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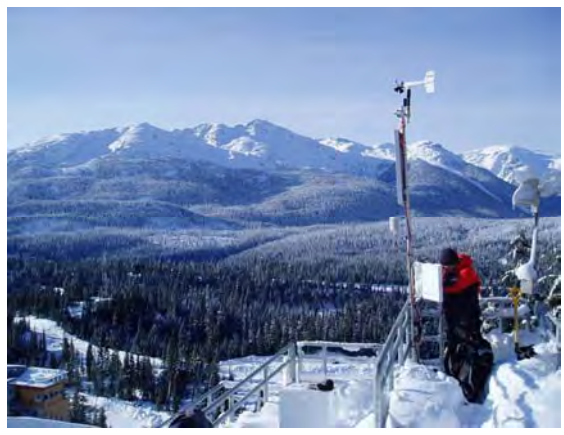
CMOS
BULLETIN
SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

April / avril 2010 Vol.38 No.2

The Vancouver 2010 Olympic Games
Les Jeux Olympiques de Vancouver 2010



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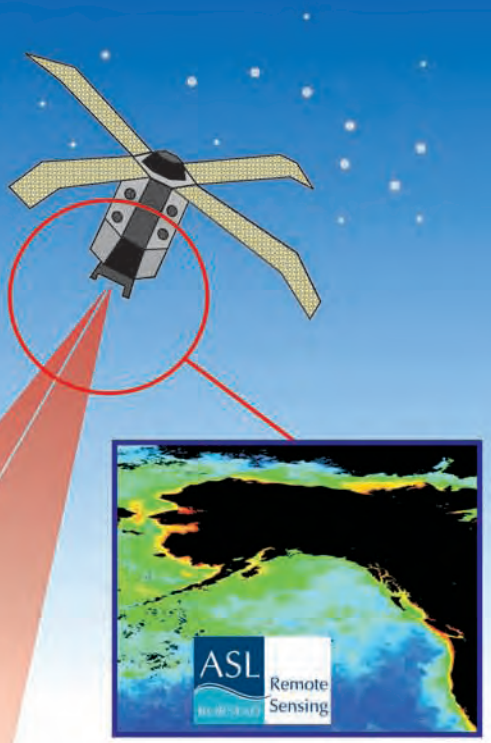

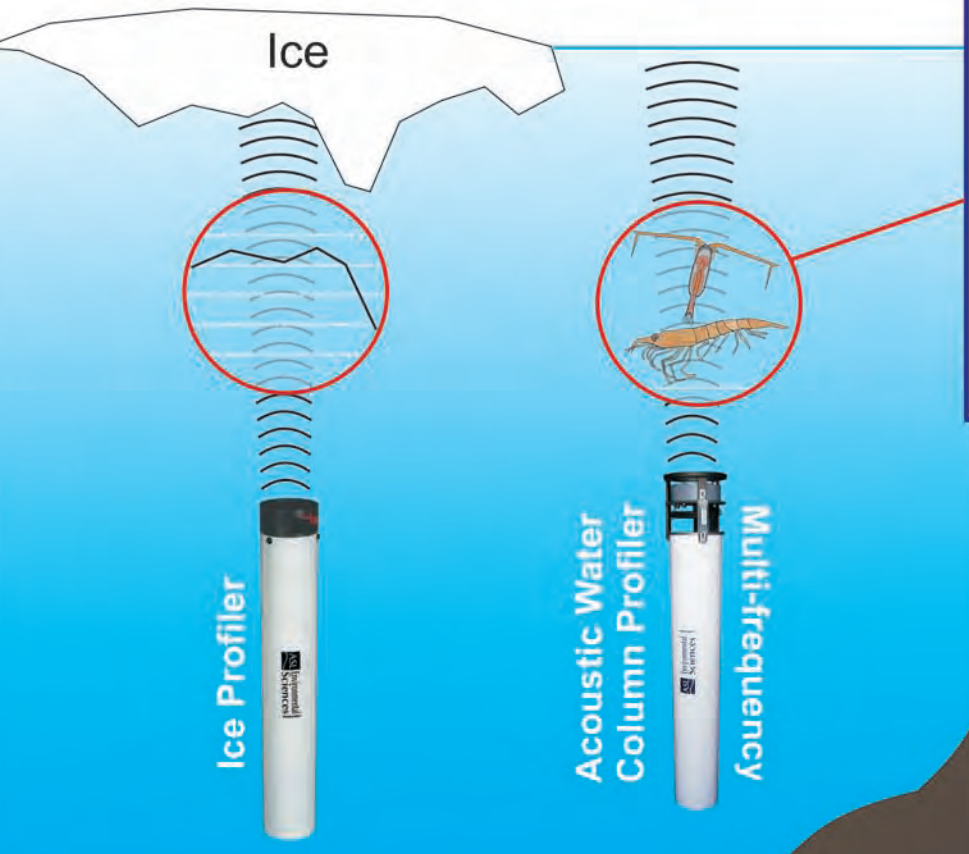

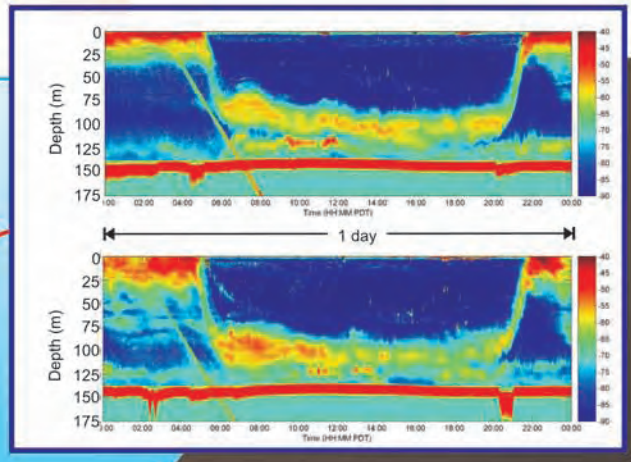

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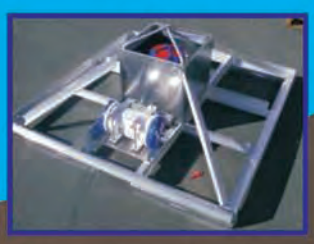

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....from the President's Desk

Friends and colleagues:

Bill Crawford
CMOS President
Président de la SCMO

The 2010 Congress in Ottawa in May-June looks to be a big, exciting event, with a near-record number of abstracts submitted by the deadline in February. We share Congress this year with the Canadian Geophysical Union and will see exciting papers and exhibits across a range of disciplines. The large number of abstracts allowed organizers to project more registration income, so they have increased the travel subsidies for students. I wish to thank our lead organizers Dick Stoddart, John Falkingham and Ron Blais as well as the many volunteers who have been working on this event for almost two years.

My letter goes to press just after release of the federal budget. We in CMOS had hoped for specific mention of renewed funding for the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), which did not appear. This fund has supported many productive research networks and projects in atmospheric, climate and oceanographic research over the past years, and without renewed funding many programs will end. CMOS asked for CFCAS renewal in its brief to the federal finance committee in late 2009 and we hope for a change of mind before the budget vote. The budget does propose an increase of $32 million per year to be shared among Canada's research councils, including NSERC, as well as $8 million in indirect costs and more funding for post doctoral fellows.

CMOS is soon to consider the future of our research journal ATMOSPHERE-OCEAN. We anticipate that by next year we will have entered into an agreement with a private scientific publisher to share much or most of its publication. The groundwork for this move will be described in a future issue of the *Annual Review 2009* by Richard Asselin, Director of CMOS publications, who has led this project for the past year. I encourage CMOS members to read through his article and provide us with your recommendation. We expect to decide its future at the Annual General Meeting at this year's Congress.

See you in Ottawa at Congress!

Bill Crawford, President / Président

CMOS Bulletin SCMO
Volume 38 No.2
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Cover page: The composite image on the cover page illustrates the different venues used during the 2010 Vancouver Olympic Games. A continuous subject of discussion during the Games was the "warmer" than usual weather and the lack of snow. To learn more, please read Claire Marin's article on **page 55.** Usual photo credits and descriptions can be found within the text.

Page couverture: L'image composite en page couverture illustre les différents sites utilisés durant les Jeux Olympiques d'hiver de Vancouver. Un sujet de discussion omniprésent durant les Jeux fut sans contredit le temps « doux » ainsi que l'absence de neige. Pour en savoir plus, prière de lire l'article de Claire Martin en **page 55**. La description des photos individuelles ainsi que les remerciements d'usage sont inclus dans le texte.

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Canadian Meteorological and Oceanographic Society (CMOS)
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Executive / Exécutif

Highlights of Recent CMOS Executive and Council Meetings

CMOS congresses

2009 Halifax. The final report on the Halifax Congress was received by the executive. This was a very successful meeting, financially and scientifically. Oceanographers and meteorologists worked together to organize the meeting.

2010 Ottawa. The abstract deadline has passed, and registration is now open. Exhibit bookings are coming in, despite limited space in the venue.

2011 Victoria. The Local Organizing Committee is almost fully assembled. Sponsorship is in progress. It was decided that congress presentations would not be recorded.

2012 Montréal. Organizers are working to select a venue. This meeting may be held in conjunction with an American Geophysical Union meeting.

CMOS funds have increased in the past few years due to strong profits of Congresses. However, recent profits at Congresses might be temporary, due to healthy research funding to scientists from IPY and CFCAS projects, which are coming to an end. The Executive recognized the need to maintain a contingency fund sufficient to cover a disastrous loss at a future Congress.

Other business

The Executive discussed two options for the future of ATMOSPHERE-OCEAN. The report, written by the Director of Publications, will be published in the *CMOS Annual Review 2009*. We have decided to poll the Executive and Council and then to present the two options and Council's recommendation to the membership for a vote at the Annual General Meeting in June.

Past-President Andy Bush participated in the First Global Meeting of the International Forum of Meteorological Societies (IFMS) in Atlanta, GA, Jan. 19-20, 2010, held in conjunction with the American Meteorological Society meeting. He noted that the next meeting is planned for 2011 in China. The Executive agreed that participation in these meetings was worthwhile and provided CMOS Presidents / Vice-Presidents with experience, while also benefiting the Forum.

The CMOS Head Office has moved to 360 Laurier Ave in Ottawa. All contact addresses, including the mailing address will stay the same. The move went smoothly. Once renovations are complete at 200 Kent St., the Head Office will move back there.

Sophia Johannessen,
Recording Secretary / Secrétaire d'assemblée

Letters to the Editor / Lettres au rédacteur

From: Arnold Ashton
Ontario Storm Prediction Centre
Toronto, ON

Date: February 01, 2010

Subject: Response to Pierre Dubreuil's article On the future of operational forecasting tools

Pierre Dubreuil's response presents an interesting reply to David Sills' Forecaster Forum article. In fact, the over-arcing tone of the response is not unlike the philosophy of Dr. Sills – both recommend an area-based, object-oriented forecast system. It's just the means to that end may be somewhat different. Mr. Dubreuil, rightly so, recommends more emphasis on analysis and diagnosis. While many of his points are well grounded (our resource constraints in Canada, the advantages of PHOENIX and the necessary foundation of a good analytical and diagnostic focus, etc), there's one issue that I'd like to address. I will not comment on the issues of SCRIBE, forecast automation, or the merits of a graphical interface. But rather the specific statement of NWP use among forecasters. Obviously there have been significant improvements in NWP over the years, and there's certainly no dearth of disparate model or ensemble guidance to peruse.

Mr. Dubrieul mentions the timesavings when the forecaster agrees with the GEM-Regional model guidance (as displayed by SCRIBE), and indeed this is true most of the time. But SCRIBE's inherent failings in complex terrain or when the GEM-REG poorly captures an evolving weather event, need to be addressed. Mr. Dubrieul indeed raises this issue and discusses it in relation to a graphical interface, but doesn't address how one modifies SCRIBE when the GEM-REG goes awry. One naturally should adjust the concepts/graphics according to 'initial conditions' (say, in the first 12 hours or so), but beyond that timeframe, a reliance on other model guidance increases. And perhaps that is why many SPC forecasters spend time 'analyzing and comparing a broader range of NWP'. To say that an SPC forecaster lacks any consistent ability to select the best model for a particular weather situation seems somewhat dismissive of an experienced forecaster's ability to absorb model behaviour (even in a subjective way), and gain awareness of its strengths and weaknesses over time (in spite of model updates/changes!). This is, of course, done in conjunction with pattern recognition.

A case in point has been recently documented to CMC, and involved a 6 to 15 hour freezing rain event on this past Christmas Day across eastern and central Ontario. It became apparent early on that the GEM-REG was exhibiting a warm-bias in the boundary layer affecting some 50 public sub-regions (SCRIBE forecast only a small duration of freezing rain for very few regions). This affected

most SCRIBE temperature, phase, and QPF concepts across a wide area in the entire 48-hour GEM-REG timeframe. Short-range forecasting techniques can handily aid in the required short-term adjustments, but what to do at 24 hours and beyond? This is where other model guidance with known strengths comes in. Without going into further detail, 2 or 3 'other' models (which were well-known to handle phase issues) were used with confidence, exhibiting a nearly 1:1 correlation between the freezing rain and all 50 warned regions, with substantial lead times up to 20 hours. However, it must be pointed out that most of the time the CMC products are reliable, accurate and top-notch. It's only in certain instances, such as some freezing rain cases, where some weaknesses linger.

Here's another example, which strips out any short-range forecasting techniques altogether by delving into the longer-term model guidance. The OSPC has been making some changes to the extended-range forecasts for some time. The reasoning has always been to try to convey consistency between regions and between model runs (reduce potential flip-flopping), relying on some of the afore-mentioned model behaviour. Unfortunately, much of the effects of these changes are washed out in the array of statistics displayed by national performance measurements, and a cursory review of those statistics would regard any OSPC changes as not worthwhile. Since the implementation of the 7-day forecast (spring, 2009) OSPC has documented all changes to the extended forecasts. Results up to early January 2010 indicate a total of 1,215 value-added degrees (C) (sum total of all the net temperature changes) have enhanced the temperature forecasts since last spring, and the average value-added change has been 2.1 ^{o}C. Total value-added POP (Probability of Precipitation) is around 19,500 in percent (sum total of all the net POP changes) with an average improvement of 24% whenever the POP was adjusted. For example, if the OSPC correctly changed POP for 3 regions from 40% to 100% then the total value-added change would be 180%. The improvement rate for both temperature and POP averaged close to 85% (85% of all changes were positive). So, in essence, the OSPC was able to beat UMOS 85% of the time in the extended-range forecast, assisted by other model guidance in conjunction with the GEM-GLB output. It should be noted that most of the time the forecast is untouched: 99.5% of the time for temperature and 98.8% for POP (a fairly brief review of the guidance in operations leads to the decision to accept or modify the concepts on a day to day basis). Based on the percentage of untouched concepts, one can see why these statistics would get lost in the monthly national verification. It should also be pointed out that quite often the changes are made leading up to incoming significant weather systems. This model assessment has, in the past, led to the recognition of occasional warm model bias issues with the GEM-GLB, followed by further scrutiny by CMC with positive feedback. There may also be a decrease in the number of NIRT complaints to the long-range forecasts. Incidentally, time constraints or resources aren't really an issue, as any extended forecast adjustments are placed low on the priority pole.

From: Dov Bensimon
Meteorologist, National Prediction Operations, Canadian Meteorological Centre (CMC), Dorval, QC

Date: February 22, 2010

Subject: On the MSC Forecasters Forums and the Future Role of the Human Forecaster

The article "*On the MSC Forecasters Forums and the Future Role of the Human Forecaster*" by David M. L. Sills published in the October 2009 issue of the CMOS bulletin has spurred responses and discussions on this topic within the meteorological community. I personally am encouraged to see this article stir up discussions which, I believe, will ultimately help to improve weather forecasts in this country and potentially elsewhere.

One of the more recent voices to join this discussion is that of James McCulloch (February 2010 edition of the CMOS Bulletin). I echo Mr. McCulloch's sentiment that *"great progress has been made*" in weather forecasting over the years. This is something that the meteorological community can be proud of.

I note, however, that his comment that *"Modelers seem to believe that only they know what the forecasters need, and that only CMC can supply it*" is not what I have observed in my own career. It is unfortunate if this was once true in the past, but I don't believe this to be the case in the present. I have seen too many cases to the contrary to believe this to be true. The recent Olympics held in Vancouver are a good example of this.

Many specialized forecast products were developed at CMC to aid forecasters in their work for the Olympic Games. As a forecaster from CMC assigned to the team of forecasters for the Olympics and Paralympics, I have had the opportunity to use several of these products in an operational setting and can attest to their usefulness on the forecast desk. I have also had many chances to give feedback to the research and development teams regarding these products and comments from operational forecasts have always been well received and considered for bringing modifications to these products if need be, or in planning future products. Feedback has also been received from other forecasters working the Olympics and Paralympics and always given consideration by the modeling community.

This is but one setting in which I have witnessed good collaboration and exchanges between modelers and forecasters. If this was not the case in the past, then I am at least encouraged to see that it is present now and can only

hope it will continue this way in the future.

The future shape of forecasting is full of unknowns, but through exchanges such as those recently published in the CMOS bulletins, I am confident that we will steer towards continued improvements in weather forecasting. Let's keep these discussions going!

Correspondance / Correspondence

From: Howard Freeland
Institute of Ocean Sciences

To: Canadians interested in Argo

Date: February 16, 2010

Subject: Update on Canadian Argo

It has been a while since I sent a message to my list of Canadians interested in Argo. Much has happened since the last message.

The last year was a complicated one for two reasons.

1) We discovered that too many floats were failing prematurely and this finally was narrowed down to the pressure sensors being used. As such, this affected all floats built for Argo, all manufacturers. The problem was traced to a micro leak that initially would not cause observable problems with the float sampling, but as oil was forced out
of the sensor case by the slow leak, deformation of the cell slowly increased until a catastrophic failure occurred. This potentially affected up to 30% of all floats and was a sufficiently large number that we recommended a world-wide moratorium on float launches as the manufacturers issued a world-wide recall of affected floats. Methods were developed for identified potential leakers, so some floats were tested and declared safe to launch, and for some the floats had their pressure sensors replaced.

This pressure problem seriously affected float numbers. The number of floats running is a balance between the death rate of floats and the launch rates. We do expect floats to be able to last 4 years, or about 150 profiles and we have a launch rate which will keep the number of floats above 3000 as long as floats on average last that long. You can see the effect of the float launch moratorium on the following list of floats operating each month through 2009 and into early 2010:

# of Floats	Month / Year	# of Floats	Month / Year
Jan 2009	3237	Feb 2009	3233
Mar 2009	3237	Apr 2009	3266
May 2009	3222	Jun 2009	3175
Jul 2009	3142	Aug 2009	3082
Sep 2009	3048	Oct 2009	3002
Nov 2009	3001	Dec 2009	3042
Jan 2010	3082		

The moratorium was started in May 2009, at which point the number of floats operating began to decline. We have passed the difficult period and numbers are now recovering.

2) Argo was started at the OceanObs'99 meeting in San Raphael, France, in 1999. For some time a major focus for Dean Roemmich and for me has been preparation for the OceanObs'09 meeting where we effectively presented a statement on what we had done over the last 10 years. The meeting was very successful and very useful to us. We have a road map for the course we should take over the next 10 years.

I am really hoping that I'll be able to get to the big OceanObs'19 meeting, wherever it happens to be.

The progress report that was submitted to the OceanObs'09 has been accepted for publication and if you wish to see it please get it from:-

http://www.pac.dfo-mpo.gc.ca/sci/osap/people/howard/Argo_CWP_Reformatv2.pdf

It has been a thrilling time running Canadian Argo for the last decade, and being co-Chairman of Argo for most of that time.

Effective January 1st, 2010, I actually stepped down as head of the Canadian Argo Program and have handed the baton over to Denis Gilbert.

I'm very happy with this transfer, but don't expect to disappear quickly. There are so many things to transfer I think we will be lucky to manage it all in 2 years. I expect the next letter you get will be from Denis.

