

Figure 3: Groundwater Level Data in 3D Google Earth Visualization (Harder, 2009)

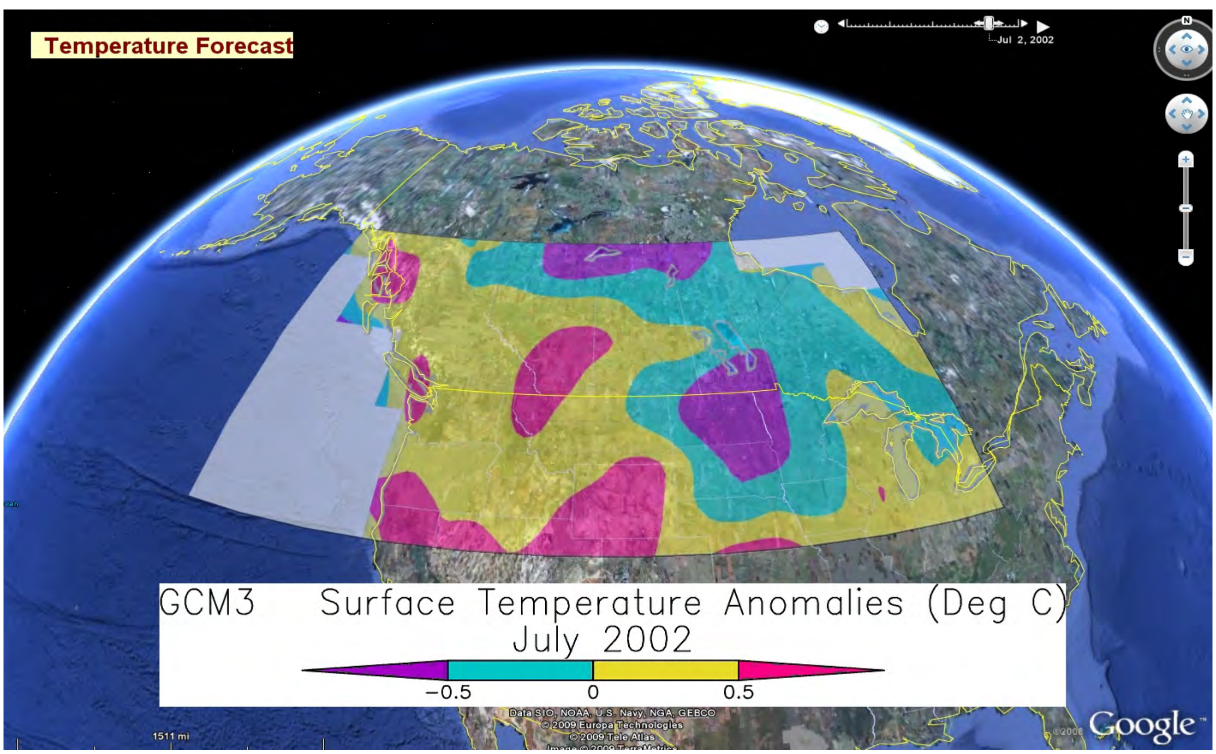

Figure 4: GCM3 Temperature Forecast Anomaly Google Earth Overlat (Harder, 2009)

4. Lessons Learned

Many lessons were learned in the course of the DRI project in regard to data management in Canada. Most importantly, more than ever, data management is integral to successful science. Operationally DRI was able to supply and find solutions for investigators' data needs pre-emptively as well as when requests were made. This was the intended and mandated goal of DRI DM. The greatest limitation on the operational Data and Information System was a result of the centralized nature of the DM. Within the network many investigators work within their own research groups on their own projects and did not utilize the capabilities of the DRI DM. This individual ad-hoc data management, which possibly is typical of many research projects in Canada, led to some redundant efforts in different parts of the network. This may have been the result of investigators lacking awareness of the tools at their disposal and due to DRI DM only being implemented after the strategic and long terms plans for DRI were made and individual researchers had commenced their studies. The science work done has been tremendous nonetheless on this crucial project with the allocated resources. The lesson to be learned in this regard is that future research must endeavour to develop centralized data management with strong linkages to the research groups from the proposal writing stage rather than an after-the-fact ad-hoc operation to be most effective.

The attempt to archive and retain data for posterity within the DRI Data Legacy is not a new concept. Intellectual property law generally requires the federal government to retain some ownership for data that is collected as a result of its research funding. Furthermore, all science to some degree tries to retain at least a small portion of the data it produces even if it is highly summarized as results in journal articles. The difference in this effort was that as much data as possible were to be included in the archive for a much larger audience; the public rather than specific research programs. Two lessons were learned from this. Firstly, while large amounts of data are thought to be preferable than less, there are tradeoffs in terms of the quality and condition of the data being retained. It is much easier to QA/QC a handful of excel files rather than hundreds of different datasets in dozens of formats. Additionally the selection of the most valuable datasets that must be retained is difficult as each user has different data needs. Any simplification of datasets reduces the applicability of the dataset to other users in ways that the data managers may not be aware of. DRI did not come up with an answer to this specific question other than a greater appreciation of the problems associated with determining what datasets to retain. The emphasis was placed upon metadata rather than data as a realistic response within DRI's time frame and resources.

The second lesson learned was from the endeavour to make data public. Even though perspectives on data are changing it is happening slowly and as a third party data provider it is difficult to make data publicly available in this context. DRI respected the ownership rights of its data providers as it would have been impossible to do the research it did without their help but it makes it difficult to leave a legacy of datasets that have been collected. The approach to deal with this issue once again was to focus on the development of metadata relating to the datasets used. There are no limitations on metadata like there are with data. It is an incomplete solution as the overall goal of an ideal data legacy is to provide data rather than act as an intermediary. Regardless, the value of metadata is often under-appreciated and should be a component of focus in any future systems. Provided the linkages of the distributed data archive and the metadata database remain valid, the DRI Data Legacy will facilitate future access of drought data to users. From the DRI perspective it was successful in its development of a data legacy as DRI's ultimate goal was to provide a path to data, which it did, rather than hold all the data centrally.

Advances in data visualization technology, their broad dissemination and easy access provide new tools for scientists. DRI utilized and assessed the applications of Google Earth and found great potential in presenting science in interactive and visual ways. These tools will only increase in value, use and applicability with time, for all disciplines with spatial components.

The key to future success that cannot be understated is that data management must be placed in a central position in any research program from the proposal level to coordinate the data activities. Future research successes, both in networks and within research groups, will be amplified if researchers are aware of, invest in and utilize data management tools and capabilities that are available or being? developed. The more closely researchers and data managers work together the more useful, valuable and applicable the data management and archiving systems will be to the progression of science. The DRI experience has shown that data management must be placed in a central role, in the context of our information age, in order for the research community to fully utilize the available infrastructure and expertise and, overall, to maximize the benefits that end users receive from science.

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Note from the Editor: A full description of project DRI can be found in *CMOS Bulletin SCMO*, Vol.36, No.3:

- Droughts in Canada: An Overview, by Barrie Bonsal, pages 79-86.
- A Drought Research Initiative for the Canadian Prairies (DRI), by Ronald Stewart, John Pomeroy and Rick Lawford, pages 87-96.
- User Expectations for the Drought Research Initiative (DRI), by Rick Lawford, Harvey Hill, Elaine Wheaton, Irene Hanuta, Alf Warkentin and Bill Girling, pages 97-102.

Note: This project was funded by the Canadian Foundation for Climate and Atmospheric Sciences.

2010 equals record for world's warmest year

Résumé: Selon l'Organisation météorologique mondiale (OMM), l'année 2010 est l'une des années les plus chaudes jamais observées, avec 2005 et 1998. En effet, les données recueillies par l'OMM ne montrent aucune différence statistiquement significative entre les températures moyennes à l'échelle du globe relevées durant ces trois années. En 2010, la température moyenne à l'échelle du globe s'est révélée supérieure de 0,53 °C à la moyenne pour la période 1961-1990. Cette valeur est supérieure de 0,01 °C et de 0,03 °C à la température nominale en 2005 et 1998, respectivement. L'écart entre les valeurs relatives à ces trois années est inférieur à la marge d'incertitude (± 0,09 °C) pour la comparaison des données.

Geneva, 20 January 2011 (WMO) - The year 2010 ranked as the warmest year on record, together with 2005 and 1998, according to the World Meteorological Organization. Data received by the WMO show no statistically significant difference between global temperatures in 2010, 2005 and 1998.

In 2010, global average temperature was 0.53°C above the 1961-90 mean. This value is 0.01°C above the nominal temperature in 2005, and 0.02°C above 1998. The difference between the three years is less than the margin of uncertainty (± 0.09°C) in comparing the data.

These statistics are based on data sets maintained by the UK Meteorological Office Hadley Centre/Climatic Research Unit (HadCRU), the U.S. National Climatic Data Center (NCDC), and the U.S. National Aeronautics and Space Administration (NASA).

Arctic sea-ice cover in December 2010 was the lowest on record, with an average monthly extent of 12 million square kilometres, 1.35 million square kilometres below the 1979-2000 average for December. This follows the third-lowest minimum ice extent recorded in September.

"*The 2010 data confirm the Earth's significant long-term warming trend*," said WMO Secretary-General Michel Jarraud. "*The ten warmest years on record have all occurred since 1998*".

Over the ten years from 2001 to 2010, global temperatures have averaged 0.46°C above the 1961-1990 average, and are the highest ever recorded for a 10-year period since the beginning of instrumental climate records. Recent warming has been especially strong in Africa, parts of Asia, and parts of the Arctic, with many subregions registering temperatures 1.2 to 1.4°C above the long-term average.

2010 was an exceptionally warm year over much of Africa and southern and western Asia, and in Greenland and Arctic Canada, with many parts of these regions having their hottest years on record. Over land few parts of the world were significantly cooler than average in 2010, the most notable being parts of northern Europe and central and eastern Australia.

December 2010 was exceptionally warm in eastern Canada and Greenland. It was abnormally cold through large parts of northern and western Europe, with monthly mean temperatures as much as 10°C below normal at some locations in Norway and Sweden. Many places in Scandinavia had their coldest December on record. December in Central England was the coldest since 1890. Heavy snowfalls severely disrupted transport in many parts of Europe. It was also colder than average in large parts of the Russian Federation and in the eastern United States, where snow also severely disrupted transport.

Recent significant weather and climate events

The year 2010 was characterized by a high number of extreme weather events, including the heatwave in Russia and the devastating monsoonal floods in Pakistan. These were described in WMO's provisional statement on the status of the global climate issued December 2010 and reproduced in the CMOS February Bulletin (Vol.39, No.1, pages 8-11).

There have been many major weather and climate events in late 2010 and early 2011. These include:

1) In early January floods affected more than 800 000 people in Sri Lanka according to the UN Office for the Coordination of Humanitarian Affairs. The Philippines were also severely affected by floods and mudslides during January.

2) Flash floods in the mountain areas near the city of Rio de Janeiro in Brazil in the second week of January resulted in more than 700 deaths, many of them in mudslides. This is one of the highest death tolls due to a single natural disaster in Brazilian history.

3) Severe flooding occurred in eastern Australia in December and the first half of January, associated with the continuing strong La Niña event. The most extensive damage was in the city of Brisbane, which had its second-highest flood of the last 100 years after that of January 1974. In financial terms it is expected to be the most costly natural disaster in Australia's history. Previous strong La Niña events have also been associated with severe and widespread flooding in eastern Australia, notably in 1974 and 1955.

Notes to Readers: *Background to data used in this statement*

The information for 2010 is based on climate data from networks of land-based weather and climate stations, ships and buoys, as well as satellites. The data are continuously collected and disseminated by the National Meteorological and Hydrological Services (NMHSs) of the 189 Members of WMO and several collaborating research institutions. The data continuously feed three main depository global climate data and analysis centres, which develop and maintain homogeneous global climate datasets based on peer-reviewed methodologies. The WMO global temperature analysis is thus principally based on three complementary datasets. One is the combined dataset maintained by both the Hadley Centre of the UK Met Office and the Climatic Research Unit, University of East Anglia, United Kingdom. Another dataset is maintained by the National Oceanic and Atmospheric Administration (NOAA) under the United States Department of Commerce, and the third one is from the Goddard Institute of Space Studies (GISS) operated by the National Aeronautics and Space Administration (NASA).

The updated data complements the Provisional Statement on the Status of the Global Climate 2010 published by WMO on 3 Dec. 2010 (http://www.wmo.int/pages/mediacentre/press_releases/pr_904_en.html). The final statement will be published in March 2011.

Source: WMO website: www.wmo.int visited January 21, 2011.

Greenhouse Gases Reach Record Levels WMO Highlights Concerns about Global Warming and Methane

24 November 2010 (WMO) – The main greenhouse gases have reached their highest levels recorded since pre-industrial times, according to the World Meteorological Organization's 2009 Greenhouse Gas Bulletin. The report also highlights concerns that global warming may lead to even greater emissions of methane from Arctic areas.

According to the Bulletin, total radiative forcing of all long-lived greenhouse gases increased by 27.5% from 1990 to 2009 and by 1.0% from 2008 to 2009, reflecting the rising atmospheric burdens of carbon dioxide, methane and nitrous oxide.

"*Greenhouse gas concentrations have reached record levels despite the economic slowdown. They would have been even higher without the international action taken to reduce them*," said WMO Secretary-General Mr Michel Jarraud. "*In addition, potential methane release from northern permafrost, and wetlands, under future climate change is of great concern and is becoming a focus of intensive research and observations*."

Carbon dioxide (CO_2) is the single most important anthropogenic greenhouse gas in the atmosphere and contributes 63.5% to the overall global radiative forcing by long-lived greenhouse gases. Global radiative forcing is the balance between radiation coming into the atmosphere and radiation going out. Positive radiative forcing tends to warm the surface of the Earth and negative forcing tends to cool it.

For about 10,000 years before the start of the industrial era in the mid-18th century, atmospheric carbon dioxide remained almost constant at around 280 ppm (ppm=number of molecules of the gas per million molecules of dry air). Since 1750, it has increased by 38%, primarily because of emissions from combustion of fossil fuels, deforestation and changes in land-use. During the past 10 years, it has increased by an average annual 1.88%, according to WMO.

Methane (CH_4) contributes 18.1% to the overall global radiative forcing and is the second most important greenhouse gas after carbon dioxide.

Before the start of the industrial era, atmospheric methane was about 700 parts per billion. Since 1750, it has increased 158%, mostly because of increasing emissions from human activities such as cattle-rearing, rice planting, fossil fuel exploitation and landfills. Human activities now account for 60% of methane emissions, with the remaining 40% being from natural sources such as wetlands.

After a period of temporary stabilization from 1999 to 2006, atmospheric methane has risen again from 2007-2009. The Greenhouse Gas Bulletin reports that the likely causes were above average wetland methane emissions due to exceptionally warm temperatures at high northern latitudes in 2007 and heavy precipitation in tropical wetlands in 2007 and 2008. However, it cautions that the reasons for the recent increases are not yet fully understood.

Northern permafrost contains large reservoirs of organic carbon and methane clathrates (a form of water ice that contains a large amount of methane within its crystal structure). Rapid warming and melting of the permafrost therefore has the potential to release large quantities of methane into the atmosphere which would contribute further to global warming.

Nitrous oxide (N_2O) contributes 6.24% to the overall global radiative forcing. It is emitted into the atmosphere from natural and anthropogenic sources, including the oceans, biomass burning, fertilizer use and various industrial processes. Globally averaged nitrous oxide in 2009 was 19% higher, at 322.5 parts per billion than the pre-industrial era.

