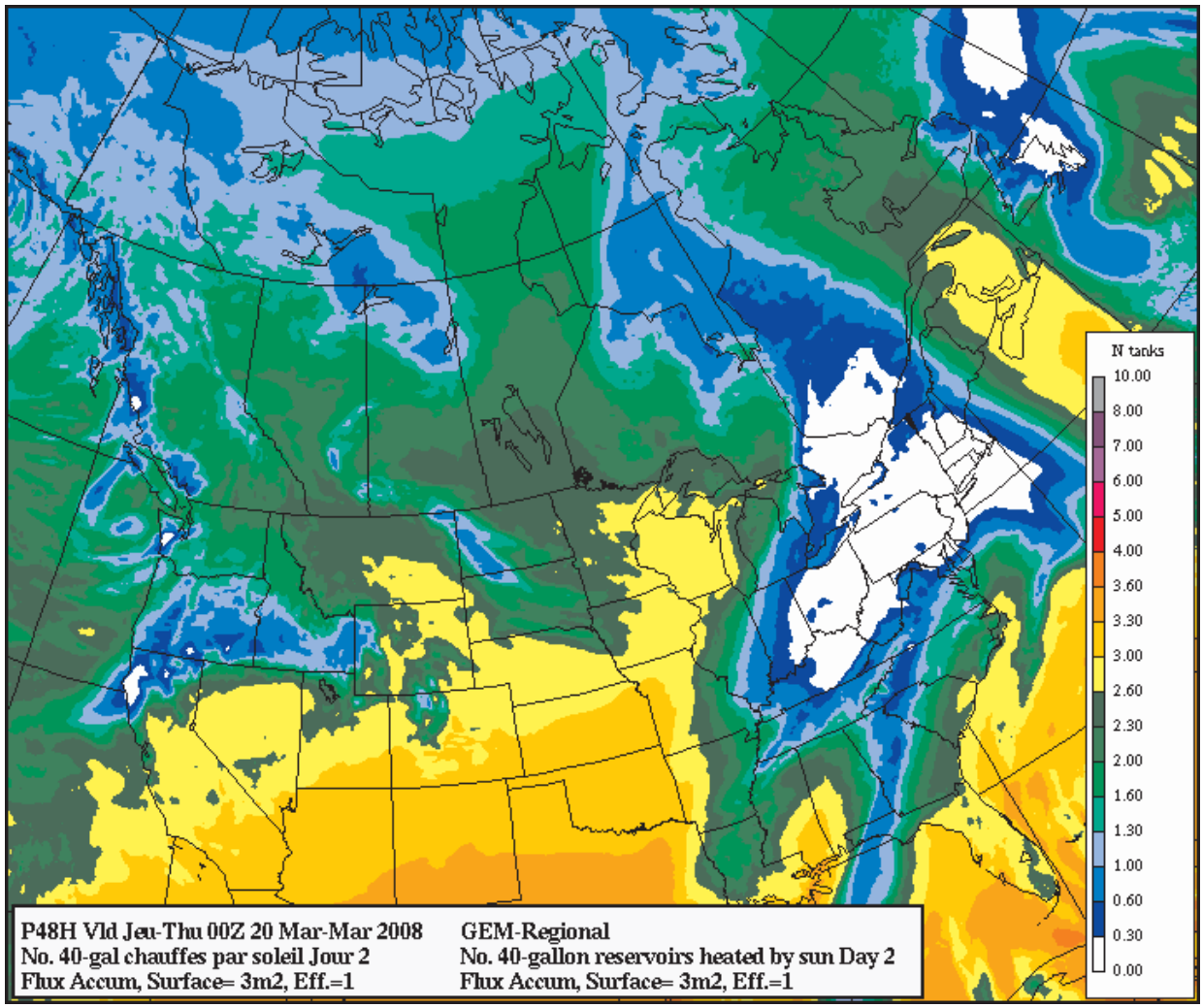
ISSN 1195-8898

CMOS
BULLETIN
SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

August / août 2008 Vol.36 No.4



2008 CMOS Photo Contest / Concours photographique 2008 de la SCMO

First Prize / Premier prix - *Supercell Panorama* by/par Dave Sills

Second Prize
Deuxième prix
Awesome Lightning
by/par John Hanesiak

Third Prize
Troisième prix
Advection Fog, Icebergs and Sea Gulls
by/par Geoff Strong

....from the President's Desk

Friends and colleagues:

Andy Bush
President of CMOS
Président de la SCMO

We all enjoyed a fantastic congress in Kelowna. Many thanks are given to the Chair of the Local Arrangements Committee, Kent Johnson, and the chairs of the Scientific Program Committee, Peter Jackson and Diane Masson.

Probably the most interesting recent development was the approval by council of CMOS becoming a part of the Canadian Societies for the Geophysical Sciences (CSGS). This exciting new development will allow more interaction between CMOS and CGU, and perhaps other earth science unions or societies who also wish to join. This organisation, which CGU Council also voted to join, will be able to coordinate congresses in such a way as to eliminate overlap, and hopefully bring CMOS and CGU together in one meeting as was done in St. John's in 2007 and will be done again in Ottawa in 2010.

Our meeting with the CFCAS Board of Trustees indicated the timeline for the Foundation, which appears to end the fiscal year 2010-2011. Nothing beyond that is in the works. NSERC will be restructuring the way their Discovery Grants are managed and reviewed, but not for another couple of years. So the funding future looks challenging indeed for climate science.

I look forward to the next year with CMOS and hope that we will be able to make some progress in advancing climate science both professionally and publicly.

I'd like to thank Paul Myers for his efforts over the past year and wish him a very relaxing sabbatical.

Andy Bush

President / Président
Canadian Meteorological and Oceanographic Society
Société canadienne de météorologie et d'océanographie

Volume 36 No.4
August 2008 — Août 2008

Inside / En Bref

from the President's desk
Allocution du président by/par Andy Bush **page 113**

Highlights of Recent CMOS Meetings **page 115**

Correspondence / Correspondance **page 116**

Articles

Renewable Energy Forecasts for solar water heaters by Lewis Poulin **page 118**

Concordia's Solar Laboratory preliminary use of forecast flux data in solar buildings applications by José Candanedo, Lewis Poulin, Yu Xiang Chen and Andreas Athienitis **page 127**

Patterson and Parsons Medals Presentation **page 131**

CMOS Prizes and Awards announced at the 42nd Annual Banquet **page 134**

Third Annual Photo Contest Report by Bob Jones **page 139**

CMOS 42nd Annual Congress Photo Memories by Paul-André Bolduc **page 140**

Our regular sections / Nos chroniques régulières

Book Review / Revue de littérature **page 141**

Short News / Nouvelles brèves **page 146**

CMOS Accredited Consultants / Experts-conseils accrédités de la SCMO **page 148**

Printed in Kanata, Ontario, by Gilmore Printing Services Inc.
Imprimé sous les presses de Gilmore Printing Services Inc., Kanata, Ontario.

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.

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

Editor / Rédacteur: Paul-André Bolduc
Associate Editor / Rédactrice associée: Dorothy Neale
Canadian Meteorological and Oceanographic Society
Société canadienne de météorologie et d'océanographie
P.O. Box 3211, Station D
Ottawa, ON, Canada K1P 6H7
E-Mail: bulletin@cmos.ca; Courriel: bulletin@scmo.ca

Cover page: Downward short wave solar flux reaching the surface available in CMC's regional model was used to make this experimental day-2 forecast of the number of 40-gallon tanks of hot water that can be produced by a 3 m^2 solar water heater. This type of information could assist in decision support systems in solar buildings applications. To learn more, read the articles on **page 118 and 127.**

Page couverture: Le flux solaire d'ondes courtes arrivant à la surface et fourni par le modèle régional du CMC a été utilisé pour faire une prévision expérimentale pour le jour 2, du nombre de réservoirs de 40-gallons qui peuvent être produits par un chauffe-eau solaire de 3 m^2. Ce type d'information pourrait aider à gérer les activités des édifices utilisant l'énergie solaire. Pour en apprendre plus, prière de lire les articles en **page 118 et 127.**

CMOS Executive Office / Bureau de la SCMO

P.O. Box 3211, Station D
Ottawa, Ontario, Canada, K1P 6H7
Fax / Fascimilé: 613-990-1617
homepage: http://www.cmos.ca
page d'accueil: http://www.scmo.ca

Dr. Ian Rutherford
Executive Director - Directeur exécutif
Tel/Tél.: 613-990-0300
E-mail/Courriel: cmos@cmos.ca

Dr. Richard Asselin
Director of / Directeur des Publications
Tel/Tél.: 613-991-0151
E-mail/Courriel: publications@cmos.ca

Ms. Qing Liao
Office Manager - Chef de bureau
Tel/Tél.: 613-991-4494
E-mail/Courriel: accounts@cmos.ca

Canadian Meteorological and Oceanographic Society (CMOS)

Société canadienne de météorologie et d'océanographie (SCMO)

Highlights of Recent CMOS Meetings

May Council Meeting

- Approval of CMOS joining the Canadian Societies for the Geophysical Sciences, (CSGS) which will create a tighter link between CMOS and CGU; Paul Myers, Andy Bush, and Geoff Strong met with CGU president John Pomeroy to discuss this about two weeks before bringing it to CMOS council;

- Updates on future congresses: Halifax, 2009 and Ottawa, 2010; some discussion on where the 2011 congress should be held;

- Overview of this year's CMOS tour speaker Ed Hudson and the talks he gave, which were all well received;

- New memberships were discussed, with the number at 14 since the last council meeting of March 25; all applications were approved;

- Update on publications: the Ozone special issue came out in March; a special issue on internal waves is now scheduled for December; a future special issue celebrating Canada's participation in the International Polar Year was discussed for publication in 2009;

- CMOS members participated in judging a Science Fair in Alberta, with Global television giving coverage.

Andy Bush,
CMOS President
Président de la SCMO

URGENT - URGENT - URGENT - URGENT

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **October 2008.** Please send your articles, notes, workshop reports or news items before **September 5, 2008** to the address given on page 114. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **octobre 2008.** Prière de nous faire parvenir avant le **5 septembre 2008** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page 114. Nous avons un besoin URGENT de vos contributions écrites.

Admiral Award

Above is a picture taken at St. John's City Hall Council Chambers of Cathy Hogan and Fraser Davidson accepting the Admiral Award on behalf of the CMOS-CGU-AMS Congress 2007. The Admiral Award is given in recognition of significant contribution to the enhancement of tourism in the City of St. John's. The representative of the Department of Tourism, when announcing the award winner, gave a conservative estimate of the CMOS-CGU-AMS Congress 2007 monetary contribution to the province to be in the neighbourhood of 1 - 1.5 million dollars.

Congratulations to the Local Arrangements Committee and particularly to Cathy Hogan and Fraser Davidson for their valuable contribution.

Debbie Power,
Department of Fisheries and Oceans
NAFC, St. John's, NL

Addendum to the Canadian Contributors to the IPCC

Ajout à la liste des contributeurs canadiens au GIEC

It is recognized that it is just about impossible to list all the Canadian contributors to the recent IPCC reports. But, nevertheless, the following names should be added to the list already published in the April issue:

- Brian Amiro and Paul Bullock, Soil Science, University of Manitoba;

- Hank Margolis, Université Laval.

Il est presque impossible d'établir avec certitude la liste complète des contributeurs canadiens au Groupe d'experts integouvernemental sur l'évolution du climat. Par contre, les trois noms ci-haut mentionnés doivent être ajoutés à la liste.

Ref.: *CMOS Bulletin SCMO*, Vol.36, No.2, page 73.

Correspondence / Correspondance

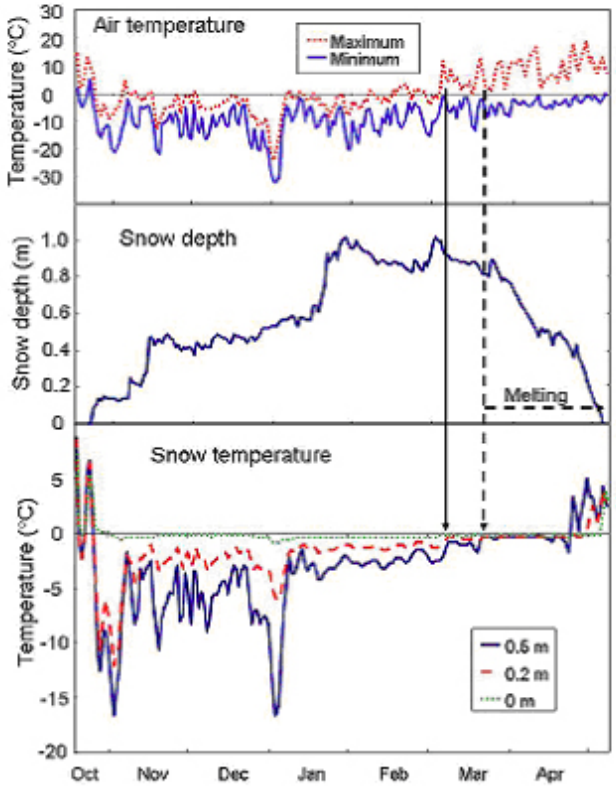
From: Dave Spittlehouse, BC Ministry of Forests and Range, Victoria, BC

To: Bob Jones, CMOS Webmaster

Date: April 26, 2008

Subject: The Temperature of Snow

I just saw your note (*CMOS Bulletin SCMO*, Vol.36, No.2, April 2008, p.58) on snow temperature. Attached is a figure showing winter air and snow temperature and snow depth at one of our forest hydrology research sites at 1600 m in the interior of BC. Note the large change in temperature variation of the 0.5 m height sensor when it became covered by snow. As you noted in your article, as soon as the temperature sensor is covered by snow its variation is moderated. Cold conditions will penetrate into the pack but are moderated with depth. Temperature increases with depth in the pack and is a "balmy" 0°C at the base.



Daily maximum and minimum air temperature, daily average snow temperature and snow depth at midnight during the winter at the Upper Penticton Creek Watershed Experiment, British Columbia.

From: Peter Taylor, York University

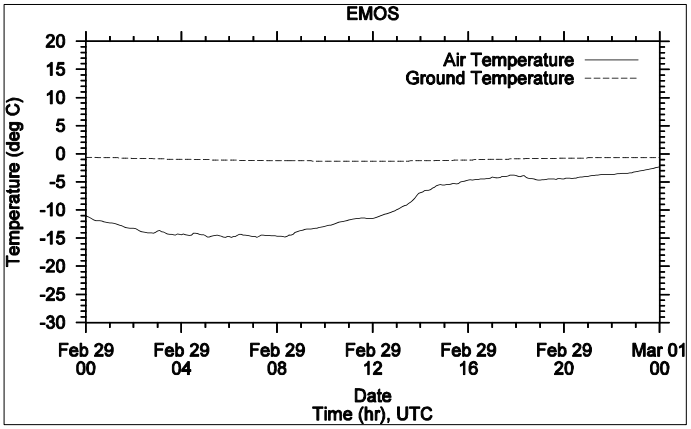
To: Bob Jones, CMOS Webmaster

Date: May 6, 2008

Subject: The Temperature of Snow

Bob Jones (*CMOS Bulletin SCMO*, Vol.36, No.2, April 2008, p.58) notes the insulating properties of snow in his April 2008 Bulletin article and indeed temperatures in and beneath snow cover can be very different from those in the air. The tendency of ground temperatures beneath snow cover to be close to 0°C as a result of melting and freezing of snow or ground water at that level is well known (e.g. Oke, 1987, p 96/97; Gray and Male, 1991, p55) and models such as "Snowpack" developed by the Swiss Federal Institute for Snow and Avalanche Research predict this behaviour well (see Lundy et al, 2001). Any heat conduction into that layer tends to be used for melting snow rather than changing its temperature, while freezing releases latent heat and again maintains the temperature near zero.

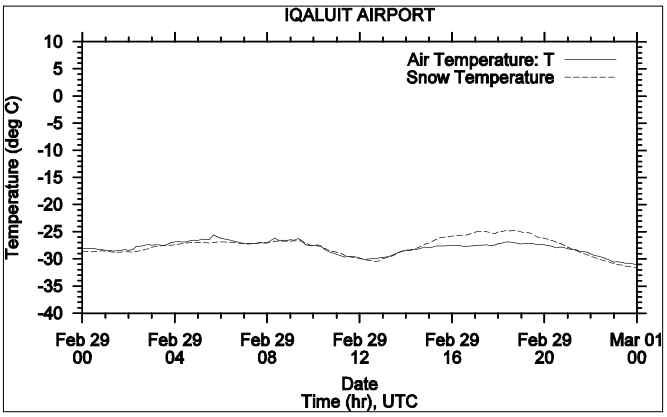
We often place thermocouples at or just below ground at our weather stations. At York University (see http://www.yorku.ca/pat/weatherStation/index.asp) for example the figure below for our York (EMOS) station from February 29th, 2008 shows ground temperature (dashed line) just below 0°C while air temperatures (solid line) dropped to -15°C. Snow depth was about 10 cm. Three days later (March 3, 2008) air temperature rose to +12°C while the temperatures at the snow/ground interface remained just below 0°C.



These results apply fairly generally in those parts of Canada where the ground is only moderately frozen but in more extreme climates where the ground is frozen hard the snow/ground temperatures can be much colder. There may still be some conduction of heat up through the ground but it is not always enough to maintain temperatures near 0°C.

As it happens, we were also running a weather station and monitoring temperatures just below the snow surface near the airport in Iqaluit, Nunavut this winter. Data from that station are shown below. Note that the snow temperatures

here were just about 1 cm below the snow surface.



Snow remains a good insulator, and temperatures well under snow surfaces are more stable. If you are stranded, burrowing under snow is still a good plan to conserve body heat but do not expect to find a -5°C layer after several months of -30°C temperatures!

References

Gray, D.M and Male, D.H., 1981, *Handbook of snow : principles, processes, management & use*, Pergamon Press, Toronto, 776pp.

Lundy C, C., Brown, R.L., Adams, E.E., Birkeland K.W. and Lehning, M, 2001, *A statistical validation of the snowpack model in a Montana climate*, Cold Regions Science and Technology **33**, 237-246.

Oke, T.R., 1987, *Boundary-Layer Climates*, 2nd Edition, Methuen, New York, 435pp.

Correction - Correction

On the cover page description for Volume 36, No.2, April 2008, page ii, the correct English description should have read as follows:

Cover page : The cover page picture illustrates the collection of expendable bathythermographs (XBTs) along the seismic survey tracks during the summer of 2007 on board of the *RN Endeavor* off the East Coast of Canada. The XBTs were taken at the most hydrographically interesting section defined by sea surface temperature satellite images and are shown by the white lines along the tracks. Both the seismic and XBT data will be used in the **R**eflection **O**cean **S**eismic **E**xperiment - ROSE. To learn more, please read the article on **page 43**.