Near the end of March 2010 I will be in La Jolla, CA, for the 11th Argo Steering Team meeting and Executive meeting. One item on the agenda will be replacing Howard Freeland as co-Chairman with someone else. Dean Roemmich and I asked Susan Wijffels, head of the Australian Argo Program, if she would take over at AST-11 and she has agreed. We then polled the Argo Executive, which was in 100% agreement, and then polled the Argo Steering Team,

which is also in 100% agreement. So she will become co-Chair at the next meeting as long as there are no surprising objections.

Both Dean and I consider Susan Wijffels to be managing the most successful Argo program in the world. Certainly, both the USA and Japan have more floats in the water, but both of those countries have vastly greater resources. The Australian success can be seen rather clearly on any recent map of the distribution of floats, such as:-

http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/argo/images/World_e.gif

Finally, there **WILL** be an Argo session at the next CMOS Congress and the call for abstracts is still open. I'd like to encourage you all to consider submitting an abstract on the Congress website:

http://www.cmos.ca/congress2010/

From: Denis Gilbert
Institut Maurice-Lamontagne

To: Canadians interested in Argo

Date: February 18, 2010

Subject: Canadians interested in Argo

As a follow-up to Howard Freeland's email, I wish to mention that Howard remains responsible for the Pacific float deployments.

For Atlantic float deployments, Igor Yashayaev agreed to replace Ross Hendry, effective January 01, 2010. Howard and I are grateful to Ross for the time and energy that he invested in running Canadian Argo in the Atlantic over the past few years, when he took over this job from Allyn Clarke.

As Howard mentioned, the transition from him to me as head of Canadian Argo will be gradual over the next two years. I count on your collaboration to assist me in this transition process. One of my first duties in this new role will be to produce an annual report for Canadian Argo. Amongst the items that I need to include in this report, I was asked to produce a list of Canadian publications that made use of Argo data. If you published a paper in 2009 that used Argo > data, please let me know and I will add it to the list. This list of publications from Canadian authors using Argo data can be helpful in showing the program's utility to Canadian oceanographers for their research or operational activities.

From: Ken Denman
Canadian Centre for Climate Modelling and Analysis

To: Howard Freeland & Denis Gilbert

Date: February 19, 2010

Subject: Update on Canadian Argo - taking a broader view...

I too attended the OceanObs09 meeting last September, and Argo clearly has been **THE** success story of the last decade. Howard Freeland deserves much credit for the energy, guidance and leadership he has put into making Argo succeed, both in Canada and internationally.

OceanObs09 was obviously designed by the organizers to impress intergovernmental and other international organizations and thereby individual national governments to continue to fund and support sustained ocean observations and the observing systems required to make them. However, I felt that the Argo community arguments for support for the next decade were a little bit too much along the lines of 'we have a very successful programme, therefore support us to continue in the same direction'. I personally felt that the most compelling argument for continuing Argo came from Jim Hurrell's presentation on the needs for short term (one year to several decades) climate prediction, that is part of a WCRP project and will be part of the IPCC AR5. Including the influence of the ocean in climate forecasting is clearly essential. It seems to me that to run climate models in 'forecast' mode requires initial conditions of the current and recent state of the climate system, including the oceans. To 'know' the state of the oceans in the last decade prior to going into 'forecast' mode, the Argo array is an essential component. I think that this argument should be made more effectively and forcefully to international and national agencies that control and influence funding of large scale science infrastructure.

Denis Gilbert and I just attended a workshop at BIO on climate change and ocean ecosystems in the NW Atlantic, aimed at other 'partners and stakeholders' in Atlantic Canada (sorry for these awful but apparently necessary buzzwords).

People are crying for better downscaling techniques, and regional climate models that can drive better models of continental shelf ocean circulation and ecosystem behaviour. The need for Argo is there, but for the next decade and beyond, I think it needs to be argued more in terms of short term climate forecasting.

From: Gordon McBean
University of Western Ontario

To: Ken Denman & Denis Gilbert

Date: February 19, 2010

Subject: Update on Canadian Argo - taking a broader view...

I concur. I am at the JSC_WCRP meeting in Turkey and the WMO Commission for Climatology is meeting at same time. The emphasis is on climate services and the role of Argo and like observations will be very important to seasonal-to-decadal climate forecasting.

I go from here to Beijing to open the new IPO for the Integrated Research on Disaster Risk program. We will have a focus on climate extremes - like how many typhoons of what character in the coming season - that will depend on ocean obs.

From: Denis Gilbert

To: Ken Denman & Gordon McBean

Date: February 21, 2010

Subject: Update on Canadian Argo - taking a broader view...

Thanks for making these useful comments on seasonal and decadal climate predictability. Incidentally, a paper published in GRL 3 weeks ago by the UK Met Office (Dunstone and Smith 2010) shows that useful forecast skill can be provided by the Argo profiling array on a decadal timescale. Importantly, they also showed that assimilation of monthly average temperature and salinity in the upper 2000 m produces forecasts with similar skill to full depth assimilation. From the practical point of view of Argo implementation, this is an important result as we've been contemplating the possibility to profile deeper than 2000 m if required or justified at the third Argo Science workshop (Hangzhou, March 2009). The upshot was that deeper profiling (possibly down to 3000 m) will only be performed on a small fraction of the floats. The technology for this now exists, but the penalty is reduced float lifetime and thus greater costs.

Dunstone, N. J., and D. M. Smith (2010), *Impact of atmosphere and sub-surface ocean data on decadal climate prediction*, Geophys. Res. Lett., 37, L02709, doi:10.1029/2009GL041609.

Canadian Water Security
How Science Can Help

Thursday May 27 — Friday May 28, 2010

Canada has vast reserves of water – yet only 7% of the world's renewable supply. Water is of critical economic and strategic importance — a resource, a commodity and an essential element in health, agriculture, energy, urban, commercial and industrial development. What is happening to our water resources? What have we learned about changing water conditions across Canada over the last few years — and what questions remain?

The Canadian Foundation for Climate and Atmospheric Sciences and **Environment Canada invite you to find out.**

Since 2000, the Foundation has invested $14.4 million in water related research. The workshop will look at what has emerged from this work and its relevance to safety, security, ecosystems, health and economic development. The Symposium will provide a forum on water security for policy and decision makers, in cooperation with researchers.

Why: Water is essential to our existence. While Canada appears to have infinite supplies, only a very small proportion of it is renewed annually. Most of Canada's rivers flow north, away from major population centres and there is increasing pressure on the reserves we do have. Scientists predict an acceleration of changes in water supply, which will impact on water use for consumption, production and development. To what extent can we foresee, forestall or adapt to the changes? Speakers will report on what we've learned and on what we still need to know.

Where: The Drawing Room, Fairmont Château Laurier Hotel, 1 Rideau Street, Ottawa, Ontario.

When: 09:00 –17:30, Thursday May 27 — 09:00-15:00 Friday May 28, 2010. A **reception** will be held from 17:30-18:30 on Thursday May 27.

Who: Participants from federal, provincial and private sector organizations, universities, non-governmental organizations and the media.

Registration: There is no fee; however, delegates must confirm their participation to bellerive@cfcas.org (tel.: 613 238-2223 ext. 201).

For more information: contact conway@cfcas.org (tel.: 613 238-2223 ext. 202).

ARTICLES

Development of the Brewer Spectrophotometer

by Kenneth A. Devine[1]

Ozone in the atmosphere of the Earth was initially discovered by astronomical techniques in 1880. Later measurements of the air near the surface indicated very little ozone (O_3), suggesting the ozone existed well above the surface. In 1924 G.M.B. Dobson built the first of six portable ultraviolet spectrographs in wooden cases (McElroy, 2005). He designed a much larger instrument with a photocell and two prisms in a cast alloy case in the years leading up to 1931. After WWII these instruments included a sensitive photomultiplier. Know as the Dobson spectrophotometer they were used world-wide to measure total ozone. By the late 1960s the Dobson had become costly to construct as the numbers being sold were diminishing.

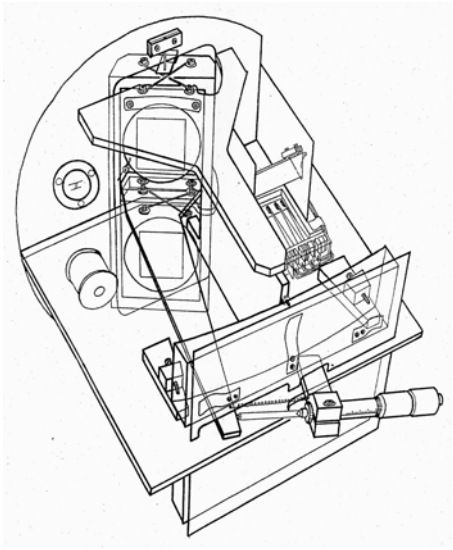

Figure 1: Portable Stellar Spectometer (Wardle, 1963)

During WWII Dobson was assisting Meteorological Flight Research in the UK where he came in contact with Alan Brewer. A.W. Brewer, a meteorological officer, had been assigned to flight test Dobson's frost-point hygrometer and he did much of the design work on the hygrometer. The importance of this research was to explain how condensation trails developed which allowed aircraft to be easily spotted. Brewer came to lecture in meteorology at Oxford in 1948 and took over from Dobson in 1950 when the latter retired. In 1960 and before, he and J.R. Milford at Oxford developed an ozone radiosonde based on the reaction of ozone with a solution of potassium iodide. Brewer moved to the University of Toronto in 1960 as Professor of Physics where much of the later spectrophotometer development was done. Interestingly, he had been born in Montreal when his family had spent a short time there.

In 1960, Professor C.D. Walshaw of Cambridge University succeeded G.M.B. Dobson as president of the International Ozone Commission. Walshaw had worked with Dobson during the International Geophysical Year of 1957, calibrating spectrophotometers in Europe. A little later in 1963 D.I. Wardle, a Ph.D. student studying under Walshaw, constructed a portable replacement for the heavy Dobson spectrophotometer (Wardle et al., 1963). This prototype (Figure 1) included a diffraction grating and the photomultiplier used in the pulse counting mode. These features differentiated Wardle's instrument from that of Dobson. The dispersion of a grating being greater than that of the prisms used in the Dobson, gave the new instrument a much improved light gathering power. The pulse-counting mode for a photomultiplier which had been used in astronomy at Cambridge University improved the signal-to-noise ratio in comparison to the current output mode used in the Dobson spectrophotometer.

David Wardle took his spectrophotometer prototype which had been constructed in a wooden case to the Canadian arctic in 1963. At Resolute Bay he compared his total ozone observations in the winter using either of two stars as the light source, with the ozone measurements from moonlight by the local Dobson spectrophotometer. After completing this observational work in 1964 Wardle traveled via Toronto where he stayed for a couple of months with Alan Brewer at the University of Toronto. Desmond Walshaw had moved to Oxford by this time. Wardle returned to the UK to complete his Ph.D. (Wardle, 1965). He went to Oxford before returning to the University of Toronto for post doctorate work in 1965. His original stellar spectrophotometer is housed at Oxford. In 1966 David Wardle built a second stellar spectrophotometer with a steel framework. The optical behaviour of this spectrophotometer was computer ray-traced by Wardle and a double monochromator version of the instrument resulted in 1968. This unit had a ¼"

[1] Meteorologist Consultant
Aurora, Ontario, Canada

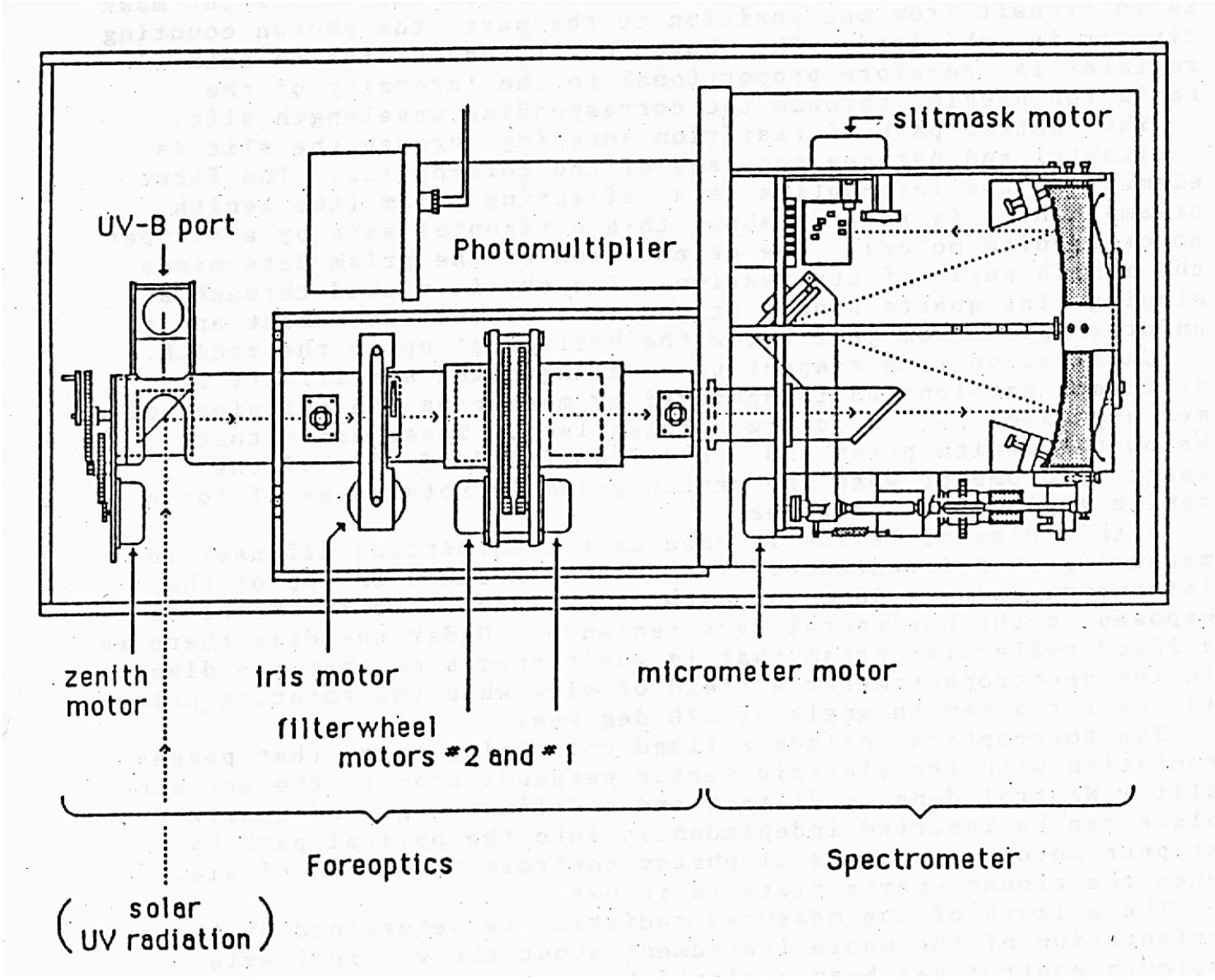

Figure 2: Internal Layout of the Brewer MKII Spectrophotometer (Evans et al, 1987)

aluminium plate framework which was used on all subsequent models. In 1970 he went to the University of McGill but later returned to Toronto. Wardle joined the Atmospheric Environment Service (AES) in 1972.

Further work was done after 1968 at the University of Toronto on the development of the new double monochromator spectrophotometer which removed the stray visible light in a fashion similar to the Dobson. It was found to be difficult to adjust and Alan Brewer suggested reverting to a single spectrograph using a nickel sulphate crystal ($NiSO_4$) and cobalt glass filter to remove the intense visible light. Some of the components of the double monochromator were used to construct two separate spectrographs: J.B Kerr worked on a single monochromator ozone spectrophotometer and C.T. McElroy worked on the second one for nitrogen dioxide (NO_2). The former unit is now in the Canadian Science and Technology Museum (CSTM) in Ottawa. Brewer's paper on this ozone spectrophotometer as a replacement for the Dobson was published in 1973. This was still a manually operated instrument and included a 1200 line/mm grating and a 324 mm radius mirror. It was expected to be less expensive and smaller than the Dobson. AES purchased the ozone prototype from the University of Toronto for $10k and, as a contribution to World Meteorological Organization, supported the development of an automated version of the Brewer for worldwide use. Having worked on the spectrograph prototypes, both Jim Kerr who had completed his PhD and Tom McElroy moved to the AES in 1975 to develop an operational instrument. McElroy completed his doctorate at York University in 1985.

At this time Wayne Evans at AES suggested having SED Systems of Saskatoon construct a commercial instrument. SED chose the name, Brewer, for the instrument to emphasize the link with Dobson. Their unit (MKI) completed in June 1978 but was unsatisfactory mainly due to its deviations from the original AES design. This MKI is also housed at CSTM, Ottawa. A prototype for a commercial Brewer was designed and constructed at AES by Kerr, McElroy and Wardle. SED Systems was commissioned to produce engineering drawings for this prototype so that a construction tender could be prepared. Subsequently Neil Foulds, Ken Lamb, Larry Cooper and Dale Sommerfeldt, left SED in 1980 to form Scientific Instrumentation Limited (SIL). In 1981 SIL was awarded a tendered contract to build the first two basic MKII Brewers for Environment Canada. During 1981, SIL decided to split into two companies: Neil and Ken formed SCI-TEC Instruments Inc. to continue with the Brewer and radiation Tracker products, and Dale and Larry continued with the balance of the products at SIL. In early 1982 SCI-TEC had orders for four more instruments which included Greece, Sweden and Germany. A federal PILP (Payment for Industry-Laboratory Projects) grant was obtained by SCI-TEC with the help of Pat Fogarty from Environment Canada. He also suggested SCI-TEC negotiate a license to manufacture and distribute Brewers. This was obtained in late 1982. One of the PILP objectives was to adapt the Cosmos Tracker technology from AES into the present Azimuth Tracker and to develop the MKIV model.

These instruments followed the general design features of the AES prototype. The MKII (Figure 2) was the first unit to have the flat optical design which rotated horizontally and included the vertically rotating zenith prism (Kerr et al., 1984). Shock mounts were also included in this model. By 1987, when the Brewer spectrophotometer was patented by AES, about thirty units were operating in eleven countries. The Meteorological Service of Canada (formerly AES) has maintained scientific control of the instrument design during each contract and still maintains the worldwide calibrations standards with a set of three Brewer instruments at Toronto. In January 1990 the MKIII (Figure 3), a double spectrometer design without the $NiSO_4$ filter, was completed by Tom McElroy. Further government support was obtained from the Canadian Network for Space Research (CNSR) program between 1992 and 1995 to help improve automation, develop the MKV model, redesign electronics, etc.

In 1993 the United States EPA selected the Brewer for their UV monitoring program and proceeded to buy 20 MKIV instruments over the next four years. In 1994 Bob Berman, President of SCI-TEC, and James Yuel, a Saskatoon investor and Chairman of the Board, took the company public on the Alberta Stock Exchange. In 1996 they negotiated a takeover of the Dutch firm of Kipp & Zonen, a company with a distinguished reputation in the production of radiation instruments. K&Z was well managed and eventually took over the complete management of SCI-

Figure 3: MKIII Brewer Spectophotometer at Toronto (Devine 2004)

TEC. The corporate name was changed to Kipp & Zonen in 2000. Nearly two hundred of the units were built in Saskatoon. In 2002 the Brewer production was moved from Saskatoon to Holland. In early 1996 Ken Lamb had left SCI-TEC and formed International Ozone Services Inc. (IOS) in Toronto which specialized in the calibration and servicing of Brewer instruments around the world.

Total column ozone in the atmosphere is measured by the automated Brewer spectrophotometer in about three minutes using the sun. Being automated, the Brewer could take almost twice as many observations as the manually operated Dobson. It measures each wavelength directly and can rapidly compute multiple ratios. In addition to measuring total column ozone, the Brewer is also capable of making altitude profiles of ozone (the Umkehr) and solar spectral UV irradiance measurements in the UV-A and UV-B portion of the spectrum. Besides the sun, the zenith sky or the moon may be used as light sources. The Brewers can measure: total ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) as well as total UV spectra. Based on a 3600 line/mm grating, the Brewer Mark III spectrophotometer (Kerr et al, 2001) covers the range of 286.5 to 363.0 nm (O_3) (also 430 to 540 nm (NO_2) for the MKIV) with an accuracy of ±1%. Internal lamps are used for wavelength

calibration and stability checks. The output of six UV wavelengths is used to compute the total ozone in the column from the sun. The nine Brewer spectrophotometer stations across Canada in 2009 also contribute information for the development of ozone and UV forecasts. The thinning of the stratospheric ozone layer has increased the harmful UVB radiation and may be affecting global warming.