Other greenhouse gases: The combined radiative forcing by halocarbons is 12%, nearly double that of nitrous oxide. Some halocarbons such as chlorofluorocarbons (CFCs), previously used as refrigerants, as propellants in spray cans and as solvents, are decreasing slowly as a result of international action to preserve the Earth's protective ozone layer.

However, concentrations of other gases such as HCFCs and HFCs, which are used to substitute CFCs because they are less damaging to the ozone layer, are increasing rapidly. These two classes of compounds are very potent greenhouse gases and last much longer in the atmosphere than carbon dioxide.

WMO, through its Global Atmosphere Watch (GAW) Programme, coordinates the observations of greenhouse gases in the atmosphere through a network of stations located in more than 50 countries, including high in the Andes and Himalayas. The measurement data are quality controlled, archived and distributed by WMO's World Data Centre for Greenhouse Gases, hosted by the Japan Meteorological Agency (JMA).

The 2009 Greenhouse Gas Bulletin is the sixth in the series, which began in 2004. The Bulletins report the global consensus of the WMO Global Atmosphere Watch community on the latest changes and atmospheric burdens of the main greenhouse gases.

Source: WMO website: www.wmo.int visited January 21, 2011.

SCOR/POGO International Quiet Ocean Experiment

SCOR and the **P**artnership for **O**bservation of the **G**lobal **O**ceans received funding from the Alfred P. Sloan Foundation to hold a workshop last October to explore the idea of an International Quiet Ocean Experiment. Participants from the scientific community, industry and several navies discussed the current knowledge of sound in the ocean, including effects on marine organisms, what could be learned if areas of the ocean could be quieted by ceasing some or all human generation of sound for a limited period, and other issues related to comparative studies of sound. They concluded that large-scale international observations and experiments are needed in relation to sound in the ocean. An open science meeting on the topic will be planned for late 2011. For more information, please contact ed.urban@scor-int.org

Note from the Editor: For more than a decade, the Partnership for Observation of the Global Oceans, **POGO**, has served as a forum for leaders of major oceanographic institutions around the world to promote global oceanography, particularly the implementation of international and integrated global ocean observing systems. POGO is an international network of collaborators who foster partnerships that advance efficiency and effectiveness in studying and monitoring the world's oceans on a global scale. Through its efforts, POGO has promoted observations underpinning ocean and climate science, interpreted scientific results for decision makers, provided training and technology transfer to emerging economies, and built awareness of the many challenges still ahead.

REPORT / RAPPORT

2010 Canadian National Report on Argo

Report submitted by Denis Gilbert[1]

1. Status of implementation (Major achievements and problems encountered in 2010).

1.1 Floats deployed and their performance

During 2010, Canada deployed 28 floats: of these 16 were deployed in the Atlantic and 12 in the Pacific. All were APEX floats with ARGOS telemetry. Eight floats had oxygen sensors, 4 in the Atlantic and 4 in the Pacific. The Atlantic effort focussed on the Slope Water and Labrador Sea, whereas the Pacific effort focussed on the Gulf of Alaska. Significant financial support (15 floats) from the Canadian Ice Service, Environment Canada, permitted enhanced coverage of the northern Labrador Sea. As of writing in February 2011 none of the floats deployed in 2010 failed.

1.2 Technical problem encountered

One peculiar incident with a float (WMOID 4901112, APEX sn 4503, apf9a controller) is worth sharing with other Argo groups. We set that float for launch on pressure activation and it somehow decided that it had been launched while it was still in its wooden case. It started its mission, retracted the piston to try and dive, and fully retracted because it was having difficulty getting to 2000 decibars while still in the box. The result was that when it was launched, it had started itself 4 days earlier and on launch it dropped like a stone. Miraculously it did not get beyond its crushing pressure and supplied a perfect profile 6 days later.

1.3 Status of contributions to Argo data management

ISDM (formerly MEDS) continues to acquire data from 127 active Argo floats. Data are issued to the GTS and GDACs every 6 hours in TESAC, BUFR and netCDF formats. We increase the frequency of acquiring data from the Argos server to hourly if we fail to access the system at a specific 6 hour interval. On average 85% of 2010 data were issued to the GTS within 24 hours of the float reporting. The observation time and location for all the profiles reported by APF9 floats since January 2011 were calculated based on Michel Ollitrault's methods as discussed at ADMT11. The observation time and location of profiles reported before January 2011 has not been updated. Data are corrected for pressure and salinity drifts in real-time. The trajectory netCDF files with format version 2.3 are ready to be sent to GDACs. However, currently, GDACs only accept version 2.2. The transition of our system to handle 6 digit Argos ID numbers back in March 2010 went smoothly. We also received and processed Argo BUFR files from other data centers via GTS for GTS monitoring purposes.

Our website, http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html, is updated daily automatically. The website is currently in the process of moving to CLF2.0 to be compliant with Canada's Treasury Board requirements.

1.4 Delayed mode quality control

Since May 2010, a total of 62 floats were delayed-mode quality controlled (DMQC) for salinity and pressure. Prior to this DMQC, the individual profiles (over 8000) from the floats were visually and individually quality controlled for the first time since the implementation of a procedure to record changes in raw quality flags. The percentage of eligible profiles which have been DMQCed for salinity (and sometimes pressure) at least once is currently 61%. However, only 22% of all eligible floats (20% of all eligible profiles) have been corrected with the latest pressure correction method. One reason for this delay is that ISDM is currently migrating its DMQC environment to a platform with increased memory, in order to successfully run the latest DMQC software.

2. Present level of, and future prospects for, national funding for Argo including a summary of the level of human resources devoted to Argo.

2.1 Funding

During 2010 the Canadian Argo program was primarily funded as a research effort. It has been our early intention to move funding to a more routine or operational basis but that has not yet occurred. We are continuing to pursue this. In the present Argo Canada funding scheme, funds to purchase floats typically appear very late in our fiscal year. The funding in 2010 including the much appreciated contribution from the Canadian Ice Service was adequate to maintain the Canadian contribution to the international Argo effort.

Funding to cover recurring Argos' communications costs is not provided as a line budget item at the beginning of fiscal years. This requires frequent and time-consuming requests to Argo data users in Canada to contribute small amounts of money for satellite communications. We are thankful that the Department of National Defence and individual DFO scientists made voluntary, vital contributions to our communications costs from their operations or research budgets.

An Argo Townhall meeting was held in Ottawa on June 3, 2010 during the annual congress of the Canadian Meteorological and Oceanographic Society (CMOS). About 40 attendees from federal government departments (DFO, Environment Canada, National Defence) and universities across the country participated. Several ideas were then proposed for consolidating the Argo Canada program and we will explore some of the most promising ones in the

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

coming years.

2.2 Human resources

Five persons from the Department of Fisheries and Oceans Canada (DFO) work part-time on the Argo project. Anh Tran (Ottawa, Ontario) is responsible for decoding the data, performing the real-time quality control, uploading the data to the GTS and GDACs and maintaining the Argo Canada website. Mathieu Ouellet (Ottawa, Ontario) conducts the delayed mode quality control on eligible floats. Howard Freeland (Sidney, British Columbia) plans float deployments, develops and maintains oceanographic products in the northeast Pacific. Igor Yashayaev (Halifax, Nova Scotia) plans float deployments, develops and maintains oceanographic products in the northwest Atlantic. Denis Gilbert (Mont-Joli, Québec) is the overall program coordinator.

3. Summary of deployment plans (levels of commitment, areas of float deployment) and other commitments to Argo (data management) for the coming year (and beyond where possible).

We have 16 floats available for launch starting March 31st, 2011. However, 15 of them are targeted for deployment in the Labrador Sea at the request of the Canadian Ice Service that purchased these floats. This leaves us with a single float for deployment in the Gulf of Alaska and zero floats available for deployment in the Slope Water region of the northwest Atlantic. But we do have ship surveys going to the latter two areas and would be happy to receive floats from other Argo groups to avoid gaps from appearing as old floats stop functioning.

4. Summary of national research and operational uses of Argo data.

Argo temperature and salinity data are assimilated in operational meteorological and oceanographic forecasts at Environment Canada (Dorval, Québec) and at the Department of Fisheries and Oceans. Numerous researchers at Canadian universities regularly download Argo T & S data for scientific projects.

5. Issues that Canada wishes to be considered and resolved by AST regarding the international operation of Argo.

The delivery of delayed mode, quality controlled Argo data to GDACs has improved significantly in the past 12 months. Despite this, we believe that there is still some room for improvement in the timely delivery of delayed mode data. International governance issues or programs (IPCC, GOOS, GCOS, ICES, PICES, etc.) that require Argo temperature and salinity data would need to be formally identified and clarified, as this may help consolidate Argo funding in Canada.

6. Bibliography.

N/A

Appendix – Summary of Canadian float launches during calendar 2010.

Launch Date YYYY-MM-DD	WMO-ID	Ocean Basin	Launching Vessel
2010-02-08	4901135	P	Tully
2010-02-11	4901134	P	Tully
2010-04-18	4901139	A	Hudson
2010-04-20	4901155	A	Hudson
2010-04-21	4901143	A	Teleost
2010-05-03	4901140	A	Hudson
2010-05-03	4901149	A	Hudson
2010-05-17	4901156	A	Hudson
2010-05-17	4901142	A	Hudson
2010-05-18	4901141	A	Hudson
2010-05-18	4901150	A	Hudson
2010-05-19	4901158	A	Hudson
2010-05-20	4901157	A	Hudson
2010-05-21	4901154	A	Hudson
2010-05-21	4901153	A	Hudson
2010-05-21	4901159	A	Hudson
2010-05-21	4901151	A	Hudson
2010-05-22	4901152	A	Hudson
2010-06-09	4901137	P	Tully
2010-06-18	4901138	P	Tully
2010-07-08	4901136	P	Laurier
2010-07-09	4901144	P	Laurier
2010-07-10	4901145	P	Laurier
2010-07-11	4901146	P	Laurier
2010-07-28	4901112	P	Tully
2010-07-29	4901117	P	Tully
2010-08-13	4901118	P	Tully
2010-08-27	4901148	P	Tully

All buoys are still operating and communicate through Argos.

CLIMATE CHANGE / CHANGEMENT CLIMATIQUE

Le réchauffement climatique en termes pratiques La situation pour Ottawa

par Richard Asselin[1]

Abstract: A practical way of feeling the impact of climate change is by quantifying the domestic heating and cooling requirement. This question is examined by using the long term records of temperature for Ottawa. For Ottawa, there is a cumulative saving of about $1 each year. The average temperature in Ottawa is increasing by about 0.01° C per year, which is not perceptible. One manifestation that can be felt is in the reduction of the extremes of temperature which are not as high as they used to be. Significantly, we do not have the cold nights that we used to have, and this seems to be related to more cloudiness. Since cloudiness is not available in the climate records found on the web, the frequency of precipitation is used as a proxy. Indeed, rainy days are another tangible effect of climate change. There are many more rainy days now than in the past, although not much more rain. These observations are in agreement with other studies that have looked at whole regions of Canada, rather than at a single city.

La plupart des endroits du Canada sont maintenant plus chauds qu'il y a 30 ou 50 ans. Mais que signifie, en pratique, un ou deux degrés de plus? Comment cela peut-il nous affecter personnellement?

Il est bien connu (eg. Sailor et coll. [1]) que la demande en chauffage domestique est directement liée à l'accumulation de degrés-jours de chauffage (18° C - température diurne moyenne) au cours de la saison. En étudiant la relation entre la température et la quantité d'énergie requise pour chauffer (à l'électricité) l'immeuble de 26 étages où je demeure, j'avais été étonné de trouver une relation très linéaire (R^2 = 0.98) sur une période de quatre ans (2003-2006) entre les degrés-jours de chauffage et le nombre de kilowatt-heures utilisés. Avec une telle corrélation, il n'y avait pas de place pour l'influence de l'insolation ni du vent. Ceci ne veut pas dire que ces deux derniers facteurs n'ont pas d'importance. En effet, les logements individuels de l'édifice qui sont du côté sud n'ont pas besoin de chauffage les jours ensoleillés, et ils sont froids lorsqu'un vent froid souffle. Mais, en moyenne, le relation est très valide. L'augmentation du nombre de degrés-jours est ce qui permet à la compagnie Enbridge d'indiquer sur votre facture: "*Votre consommation à ce jour a augmenté de 5% par rapport à l'an dernier, les températures ont été 4% plus froides*".

Si on fait un relevé du total annuel des degrés-jours de chauffage sur une longue période, on pourra donc quantifier le réchauffement climatique en termes d'énergie requise pour le chauffage domestique, ce qui peut facilement se traduire en dépense monétaire. C'est ce que nous allons maintenant démontrer pour Ottawa.

Ottawa possède deux stations climatiques de longue durée: soit la station de la Ferme expérimentale d'Agriculture et agroalimentaire Canada (CDA) (1889-2011), et l'aéroport d'Ottawa (YOW) (1939-2011). Le site YOW n'est qu'à 7.7 km au sud de CDA. Les observations de ces deux sites sont remarquablement complètes, et donc relativement faciles à utiliser. En 1889, la Ferme expérimentale était située au sud ouest du centre-ville, mais ce site est maintenant entouré de constructions diverses. De la même façon, lorsque l'aéroport a été établi en 1939, il était bien à l'extérieur de la ville, mais il y a maintenant des constructions au sud. Au début de l'étude, j'avais plutôt favorisé le site YOW afin d'éviter l'effet urbain, mais ce phénomène ne semble pas si important après la comparaison des données. J'ai donc poursuivi avec CDA, à cause de la plus longue série de données.

Les relevés journaliers de ces deux stations peuvent être téléchargés une année à la fois à partir du site d'Environnement Canada [2]. Il y a 37 jours manquants dans les relevés de YOW, et 43 jours manquant dans CDA, dont le mois complet de mai 1899. Comme les deux stations sont très rapprochées, j'ai remplacé les journées manquantes de YOW par celles de CDA. Pour les journées manquantes de CDA, qui datent toutes de bien avant l'existence de YOW, j'ai simplement interpolé entre les jours avant et après le manquement, sauf pour le mois manquant, que j'ai remplacé arbitrairement par celui de l'année suivante. L'alternative aurait été d'omettre ces journées dans le traitement, mais aurait demandé plus d'attention aux calculs. Vu le très petit nombre de jours manquant (0.1%), l'influence de la méthode de remplacement est minime.

J'ai découvert après avoir complété presque tout le travail, que Vincent et coll.[3] ont révisé les données de toutes les stations canadiennes pour les ajuster pour différents facteurs tels que changement d'instruments, location, élévation, etc. Cependant, Vincent (communication personnelle) a conclu que les données de CDA n'ont pas besoin d'ajustement. Il est donc approprié que cet article soit basé sur les données originales.