The word “expendable” was misspelled in the April issue. We apologize for any inconvenience this error may have caused.

Late-breaking news: An Open Letter on Climate Change

More than 130 Canadian climate science leaders have signed an open letter to elected government leaders in Canada. This letter is a follow-on to one sent in 2006 to the Prime Minister of Canada and it marks the 20th anniversary of the 1988 Toronto conference on “*Our Changing Atmosphere: Implications for Global Security*” that concluded with the statement “*Humanity is conducting an unintended, uncontrolled, globally pervasive experiment, whose ultimate consequences are second only to global nuclear warfare*”.

The latest letter, dated June 2008, states that “New analyses show that global greenhouse gas concentrations are increasing, sea level rising and Arctic sea ice decreasing faster than projected only a few years ago. Water shortages are predicted in the western Prairies, the Okanagan and in the Great Lakes basin. Earlier targets to avoid human interference with the climate system are now seen to be inadequate.” It expresses concern that “the pace with which action is being taken in Canada does not reflect adequately the urgency of the threat” and it warns that “Addressing greenhouse gas emissions will require a polluter-pay approach and absolute emission caps”.

For the full text of the letter and the list of signatories please visit http://www.cmos.ca/media.html

Nouvelle de dernière heure: Lettre ouverte concernant la science des changements climatiques

Plus de 130 sommités canadiennes du domaine de la climatologie ont signé une lettre ouverte à tous les dirigeants gouvernementaux élus du Canada. Cette lettre fait suite à une autre envoyée en 2006 au premier ministre du Canada et souligne le 20e anniversaire de la conférence de Toronto en 1988 intitulée «*L’atmosphère en évolution : implications pour la sécurité du globe*» qui concluait que «*l’humanité mène une expérience mondiale involontaire et non contrôlée dont les conséquences finales ne seraient surpassées sur le plan de la gravité que par celles d’une guerre nucléaire planétaire*».

La présente lettre, datée de juin 2008, affirme que «De nouvelles analyses montrent que les changements climatiques se produisent plus rapidement que ce qui avait été estimé il n’y a que quelques années; notamment l’augmentation de la concentration atmosphérique mondiale des gaz à effet de serre, la hausse du niveau de la mer et la fonte des glaces de l’Arctique. Ces analyses prédisent aussi que les Prairies, l’Okanagan et le bassin des Grands Lacs connaîtront des pénuries d’eau. À la lumière de ces analyses, les anciennes cibles d’atténuation de l’influence humaine sur le climat sont maintenant considérées comme inadéquates». Elle constate que «Le rythme d’action du Canada ne reflète pas adéquatement l’urgence de la situation» et elle recommande «l’adoption d’une stratégie basée sur le principe du pollueur-payeur et l’établissement de plafonds d’émission absolus».

Pour le texte entier de la lettre et la liste des signataires, visitez http://www.cmos.ca/media.html

Renewable energy forecasts for solar water heaters

by Lewis Poulin[1]

"I dream of a house that is powered by the sun
Where the roof and walls and windows collect power for everyone
A house that has a footprint as simple as a song
Because the sun it shines so strong"
Mr. Ozone (2001)

Résumé : Dans cet article on présente une méthode pour générer des prévisions de réservoir d'eau chauffé à l'énergie solaire en faisant intervenir les mesures du flux solaire incident à partir des Modèles de prévision numérique du temps du Centre météorologique canadien. Des schémas de prévisions d'un à cinq jours sont présentés et discutés afin de les utiliser dans une variété d'applications sur les bâtiments solaires. Les prévisions liées aux énergies renouvelables pourraient aider les utilisateurs de technologie solaire dans leur planification des activités énergétiques et aussi innover dans le domaine des outils éducatifs afin de faire progresser les secteurs des énergies renouvelables et des habitudes de vie des gens.

Introduction

Solar water heaters can be a very cost-effective way to use the sun's energy to heat water and contribute to reducing our reliance on traditional fuels such as fossil fuels. It can be asked why in certain markets do we not see more solar water heaters in action. It is possible the public may be wondering if solar water heaters are practical and can actually meet daily hot water needs. What if there was a way we could inform the public ahead of time how much solar energy, solar hot water in this case, was likely to be available in the next one to seven day period?

Some of the many variables available in the Canadian Meteorological Centre (CMC) numerical weather prediction model outputs are forecasts of instantaneous or cumulative incident solar flux, i.e. that portion of the solar spectrum that makes it through the Earth's atmosphere and reaches the surface. These forecast variables can be used to make renewable energy forecasts such as solar water heater forecasts.

Renewable energy forecasts could easily provide the public with one to five day outlooks of volumes of solar heated water. For those already using solar water heaters, such forecasts may help better plan their daily hot-water related activities. Would such forecasts allow seasonal use of solar water heaters to be extended? Or allow a user to make do with a smaller system?

Equations for solar heated water volumes from flux data

We can connect the input source of solar energy Q_{solar} and the temperature difference T_{diff} resulting on a mass of water m_{water} through the following equation:

$$Q_{solar} = c_{water} \times m_{water} \times T_{diff} \quad (1)$$

where

Q_{solar} = input energy from the sun
c_{water} = heat capacity of water equal to 1 calorie/gm °C (or 1 kcal/kg °C)
m_{water} = mass of water
T_{diff} = temperature difference in °C as a result of heat input Q_{solar}

To determine what mass of water m_{water} can be heated by a T_{diff} of 30 °C if we know (via numerical weather prediction model data) the input solar energy Q_{solar} then equation (1) can be solved for m_{water}

$$m_{water} = Q_{solar} / (c_{water} \times T_{diff}) \quad (2)$$

Since $m_{water} = density_{water} \times Volume_{hotwater,}$ we can substitute this into (2) then solve for $Volume_{hotwater}$ which provides us with an equation that converts forecast solar flux data into a forecast of volumes of solar heated water:

$$Volume_{hotwater} = Q_{solar} / (c_{water} \times T_{diff} \times density_{water}) \quad (3)$$

where $density_{water} = 1$ gm cm^{-3}

In the case of solar water heater forecasts, the solar input variables for equation (3) are defined as follows depending on whether one uses cumulative or instantaneous incident solar flux parameters:

[1] Canadian Meteorological Centre
Dorval, QC, Canada

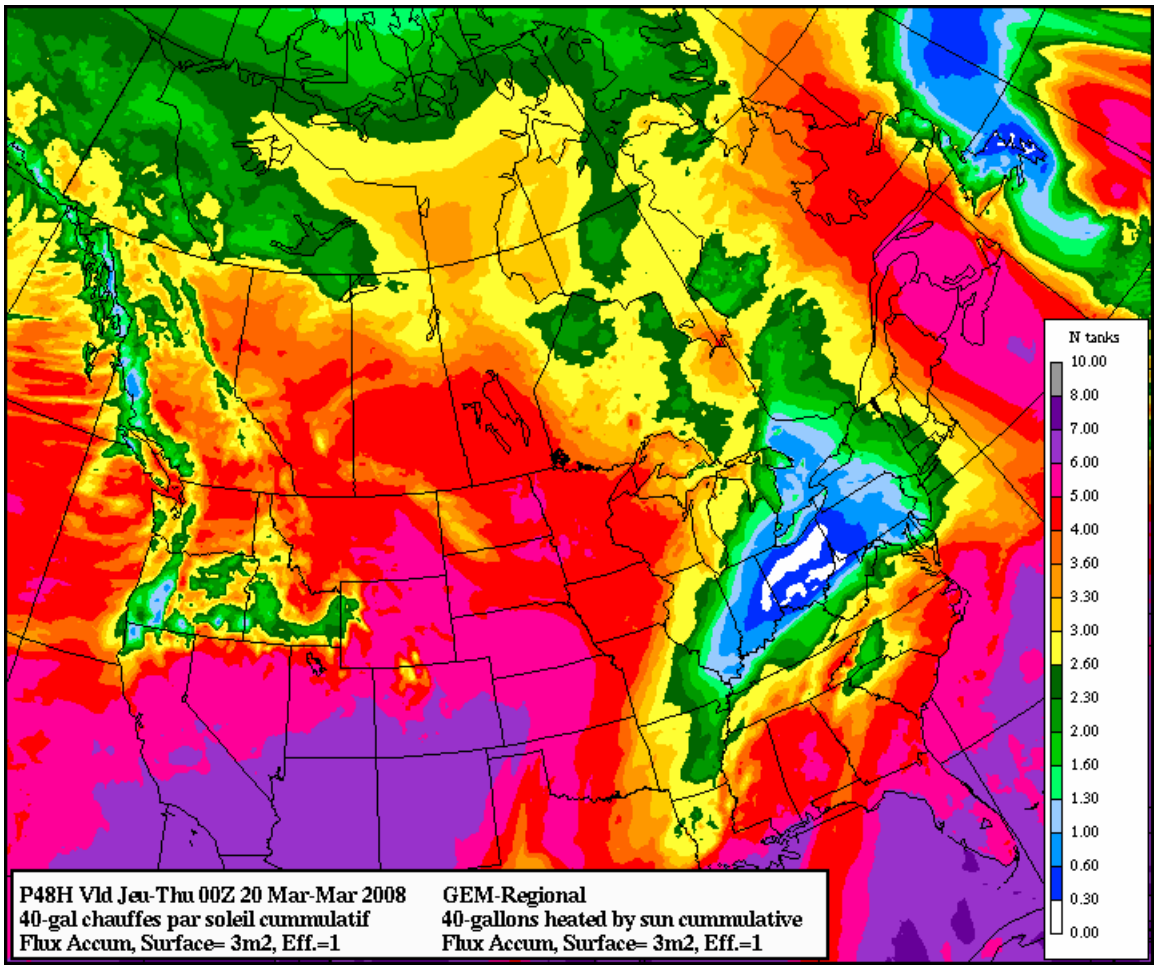


Figure 1: A 2-day forecast of total volumes of water heated by 30°C from a 3m^2 solar water heater using CMC regional model cumulative incident solar flux data from 00Z March 18, 2008. Maps such as these could indicate to users of renewable energy how many 40-gallon reservoirs of solar heated water are possible in their region in the next 2 days. Notice the area of low solar hot water volumes forecast for southern Ontario as a major low pressure system approaches that region during the period.

Using cumulative incident solar flux forecast for a particular time period

$Q_{solarCmltv}$ (calories) = Cumulative[2] solar flux (Joules m^{-2}) x A m^2 x Eff / 4.18 Joules cal^{-1}

Using instantaneous[3] incident solar flux forecasts:

$Q_{solarInst}$ (calories) = Instantaneous[3] solar flux (Joules sec^{-1} m^{-2}) x A m^2 x Eff x t sec / 4.18 Joules cal^{-1}

A_{wh} = area of solar water heater collector, ex: 1 m^2
T_{diff} = 30 degrees Celsius (°C)
Eff = efficiency of solar water heater to transfer the sun's heat to the water.

For demonstration purposes an efficiency of 100% is used here. For practical applications, efficiencies range between 50-80% (Duffie et al, 1991).

Equation (3) provides $Volume_{hotwater}$ in units of cm^3 which can be converted to litres (L) when we recall 1 (L) of water is equivalent to 1000 cm^3.

$$Volume_{hotwater(L)} = Q_{solar} / (c_{water} x T_{diff} x density_{water}) \text{ x } 1 \text{ (L)} / 1000 \text{ cm}^3 \quad (4)$$

Most people are likely more familiar with the volume of a 40-gallon (175 (L)) hot water reservoir in their basement. To make hot water forecasts more user-friendly, we divide equation (4) by 175 (L) to express the volume of solar heated water as the number of equivalent 40-gallon water tanks.

$$N_{40\text{-galTanks}} = Volume_{hotwater(L)} \text{ x 1-40-gal tank / 175 (L)} \quad (5)$$

[2] Cumulative incident solar flux is known as variable N4 in the in-house CMC dataset

[3] Instantaneous incident solar flux is known as FB in the in-house CMC dataset

Practical solution of equations (4) and (5)

Assuming:

Q_{solar} = 700 W/m2 = estimate of instantaneous incident solar flux
A_{wh} = 3 m^2
t = 6 hours => (6 hours x 60 min/hour x 60 sec/hour) => 21600 sec
$\mathbf{E_{ff}}$ = 1 (100%)
$\mathbf{T_{diff}}$ = 30°C

We obtain for equation (4), using $Q_{solarInst}$

$Volume_{hotwater(L)}$=

700 Watt m^{-2} x 3m^2 x 21600 sec x 1 / 4.184 Joules cal^{-1} / (30°C x 1cal gm^{-1}/1gm cc^{-1} x1000 cc L^{-1}) = 361 (L)

And for equation (5)

$N_{40\text{-}galTanks}$ = 361 (L) x 1 40-gal reservoir / 175 (L) = 2.1 (40-gal) reservoirs of heated water

Such renewable energy forecasts could provide decision-making power to those who use solar technology and help present energy intensive lifestyles be more in harmony with the atmosphere's renewable energy supply as will be discussed later.

Sample forecast products

A version of equation (5) was used to prepare sample solar water forecasts from CMC's regional and global model cumulative incident solar flux data. In the samples presented here, unless otherwise stated, a collector area of 3 m^2 and efficiency value ($\mathbf{E_{ff}}$) of 1 (100%) were used. Volumes of heated water are presented in terms of the number of equivalent 40-gallon water tanks the volumes of heated water would represent to assist homeowners to more easily relate to forecast hot water volumes.

Figure 1 presents a forecast of solar hot water production for a particular two-day period while the two diagrams of figure 2 present corresponding Day-1 and Day-2 forecasts. If users get a signal in the two-day forecast of abundant hot water on the way, the daily forecasts can be used to fine-tune and plan hot water related activities.

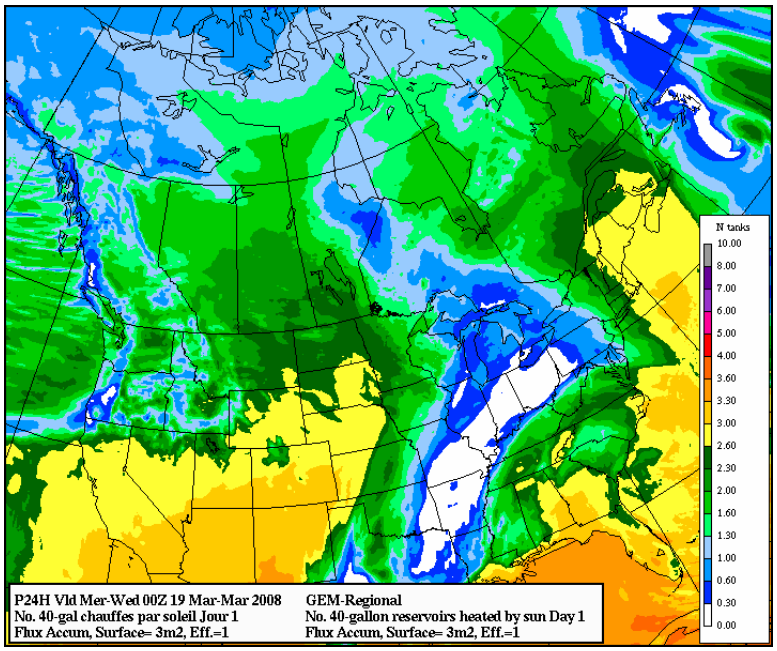


Fig 2.1: A sample today forecast for March 18, 2008

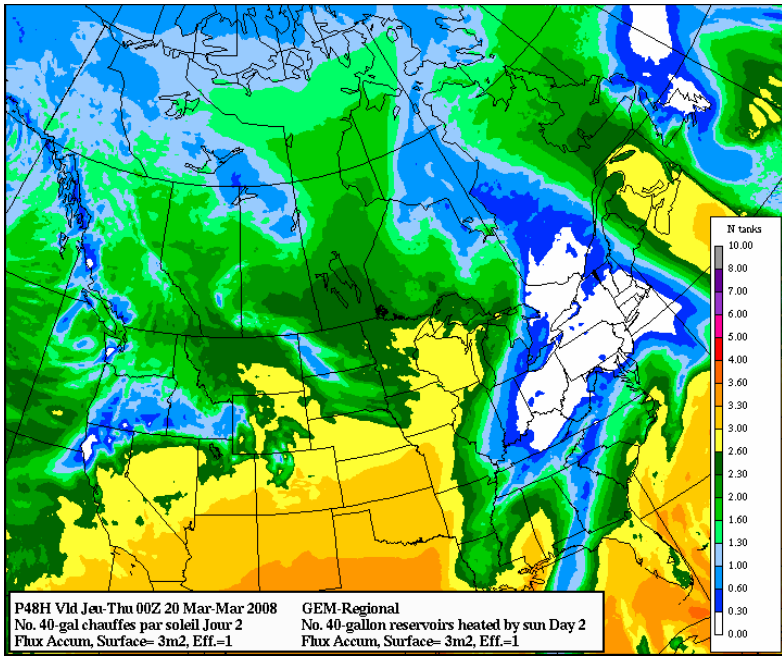


Fig 2.2: A sample tomorrow forecast for March 19, 2008 prepared from March 18 data.

Figure 2: A sample today (2.1) and tomorrow (2.2) forecast of volumes of water heated by 30°C from a 3m^2 solar water heater using CMC regional model cumulative incident solar flux data from the 00Z March 18, 2008 regional model. In this case, as an important weather system approaches, Ontario residents can plan on little solar heated water while southern Quebec residents would have had more hot water forecast for March 18 and less for March 19.

Figure 2 shows two consecutive 24-hour forecasts of volumes of water heated by 30°C by a solar water heater with a 3 m^2 collector area using accumulated solar incident flux data from the CMC regional model. Users of solar water heaters willing to manage their hot water related activities may find such detailed forecasts helpful to allow them to plan to meet their full hot water needs and possibly while using only water heated by their solar water heater.

The global model data could be used to make five-day forecasts and figure 3 presents a sample forecast of the cumulative volume of heated water generated from a solar water heater with a 3 m^2 collector area using accumulated incident solar flux data. Work is ongoing at CMC to improve the quality of forecast variables beyond the 120 hour period and comparisons between forecasts and observations as will be described later will surely assist in these efforts.

Displaying solar energy as volumes of solar heated water may encourage the public, governments and utilities to become significantly more interested in using renewable energy.