The Brewer spectrophotometer case is mounted on top of the azimuth tracker which in turn is mounted on a tripod (SCI-TEC, 1999). The azimuth tracker can rotate horizontally for a total of 480 degrees in order to face the spectrophotometer case toward the sun. A sloped quartz window on the case allows sunlight to enter the zenith prism which directs the sunlight within the instrument. The zenith prism rotates through a zenith angle of 0° to 90° to track the sun vertically, to 180° for the mercury lamp calibration and the stability lamp, and to –90° for the UV diffuser for the measurement of solar spectral UV. A total of five lenses focus, collimate or correct optical aberrations within the instrument. All of the optics are quartz and have antireflection coatings. After the zenith prism, the light passes through an iris and two filter wheels on which are mounted diffusers, attenuators, two bandpass filters, and a blank position for the dark calibration. Following the input slit the collimated light is reflected off a 324 mm focal length spherical mirror to the grating, then back for another reflection from the mirror before reaching the exit slits. The rotating slitmask selects which of six wavelengths is to be measured. The photomultiplier detects the resulting light photons. The grating is rotated slightly to change from UV (O_3) to visible (NO_2) measurements in the MKIV. The microprocessor-based electronics counts and stores the photomultipier output, positions the spectrophotometer, controls its internal operation, allows for calibration, and communicates with the controlling PC computer. The Brewer can operate fully automatically with the sequence and frequency of measurements determined by the operator. Technical details can be found in the manual available on the Kipp & Zonen web site.

In 2005 there were 184 Brewers of different versions operating in 43 countries worldwide including the Antarctic. Fifty-three Brewers had their data forwarded to the World Ozone and Ultraviolet Data Centre (WOUDC) in Toronto between 2000 and 2005. The MKIII Brewer spectrophotometer is now manufactured by Kipp & Zonen, B.V. of Holland at a cost of about $250k (CAD). The assistance of Dr. David Wardle, Dr. Tom McElroy as well as Ken Lamb, Tom Grajnar, Bill Clark and Archie Asbridge in the preparation of this article is greatly appreciated.

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Note from the Author: This article was previously published as "*Development of the Brewer Spectrophotometer*", K.A. Devine, RMetS Observing Special Instrument Group (SIG) Newsletter No. 29, October 2009.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **June 2010.** Please send your articles, notes, workshop reports or news items before **May 7, 2010** to the address given on page 42. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **juin 2010.** Prière de nous faire parvenir avant le **7 mai 2010** 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.

End-to-End Processing and Transmission of Environment Data to the Global Telecommunications System using the Iridium Satellite System

by S.K. Woodbury[1], P.E. Hill[2], M.A. MacLeod[3]

Abstract

Real time access to environmental data from remote locations on land and sea has been a major challenge for decades. Today, data transmitted over the Iridium satellite system can be accessed from the Global Telecommunications System (GTS) within a few minutes after the measurements have been taken. Thus, data can be received by forecasters in real time for use in forecasts and for assimilation into numerical weather prediction by modelling centres worldwide. This article highlights the use of Iridium by the environmental industry to collect measurements of a variety of environmental parameters and describes the contributions which two Canadian companies, *Jou*Beh Technologies Inc. and Scotia Weather Services Inc., make to this process.

Résumé

L'accès aux données environnementales des régions éloignées sur terre et en mer ont été un défi majeur sur plusieurs décennies. Aujourd'hui, les données transmises à partir du Système de satellites Iridium peuvent être obtenues du Système Mondial de Télécommunication (SMT) en quelques minutes après que les mesures ont été prises. Ainsi, les données peuvent être reçues par les prévisionnistes en tant réel et être utilisées dans les prévisions et assimilées dans la prévision numérique du temps par les centres de modélisation à l'échelle mondiale. Cet article met en évidence l'utilisation de l'Iridium par l'industrie environnementale afin de recueillir des mesures d'une variété de paramètres environnementaux. Il décrit également les contributions de deux compagnies canadiennes, soient JouBeh Technologies Inc. et Scotia Weather Services Inc, qui ont rendu ce processus possible.

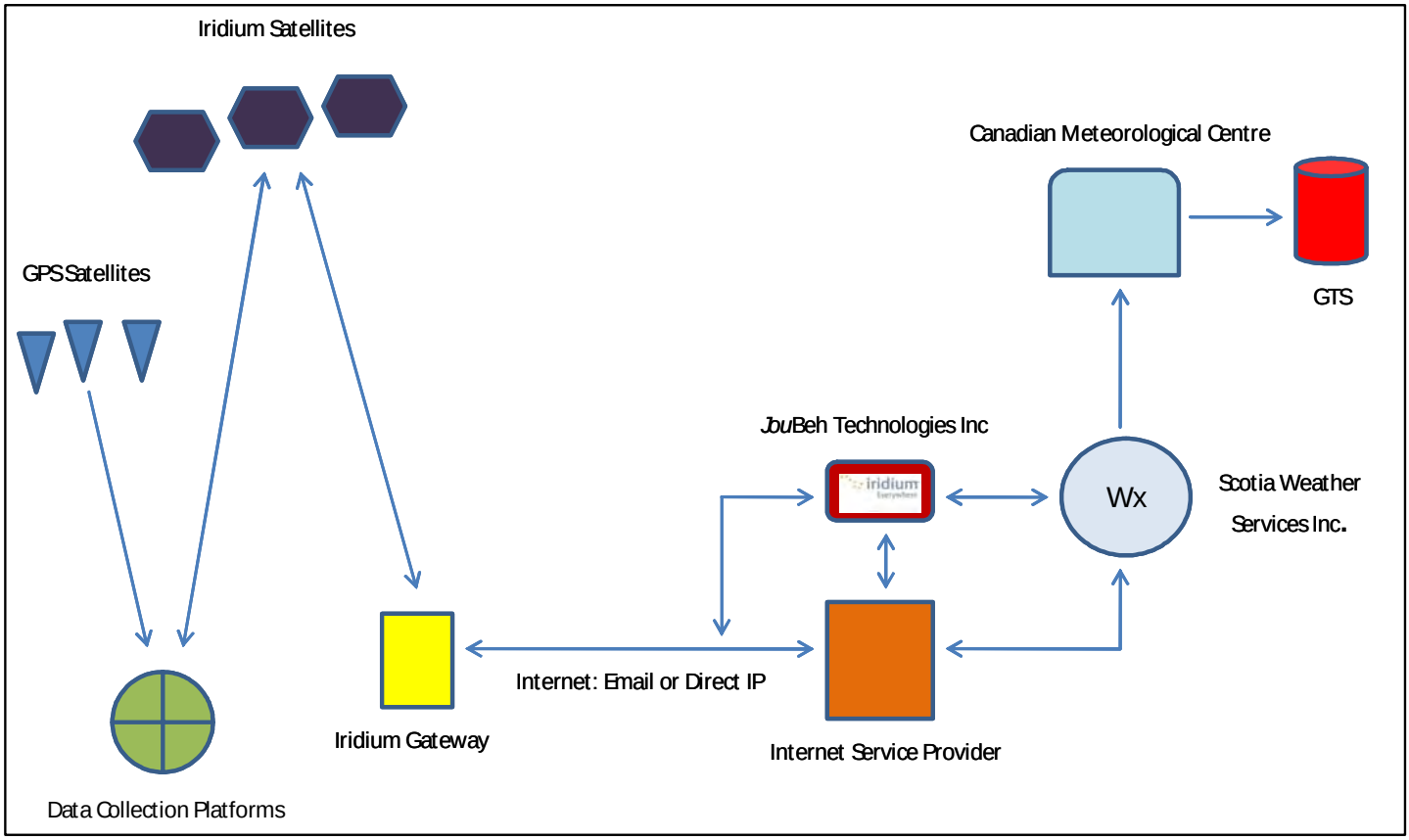

Figure 1 – GTS Schematic

[1] Woodbury Management Solutions Inc.
[2] *Jou*Beh Technologies Inc.
[3] Scotia Weather Services Inc.

Introduction

Figure 1, shown on previous page, illustrates the path travelled by messages which are sent from the data collection platforms through the Iridium satellite system to the Iridium ground station. From there they are routed via the internet to both the *Jou*Beh Technologies server and the internet provider. Messages, which have been converted from engineering units to environmental values, then travel by File Transfer Protocol (FTP) to Scotia Weather Services where they are subjected to a rigorous quality control procedure. From there they are sent by FTP to the Canadian Meteorological Centre and finally to the GTS.

Data Collection Platforms

*Jou*Beh Technologies, an Iridium value-added reseller, supplies manufacturers of data collection platforms with Iridium modems. Data are transmitted by these modems as packets in Short Burst Data (SBD) format. This is an efficient network protocol most economical for shorter sized messages, typically less than 2 kilobytes per packet. Iridium modems boast high reliability, automatic handshaking and error checking on transmission, no lost data, and low cost. Reliable data collection is achieved in data-sparse areas like the North Pacific, remote mountain sites, and Polar Regions. Data Collection Platforms include such land based equipment as weather and hydromet stations. Marine equipment using the Iridium system include drifting and moored buoys, such as the NOMAD buoys, ice beacons and the Automatic Voluntary Observing Ships System.

Satellites

The Iridium satellite system, launched in November 1998, is comprised of 55 in service satellites and 9 spares in low earth polar orbit giving ubiquitous coverage of the earth with a unique cross-linked message relay capability. It is the largest commercial satellite constellation in the world (Figure 2). There are always at least two satellites overhead anywhere on the planet. Designed for use by the military, it is a very robust and dependable system. Today about 30 percent of Iridium's business is the US Department of Defense which uses it for voice communications and GPS tracking data logistics.

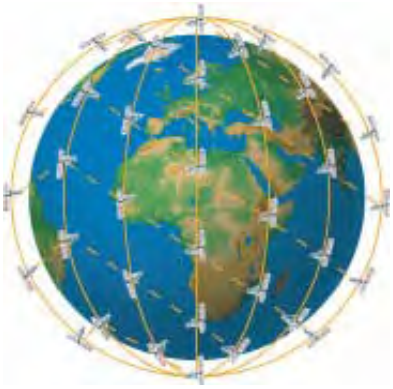

Figure 2 - Iridium Satellites

Mobile Originated Messages are comprised of two parts. Exact location is transmitted to the collection platform from a Global Positioning System (GPS) satellite. The position location and time stamp, along with the data from the data collection platform, is then sent as a SBD packet to the Iridium satellite overhead.

Unlike the ARGOS and GOES satellite systems, Iridium provides two-way communications to and from the remote device. Messages can be sent from owner to data platform (Mobile Terminated Messages), change the time of observation, change reporting intervals and deactivate sensors. For more intensive data requirements such as changing firmware in a platform or sending images from remote locations, Iridium offer Circuit Switched Data or Direct IP.

The data is transmitted from the satellite to a commercial gateway in Arizona. The gateway (ground station) generates and controls all user information pertaining to its registered users, such as user identity, geo-location and data delivery configurations.

Fibre Optic Link

Communication from the ground station to a termination is achieved by email, direct IP, or modem to modem using a fibre optic link. The SBD packet is transmitted to an internet provider in Dartmouth, Nova Scotia where *Jou*Beh has installed a processing server. The service includes emergency power generators and a 24/7 service with 99.99% reliability guaranteed. Here the messages are decoded from engineering units converted into environmental values. At *Jou*Beh's office, also in Dartmouth, there is a redundant backup server. In addition, JouBeh provides end-to-end formatting, data basing, and archiving of environmental observations from data collection platforms. For those clients who request it, an additional web based data display and analysis service is provided with a wide range of capabilities.

Data Quality Control

Once the message has been converted, it is sent by FTP to Scotia Weather Services Inc. There, messages are automatically processed every minute. Quality Control of the data, which has been extracted from the message, is achieved through comparison with model output from the National Weather Services' Global Forecast System model. If the data meets specifications it is converted into a code suitable for distribution on the World Meteorological Organizations' Global Telecommunication System (GTS). For example, drifting buoy data would be converted to a message with the header SSVX02 CWAO. The message is then automatically transmitted by FTP to the Scotia Weather portal at the Canadian Meteorological Centre in Dorval. Scotia Weather implements a manual override if difficulty sending the message is encountered, such as a glitch on the internet. At the Canadian Meteorological Centre further error checking is performed prior to the release of the message to the GTS. The time lapse from receipt of the message by Scotia Weather to circulation on the GTS is dependent on the volume of messages received

at the same time, normally five to ten minutes. Metadata does not travel with the message. Instead a General Notice is issued for each platform which traces the information about the equipment and the manufacturer.

Network of Networks
Messages transmitted in this fashion are examples of the Meteorological Service of Canada's (MSC) initiative to distribute non-MSC data through the GTS to a much broader community. MSC is exercising leadership in Canada for the management, acceptance and interoperability of meteorological and hydrometeorological data by creating a network of networks.

Data Buoy Cooperation Panel (DBCP)
Since 2006 the DBCP has operated an Iridium Pilot Project to evaluate the feasibility of Iridium technology for real-time telecommunication of drifter data under various conditions. MetOcean Data Systems Inc. is a buoy manufacturer who partnered with *Jou*Beh Technologies and is a participant in this pilot project. By working with *Jou*Beh, they have offered low cost communications for the duration of the project. The DBCP provided funds to help implement a globally distributed network of up to 50 Iridium-equipped SVP-B drifters for a two-year evaluation programme. When the pilot project has been completed it is expected that the final report will provide an analysis of the real time transmission of data, of the power demands and the overall cost effectiveness of the Iridium system in all ocean areas and under various conditions.

Iridium NEXT
NOAA, NASA and CNES have signed an agreement for Iridium NEXT which will begin launching in 2014. This new system will provide very high data transfer rates and host secondary payloads such as weather monitoring and earth observations and will provide increased opportunities for commercial and government partners.

Benefits of the Iridium System
Iridium is a dependable long term solution for the distribution of environmental data in real time. The cost of communications is an order of magnitude less than the ARGOS satellite system which has been the de facto standard for all mobile data collection platforms and has been traditionally used as a backup for stationary GOES satellite-based collection platforms. A direct benefit of Iridium for users will be increased deployments of platforms and higher resolution data sets because of the low cost of service. Iridium is the only provider of truly global satellite data solutions with complete coverage of the earth and is well funded and profitable. *Jou*Beh Technologies and Scotia Weather Services are playing an integral part in the distribution of data from remote locations.

Thank you
With thanks to Chris Marshall – Manager, Marine Networks and Champika Gallage - Marine Networks Standards Officer of the Meteorological Service of Canada, Environment Canada for their support and leadership.

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CMOS Offices Moved

Early February, the CMOS Offices moved to 360 Laurier Street, just fifty meters east from the Centennial Towers. Our offices are located on the 4th floor. The telephone and fax numbers remain the same

Déménagement des bureaux de la SCMO

Au début de févier, les bureaux de la SCMO sont déménagés au 360 rue Laurier, à quelque cinquante mètres à l'est des Tours du Centenaire. Nos bureaux sont situés au 4e étage. Les numéros de téléphone et de facsimilé demeurent inchangés.

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.

Vancouver Olympics 2010 – My Perspective

by Claire Martin[1]

Résumé: Ce ne fut pas une surprise de voir que le temps a été un des plus grands à-côtés historiques des Jeux olympiques de Vancouver. Dame nature en tandem avec El Niño a presque volé le spectacle. Toutefois, le temps chaud insensé m'a donné une opportunité exceptionnelle d'expliquer chaque soir aux téléspectateurs ce phénomène météorologique mondial et toute la rigueur de son effet. On devrait prendre note que je suis vraiment à mes débuts de comprendre le contexte lamentable dans lequel nous sont fournies les données climatiques actuellement, surtout lorsqu'il vient le moment de comprendre pleinement tous les différents scénarios du temps. En outre, nous n'avons simplement pas assez de phénomènes antérieurs d'El Niño pour les ficher et extrapoler leur tendance. Ce fut encourageant – même si c'est venu un peu tard – d'entendre Jacques Rogge, président du Comité international olympique, affirmer qu'on demandera aux futurs comités d'évaluation olympique de porter une attention particulière aux données météorologiques lorsqu'ils étudieront les candidats futurs comme villes-hôtes. Mais, en toute franchise, et en mon humble opinion, il est primordial que ce soit un facteur déterminant.

Introduction

For 17 days in February, my hometown hosted the biggest winter sporting event in the world. In the week leading up to the 2010 Olympic games, patriotism reached fever pitch in Canada - Team Canada hockey jerseys became the uniform of the streets for both residents and visitors alike!

By February 12th the crowds had arrived, the athletes were primed, and the venues were ready; all that was needed was for someone to yell "game on" and let Mother Nature do her bit – bring us our usual dose of crappy, cool, cloudy, wet Spring weather with some snow in the mountains. Little did we know that Mother Nature had her own game plan.

Firstly, for those of you that don't know the area, here is a quick look at the local geography with descriptions of the specific venue locations. I have paraphrased the following information from the Environment Canada web site http://www.weatheroffice.gc.ca/2010/climate/climate_e.html.

Figure 1 illustrates a map of the region. The outdoor events were split between the four sites clustered around Whistler Village, and Cypress Mountain – a local ski hill visible from downtown Vancouver.

Climate at the Venues

1) Vancouver

Vancouver airport (CYVR) sits at 4 metres above sea-level and has a Feb12-28 (Olympic period) daily average mean temperature of +4.8 °C, sees an average 4 cm of snow during the same time period, and 64 mm of rain. Along the North Shore mountains (in the background of the photograph overleaf, Figure 2), roughly 30 km north of the airport, average February precipitation amounts nearly triple.

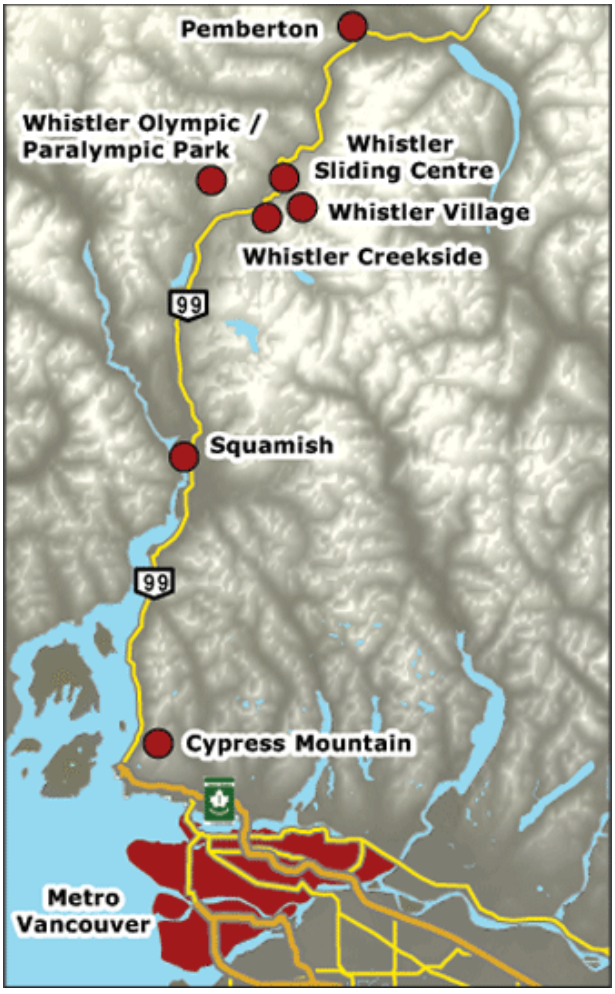

Figure 1: Map of the area; courtesy: Environment Canada

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Figure 2: A view of BC Place and the North Shore mountains. Photo courtesy VANOC/COVAN

2) Cypress Mountain

At the Cypress ski area (930 m ASL) 25 km north of the airport in the North Shore Mountains, about half the precipitation falls as snow (Figure 3). Sub-freezing overnight temperatures persist through March. The daily mean average temperature for this venue for the Olympic period is 0.1°C, and there are on average 7 days with measurable snowfall. That's the good news, the bad news is that this site also – on average during the same time period – gets 5 days with rain, and receives 99 mm of the wetstuff.