[1] Directeur des publications pour la SCMO, Ottawa, Ontario, Canada

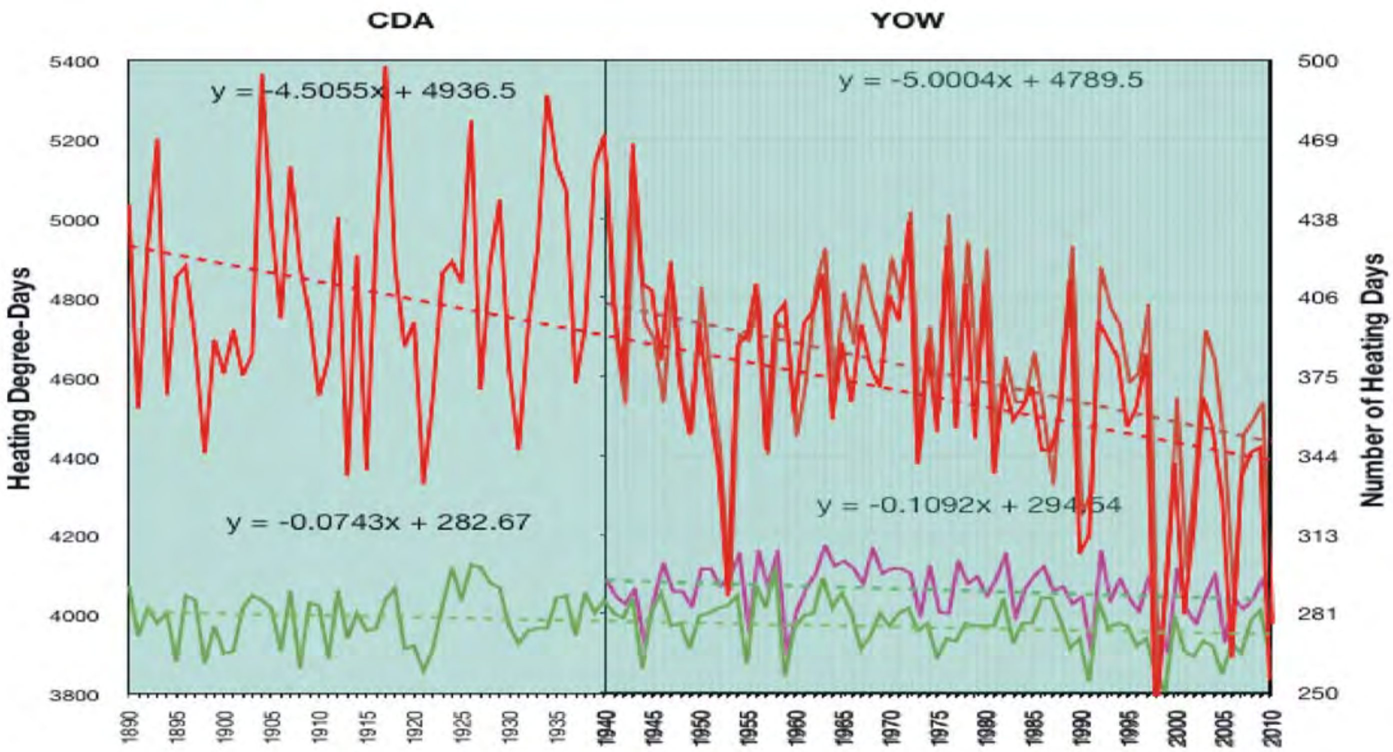

Figure 1: Superposition de CDA (1890-2010) sur YOW (1940-2010), montrant les degrés-jours de chauffage (courbes du haut) et le nombre de jours de chauffage (courbe du bas).

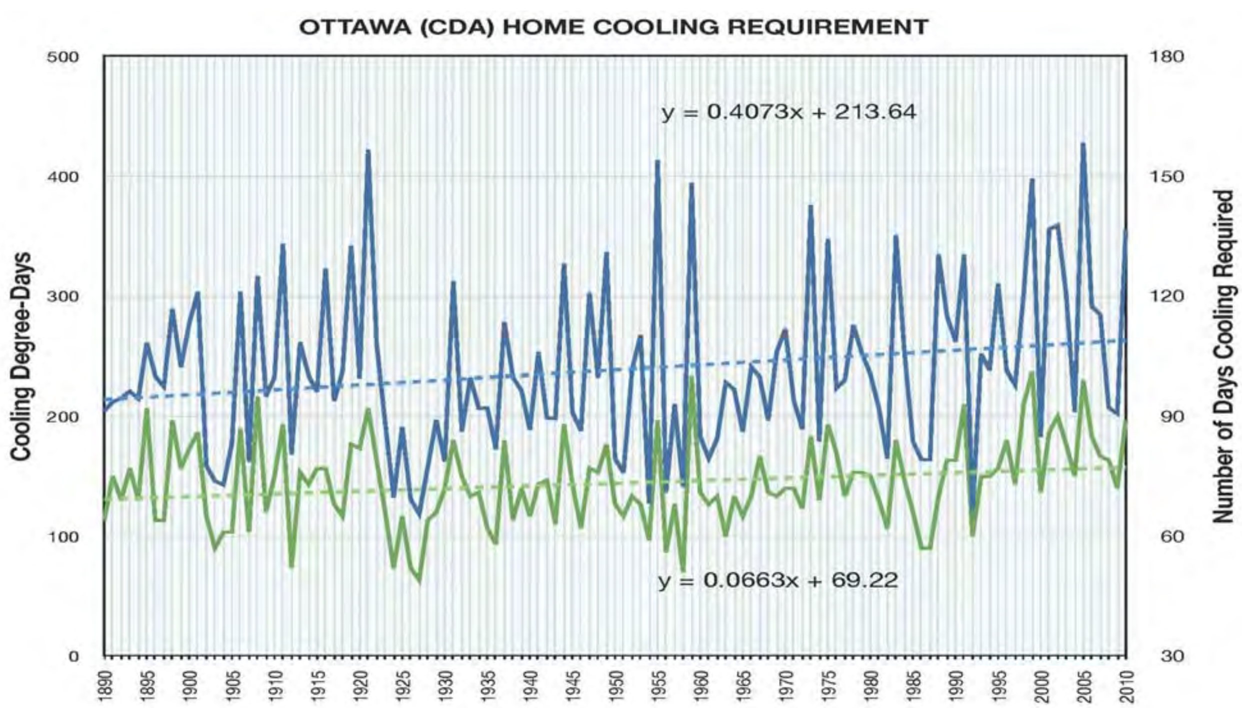

Figure 2: Courbe du haut: degrés-jours de climatisation et nombre de jours de climatisation (courbe du bas) à Ottawa (CDA).

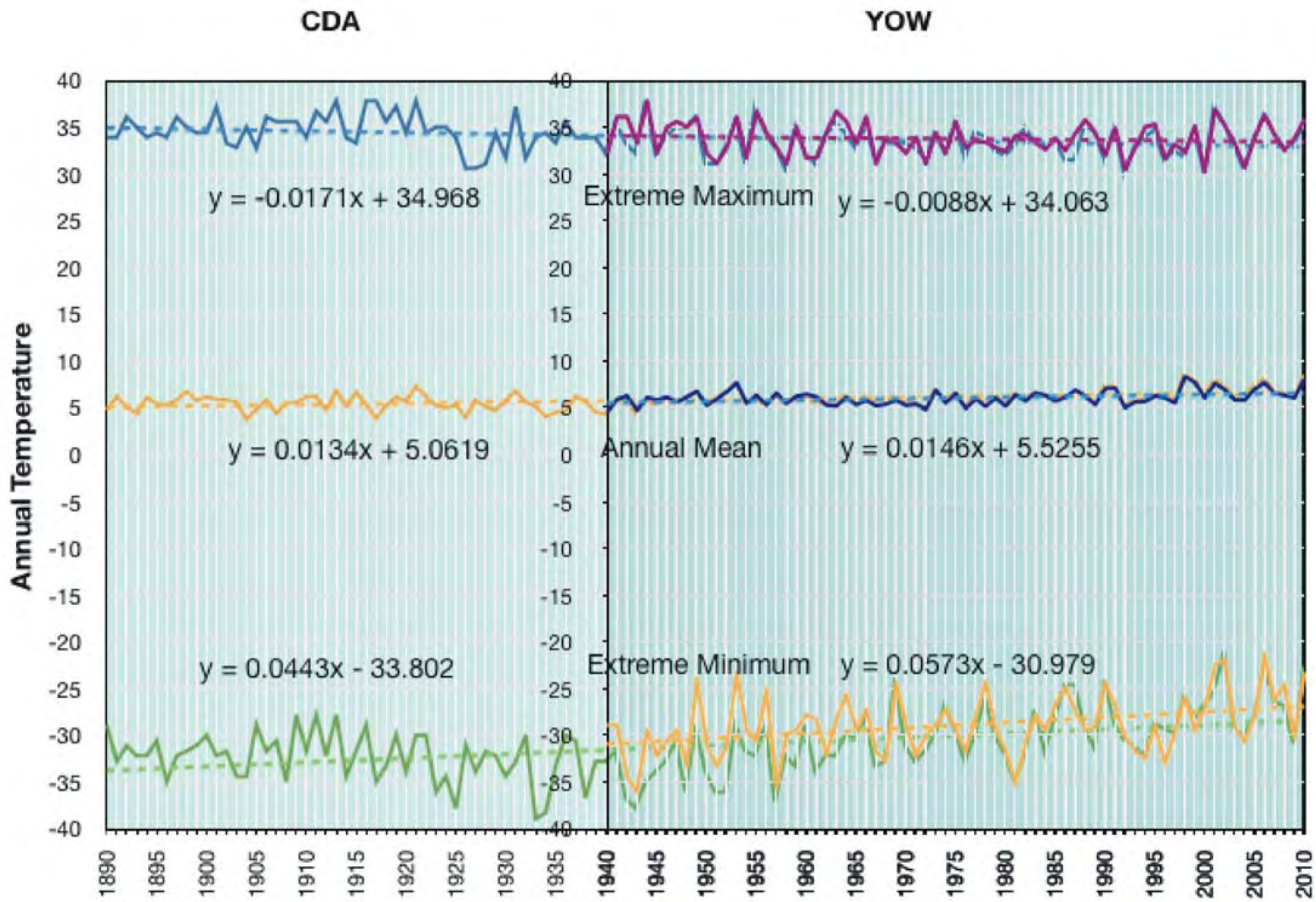

Figure 3: Température maximale atteinte chaque année, température moyenne annuelle et température minimale atteinte chaque année, pour YOW, superposées aux mêmes variables pour CDA.

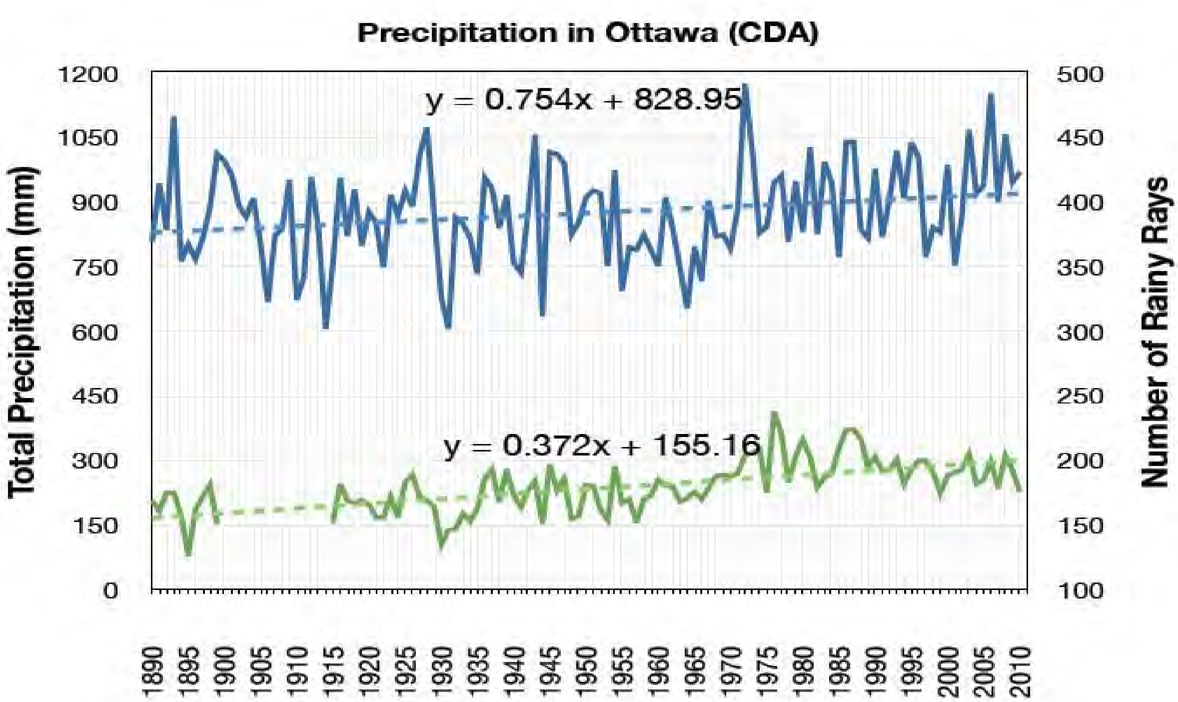

Figure 4: Précipitation mesurable à Ottawa (courbe du haut), et nombre de jours ayant au moins une trace de précipitation (les traces n'ont pas été rapportées entre 1900 et 1914), (courbe du bas).

Étude des degrés-jours

La figure 1 montre le graphique des degrés-jours de chauffage entre 1890 et 2010. La partie gauche est pour CDA, mais la partie droite est une superposition de la continuation des données de CDA et de celles de YOW. On peut constater que la correspondance des deux courbes est excellente.

L'équation de la tendance linéaire pour chaque station est donnée au dessus des courbes. Il ne fait aucun doute que la demande en chauffage a diminué de façon significative, passant de 4 937 à 4 400 degrés-jours, soit près de 11% en 120 ans, ou encore 0.1% par année en moyenne. De plus, si on examine la tendance pour les trente dernières années seulement, on constate que la diminution est deux fois plus rapide. Abstention faite de la variation du coût unitaire de l'énergie ou de l'indice d'inflation, la diminution du nombre de degrés-jours correspond à une diminution équivalente du coût de chauffage. Pour une facture typique de $600 de chauffage par année, il y aurait une économie cumulative d'environ $0.60 par année sur 120 ans, augmentant à environ $1.20 dans les dernières 30 années.

Les courbes du bas de la même figure 1 montrent le nombre de jours de chauffage (où il y a des degrés-jours positifs). Ici, on constate une diminution d'environ 9 jours de chauffage à la Ferme expérimentale depuis 1890. De la même façon, le nombre de jours de chauffage calculé pour YOW a diminué de 7.6 dans les derniers 70 ans. Les raisons pour la différence entre le nombre de jours de chauffage calculés pour les deux stations ne sont pas claires, mail il est évident qu'il faut chauffer moins souvent qu'auparavant.

Les données d'Environnement Canada incluent aussi les degrés-jours de climatisation (température diurne moyenne - 18^{o}C). La courbe des degrés-jours de climatisation est montrée en figure 2, où la courbe du haut correspond au nombre de degrés-jours de climatisation et celle du bas au nombre de jours où la climatisation est requise. LeComte et coll. ont [4] démontré que la demande de climatisation pour toute une ville est reliée linéairement au nombre de degrés-jours de climatisation (base de 65^{o}F=18.3^{o}C) , de la même façon que pour le chauffage. Cependant, dans l'étude que j'ai faite moi-même pour mon édifice, j'ai plutôt trouvé une relation logarithmique, qui indiquait probablement un manque de capacité du système central de refroidissement lorsque la demande est élevée. (Le système a depuis été changé pour un plus puissant). Quoi qu'il en soit, il reste que les données indiquent un accroissement de 48 degrés-jours sur 120 ans, soit 23%, et un accroissement de 8 jours de climatisation, soit 11%. On peut tirer de ceci que la facture de climatisation augmente de façon deux fois plus rapide que la diminution de la facture de chauffage. Pour mon édifice, la consommation électrique pour la climatisation est 1/6 de celle du chauffage. Cependant, si j'estime la facture de climatisation domestique typique à $100, l'augmentation cumulative du coût de climatisation ne serait que de $0.20 par année. Évidemment, des villes plus chaudes auraient des augmentations plus importantes.