Those already using solar water heaters can use forecasts to plan ahead in order to harness, produce, use and even market renewable energy more efficiently. For example, would users of solar water heaters consider reducing their hot water consumption today if their solar forecasts suggested a larger volume of solar heated water likely available for tomorrow? Experiments could be undertaken to determine how realistic it is, for a number of locations, to manage one's hot water needs using only a solar hot water heater and renewable energy forecast information. Would more efficient planning of hot water activities made possible by using renewable energy forecasts allow users to extend their solar hot water season, or allow users to operate with a smaller solar system or even allow them to eliminate their main hot water system completely?

Forecast data of cumulative downward shortwave radiation flux are freely available for the MSC regional, global and ensemble NWP models from MSC's public GRIB dataset (Poulin, 2006). Those interested could use software like PCGRIDDS32 or the increasingly powerful WINGRIDDS to make their own colour images of renewable energy forecasts and start using this type of information in their decision-making systems.

Renewable energy forecasts displayed as financial savings

Using renewable energy can save money, and renewable energy forecasts can also be presented as forecasts of financial savings as will be shown here. Solving equation (4) for Q_{solar} when using 1 (L) of water, a 30°C T_{diff}, an E_{ff}=1 and then converting Q_{solar} to kWhrs shows that it takes approximately 0,04 kWhrs of electricity. Assuming 1 kWhr costs $0.10 (including taxes and administration services) allows the conversion of litres of solar heated water into a forecast of money saved as a result of using a solar water heater and not using an electric hot water tank. Similar calculations could also be done for other fuel types such as natural gas, propane and oil.

A sample forecast of possible financial savings when one relies solely on a solar water heater is presented in figure 4. Such forecast products help remind users of the financial benefits of using solar energy, especially if, as is the case in some jurisdictions, unused kWhrs of locally generated electricity (pv) can be re-sold to the energy grid at a higher price than that paid by the purchaser. In those cases, users of photovoltaic power who conserve electricity by relying solely on their solar water heater to meet their full hot water demands could potentially maximize the sale of their photovoltaic generated kWhrs back to the grid. Presenting renewable energy in terms of financial savings may get people and businesses as excited about checking their daily solar energy forecasts as they are about following the stock market.

Using weather forecast data in decision-making systems

In the above samples, regional and global models, known as deterministic models, provide single solution forecasts for their forecast variables. Using temperature as an example, the regional model may forecast a temperature of 15°C while the global model may forecast 19°C. Raw data from deterministic models offers no information concerning uncertainty of the model forecast or of possible model biases. As a result, raw data from deterministic models should be used cautiously as input into energy management decision-making systems.

The Concordia Solar Lab (CSL) (Candanedo, 2008) is testing the use of forecast values of incident solar flux as input into their energy management systems for solar buildings. They have observed that raw forecasts from one model run to the next can sometimes differ greatly for forecasts that are valid for the same time period. In some cases, they have observed the most recently produced forecast is not always the best one to use.

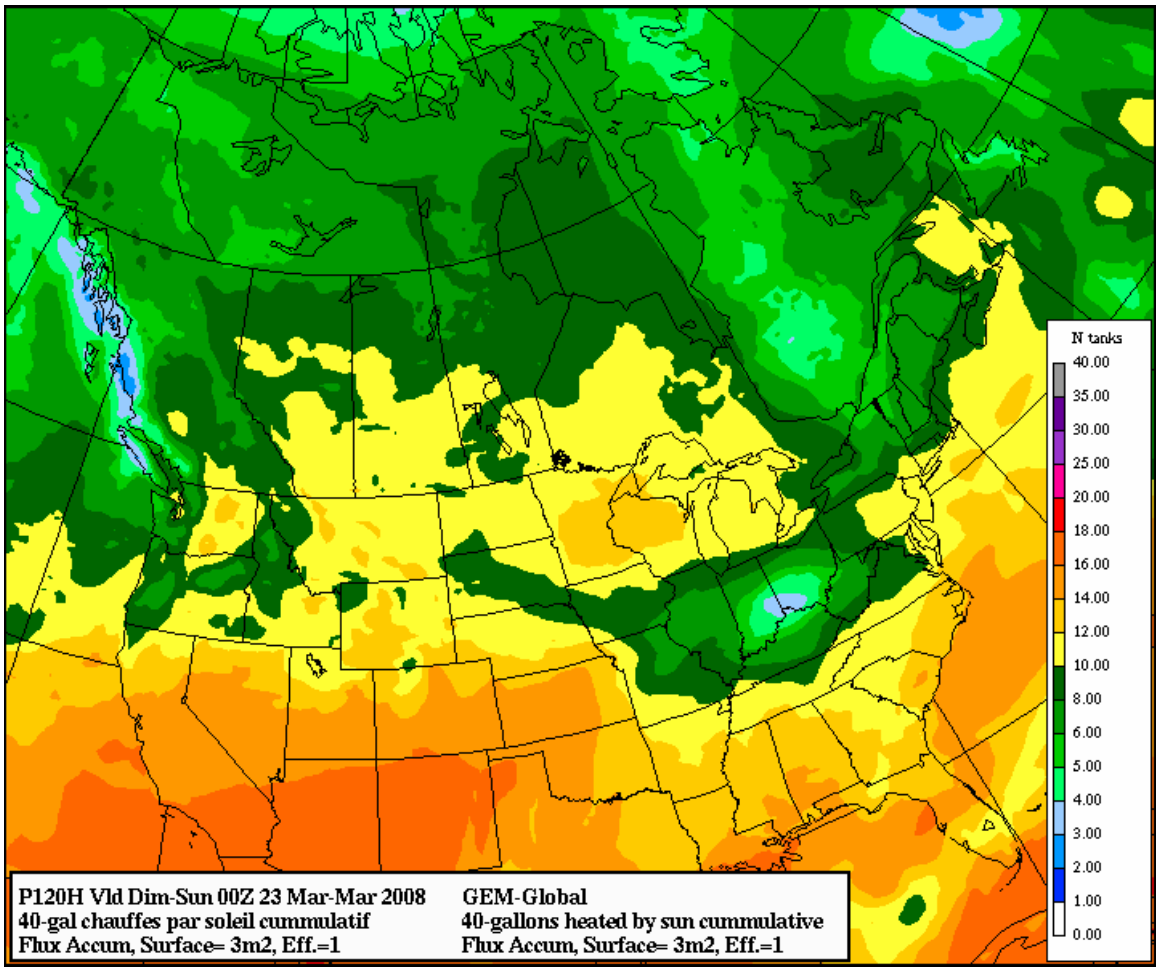


Figure 3: A sample 5-day forecast of volumes of solar heated water using CMC's global model downward solar flux at the surface from the 00Z run model run of March 18, 2008. Such forecasts can provide residents with a signal as to how much solar heated water is likely in their region during the next 5-day period.

Preliminary ground-truthing of flux forecast data also undertaken at CSL has compared solar incident flux forecasts for Montréal available in CMC's SCRIBE matrices against equivalent measurements of downward shortwave solar flux taken from CSL's solar radiometer also located in Montréal (Candanedo, 2008). Results are assisting them in making better use of forecast variables and ongoing work may also contribute to improving the parameterization of flux variables in numerical weather prediction models.

Users wanting to ingest weather forecast data into their decision-making systems will eventually have to deal with inconsistencies between different forecasts generated from one model run to the next, or when forecasts from different models differ. What are users of solar water heater forecasts to do if last night's forecast for tomorrow predicts lots of hot water but the forecast produced this morning now predicts little hot water tomorrow?

Probability forecasts of solar water heater volumes

Ensemble Prediction Systems (EPS) can provide forecast uncertainty information which should be of interest to decision-making systems. An EPS with its 20+ member models can produce a range or envelope of forecast values. For example, raw data from a 20-member ensemble system could forecast a range of temperatures for location X ranging from say 10°C to 18°C with the majority of members clustering around the value of 15°C.

It is this variety of forecasts produced by an EPS that allows the packaging of forecasts not as a single value but rather as a bundle of statistical information about the forecast such as distribution, average, median, standard deviation and probability. Ensemble systems thus make available forecast distribution information that can then be ingested into decision making support systems to plan activities that are appropriate to the confidence associated with the forecast.

Using the example of solar water heater forecasts, 20 flux forecasts of instantaneous solar flux from the CMC EPS were processed and packaged as probability forecasts of solar heater water volumes as shown in figures 5 and 6. In those images, high probability values indicate the ensemble system members pretty much agree in their forecast and with a properly calibrated EPS, this can be interpreted as a forecast that hot water volumes are more likely.

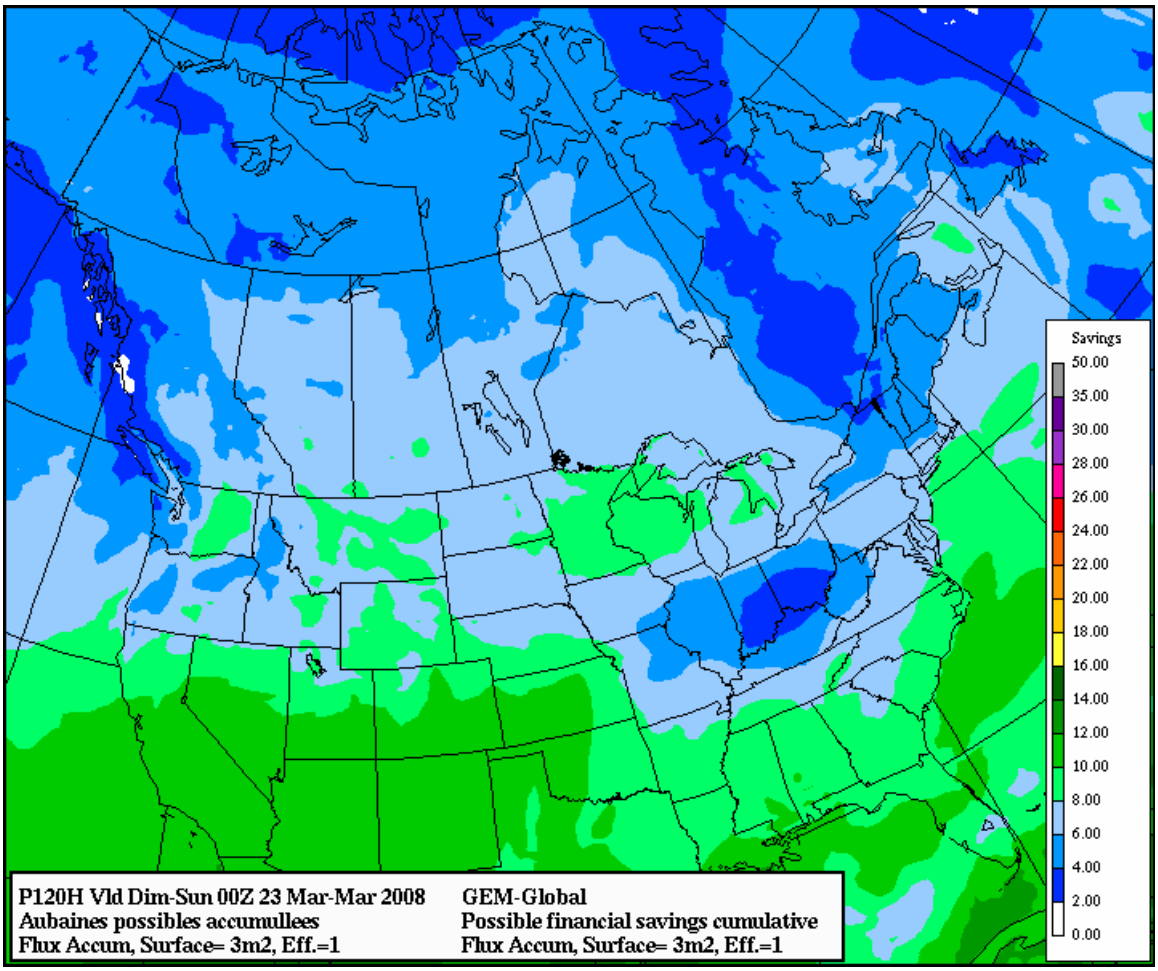


Figure 4: A sample 5-day forecast of financial savings made possible when a solar water heater with $3m^2$ collector is used and the electric water heater turned off. The calculation assumes 0.04 kWhr of electricity is required to heat 1 (L) of water by 30°C and the user normally pays $0.10 per kWhr of electricity. Input data used was the accumulated incident solar flux from the 00Z March 18 2008 run of the CMC global model. Of course sunnier seasons offer higher potential savings.

Another interesting CMC ensemble product is the EPSgram shown in figure 7 which was prepared from ensemble data. To better understand the EPSgrams one must first understand how the information is presented. See figure 8 for more details on EPSgram information.

EPSgrams are powerful tools that can convey at a glance information on the distribution of the ensemble member forecasts. As shown in figure 8, each time step has a box and whisker plot to display the range of member forecast values, in this case the number of litres of heated water. The (bottom, top) of each vertical line at each time step indicates the (minimum, maximum) value observed in the ensemble members. Also, the (bottom, top) of each of the rectangular boxes indicates the value of the forecast at the (25th, 75th) percentile in the member distribution. The small horizontal line in the rectangular box indicates the median value of the ensemble dataset.

In summary, EPSgram time steps with long (short) percentile boxes indicate a lower (higher) level of agreement between ensemble member forecasts which can be interpreted, when using a properly calibrated EPS, as a lower (higher) degree of confidence in the forecast amongst the members. For more information on EPSgrams produced as part of the NAEFS project, readers can consult:

http://www.weatheroffice.gc.ca/ensemble/info_EPSgr_e.html

or CMC's EPS-Training information (R. Verret, 2007). Ensemble forecasts with associated uncertainty information will likely be of great interest to solar building applications.

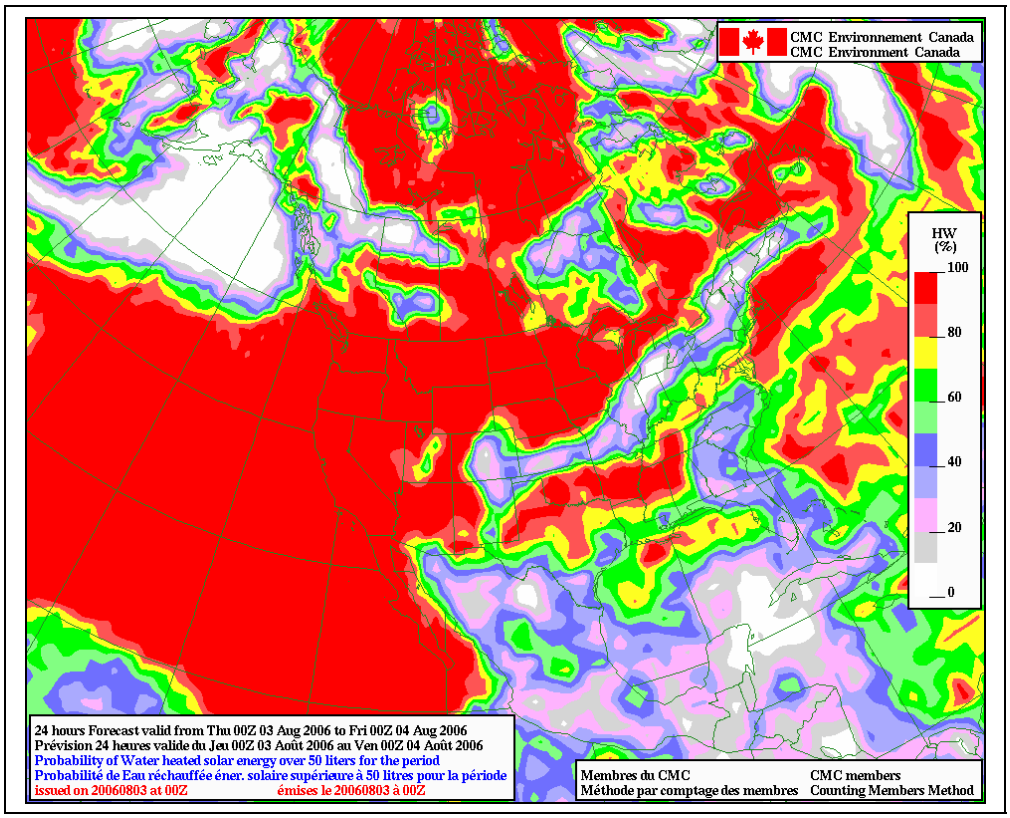


Figure 5: Ensemble probability forecast of a solar water heater system of 1 m^2 collector area producing 50 (L) in a 24-hour period. This type of probability was generated by counting the number of members in the 20 member CMC EPS that produce the required amount of hot water. Poulin et al. (2006).

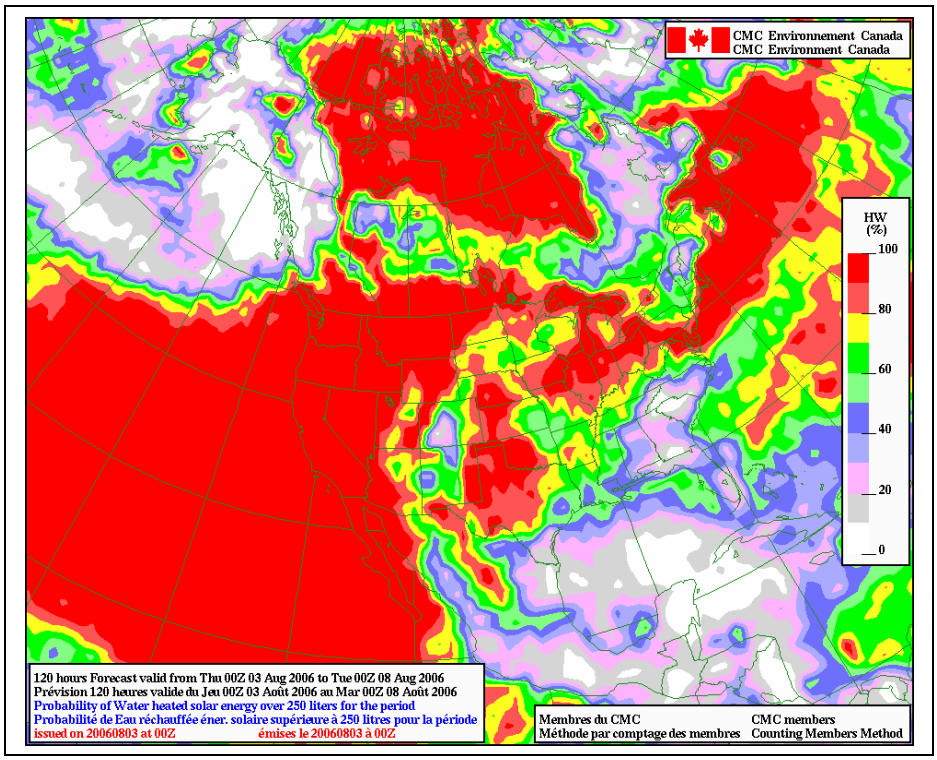


Figure 6: Ensemble probability forecast of a solar water heater system of 1m^2 collector area producing 250 (L) in a 5-day (120-hour) period. Areas in red have a 100 % probability of each 1 m^2 of solar water heater area producing 250 (L) of heated water during the period. (Poulin et. al, 2006).