Figure 3: A view of Bowen Island from Cypress. Photo courtesy Tourism BC

3) Whistler Village

Whistler Village (658 m ASL) lies in a valley about 100 km north of Vancouver (Figure 4). The inland location and higher elevation shields the valley from the moderating and warming influence of the Pacific Ocean. The mountains trap colder continental air and restrict the inland flow of warm Pacific air. Strong winds blow up Howe Sound behind storms and will often force warmer marine air into the valley but from February through March well over 50% of precipitation falls as snow. The village snow base during the Olympic period averages about 63 centimetres.

Figure 4: The Sliding Centre just above Whistler Village. Photo courtesy VANOC/COVAN

4) Whistler Creekside

At the Whistler Creekside (Figure 5), the alpine area (elevation 1835m) lies 200 metres above the top of the Olympic downhill course, the daily temperature averages minus 5.2°C. Almost all (95 per cent) of the precipitation falls as snow and it snows about every second day. Total snowfall averages over 3 metres and the snow base averages 2.5 metres. Pacific storms bring very strong winds to the highest peaks (2000m+) sometimes gusting up to 150 km/h.

5) Whistler Olympic/Paralympic Park

Whistler Olympic/Paralympic Park is in the Callaghan Valley (860m) and was the site for the biatholon, the ski jumping and the cross country ski events (Figure 6). The valley is surrounded by steep mountains except at the south entrance and is known for heavy snowfalls and light winds. The area is a little colder than the village and receives 25 to 50 per cent more snow.

Figure 5: The Whistler Creekside downhill course. Photo courtesy VANOC/COVAN

Figure 6: Callaghan Valley from the top of the ski jump located at Whistler Olympic/Paralympic Park. Photo courtesy Bill Scott, Environment Canada

OK, so that gives you the lay of the land. In all honesty, from day one, most Vancouverites knew that Cypress Mountain was a "marginal" location for the Olympics, but that Whistler would/should be fine. Whistler started the winter season with its snowiest month ever, getting 560 cm in November 2009. Cypress equally started the season quite nicely, and by the end of December had a very respectable mid-mountain base of around 280 cm.

Then in December 2009, El Niño strengthened from a weakly positive state to a moderate state with subsurface temperature anomalies exceeding +2 ^{o}C across much of the equatorial Pacific. Forecasts from the US Climate Prediction Center stated that this particular El Niño event would remain "significant" through the Jan-Feb 2010 period.

They weren't kidding.

In Vancouver, January 2010 roared in like spring! Vancouver International Airport (CYVR) registered its warmest January on record - with an average mean temperature for the month a full 4 degrees above the usual 6.1 ^{o}C. Local and national TV stations started doing weather stories on the warming being seen around the Olympic venues and the state of the various snow packs. The countdown was on, but so too was the heat!

The snow at Cypress started to melt, and melt and then melt some more.

And on TV, the weather story grew and grew and grew some more.

In one single 24-hour period in late January Cypress lost 97 cm off the base (you do the math). Suddenly this one Olympic venue was beginning to look a little bedraggled! A Herculean effort (Figure 7) from the folks based on the mountain occurred to keep whatever snow they did have, covered under massive tarps, all the while literally hand shoveling clean snow in from the closest higher surrounding slopes. Dry ice machines were placed under the snowboard jumps to keep them from melting away. Snow was trucked and flown in from the surrounding higher peaks, and hay bales were used to stabilize the underside of the moguls. The weather story grew locally, nationally and then internationally. In the final six weeks leading up to the Olympics, most major media outlets across Canada led at least one nightly newscast per week with our mountain weather conditions and vast loss of snow pack.

Figure 7: Courtesy: Rob Kuhn – Environment Canada

Welcome to the Great White North, eh!

As the games were just about to begin, the warm, oftentimes wet, sometimes-sunny weather continued. Environment Canada did some creative calculating,

amalgamating the data from two close sites (Vancouver International Airport 1937-to date, and Steveston the original Vancouver weather site 1896-1937) and discovered that if you looked at any 31 consecutive days in winter for both sites, the period ending on Feb 9th, 2010 was the warmest "winter period" in history. The departure from normal for this period, was +4.02 °C.

The meteorological synopsis for the Olympics was as follows: we started the period with a large, broad area of low pressure roughly centered 200 km west of Vancouver Island. Warm, wet weather systems were slingshot at us from around the base of the low for the first few days. By the 17th the low had gradually filled and slid south and was replaced with a Rex block situation (High sitting directly over BC over a Low at most sigma levels 500 hPa to surface). Through the next week, the situation gradually evolved into an Omega block. We therefore saw clear skies and warm weather for 7 straight days (Figure 8). On the 23rd, the blocking pattern finally broke, cloud spilled through the Lower Mainland, and showers developed as a more zonal 500 hPa pattern set up. Showery weather lingered throughout the remaining Olympic period.

Figure 8: Courtesy: Richard Klyne. (Note: the lack of snow except on the top peaks of the mountains. Afternoon freezing levels on the day of this shot averaged around the 1800 m mark. Freezing levels peaked around the 21st at 2400 m locally. The ski hill visible front and centre is Grouse Mountain – not an Olympic venue. Cypress Mountain is on the far left of the shot, in the branches of the foreground tree).

Whistler faired quite well, compared to Cypress Mountain, at the beginning of the games. Daytime temperatures consistently remained below the freezing mark. But from Feb 9th to the morning of Feb 14th some 80+ cm of fresh snow fell at the top of the Alpine runs. Unlike the rest of us, downhill racing Olympians do not want powder; they want hard, icy, fast runs. That 80+ cm was therefore manually scraped off the hill, and at night water was sprinkled on the top of the runs, before grooming, to keep them as hard and icy as possible.

Callaghan Valley – home of the biathlon, cross-country skiing and ski jumping – by the 18th through to the 20th saw valley bottom temperatures of +10 to +13.8 °C. These temperatures are especially hot for the cross-country competitors, raising hydration issues for many of the athletes, and an upslope afternoon breeze of around 10-12 km/h affected the accuracy of the biathletes in the mid-afternoon shooting.

On the 18th, one of the new automatic weather stations being used by Environment Canada registered a whopping 17.0 °C (CVOT – Whistler Timing Flats, elevation 804 m), making it the hot spot in Canada for the day. Upon inspection, however, it was discovered later that evening, that the main temperature sensor and bracket had fallen out of their housing tripod and landed directly on the stations' black roof. This sensor was duly removed from the network!

The following (Table 1) is a day-by-day breakdown of daily high temperatures in Vancouver – at CYVR. It should be noted that this airport is stuck out on a peninsula, southwest of the downtown core, and due to the close proximity and hence moderating influence of the ocean, often reads anywhere from 5-10 °C colder than the city itself. Abbotsford (CYXX) is 72 km due SE of CYVR, and far more continental in nature, and hence gets warmer readings that are often much more representative of the city.

Day 1: Feb 12th Cloudy with heavy rain showers. High 11.5 °C. Normal 7.7 °C.
Day 2: Feb 13th Cloudy with heavy rain showers. High 9.9 °C. Normal 7.8 °C.
Day 3: Feb 14th. Am showers, Pm sunshine. High 12.4 °C. Normal 8.0 °C.
Day 4: Feb 15th Partly cloudy day. Heavy rain overnight. High 10.2 °C. Normal 8 °C.
Day 5: Feb 16th Dense fog on Cypress to mid pm, then sunshine. High 11.7 °C.
Day 6: Feb 17th. Hot and sunny. Record CYXX of 14.0 °C. CYVR 8.2 °C.
Day 7: Feb 18th. Hot and sunny. Cypress morning low –0.2 °C. High 9.1 °C.
Day 8: Feb 19th. Hot and sunny. High 10.0 °C. Normal 8.5 °C.
Day 9: Feb 20th. Hot and sunny. High 9.7 °C. Record high CYXX 16.1 °C.
Day 10: Feb 21st. Hot and sunny. High 10.2 °C. Normal 8.6 °C.
Day 11: Feb 22nd. Hot and sunny. High 10.9 °C. Normal 8.6 °C.
Day 12: Feb 23rd. Cloudy. Pm showers. High 9.2 °C. Heavy wet snow at Cypress.
Day 13: Feb 24th. Cloudy with scattered showers. High 8 °C. Normal 8.7 °C.
Day 14: Feb 25th. Cloudy with scattered showers. High 12.2 °C.
Day 15: Feb 26th. Cloudy with frequent showers. High 10 °C.
Day 16: Feb 27th. Cloudy with rain. High 10.5 °C.
Day 17: Feb 28th Am showers, Pm sunshine. High 12.8 °C.

Table 1: Day-by-day breakdown of daily high temperatures in Vancouver (CYVR).

My station – located in the heart of downtown Vancouver – was not, for the first time in 16 years, the host broadcaster of the Games. So we had decided to cover "the party" instead (Figure 9). So for the entire period, we took the news shows out of the studios and broadcast nightly from outside of our building. Crowds surrounded us the entire time. They were loud, exuberant, completely chaotic fun-filled shows. It is entirely different to do a weathercast with a live audience – I highly recommend having a go at it at least once in your career!

Figure 9: Courtesy: Dave Bryson

In Summary

So the weather, not surprisingly, was one of the biggest sidebar stories of the Games. Mother Nature in tandem with El Niño, almost stole the show. But the ridiculously warm weather provided me with an exceptional opportunity to explain this global weather phenomenon and the full extent of its effect, almost nightly to our viewers. It should also be noted that I am truly beginning to comprehend the pitiful contextual help that climate data now gives when it comes to fully comprehending various weather scenarios. Furthermore – we simply do not have enough previous El Niño events to tally up and extrapolate trends from.

Finally, it was encouraging — even if it came a bit late — to hear Jacques Rogge, the International Olympic Committee president, confirming that future Olympic evaluation committees would be asked to take a closer look at weather data when they examined future candidates for host cities. But, quite frankly, in my humble opinion, it needs to be a determining factor.

Meanwhile, here's hoping our 2014 Olympians get more snow than rain in Sochi, Russia, a city, by the way, found on the Black Sea and much better known as a summer resort than a winter one!

I would also like to take the opportunity to congratulate Chief Forecaster, **Chris Doyle** and all the staff that manned the Olympic weather office stationed on Cypress Mountain. After years of practice and simulations, they provided timely, accurate forecasts for all the venues under huge pressure as the snow literally melted from under their feet.

The biggest operational hurdle for me came from my weather-graphics package provider, WSI. This is a company based in the US that mass-produced Olympic weather graphics for all of its customers. Needless to say, wide views of the Pacific Northwest, with "CANADA" clearly labeled, were not what I was after!

With all that being said, I have to say that my personal Olympic experience was breathlessly fantastic! Vancouver was transformed with euphoric crowds, adorned with maple leaves and my days were filled noisy and chaotic TV shows. Most of us worked an average 14-16 hours a day, 7 days a week for 21 days straight. And I wouldn't have missed it for the world!

Further reading suggested by the Editor:

Weather Services for the 2010 Winter Olympic and Paralympic Games, by Chris Doyle, Al Wallace, Bill Scott, Patricia Wong and Paul Joe, CMOS Bulletin SCMO, Vol.37, No.6, pages 192-198.

High Resolution Near Surface and Land Surface Assimilation and Forecast System for the Vancouver 2010 Winter Olympic and Paralympic Games, by N.B. Bernier, S. Bélair, B. Bilodeau, L. Tong and M. Abrahamowicz, CMOS Bulletin SCMO, Vol.36, No.6, pages 198-204.

Ottawa Congress 2010 – Register Now!

The program for the 2010 Joint CMOS-CGU Congress in Ottawa May 31-June 4 is now complete. With over 800 abstracts grouped into some 64 theme areas, this Congress promises to be one of the largest and most exciting ever. The program will be organized into 13 parallel sessions on each day of Congress, including to the very end of the last day. Every session room and every possible time slot will be used to accommodate the oral sessions. As well, the poster sessions are booked to full capacity. Please take a few minutes to register right now by going to the Congress website

http://cmos.ca/congress2010/indexe.html

and clicking on "*Registration*". Book your hotel accommodation at the same time. This is high tourist season in Ottawa so don't be disappointed.

REPORT / RAPPORT

Workshop Report: Simulation of the Canadian Cryosphere

by Paul J. Kushner[1], Karen L. Smith[1], Ross D. Brown[2], Chris Derksen[2], Claude R. Duguay[3], Richard Fernandes[4] and W. Richard Peltier[1]

Résumé
Dans ce compte rendu, on résume les activités du projet initié depuis peu sur la simulation du climat des processus cryosphériques et leur comparaison avec les produits récemment observés. Le projet implique des chercheurs de Toronto, de Waterloo, d'Environnement Canada et des Ressources naturelles Canada. Le groupe a tenu un atelier d'un jour à Toronto qui a mis en évidence plusieurs articles sur les processus de la neige, la glace terrestre et de mer. Dans ces articles, les auteurs ont eu accès aux données nouvellement disponibles du projet fédéral sur la cryosphère de l'Année polaire internationale, du satellite GRACE, et des reconstitutions des paléoclimats. En rapport avec cette recherche, l'atelier a donné lieu à des discussions sur les perspectives politiques. Le compte rendu résume ces articles ; les présentations de l'atelier ont été affichées en ligne.

I) Introduction

We report here on a kick-off workshop for a project entitled "*Simulation of the Canadian Cryosphere"* that was recently funded by the Natural Science and Engineering Research Council of Canada's (NSERC) Strategic Project Grants program. The project is motivated by:

1) the need to improve our understanding of and ability to realistically simulate high latitude cryospheric processes in light of rapid changes in the Arctic;

2) new observational data and research questions stemming from International Polar Year (IPY) activities;

3) new large-scale computing resources at the SciNet computational facility hosted at the University of Toronto.

The project partners-scientists with modelling and observational expertise from the University of Toronto (Kushner and Peltier), the University of Waterloo (Duguay), Environment Canada (EC – Derksen and Brown) and Natural Resources Canada (NRCan – Fernandes). Through this project we are making an effort, as IPY projects such as the Canadian Federal IPY Cryosphere Network wind down, to maintain a strong connection between the observational and modelling side of cryosphere-climate process research. Besides the standard outlets for dissemination of scientific research, the output from this research team is intended to be transferred to EC and NRCan to be employed in policy development for the Canadian North.

The workshop, which took place January 19 in the Department of Physics at the University of Toronto, was organized along the three main themes of the project: land ice, seasonal snow cover, and sea ice. It was intended to highlight directions where rapid research progress can be made that involves a close connection between simulation and observation. The expertise within the project resides primarily in the area of land-ice and snow processes, and for these processes the project is intended to capitalize upon newly available observational products and computational resources. During the workshop, a key discussion question involved how these new resources can best be used to make progress on land-ice and snow issues. The sea-ice component required further fleshing out, and discussion in the workshop was directed towards this aim. We also discussed the issue of mixing dynamics in Arctic lakes and long-term plans to carry out research in this area. We rounded out the day with a discussion of our science from the perspective of policy needs and how we might seek longer-term support for this research that extends outside the current project.

A list of workshop participants is shown in Table 1, and selected papers from the workshop are available at http://pjk.atmosp.physics.utoronto.ca/workshop-presentations

We will summarize the main results of the workshop in the next section and conclude with a discussion of next steps for the three-year term of the project.

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[2] Environment Canada

[3] Department of Geography University of Waterloo

[4] Natural Resources Canada

Heather Andres	University of Toronto
Ross Brown	Environment Canada
Chris Derksen	Environment Canada
Claude Duguay	University of Waterloo
Richard Fernandes	Natural Resources Canada
David Fisher	Natural Resources Canada
Chris Fletcher	University of Toronto
Stephen Howell	Environment Canada
Ashleigh Ingle	University of Toronto
Paul Kushner	University of Toronto
Frédéric Laliberté	New York University
Sally Macintyre	University of California at Santa Barbara (telecon)
Lawrence Mudryk	University of Toronto
Richard Peltier	University of Toronto
Karen Smith	University of Toronto
Gordan Stuhne	University of Toronto
Anne Walker	Environment Canada
Libo Wang	Environment Canada
Mathew Wells	University of Toronto
Nick Xenos	Indian & Northern Affairs Canada (telecon)
Christian Zdanowicz	Natural Resources Canada
Hongxu Zhao	EC / NRCan

Table 1: Workshop Participants

II) Workshop summary

Land Ice Theme

David Fisher (NRCan) opened by presenting recent developments in ice core research, specifically Holocene temperature reconstructions. New cores from the Greenland Agassi and Renland ice sheets, which are less sensitive to elevation effects than the central Greenland cores from the Greenland Ice-core Project (GRIP), provide high quality temperature records that can be used to adjust the records from central Greenland cores and to quantify the extent of elevation changes in this region (Vinther et al., 2008; Vinther et al., 2009). Cores from the North Atlantic sector stand in contrast to a new core from Mt. Logan in Alaska in depicting Holocene variability: North Atlantic cores show one large climate cooling event, 8,200 years ago (8.2 ky); however, the Mt. Logan record is marked by numerous large, abrupt temperature changes, many larger than the 8.2 ky event. Analysis of paleo El Niño-Southern Oscillation (ENSO) records indicate that the large shifts in $\delta^{18}O$ are associated with the state of ENSO (Fisher et al., 2008). The direction of the change in fluctuations associated with the ENSO events suggests that the core is recording a change in source water rather than a change in temperature. This paleo perspective was of great interest to workshop participants who are involved in understanding the long-time variability of the high-latitude system and new ideas for simulation tests were put forward.

Richard Peltier (Toronto) highlighted the value of the Gravity Recovery and Climate Experiment (GRACE) satellite's measurements of Earth's gravitational field, in understanding cryospheric contributions to recent sea level rise. Once the effects of glacial isostatic adjustment (GIA) and of hydrological processes are accounted for, the GRACE data indicate regions of ice sheet mass loss due to recent climate change over Greenland, Alaska, and the Amundsen Sea and Peninsula regions of Antarctica (see Fig. 1). The Alaskan glacial ice sheet loss is accounting for 0.15 mm/y of sea level rise, and the Greenland ice sheet loss is accounting for 0.62 mm/y of sea level rise, both of which contribute significantly to the global total of 1.95 mm/y (Peltier, 2009). The potential utility of the GRACE data will only improve in the future; the longer it flies, the greater spatial resolution will be obtained. Prof. Peltier's group will focus within our project on how to better understand the dynamics and climate controls of these ice sheets. **Gordon Stuhne** (Toronto) discussed how most ice sheet models can reproduce the general features of ice sheets but poorly represent details that appear to be key in determining the mass balance of an ice sheet. He has developed a model that employs an unstructured grid to better model the ice sheet margins of Greenland and has found much better agreement with the observations. **Heather Andres** (Toronto) will be using the National Center for Atmospheric Research (NCAR) climate model, CCSM4, to investigate the role local climate (e.g., cloud cover, sea-ice, etc.) on the mass balance of the Greenland Ice Sheet over the past 150 years.