Étude de la température elle-même

Comment ces tendances pour le chauffage et la climatisation sont-elles reliées à l'augmentation de la température elle-même à Ottawa? La figure 3 montre trois courbes de température, soit la température extrême atteinte chaque année, la température minimale atteinte ainsi que la température moyenne de chaque année. Les courbes pour CDA sont superposées sur celles de YOW comme pour la figure 1. On constate d'abord que la température moyenne augmente comme on s'y attend au rythme d'environ 0.01^{o}C par année, pour une augmentation totale d'environ 1.6^{o}C depuis 1890. Mais, chose surprenante, les températures extrêmes diminuent d'autant (0.01^{o}C par année) alors que les températures minimales augmentent de façon appréciable, soit environ 0.05^{o}C par année. Après avoir atteint -38.9^{o}C (CDA) en 1933, la plus basse température depuis 1981 a été de -33.1^{o}C (YOW), en 1996. En bref, nous n'avons plus les froids extrêmes d'antan, mais il ne fait pas plus chaud! Pourquoi?

Les nuits froides d'hiver (et d'été) évoquent chez moi le souvenir de nuits étoilées (sans nuage) dans ma jeunesse. Est-ce que Ottawa aurait maintenant moins de ciels clairs qu'en 1890? Il existe des relevés d'observation de la couverture nuageuse à Ottawa en archives, mais elles ne sont pas disponibles à partir du site utilisé. McGuffie et coll. [5] ont étudié le changement de nébulosité au Canada, mais leurs cartes ne permettent pas de déterminer la situation précise à Ottawa. En général, ils ont conclu qu'il y a eu une augmentation de nébulosité au Canada incluant dans la région d'Ottawa, mais je ne peux répondre directement à la question du changement dans la couverture nuageuse à Ottawa. Cependant, les stations climatologiques rapportent la précipitation, et on ne peut avoir de pluie sans nuage!

J'ai donc réexaminé les données de CDA en comptant le nombre de jours de chaque année où il est tombé de la précipitation et j'ai porté ce nombre en graphique sur la figure 4 (courbe du bas). On y constate que le nombre de jours de précipitation a en effet augmenté considérablement, passant de 155 à 200 jours par année. Cette constatation me permet de postuler (sans le prouver) que le ciel est plus souvent nuageux à Ottawa, ce qui supporte l'avancé que ce sont les nuages qui empêchent la température d'atteindre les froids intenses d'antan. Une plus grande couverture nuageuse aurait probablement aussi l'effet de modérer les températures extrêmes, et c'est ce qu'on constate à la figure 3. Il faudrait cependant plus d'étude pour étoffer cette hypothèse.

Mais pleut-il plus? Les données du site d'environnement Canada indiquent une augmentation moyenne de 0.54 mm par année depuis 1890 (non illustré). Cependant, jusqu'en

1961, les données indiquent que l'équivalent en eau de l'épaisseur de neige était obtenu en multipliant cette dernière par le facteur 0.1, mais qu'à partir de 1962 il y a eu un changement de protocole et que l'équivalent en eau a été obtenu d'une autre façon, probablement en fondant la neige. Pour la période 1962 à 2010 il est facile de calculer le rapport entre l'équivalent d'eau moyen et l'épaisseur de neige, et je trouve 0.09 plutôt que 0.1 pour CDA. En supposant que la densité moyenne de la neige n'a pas varié depuis 1889, il semble raisonnable d'ajuster les données de précipitation totale d'avant 1962 en utilisant le facteur de 0.09 pour déterminer l'équivalent en eau de l'épaisseur de neige: c'est ce que j'ai fait et que je montre avec la courbe du haut de la figure 4. Après cet ajustement, je trouve que la précipitation aurait plutôt augmenté de 0.75mm par année (environ 0.08% par année). D'une façon ou d'une autre l'augmentation du total de précipitation est modeste. Je conclus q'il pleut ou neige beaucoup plus souvent à Ottawa, mais pas beaucoup plus par année au total.

Conclusion

J'ai quantifié le réchauffement climatique à Ottawa en termes énergétiques ou monétaires, que j'estime à une diminution d'environ $1.20 par année pour le coût du chauffage domestique et une augmentation de l'ordre de $0.20 par année pour la climatisation. J'ai aussi démontré qu'il pleut ou neige beaucoup plus souvent à Ottawa qu'il y a cent ans, sans toutefois donner beaucoup plus de précipitation.

J'ai démontré que l'accroissement de la température moyenne est surtout dû à l'augmentation des températures les plus froides, et soutenu l'hypothèse que cet accroissement serait dû à une augmentation importante de la couverture nuageuse. Ces conclusions sont très compatibles avec celles de Xuebin et coll.[6] et de McGuffie, qui s'appliquent à des régions entières.

Il y a probablement du mérite à analyser les archives climatologiques d'une façon annuelle plutôt que mensuelle ou saisonnière comme ça se fait habituellement. En effet, l'énoncé conventionnel que les hivers sont maintenant plus chauds nous amène à chercher des causes de nature dynamique (déplacement du courant jet, téléconnexions), alors que l'observation que les nuits sont plus chaudes nous amène plutôt à regarder du côté de la radiation. Aussi il serait peut-être plus révélateur d'analyser les 30 jours les plus chauds ou les plus froids de l'année sans se préoccuper du mois ou de la saison, plutôt que d'analyser les mois les plus chauds ou les plus froids. En effet, la méthode habituelle de diviser l'année en mois (ou en saisons de trois mois) est une convention arbitraire qui peut empêcher de bien voir les changements durant le cycle annuel complet.

Il y a une vingtaine d'autres stations centenaires au Canada. Il pourrait être instructif de les analyser comme je l'ai fait. À noter que ce travail peut être fait à domicile en utilisant seulement un chiffrier comme Excel ou Numbers (Mac), et un peu de patience. Si mes résultats se confirment, l'étude pourrait être étendue plus globalement. Il faudrait cependant s'assurer d'utiliser les données corrigées par Vincent et coll.

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http://climate.weatheroffice.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=4337&Year=2010&Month=1&Day=4&.

[3] Vincent, L.A., X. Zhang, B.R. Bonsal and W.D. Hogg, 2002: Homogenization of daily temperatures over Canada. Journal of Climate, 15, 1322-1334.

[4] LeComte, Douglas M. and Warren, Henry E.: Modelling the Impact of Summer Temperatures on National Electricity Consumption, Journal of Applied Meteorology, Vol 20, 1981.

[5] K. McGuffie and A. Henderson-Sellers: Is Canadian Cloudiness Increasing?, Atmosphere-ocean 26(4), 1988.

[6] Zhang, X., L.A. Vincent, W.D. Hogg and Ain Niitsoo, 2000: Temperature and precipitation trends in Canada during the 20th Century. Atmosphere and Ocean, 38, 395-429.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **juin 2011.** Prière de nous faire parvenir avant le **6 mai 2011** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page 42. Nous avons un besoin URGENT de vos contributions écrites.

The IPCC at a Crossroads

by John Stone[2]

The Intergovernmental Panel on Climate Change (IPCC) is at a crucial crossroads; how well it responds to the criticisms in the recent public reviews will determine its future usefulness.

There is no doubt that the IPCC has been a considerable success. It has been a remarkable social innovation bringing together in joint ownership the scientific and government communities. It has successfully raised the awareness of the threat of climate change as a public policy issue by bringing together scientific experts from many disciplines and around the World to assess what we know and what we don't know about climate change. It has stimulated governments through the negotiation and adaptation of the UN Framework Convention on Climate Change and the subsequent Kyoto Protocol.

The scientific evidence for climate change is now unambiguous. We don't need more science to tell us we need to act; indeed more science is likely to tell us we have already left it too late. While solid science has been necessary it has clearly not been sufficient to stimulate the action that many believe is increasingly urgent. This would seem to have implications for the IPCC. This has been evident for some years but the IPCC went on to win the Nobel Peace Prize and the euphoria blinded everyone to the need for change. In addition, governments were now comfortable with the IPCC - they knew what to expect - and saw no need to change things. Well that was until 2010 with the events surrounding ClimateGate and the allegations of errors in the most recent IPCC Report.

The fact is the landscape in which the IPCC acts has changed significantly since it was established over 20 years ago. The science is now well established even though there are still uncertainties and a great deal remains to be discovered. The political engagement is stronger; in fact climate change has become a political issue clashing with explicit or unacknowledged ideologies (for example the role of governments, constraints on business and trade and moral issues). A wider variety of interests has entered the climate change discussion including stakeholders on both sides hoping for evidence that their interests are supported by the latest scientific developments. Climate change is no longer recognized as only an environmental issue; it is seen as a security issue, an energy issue, a trade issue, a development issue and so on. Finally, the IPCC no longer has the stage to itself; governments, intergovernmental organizations and environmental groups (to mention but a few) are producing reports and information material such as books, videos and films.

There is some evidence that the 2010 events have damaged the IPCC brand. This has been accentuated by the several public reviews of the IPCC that have prolonged media attention. While these reviews concluded that the main scientific conclusions were solid, they have nevertheless supported an impression that the IPCC procedures have some flaws. Some have suggested this undermines the strength and even validity of the outputs. It is not surprising then that changes have been called for to enhance the rigour and transparency of the IPCC.

While some organizational changes can be helpful, there is a danger of misunderstanding the nature of the scientific assessment exercise - the IPCC is a process first and only secondarily an organization. The real changes that must occur are not ones of structures and rules but mind-sets.

There are undoubtedly some lessons to be learnt from the events of 2010 for the scientists involved in the IPCC. However, it is not yet clear that the lessons have been fully internalized by the scientific community. Most will go on as in the past - and to some extent that is a good thing - but unless some of the criticisms of tribalism as well as insufficient inclusiveness and transparency are acknowledged there will always be the threat of the past being repeated. The notion of transparency, which was noted by all reviews, may be particularly tricky for it is not something that is universally understood. Nevertheless, the strength of commitment of the scientists has again been demonstrated by the fact that, despite the attacks on the IPCC, even more (some 3000) volunteered to help write the next Assessment Report.

Finally, there needs to be a fuller appreciation that there is more to addressing the issue of climate change than reinforcing the scientific evidence. Effective communications, an area where the IPCC has been found weak, is clearly essential. We also need to understand better the human barriers to taking action, what the late Steve Schneider referred to as the "five horsemen of the environmental apocalypse: ignorance, greed, denial, tribalism and short-term thinking". To which we might add "inconvenience". Unless we accept this reality we may be on a path where we will only effectively start to address the issue when the impacts are undeniable - and then it is likely to be too late.

[2] Retired Meteorologist and Adjunct Research Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, ON, Canada.

CMOS Congress 2011: "Ocean, Atmosphere and the Changing Pacific"

The Congress is hosted by the Canadian Meteorological and Oceanographic Society and will be held June 5 to 9, 2011 at the Victoria Conference Centre, Victoria, British Columbia, Canada.

Registration and hotel reservations are now open. Interesting sessions in fields ranging ranging from weather, climate and atmospheric sciences, to oceanography and biogeochemistry will be held during Congress.

Eight high-profile plenary speakers are confirmed at the Victoria conference:

- David Battisti, University of Washington
- Peter Brewer, Monterey Bay Aquarium Research Institute
- Clara Deser National Center for Atmospheric Research
- Shin-ichi Ito, Tohoku National Fisheries Research Institute, PICES Plenary lecture
- Randall Martin, Dalhousie University
- Jim McWilliams, University of California at Los Angeles (UCLA)
- Phil Mote, Oregon Climate Change Research Institute
- Thomas Stocker, University of Bern, PICS Plenary Lecture

Ken Denman, Chief Scientist Venus Network, University of Victoria and Environment Canada and **Verena Tunnicliffe**, Canada Research Chair in Deep Ocean Research, University of Victoria, will be the public speakers in Victoria.

Now it is the time to do your registration. Early registration closes on **April 12, 2011.**

The Congress Scientific Program Committee and the Local Arrangements Committee invite you to come and enjoy the Victoria congress. For any enquiries please email lac@cmos.ca.

Congrès SCMO 2011 "Océan, Atmosphère et le Pacifique en transition"

Le Congrès est présenté par la Société Canadienne de Météorologie et d'Océanographie (SCMO) du 5 au 9 juin 2011au Centre des congrès de Victoria, Victoria, Colombie-Britannique, Canada.

L'inscription et les reservations d'hôtel sont maintenant ouvertes. De nombreuses sessions scientifiques intéressantes dans des domaines allant de la météo, du climat et des sciences atmosphériques à l'océanographie et la biogéochimie sont prévues au programme.

Huit orateurs pléniers de grande renommée ont confirmé leur participation au congrès:

- David Battisti, Université de Washington
- Peter Brewer, Monterey Bay Aquarium Research Institute
- Clara Deser National Center for Atmospheric Research
- Shin-ichi Ito, Tohoku National Fisheries Research Institute, PICES Plenary lecture
- Randall Martin, Université de Dalhousie
- Jim McWilliams, University of California at Los Angeles (UCLA)
- Phil Mote, Oregon Climate Change Research Institute
- Thomas Stocker, Université de Bern, PICS Plenary Lecture

Ken Denman, Chercheur principal du réseau Venus, Université de Victoria et Environnement Canada et **Verena Tunnicliffe** Chaire de recherche du Canada sur les grandes profondeurs océaniques seront les orateurs publics à Victoria.

C'est maintenant le temps de vous enregistrer. La date limite pour l'inscription anticipée est le **12 avril 2011.**

Le comité du programme scientifique et le comité local des arrangements vous invitent à prendre part et de profiter du congrès de Victoria. Pour plus de renseignements, veuillez nous contacter à lac@cmos.ca

A-O Abstracts Preview

Avant Première des résumés de A-O

The following abstracts will soon be published in your next *Atmosphere-Ocean* publication (49-1).

Les résumés qui suivent paraîtront sous peu dans votre prochaine revue *Atmosphere-Ocean* (49-1).

Possible Impacts of Climate Change on Freezing Rain Using Downscaled Future Climate Scenarios: Updated for Eastern Canada AO-1300

by Chad Shouquan Cheng and Guilong Li

Abstract
The methods used in an earlier study focussing on the province of Ontario, Canada were adapted for this current study to expand the study area over eastern Canada where the infrastructure is at risk of being impacted by freezing rain. To estimate possible impacts of climate change on future freezing rain events, a three-step process was used in the study: (1) statistical downscaling, (2) synoptic weather typing, and (3) future projections. A regression-based downscaling approach, constructed using different regression methods for different meteorological variables, was used to downscale eight general circulation models outputs to each of 42 hourly-observing stations over eastern Canada. Using synoptic weather typing (principal components analysis, a clustering procedure, discriminant function analysis), the freezing rain-related weather types under historical climate (1958–2007) and future downscaled climate conditions (2016–2035, 2046–2065, 2081–2100) were identified for all selected stations. The potential changes in the frequency of future daily freezing rain events can be quantitatively projected by comparing future and historical frequencies of freezing rain-related weather types. The modeled results show that eastern Canada could experience more freezing rain events late this century during the coldest months (e.g., December–February) than the averaged historical conditions. Conversely, during the warmest months of the study season (e.g., November and April in the southern regions; October in the northern regions), eastern Canada could experience less freezing rain events late this century. When moving from the south to the north or from the southwest to the northeast across eastern Canada, the increased magnitude of future freezing rain events for the coldest months is projected to be greater and greater. The relative decrease in magnitude of future daily freezing rain events in the warmest months is projected to be much less than the relative increase in magnitude in the coldest months.