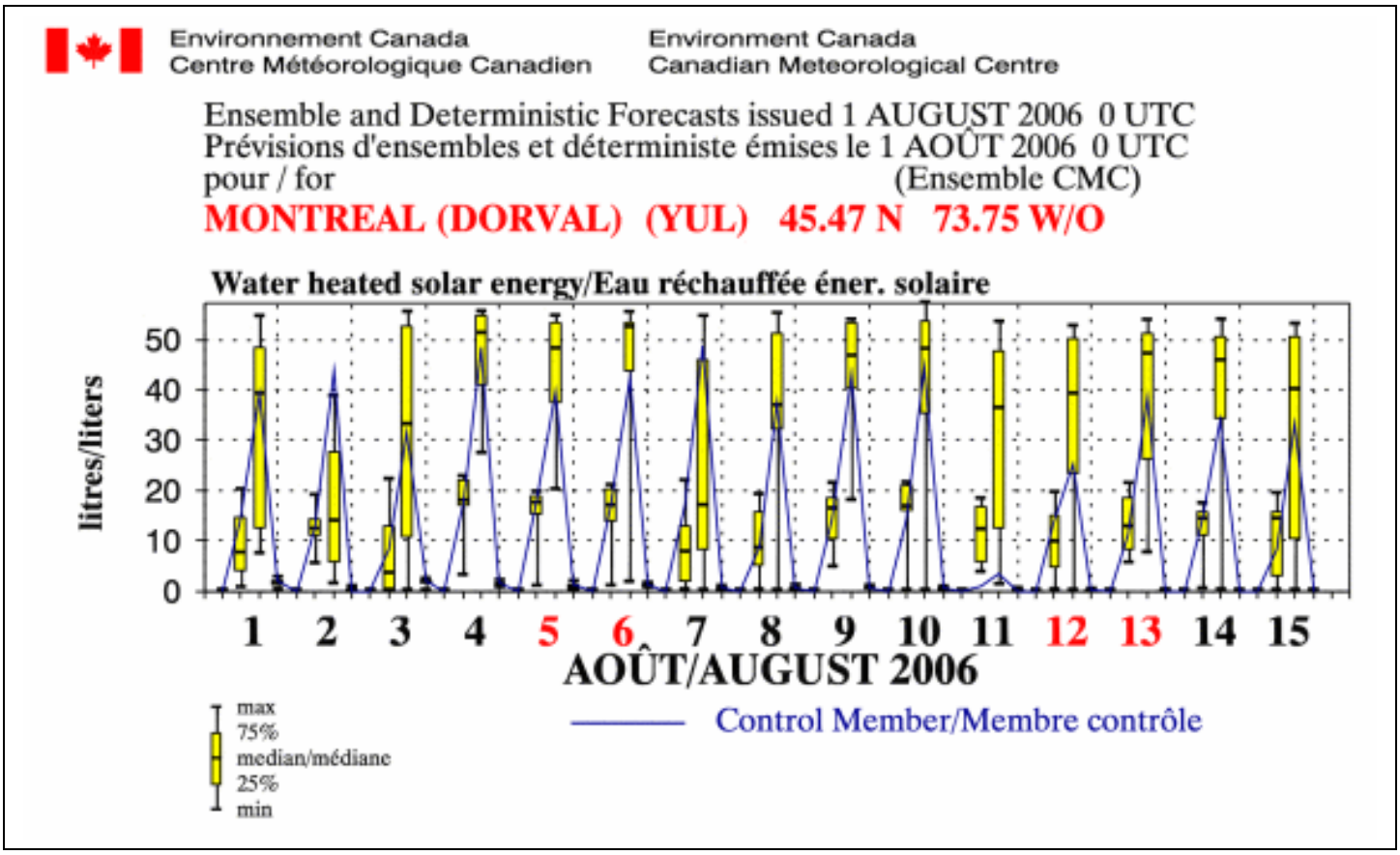


Figure 7: An EPSgram forecast of solar heated water volumes at 6-hour intervals over a 15-day period for Montréal, Qc. generated from CMC ensemble data.

Renewable energy forecast activity matrix

Extending the concept of renewable energy forecasts further, a number of other potentially useful forecasts could be developed to support solar energy activities, including for example forecasts for solar photovoltaic, solar cooking, solar drying, wind energy, water collection etc.

To make forecast information more user-friendly, a number of renewable energy forecasts could be bundled together and presented as a renewable energy activity matrix forecast, an example of which is shown in figure 9. In this example, the higher the positive values on the scale, the better the conditions are for that particular activity. Negative values indicate low energy input and would be appropriate periods for maintenance or tune-ups of solar technology or periods where backup power may be required.

It would also be possible to sum the various forecasts in a manner to produce a net renewable energy activity index to summarize, in one easy number, if a solar building is likely, or not, to meet its full energy needs from renewable energy for a particular 24-hour period.

Such types of forecasts could be packaged in image, text, digital, or ASCII matrix formats then fed to residences, solar buildings, businesses, etc. Decision-making support systems could ingest these and use them to assist with the planning of renewable energy based activities to maximize their harvesting, use and possibly sale of renewable energy.

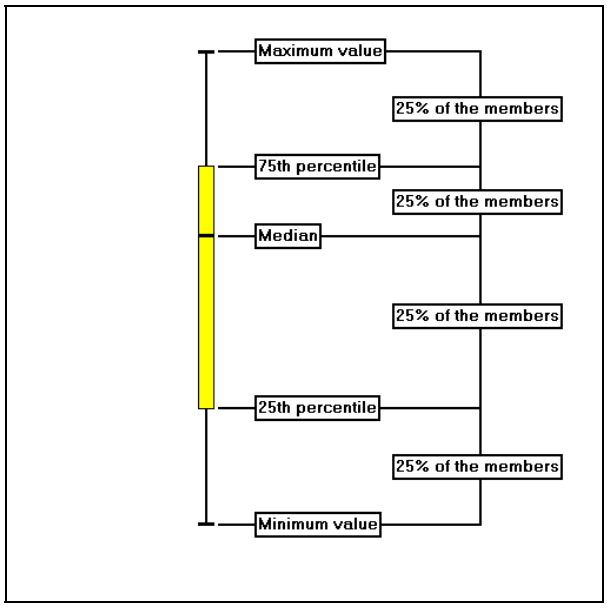


Figure 8: Component description of EPSgram plot. For more details see text.

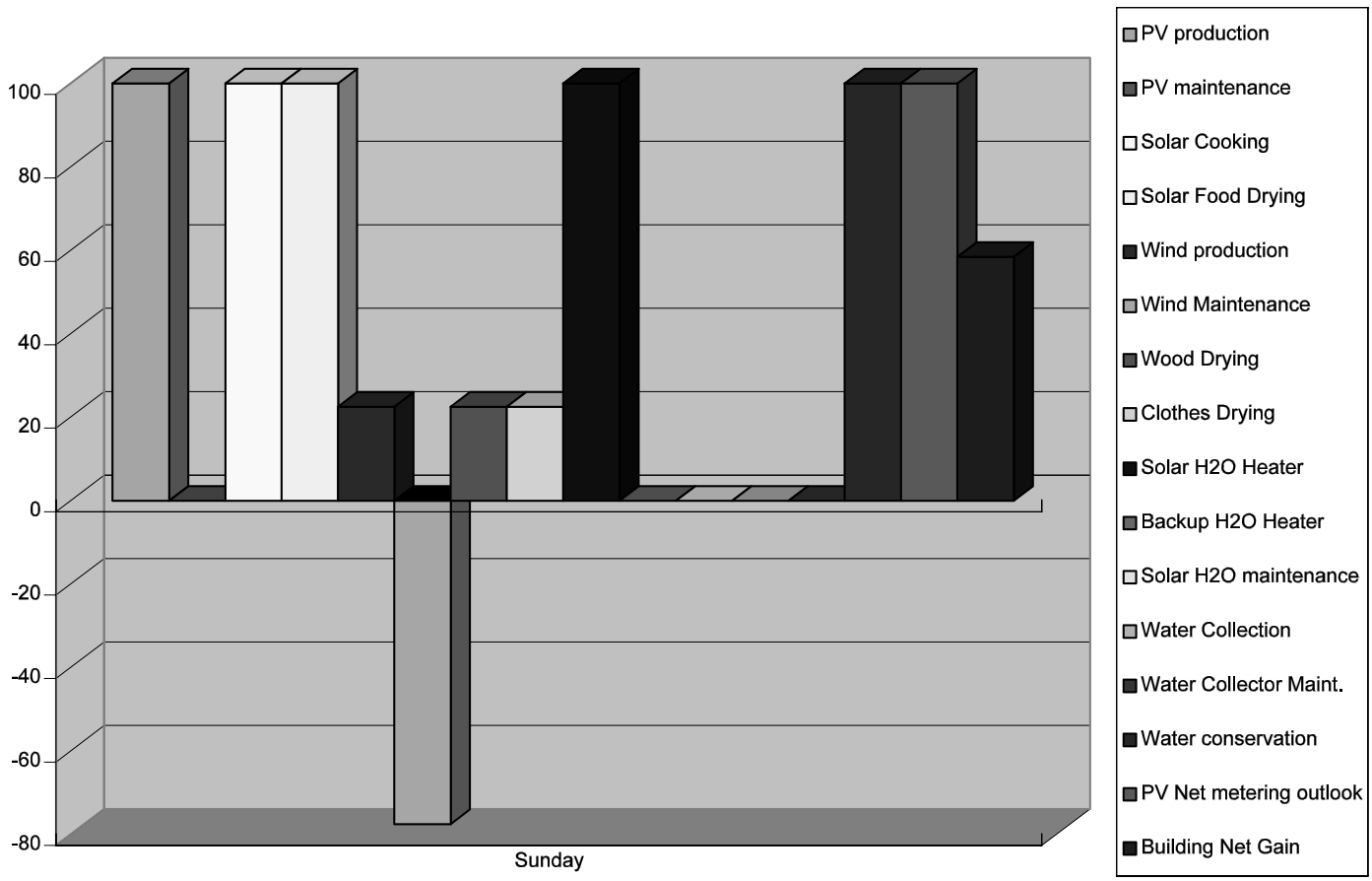


Figure 9: A sample one-day Renewable Energy Forecast Activity Matrix displayed as bar chart. Increasing [positive, negative] values indicate improving conditions for [RE harvesting, doing maintenance]. Large positive values of PV Net Metering indicate good conditions for selling excess power back to the grid. Large positive values of Building Net Gain indicate if as a whole, the location is a net energy producer.

Conclusion

As CMC numerical weather prediction models become more sophisticated, their forecast variables can be used to support the needs of a growing renewable energy sector. Forecasts of incident solar flux can be easily post-processed into renewable energy forecasts such as solar water heater forecasts. Examples of 1-day, 2-day and 5-day forecasts are presented and discussed. Also, it is shown how forecasts of possible financial savings may be possible if one can meet their hot water needs using only a solar water heater.

When packaged properly renewable energy forecasts may help educate the public about the potential of renewable energy and help show that a solar powered lifestyle is possible, practical and within reach.

As interest in renewable energy forecasts grows, it's important to explore how to make the best use of forecast information from deterministic (regional, global) and probabilistic (ensemble) models. Ensemble models hold great potential for enhancing the capacity of emerging decision support systems which are presently being developed for solar building applications.

To promote the awareness and use of renewable energy further, forecast data could be used to produce a variety of solar forecasts to support emerging sectors such as solar photovoltaic, passive solar heating, wind energy, etc. Work undertaken with the Concordia Solar Lab (CSL) will likely assist in ground-truthing forecast variables, including flux data, against real-time observations of weather parameters to maximize their benefit to solar applications.

Bundling renewable energy forecasts into a matrix of information or as a renewable energy index may facilitate the integration of forecast data into solar building energy management systems and further help support solar powered lifestyles.

Acknowledgements
The author thanks Wei Yu of RPN and Jacques Hodgson of CMC for ongoing discussions and assistance in this area of mutual interest. José Candanedo at Concordia Solar Lab provided helpful information on solar energy uses and solar water heater efficiencies.

References

José A. Candanedo, Lewis Poulin, Yu Xiang Chen, Andreas K. Athienitis, "Concordia's Solar Laboratory preliminary use of forecast flux data in solar buildings applications", *CMOS Bulletin SCMO*, In this issue.

Duffie, John A., Beckman, William A., "Solar engineering of thermal processes", 2nd ed., John Wiley & Sons, Inc., Hoboken, New Jersey, 2006.

Mr. Ozone, "Solar Energy Forever", from "Brother Sun, Sister Moon Homegrown songs to help change the world" CD, produced by Lewis Poulin, 2001.

Poulin, L., «Solar energy and water forecasts for a greenhouse planet», CMOS presentation, Winnipeg, 2001. http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SolarScribe/RE_Fcsts/Archive/2001_CMOS_Prev_energie_solaire.mht

Poulin, L., Yu, W., Hodgson, J., "Renewable energy forecasts for solar powered applications", poster presented at Canadian Solar Buildings Conference 2006. http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SolarScribe/RE_Fcsts/SolarBuildings/2006/2006_REFcsts_SolarBuildings_latest.ppt

Poulin, L., "Using PCGRIDDS32 to play with CMC model data", *CMOS Bulletin SCMO,* 2007, Vol.35, No.5, pp.153-156 http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SolarScribe/PCGRIDDS32/PCGRIDDS32_CMOSBUlletin_153.pdf

Verret, R., Module 5: EPS products, from CMC EPS-Training workshop, 2007. Workshop notes are available at http://collaboration.cmc.ec.gc.ca/cmc/ensemble/Formation-Training/Read-me.html

---

Concordia's Solar Laboratory preliminary use of forecast flux data in solar buildings applications

José A. Candanedo[4], Lewis Poulin[5], Yu Xiang Chen[4], Andreas K. Athienitis[4]

Résumé: La prévision du temps peut être utilisée dans différentes applications dans la régulation de bâtiments solaires afin de mettre en valeur la récupération et l'utilisation de l'énergie renouvelable. Le Laboratoire solaire de l'Université Concordia cherche à utiliser diverses sources à partir des prévisions du temps pour maîtriser le chauffage solaire passif dans les bâtiments. Le travail consiste à comparer les observations de température et des mesures de flux, à partir de diverses localisations de bâtiments solaires, avec les valeurs de la prévision pour ces mêmes paramètres, à partir des matrices des prévisions SCRIBE du SMC, obtenues par les modèles de prévision numérique du temps à l'échelle régionale et globale.

Introduction

By its abundance, passive and photovoltaic solar energy is the most promising source of renewable energy. However, one of the main hurdles for its widespread implementation is the fact that it is only available during daytime hours, and even then it is intermittent due to weather conditions. Therefore, being able to estimate beforehand the availability of solar energy at a particular location offers a significant advantage. This is particularly true for building applications. In some cases, a rough estimate of expected solar energy may be enough, but obviously, the usefulness of the forecast data increases with higher accuracy and detail.

The idea of using weather forecasts in building control applications has been explored before. Years before online forecasts were available, statistical projections relying on previous data were developed, (see Scartezzini et al., 1987). Recent studies have evaluated possibilities of controlling a floor heating system (Chen, 2001) by using public weather forecasts. They have also been considered for using night pre-cooling when required (Wittchen et al., 2005). Commercial systems have also been developed (Berglund and Lundberg, 2000; Régulvar, 2007).

Concordia Solar Lab Work

The Concordia Solar Laboratory (CSL)

http://www.bcee.concordia.ca/index.php/Dr._A._Athienitis

[4] Solar Laboratory, EV16.117
Department of Building, Civil
and Environmental Engineering
Concordia University, Montréal, Canada

[5] Canadian Meteorological Centre
Dorval, Québec, Canada

is a member of the Canadian Solar Buildings Research Network (http://www.solarbuildings.ca/), a national research organization integrating universities, government institutions and industrial partners. The CSL has carried out investigations on using weather forecasts for the control of passive solar heating in buildings. In early work by Candanedo et al. (2007), forecasts for the sky condition over a period of a couple of days were read by a human operator from different websites, classified according to previously defined solar radiation curves and then introduced manually in a control program for the operation of roller blinds on the south façade of the Concordia Solar House.

The shape of the solar radiation curves used by Candanedo et al. (2007), albeit arbitrary, attempted to reproduce particularities of real solar radiation data on the Solar House, (e.g., accounting for shading from nearby trees and buildings) as expected for different "typical days" including sunny, partly sunny, partly cloudy and overcast. Previous measurements of solar radiation and temperature for a clear day allowed the identification of key thermal response characteristics (referred to as thermal admittance) in the frequency domain.

The control program used a table of interior temperature fluctuations, which was calculated for different blind positions and different "typical days" by working in the frequency domain with the corresponding "typical day" curve and the already-mentioned thermal admittance. An important assumption was to neglect the influence of the exterior temperature on the indoor temperature oscillations, as the house is well insulated.

Comparing Weather Observations against Scribe Forecasts

In a study carried out a few months later, forecast values of incoming solar flux data provided in the Meteorological Service of Canada (MSC) SCRIBE matrices were used as input into a system to predict temperature swings inside the solar house (Malys, 2007). General information on the Scribe matrices is available in the Canadian Meteorological Centre's (CMC) Product Guide at the following link:

http://collaboration.cmc.ec.gc.ca/cmc/CMOI/product_guide/product-pages/alpha_glb_scrib_scribe-documentation_gen_e.html

Also, some very general information on using SCRIBE matrices is also available at:

http://collaboration.cmc.ec.gc.ca/cmc/CMOI/SolarScribe/SolarScribe/readme.txt

During these experiments, SCRIBE matrix files were downloaded and sorted automatically, permitting the frequency analysis for real curves. This allowed the additional benefit of being able to compare measurements of various weather parameters like temperature and solar radiation taken at the solar house against equivalent forecast values from the SCRIBE forecasts.

The instrumentation of an energy efficient solar demonstration house (Maison EcoTerra Alouette, located at Eastman, QC)

http://www.maisonalouette.com/french/ecoterra2/index.htm

has allowed the comparison of measurements taken at this house with forecasts for a nearby location (Lac Memphremagog, 15 km SE of Eastman). Figure 1 presents a comparison of two consecutive (00Z, 12Z) SCRIBE 2m temperature forecasts at Lac Memphremagog (QC) against observed temperature values at the Maison ÉcoTerra Alouette for the 48-hour period ending on February 3 at 00Z. It can be seen that temperature forecasts compare quite favourably against observed values for the first 24-hour (Day 1) period. For the second 24-hour period (Day 2) both SCRIBE forecasts differ greatly from the observed temperature values. Interestingly, the older 00Z temperature forecast appears to better follow the trend of the observed temperatures.