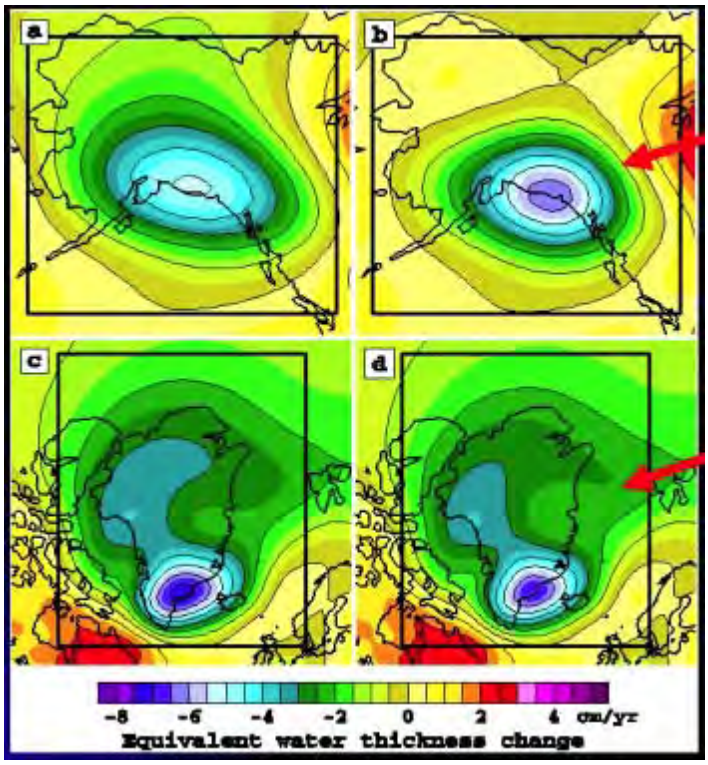

Figure 1: (a) Surface mass-rate field over Alaska from GIA corrected GRACE data. (b) Alaska mass-rate field corrected for the influence of surface hydrology using GLDAS and glacial isostasy using the predictions of the ICE-5G (VM2). The box drawn around the anomaly defines the region within which the negative anomaly is considered to be due to land ice melting. (c) Surface mass-rate field for Greenland based upon the glacial history for this region in the original ICE-5G model that contained a neoglacial re-advance of ice that continued until the present day (denoted "no stop at 2 ka"). (d) The mass-rate field for Greenland assuming that the neoglacial re-advance in the original ICE-5G model is eliminated from 2 ka onwards (Peltier, 2009).

Snow Theme

Ross Brown (EC/OURANOS) summarized the latest observational trends in snow cover extent and highlighted the differences between North American and Siberian snow trends. The Siberian snow onset date has not changed much over the observational record while the North American snow onset date is trending later in the season. The snow off date is earlier in both the Canadian Arctic and Northern Siberia and trends are strongest in coastal areas likely in response to decreasing sea-ice and more open water near the coastlines. Over the last half century wintertime snow depth has been increasing in Siberia but decreasing in North America. The latter is somewhat difficult to explain as precipitation has been increasing over northern Canada. One possible explanation is that the Canadian snow depth observing network, which is based on open site areas near airports, is not responding to the trend toward increased shrubbiness and associated snow catching potential. New multidataset estimates of Arctic spring snow cover trends over the 1979-2008 period (see Fig. 2) show that snow cover, sea-ice, and temperature track each other very closely. Brown pointed out that the Intergovernmental Panel on Climate Change (IPCC) models underestimate the temperature sensitivity of snow cover over the Arctic during the spring melt period which may be related to a number of factors including overestimation of precipitation, not accounting for black carbon effects on snow albedo, and simplified representation of Arctic snow processes (Brown and Mote, 2009).

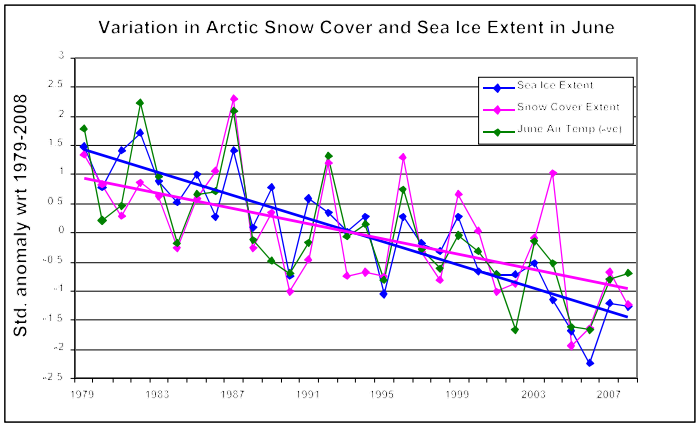

Figure 2: Variation in Arctic June snow cover extent, sea ice extent and air temperature (plotted as negative anomaly) over the 1979-2008 period. Least squares trends are shown for snow cover and sea ice extent (from Brown et al., submitted).

Chris Derksen (EC) reported on the latest in satellite-derived snow observations developed during the IPY. The observing network in the Canadian Arctic is sparse and EC's satellite-derived products are designed to fill in these spatial gaps. A new tundra specific snow water equivalent (SWE) algorithm was developed and validated for satellite passive microwave data through a series of sub-Arctic field campaign in 2008 (Derksen et al., in press). The passive microwave time series (1979-2008) indicates that peak SWE is increasing over the Canadian Arctic (see Fig. 3). This finding is not consistent with observed trends in maximum snow depth from station observations, but agrees with observations of increasing winter season precipitation over northern Canada. The discrepancy between the satellite-derived and conventional observations is likely due to differences between single point surface observations which are influenced by local conditions at observing stations, and the spatially integrated satellite measurements. These time series will be investigated further to clarify these differences. Because Arctic spring snow cover duration is decreasing, an increase in winter season snow depth or SWE would suggest an intensification of the high latitude water cycle in spring. Time series analysis of terrestrial snow and sea ice extent datasets identified linkages between the terrestrial and marine cryosphere, with the timing of pan-Arctic terrestrial snow melt onset significantly correlated with summer sea ice extent anomalies. The strength of this terrestrial melt versus sea ice extent relationship peaks in July, which suggests early melt onset on land during spring reinforces large scale warming in the Arctic.

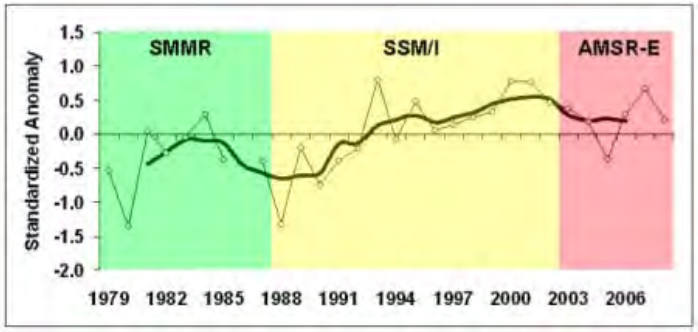

Figure 3: Standardized SWE anomalies for the Canadian sub-Arctic tundra derived from the satellite passive microwave data record (Derksen et al., in preparation).

Claude Duguay from the University of Waterloo discussed an important limitation of conventional passive microwave algorithms for SWE. Over regions with large lake fraction, standard algorithms yield very low or even negative SWE values for snow cover on frozen lakes. This artifact arises because conventional algorithms retrieve SWE by taking the difference between the 19 GHz band and the 37 GHz band which are differentially influenced by lake ice due to different penetration depths. The new EC tundra-specific algorithm avoids this issue by utilizing the temporal change of single frequency measurements (37 GHz) which are uncorrelated with lake fraction. This highlights the need to develop algorithms using field data and models specific to lake-dominated landscapes.

Chris Fletcher (Toronto) continued the discussion of snow processes by presenting his analysis of snow-albedo feedback (SAF) using the new NRCan/CCRS snow cover and albedo data product (Zhao and Fernandes, 2009). SAF contributes approximately 10-20% to global climate sensitivity. Previous work has indicated that there is a three-fold spread in the IPCC-AR4 models' SAF (Qu and Hall, 2006) and that this spread contributes up to 20-30% of the spread in the surface temperature response to climate change over North America (Fletcher et al., 2009). The SAF due to climate change roughly corresponds with the SAF due to seasonal winter-to-spring melt within each model, implying that accurate observations of what the true winter-to-spring SAF should be could allow models to be better constrained (Fernandes et al., 2009). Dr. Fletcher and collaborators have used the new snow cover and albedo product to better quantify the seasonal SAF in the climate system (see Fig. 4). On average, the models reproduce the observed regional patterns of SAF factors but the spread among models is quite large, particularly in the snow metamorphosis contribution to the SAF that is inferred from this analysis.

To conclude the snow section of the workshop, **Karen Smith** (Toronto) discussed how snow cover remotely affects the large-scale atmospheric circulation through teleconnection dynamics involving the Northern Annular Mode/Arctic Oscillation (NAM/AO). Observational data indicate that years in which there is anomalously high snow cover over Eurasia in October are correlated with negative phased-NAM wintertime climate. The lead-lag relationship between anomalous autumn snow cover and wintertime tropospheric climate points to the utility of snow cover as a seasonal forecasting tool and to connections between cryospheric processes and large-scale circulation.

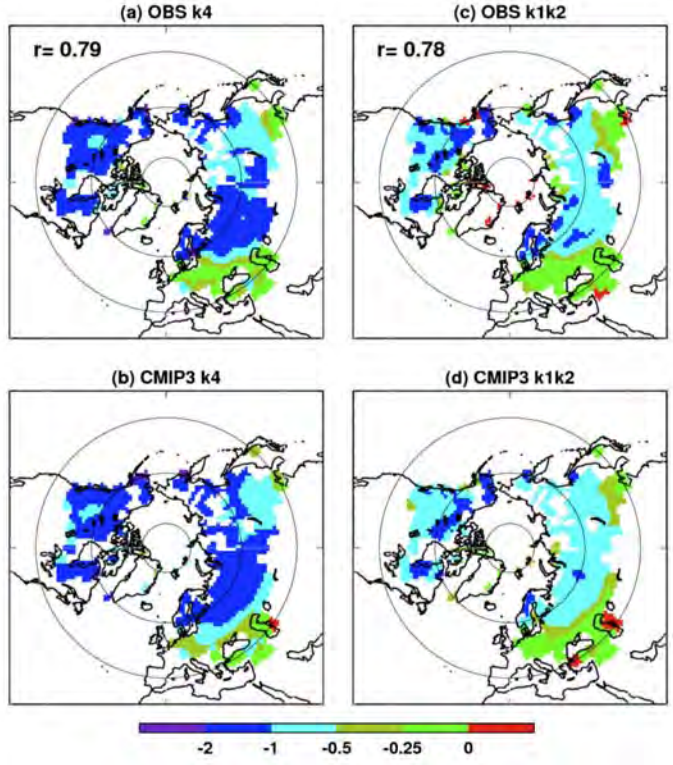

Figure 4: Maps of total snow albedo feedback (SAF) sensitivity in %/K ("k4"), and the contribution to the total from snow cover effects ("k1k2") derived from observational data (top row) and CMIP3 multi-model ensemble mean data (bottom row). All data are March-April-May averages; the observations cover the period 1982-1999, while CMIP3 covers the period 1900-99 from the 20c3m simulations. Positive values are coloured red and missing values are not shaded. The anomaly correlation between the observed and CMIP3 maps is shown in the top left corner of each observational plot (Fletcher et al., in preparation).

However, this observed connection is not simulated in climate models. Ms. Smith discussed recent insights into the underlying dynamics of the process based on GCM studies, establishing the role of linear interference in determining the nature of the NAM response in a series of snow forcing experiments (Smith et al., submitted to *J. Climate*). Greater understanding of snow processes and accurate simulation of snow cover extent and variability are vital to capturing this process within the natural variability of GCMs.

Sea-Ice Theme and Future Research Directions

Christian Zdanowicz (NRCan) opened the final session of the workshop with a discussion of his recent work to characterize the climatology of Canadian Arctic sea-ice. The trend from 1980-2004 indicates decreasing concentrations in Hundson Bay, to the east of Ellesmere Island and off the

north shore of Yukon and Alaska, and increasing concentrations within the Archipelago. Overall, he notes a 3.6% per decade decrease in Canadian Arctic sea-ice concentration (Kinnard et al., 2006). His group conducted a principal component (PC) analysis of a multi-paleo-proxy data set from the Arctic region in order to develop a long-term reconstruction of Arctic sea-ice extent. The first PC corresponded to temperature variability while the second roughly corresponded to the sea-ice extent minimum. Detailed analysis could only be conducted for a few years as the proxy data become sparse further back in time; however, they extrapolated their analysis to reconstruct a sea-ice extent time series from 1128-2003 (Kinnard, 2009). The reconstruction indicates that sea-ice extent in the last decade is the lowest it has been in the past 875 years.

Stephen Howell (EC) then discussed the observed sea-ice record in the Canadian Archipelago, which lag those in the Arctic Ocean due to the protected nature of the region. The Archipelago sea-ice minimum during the observational record was in 1998, not 2007 as in the Arctic Ocean, and the minimum in multi-year ice was in 1999 (see Fig. 5; Howell et al., 2009). Over the last 30 years, the source of multi-year ice in the Archipelago has changed. In the past, first-year ice was promoted to multi-year ice but now multi-year ice is imported as first-year ice melts each season. The most important determinant of a sea-ice minimum in the Archipelago is the winds, which can act to prevent the import of multi-year ice. Dr. Howell and others have found that over the past 30 years, ENSO is positively correlated with multi-year ice and negatively correlated with first-year ice in the Archipelago. A warm temperature anomaly over the Archipelago during El Niño melts first-year ice, which allows multi-year ice to flow into its place along the currents (Tivy et al., in press).

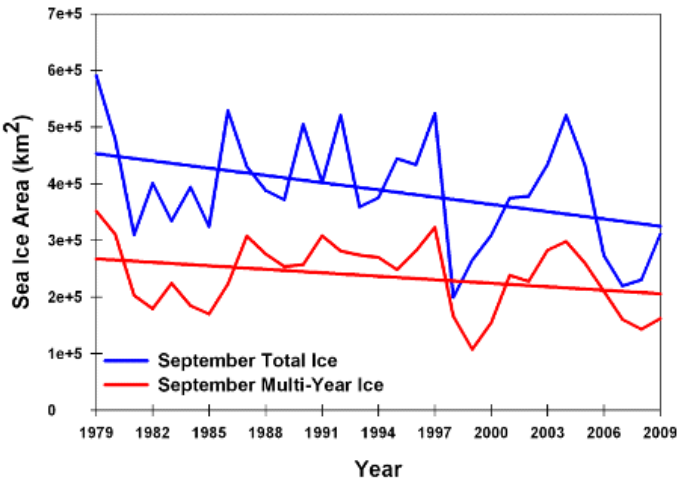

Figure 5: Time series of average monthly September total ice and multi-year ice area within the Canadian Arctic Archipelago, 1979-2009. Data is from the Canadian Ice Service Digital Ice Chart Archive.

The science portion of the workshop concluded with a discussion of lake mixing dynamics by **Mathew Wells** (Toronto) and **Sally Macintyre** (UC Santa Barbara), which is a potential new research direction of interest to several participants. The primary research question for this discussion was how increasing temperatures affect lake dynamics and, consequently, lake biology in Arctic lakes. The manner in which different climate variables such as temperature or surface wind speed influence lake mixing depends on the type of lake and its seasonal mixing properties (monomictic, dimictic or polymictic). As the climate warms, these lakes could potentially experience regime shifts which could dramatically alter the mixing properties of the lake. Studies at Toolik Lake in Alaska and Lake Opeongo in Algonquin Park suggest that Arctic and boreal lakes are already showing the effects of climate change.

Policy Theme

A general goal of our proposal to NSERC was to provide useful policy information to EC and NRCan. During his presentation on snow trends, Ross Brown presented snow parameters that are connected to societal and policy needs, such as SWE for hydrological forecasting, annual maximum snow depth for snow-loading calculations in building standards, etc.. In the final part of the workshop, we focussed on larger policy questions. **Nick Xenos**, director of Arctic science policy at Indian and Northern Affairs Canada, discussed Canada's Northern Strategy and Arctic Science. Mr. Xenos discussed how federal support for Arctic research fits into larger plans for infrastructure and resource development in Canada's North. His presentation detailed the proposed High Arctic Research Station (HARS), a permanent scientific research and technology centre in an Arctic location to be decided in the coming year, and its potential benefits for high-latitude research across the country. The next steps in this process include finalizing plans for the HARS, continuing to refine the science and technology strategy for Northern research, and delivering on funded infrastructure investments.

III) Conclusion

This kick-off workshop helped to energize the "Simulation of the Canadian Cryosphere" project as it starts its three-year term. It brought together scientists deeply involved in Arctic field campaigns, remote sensing analysis, and climate simulation for a structured but informal and friendly discussion on recent research issues. It highlighted the value of the Canadian Federal IPY Program in initiating new partnerships that will continue important activities well past the IPY period. A new research theme that emerged was to make a strong effort to link our work to the latest ice-core research. The workshop also opened possible directions for exploring the policy implications of our research, for example by improved characterization of our confidence in Arctic climate predictions for parameters critical to infrastructure and ecosystems. An ongoing challenge will be to make the broader policy community aware of these research efforts and of the value in bridging the observational and simulation sides of our science. We closed the day with a proposal to hold a second workshop in about two years' time to review the status and achievements of the project.

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Congrès 2010 – Inscrivez-vous maintenant!

Le programme du congrès conjoint SCMO-UGC qui se tiendra à Ottawa du 31 mai au 4 juin 2010 est maintenant complet. Avec plus de 800 résumés regroupés sous 64 thèmes, ce congrès promet d'être parmi des plus grands et des plus passionnants. Le programme sera présenté chaque jour en 13 sessions parallèles jusqu'à la toute fin du congrès le dernier jour. Toutes les salles et toutes les heures seront utilisées pour présenter les sessions orales. La session pour les affiches est également à pleine capacité. Prenez quelques instants pour vous inscrire immédiatement en allant sur le site web du congrès

http://scmo.ca/congress2010/indexf.html

et cliquez sur "*Inscription*". Reservez votre chambre d'hôtel en même temps. Durant cette période de l'année, la région d'Ottawa est très populaire auprès des touristes! Ne soyez donc pas désappointés.

CLIMATE CHANGE / CHANGEMENT CLIMATIQUE

It has been proposed that *CMOS Bulletin SCMO* print a regular bi-monthly section devoted to Climate Change. The purpose would be to keep members informed on recent results and related information on climate change, especially on the hot topic of global warming. These could be volunteered or solicited, and would be mostly short snippets, but with occasional longer articles. Please forward your thoughts, suggestions, or better still, your articles on this to the Bulletin editor, bulletin@cmos.ca.

Il a été suggéré que le *CMOS Bulletin SCMO* publie régulièrement une section bimensuelle concernant le changement climatique. Le but serait d'informer les membres sur les plus récents résultats et les sujets reliés au changement climatique, en particulier sur les sujets d'actualité comme le réchauffement climatique. Ces informations pourraient être fournies sur une base volontaire ou sur demande. Elles prendraient la forme de courts articles et occasionnellement les articles pourraient être plus longs. Nous vous invitons à faire parvenir vos idées, suggestions ou mieux encore vos articles sur le sujet au rédacteur du Bulletin, bulletin@scmo.ca.

Why Defend Climate Science?

by Geoff Strong[1]

This article addresses the problem of 'climate science under attack'; why is this so, and why should we defend climate science and scientists? Opinions expressed in this article are those of the author, not of CMOS.

Public, Government and Industry Attitudes to Global Warming

Despite overwhelming scientific evidence and consensus concerning *anthropogenic global warming* (AGW) caused by elevated greenhouse gas (GHG) emissions, recent U.S. and U.K. opinion polls show a continuing collapse in public conviction that climate change is a serious and urgent issue. Several factors have led to this decline in public acceptance of AGW. One is the renewed (albeit false) perception of scientific uncertainty concerning AGW theory; another factor is the inability of most individuals to experience or recognize any direct impacts of short-term global warming, a seemingly paltry 0.2 to 0.3 °C per decade! They cannot relate to this because the cumulative effects are relatively far in the future.

The false perception of scientific uncertainty on AGW can be largely attributed to the successful (and in many ways, unethical) efforts by 'climate skeptics' (hereafter referred to as '*skeptics'*, meaning *disbelievers in the scientific consensus on AGW*) to encourage this uncertainty through public media. The question of 'scientific consensus' was hopefully put to rest in the December issue (CMOS Bull., 37, No. 6, p.179-180). 'Skeptics' do not carry out any original scientific research (as they freely admit at http://www.friendsofscience.org/), but instead promote an *ideology* and what can be described as a *vendetta* against climate science in public media, as will be made clear in this article. The failure of the scientific community to effectively counteract this ideology through the same public media has unintentionally contributed to the skeptics' cause. It is part of human psyche that unless we understand any threat to society *very* clearly, we are reluctant to act proactively against it, and are then unlikely to make demands for government action. This reluctance has been demonstrated throughout history, and glaring examples include the buildup of the Nazi war machine in the 1930s, and the Rwanda genocide in the 1990s. Most certainly the threat of global warming belongs to that list, and partly explains why we have not reached any clear means to curb GHG emissions. Comparing this to the related issue of industrial pollutant and CFC emissions, international agreements to curb these pollutants were made possible because the public could readily see damage caused by acid rain, and to the ozone layer for example. But individuals cannot easily visualize global warming as a threat, because its maximum impact likely won't occur in their lifetimes, making the skeptics' job relatively easy.