Résumé
Nous avons adapté pour la présente étude les méthodes utilisées dans une étude précédente concernant l'Ontario, au Canada, afin d'étendre la zone étudiée à l'est du Canada où l'infrastructure risque d'être touchée par la pluie verglaçante. Pour estimer les répercussions possibles du changement climatique sur les événements de pluie verglaçante futurs, nous avons adopté un processus en trois étapes dans cette étude : (1) la réduction statistique, (2) le typage des conditions synoptiques et (3) les projections dans le futur. Nous avons employé une méthode de réduction basée sur la régression, construite à l'aide de différentes techniques de régression pour différentes variables météorologiques, pour réduire les sorties de huit modèles de circulation générale à chacune de 42 stations d'observations horaires dans l'est du Canada. Au moyen du typage des conditions synoptiques (analyse des composantes principales, une procédure d'agrégation, analyse discriminante), nous avons identifié les types météorologiques liés à la pluie verglaçante dans le climat historique (1958–2007) et les conditions climatiques réduites futures (2016–2035, 2046–2065, 2081–2100) pour toutes les stations sélectionnées. Les changements potentiels dans la fréquence future des jours avec pluie verglaçante peuvent être projetés quantitativement en comparant les fréquences futures et historiques des types météorologiques liés à la pluie verglaçante.

Les résultats modélisés montrent que l'est du Canada pourrait subir plus d'événements de pluie verglaçante dans la dernière partie du présent siècle durant les mois les plus froids (c.-à-d. de décembre à février) que ce qu'indiquent les conditions historiques moyennées. Réciproquement, durant les mois les plus chauds de la saison à l'étude (c.-à-d. novembre et avril dans les régions méridionales; octobre dans les régions septentrionales), l'est du Canada pourrait subir moins d'événements de pluie verglaçante dans la dernière partie du siècle. En se déplaçant du sud vers le nord ou du sud-ouest vers le nord-est dans l'est du Canada, il est prévu que l'accroissement du nombre d'événements de pluie verglaçante durant les mois les plus froids ira en grandissant. La diminution relative du nombre d'événements futurs de pluie verglaçante durant les mois les plus chauds devrait être beaucoup moins importante que son accroissement relatif durant les mois les plus froids.

Surface Wind Speed Prediction in the Canadian Arctic using Non-Linear Machine-Learning Methods AO-1121

by Zhen Zeng, William W. Hsieh, William R. Burrows, Andrew Giles and Amir Shabbar

Two non-linear, machine-learning/statistical methods, i.e., Bayesian neural network (BNN) and support vector regression (SVR), plus multiple linear regression (MLR), were used to forecast surface wind speeds at lead times of 12, 24, 48 and 72 h. Three different schemes, a statistical downscaling model (Scheme 1) using daily reforecast data from the National Centers for Environmental Prediction (NCEP) Global Forecasting System (GFS), an autoregressive model (Scheme 2) based on past wind observations, and a full model (Scheme 3) combining the two, were investigated in this study for the October–March winds from two meteorological stations in the Canadian Arctic (Clyde River and Paulatuk). At very short lead times, Scheme 2 provides better wind speed prediction than Scheme 1, but its forecast scores decrease rapidly with lead time. Scheme 3 generally performs best, especially at shorter lead times. All the linear and non-linear downscaling methods have significantly higher forecast scores at the two stations than the GFS reforecast. The nonlinear methods tended to have slightly better forecast scores than linear methods (MLR and the linear version of SVR).

There is particular interest in high-wind events, defined as having wind speeds over 22 knots (11.3 m s^{-1}). After rescaling, the continuous wind predictions from Scheme 3 were classified into two types — high-wind event or non-event. For high-wind event forecasting, the non-linear methods have marginally better binary forecast scores than the linear methods for Clyde River but not for Paulatuk. The alternative approach of using support vector classification (SVC) did not perform better, but weighting the high-wind events more heavily than the non-events during model training improved the binary forecast scores.

Résumé

Nous avons utilisé deux méthodes d'apprentissage automatique/statistiques non linéaires, c'est-à-dire un réseau neuronal bayesien (RNB) et la régression des vecteurs de support (RVS), en plus de la régression linéaire multiple (RLM) pour prévoir les vitesses du vent de surface à 12, 24, 48 et 72 heures dans le futur. Nous avons examiné, dans cette étude, trois schémas différents, soit un modèle de réduction statistique (schéma 1) utilisant les données quotidiennes reprévues du Global Forecasting System (GFS) des NCEP (National Centers for Environmental Prediction), un modèle autorégressif (schéma 2) basé sur les observations passées du vent et un model complet (schéma 3) combinant les deux, pour les vents d'octobre à mars à deux stations météorologiques dans l'Arctique canadien (Clyde River et Paulatuk). Pour des échéances très courtes, le schéma 2 produit de meilleures prévisions de vitesse du vent que le schéma 1 mais ses scores de prévision diminuent rapidement à mesure que l'échéance recule. Le schéma 3 donne habituellement les meilleurs résultats, surtout pour les échéances plus courtes. Toutes les méthodes de réduction linéaires et non linéaires ont des scores de prévision nettement plus élevés aux deux stations que la reprévision du GFS. Les méthodes non linéaires ont tendance à donner des scores de prévision légèrement meilleurs que ceux des méthodes linéaires (la RLM et la version linéaire de la RVS).

Les événements de grand vent, définis comme des vents d'une vitesse supérieure à 22 nœuds (11,3 m s^{-1}), présentent un intérêt particulier. Après réduction, les prévisions continues de vent du schéma 3 ont été classifiées en deux types — événements de grand vent et non-événements. Pour la prévision des événements de grand vent, les méthodes non linéaires obtiennent des scores de prévision binaires quelque peu meilleurs que ceux des méthodes linéaires pour Clyde River mais pas pour Paulatuk. L'autre approche, qui emploie la classification des vecteurs de support (CVS), n'a pas fait mieux, mais une pondération des événements de grand vent plus forte que celle des non-événements durant la période d'entraînement du modèle a amélioré les scores de prévision binaires.

Continuous 1064/532 nm Lidar Measurements (CORALNet-UBC) in Vancouver, BC: Selected Results from a Year of Operation AO-1201

by I.G. McKendry, K. B. Strawbridge and A. Jones

Abstract

CORALNet-UBC was installed in April 2008 as a "proof of concept" and the first facility in a proposed cross-Canada network of similar lidars. Despite its location on the wet West Coast of Canada, data recovery ranged from a low of 45% of the total time in December, when heavy snowfall interrupted operations, to a high of 90% in July. The facility has been a spectacular success in terms of its operational characteristics (as measured by data recovery), the range of phenomena observed and the research that it has spawned. Examples are provided of the types of phenomena observed since its initial deployment. These include observations of boundary layer structure, cloud signatures, forest fire plumes and evidence of singular long range pollutant and volcanic transport events. Observations from CORALNet-UBC complement data from other aerosol measurement initiatives in the region and provide a rich source of information that is relevant to researchers, operational forecasters and air quality managers. Future research will be directed at elucidating the processes and phenomena revealed by the instrument as well as developing new products that exploit the real-time forecasting and public advisory potential of the facility.

Résumé

Le lidar CORALNet-UBC a été installé en avril 2008 comme une «démonstration de faisabilité» et constitue le premier élément d'un réseau de lidars semblables proposé pour couvrir le Canada. Malgré son emplacement sur la pluvieuse côte ouest du Canada, la récupération des données a varié d'un minimum de 45 % du temps total en décembre, alors que de fortes chutes de neige ont interrompu les opérations, à un maximum de 90 % en juillet. L'installation s'est avérée un succès spectaculaire du point de vue de ses caractéristiques d'exploitation (telles que mesurées par la récupération des données), de la gamme des phénomènes observés et de la recherche qu'elle a engendrée. Nous présentons des exemples des types de phénomènes observés depuis sa mise en place initiale. Ceux-ci comprennent des observations de la structure de la couche limite, de signatures de nuages, de panaches de feux de forêt et de manifestations d'événements singuliers de transport de polluants et de cendre volcanique à grande distance. Les observations du CORALNet-UBC s'ajoutent aux données d'autres projets de mesure d'aérosols dans la région et fournissent une riche source d'information utile pour les chercheurs, les prévisionnistes opérationnels et les gestionnaires de la qualité de l'air. Les recherches futures viseront à élucider les processus et les phénomènes que révèle l'instrument ainsi qu'à mettre au point de nouveaux

produits permettant de tirer profit des capacités de l'installation en ce qui a trait à la prévision en temps réel et à l'émission d'avis pour le public.

Benchmarking Climate-Carbon Model Simulations against Forest FACE Data AO-1206

by ANDREW J. PINSONNEAULT, H. DAMON MATTHEWS AND ZAVAREH KOTHAVALA

Abstract

Terrestrial carbon fluxes are an important factor in regulating concentrations of atmospheric carbon dioxide (CO_2). In this study, we use a coupled climate model with interactive biogeochemistry to benchmark the simulation of net primary productivity (NPP) and its response to elevated atmospheric CO_2. Short-term field experiments such as Free-Air Carbon Dioxide Enrichment (FACE) studies have examined this phenomenon but it is difficult to infer trends from only a few years of field data. Here, we employ the University of Victoria's Earth System Climate Model (UVic ESCM) version 2.8 to compare simulated changes in NPP due to an elevated atmospheric CO_2 concentration of 550 ppm to observed increases in NPP of 23 ± 2% from four temperate forest FACE studies between 1997 and 2002. We further compare two scenarios: elevated CO_2 with climate change, and elevated CO_2 without climate change, the latter being consistent with FACE methodology. In the climate change scenario global terrestrial and forest-only NPP increased by 24.5% and 27.9 % respectively while these increases were 21.0% and 17.2%, respectively, in the latitude band most representative of the location of the FACE studies. In the scenario without climate change, terrestrial and forest-only NPP increased instead by 28.3% and 30.6%, respectively while these increases were 24.3% and 14.4%, respectively, in the FACE latitudes. This suggests that the model may underestimate temperate forest NPP increases when compared to results from temperate forest FACE studies and highlights the need for both increased experimental study of other forest biomes and further model development.

Résumé

Les flux de carbone terrestres sont un facteur important dans la régulation des concentrations de dioxyde de carbone (CO_2) atmosphérique. Dans cette étude, nous utilisons un modèle climatique couplé et une biogéochimie interactive pour mettre au banc d'essai la simulation de la productivité primaire nette (PPN) et sa réponse à une concentration élevée de CO_2 atmosphérique. Diverses expériences à court terme sur le terrain, comme le projet FACE (Free-Air Carbon Dioxide Enrichment), se sont penchées sur ce phénomène, mais il est difficile de dégager des tendances avec seulement quelques années de données de terrain. Ici, nous employons la version 2.8 du modèle climatique du système terrestre de l'Université de Victoria (UVic ESCM) pour comparer les changements simulés dans la PPN résultant d'une concentration de CO_2 atmosphérique élevée de 550 ppm aux accroissements observés de PPN de 23 ± 2 % d'après quatre études FACE sur la forêt tempérée menées entre 1997 et 2002. Nous comparons, en outre, deux scénarios : CO_2 élevé avec changement climatique et CO_2 élevé sans changement climatique, ce dernier correspondant à la méthodologie FACE. Dans le scénario avec changement climatique, la PPN de la terre entière et celle de la forêt seulement se sont accrues de 24,5 % et 27,9 %, respectivement, alors que les accroissements étaient de 21,0 % et 17,2 %, respectivement, dans la bande de latitudes la plus représentative du lieu où le projet FACE s'est déroulé. Dans le scénario sans changement climatique, la PPN de la terre et celle de la forêt seulement se sont plutôt accrues de 28,3 % et 30,6 %, respectivement, alors que les accroissements étaient de 24,3 % et 14,4 %, respectivement, dans les latitudes FACE. Cela donne à penser que le modèle sous-estime peut-être les accroissements de PPN de la forêt tempérée comparativement aux résultats du projet FACE sur la forêt tempérée et met en évidence le besoin de poursuivre les études expérimentales sur d'autres biomes forestiers et de développer davantage les modèles.

Submonthly Forecasting of Winter Surface Air Temperature in North America Based on Tropical Organized Convection AO-1117

by WENQING YAO, HAI LIN AND JACQUES DEROME

Abstract

Using outgoing longwave radiation (OLR) data as a proxy for tropical convection, the relationship between the Madden-Julian Oscillation (MJO)-related tropical convection and North American winter surface air temperature (SAT) is investigated. A lagged regression analysis between one of the leading OLR principal components (PCs) and SAT shows highly significant correlations over south-southeastern Canada, with the strongest SAT anomalies occurring at a lag of 2–3 pentads. The lagged temperature composite shows an extensive intensified positive SAT anomaly over southern Canada and the northern United States 10–15 days after the occurrence of enhanced convection over the Indian Ocean and the Maritime Continent and reduced convection near the tropical central Pacific. The lagged regressions of 500 hPa geopotential height with the OLR PC reveal a wave train propagating from the tropics to North America. This observation has been reproduced in a simple general circulation model (SGCM) with an idealized forcing that mimics the tropical MJO convection anomaly. A simple regression model is constructed to predict winter SAT over North America with tropical MJO convective activity as the single predictor. Under a cross-validation framework, this statistical model produces 10–15 day SAT forecasts with modest, yet statistically significant, skill in winter over North America.

Résumé
En utilisant les données de rayonnement sortant de grandes longueurs d'onde (RGLO) comme données indirectes de convection tropicale, nous étudions la relation entre la convection tropicale liée à l'oscillation Madden-Julian (OMJ) et la température de l'air à la surface (TAS) en hiver en Amérique du Nord. Une analyse de régression décalée entre l'une des premières composantes principales (CP) du RGLO et la TAS révèle des corrélations très nettes dans le sud-sud-est du Canada, les plus fortes anomalies de TAS se produisant avec un décalage de 2 à 3 pentades. La carte composite décalée des températures montre une vaste anomalie positive intensifiée de TAS dans le sud du Canada et le nord des États-Unis de 10 à 15 jours après qu'une convection accentuée au-dessus de l'océan Indien et du Continent maritime et qu'une convection réduite près du Pacifique central tropical se soient produites. Les régressions décalées de la hauteur géopotentielle à 500 hPa avec la CP du RGLO font voir un train d'ondes se propageant des tropiques vers l'Amérique du Nord. Cette observation s'est reproduite dans un modèle de circulation générale simple (MCGS) avec un forçage idéalisé qui imite l'anomalie de convection tropicale OMJ. Nous construisons un modèle de régression simple pour prévoir la TAS en hiver en Amérique du Nord avec l'activité convective tropicale OMJ comme prédicteur unique. Dans un cadre de validation croisée, ce modèle statistique produit des prévisions de TAS de 10 à 15 jours avec une habileté modeste, mais statistiquement significative, en hiver en Amérique du Nord.

Performance of nowcast and forecast wave models for Lunenburg Bay, NS.

by Ryan P. Mulligan, Will Perrie, Bash Toulany, Peter C. Smith, Alex E. Hay, Anthony J. Bowen

Abstract
The results from a numerical modelling system are presented for wave prediction inside Lunenburg Bay. The Bay, typical of the coast in Atlantic Canada, is an environment where ocean swell enters only from selected directions, wind-sea dominates the wave spectrum from other directions and shallow water physics are important. The modelling system consisted of wave models for both the present time (nowcasts) and forecasts using the Simulating Waves Nearshore (SWAN) model inside the Bay. Nowcasts (stationary computations of the wave field that ran every 30 minutes) were driven by real-time observations of the directional wave boundary conditions, winds and water levels. Forecasts (48 hourly non-stationary computations) were driven by boundary conditions from the WAVEWATCH III ocean wave model (implemented on a larger domain) and winds from the Global Environmental Multiscale (GEM) atmospheric model. The results were compared with wave observations inside the Bay and provided in real-time. Model performance was assessed for a storm event with 2.8 m significant wave heights that occurred in October 2007, by comparing nowcast predictions, forecast predictions and observations. The nowcasts provided the best correlation, R^2= 0.75, with observations inside the Bay, since they were driven by observations made at the model boundary. The forecasts tended to underpredict the significant wave height and peak period, but overall the model results compared well with the data over a wide range of wind and wave conditions.