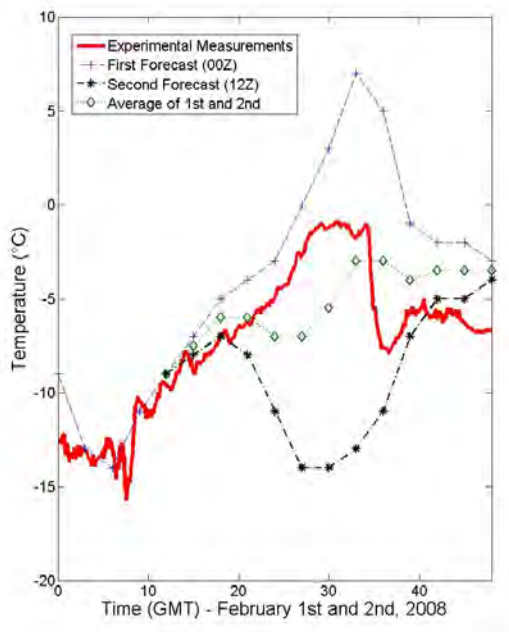


Figure 1: Comparison of 00Z and 12Z 2m temperature forecasts for Lac Memphemagog, Québec against measurements at a nearby location (Eastman, QC) for the 48 hour period ending at 00Z February 3, 2008.

Such discrepancies between forecast values and observed values suggest it may be risky to base building energy management decision systems on a single forecast from a single model as each forecast has its own set of uncertainties.

Since forecasts from numerical weather prediction models are not always correct, strategies will have to be developed to deal with forecast uncertainties. In this simple example, management of forecast uncertainty may possibly be reduced by collecting forecasts from consecutive runs of the same weather model and comparing forecasts for the same valid times. Consecutive runs that produce similar (different) forecasts could be interpreted to mean a higher (lower) degree of confidence in the forecast. Some call this strategy the poor-man's ensemble.

Also, statistical calculations could be done on forecast data collected. Again, in this example, using the average calculated from two successive deterministic forecasts, for data valid at the same times may help to either absorb the shock of an incorrect forecast or add confidence to the desired actions when the forecast is correct.

As ensemble prediction systems are gaining in popularity, making available information on uncertainty associated with weather forecasts, architects and engineers should ensure their building management systems can properly integrate raw weather forecast data and statistical information associated with the forecast such as distribution of values, averages, standard deviation, median, etc. (Poulin et al., 2006; Poulin, 2008).This type of information will allow solar applications to make decisions based on forecast probabilities of weather events.

A comparison of SCRIBE forecast and observed flux values was also performed with rather encouraging results. In a previous work, Malys (2007) employed both the instant SCRIBE flux forecasts, as well as intermediate points from the derivative of the accumulated flux forecasts, for tracing forecast solar radiation curves. The Perez model (Perez et al., 1990) was used in this work for the calculation of the radiation on the south façade. Malys also pointed out some problems associated with the work in the frequency domain, and subsequently employed a time and space discretization for the analysis of the weather forecasts. After determining two empirical parameters in the system-identification phase, satisfactory measurements of indoor temperature swings were obtained when the forecast was accurate.

Figure 2 compares the performance of two SCRIBE forecasts delivered on February 1st, 2007 for solar irradiance at Memphremagog (Québec) with measurements taken at the Maison ÉcoTerra Alouette. Besides the individual raw forecast data points, "intermediate" points and curves based on the prediction of accumulated irradiance were used for a "processed" forecast. In general, it has been noticed that the first processed forecast (from 00Z data) of a given day tends to perform better than the second processed forecast (from 12Z data) for that same day. In Figure 2, processed forecast 1 (from 00Z data) compares better with the measured data on day one than processed forecast 2 (from 12Z data) for the same day. On the other hand, processed forecast 2 (from 12Z data) of February 1st provides a better prediction for the next day (February 2nd) than processed forecast 1 of February 1st.

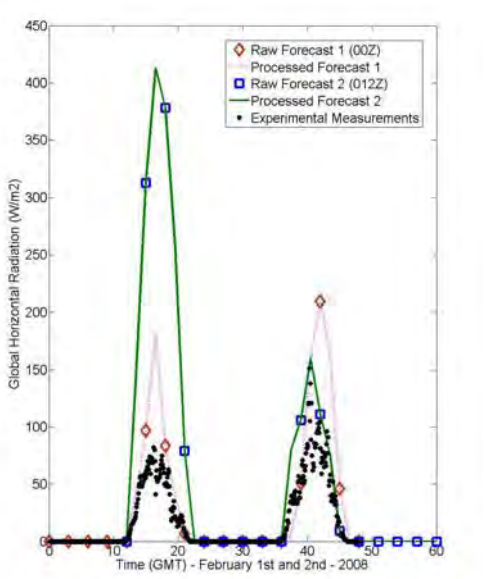


Figure 2: Comparison of 00Z and 12Z SCRIBE flux forecasts (Forecast for Lac Memphremagog, Québec) against measurements at Eastman, QC, for the 48 hour period ending on February 3, 2008.

The agreement of solar radiation is reasonable, although it is not yet quite as good as desirable, especially for cloudy days.

Ongoing and Future Work

Maison ÉcoTerra is currently undergoing a commissioning and monitoring phase. The CSL has also participated in the design of another energy-efficient solar house demonstration project: Alstonvale Net Zero House

http://www.montrealzero.ca/

http://www.spd.ca/spd/

In both projects (ÉcoTerra and Alstonvale), a commercial control system makes use of simplified weather forecasts. The Alstonvale Net Zero House will be built during 2008.

There is great interest in this emerging type of work and a number of efforts are underway. Currently, computer programs are being developed at CSL to compare data measured at these two demonstration projects against forecast values contained in the SCRIBE matrices. For these inter-comparisons, SCRIBE forecast grid point values for Magog and Montréal are used as representative

forecasts for the ÉcoTerra Alouette and Alstonvale houses respectively.

Collected forecast data will also be used for controlling a test hut located on top of a building in downtown Montréal designed for experiments on solar engineering devices as part of the CSL ongoing research activities.

Future work involves using grib format data of high resolution Meteorological Service of Canada (MSC) regional and global models (Poulin, 2007) to interpolate forecast weather parameters at grid points close to each specific geographical location of interest. To complete this work, software will be developed to automatically download and process SCRIBE and grib forecast datasets so that forecast weather values can be extracted for a particular location and packaged in an easy to use table in text format.

Adding quantitative information on solar radiation to forecast datasets like SCRIBE and grib would be most useful. Additional variables of interest include: beam and diffuse horizontal radiation components, expected total radiation on a horizontal surface, on a south-facing slope with an angle equal to the location's latitude and on a south-facing vertical surface.

There is also great interest in more rigorously ground-truthing numerical weather model flux forecasts and other variables against actual observations of those variables. The growing network and activities of CSL labs will hopefully provide valuable feedback to the MSC for improving the parameterization of forecast data of interest to the solar community.

Acknowledgements
The authors would like to acknowledge the financial support of the Canadian Solar Buildings Research Network – a strategic NSERC (Natural Sciences and Engineering Research Council of Canada) research network. The contributions and technical expertise of NRCan, Hydro-Québec and CMHC on the instrumentation and monitoring of the ÉcoTerra Alouette House are gratefully appreciated. We would like to express our gratitude to Bradley Berneche (Alouette House Project) and Sevag Pogharian (Alstonvale House Project). The first author would like to thank the generous financial support of NSERC through a CGS D2 Alexander Graham Bell Graduate Scholarship.

References

Berglund, U.S., Lundberg, B.H. (2000), Comfort control system incorporating weather forecast data and a method for operating such a system, *United States Patent #6,098,893*.

Candanedo, J.A., O'Neill, B., Pantic, S., and Athienitis, A.K. (2007), Studies of Control Strategies for the Concordia Solar House, S*econd SESCI/SBRN Joint Conference,* Calgary, Canada.

Chen, T.Y. (2001). Real-time predictive supervisory operation of building thermal systems with thermal mass, *Energy and Buildings* 33: 141-150.

Malys, L. (2007), Modélisation et Contrôle d'une Maison Solaire, *Technical report*, École Normal Supérieure de Cachan, Cachan, France.

Perez, R., Ineichen, P., Seals, R., Michalsky, J., and Stewart R., (1990). Modeling daylight availability and irradiance components from direct and global irradiance, *Solar Energy*, 44: 271–289.

Poulin, L., (2007), Using PCGRIDDS32 to play with CMC model data, *CMOS Bulletin SCMO,* Vol.35, No.5, pp153-156.

Poulin, L., Yu, W., Hodgson,J., (2006) "Renewable energy forecasts for solar powered applications", poster, Canadian Solar Buildings Conference
http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SolarScribe/RE_Fcsts/SolarBuildings/2006/2006_REFcsts_SolarBuildings_latest.ppt

Poulin, L., Renewable Energy forecasts for solar water heaters, *CMOS Bulletin SCMO*, In this issue.

Scartezzini, J., Faist, A. and Liebling, T. (1987). Using Markovian stochastic modelling to predict energy performances and thermal comfort of passive solar systems., *Energy and Buildings* 10(2): 135-150.

Wittchen, K., Løgberg, E., Pedersen, S., Djurtoft, R. and Thiesen, J. (2005). Use of weather forecasts to control night cooling, *Proceedings of the Ninth International IBPSA Conference*, Montréal, Canada.

Regulvar (2007), RW-RUBI-01 Bidirectional EnOcean to BACnet Gateway. Technical datasheet.

Climate change

I hope that we can arrange
to deal with climate change.
Only very few say
change is not 'vrai'.
I think they are all a bit strange.

Uri Schwarz
Executive Director Emeritus
June 2008

2007 Patterson Medals Award Presentation

Kelowna, British Columbia, May 27, 2008 – The Patterson Distinguished Service Medal, first presented in 1954, is considered the pre-eminent award recognizing outstanding work in meteorology by residents of Canada. This award is named in honour of Dr. John Patterson, a meteorologist who was Director and Controller of the Meteorological Service of Canada from 1929 to 1946, a crucial period in the development of Canada's weather service. This year, there were two medals presented at the 42nd CMOS Annual Congress held in Kelowna, BC.

David Grimes, Assistant Deputy Minister, Meteorological Service of Canada, presented the medals to two individuals who, throughout their careers, have provided distinguished service to meteorology in Canada, **Dr. Francis Zwiers** and **Dr. John C. Connell,** with the following words:

"For over 30 years, Jack McConnell has been a leading member of the Canadian atmospheric science community. He has made significant contributions to meteorology and atmospheric science through his research in atmospheric chemistry, air quality and the study of atmospheres of other planets, and through his devotion to teaching at both undergraduate and graduate levels.

Jack's research is his passion. He can be found working late into the night and on weekends in hot pursuit of new ideas.

At York University he was awarded the rare title of Distinguished Research Professor (DRP) and his scientific merit was recently recognized by the recent conferring of the title of Fellow of the Royal Society of Canada (FRSC).

Professor Jack McConnell is enthusiastic. His career as outstanding professor, as an eminent atmospheric scientist and his distinguished service to meteorology is recognized by all who have had the opportunity to work with him.

Dr. Francis Zwiers has made significant contributions over several decades as a leader in statistical climatology and climate system science, contributions that are well-known both nationally and internationally. As a senior researcher and a science manager with Environment Canada, you have been a mentor to young scientists, as well as an authoritative source of advice for public officials and scientists alike.

You are highly respected for your research, recognized as a world leader in climate research and have contributed to making the Canadian Centre for Climate Modelling and Analysis (CCCma) a world class centre.

As a lead author for the Intergovernmental Panel on Climate Change (IPCC) 4, named Fellow of the Royal Society, Fellow of the American Meteorological Society, CMOS Presidents Prize (2000) winner, you have been recognized by your peers both here in Canada and Internationally.

What stands out about Dr. Zwiers above the many significant scientific contributions, his expertise in statistical and climate science, his mentoring to students and researchers and his communications skills, is his leadership skills. Staff, scientists and students see an exceptional leader and a man of great integrity.

On behalf of the Meteorological Service of Canada, it gives me great pleasure to present the Patterson Distinguished Service Medal to Jack McConnell and Francis Zwiers.

Congratulations to both recipients."

Présentation des médailles Patterson 2007

Kelowna, Colombie-Britannique, le 27 mai 2008 – La médaille pour services distingués de Patterson, qui a été décernée pour la toute première fois en 1954, est considérée comme le prix le plus important pour la reconnaissance du travail exceptionnel réalisé en météorologie par des Canadiens. Le prix a été créé en l'honneur de M. John Patterson, un météorologue qui a été directeur et contrôleur du Service météorologique du Canada de 1929 à 1946, un période importante dans le développement du service météorologique du Canada. Cette année, deux médailles ont été présentées au 42e congrès annuel de la SCMO tenu à Kelowna, Colombie-Britannique.

David Grimes, Sous-ministre adjoint, Service météorologique du Canada, a présenté les médailles à deux personnes qui ont fournis au cours de leur carrière des services exceptionnels à la météorologie canadienne: **John McConnell** (Ph. D.) et **Francis Zwiers** (Ph. D.).

Parsons 2008 Medal Award Presentation

Dr. Wendy Watson-Wright, Assistant Deputy Minister, Science, Fisheries and Oceans Canada, presented the 2008 Parsons Medal with the following words:

"Dr. Donald C. Gordon is the 2008 recipient of the Timothy R. Parsons Medal for Excellence in Multidisciplinary Ocean Sciences. In a research career spanning 35 years at Fisheries and Oceans Canada (DFO) and in his retirement, Dr. Gordon has authored over 65 primary publications and close to 100 interpretive scientific reports and popular articles. He has had an important influence on government policy and regulation with respect to the protection and ecosystem-based management of Canadian ocean resources. He has influenced the assessment and regulation of offshore oil and gas development on the east coast, provided the scientific basis for fisheries closures to protect coral communities, spearheaded the inclusion of habitat issues into fisheries management plans, and provided the baseline information on benthic habitats necessary for the development of integrated management plans for the Scotian Shelf.

Dr. Gordon joined DFO in 1970 and immediately demonstrated strong science leadership skills and a holistic approach to problem solving on oil spills and their impact on the ocean and coastal environments on the Atlantic coast of Canada. He worked hard to clarify the science for regulators and much of his work from that era is used as standard method references today. He reached out to the community and industry, initiating a workshop that grew into an annual Atlantic Regional workshop with international participation.


Dr. Donald C. Gordon

He next turned the holistic approach to the study of tidal power in the Bay of Fundy. Extracting energy from tidal power became a focus in the late 1970s due to the increasing price of crude oil. Dr. Gordon tackled the problem of predicting the ecological impacts of tidal power development in this macrotidal coastal area. Following consultations, he assembled a multidisciplinary team of scientists from DFO, Natural Resources Canada (NRCan), Environment Canada, and universities including Dalhousie, Acadia, Mount Allison and the University of New Brunswick which conducted field studies in the intertidal and sub-tidal regions of Cumberland and Minas Basins. The research encompassed the full range of ecosystem functions from primary production to nutrient and ice dynamics. He spearheaded collaboration with Dutch and British scientists to apply ecosystem modelling for the direction of research and the holistic interpretation of research studies. He co-authored substantial ecosystem-level reviews of our knowledge base and ability to predict impacts. At the end of the extensive field program, data analysis, and publication of results, he chaired a regional workshop that reviewed the relevant research and provided a synopsis of the scientific understanding of the potential consequences of tidal power development in the upper reaches of the Bay of Fundy. The ecosystem approach to this research was novel at the time but is presently considered essential to the provision of sound scientific advice on the management of human activities in our oceans.

In the late 1980's, Dr. Gordon provided scientific advice on the potential impacts of proposed oil drilling activity on Georges Bank. He assembled a multidisciplinary scientific team that prepared an influential report reviewing the state of knowledge of the Georges Bank ecosystem and how it might interact with the various activities associated with exploratory drilling. Subsequently, a 10-year moratorium was placed on oil exploration on Georges Bank and special funding was provided to support research to fill some of the critical knowledge gaps identified by the science review.

After several years managing science programmes, Dr. Gordon returned to research in the early 1990's and the growing concern for the impact of mobile fishing gear on benthic communities. Again Dr. Gordon assembled scientists from within DFO and NRCan to tackle this difficult research problem and developed a novel approach to sampling the bottom using a combination of video and still photography, grab samples, acoustic sampling and directed trawling. Analysis of the data required the development of custom software to manage and analyse this complex array of geo-referenced information. The results of this research have made a major contribution to Canada's policy on the regulation of benthic trawl fisheries. A minor diversion to this work was the first directed mapping of cold water corals on the Atlantic coast of Canada. This quickly led to fishing closure areas being established to protect this essential fish habitat.

Having made a significant contribution to the global debate on the impacts of trawling, Dr. Gordon's team turned their attention to the related, but more difficult problem of defining essential fish habitat on the Scotian Shelf. This work is on-going, using many of the techniques developed for the trawling impacts studies and adding a third dimension, fish activity and physical and chemical characteristics of the overlying water. The goal is to be able to predict fish community structure and abundance based on knowledge of the biotic and abiotic habitat. This has been the subject of a series of regional workshops to classify the benthic communities of the Scotian Shelf and provide Fisheries and Oceans managers with guidance on the use of this classification system. Such knowledge will be critical to providing advice for an ecosystem-based approach to the management of ocean activities.

Perhaps Dr. Gordon's greatest contribution has been his influence in motivating, mentoring, and providing leadership to other scientists, support staff and students to contribute synergistically to multidisciplinary research. He repeatedly demonstrated the value of the holistic approach which includes not only all scientific aspects of the problem but also engages all stakeholders throughout the process.

Congratulations Don Gordon!"