At the same time, politicians and governments are reluctant to impose significant measures to control GHG emissions, especially when the benefits of doing so cannot be detected within their elected mandate, so that any GHG emissions legislation might later become unpopular (at the next election). Consequently, despite hopeful aspirations leading up to the Copenhagen talks in December 2009, Earth was left with no decisive international agreement or process to curb GHG emissions.

A similar inertia applies to industry. The petroleum industry, for example, is unlikely to respond proactively towards reduction of greenhouse gas emissions, and why should they and how could they? After all, they simply provide the fuels; it is consumers (the general public and other

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commercial/industrial interests) who demand the fuels and release CO_2 emissions. The same reasoning applies to the forestry industry, who clear-cut forests to supply our insatiable appetites for bigger houses and other general waste of this most important land-based resource for removing CO_2 from the atmosphere. As a famous 1970 Walt Kelley '*Pogo*' cartoon declared, "*we has found the enemy, and he is us!*"

The resulting overall intransigence provides industry with the perfect reason to keep the *status quo* when it comes to GHG emissions. The public is unsure about global warming; therefore they do not demand government action, and neither have they reduced their demands for fossil fuels and forest products. Both governments and industry are hesitant to be proactive on reducing GHG emissions, for their timelines are of the order of four years maximum (to report to their electorate) and one year (to report to shareholders) respectively. These arguments provide fertile ground, and in some cases, funding, for climate skeptics to make their appalling, yet effective campaign of misinformation against AGW and climate science in general.

Climate Skeptic Tactics

Climate skeptics and their disingenuous tactics are thus major contributors to all the confusion over global warming. Their main tactics involve: (1) ignorant or deliberate (you choose) misinterpretation of science processes; (2) selectively using (i.e., *cherry-picking*) data to present biased and incorrect results; (3) misquoting scientific results completely out of context, all aimed at maintaining a public perception of global warming uncertainty; and (4) further disparaging climate science and scientists by claiming that there is an international conspiracy to fabricate global warming in order to continue funding. Unsubstantiated and libelous accusations of fraud and misconduct are part of their attacks against climate scientists. Specific examples of each of these four misleading tactics are provided in what follows:

1) One of the most popular claims of skeptics is that "*Over the past few hundred years, there has been a steady increase in the numbers of sunspots while the Earth has been getting warmer, and that the data suggest that this increased solar activity is the cause of global warming*" (e.g., see

http://news.bbc.co.uk/2/hi/science/nature/3869753.stm).

In reality, the sun has shown a slight cooling trend over the last 35 years of global warming, so that solar radiation and climate are trending in opposite directions. At the same time, sunspots have been at an all-time low for several years (see

http://science.nasa.gov/headlines/y2009/03sep_sunspots.htm?list1326944).

2) One favorite motivation for skeptics to cherry-pick data is to claim that the climate is actually cooling, or at least not warming. They do this by picking a warm starting year for their trend (1998 is popular), then project that single year forward to whatever year fits their alleged trend, effectively producing a linear regression extrapolation based on two points. For example, MIT scientist Richard Lindzen used 1993-2007 data to claim that "*there has been no warming since 1997 and no statistically significant warming since 1995*", completely ignoring the overall warming trend that is apparent even in his own short-term (15-year) temperature anomaly plot (see at

http://wattsupwiththat.com/2008/03/11/a-note-from-richard-lindzen-on-statistically-significant-warming/).

The skeptics are also well aware of the contradiction between the above two claims (i.e., they alternate between warming and cooling, whichever suits their purpose), but that is all part of their objective to reinforce public uncertainty over global warming. Sometimes they use the U.S. temperature anomalies with the inference that it represents the global trend. In any event, even for this short a period (~15 years), a warming 'trend' is suggested in our own reconstructed *global* temperature anomalies for the same period (Figure 1), using either CRU or NASA/GISS data. Despite the different anomaly baselines used, the CRU and GISS linear regression trends (dashed lines) are the same.

3) Misquoting scientific results is also a common unethical practice by skeptics, as it not only serves their purpose to increase public uncertainty about global warming, but it is also aimed at ruining careers and lives of targeted scientists. The illegally hacked CRU emails (so-called *Climategate*) are perfect examples of this. One of the most quoted emails involved Phil Jones discussing paleo-data used to reconstruct past temperatures, where he states: "*I've just completed Mike's Nature trick of adding in the real temps to each series for the last 20 years (i.e., from 1981 onwards) and from 1961 for Keith's to hide the decline. Mike's series got the annual land and marine values while the other two got April-Sept for NH land N of 20N. The latter two are real for 1999, while the estimate for 1999 for NH combined is +0.44C wrt 61-90. The Global estimate for1999 with data through Oct is +0.35C cf. 0.57 for 1998*." The 'trick' simply referred to a 'technique' used in a paper published in Nature by lead author Michael Mann, of plotting recent instrumental data along with the reconstructed paleo-data from tree rings, which was clearly indicated to the recipient in the email thread. The 'decline' referred to proxy tree ring data that are known to diverge from temperature records after 1960. Jones was simply recommending not using the post-1960 part of their tree-ring reconstruction (since they had absolute temperature data), and so while 'hiding' was a poor choice of words, not using those data was appropriate. The skeptics took this out of context by reporting it as "*Phil Jones, head of East Anglia's Climatic*

Research Unit (CRU) completed Mike's Nature trick to hide the decline in temperature" (e.g., see

http://climateaudit.org/2009/12/21/terence-corcoran-on-climategate/).

Other examples of how the CRU emails were quoted out of context can be found at

http://www.skepticalscience.com/Climategate-CRU-emails-hacked.htm.

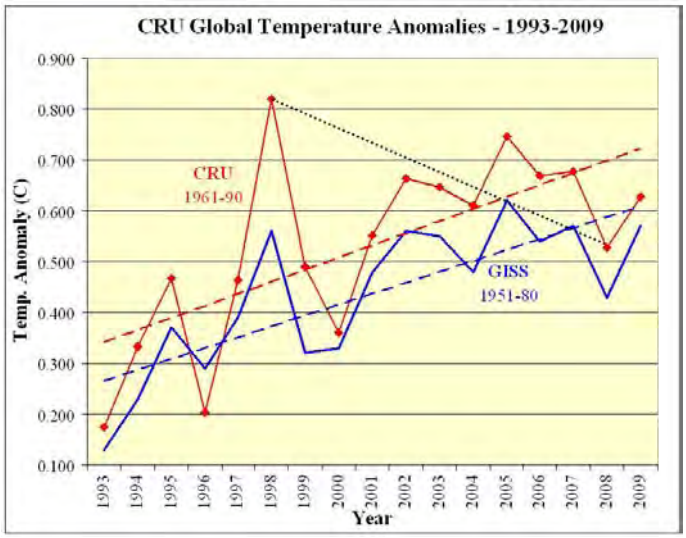

Figure 1: Global land-sea annual temperature anomalies (solid lines) and linear trends (dashed lines) for 1993-2009 for Climate Research Unit (red) and NASA/GISS (blue) data. Lower anomalies appear in NASA/GISS data because of the different baseline years used (1951-80 versus 1961-90 for CRU). Dotted black line that connects the CRU 1998 maximum and 2008 anomalies, represents the tactic that skeptics use, but *does not* represent a trend. [Reproduced from CRU and NASA data sources.]

It is true that mistakes were made at the UK CRU in terms of a few inappropriate comments on others in private emails, and the institute needs to be admonished for that, yet bear in mind these were made in private. However, there was no attempt to falsify or hide scientific results, and most certainly no evidence that global warming is a hoax. Meanwhile the global thermometer continues to rise.

4) The conspiracy theory, that IPCC and CRU climate scientists have fabricated global warming in order to keep funding flowing, has been promoted by climate skeptics throughout the internet to deliberately discredit scientists (e.g., see

http://www.friendsofscience.org/index.php?id=465).

This is clearly an affront to science, and an iniquitous attack on climate scientists. The fraud claims have since been adopted and promoted by many politicians worldwide, and by well-known media personalities who choose not to check their information sources, including Canadian CanWest newspaper columnist Lorne Gunter, and CBC's Rex Murphy. This saga continues and goes much deeper: on 04 March 2010, the UK Guardian newspaper reported that a submission requested from the UK Institute of Physics (IOP) by a parliamentary inquiry examining the behaviour of CRU scientists, was highly critical of the institute, *but was prepared by an oil and gas industry consultant* (see

http://www.guardian.co.uk/environment/2010/mar/05/climate-emails-institute-of-physics-submission).

It is perplexing how petroleum industry interests are frequently linked (though carefully indirectly) with those of the skeptics.

The skeptics rarely make any attempt to either publish their results in scientific journals or present them at scientific conferences such as CMOS Congress, for the simple reason that their arguments do not stand up to rigorous scientific scrutiny. Yet, and here is their main strength, they continually report their deceptions in all forms of public media, particularly newspapers and radio talk shows, and, of course, on internet blogs. This same tactic was used in the 1980s and 90s to maintain uncertainty concerning the link between cigarette smoking and lung cancer, and in fact, *some of the same people are now involved in undermining the science behind AGW* (e.g., Fred Singer)! Newspapers, suffering financially in recent years from a downturn in sales due to the explosion of instant internet information sources, and compounded by the present poor economy, tend not to check their climate information sources very closely, especially since climate change controversy is one of the hot topics, and newspaper sales feed off controversy and blood stories. Climate scientists have unintentionally contributed to the uncertainty by largely avoiding public media and ignoring the skeptics, so that the public reads, hears, and sees primarily the deceptions of climate skeptics and their journalistic disciples; hence, to the public, climate science is deemed guilty through silence.

By making full use of the conspiracy theory (4 above), the same skeptics have also managed to gain the ear of influential politicians in both Canada and the U.S. For example, here in Canada, the climate controversy is partly to blame for the termination of federal funding to the Canadian Foundation for Climate and Atmospheric Science (CFCAS), the only specific funding source available for climate research in Canadian universities, at a time when we desperately need more research. In the U.S., Senator James Inhofe, ranking Republican on the Environment and Public Works Committee, is actively seeking to criminalize the actions of 17 leading U.S. and British scientists who have been associated with the Intergovernmental Panel on Climate Change (IPCC) assessment reports. Because Inhofe's allegations are completely unfounded, this act is in

itself a crime against science and the integrity of scientists, and should not go unanswered.

The scientific processes concerning GHGs and AGW have been well understood since the early-1800s (e.g., see

http://en.wikipedia.org/wiki/Greenhouse_effect),

and even the most radical climate skeptics cannot put forward a rational scientific argument against the original theory. But they are not even interested in scientific arguments anyway. Their sole objective is to keep uncertainty in the minds of the public by using deceptive arguments, and to detract from the reality/evidence of AGW that we have been seeing for some time now. In this way, the skeptics utilize ripe and ready public media for publishing and distributing their deceptions. The only thing missing from the skeptics' agenda then is their '*mission objectives*'. *Why are they so intent on sabotaging any attempt by countries to reach agreement on global warming by promoting non-existent uncertainties in the science*? Some climate deniers are known to be funded by energy and related industries, often obscured by third-party transfer of funds through various 'institutes' and 'think-tanks'. How widespread this obvious conflict of interest goes is still uncertain. It may be years before the degree of risk that mankind is taking with GHG emissions becomes obvious to everyone, so that if their false views are not openly and critically challenged, skeptics are likely to continue their vendetta against climate science unhindered. Scientists need to take every opportunity to counter claims by climate skeptics, thereby defending climate science, and they should engage the public directly in doing so.

The foregoing discussions regarding public, government and industry intransigence on global warming, and the confusing invective concocted by climate skeptics, should make it obvious that any significant response to the global warming problem must start first with public education, and with climate scientists interacting directly with the public.

The next question to address is how do we defend climate science?

Importance of Public Education

The inescapable conclusion from the foregoing is that no successful controls on carbon emissions can be achieved until the public (the government's electorate) demands it. That electorate will not proactively demand such controls until they understand, believe, and can see for themselves the negative impacts of the undeniable link between GHG emissions and AGW. In turn, that public understanding can only be reached by providing the public accurate information and education on climate change. Moreover, unless climate scientists take a direct role in this public education process now, then it cannot be achieved before the 'next' generation or even later; however, we likely cannot afford to wait that long before the climate reaches some as yet undefined *tipping point* beyond which the process is irreversible. It is unfortunate, but that public education process means fighting the unethical practices of climate skeptics head on. We can ignore the individuals if necessary to avoid obvious direct conflict, but we must still defend against the disreputable tactics that many skeptics use, so that the public can at least sort out real science from the fictions that these people fabricate.

Even students studying climate change have widely varying opinions on global warming, and require continuing updated information. This was demonstrated to me through a sessional course in physical geography that I teach each fall at The King's University College in Edmonton. During the past three years, and following several lectures on climate change each year, students completed a mandatory climate change survey with the clear instruction that there were no strictly right or wrong answers, and that their survey opinions, on a scale of 1 to 10 (10 meaning 'agree completely'), would not count against their grades. This is admittedly a biased survey towards the scientific consensus view on global warming, but there still was some resistance to scientific consensus. For example, Figure 2 shows that while 35% of (110) students agreed strongly with the consensus answer to the question "*Is there clear evidence that GHG emissions are the primary contributing source to present climate warming?*", more than 30% were only moderately convinced (answered a 7 or 8), another 25% were 'indefinite maybes' (answered 4-6), while the remainder, almost 10% did not agree with the consensus at all. These were students who were lectured on the factors affecting global warming, the overwhelming scientific consensus, and the refuting of climate change myths (the skeptics will call this '*brain-washing*', something they are quite familiar with).

Figure 3 suggests a small positive correlation (+0.28) between consensus opinion and final course grades for the students (I hasten to repeat that their answers were not, consciously or sub-consciously, used in determining their course grade). This suggests, somewhat at least, that understanding of the scientific principles of global warming increases with education and training. One can also infer from this survey that public education on climate change, even after receiving part of a course on the topic, will be an uphill battle. There was no detectable year-to-year difference in surveyed opinions, perhaps because of the small sample size (30-40 students each year).

This small survey supports the contention that educational information provided by climate science itself may be the only way to sway the public to be proactive on the global warming issue. A consensus within the public would promptly translate into changing actions by both governments and industry (reducing fuel demands and election votes ***will*** move both). Moving forward on public education on climate change will require a small shift in attitude by scientists in climate and related fields, to speak

more to and write more for public consumption. This does not mean that scientists must abandon their research work to take on public education. In fact, one well-written article by a scientist in a newspaper or magazine could undo some of the damage caused by skeptics where a non-expert article might have no effect. Also, making oneself available for one or two public speaking engagements a year to schools, libraries, civic functions, and even churches, should not cause much grief or effort for a climate scientist.

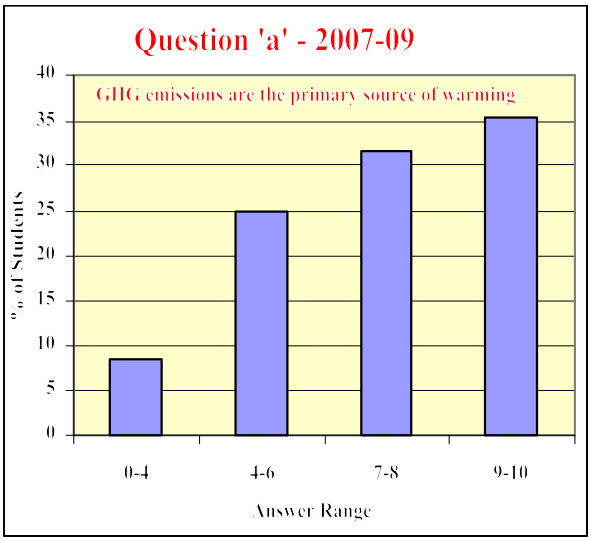

Figure 2: 2007-09 Student climate survey response to statement "*There is clear evidence that GHG emissions are the primary contributing source to present climate warming*", graded 1-10 where 1 was "disagree completely" and 10 was 'agree completely'.

Changing Climate Science Attitudes and Response

So how do we change our attitudes and responses to public perceptions on global warming? How do we convince the public of the potential serious impacts of global warming? To begin with, we (because some of our own membership are not yet convinced), followed by the general public, must be convinced of the seriousness of something that probably won't reach its worst extent in many of our own lifetimes. That makes the task a tad difficult. It can be accomplished through public education, but that needs to involve those who understand the problem best, our experts in climate and closely related sciences. Those experts, however, cannot accomplish this in a meaningful way through the usual journal publications. Public media need to be utilized – newspaper and magazine articles and letters, radio and television interviews; and perhaps most important of all, meeting with and speaking to the public face-to-face, at schools, civic groups, public meetings, churches, however best each individual can contribute. It sounds challenging, but it doesn't need to be that huge an effort by individual scientists.

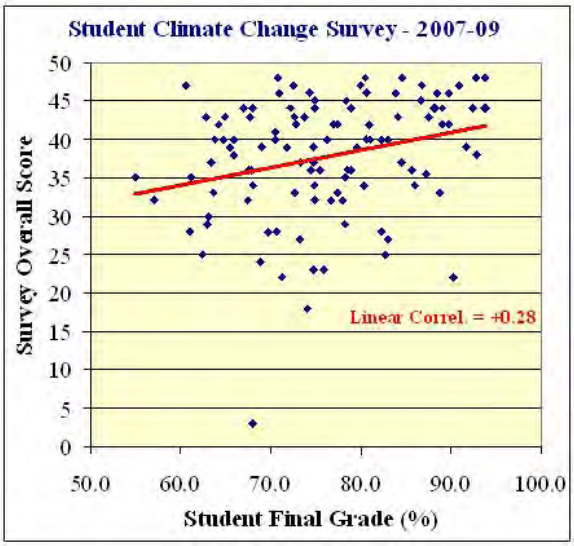

Figure 3: 2007-09 Student climate survey total opinion score (combining 5 questions where each question was graded 1-10, with 10 as scientific consensus opinion) against overall student grades. Solid line is linear regression with correlation +0.28.

An article in the New York Times on 02 Mar. 2010 quotes Gavin A. Schmidt, a senior climatologist with NASA as saying "*that responding to climate change skeptics was a fool's errand*", that "*climate scientists are paid to do climate science*", that "*their job is not persuading the public*", and that "*good science is the best revenge*". I believe that attitude belongs to the past and is not relevant to the climate change scenario today. Rajendra Pachauri, the head of IPCC suggests that "*scientists must continually earn the public's trust or we risk descending into a new Dark Age where ideology trumps reason*". To earn that trust, the scientist can no longer isolate himself from the public, focussing primarily on scientific journal articles and ignoring that public. Juan Cole, President of the Global Americana Institute put it in context by advising climate scientists that "*publishing only in technical refereed journals is guaranteed to quarantine the information away from the general public*" (Informed Comment, http://www.juancole.com, 28 Feb. 2010). This should have been proven beyond reasonable doubt by the notorious events initiated by climate skeptics preceding the Copenhagen meetings, the anticipated agreements that were not achieved, and the widespread storm of controversy alleging a global conspiracy that has arisen.

There is a caution when dealing with public media, simply because most scientists have little or no training to handle media interviews. When asked a question with a potential negative impact, the scientist may honestly respond with statements beginning with "*No, but . . .*", when he really should say "*Yes, and this is why . . .*", because the interviewer almost invariably hears only the "*No*". This trap was demonstrated in a BBC interview on 13 February 2010

(http://news.bbc.co.uk/2/hi/science/nature/8511670.stm),

when CRU Director, Phil Jones was asked: "*Do you agree that from 1995 to the present, there has been no statstically-significant global warming?*" Jones replied (quote): "*Yes, but only just. I also calculated the trend for the period 1995-2009. This trend (0.12 per decade) is positive, but not significant at the 95% significance level. The positive trend is quite close to the significance level. Achieving statistical significance in scientific terms is much more likely for longer periods and much less likely for shorter periods*" (unquote). The Daily Mail newspaper immediately picked up on the interview

(http://www.dailymail.co.uk/news/article-1250872/),

stripped it of its context, and reported the following: "*Climategate U-turn as scientist at centre of row admits: There has been no global warming since 1995*" This is 'freedom of the press full circle', and it is entirely valid to question how far journalistic freedom should be allowed to stray from truth?