Résumé [Traduit par la rédaction]
Nous présentons les résultats d'un système de modélisation numérique pour la prévision des vagues dans la baie Lunenburg. La baie, typique de la côte dans le Canada atlantique, constitue un environnement où la houle océanique n'entre que par certaines directions, où la mer du vent domine le spectre des vagues provenant d'autres directions et où la physique des eaux peu profondes est importante. Le système de modélisation consistait en des modèles de vagues tant pour l'heure courante (prévisions pour l'immédiat) et que pour les prévisions proprement dites, en utilisant le modèle Simulation des vagues près des côtes (SWAN) à l'intérieur de la baie. Les prévisions pour l'immédiat (calculs stationnaires du champ de vagues exécutés toutes les 30 minutes) étaient basées sur des observations en temps réel des conditions de vagues directionnelles aux limites, du vent et des niveaux d'eau. Les prévisions (calculs instationnaires aux 48 heures) étaient basées sur les conditions aux limites fournies par le modèle de vagues océaniques WAVEWATCH III (exécuté dans un domaine plus large) et sur les vents du modèle atmosphérique Global environnemental multiéchelle (GEM). Nous avons comparé les résultats aux observations de vagues faites dans la baie et fournies en temps réel. Nous avons évalué la performance du modèle dans un cas de tempête ayant produit des vagues d'une hauteur significative de 2,8 m en octobre 2007 en comparant les prévisions pour l'immédiat, les prévisions et les observations. Les prévisions pour l'immédiat ont fourni la meilleure corrélation, $R^2 = 0,75$, avec les observations faites à l'intérieur de la baie, étant donné qu'elles étaient basées sur des observations faites aux limites du modèle. Les prévisions avaient tendance à sous-prévoir la hauteur significative des vagues et la période de pointe, mais dans l'ensemble les résultats du modèle se comparaient bien aux données dans une vaste gamme de conditions de vent et de vagues.

BOOK REVIEWS / REVUES de LITTÉRATURE

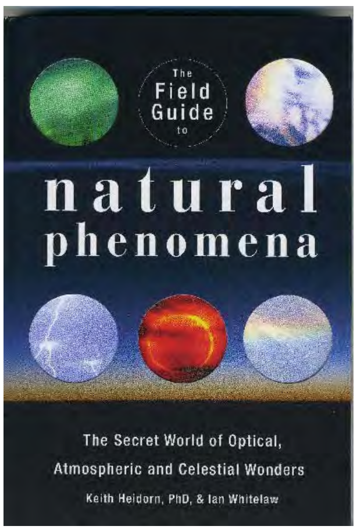
The Field Guide to Natural Phenomena

The Secret World of Optical, Atmospheric and Celestial Wonders

by Keith Heidorn, PhD and Ian Whitelaw

Published by Firefly Books Ltd., 2010; Paperback, ISBN 978-155407-7078-6, pp. 224, $24.95

Book Reviewed by: T. Colleen Farrell[1]



While this is a paperback, the cover is quite sturdy, which you would expect for a book titled as a field guide. The front cover unfolds to reveal descriptions of the pictures on the cover, which makes handling it a little awkward, and could affect the cover's durability if carried around in a knapsack for a long time. This guide is divided into six chapters: Celestial Phenomena (such as stars, comets and meteors), Optical Phenomena (ex. Rainbows, aurora), Atmospheric Phenomena (clouds, precipitation, etc.), Electrical Phenomena (thunder and lightning), Geological Phenomena (volcanoes and geysers) and Aquatic Phenomena (Ocean waves, tides and Ice). There is a separate general reference section (books and websites) and by chapter. Website addresses can become dated rather quickly and be no longer available within a short period of time, so I'm not sure of the wisdom of this approach when a single *Google* search could easily come up with many more relevant sites. There is also an index which is always helpful to find individual topics quickly and efficiently. There are dozens of colour photographs as well as illustrations that entice you to delve deeper for their explanation. There are numerous pertinent quotations throughout each chapter, which I really enjoyed, including Julius Caesar's observations of a lightning storm; Benjamin Franklin ("*Know the signs of the sky and you will far happier be*"); Charles Dickens' descriptions of fog; excerpts from poets such as Walt Whitman, Percy Bysshe Shelley and Langston Hughes, and Michael Ondaatje's novel "*The English Patient*". A list of lunar and solar eclipses from 2010 to 2020 is included. Everyone has heard of the "harvest moon", occurring closest to the autumnal equinox, but did you know all full moons were given names in Native American and Celtic (pagan) traditions? The full moon in June, for example, is called the Strawberry Moon in Native American lore. There are so many of these neat tidbits, there is something to catch anyone's attention. While I was first expecting the book to deal only with atmospheric and celestial phenomena, the sections on geological phenomena (such as mesas, buttes, hoodoos and caves), including where great examples can be seen in the US, Canada and other parts of the world, make it a great guide for world travelers as well as armchair adventurers, young or old. Most individual topics are covered over 4 or 5 pages, packing a lot of information into digestible portions. The authors' analogies make the content very accessible. For instance, in the chapter on Optical Phenomena, under the section on Crepuscular Rays, "*We have all seen dust dancing in a sunbeam as it shines through a window; that dust provides the effect we seek to make crepuscular rays visible*." This book is very readable and, as a reference, it will suit students in the Grades 4 to 6 range, and as a starting point for older students to be inspired to seek out even more information on these topics. I look forward to seeking out some of the places described in this book on my travels across the US, Canada and Australia. This book would make a great gift for just about anyone with a curiosity about the world around us.

[1] Environment Canada, Dartmouth, Nova Scotia

Challenged by Carbon: The Oil Industry and Climate Change

by Bryan Lovell

Cambridge University Press (2010), Paperback 212 pages, $30, ISBN 978–0 521-14559-6

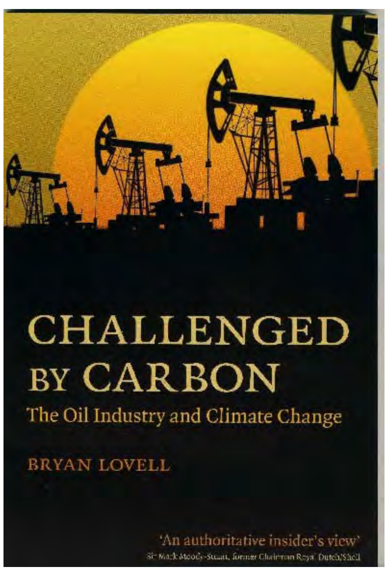
Book reviewed by John Stone[2]

Among the more scientifically qualified of the climate change deniers are often geologists. Their scepticism is based on evidence that the Earth has previously gone through periods of climate change. However, these "natural" changes have occurred over much longer time-scales than what we are witnessing today. This would include the ice ages that happened every 120 thousand or so years caused by variations in the orbit of the Earth around the Sun. Other large-scale changes include the Paleocene-Eocene

[2] Retired Meteorologist and Adjunct Research Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, ON, Canada.

Thermal Maximum (PETM) that occurred some 55 million years ago.

At the time of the PETM a large amount of carbon was released into the atmosphere, most likely by unusual volcanic activity (the North Atlantic was just beginning to open and India was crashing into Asia). Over a geologically short time - some 10 thousand years - it is estimated that in the order of 1 to 2 x 10^{18} g of carbon was ejected into the atmosphere (an amount of the same order of magnitude as that expected to be released in the next century). This significantly changed the climate, warming the deep waters of the oceans by around 5-7 ^{o}C, raising sea-level by 5-6 metres (there were no significant accumulations of ice to melt at that time) as well as making the oceans significantly more acidic and resulting in a considerable extinction of life on or near the sea-bed. There were also a large number of extinctions of mammal groups – perhaps one of the more important since the disappearance of the dinosaurs. The most salient point is that the rate of increase in carbon dioxide concentrations in the atmosphere during the PETM and today is remarkably similar. Unfortunately, the rate of recovery is estimated to have been around 100 thousand years which supports recent research that carbon dioxide can stay in the atmosphere for thousands of years and give rise to a considerable inertia in the climate system.



It is notable then when a leading petroleum geologist, who has spent some of his career with a major oil company, publishes a book that uses the PETM as a warning and supports the view that: "within the last decade the scientific case for anthropogenic climate change has become significantly more plausible". Perhaps not as categorical as the Intergovernmental Panel on Climate Change's (IPCC's) statement that climate change is now unequivocal and very likely (more than 90% certainty) caused by human actions. Equally notable is that this book comes with praise from many leading scientific and corporate leaders in the oil and gas industry in the UK and the US.

This is the first, and more negative, theme addressed in this slim volume. Geologists are taught how to read rocks, and the evidence of catastrophic damage to life on this planet at the time of the PETM convinces many that we are again facing a major global challenge but this time of our own making. The author argues rather bleakly that, while we cannot be sure that we have not already passed a "tipping point", if we now unite in wise action we can still "turn back from the edge, if not to stability at least away from the apocalypse".

I am not entirely surprised by the support of the oil and gas industry. Since retiring I have had several opportunities to meet with several well-informed senior managers from this sector. Although they have one over-riding objective to make money for their investors, they generally accept that climate change is an issue that they cannot ignore. Indeed, many oil executives have stated quite clearly that they believe they have a responsibility to contribute to addressing climate change through their own and their customers' behaviour. They also believe that if tackled appropriately they could achieve long-term returns for their share-holders. And this is the second and more positive theme addressed in this book.

The oil and gas industry hopes it may have a chance to redeem itself from the role of villains of climate change by using its expertise and inventiveness to safely store underground a good part of the fossil carbon released to the atmosphere through their own agency. The author recognizes, however, that the tar sands do nothing to reassure the public that the industry takes the environment as anything but greenwash.

The book reads as an extended lobbying effort in support of carbon capture and sequestration (CCS). The campaign is directed mainly at governments arguing for a policy and regulatory environment that would reward the industry. But it also recognizes some barriers: that the greater part of our planet's oil and gas resources are controlled by state-run companies in unstable parts of the world and that we will need a political resolve over fifty years rather than five to implement this technology. In addition, any successful approach will need an educated awareness of unfamiliar and long-term issues within the investment community.

Progress on CCS has been slow. The IPCC published a Special Report in 2005 that concluded that although this technology could be expensive (particularly the capture of carbon dioxide) overall the costs are in the same range as other energy technologies. The magnitude of the task however is enormous: locking away 4% of global emissions (about 250 million tonnes of carbon) would require injecting an amount of carbon dioxide equivalent to a third of the flow of oil per day.

There are a small number of sites where carbon dioxide is being pumped into oil and gas reservoirs or saline aquifers such as the test facility at Wayburn in Saskatchewan, the Sleipner gas field in the North Sea which contains almost 10% of carbon dioxide and at Salah in Algeria. The oil and gas industry is also handsomely funding some university research: ExxonMobile with General Electric and Toyota are putting in more than $200 million to the Global Climate and

Energy project at Stanford University and BP and Ford are supporting the Carbon Mitigation initiative at Princeton University.

There are many issues still unanswered but where the experience of the oil and gas industry can help. One is how to ensure the integrity of any sequestration site. We are dealing with a waste product and there are some instructive parallels in dealing with another waste product - that from the nuclear power industry. There are also concerns that the carbon dioxide will chemically alter the structure of the geological formations within which the gas is stored (or buried if it is possible to store for geological time periods). And oil and gas geologists have relatively little understanding of the behaviour of saline aquifers.

Ultimately, we need a market and a decent price on carbon to unleash a cascade of innovation. Smart energy companies will also use their considerable cash flows to invest in new technologies needed for a carbon-constrained economy. As has been noted before, the Stone Age didn't end because of a lack of stones but because we adopted new technologies.

This is an encouraging book for it demonstrates the engagement of some leaders in the oil and gas industry in not only recognizing the threat that is climate change but also in wanting to put their own expertise and resources into being part of the solution. It gives one example of how it is possible to be an energy power and to be environmentally responsible. As such, this book needs to be read in the boardrooms of Calgary and the offices on Parliament Hill.

Measuring Global Temperatures: Their analysis and interpretation

by Ian Strangeways

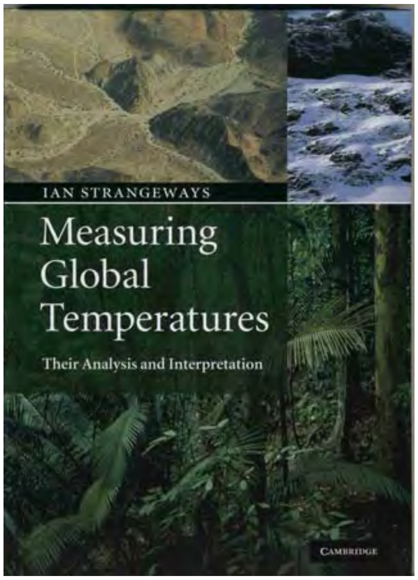
Cambridge University Press, ISBN:978-0-521-89848-5: 233 pp., Hardback, US$115

Book reviewed by Madhav Khandekar*

This little book published in early 2010 provides an excellent account of the problems and difficulties encountered in measuring global mean temperature, an important climate variable which has become perhaps the most intensely discussed parameter in the present global warming & climate change debate. The author (Ian Strangeways) is an expert in the topic of data collection, climate measurements and instrumentation as evidenced by his earlier books and papers on measuring natural environment & precipitation. The book provides a comprehensive account of how global temperatures are measured over land and sea, how the data are analyzed, what uncertainties and potential errors are and what needs to be done to improve (global and regional) temperature measurements in future.

The first chapter of the book provides a very readable account of solar radiation and its measurements, solar constant, changes in solar activity and its possible impact on climate change. Chapter two provides a brief history of thermometry from Byzantine time (second century BC) to the development of *liquid-in-glass* thermometers in France, England, Italy and elsewhere in Europe during the early-to-mid-1600s. This chapter also provides an account of various temperature scales like, Romer, Fahrenheit & 'Centigrade' or Celsius which is now the most universally used temperature scale in the world. The absolute temperature scale, the Kelvin scale was proposed by William Thompson (Lord Kelvin) in 1848. A short chapter 3 discusses operational aspects of temperature measurements using appropriate screen/shelter so as to yield temperature values free of local effects like exposure to direct sunlight, falling rain etc. The *Stevenson Screen* introduced around 1860, is today the most commonly used enclosed screen with louvers to measure temperature at a location. Chapters four and five discuss temperature measurements over land and over sea surface. Several important issues like impact of urban environment on temperature, measuring air temperature on ships, buoy measurements etc. are discussed and provide a flavour of inherent difficulties in producing reliable temperature data free of any extraneous influence. Chapter five also discusses some of the difficulties in measuring the MAT (marine air temperature) that must be compatible with LAT (land air temperature) which is prescribed to be measured at a height of 1.5 m inside Stevenson-like screens. Logistical difficulties of measuring air temperature over sea surface at a height of 1.5m require substituting MAT with SST (sea surface temperature) which is a slowly varying parameter, but is still beset with many problems. All this discussion conveys several inherent problems of accurately measuring temperature over the earth's surface, an issue which is often overlooked in the present debate on *human-induced* climate change and warming and/or cooling of the earth's surface. The last section of Chapter five provides a good discussion on various buoys (drifting as well as moored) and their measurements of SST and its accuracy.