Présentation de la médaille Parsons 2008

Le scientifique Donald C. Gordon Jr., Ph.D., est récipiendaire pour 2008 de la médaille Timothy R. Parsons, qui souligne l'excellence dans les sciences océaniques multidisciplinaires. Le Dr. Wendy Watson-Wright, Sous-ministre adjoint, Science, Pêches et Océans Canada, en a fait l'annonce lors du dernier congrès de la SCMO tenu à Kelowna, Colombie-Britannique en utilisant les mots suivants:

"Durant sa carrière de recherche qui s'étend sur 35 années au ministère des Pêches et Océans Canada (MPO) et au cours de sa retraite, M.Gordon a été l'auteur de plus de 65 publications primaires et de près de 100 rapports scientifiques analytiques et d'interprétation ainsi que d'articles de vulgarisation. Il a exercé une influence importante sur les politiques et les règlements du gouvernement relativement à la protection et à la gestion écosystémique des ressources

océaniques du Canada. Il a joué un rôle dans l'évaluation et la réglementation de l'exploitation pétrolière et gazière en milieu hauturier sur la côte Est, a fourni les fondements scientifiques des fermetures des pêches pour protéger les communautés coralliennes, diriger l'intégration de questions en matière d'habitat aux plans de gestion des pêches et a fourni des renseignements de base sur les habitats benthiques, qui sont nécessaires à l'élaboration de plans de gestion intégrée pour la plate-forme Scotian.

M.Gordon s'est joint au MPO en 1970 et dès son entrée en service, il a démontré de solides compétences en matière de leadership scientifique et a proposé une approche holistique pour la résolution de problèmes liés aux déversements d'hydrocarbures et leurs incidences sur les milieux océaniques et côtiers de la côte atlantique du Canada. Il a déployé beaucoup d'efforts pour apporter des éclaircissements sur les sciences à l'intention des autorités de réglementation, et la majorité de ses travaux réalisés à cette époque servent de références pour les méthodes normalisées aujourd'hui. Il a communiqué avec la communauté et l'industrie, initié un atelier qui s'est développé en un atelier régional annuel dans l'Atlantique et qui a suscité la participation internationale.

Il s'est ensuite tourné vers une approche holistique pour l'étude de l'énergie marémotrice dans la baie de Fundy. L'extraction de l'énergie à partir de l'énergie marémotrice est devenue un point central de ses recherches à la fin des années 1970 en raison de l'accroissement du prix du pétrole brut. M.Gordon s'est attaqué à ce problème en faisant des prévisions sur les incidences écologiques de l'exploitation de l'énergie marémotrice sur la zone côtière macrotidale. Suite à des consultations, il a formé une équipe multidisciplinaire de chercheurs du MPO, de Ressources naturelles Canada (RNCan), d'Environnement Canada (EC) et des universités, y compris les suivantes : Dalhousie, Acadia, Mount Allison et l'Université du Nouveau-Brunswick, qui ont mené des études sur le terrain dans les zones intertidales et infralittorales des bassins de Cumberland et de Minas. Les recherches comprenaient la gamme entière des fonctions écosystémiques allant de la production primaire à la dynamique des nutriments et de la glace. Le scientifique Gordon a été l'initiateur de la collaboration des scientifiques de la Hollande et du Royaume-Uni en vue d'appliquer la modélisation écosystémique pour l'orientation de la recherche et l'interprétation holistique des études de recherche. Il a publié en collaboration un grand nombre d'examens à l'échelle de l'écosystème, qui portent sur nos connaissances de base et notre capacité à faire des prévisions sur les impacts. À la fin du programme de recherche exhaustif sur le terrain, de l'analyse des données et de la publication des résultats, il a présidé un atelier régional qui visait à examiner les résultats de recherche pertinents et il a fourni un sommaire des connaissances scientifiques sur les conséquences potentielles de l'exploitation de l'énergie marémotrice dans les tronçons supérieurs de la baie de Fundy. À cette époque, l'approche écosystémique utilisée pour la recherche était novatrice, mais à l'heure actuelle, elle est considérée essentielle à la fourniture d'avis scientifiques rigoureux sur la gestion des activités humaines dans nos océans.

À la fin des années 1980, M.Gordon a donné des avis scientifiques sur les incidences potentielles des activités de forage pétrolier proposé sur le banc Georges. Il a formé une équipe scientifique multidisciplinaire qui a élaboré un rapport influent visant à examiner l'état des connaissances de l'écosystème du banc Georges et la façon dont les diverses activités associées au forage pétrolier pourraient avoir des impacts sur ce milieu. Par la suite, un moratoire de 10 ans a été imposé sur l'exploration pétrolière sur le banc Georges, et des fonds spéciaux ont été affectés pour appuyer la recherche afin de combler certaines lacunes importantes en matière de connaissances, qui ont été cernées lors de l'examen scientifique.

Après plusieurs années de gestion de programmes scientifiques, M.Gordon a repris ses activités de recherche au début des années 1990 pour examiner la préoccupation croissante découlant des incidences des engins de pêche mobiles sur les communautés benthiques. Une fois de plus, M.Gordon a suscité la collaboration de scientifiques du MPO et de RNCan pour s'attaquer à ce problème de recherche complexe et a élaboré une approche novatrice pour l'échantillonnage de l'habitat benthique en utilisant une combinaison de techniques : vidéos et photos, échantillons instantanés, échantillons acoustiques et chalutage dirigé. L'analyse des données a nécessité l'élaboration d'un logiciel fait sur mesure pour gérer et analyser la gamme complexe de données géoréférencées. Les résultats de cette recherche ont contribué de façon importante à la politique du Canada sur la réglementation de la pêche au chalut de fond. Parallèlement à ces travaux, il a amorcé la première cartographie dirigée des eaux coralliennes froides de la côte atlantique du Canada. Cela a entraîné rapidement la fermeture de la pêche dans certaines zones établies pour protéger cet habitat essentiel pour le poisson.

Après avoir apporté une contribution importante au débat mondial entourant les impacts du chalutage, l'équipe de M.Gordon s'est attaquée au problème connexe, mais plus complexe de la définition de l'habitat essentiel pour le poisson sur la plate-forme Scotian. Ces travaux sont en cours et font appel à de nombreuses techniques élaborées pour les études concernant les impacts du chalutage et ajoutent une troisième dimension, l'activité du poisson ainsi que les caractéristiques physiques et chimiques des eaux sus-jacentes. Le but est d'être en mesure de faire des prévisions sur la structure et l'abondance de la communauté de poissons en se fondant sur les connaissances liées aux milieux biotique et abiotique. Ses travaux ont fait l'objet d'une série d'ateliers régionaux visant à classifier les communautés benthiques de la plate-forme Scotian et à fournir aux gestionnaires de Pêches et Océans des lignes directrices sur l'utilisation de ces systèmes de classification. De telles connaissances seront fondamentales à la fourniture d'avis pour une approche écosystémique de la gestion des activités océaniques.

La contribution la plus importante du chercheur a peut-être été l'influence qu'il a exercée pour motiver et encadrer d'autres scientifiques, le personnel de soutien et les étuidants, et leur assurer un leadership en vue de contribuer de façon synergique à des recherches multidisciplinaires. Il a démontré à maintes occasions la valeur de l'approche holistique, qui non seulement intègre tous les aspects scientifiques du problème, mais suscite également la participation de tous les intéressés à l'ensemble du processus.

Félicitations Don Gordon!"

CMOS Prizes and Awards announced at the 42nd Annual Banquet

Grand Okanagan Hotel, Kelowna, British Columbia
May 28th, 2008

President's Prize
may be awarded each year to a member or members of the Society for a recent paper or book of special merit in the fields of meteorology or oceanography. The paper must have been accepted for publication in ATMOSPHERE-OCEAN, the *CMOS Bulletin SCMO* or another refereed journal.


Dr. François Saucier

Awarded in 2007 to **François Saucier** for his leading role in two papers that represent a major advance in ocean-ice modelling in Canada, as well as in our knowledge of the Gulf of St. Lawrence and Hudson Bay: (1) "*Modelling the formation and circulation processes of water masses and sea ice in the Gulf of St. Lawrence, Canada*", by Saucier and co-authors (Roy, Gilbert, Pellerin and Ritchie), Journal of Geophysical Research, 2003.; (2) "*Modelling the sea ice-ocean seasonal cycle in Hudson Bay, Foxe Basin and Hudson Strait, Canada*", by Saucier and co-authors (Senneville, Prinsenberg, Roy, Smith, Gachon, Caya and Laprise), Climate Dynamics, 2004. Through his brilliant capabilities in numerical modelling, combined with his understanding of ice and ocean dynamics, Dr. Saucier has made a pioneering contribution to ice-ocean prediction in Canada in leading the development and application of a state-of-the-art system. This system is now being used to provide regular forecasts of ice and ocean variability in the Gulf of St. Lawrence, forced by Environment Canada's atmospheric prediction.

Tully Medal in Oceanography
may be awarded each year to a person whose scientific contributions have had a significant impact on Canadian oceanography.


Dr. Sus Tabata (right) receiving his prize from Dr. Paul Myers

Awarded in 2007 to **Sus Tabata** for his dedication to the collection, quality control and evaluation of open-ocean data over the time scales of climate change before the importance of such work was widely recognized. His seminal contributions to the collection of unique observations at Ocean Station Papa and along Line P are particularly recognized by this award. Dr. Tabata was one of the first oceanographers to study both eddy and decadal changes in ocean conditions and his work has inspired generations of oceanographers to hypothesize and explore explanations for the changes that he revealed. Dr. Tully was one of Dr. Tabata's mentors and we are sure that he would be very proud of his student and colleague today.

The Prize in Applied Oceanography
may be awarded each year to a member or members of the Society for an outstanding contribution to the application of oceanography in Canada.


Dr. Bill Crawford

Awarded for 2007 to **Bill Crawford** for his important contributions, through a synthesis of basic and applied research, to improved tide tables and to our knowledge of Pacific coastal and open ocean circulation and dispersal processes. Of the numerous applications of his work, his thoughtful contributions to discussions of the fate of potential oil spills in the Queen Charlotte Basin and his leadership in the preparation of the annual state of the Pacific report have been particularly valuable. Bill's contributions to applied marine studies together with his great integrity bring credit to our profession and are appropriately acknowledged by the presentation of the CMOS Applied Oceanography Award.

CMOS Citation
may be awarded each year to an individual, group or organization which has, in the previous year, made some outstanding contribution towards promoting public awareness of meteorology or oceanography in Canada.

Mike Roberts from Kelowna, BC

Awarded in 2007 to **Mike Roberts, "*The Okanagan's Very Own*" weatherman in Kelowna,** for his dedication and proactive approach in conveying weather forecasts and meteorological processes unique to the southern interior of B.C.

Neil J. Campbell Medal for Exceptional Volunteer Service

may be awarded each year to a member who has provided exceptional service to CMOS as a volunteer. The award may be made for an exceptional contribution in a single year or for contributions over an extended period. The contribution should have resulted in an important advancement for CMOS and/or its aims, nationally or locally.

Dr. Geoff Strong (right) receiving his prize from Dr. Neil Campbell

Awarded for 2007 to **Geoffrey S. Strong** for his active support of CMOS over several decades having served as President and Member-at-Large of the Society, as secretary and chair of the Scientific Committee, as a member of School and Public Education, the Nominating and the Finance and Investments Committees, as chair of both the Saskatchewan and Alberta Centres on several occasions, as principal organizer of the 31st Congress in 1997 in Saskatoon and the 38th Congress in 2004 in Edmonton, as a presenter of papers at many CMOS Congresses, as a contributor to the *CMOS Bulletin SCMO* and as an author or co-author of numerous papers published in A-O. In addition to these "official" positions, Geoff has been an active nominator of others for CMOS awards, recruiter of new CMOS members and long time promoter of recognizing contributions to CMOS' goals.

CMOS Fellow

may be awarded for exceptional long term service and support to the Society and/or for outstanding contributions to the scientific, professional, educational, forecasting or broadcasting fields in atmospheric or ocean sciences in Canada. In 2007, there were two Fellows awarded.

Claude Labine (right) receiving his fellow from Dr. Paul Myers

1) The title of CMOS Fellow is conferred on **Claude Labine** for his generous and enthusiastic support of CMOS from programs in the local Alberta Centre to corporate and other sponsorships such as the best student poster paper. For over three decades of dedication to Arctic climate research demonstrated by his unwavering pursuit of better monitoring programs and environmental measurements.

Dr. Savithri Narayanan (right) receiving her fellow from Dr. Paul Myers

2) The title of CMOS Fellow is also conferred on **Savithri Narayanan** for her outstanding leadership in Canadian and international ocean science programs, and for her long-standing support to the programs of the Canadian Meteorological and Oceanographic Society (CMOS) and the Canadian National Committee for the Scientific Committee on Oceanic Research (CNC/SCOR).

The Roger Daley Postdoctoral Publication Award

The **Roger Daley Postdoctoral Publication Award**, valued at $2000, is to be made annually to a candidate who, at the time of nomination, is working in Canada in a non-permanent position as a postdoctoral fellow or research associate, and is within five years of having received a doctoral degree. The award is to be based on the excellence of a publication in the fields of meteorology or oceanography that has appeared, or is in press, at the time of nomination. The first award was made in 2005, and the awards will continue as long as the fund established by Mrs. Daley, together with other contributions solicited through CMOS, will permit.

Awarded in 2007 to **Dr. Matthias Mauder** for his key contribution to the field of micrometeorology in understanding the nature of the flux underestimation in the energy budget closure. His research led to experimentally testing the hypothesis that the 'missing' flux can be explained by the contribution from meso-scale structures, which can be quantified by spatial and temporal averaging. His paper, co-authored with his doctoral supervisor Raymond Desjardins, and Ian MacPherson, entitled "*Scale analysis of airborne flux measurements over heterogeneous terrain in a boreal ecosystem*", was published in the Journal of Geophysical Research, 2007, Volume 112, D13112.

The CMOS Graduate Student Prizes
may be awarded each year for contributions of special merit by graduate students registered at a Canadian university or by Canadian graduate students registered at a foreign university. One of these prizes should be named the **Tertia MC Hughes Memorial Prize**.

The **Tertia M.C. Hughes Memorial Graduate Student Prize** for 2007 is awarded to **Xiaoming Zhai** for his outstanding Ph.D. research at Dalhousie University, in which he showed how the presence of a meso-scale oceanic eddy field drastically changes our view of how near-inertial energy is redistributed and for his assessment of the role played by eddies in the large-scale ocean circulation.

CMOS Graduate Student Prize
is awarded for 2007 to Tiffany Shaw for her Ph.D. research at the University of Toronto, in which she was the first to develop wave-activity conservation laws for three-dimensional equations and a vertically sheared background flow. The result was published in the Journal of Fluid Mechanics in 2008. The research provides a solid foundation for the quantification of energy and momentum transfer by disturbances to a stratified sheared flow.

The CMOS CNC/SCOR NSERC Scholarship Supplement
provides a supplement of $5000 to a holder of an NSERC Postgraduate Scholarship or Canada Graduate Scholarship. It is renewable for a second year provided the Scholarship continues to be held.

Awarded for 2007 to **Peter J. van Hengstum** for academic excellence.

The CMOS Weather Research House NSERC Scholarship Supplement
provides a supplement of $5000 to a holder of an NSERC Postgraduate Scholarship or Canada Graduate Scholarship. It is renewable for a second year provided the Scholarship continues to be held.

Awarded in 2007 to **Gabrielle Gascon** for academic excellence.

The previous year's winner, **Dmitry Vyushin,** continues to hold his NSERC scholarship and hence he will also receive a $5000 cheque.

CMOS Undergraduate Scholarships
Provides $500 for students in their penultimate year of studies to support their final year.

In 2007, the scholarships are awarded to:

- **Alanna Krepakevich** for academic excellence;
- **Bessam Bouagila** for academic excellence.

Campbell Scientific (Canada) Corp. Best Student Poster Prize

was presented by Claude Labine to Derek Van Der Kamp, University of British Columbia, for his poster entitled *"Mini-lidar observations of Vancouver's boundary layer".*

Derek Van Der Kamp (left) receiving his prize from Claude Labine

CMOS 42nd Congress - Kelowna, BC

Kelowna, BC, May 29, 2008. The 42nd annual Congress of the Canadian Meteorological and Oceanographic Society wrapped up a successful week of presentations and meetings here today. Over 500 delegates attended the Congress. Some of the main messages left by a series of impressive plenary speakers included:

■ not only is climate change real and here now, but the most pressing task ahead is to adapt to the changes as well as continue mitigation efforts;

■ multi-year sea ice is disappearing from the Arctic in huge amounts, seasonal re-freezing each winter is masking this;

■ a water shortage is looming, even in Canada where we are thought to have so much fresh water;

■ USA cutbacks are poised to seriously affect the continuity of existing meteorological and oceanographic satellite coverage;

■ global non-renewable energy supplies are dwindling as demand continues to increase, creating an unsustainable

scenario which will bring us to a critical shortage much sooner than most governments will admit; and

■ numerical weather prediction science is now well enough developed that more data observations and the cost of faster computers are all that stand in the way of producing good numerical forecasts for difficult points such as Whistler, BC.

On Tuesday evening, two public talks were held at the Congress hotel. A large attendance of Kelowna residents and Congress delegates heard Mike Roberts, local TV weatherman “extraordinaire”, take the audience behind the scenes of his special way of reporting Okanagan weather. Following Mike, David Phillips gave one of his patented Canadian Weather Story talks. David reiterated that he had also observed enough evidence to conclude climate change was indeed under way now. He suggested we can adapt to it in a practical manner without experiencing the scary scenarios set out by many commentators.

Several awards were announced and presented during the Congress. These included the Society's prizes and awards as well as the Environment Canada Patterson Medal for a major achievement in meteorology and the Fisheries and Oceans Parsons Medal for oceanography. The names, and photos (where available) of all the winners are shown elsewhere in this Bulletin.

On the final day of the Congress, delegates were treated to the latest available information about weather and dust conditions on Mars. Dr. Peter Taylor, long-time member and supporter of CMOS is a lead investigator of Canadian-built temperature and pressure sensors which are aboard the *Phoenix* lander which touched down on Mars on the first day of the Congress.

Bob Jones,
CMOS Webmaster

Mars Phoenix Landing Site

First Weather Report published in Newspaper during Kelowna Congress:

Low: -80 ºC
High: -30 ºC
Average Pressure: 0,855 kPa
Wind Speed: NE 20 km/h

Data Source: NASA.

CMOS President's speech in Kelowna, BC May 28, 2008

Good evening ladies and gentlemen.

Bonjour tout le monde. Je m'appelle **Andy Bush** et je suis le nouveau président de la SCMO. Je ne me suis pas exprimé en français depuis plus de vingt ans. Je promets de m'exercer maintenant que j'ai découvert la traduction en ligne. Je m'excuse mais ... je parlerai tout de même en anglais avant que je dise quelque chose de vraiment mal.

I would like to thank you all for coming to the congress and for your support of CMOS.

We must give particular thanks to **Kent Johnson** for his efforts as Chair of the Local Arrangements Committee, as well as to all of his volunteers.

Also, to **Peter Jackson** and **Diane Masson** as co-Chairs of the Scientific Program Committee as well as to all of their volunteers. Your efforts are very much appreciated by us all.