CMOS Members' Responses?

An attack on climate science and on climate scientists is an attack on the whole membership of CMOS. It has been suggested that CMOS give careful consideration to whether we should as a society respond to dishonest tactics against climate science and scientists, and what form those responses should take, especially when many of our individual members, such as government scientists, have tight restrictions on dealing with media. The various Science Position Statements we have on climate change

(http://www.cmos.ca/policies.html)

are necessary, but do not cover the needs identified here. CMOS could do more to defend our sciences and scientists, but more importantly, to defend future generations threatened by very real potential climate catastrophes with a more proactive approach now. I urge our membership to express their concerns and suggestions to CMOS, particularly with respect to the above public education challenge to climate scientists.

Graduate and Post-doctoral Fellowships at Dalhousie University

Graduate and post-doctoral fellowships in ocean observation, modeling and data assimilation are available at Dalhousie University through a newly funded NSERC Strategic Network Grant (SNG). The SNG builds on the Ocean Tracking Network, a global, $168-million conservation project, which is conducting the world's most comprehensive and revolutionary examination of the movement of marine life and its relationship to changing ocean conditions (http://oceantrackingnetwork.org).

We are currently seeking six graduate and three post-doctoral fellows with strong quantitative abilities who will participate in the implementation of an integrated observation and modeling system. The system will include cutting-edge ocean measurements (through sensors on ocean gliders, moorings and animals), physical and biological models, and advanced data assimilation, and is funded through the SNG. The initial geographic focus is the Northwest Atlantic Ocean and adjacent shelf seas.

- One graduate fellowship is available for analysis of mooring data (contact: Blair Greenan <Blair.Greenan@dfo-mpo.gc.ca> or Peter Smith <Peter.Smith@dfo-mpo.gc.ca>).
- One graduate fellowship is available for analysis of physical and bio-optical data from gliders (contact John Cullen <John.Cullen@dal.ca>).
- One graduate fellowship is available for analysis of sensor data (lab and field) from fish (contact Christopher Taggart <Chris.Taggart@dal.ca>).
- One graduate and one post-doctoral fellowship are available for the development of nested physical models (contact Jinyu Sheng <Sheng@dal.ca>).
- One graduate and one post-doctoral fellowship are available for coupled physical-biological modeling (contact Katja Fennel <Katja.Fennel@dal.ca>).
- One graduate and one post-doctoral fellowship are available for implementation of advanced data assimilation techniques (contact Keith Thompson <Keith.Thompson@dal.ca>).

An expression of interest should be accompanied by a curriculum vitae, transcripts (unofficial are acceptable for now) and a brief statement of research interests and goals. Consideration of applications will begin immediately and continue until positions are filled. Post-doctoral fellowships are for one year initially with possible extension to up to 3 years based on satisfactory performance. Fellowships are located at Dalhousie University's Oceanography Department (http://oceanography.dal.ca) in Halifax, Nova Scotia, Canada.

Ocean Science Programs

Two new working groups were formed at SCOR's 2009 Annual Meeting.

1) SCOR WG136: Climatic Importance of the Greater Agulhas System
The overarching goal of this new working group is to improve understanding and awareness of the global climate impacts of the greater Agulhas Current system. Although this system is, by nature, regional, the WG's thrust is about understanding changes in the Atlantic Meridional Overturning Circulation (AMOC) and climate that are forced from the southern hemisphere - i.e. by Agulhas leakage - hence the implications are of global significance. The WG plans to hold regular planning meetings leading to a review publication and a steering report that raises the profile of this important region, both in terms of its climatic significance and in terms of the representation it deserves as part of the Global Ocean Observing System. The WG will be co-funded through the World Climate Research Programme. The co-chairs are Lisa Beal (U Miami) and Anne Biastoch (IFM-GEOMAR, Germany). There are no Canadian members. The full WG proposal can be seen at:

http://www.scor-int.org/2009EC/Agulhas.pdf

2) SCOR WG 137: Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation
Information on this new group will be reported when it becomes available.

Call for Proposals for New SCOR Working Groups

The XXXth SCOR General Meeting will take place in Toulouse, France on **14-16 September 2010**. Preliminary information is now available at:

http://www.scor-int.org/2010GM/2010GM.htm

The French SCOR Committee will convene a one-day symposium on **13 September** to highlight French ocean science and its contributions to SCOR. The SCOR Secretariat will accept proposals for new working groups from now until **14 April 2010**. Model proposals and other information about working groups can be found on SCOR's website at:

http://www.scor-int.org/wkgrpinfo.htm

SCOR examines the disciplinary balance of its working groups annually. The 2009 evaluation found that the set of SCOR working groups is relatively balanced. For 2010, SCOR particularly welcomes proposals based in marine geology, chemistry and paleoecology and related disciplines. Additionally, SCOR would welcome proposals specifically in:

- Climate-related studies in preparation for the next IPCC assessment;
- Identifying limitations to prediction and confidence in the future state of the ocean;
- Interactions and mechanisms in abrupt climate change;
- Human health and disaster impact;
- Sea level changes and ice movement.

Each proposal will be evaluated by national SCOR committees in terms of scientific merit and quality, timeliness, and achievability of the proposed terms of reference. SCOR tentatively plans to start two new working groups in 2011, pending availability of adequate funding. SCOR may be able to approve more than two new groups if they are partially funded by other organizations or national bodies.

Canadian proposals for new working groups should be submitted through the CNC-SCOR Chair at rob.macdonald@dfo-mpo.gc.ca

Changes to CNC-SCOR Membership

The Canadian National Committee for SCOR is composed of ten members, including the Chair, the immediate Past Chair, the Secretary and 7 others. Members are appointed for a 3 year term that may be renewed once. New members are selected every year to assure a steady rotation, and this year's new members are Catherine Johnson and Gary Stern.

Catherine Johnson is a research scientist with Fisheries and Oceans Canada in the Ecosystem Research Division at the Bedford Institute of Oceanography in Dartmouth, NS. Her research interests include the ecology and life history of marine zooplankton, long-term changes in zooplankton populations and communities, interactions between the physical environment and zooplankton, and environmental monitoring. She received her PhD from the University of California, San Diego in 2003. She is currently a member of the ICES GOOS Steering Group and the Scientific Steering Committee for the Fifth International Zooplankton Production Symposium.

Gary Stern is a Senior Research Scientist with Fisheries and Oceans Canada in Arctic Ecosystem Health and also holds a DFO Research Chair position with the Department of Environment and Geography at the University of Manitoba. His research involves the study of environmental

pathways of contaminants, including their delivery, transport, and elimination from Arctic marine and freshwater aquatic ecosystems. In particular, it is directed toward linking contaminant levels in Arctic marine food webs to oceanographic provinces, inputs from land and the atmosphere and ultimately, climate variation which has been shown to alter for example, hydrology, organic carbon, sea ice dynamics, primary productivity, foodweb structure and foraging of top trophic level feeders such as beluga and ringed seals. Currently, he is the co-leader of the Circumpolar Flaw Lead (CFL) System Study, the largest IPY project in the world, and the newly funded ArcticNet Phase II proposal entitled "Effects of Climate Change on Carbon and Contaminant Cycling in the Arctic Coastal and Marine Ecosystems: Impacts, Prognosis and Adaptations Strategies". He also leads two major projects funded by the Fisheries Joint Management Committee (FJMC) and the Nunavut Wildlife Research Trust Fund (NWMTF) to study the effects of climate change on mercury in marine mammals. In collaboration with colleagues from the Department of Fisheries and Oceans, other government departments and universities, Dr Stern has contributed to, either as lead or co-author, to approximately 100 publications in the open literature.

Thanks to Allyn Clarke and David Barber, who have left the Committee after serving two three-year terms.

Rescuing old oceanographic data

Consciousness has grown in the last decade across the whole of science about the need for permanent data archives with a capability for broad access. Canadian oceanographers are a bit fortunate that DFO had recognized the issue and begun to 'rescue' irregular departmental data repositories by the early 1990s. But how fortunate are we?

Christopher Taggart (Dalhousie University) wrote (Oct. 5, 2009):

I was recently contacted by GLOBEC's International Project Office (Plymouth Marine Lab, UK) about archiving data. My response was as follows:

I have much GLOBEC related data and even more from non-GLOBEC sources that may be of value (physical and biological). These data have never been properly archived. I have neither time nor funds nor internal/external support to properly archive the data.

If you know of a funding source to achieve the archiving, I would happily follow-up. Otherwise, when I "go" the data also "go". It is a sad situation and within the academic sector it is a ubiquitous problem that is only getting worse as the first generation of "digital" scientists fades into history along with their hard-disks and floppies, and in most cases paper records do not exist. Most government agencies are on top of this, but they ignore the academic sector and the academic sector has no means or funds to achieve it.
It is high time, at least in Canada and perhaps elsewhere in the world, that agencies such as NSERC and other government bodies recognized the impending loss of much data (some already gone with the leading-edge of retirements now coming on strong) and mobilized an archiving programme with funding before it is too late. We stand to lose nigh-on two or more decades of data.

Perhaps the Canadian National Committee for SCOR would champion this?

We asked Robert Keeley (DFO, Ottawa) to comment on this situation. He wrote on November 24, 2009:

In Science we have had special funding support each year for the last five years for data management activities, and some of this is used for data rescue. It is complicated to provide funding to Universities to do this work from our fund. Another complication arises from the fact that DFO also has data in need of rescue. We need good reasons to choose rescuing data held outside of DFO over those data held internally.

One way to proceed is to arrange the transfer of the data from a university to a DFO office so that at least the data will not be lost. It will take some work to be sure everything in the collection is clear and understood, but once that is done, we can be a bit more deliberate about converting the data into archives. Once within DFO, a data rescue is easier to accomplish with DFO funding. The Integrated Science Data Management group has been the recipient of such data sets from time to time and it is not a very satisfactory way to do things, but if the choice is do this or lose the data, I would rather see us try this. The proviso is that once the data come under DFO custody, our rules for release of data apply.

This could be the tip of a data iceberg and dealing with a single data set in this way is possible. Dealing with many will be very difficult. Some more sensible arrangement for data stewardship is needed.

This interesting correspondence raises a few questions:

- Whose responsibility is it in Canada to ensure that recent and historical oceanographic data are not lost? Whose responsibility is it to fund permanent data archives?
- Whose responsibility is it to ensure that the broader community has access to permanent data archives? What might a "sensible arrangement for data stewardship" look like?

The debate is open for discussion.

Source: Canadian Ocean Science Newsletter, Vol.48, January 2010.

CMOS 2010 Photo Contest

All members with a photographic bent are invited to participate in the 2010 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, 2010.** If you have any questions please contact Bob Jones at webmaster@cmos.ca.

Concours photographique 2010 de la SCMO

Tous les membres qui ont une passion pour la photographie sont invités à participer au concours de photographie 2010 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 2010.** Pour toutes questions, prière de contacter Bob Jones à webmaistre@scmo.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.

Les résumés qui suivent paraîtront sous peu dans votre prochaine revue ATMOSPHERE-OCEAN.

Climate Trends at Eureka in the Canadian High Arctic

by G. LESINS, T. J. DUCK and J. R. Drummond

Abstract
Weather observations made at Eureka, on Ellesmere Island in the Canadian High Arctic, have been archived since 1953. The time series, averages and seasonal cycles of surface temperature, pressure, dew point, relative humidity, cloud cover, wind speed and direction are presented for the period from 1954 to 2007. Also shown are the time series and averages for the 500 mb temperature, 900 to 500 mb thickness, 500 mb wind speed and various boundary-layer stability parameters. Some of the main trends found are 1) an annual average surface warming of 3.2°C since 1972, with summer exhibiting the least warming; 2) a reduction in the frequency of strong anticyclonic events in the winter; 3) a reduction in surface wind speeds except in the summer; 4) a 1.0°C warming in the 500 mb temperature since 1961, with the greatest warming occurring in the spring and summer; and, 5) a 10% increase in precipitable water all year round since 1961 but dominated by the spring, summer and autumn seasons. The importance of open water in the Arctic Ocean for summer temperatures and humidity, of the North Atlantic Oscillation for winter interannual pressure variability, and of precipitable water for winter temperatures are highlighted in this climatology.

Résumé
Les observations météorologiques faites à Eureka, sur l'île Ellesmere, dans l'Arctique canadien septentrional, ont été archivées depuis 1953. Nous présentons les séries chronologiques, les moyennes et les cycles saisonniers de la température de surface, de la pression, du point de rosée, de l'humidité relative, de la couverture nuageuse ainsi que de la vitesse et de la direction du vent pour la période allant de 1954 à 2007. Nous présentons également les séries chronologiques et les moyennes pour la température à 500 mb, l'épaisseur 900-500 mb, la vitesse moyenne du vent à 500 mb et divers paramètres de stabilité dans la couche limite. Certaines des principales tendances que nous trouvons sont 1) un réchauffement annuel moyen à la surface de 3,2 °C depuis 1972, l'été étant le moment du plus faible réchauffement; 2) une réduction de la fréquence des forts événements anticycloniques en hiver; 3) une réduction de la vitesse moyenne des vents de surface, sauf en été; 4) une augmentation de 1,0 °C de la température à 500 mb depuis 1961, le réchauffement le plus marqué se produisant au printemps et à l'été; et, 5) une augmentation de 10 % de l'eau précipitable toute l'année depuis 1961 mais plus particulièrement au printemps, à l'été et à l'automne. Cette climatologie met en évidence le rôle important de l'eau libre dans l'océan Arctique relativement aux températures et à l'humidité en été, de l'oscillation Nord-Atlantique relativement à la variabilité interannuelle de la pression ainsi que de l'eau précipitable relativement aux températures en hiver.

Measurements of Drifting and Blowing Snow at Iqaluit, Nunavut, Canada during the STAR Project

by MARK GORDON, SUMITA BISWAS, PETER A. TAYLOR, JOHN HANESIAK, MARNA ALBARRAN-MELZER and SHANNON FARGEY

Abstract
A 10 m meteorological tower near Iqaluit Airport was operational from late October 2007 to early April 2008. Measurements included wind speed, temperature, pressure, humidity, visibility, and blowing snow number flux. Number flux measurements give a frequency of blowing and drifting snow of approximately 10% for the duration of the study, while meteorological observations from the Iqaluit weather office give a frequency of approximately 5%. Winter winds were predominantly from the northwest, and some strong southeasterly winds were also observed, especially in early spring. The average roughness length determined from the variance of wind speed is z_0 = 0.14 mm. Threshold wind speeds for the onset of blowing snow ranged from 7 m s^{-1} to 12 m s^{-1}, excluding events with falling snow. Measurements of visibility correlate well with the measured number density (R^2 = 0.83), assuming a constant particle diameter of $d \approx$ 100 µm at a height of 2 m. A camera system was used during blowing snow events in February to measure the size of blowing snow particles and the mass flux of blowing snow. At a height of 0.35 m, the particle size distribution can be approximated by a gamma distribution with shape parameter $4.4 < \alpha < 6.4$ and an average particle diameter of $70 < d < 148$ µm. The particle size at a height of 0.35 m increases linearly with the 10 m wind speed (R^2 = 0.69). Mass flux measurements demonstrate a power law relation with height between 0.1 and 0.9 m, with a negative exponent of approximately 2.5.

Blowing snow density follows a power law relation with height between 0.85 and 1.85 m, with a negative exponent of approximately 1.3 for friction velocity $0.25 < u_* < 0.55$ m s^{-1}. In February 2008, a field mill was installed, which

measured electric field strengths as high as 26.2 kV m^{-1} at a height of 0.5 m.

Résumé
Une tour météorologique de 10 m près de l'aéroport d'Iqaluit a été en fonction de la fin d'octobre 2007 jusqu'au début d'avril 2008. Les mesures portaient, entre autres, sur la vitesse du vent, la température, la pression, l'humidité, la visibilité et le flux en nombre de la poudrerie élevée. Les mesures de flux en nombre donnent une fréquence de poudrerie élevée et basse d'environ 10 % pour la durée de l'étude alors que les observations météorologiques provenant du bureau météorologique d'Iqaluit donnent une fréquence d'environ 5 %. Les vents dominants en hiver étaient du nord-ouest et de forts vents du sud-est ont aussi été observés, surtout au début du printemps. La longueur de rugosité moyenne déterminée d'après la variance de la vitesse du vent est z_0 = 0,14 mm. Les vitesses de vent seuils pour les événements de poudrerie variaient de 7 m s^{-1} à 12 m s^{-1}, à l'exclusion des cas où il tombait de la neige. Les mesures de visibilité concordent bien avec la densité en nombre mesurée (R^2 = 0,83), en supposant des particules de diamètre constant $d \approx$ 100 µm à une hauteur de 2 m. Un système à caméra a été utilisé durant les événements de poudrerie élevée pour mesurer la taille des particules de poudrerie et le flux en masse de la poudrerie. À une hauteur de 0,35 m, la distribution de la taille des particules peut être approximée par une distribution gamma avec un paramètre de forme 4,4 < α < 6,4 et un diamètre moyen des particules de 70 < d < 148 µm. La taille des particules à une hauteur de 0,35 m augmente linéairement avec la vitesse du vent à 10 m (R^2 = 0,69). Les mesures de flux en masse exhibent une relation de loi de puissance avec la hauteur entre 0,1 et 0,9 mètre, avec un exposant négatif d'approximativement 2,5. La densité de la poudrerie élevée suit une relation de loi de puissance avec la hauteur entre 0,85 et 1,85 m, avec un exposant négatif d'approximativement 1,3 pour une vitesse de frottement 0,25 < u_* < 0,55 m s^{-1}. En février 2008, un moulin à champ a été installé et cet instrument a mesuré des intensités de champ électrique allant jusqu'à 26,2 kV m^{-1} à une hauteur de 0,5 m.

A 3-D Data-Assimilative Tidal Model of the Northwest Atlantic

by GUOQI HAN, SHASTRI PATURI, BRAD DE YOUNG, YUCHAN YI and C.-K. SHUM[3]

Abstract
A three-dimensional (3-D) barotropic tidal model for the northwest Atlantic is developed for eight leading semi-diurnal (M_2, S_2, N_2, K_2) and diurnal (K_1, O_1, P_1, Q_1) tidal constituents based on the Princeton Ocean Model (POM). Multi-mission altimetric tidal data are assimilated into the model using a simple nudging scheme. The assimilative model results are validated against independent in situ observations and compared with a non-assimilative run and previous tidal models. The root-sum-square error for the assimilative M_2, S_2, N_2, K_1 and O_1 tidal elevations is 3.1 cm excluding the Bay of Fundy region and 10.1 cm otherwise. Assimilation improves the accuracy of the model tidal elevation by 40-60% and that of the tidal currents by 20-30%. The semi-diurnal tidal currents agree better with observations than do the diurnal constituents. The model K_1 and O_1 tidal currents are intensified on several outer-shelf areas, qualitatively consistent with shelf-wave theory and moored measurements, but quantitatively overestimated over the outer Labrador Shelf. Results show that the present assimilative model reproduces the primary tidal constituents better than previous regional and inter-regional models. In particular, the present model results are as accurate as those of Egbert and Erofeeva (2002) for the Northwest Atlantic shelf seas as a whole and better if the Bay of Fundy is excluded, pointing to the importance of the high-resolution multi-satellite tides to partially compensate for the simple assimilation technique.