A short chapter six discusses measuring sea temperature profiles through various ocean depths using new oceanic technology with instruments like the Argo (a drifting profiler float) and the electronic expendable bathythermograph (XBT). Also discussed in this chapter is measurement of global sea level using TOPEX/Poseidon satellites. (TOPEX: Ocean Topography Experiment/Poseidon: a Greek God of sea). Chapter seven provides a good account of global data networks like WWR (World Weather Records), CRU (Climate Research Unit) network, Global Historical Climatology Network (GHCN) and Global Climate Observing System (GCOS). A map showing locations of 1023 GCOS stations (in 2008) reveal how oceanic regions (especially in southern hemisphere) still remain sparsely



observed at present.

Chapters eight and nine provide a detailed account of how point measurements at thousands of observing stations are combined to produce global averages, their trends and changes in air and sea temperatures. These chapters also provide several interesting diagrams showing temperature trends since about 1850 together with changes in important atmosphere/ocean oscillations like SO (Southern Oscillation) and PDO (Pacific Decadal Oscillation). Of particular interest are air and sea temperature trends for northern and southern hemispheres separately, something that is not often discussed in the present debate on global warming & climate change. These temperature trends bring out subtle but important differences between northern and southern hemisphere temperature changes and evolution of climate over the two hemispheres in the last 150 years. Among the important differences are: **a.** the southern hemisphere land-area has warmed only modestly since the new millennium, when compared with similar warming over northern hemisphere and **b.** the northern & southern hemisphere oceans appear to be cooling in the last few years. Chapter seven also shows Central England Temperature (CET) trend, from 1659 to the present, possibly the best documented longest available temperature trend based on instrument data. This temperature trend show several short-term temperature swings including a steep cooling of CET during 1650-1700, a period identified with the *Little Ice Age (LIA)* and the recent warming trend since about 1980. Chapter ten discusses temperature measurements through the depths of the atmosphere using the well established network of radiosonde stations; also discussed here is the Microwave Sounder Unit (MSU) aboard a number of recent satellites and the data they are able to produce. The last Chapter discusses future climate measurements and includes brief discussions on a need for more/less measurement locations, ocean climate monitoring using small uninhabited islands, improving accuracy etc.

All in all, this book offers an excellent survey of global temperature measurements and problems and difficulties associated with such measurements. The book provides a well balanced and a readable account of the problems and uncertainties associated with determining a seemingly simple calculation of temperature trend on regional, hemispheric or global scale. The author has referred to a large number of latest peer-reviewed literature as well as other important documents while bringing out several uncertainties in data collection, analysis etc. The author seems well aware of the current acrimonious debate between the supporters and the skeptics of the anthropogenic global warming (AGW) hypothesis as he concludes *"I am aware that by stressing the complexity of the climate system, the uncertainty of measurements and the intricacy of what they show, I run the risk of offending the committed environmentalists and possibly encouraging the skeptics. I sit in the middle, unhappy with the often petulant tone of the skeptics but also unable to support the appearance of certainty and simplicity that many climatologists try to covey. We have a long way to go yet"*

Yes indeed, we have a long way to go before we arrive at a complete understanding of the past, present and future climate change. I highly recommend the book for every one interested in climate and environmental sciences and future climate change.

* Madhav Khandekar is a former research scientist from Environment Canada and was an Expert Reviewer for the IPCC(Intergovernmental Panel on Climate Change) 2007 climate change documents. Khandekar has been in the weather & climate science for over 53 years and continues his research on extreme weather, global weather anomalies and monsoon inter-annual variability.

Measurement Methods in Atmospheric Sciences, *In Situ* and Remote

by Stefan Emeis

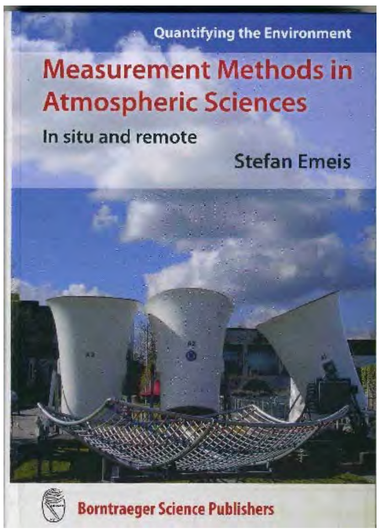
Published by Borntraeger Science Publishers, 2010
Hardback, ISBN 978-3-443-01066-9, pp. 258, € 68

Book reviewed by T. Colleen Farrell[3]

The origins of this book were a series of lecture notes at the University of Cologne, therefore it is very much a general overview of basic principles and measurement techniques aimed at the student of atmospheric sciences, but will serve as a general reference for anyone interested in an overview of available measurement techniques. Any single method is not described in any great detail, but could serve as a quick reference or a guide to which method one might choose for a given task, when there are options available. The author acknowledges that his first language is not English and he relied on others to review and make suggestions to improve the flow of the text.

[3] Environment Canada, Dartmouth, Nova Scotia

The appearance of corporate advertisement pages throughout the book is a little out of the norm from texts I have reviewed in the past, but the author acknowledges the support from various instrument manufacturers to review and supply additional information and illustrative materials. There are 103 figures within 208 pages of the main text, so almost one figure or photograph every other page, most in colour, which makes the book very readable. The aforementioned advertisements are not counted in the final figure count.



The chapters are broken down into an Introduction, which deals with the need for measurements, definitions and historical aspects. "*Measurement basics*" includes a section on quality assurance and quality control. "*In situ measurements*" includes thermometers, hygrometers, pressure and wind, methods for observing liquid water and ice, including precipitation and soil moisture, trace substances (gases, particles, olfactometry and radioactivity - definitely something for everyone!) and flux measurements (radiation, visual range, evaporation and soil heat flux. "*Remote sensing*" methods, including active and passive methods (RADAR, Windprofilers, Lidar, just to name a few of the former and Radiometers, Photometers and Infrared-Interferometers of the latter) of atmospheric state variables (ex. temperature, humidity, wind and turbulence, turbulent fluxes, electron density), water and ice, trace gases and aerosols, and surface properties (ex. surface roughness, vegetation, sea surface (ice cover, wave height, SST, ocean currents)), and electrical phenomena, making the book quite comprehensive for a thin volume. This would make a useful reference for a broad range of students and scientists who are only looking for a general introduction to a measurement method or as the gateway into finding more detailed treatment of individual instruments. There is a fairly lengthy reference (Literature) list, index and appendices (as well as an extra index to the appendices, which is helpful) at the back.

The strength of this book appears to be in the breadth it covers, which also may serve as its weakness: for a student of Atmospheric Science, it would serve as a great introduction to the technology, but a practitioner would need to delve further to get the answers he may be looking for. For this reason, I think it would suit the undergraduate students of Meteorology or Masters student in Environmental Sciences. As this is its intended audience, I think it is successful. For others looking for a quick reference on a particular measurement technology, this would be a great place to start. It is an attractive and slim volume with enough detail to get you started and a fairly extensive literature review to direct you further.

On Sea Ice

by W.F. Weeks with (chapter 16)
W.D. Hibler III

Published by the University of Alaska Press
Fairbanks, Alaska

Hardcover, 664 pages, ISBN 978-1-60223-079-8
US$85.00

Book Reviewed by John Falkingham[4]

"Willy" Weeks is one from that small community of researchers in the post-war period who has devoted much of his life to the study of sea ice. With his extensive field experience in both the Arctic and Antarctic and his analytical mindset, he has been a major contributor to the scientific literature. That he has chosen to commit his encyclopaedic knowledge to this book is to the benefit of all who study sea ice and its impacts on everything from offshore structures to climate.

This book spans the gamut of sea ice science in 19 chapters, 5 appendices and an extensive bibliography with over 1500 references. In a refreshing change from the norm, Weeks writes in the first person rather than the more typical third. This allows him to pepper the technical text and mathematics with personal anecdotes from his field experience, providing a valuable reality to the theory.

Following a brief introduction, Chapter **2** (Historical Background) and Chapter **3** (The Ocean Setting) serve to ease the reader into the book by setting the context and establishing the global nature of the phenomenon and its past study.

Chapter **4** (An Introduction to Sea Ice Growth) starts to delve into the theory, presenting 15 equations and 5 figures to illustrate several models of sea ice growth. As is common throughout the book, Weeks points to observational data to support theory. He is also deliberate in pointing out where theory falls short of observations and encourages readers to further the research.

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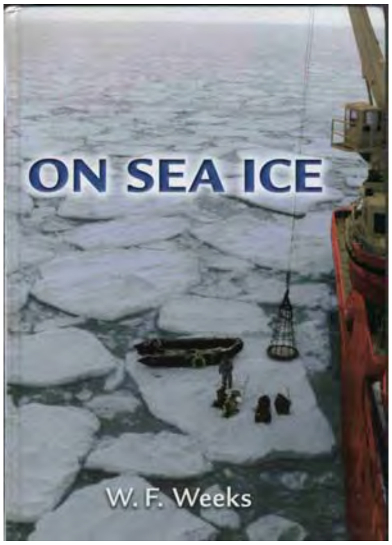
[4] Retired from Canadian Ice Service, Environment Canada, Ottawa, Ontario, Canada

By Chapters **5** (Components) and **6** (The Phase Diagram), Weeks is well into academic mode starting with an atomic model of water and moving to the complexities of added salts. He describes experimental methods of analysing brine and, despite the tough scholastic slog, manages to inject a sense of authenticity thanks to his writing style and personal references.



Chapter **7** (Sea Ice Structure) devotes 64 pages of dense text, smattered with equations, graphs and diagrams to the crystal structure of the various forms of sea ice. While there are many photographs of the microstructure of ice, a reader who is new to the field might wish for more life-size photos of the types of ice discussed.

Chapters **8** (Sea Ice Salinity), **9** (Sea Ice Growth: The Details) and **10** (Properties) provide an in-depth review of these topics supported by a good deal of mathematics, chemistry and physics interjected with discussions of field and laboratory measurement techniques and the practical results of many previous researchers. As an example, on the simple observation that sea ice becomes less saline with age, Weeks uses 8 pages to explain three different causative mechanisms complete with 21 equations and several graphs and diagrams.

Chapter **11** (Polynyas and Leads) dedicates 40 pages to the importance of, and processes for, openings in sea ice as well presenting models for predicting lead formation. I did find it a little curious, from a Canadian perspective at least, that there are no references to Canadian polynya research (e.g. Barber, Fortier, Melling, Wilson). He can be forgiven for not citing the International Polar Year work since it post-dates the writing but there are several valuable publications on this topic that I found missing in the excellent bibliography.

The first part of the extensive Chapter **12** (Deformation) describes the many types of surface deformations in detail with numerous photographs and personal anecdotes. These act almost as a field guide and partly make up for the lack of photos in Chapter 7. The second part of the chapter delves into the theory of ice deformation with mathematical models well supported by observations.

Chapter **13** (Sea Ice-Seafloor Interactions) and Chapter **14** (Marginal Ice Zone) are both fairly short chapters that serve to cover the highlights and point the reader to more in-depth sources. Weeks does not reference the lengthy bibliography blindly but, as is common throughout the book, he points out those references that are of particular value for further reading.

Chapter **15** (Snow) relies on personal observations, photographs and diagrams to describe the effects of snow on sea ice. Of particular interest, are the descriptions of the significant differences between the Arctic and Antarctic in this characteristic.

Chapter **16** (Ice Dynamics) is Hibler's contribution to the book. Covering 57 pages, it is an excellent overview of ice dynamics modelling from one of the foremost practitioners of the science. Although well integrated into the book, it is clearly written by a different author. It uses the more common third person and contains none of the personal anecdotes of the other chapters (although this could also be a function of the subject matter).

Chapter **17** (Underwater Ice) offers a fascinating treatise on a more esoteric form of sea ice. It is treated with as much rigor as current scientific understanding will allow and entreats the reader to further research. The chapter lends credence to Coleridge's "emerald green ice" and offers a plausible explanation for its origin.

Chapter **18** (Trends) is a bit of a curiosity. Writing on the heels of the record minimum Arctic ice extent of 2007, Weeks presumably felt it incumbent to say something about the diminishing ice trend that was, and remains, such a hot topic. His observations and speculations are not wrong – indeed he is quite prescient. It just seems a bit dated in light of the experience and research of the past two years.

While this is a very significant publication on sea ice, it is not a climatology, except in a very general sense. Nor does it deal with the remote sensing of ice or the biological aspects. It is not an engineering text, although it does contain considerable material that someone interested in ice engineering would find useful. A minor criticism is that the photographs and diagrams in the book are not colour. Some of the photos (particularly the thin-sections) and a few of the more complex diagrams suffer as a result but the trade-off is a more affordable publication.

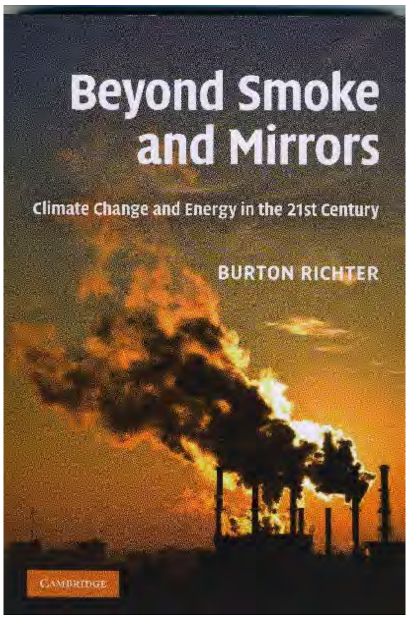
"On Sea Ice" is a superb, advanced level treatment of its title subject. It is a text that could readily serve as the basis for a graduate level course of study and as a reference for researchers, engineers, mariners and operational ice analysts and forecasters. Weeks weaves a personal, easy writing style into the rigorous scientific treatment of his complex subject making it a pleasure to read. It is a book that every polar library should have.

Beyond Smoke and Mirrors: Climate Change and energy in the 21st Century

by Burton Richter

Cambridge University Press, 2010, 248 p.p.
ISBN 978-0-521-74781-3, Paperback US$30
Hard cover US$99US

Book Reviewed by Daniel Johnston[5]



This book provides an overview of what changes greenhouse gases will play in future generations. The author quickly labels three main views of climate change as: Business as usual, immediately stop all usage of items that are known now to contribute to climate change, and continue on a path of progressive change toward products and practices that will limit and/or eliminate negative greenhouse gases in the future. His own viewpoint is the latter. The author points out that the "blind eye" approach that declares climate change is false is unintelligent because the scientific community unequivocally agrees that it's occurring. Immediately eliminating greenhouse gas emissions is not possible because of the strain individual lives would be under to comply. Also, one hastily-made decision, he contends, could erroneously pave the way for a replacement gas that could have worse climate effects than the initial gas eliminated.

The first two sections of the book provide the reader enough information to grasp the major points that have led to the study of greenhouse gas emissions from the 1800s until the present day. The appendix within each chapter includes in-depth scientific explanations of the points made therein. However, reading these appendices requires a senior high school level understanding of general science topics. In the second part of the book, the author methodically draws the reader into more concrete arguments and their individual implications to everyday life. For example, he analyzes the benefits of owning an electric versus a gasoline powered vehicle. Even though he's in favor of owning an electric powered vehicle, comprehending the total effects on the owner and society is crucial before finalizing a decision. Through his argument, he states that switching from a gas powered one to an electrical one will benefit the owner in the short term costs because it will eliminate their gasoline bill and will, therefore, decrease their individual greenhouse gas emission. However their total greenhouse gas emissions are not entirely eliminated if the electricity used to run their car is made by a coal-burning plant. One can only speculate too that the financial savings from not buying gasoline would be replaced by the increased cost of their electricity bill.