I suspect that most of you believed that you would be free of President Bush in November. I'm sorry to say that you'll have to suffer through a few extra months with another one in the world. Even though my middle name is, in fact, George, I've kept it nicely hidden as an initial over the 12 years when there was one President Bush or another down south.

I'd like to take this opportunity to introduce my new Vice-President, Bill Crawford.

“Water, weather, and climate: Science informing decisions.” That is the theme of this meeting and it is certainly a very topical one. Given emerging public awareness of climate change, we as scientists have an added responsibility (Al Gore would call it a moral responsibility) to not only do research but to educate the media, the politicians, and most important of all, our youth, who have been unwittingly and extremely unfairly targeted by so-called climate skeptics in a recent misinformation campaign.

But now that the climate system and its evolution is headline news and a very political topic, the pressure is on for us as scientists to broaden the scope of our individual disciplines to include all of those processes that play an important role in the Earth system, and to be able to actively and intelligently discuss them from all angles.

If one speaks of climate change one cannot help but think of the polar environment of the high Arctic, which is of particular relevance to Canada. But we cannot forget the high altitude environment of the Himalaya, my own personal playground, where climate change has also been extremely rapid; it is a region that is now being touted as the world's third pole. The enormous populations of countries bordering the Himalaya such as India, Pakistan, Nepal and

Tibet, to name a few, are entirely dependent on glacial meltwater.

Climate change in both high latitude and high altitude regions, the proverbial canaries in the coal mine, naturally involves the cryosphere and hydrology.

These disciplines, at least in Canada, have traditionally been subsumed in the Canadian Geophysical Union.

I think most of you who attended last year's joint meeting in St. John's felt that having all geoscientists from CMOS and CGU together was extremely beneficial, enlightening and scientifically broadening.

It was therefore felt that CMOS and CGU, and perhaps other Canadian geoscience groups, should present a united front not only to the public but to funding agencies as well.

We all agreed that to join an umbrella entity, now named the **Canadian Societies for the Geophysical Sciences**, or CSGS, would serve this purpose well.

During the second week of May, the **CGU council** formally approved their involvement in CSGS. I'm very pleased to say that this Sunday the **CMOS council** also approved participation in this umbrella organization. This will foster more interaction between our two groups, to the benefit of both. As you are probably aware, we are having another joint congress with the CGU in Ottawa in 2010 as a first in this new cooperation.

But in a broader political context, the atmosphere knows no boundaries. There is no such thing as **Canadian** air. The oceans, rivers, sea ice are equally indifferent to any political boundaries. Pollution and resources — freshwater resources in particular — are a **global** problem and should not necessarily be dealt with on a country-by-country basis. Yes, we each have to deal with our individual governments and yes, our individual funding bodies. But if we take a global perspective, and truly have science informing decisions, perhaps we can make a difference at more than the national level.

Adaptive strategies are what are being looked at for us as humans — strategies such as genetically modified food, carbon sequestration, nanotechnological methods for desalination of ocean water, and so on.

But are our adaptive strategies helping the rest of the biosphere? Are they **sustainable**? Are they simply **engineering bandaids** rather than a **scientific cure**?

These are **global** questions that all geoscientists should ponder, particularly the students in the audience who represent the next **generation** of Earth scientists to grapple with these important issues.

I quote: “And if we cannot end now our differences, at least we can make the world safe for diversity.

For in the final analysis, our most basic common link is that we **all** inhabit this **small** planet.

We all **breathe** the same air. We all **cherish** our children's future. And we are **all** mortal”.

Those words, spoken by **John F. Kennedy**, are probably more relevant today than they were when he had the wisdom to voice them in 1963.

In closing, I'd like to thank everyone who volunteers their time to keep CMOS, the *CMOS Bulletin SCMO*, the website and our journal ATMOSPHERE-OCEAN running. In particular, special mention is deserved for our Executive Director, **Ian Rutherford**, without whom it is not clear that any president would keep his head above water. I'm just happy that Ian is continuing, though at times with me he may find himself second guessing that choice.

I would finally like to thank Past President, **Paul Myers**, for his dedication and hard work over the past year.

At the University of Alberta, Paul is in the office next door to me so I certainly witnessed what effort he put into the job and can at best only hope to come close to the bar that he's set. On behalf of last year's executive, Paul, we thank you.

But I also know for a fact that you pass this role on willingly and gleefully, despite the fact that you've created another President Bush.

Merçi beaucoup pour votre attention. Thank you very much and enjoy the rest of your evening.

Next CMOS Congress

The next CMOS Congress will be held in Halifax, Nova Scotia, May 31- June 4, 2009. The selected theme is “*Sea and Sky Come to Life*”. It will be held at the World Trade and Convention Centre. Please book these important dates on your 2009 agenda.

Prochain Congrès de la SCMO

Le prochain congrès de la SCMO se tiendra à Halifax, Nouvelle-Écosse, du 31 mai au 4 juin 2009. Le thème choisi est “*Mer et ciel s’animent*”. Il se tiendra au World Trade and Convention Centre. Prière d’inscrire ces dates importantes à votre agenda pour 2009.

Third Annual CMOS Photo Contest

And the prizes go to . . .

✦ First place ($100) – Dave Sills, “Supercell Panorama” Chatam, ON

✦ Second place ($50) – John Hanesiak, “Awesome Lightning*” Red Deer, AB*

✦ Third place ($25) – Geoff Strong, “Advection Fog, Icebergs and Sea Gulls” Signal Hill, NL

Supercell Panorama

First place winner, David Sills, is a severe weather scientist with Environment Canada in Toronto. He has a life-long interest in storms and weather and enjoys creative photography. He has been photographing storms with an artistic eye in parts of Canada, the United States and even Australia over the past two decades. David also won first place in last year’s photo contest.

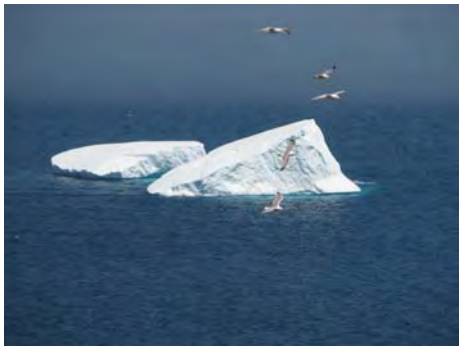
Supercell Panorama was taken on July 18, 2007, at 5:07 pm near Chatham, ON. It was created using three separate photographs stitched together.

Awesome Lightning

Second place winner, John Hanesiak is currently Associate Professor, Centre for Earth Observation Science, Department of Environment and Geography, University of Manitoba. He teaches meteorology there and takes his classes on storm-chasing field trips. In the summer of 2007, in central Alberta while on such a trip, he was able to photograph spectacular lightning near Red Deer, AB.

Awesome Lightning was taken on July 19, 2007 north west of Red Deer in the agricultural region looking west.

Advection Fog, Icebergs and Sea Gulls



Third place winner, Geoff Strong is well known to CMOS. Following retirement from Environment Canada in 1998, Geoff returned to Alberta to resume free-lance research on thunderstorms, atmospheric moisture, drought, and climatic cycles. Other endeavours include teaching university courses in meteorology and physical geography in Edmonton and supervising graduate student research at the University of Alberta where he is an adjunct professor. He was President of CMOS in 2006.

Advection Fog, Icebergs and Sea Gulls was taken at 1 pm on June 9, 2007 from Signal Hill, St. John’s NL while Geoff was visiting St. John’s following the 2007 CMOS Congress.

About the contest

Entrants to our third photo contest included nine very talented photographers who submitted twenty-six pictures. Thanks are extended to Edwin Campos, Maxime Courteau, John Hanesiak, Stephen Hatt, Pat McCarthy, David Sills, Geoff Strong, Richard Verret and Chris Wielki for their delightful submissions.

For this year’s contest, voting took place both on-line and at the CMOS booth at the Kelowna Congress from May 26-29. On line voting was available for a month between mid-May and mid-June. Photos were displayed on the CMOS web site and 5” by 7” prints were also available at the booth. Ballots were provided in both French and English. Voting was anonymous, that is, people voted for the picture without knowing the photographer’s name.

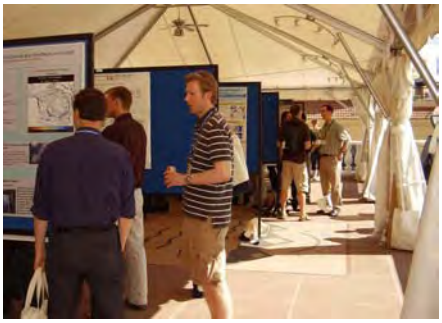
Many thanks go to those people who assisted with this year’s contest. In particular Richard Asselin who actively encouraged people to sit down and vote at the booth and Uri Schwarz who helped count and verify the ballots.

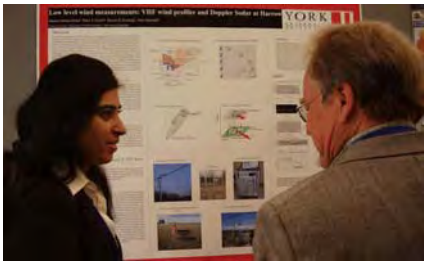
Keep your camera at the ready. Plans are under way for the 4th Annual Photo Contest to celebrate the artistic and creative talents of CMOS members.

Bob Jones, CMOS Webmaster

Note from the Editor: The three winning photos are shown in colour on the inside front cover page of this issue of the *CMOS Bulletin SCMO*.

42nd CMOS Congress Photo Memories
Souvenirs photographiques du 42e Congrès de la SCMO





Photos legend (from left to right, top to bottom). 1. **Tye Lougheed** from Aquatic Informatics Inc. with **Richard Asselin**, CMOS Director of Publications. 2. Quick view of the registration desk minded by **Qing Liao**, CMOS Office Manager. 3. Well attended posters session located outside. 4. Busy Internet room. 5. **Danielle Romanick** and **Marlene Wiig** minding Campbell Scientific booth. 6. **Shama Sharma Kalia** and **Peter Taylor** discussing their poster. 7. **Susan Woodbury** and **Neil Campbell** minding the CMOS booth. 8. **David Phillips**, Congress public speaker and **Bob Jones**, CMOS Webmaster. 9. The Argo speakers group, **Matthieu Ouellet**, **Howard Freeland** and **Anh Tran**.

Photos courtesy of the Editor, *CMOS Bulletin SCMO*, May 2008.

Seeking Sustainability in an Age of Complexity

By Graham Harris

Cambridge University Press, New York, 2007,
ISBN 978-0-521-87349-9, 366pp., Hard Cover, $US 130

Book reviewed by Charles Schafer[1]

In the preamble (Chapter 1) of his book, Graham Harris argues that humans are now *the dominant planetary engineers* that, collectively, have exploited *just about every corner of the globe.* Presently, this perspective is reflected by population growth, changes to global biogeochemical cycles, the information technology revolution, and by the globalization of science to name but a few. Recognizing the contemporary setting as a time of increased complexity and uncertainty – and a growing consensus that the next 50 years or so are going to be critical – Harris devotes the remaining 22 chapters of the book to a careful evaluation of factors that modulate the degree to which *true* sustainability can be achieved. His aim seems to be to help the reader gain an in-depth understanding of *the complexity of it all* and what forms and pathways possible solutions might take in attempting to balance the six key forms of *capital* (natural, physical, financial, human, social and knowledge). He feels that many textbooks of ecology are ignoring the issue of information flows between the human and natural worlds, and that community development literature appears to have remained more focused on social and economic factors and has tended to discount environmental linkages. In his view, true sustainability requires a balanced account consisting of all forms of capital.

Chapters 2, 4 and 5 focus on the complexity of the environment. Complex adaptive systems (CAS), emergence, aggregate complexity, highly optimized tolerance (HOT) systems, non-linearity, and non-equilibrium systems and their *trajectories* are among the topics addressed by the author to show the intimately interconnected character and behaviour of natural systems. Harris argues that the CAS's found in nature feed on variability and that, in the world of CAS, variability is not noise, *it is signal* i.e., *a real measure of systems dynamics* and an indicator of unknown processes. As such, the resulting systems display variability over a wide range of scales, often showing a spectrum of responses without displaying any single characteristic or easily identifiable periodicity. These features have major implications for the ways that we study and monitor natural systems. Regardless of how conservative our approach may be (Harris proposes several strategies in the later chapters of his book), the fact remains that natural CAS's, with their high degree of non-linearity – and the complexity of their internal interactions at various scales – will always leave us with surprises, points of no return and hysteresis. Harris appears to view the issue as one in which the properties of complex systems evolve continuously over time (i.e., *a world of trajectories not states*), and that many small-scale entities are, in fact, responsible for many globally-significant processes (e.g., biofilms and nutrient recycling in ocean surface waters). As such, the effective management of CAS's requires acceptance that the past is no guide to the future.

Chapters 3 and 11 explore the tools, perspectives and science that will be needed to gain useful knowledge about CAS's. Instead of a classical emphasis on balance and equilibrium, the author's new science approach targets non-linearities, dynamic interactions, contexts, network structures, and emergent properties that develop as the result of interactions between *agents*. His approach also engages the community in a debate about values, purposes and outcomes to a much greater degree than what has been witnessed up to this point. According to Harris, [environmental] *science is not now seen as a source of truth but more as an argument and partial explanation.* He points out that the natural world, which demands variability and change, is presently at odds with capital and resource markets that are concerned with security and predictability. Correcting this dilemma poses significant challenges with respect to how we monitor and sample the system – which has implications in regard to manpower and budgets. If interaction and variability are as important as Harris believes, then looking at the natural world in terms of averages and equilibria will obviously no longer suffice.

System complexity is characterized by the author as being exacerbated by the inter-penetration of the biosphere and the anthroposphere because of connections between natural processes and human activities across a range of scales. This situation poses questions such as how do we actually exploit the natural variability at a site for both increased profit *and* sustainability? Part of the answer can be found in the authour's support for a new model of science (*postnormal* science) which depends on greater levels of collaboration among other things. He also calls for new approaches in data collection that stress *when* we collect data, at what frequency and over what scales of space and time. In analyzing ecological systems, Harris views classical approaches as lacking the power to detect changes in means and variances over time, or to pinpoint changes in the sign and character of generating functions. He seems to consider many of the current suite of

[1] Emeritus Scientist, Bedford Institute of Oceanography, Dartmouth, NS.

numerical models as not being able to capture the fine-scale dynamics of ecological systems because they must usually rely on a *lumped* representation of the ecosystem and its constituent species (e.g., the phytoplankton box in aquatic models is very often defined as the biomass of all species as estimated by chlorophyll "A" concentration). Harris believes that data gathering in the field has not kept pace with the conceptual revolution in sustainability science [21st century satellite arrays and underwater cable networks now under development should help to alleviate a good part of this problem].

The remaining 17 chapters of the book cover a range of scientific and philosophical topics from micro-interactions to environmental flows and from catchment form and function to managing environmental systems. They are aimed at demonstrating exactly why a change in how we approach natural science problems is needed if society is to make progress in achieving new levels of *true* sustainability over the next 50 years. In Chapter 12, Harris stresses that, in many environmental matters, we are beyond *risk* (system behaviour is known) and that the situation is usually at least *uncertain* (system parameters are not known) or *indeterminate* (causal chains, networks and processes are open and defy prediction). He observes that some experts suggest that we often fool ourselves into thinking that events are more predictable than they really are and that the risks are contained when, in fact, they are not. These issues auger for a new scientific perspective which Harris refers to as *Mode III* science. Mode III science *works with and through various forms of natural, social and human capital to achieve outcomes.* It is transdisciplinary in character and acknowledges that reason is not a sufficient guide to our actions. Previous science paradigms are viewed as neglecting inconveniently small scales of pattern and process that are often responsible for the major environmental changes that we have witnessed (e.g., small-scale stochastic effects that drive the large-scale dynamics of ecosystems). In Chapter 7, the author concentrates on *sense of place.* Here Harris notes how all of us have a deep sense of *place* that is built around landscape, ecology and biogeography. As such, we are seen as having preferences for particular scales (e.g., road widths, building sizes) and have imposed these preferences on the landscape through *generations of tinkering.* As a consequence, we fail to see landscape degradation *until it hits us in the face* and are often unable to distinguish between natural and created landscapes – thereby making it difficult to see early warning indicators of change. According to the author, it is our *sense of place* that causes society to pay most attention to the 0.26% of the world's water that resides in lakes and rivers i.e., only a very small and transient part of the whole water picture.

A number of the later chapters in the book touch on restoration issues. For example, in Chapter 14, Harris points out that, in general, much of the small-scale pattern in landscapes is produced by self-organization and self-generated complexity (SGC) through local interactions that, in turn, promote maximum water and nutrient use efficiencies on the part of the entire system. These pattern and process relationships begin to change at about a 50% reduction (i.e., clearing) in natural cover. Reversing this trend requires the design of new landscape and waterscape *mosaics* where sustainability, as he frames it, *is not achieved on every hectare, but an overall ensemble approach to a more sustainable solution is realized.* In urban (as opposed to rural) settings, progress is being made through advances in various technologies (e.g., information technology applications, water recycling, desalination). However, Harris worries that globalization is driving patterns of social and economic change that override the natural scales of heterogeneity which underlie the natural production process. As an example of an improved organizational structure for addressing sustainability issues in rural settings, he mentions Australia's Heartlands Program. This program brings together an array of scientific teams (crop scientists, hydrologists, ecologists etc.) who are charged with the responsibility of providing decision support tools for farmers and regional communities that desire to achieve a more sustainable landscape.

Two chapters (9 and 10) explore catchment issues such as the interaction of landscapes and waterscapes and the impacts of human interference (i.e., ecosystem responses). In addition to anthropogenic forcing, natural disturbances and climate variability are viewed as sufficient to compromise the effectiveness of the internal compensation and recycling mechanisms of natural systems. Fire, for example, totally alters catchment water and nutrient balances for long periods. On the anthropogenic side, sulphur and nitrogen emissions (and fertilizer use) are causing acid rain, catchment exports of nutrients, and the enrichment of surface waters in lakes and rivers. Harris remarks that, *although there is an intimate connection between land use and water quality, new work shows that these systems are highly heterogeneous at very small scales, a finding that has fundamental importance for our ability to model and predict the outcomes of our actions.* Impacted systems do not usually recover easily and often show strong hysteresis effects. Manipulations such as the removal of top predators from ecosystems can have a major impact on ecosystem biodiversity and function. Consequently, the ecosystems that we know today are very much modified compared to those that existed as little as 50 to 100 years ago.