Résumé
Nous mettons au point un modèle tridimensionnel barotrope de marée pour l'Atlantique Nord-Ouest pour huit composantes principales de marée semi-diurne (M_2, S_2, N_2, K_2) et diurne (K_1, O_1, P_1, Q_1) basé sur le modèle océanique de Princeton (POM). Les données altimétriques de marées de plusieurs missions sont assimilées par le modèle au moyen d'un schéma simple de poussée. Les résultats du modèle assimilatif sont validés par rapport à des observations *in situ* indépendantes et comparées à une passe non assimilative et aux modèles de marée précédents. L'erreur quadratique résultante pour les élévations de marée M_2, S_2, N_2, K_1 et O_1 assimilatives est de 3,1 cm en excluant la baie de Fundy et de 10,1 cm autrement. L'assimilation améliore l'exactitude de l'élévation de la marée du modèle de 40 à 60 % et celle des courants de marée de 20 à 30 %. Les courants de marée semi-diurne concordent mieux avec les observations que les composantes diurnes. Les courants de marée K_1 et O_1 du modèle sont intensifiés dans plusieurs zones de la plate-forme continentale extérieure, ce qui correspond qualitativement à la théorie des vagues de plate-forme et aux mesures de bouées mais qui, quantitativement, mène à une surestimation sur la plate-forme du Labrador extérieure. Les résultats montrent que le présent modèle assimilatif reproduit mieux les composantes de marée principales que les modèles régionaux et interrégionaux précédents. En particulier, les résultats du présent modèle sont aussi précis que ceux d'Egbert et Erofeeva (2002) pour l'ensemble des mers de la plate-forme de l'Atlantique Nord-Ouest et meilleurs si l'on exclut la baie de Fundy, ce qui fait ressortir l'importance des données de marées multisatellite haute résolution pour compenser partiellement la technique d'assimilation simple.

Drought and Associated Cloud Fields over the Canadian Prairie Provinces

by HEATHER GREENE, HENRY G. LEIGHTON AND RONALD E. STEWART

Abstract
Little is known about clouds during drought. From 1999 to 2005 the Canadian Prairies experienced one of the most severe and prolonged droughts in the historical record. This study characterizes clouds during drought in the Canadian Prairie Provinces with a particular focus on this recent drought.

Drought severity was determined using the Standardized Precipitation Index (SPI) based on monthly precipitation on a 1^{o}x1^{o} grid. Cloud fields from the National Aeronautics and Space Administration/Global Energy and Water Experiment's (NASA/GEWEX) Surface Radiation Budget database were used to examine overall cloud amount, optical thickness, and top-of-the-atmosphere albedo. Anomalies in monthly precipitation in the satellite record from 1984 to 2004, with an emphasis on the recent drought from 1999 to 2004, were related to anomalies in cloud fields.

During drought, a decrease in cloud amount was observed. During the spring and summer months of the 1999-2004 drought, for example, the observed cloud cover fraction decreased by approximately 7% between severely wet and severely dry conditions. There was, however, large month-to-month and spatial variability, and the correlation of cloud cover fraction anomaly with precipitation was weak. A higher correlation was found between the top-of-the-atmosphere albedo and precipitation. The occurrence of thick clouds and clouds of medium thickness did decrease with drought severity. These trends also applied to sub-regions within the overall domain. These observations further the understanding of the role of clouds in feedback mechanisms during drought.

Résumé
On sait peu de choses à propos des nuages durant les sécheresses. De 1999 à 2005, les Prairies canadiennes ont connu l'une des périodes de sécheresse les plus longues et les plus intenses depuis que l'on tient des relevés. La présente étude porte sur les nuages durant les périodes de sécheresse dans les Prairies canadiennes, en mettant l'accent sur les sécheresses récentes.

Nous avons déterminé l'intensité des sécheresses au moyen de l'indice de précipitations normalisé (SPI) fondé sur les précipitations mensuelles sur une grille de 1^{o} x 1^{o}. Nous avons étudié les champs de nuages obtenus de la base de données du bilan radiatif de la surface du GEWEX (Expérience mondiale sur les cycles de l'énergie et de l'eau) de la NASA pour examiner l'étendue générale des nuages, l'épaisseur optique et l'albédo du sommet de l'atmosphère. Nous avons mis en relation les anomalies dans les précipitations mensuelles d'après les données satellitaires de 1984 à 2004, en mettant l'accent sur la sécheresse récente de 1999 à 2004, avec les anomalies dans les champs de nuages.

Pendant les sécheresses, nous avons noté une diminution de l'étendue des nuages. Durant les mois de printemps et d'été de la période de sécheresse de 1999 à 2004, par exemple, la fraction de couverture du ciel observée a diminué d'environ 7 % entre les conditions très humides et très sèches. Cependant, la variabilité intermensuelle et spatiale est grande, et la corrélation de l'anomalie de la fraction de couverture nuageuse avec les précipitations est faible. Nous avons trouvé une meilleure corrélation entre l'albédo du sommet de l'atmosphère et les précipitations. La quantité de nuages épais et de nuages d'épaisseur moyenne diminuait quand l'intensité de la sécheresse augmentait. Ces tendances s'observent aussi dans les sous-régions à l'intérieur domaine général. Ces observations permettent de mieux comprendre le rôle des nuages dans les mécanismes de rétroaction au cours des sécheresses.

ATMOSPHERE-OCEAN 48-1 Paper Order

A Systems Dynamic Modelling Approach to Assessing Elements of a Weather Forecasting System by V. RAJASEKARAM, G. A. MCBEAN and S. P. SIMONOVIC

Impact Study with Observations Assimilated over North America and the North Pacific Ocean on the MSC Global Forecast System. Part I: Contribution of Radiosonde, Aircraft and Satellite Data by STÉPHANE LAROCHE and RÉAL SARRAZIN

Impact Study with Observations Assimilated over North America and the North Pacific Ocean on the MSC Global Forecast System. Part II: Sensitivity Experiments by STÉPHANE LAROCHE and RÉAL SARRAZIN

A 3-D Data-Assimilative Tidal Model of the Northwest Atlantic by GUOQI HAN, SHASTRI PATURI, BRAD DE YOUNG, YUCHAN YI and C.-K. SHUM

SHORT NEWS / NOUVELLES BRÈVES

Climate foundation deplores budget blind spot

(Ottawa, March 5th, 2010) – The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), Canada's lead agency for climate research in our universities, is acutely disappointed at the Budget's abandonment of climate sciences and highly-qualified people.

Innovation and economic growth need skilled people and a healthy research environment. Nowhere is this more true than in weather and climate - where we face some of the biggest scientific problems confronting humanity. The government and Canada's $400B per year weather-dependent industries need a constant supply of new information for their policy, regulatory and investment decisions. This is supplied by world-class scientists — people dedicated to understanding Canada's air quality, violent weather, climate and Arctic conditions. CFCAS urgently calls on the Government to reinvest in research, in skilled people and in Canada's knowledge economy in this vital area.

"*Budget 2010 is basically the nightmare scenario for scientists across the country – our community is gutted*," said **Gordon McBean**, Chair of CFCAS. "*Science is the best tool for building sound policy to adapt to, and mitigate, climate change, and to protect the environment and Canadians. There is so much to learn, to be discovered and transformed into effective actions for Canadians. Without sound scientific information, how will the government evaluate the effectiveness of green technologies, or build northern infrastructure, or develop our energy industry, or assure water supply and clean air?*"

Most research studies in these sectors are funded by one agency – the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS). CFCAS has invested over $117 million in 198 research initiatives across Canada since 2000. The work has led to breakthroughs in climatology, meteorology and oceanography, many of which have transformed operations in the federal government and private companies.

But CFCAS has received no new federal funds for six years. In less than 12 months, major research collaborations among industry, government laboratories and universities will collapse – and with them the jobs of numerous scientists, students and technicians. The country is already bleeding talent. Programs to attract new scholars will not achieve their objectives if the country is unwilling to support and retain current ones.

La recherche sur le climat oubliée dans le budget

(Ottawa, 5 mars 2010) – La Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA), principal organisme canadien appuyant la recherche sur le climat dans nos universités, est très déçue par le dernier budget fédéral et déplore qu'il laisse tomber les sciences du climat et les personnes hautement qualifiées qui y sont liées.

L'innovation et la croissance économique exigent des personnes qualifiées et un environnement de recherche sain. Cela est particulièrement vrai dans les domaines de la météo et du climat dont relèvent certains des problèmes scientifiques qui comptent parmi les plus importants que l'humanité doit confronter. Le gouvernement et les industries canadiennes dépendantes du climat, qui représentent 400 milliards de dollars par année, ont besoin constamment de nouvelles informations pour leurs décisions en matière de politiques, de réglementation et d'investissements. Ces informations sont fournies par des scientifiques de classe mondiale – des personnes qui se consacrent à l'étude de la qualité de l'air, des phénomènes météorologiques violents, du climat et des conditions arctiques. La FCSCA lance un appel pressant au gouvernement pour qu'il encourage à nouveau la recherche, le talent et l'économie canadienne de la connaissance dans ces domaines d'importance cruciale.

Gordon McBean, président de la FCSCA, assimile le budget de 2010 à un scénario cauchemardesque pour les scientifiques du pays. La communauté scientifique est dévastée, dit-il. La science est le meilleur outil afin d'élaborer des politiques rationnelles pour l'adaptation aux changements climatiques, l'atténuation de leurs effets et la protection de l'environnement et des Canadiens. Il y a tant d'informations à acquérir, de découvertes à faire et de connaissances à transformer en actions efficaces au profit des Canadiens. En l'absence d'informations scientifiques pertinentes, demande M. McBean, comment le gouvernement s'y prendra-t-il pour évaluer l'efficacité des technologies vertes, construire des infrastructures dans le Nord, développer notre industrie de l'énergie ou assurer des ressources en eau adéquates et la qualité de l'air que nous respirons?

La majorité des études scientifiques dans ces secteurs sont financées par un organisme : la Fondation canadienne pour les sciences du climat et de l'atmosphère. Depuis 2000, la FCSCA a consacré plus de 117 millions de dollars à la réalisation de 198 initiatives de recherche au Canada. Cet investissement a permis des percées considérables en climatologie, en météorologie et en océanographie, dont un bon nombre qui ont transformé les activités du

gouvernement fédéral et d'entreprises privées.

Or, depuis six ans, la FCSCA n'a bénéficié d'aucune nouvelle injection de fonds fédéraux. Dans moins de 12 mois seront anéanties des collaborations majeures de recherche entre entreprises, laboratoires gouvernementaux et universités – ainsi que les emplois de nombreux scientifiques, étudiants et techniciens. Déjà le pays voit ses talents s'expatrier. Les programmes visant à attirer de nouveaux universitaires n'atteindront pas leurs objectifs si le pays n'est pas disposé à appuyer et à retenir ceux qu'il a déjà.

Three New Fisheries and Oceans Canada Science Videos Now Available

Three new Fisheries and Oceans Canada videos about aquatic sciences have just been posted on the Government of Canada's science portal:

www.science.gc.ca

1) Revealing a Hidden Realm: Canada's First Biodiversity Corridor tells the story of collaborative scientific work to explore the Discovery Corridor in the Gulf of Maine, its biodiversity and previously unknown species and processes.

2) Cold Water Corals of Canada: Oasis of the Deep is an educational look at stunning corals of Atlantic Canada captured on video using ROPOS.

3) Scott and Crossman: The Freshwater Fishes of Canada is the story of scientist emeritus William Beverly (Bev) Scott, formerly of the Royal Ontario Museum and the Huntsman Marine Science Centre and Edwin (Ed) J. Crossman, formerly of the Royal Ontario Museum, authors of the definitive texts on freshwater fish in Canada.

Trois nouvelles vidéos scientifiques du Ministère des Pêches et Océans Canada maintenant disponibles

Trois vidéos du Ministère des Pêches et Océans Canada, sur les sciences aquatiques, viennent d'être placées sur le portail scientifique du gouvernement du Canada:

www.science.gc.ca

1) Exploration d'un royaume caché relate les travaux scientifiques menés en collaboration pour étudier un corridor du golfe du Maine, sa biodiversité et les espèces et processus encore inconnus qu'il contient.

2) Oasis des profondeurs : les coraux des eaux froides de l'Atlantique canadien fait connaître les splendides coraux de l'Atlantique canadien. La vidéo a été tournée grâce au ROPOS.

3) Scott and Crossman : Poissons d'eau douce du Canada raconte l'histoire de William Beverly (Bev) Scott, un éminent scientifique qui a autrefois travaillé au Musée royal de l'Ontario et au Centre des sciences de la mer Huntsman, et de Edwin (Ed) J. Crossman, qui était autrefois au Musée royal de l'Ontario. Ces deux chercheurs sont les auteurs de textes qui font autorité sur les poissons d'eau douce du Canada.

New world record wind gust

According to a recent review and evaluation conducted by a panel of experts in charge of global weather and climate extremes within the WMO Commission for Climatology (CCl), the new record wind gust, not related to tornados, registered to date is 408 kilometres per hour. This record occurred during Tropical Cyclone *Olivia* on 10 April 1996 on Barrow Island, Australia. The previous record was of 372 kilometres per hour, registered in April 1934 across the summit of Mount Washington, New Hampshire (USA).

Source: WMO Website posted on January 22 and visited on February 11, 2010.

Sea Level Rise: Retreat, Defend, Attack?

The think-piece entitled "*Facing up to Rising Sea Levels: Retreat, Defend, Attack?*", by the Royal Institute of British Architects and the Institution of Civil Engineers, presents scenarios for coastal and estuarine cities and proposes three main approaches to dealing with extreme flooding and rising sea levels - retreating inland, creating habitable defence structures and building out into the sea - http://www.buildingfutures.org.uk/projects/building-futures/facing-up.

Myths Associated with ICZM

The author of the perspective entitled "*Integrated Coastal Zone Management: four entrenched illusions*", published in SAPIENS, outlines four illusions associated with ICZM: 1) round table discussions can solve any problem; 2) the myth of the coastal manager; 3) the community illusion; and, 4) the positivist illusion. It is argued that these illusions result from unproved conceptual over-simplifications and lead to a naive conception of action that often impedes ICZM implementation - http://sapiens.revues.org/index198.html.

IOC Conference

"*50 Years of Education and Awareness Raising for Shaping the Future of the Oceans and Coasts*" IOC Conference will be held 27-30 April 2010 in Saint Petersburg, Russia. For more information, http://www.ioc50.ru.

UNESCO Report on Climate Change

The UNESCO publication entitled "*Climate Change and Arctic Sustainable Development*" documents the knowledge, concerns and visions of Arctic scientists, leaders and international experts. Topics include: ice, oceans and atmosphere; biodiversity and ecosystems services; community-level impacts and adaptation; and monitoring systems. Purchase information is available at http://publishing.unesco.org/details.aspx?Code_Livre=4722.

IPCC under Review

The InterAcademy Council, a multinational body of science academies, has been asked to conduct an independent review of the processes and procedures of the Intergovernmental Panel on Climate Change (IPCC). The review was requested by the United Nations Secretary-General and the chair of the IPCC - http://www.nationalacademies.org/morenews/20100310.html.

CMOS Accredited Consultants
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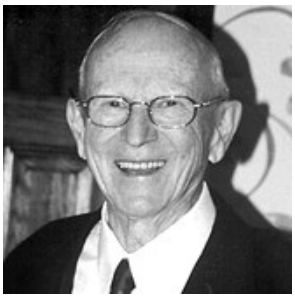
In Memoriam

Waldemar (Wally) Gutzman

1920 – 2010

Waldermar Gutzman passed away on January 6 at the Lakeshore General Hospital, in his ninetieth year. He was blessed with a full and happy life; one that he has shared for almost sixty years with his dearly beloved wife Wanda Patterson. He was the proud father of Beverley (Joe), Barbara (Richard) and Dr. Donald (Lyne), and special uncle of Heather Gray. Cherished Popa of four granddaughters and three grandsons.


Waldermar Gutzman

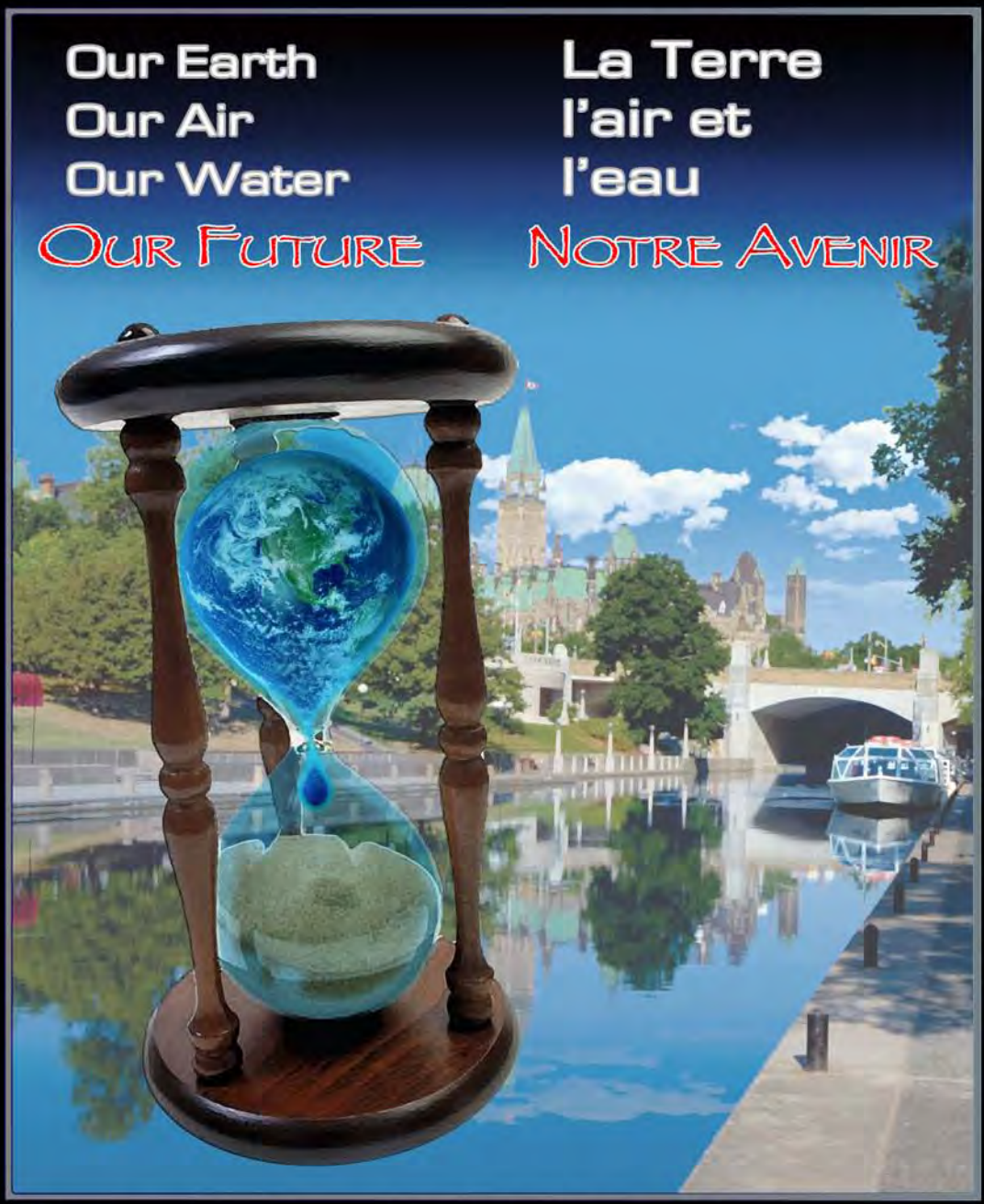
Wally was born in Petawawa, Ontario, the seventh child of William and Elizabeth Gutzman, whose parents were pioneers in that area. After his elementary education in a one-room schoolhouse, Wally won entrance to Pembroke Collegiate, and later a Maths and Physics scholarship to the University of Toronto. He graduated with an M.Sc. in meteorology and an M.A. in mathematics.

During WW II, he was attached to RAF Ferry Command at Goose Bay, Labrador as a Meteorologist, forecasting Atlantic weather for the delivery of war planes to Europe. After the war, Wally joined the developing Canadian Meteorological Centre, where he became Chief of Analysis and Forecasting prior to retiring in 1980. Ian Rutherford knew Wally very well during his time in Montreal (CYUO) during the '60s. Wally was one of the best forecasters at CMC at that time, in Ian's opinion, and was a great example for the younger staff.

Wally was an accomplished skier, gardener and collector, and published three books to capture his extensive knowledge in the latter. For many years, Wally and Wanda have been enthusiastic ballroom dancers and bridge players.

Our Earth
Our Air
Our Water
Our Future

La Terre
l'air et
l'eau
Notre Avenir



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