The author's only flaw is his coverage of renewable resources. He states "the discussion of renewable resources of energy is where you will find the largest collection of half-truths and exaggerations [about their worldwide feasibility]." The author argues that the economical feasibility of this approach on a country and/or world scale remains impossible. The largest reason is the initial and yearly maintenance costs of renewable energy in most countries.

The book's final section explains the current energy policies in place around the world for most countries. This section is very heavily weighted toward nuclear power and the ability to produce adequate, low greenhouse gas emission energy for the world's use through the mid-21st Century. The author takes this opportunity to state his membership in the United States' Department of Energy Nuclear Energy Advisory Committee and his role as a member of the board of director of the United States' subsidiary of the French nuclear power reactor builder AREVA. It is a minor flaw but one that should have been made clearer earlier in the book. This might have lent a non-biased interpretation of Richter's following statement on nuclear power. "*There is no silver bullet to slay this climate-change dragon…but nuclear power provides the safest and cost-efficient alternatives to continuing our present course. Therefore, we should be moving vigorously to increase the nuclear energy supply*."

Overall, the author adequately outlined the past, current and future effects on greenhouse gas emissions without requiring the reader to have any preconceived notions of the topic. I would recommend anyone with an interest in climate change to read this book with complete understanding toward those with a background in high school level general science.

[5] Meteorologist, The Weather Network, Burlington, Ontario, Canada

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

Latest Books received / Derniers livres reçus

2010-17) *Introduction to Coastal Processes and Geomorphology*, Robin Davidson-Arnott, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-87445-8, pp.442, US$125.

2010-19) *Stochastic Physics and Climate Modelling*, Edited by Tim Palmer and Paul Willimas, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-76105-5, pp.480, US$150.

2010-24) *The Climate Connection, Climate Change and Modern Human Evolution*, by Renée Hetherington and Robert G.B. Reid, Cambridge University Press, Paperback, ISBN 978-0-521-19770-0, pp.422, $44.

2010-28) *Heliophysics: Space Storms and Radiation: Causes and Effects*, Edited by Carolus J. Schrijver and George L. Siscoe, Cambridge University Press, Hardback, ISBN 978-0-521-76051-5, pp.447, $75.

2010-29) *Contemporary Issues in Estuarine Physics*, Edited by Arnoldo Valle-Levinson, Cambridge University Press, Hardback, ISBN 978-0-521-89967-3, pp. 315, $120.

2010-31) *Introduction to Atmospheric Physics*, by David G. Andrews, 2nd edition, Cambridge University Press, Paperback, ISBN 978-0-521-69318-9, pp. 237, $65.

2011-01) *Discoveries of the Census of Marine Life, Making Ocean Life Count,* Paul V.R. Snelgrove, Cambridge University Press, Paperback, 2010, ISBN 978-1-107-00013-1, pp. 270, US$45.

2011-02) *Internal Gravity Waves*, by Bruce R. Sutherland, 2010, Cambridge University Press, ISBN 978-0-521-83915-0, Hardback, pp.377, US$120.

2011-03) *Groundwater Modelling in Arid and Semi-Arid Areas*, Edited by Howard S. Wheater, Simon A. Mathias and Xin Li, International Hydrology Series, Cambridge University Press, ISBN 978-0-11129-4, Hardback, pp.137, US$99.

2011-05) *Climate Change and Climate Modeling*, by J. David Neelin, Cambridge University Press, ISBN 978-0-521-60243-3, Paperback, pp.282, US$55.

2011-06) *Numerical Weather and Climate Prediction*, by Thomas Tomkins Warner,Cambridge University Press, ISBN 978-0-521-51389-0, Hardback, pp.526, US$75.

2011-07) *The Development of Atmospheric General Circulation Models, Complexity, Synthesis and Computation*, Edited by Leo Donner, Wayne Schubert and Richard Smerville, Cambridge University Press, ISBN 978-0-521-19006-0, Hardback, pp.255, US$85.

2011-09) *Principles of Planetary Climate*, by Raymond T. Pierrehumbert, Cambridge University Press, ISBN 978-0-521-86556-2, Hardback, pp.652, US$80.

CMOS 2011 Photo Contest

All members with a photographic bent are invited to participate in the 2011 Photo Contest. Please submit your own original image files, either in colour or black and white, from scans or digital capture of a meteorological or oceanographic subject, event, or phenomenon. Details on the photo contest can be found on the CMOS Web Page at:

http://www.cmos.ca/photocontest.html

The deadline for submissions is **May 15, 2011.** If you have any questions please contact Bob Jones at webmaster@cmos.ca.

Concours photographique 2011 de la SCMO

Tous les membres qui ont une passion pour la photographie sont invités à participer au concours de photographie 2011 de la SCMO. Prière de soumettre vos photos numériques originales, soit en couleur, soit en noir et blanc, à partir de copie papier ou de fichier numérique portant sur des sujets ou phénomènes météorologiques ou océanographiques. Les détails du concours se trouvent sur le site web de la SCMO à:

http://www.scmo.ca/photocontest.html.

La date butoir pour les soumissions est le **15 mai 2011.** Pour toutes questions, prière de contacter Bob Jones à webmaistre@scmo.ca.

SHORT NEWS / NOUVELLES BRÈVES

Chaire UNESCO à l'UQAR

L'Université du Québec à Rimouski (UQAR) a annoncé en octobre qu'elle se voit accorder une Chaire UNESCO dans le secteur des sciences de la mer. "*Au Canada, c'est la première fois qu'une Chaire UNESCO voit le jour dans le domaine des milieux marins", a affirmé le recteur de l'UQAR, Michel Ringuet. "Nous sommes très fiers de cette réussite. Il s'agit d'un atout de plus pour illustrer la vocation maritime de la région*".

Cette Chaire portera sur l'"Analyse intégrée des systèmes marins". Elle fera appel aux spécialistes en océanographie et en gestion des ressources maritimes. Le premier titulaire de la Chaire sera M. **Jean-Claude Brêthes**, chercheur de l'Institut des sciences de la mer de Rimouski (ISMER-UQAR).

"*La Chaire que nous avons proposée"*, a expliqué M. Brêthes, "*répond aux priorités de l'UNESCO et de sa Commission océanographique intergouvernementale (COI) dans la protection de la biodiversité et de l'environnement marins. Notre objectif est d'appuyer, par la formation et la recherche, la mise en place de politiques pertinentes qui permettront de renforcer les capacités dans l'analyse des systèmes marins et de leur fonctionnement*".

Lors du lancement de la Chaire, le député Patrick Huot (adjoint parlementaire au ministre du développement durable du Québec), le recteur Michel Ringuet, le titutaire de la chaire Jean-Claude Brêthes et Mme Ariane Plourde, de Pêches et Océans Canada, ont pris la parole.

A.G. Huntsman 2010 Award

Professor Curtis A. Suttle (FRSC) received the 2010 A.G. Huntsman award in November 2010 as recognition of his contributions to biological oceanography. Dr. Suttle is one of the World's leading marine virologists, and is among a small group of researchers credited with launching the field of marine virology nearly twenty years ago. These studies demonstrated that viruses are not only the most abundant and genetically diverse biological entities in the World's oceans, but they are major agents of mortality. The results have had a significant impact on our understanding of nutrient and energy flow in the oceans, and have been a catalyst in the re-invigoration of phage biology and environmental virology. His contributions cross over many fields including biological oceanography, environmental microbiology, microbial ecology, virology and phycology.


Professor Curtis A. Suttle

Dr. Suttle has been Associate Professor (1996 – 2000), Professor (since 2000), and Associate Dean of Science (since 2001) at the University of British Columbia in Vancouver, British Columbia. He received his B.Sc. in zoology in 1978 and his Ph.D. in botany in 1987, both from UBC. His career has taken him to government laboratories and academic institutions in Canada, the United States, and Germany, with a significant amount of time (1988 – 1996) at the University of Texas at Austin.

Source: A.G. Huntsman Award website.

New Chief Scientist at the VENUS Observatory

Last January, Ken Denman has taken up the post of Chief Scientist of the VENUS observatory (the Victoria Experimental Network under the Sea). This is a new position aimed at enhancing activities with the research community as VENUS extends in the water column with gliders, a fixed profiler, CODAR and the instrumenting of selected BC ferries for under water sampling. Ken's research interests address the effects of climate change on marine ecosystems and biogeochemical cycles, in particular: how will marine ecosystems adapt to a future ocean that will be warmer, more stratified, less oxygenated and more acidic? The cabled VENUS network, a part of

Ocean Networks Canada, is operated from the University of Victoria.


Dr. Ken Denman

For the last 10 years Ken worked at the Canadian Centre for Climate Modelling and Analysis, also located at UVic. He worked previously at the Institute of Ocean Sciences in Sidney BC and the Bedford Institute of Oceanography. He was a Coordinating Lead Author in the Second (1996) and Fourth (2007) IPCC assessments of climate change. Ken obtained a PhD in Physics and Oceanography from UBC.

Source: Uvic website.

From Knowledge to Action IPY Conference April 22-27, 2012, Montreal, Quebec

A conference in 2012 will be the final event of International Polar Year 2007 - 2008, the largest international program of interdisciplinary polar research ever undertaken. This conference will provide an opportunity to apply and disseminate the knowledge and scientific results from IPY from around the world and focus on next steps. Participants will consider ways to translate those new understandings into policy that will guide activities in and enhance stewardship of the polar regions.

The call for abstracts will open this coming June with registration in September.

De la connaissance à l'action Conférence API, 22-27 avril 2012 Montréal, Québec

La conférence API de 2012 est le dernier événement de l'Année polaire internationale (API) 2007-2008, le plus grand programme international de recherches polaires interdisciplinaires jamais entrepris. Cette conférence donnera l'occasion d'appliquer et de diffuser les connaissances et les résultats scientifiques de l'API du monde entier et de se pencher sur les prochaines étapes. Les participants concevront des moyens de traduire ces nouvelles connaissances en politiques afin d'orienter les activités à venir et d'améliorer l'intendance des régions polaires.

La demande de communications s'ouvrira en juin et le début des inscriptions en septembre.

Carleton Students and Professors headed to Antarctica for an 'Anything But Textbook' Experience

Seven Carleton University students will be earning course credits next month while conducting research on the Earth's southernmost continent.

The students and their instructors, Claudia Schroder-Adams and Natalia Rybczynski, traveled to Antarctica February 12 to 28 as part of the **Students on Ice Program**.

Led by Canadian adventurer, environmentalist and educator Geoff Green, the program provides participants with a unique educational opportunity that allows them to visit some of the world's most wild and awe-inspiring ecosystems in order to experience a transformative connection with nature – a connection that changes the way they understand and act in the world. Green has already travelled to Antarctica 80 times.

"*A lot of tourists head to Antarctica for a sightseeing adventure, but this is not going to be a show-and-tell holiday for our students*," says Prof. Schroder-Adams. "*It's an opportunity to do serious scientific research while gaining hands-on experience in a very fragile ecosystem*."

"*The polar regions are 'ground zero' for climate change as they are the most sensitive areas for global warming*," notes Rybczynski, an adjunct professor in earth sciences and biology and Carleton alumna. "*Our students will be able to see this pattern first-hand while learning more about the causes and consequences of climate change by studying the geological record in Antarctica*."

The field work is part of the coursework for three courses at Carleton that focus on the origin and evolution of Antarctica ecosystems over time. Of the seven students taking the undergraduate and graduate courses, six are earth sciences students while one is neuroscience. Three are undergraduates. The other four graduate students also conducted their research in the Canadian Arctic, making them pole-to-pole adventurers.

"*I was very lucky to be part of a research expedition to the Canadian High Arctic last summer, an opportunity that very few people get to experience*," says grad student Thomas Cullen. "*The chance I have been given to visit the Antarctic as part of my Carleton coursework, and see both poles in the period of a year, is an extraordinary experience I will remember for the rest of my life*."

The group will fly to Ushuaia, a picturesque community at the southern tip of Argentina, and then board MV Ushuaia, a 3,000-tonne, ice-strengthened vessel outfitted for supply and oceanographic research. They will be joined by students and staff from elsewhere in Canada, the United States, Australia, New Zealand, India, Kuwait, United Kingdom, Spain, Norway, Sweden, France and Argentina.

While on board, expeditioners will conduct scientific research such as taking ocean water and sediment samples, as well as attend lectures and workshops. Daily trips by Zodiac to the mainland will facilitate hands-on studies of rocks, fossils, ice and ecological habitats.

Note from the Editor: Geoff Green gave a very interesting talk on **Students on Ice Program** to members of the CMOS Ottawa Centre in October 2009. The title of his talk was: "*Inspiring 'Generation G' from Pole to Pole*".

High drama in the High Arctic HMS Investigator

Their run of good luck was dizzying! Within three days of landing at Mercy Bay in Aulavik National Park on Banks Island, a team from Parks Canada's Western Arctic Field Unit and the Underwater Archaeology Service had found HMS Investigator, the graves of three of her crew, and stone artefacts from a 2300-year-old aboriginal camp. Their discoveries could not have been better timed as the team was joined by Environment Minister Jim Prentice on the project's fifth day. "I'm elated," the Minister exclaimed, "it's a special moment linking our past and future in the Canadian Arctic."

Captain Robert McClure and the crew of HMS Investigator were credited with charting the last link in the North-West Passage connecting the Atlantic to the Pacific, but this prize came at a cost. In 1854, after more than two years trapped in ice at Mercy Bay, the 'Investigators' were forced to land their supplies and abandon ship. Shortly afterwards, Copper Inuit found the depots left on shore and in the following decades returned to salvage iron, copper and other materials.

The HMS *Investigator* story thus figures prominently in Inuit oral history. For the Inuvialuit who played a key role in the 2010 archaeological work, it was an exciting opportunity to directly follow in their ancestors' footsteps.

In finding HMS *Investigator* and its associated graves, the Parks Canada team solved a mystery more than 150 years old. Parks Canada underwater archaeologists are also seeking to unlock another enduring mystery of Canada's Arctic past—the final resting place of HMS Erebus and HMS Terror, the two ships lost during Sir John Franklin's ill-fated quest for the North-West Passage.

Source: Parks Canada website visited on December 19, 2010.

In Memoriam

Roy Dahl

1907-2011

With deep sorrow we announce the passing of Roy Dahl on February 14, 2011 at the age of 103. Roy may have been the oldest meteorologist in Canada. Until his passing he blessed us with his heartwarming stories, songs, humour and presence. His kindness, honesty and gentle understanding will live in our hearts forever. Roy was born May 28, 1907 on a farm outside Outlook Saskatchewan to a family of six brothers and three sisters. He obtained a Bachelor of Science degree from the U of Saskatchewan and Teaching Certificate through Normal School. He started his career as a public and high school teacher in the Outlook area before moving to Regina and working 10 years as a meteorologist for the Federal Government. The war years saw him instructing the RCAF in meteorology. In 1948 he joined the Saskatchewan Government becoming Director of Petroleum Lands until his retirement in 1972. Roy's major interest throughout his life was singing, beginning with his formation of a men's quartet which toured the province from 1929 to 1931. At 103 he continued to sing whenever the opportunity arose. Roy also took an avid interest in sports, playing baseball, golf and curling well into his 90's. He keenly followed professional sports, especially the Roughriders (the Saskatchewan Canadian Football team).

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Race Rocks Lighthouse: Photo courtesy of SpringTideCharters


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