In the remaining seven chapters, the author turns his attention to a number of other terms in the *true* sustainability equation. In Chapter 17 (Values and Beliefs), Harris argues that achieving more sustainable outcomes involves ethics and trust as well as communication and collaboration between people and cultures. In his view, community ownership and empowerment is the best and most sustainable solution to the management of resources. When it comes to the management of environmental, social and economic systems (Chapter 18), he stresses the demand for integration, systems thinking and trans-disciplinary science; *scientists with a strong reductionist*

and narrow disciplinary focus may never manage it. Finding ways to understand and to manage the interactions of the many forms of capital that lead to sustainability is treated in Chapter 19. Harris predicts that a new world of systems thinking is emerging which is characterized by a different set of values than found in the *instrumentalist, corporatist world of globalization, economic efficiency, profit, and shareholder value.* Systems thinking is seen as an approach that exploits complexity and variability instead of trying to control or eliminate it, i.e. a world in which CAS's are understood.

The theme in Chapter 20 is on capacity, collaboration, and innovation at both the individual and community levels. Harris reminds us here that wealth is an important driver of sustainability, and that progress on the sustainability front rests on the combination of wealth generation with other forms of capital. This poses a massive challenge to the increasingly globalized and economy efficiency-driven world in which we find ourselves today. The author's discussion of the features of a new environmental paradigm (Chapter 21) is aimed at defining a mechanism for the management and restoration of *multiple capitals* (e.g., ecosystem structure, biodiversity) among other things, and to apply this technique at regional and watershed scales. He states that this must likely be accomplished in a setting of central government values and beliefs that are typically focussed on globalization and the competitiveness of nations, i.e. values which are not necessarily those of local and regional communities. The new paradigm involves recognition of the precarious nature of the present state of affairs and offers strategies such as decentralization, systems thinking, ethical considerations of justice, equity, and fairness as the tools necessary for making significant progress. The material in Chapter 22 is concerned with emerging problems and emerging solutions. One novel proposition made by the author in this part of the book calls for the development of an *ecolophysics*, a new discipline featuring investigative strategies that stress the analysis of high frequency ecological data as a means of elucidating warning signals of impending systems crashes. Ecolophysics recognizes *noise as valuable signal.* The book's final chapter (23) discusses strategies for avoiding ecosystem collapse. It outlines some of the important reasons for ecosystem collapse (e.g., failure to anticipate impending environmental collapse and failure to perceive imminent change because of slow imperceptible change) and provides a list of the great issues of the day that require urgent consideration (e.g., climate change, building from local/regional restoration work to achieve global outcomes, building regional community capacity). Harris calls for a new set of performance measures for *all of nature* (i.e., both developed and more pristine settings) which should encompass social, economic and environmental robustness and resilience. If successful, this strategy leads to an ability to identify system *tipping points* – especially those that lie beyond the scope of both our everyday experience and that of numerical models. Harris seems to concede that the success of this approach will require the analysis of the non-linearities and emergent properties of coupled systems and some hard decisions with respect to tradeoffs. Many of these thoughts are incorporated into what he refers to as *postnormal* science that, by its very nature, is *inescapably radical*. Its aims include the subversion of the *boundary-work* of scientists operating in the policy domain where they have been found to have established a monopoly of expertise on policy problems that feature technical components.

Harris's message is broad and provocative, and one that poses some very significant challenges to 21st century society and science alike. As such, there are numerous important conclusions and recommendations that are scattered throughout the book's 23 chapters. Some worthy of mention are listed below:

- Achieving *stronger* sustainability will require a massive research effort at landscape scales. Much of the knowledge gained will come through empirical research and adaptive experimentation – too complex a task for computer simulation alone.

- A complex world view rests on an appreciation of the inter-penetration of the biosphere and the anthroposphere that reflects complex connections between natural processes and human activities across a range of scales. From the physical separation of financial and natural capitals, we are now considering the emergent forms of multiple types of capital integrating across scales in landscapes and waterscapes.

- A new model of science (i.e., postnormal science) is emerging, featuring not just excellence in science, but also excellence in delivery, adoption and innovation. It calls for working with and through others to achieve new understandings about sustainability/economic relationships. This trend requires more complex modes of operation, changes in old (often monolithic) institutions, and new modes of thought and behaviour. Regardless of how successful we are in making this transition, Harris feels that we will always be managing and setting environmental/sustainability policy in a data-poor environment, i.e. one that uses limited and uncertain knowledge.

- Slowly but surely, adaptive co-management that exploits forms of knowledge other than pure science – and other institutional frameworks – is being developed around the world to manage common pool resources.

- All institutions (scientific, corporations, government jurisdictions) must realize that a greater focus on ethics is slowly but surely being demanded by an even more skeptical and educated public. Consequently, institutions must engage in new forms of collaborations in pursuing solutions that work *with* the natural world rather than against it.

This concisely written and comprehensively organized book is best digested if the reader has at least an undergraduate

background in ecology, biology and/or resource management. Although it is very much a work that appears to be intended for graduate-level students, it will also be of interest to resource managers, green NGO executives and to future-focused politicians as well. The book is, in effect, a course in complex natural systems and postnormal science philosophy that attempts to stand conventional environmental science/management thinking on its end. Each individual chapter is very well referenced and the seventeen-page index found at the end of the book covers virtually all of the key ideas detailed in the text. Perhaps the most unusual feature of this work is that it is completely devoid of any photos, figures or tables. Nevertheless, I found the writer's propositions to be very thought provoking and, if I were just at the beginning of my research career, Harris's ideas would definitely change the way that I would go about conceptualizing field experiments and survey protocols.

Numerical Modelling of Ocean Circulation

by Robert N. Miller

Cambridge University Press, 2007 $65, Hard Cover, 242 pages ISBN 0-521-78182-4

Book reviewed by Iain Russell[2]

The book is based on material from Graduate University courses taught by the author. Chapter 1 describes the importance of numerical models as tools in operational oceanography, and the limitations of those models. Chapter 2 guides the reader through the various properties and pitfalls of numerical discretization techniques to solve partial differential equations of motion, explaining that the choice of scheme for solving the equations is critical to numerical stability. Chapter 3 describes the shallow water equations, based on the assumption that the oceans are shallow (relative to their horizontal dimensions). Chapter 4 is the largest chapter, with about one third of the book dedicated to models based on the primitive equations. Chapter 5 is a much shorter chapter introducing quasi-geostrophic models. Chapter 6 describes coastal ocean models and why they are so important (due to resource management in the shelf-seas). Tropical Ocean modelling is described in the final chapter (7), providing somewhat of a historical perspective of the successes of this form of modelling in the 1980's, especially in the Pacific Ocean ENSO phenomenon.

This is an excellent book on numerical modelling techniques for the student, with an extensive array of information in a relatively short text; the author has been very concise in his explanations of key concepts. The text mixes complex mathematical concepts with a refreshing sense of humour as well – I imagine that the courses taught by the author would be very entertaining. The diagrams included within the text are sufficient to demonstrate the material, but I felt that it would benefit from some additional diagrams to further explain some of the basic technical concepts. At the end of each chapter there are problems/exercises to enhance learning; it would be useful for the author to have provided example solutions to the problems perhaps in an appendix.

The style of the book is very engaging, introducing concepts by asking the reader direct questions in the process; essentially it makes the reader think about the material presented. The author uses humour sparingly and effectively, again it helps to make the text engaging. There is a lot of mathematical material in the text, and whilst this is necessary to explain the technical concepts of numerical modelling, the author endeavours to explain the mathematical principles in the text which is useful I think.

Overall I was somewhat surprised and pleased to find a textbook on this subject which was relatively short; there is a lot of specialised material in such a concise text. I don't think that this is a weakness, but it may limit the book's appeal to those with Masters degrees and beyond. That being said, it should also be of interest to professional oceanographers and meteorologists engaged in service provision to the offshore industry. The author has avoided excessively lengthy descriptions, and it is a good text to find information on the state of the art of numerical ocean modelling quickly.

Books in search of a Reviewer
Livres en quête d'un critique

Nonlinear Dynamics and Statistical Theories for Basic Geophysical Flows, by Andrew J. Majda and Xiaoming Wang, Cambridge University Press, 2006, pp.551, ISBN 0-521-83441-4, Hardback, US$90.

The Equations of Oceanic Motions, by Peter Müller, Cambridge University Press, ISBN 0-521-85513-6, 2006, pp.291, Hardback, US$80.

The Chronologers' Quest: The Search for the Age of the Earth, by Patrick Wyse Jackson, Cambridge University Press, ISBN 0-521-81332-8, 2006, pp.291, Hardback, US$30.

The Gulf Stream, by Bruno Voituriez, IOC Ocean Forum Series, UNESCO publishing, ISBN 978-92-3-103995-9, Paris, 2006, pp.223.

Solitary Waves in Fluids, Editor: R.H.J. Grimshaw, Wessex Institute of Technology Press, ISBN 978-1-84564-157-3, pp.183, Hardback, February 2007, US$130.

---

[2] Pelmorex, CMOS Member, Toronto Centre

Inter-Basin Water Transfer, Case Studies from Australia, United States, Canada, China and India, Fereidoun Ghassemi and Ian White, International Hydrology Series, Cambridge Universtiy Press, ISBN 978-0-521-86969-0, Hardback, pp.435, US$165.

Radiation in the Atmosphere: A Course in Theoretical Meteorology, by Wilford Zdunkowski, Thomas Trautmann and Andreas Bott, Cambridge University Press, ISBN 978-0-521-87017-5, Hardback, 2007, pp.482, US$135.

Human Impacts on Weather and Climate, by William R. Cotton and Roger A. Pielke Sr., Second Edition, Cambridge University Press, ISBN 978-0-521-60056-9, 2007, Paperback, US$55, pp.308 + 12 colour plates.

Fishers' Knowledge in Fisheries Science and Management, Edited by Nigel Haggan, Barbara Neis and Ian G. Baird, Coastal Management Sourcebooks 4, UNESCO Publishing, ISBN 978-92-3-104029-0, 2007, Hardback, pp.437.

Marine Habitat and Cover, Their Importance for Productive Coastal Fishery Resources, John F. Caddy, Oceanographic Methodology Series, UNESCO Publishing, ISBN 978-92-3-104035-1, 2007, Hardback, pp.253.

The Geomorphology of the Great Barrier Reef, by David Hopley, Scott G. Smithers and Kevin E. Parnell, Cambridge University Press, ISBN 978-0-521-85302-6, 2007, pp.532, US$150.

Lagrangian Analysis and Prediction of Coastal and Ocean Dymanics, Edited by Annalisa Griffa, A.D. Kirman, Jr,, Arthur J. Mariano, Tamay Özgökmen, and Thomas Rossby, Cambridge University Press, ISBN 978-0-521-87018-4, 2007, Hardback, US$160.

An Introduction to Atmospheric Thermodynamics, by Anastasios A., Tsonis, Cambridge University Press, ISBN 978-0-521-69628-9, 2007, pp.187, US$55.

Ebb and Flow: Tides and Life on our Once and Future Planet, by Tom Koppel, The Dundurn Group, Toronto, Canada, ISBN 978-1-55002-726-6, Paperback, pp.292, CDN$26.99.

Survival: Survival of the Human Race, Edited by Emily Shuckburgh, Cambridge University Press, ISBN 978-0-521-71020-6, 2008, pp.233, Paperback, US$25.

The Art and Science of Lightning Protection, by Martin A. Uman, Cambridge University Press, ISBN 978-0-521-87811-1, 2008, pp.240, Hardback, US$110.

The Dynamics of Coastal Models, by Clifford J. Hearn, Cambridge University Press, ISBN 978-0-521-80740-1, 2008, pp.488, Hardback, US$100.

Basics of the Solar Wind, by Nicole Meyer-Vernet, Cambridge University Press, ISBN 978-0-521-81420-1, 2008, pp.463, Hardback, US$132.

SCOR 50th Anniversary Symposium

The Scientific Committee on Oceanic Research (SCOR) will be convening a symposium to celebrate SCOR's 50th Anniversary on 20-21 October 2008. The meeting will be held in Woods Hole, Massachusetts, USA, where the first SCOR meeting was held in 1957. This symposium - ***The Changing Ocean: From Past to Future*** - will bring together scientists who contributed to SCOR's history, as well as the new generation that will be entrusted with the field's future.

The major goal of this symposium is to guide SCOR's activities during the next decades of international ocean research and to help SCOR fulfill its mission to increase our basic knowledge of the ocean and contribute to a better understanding of the impacts of global changes and human activities. For more information, please contact Dick Stoddart at dick.stoddart@sympatico.ca

---

Special Offer
All about Ozone (almost)

Copies of the 200 page special issue of ATMOSPHERE-OCEAN on Ozone (Vol. 46 No.1, 2008) are available for $15.00, shipping included. View the preface and the abstracts of the nine articles at http://www.cmos.ca/Ao/Abstracts/chrono.pdf.

To order, send a fax to CMOS at 613 990-1617, including your credit card information; or send an e-mail to accounts@cmos.ca including your phone number and we will call you for your credit card information.

Please call 613 991-0151 to order bulk quantities.

CMOS Publications

Offre Spéciale
Tout sur l'ozone (ou presque)

Des copies du numéro spécial de ATMOSPHERE-OCEAN sur l'ozone (Vol. 46, No.1, 2008), sont disponibles au coût de 15,00$ incluant les frais de poste. Vous pouvez visionnez la préface ainsi que les résumés des neuf articles à http://www.cmos.ca/Ao/Abstracts/chrono.pdf

Pour commander, envoyez un facsimilé au 613 990-1617, incluant les détails de votre carte de crédit, ou envoyez un couriel à affaires@scmo.ca en incluant votre numéro de téléphone et nous vous rappellerons pour la facturation.

Prière d'appeler le 613 991-0151 pour commander des quantités plus importantes.

Publications SCMO

Job Appointment

Kevin Hamilton, a long-time CMOS member, was appointed Interim Director of the International Pacific Research Center (IPRC) on April 1, 2008. The IPRC was founded in 1997 at the University of Hawaii under the "US-Japan Common Agenda for Cooperation in Global Perspective". It has developed with a unique organizational structure that embodies and encourages US-Japan collaboration, which remains central to its research activities. The IPRC has grown to become a center of excellence in climate research with a scientific staff of over 40 and an international reputation for its accomplishments in diagnostics and modelling of the climate system.

Kevin Hamilton

Hamilton, who won the CMOS President's Prize in 1993, held positions at NCAR, the University of British Columbia, McGill University, and the NOAA Geophysical Fluid Dynamics Laboratory prior to joining the IPRC and the University of Hawaii as Professor of Meteorology in 2000. He served as Department Chair of the Meteorology Department at the University of Hawaii from 2004 to 2007.

Gisela Speidel, Outreach Specialist
International Pacific Research Center
School of Ocean & Earth Science & Technology
University of Hawaii at Manoa

Yellow Submarine

It floats like a bird. It looks like a plane. But don't look up in the sky if you're expecting to find these gliders — recast your gaze to the deep blue sea, where a Beatles-like "Yellow Submarine" can be found soaring beneath the waves.

The Slocum Glider takes its nickname from Joshua Slocum, a Nova Scotian who was the first person to sail single-handedly around the world. And like its namesake, the unmanned glider is amazingly independent. It can dive for days or even weeks before being recovered. It conserves energy by using ocean currents while it "glides" up and down through the water. It can dive from 10 metres up to as deep as 2,000 metres before resurfacing and sending the data it collected to researchers via satellite. And, best of all, it's considerably cheaper and more energy-efficient than commissioning ships to canvas the ocean for days on end.

No wonder Marlon Lewis calls gliders "the future of oceanography". "You see much more detail than you would ever see in a ship", explains Dr. Lewis, professor of oceanography at Dalhousie and founder of Satlantic Incorporated. "They can take measurements with higher resolution and can travel in far worse conditions. They're pretty amazing".

Since early March, Dr. Lewis and his fellow Dalhousie oceanographers John Cullen and Katja Fennel have been checking their computers for daily updates from the RU15 Slocum Glider making its way through the Atlantic Ocean from New Jersey to Nova Scotia. Launched by a team of colleagues at Rutgers University – world leaders in working with these devices — the RU15 was embarking on its longest journey to date, pushing the boundaries of how far this technology can go.

Slocum Glider "Yellow Submarine"

To ensure that the glider had enough juice to survive the trip, a creative energy-saving route was used. After crossing the continental shelf, the glider "flew" into the Gulf Stream and used the current's natural movement to guide its path before exiting and following the Halifax Line — a traditional oceanographic transect — to shore. During its two-month journey, it survived a storm with 25-foot seas, got caught in a warm core ring, and had a close call with a Gulf Stream meander.

The entire time, the glider was sending back valuable data about ocean temperature, salinity and density. For Dr. Fennel, this data can provide key information for her oceanographic modelling. As an example, she describes how the gliders can be used to explore changes to the coastal current system transporting cold and fresh water from the Labrador Sea along the east coast.

"It's something that we expect to change dramatically with global warming and the melting of the ice caps", she explains. "With glider capability we have the chance to observe and understand these changes. They open our observational window, and enable us to do things that we haven't done before".

Dr. Cullen agrees: "They have a spectacular capability to cruise through the oceans and tell us a number of things about the ocean interior. This is really connecting the dots for what we do as oceanographers".

Last week [around May 1], the glider was recovered 30 nautical miles offshore from Halifax by a team from Dalhousie and Satlantic, after completing a voyage of 2,600 km, measuring more than 2,150 vertical oceanographic profiles. The team from Rutgers hopes to lead further voyages in the future and plans are for three similar gliders to be purchased and utilized as part of the Dalhousie-led Ocean Tracking Network.

Ryan McNutt, News Media Officer
Communications and Marketing
Dalhousie University

Note from the Editor: News from Dalhousie University Website visited on May 8, 2008. Reproduced here with the written authorization of the author.

In Memoriam

Patrick Spearey
1931 - 2008

Patrick Spearey, a member of CMOS for over thirty years, died peacefully at home on 30 April 2008 in his 77th year. Pat was a faithful attendee at regular luncheon meetings of the Ottawa Centre and undertook a number of book reviews for the *CMOS Bulletin SCMO*. Among these were:

1) *Climate into the 21st Century*, Editor William Burroughs, WMO, Vol.32, No.2, pages 54-55.

2) *Global Change and Local Places, Estimating, Understanding and Reducing Greenhouse Gases*, by the Association of American Geographers Global Change and Local Places Research Team, Vol.33, No.2, pages 55-56.

3) *Hard Choices Climate Change in Canada*, edited by Harold Coward and Andrew J. Weaver, Vol.33, No.4, page 126.

4) *Desert Meteorology*, by Thomas T. Warner, Vol.33, No.6, pages 179-180.

5) *And Now ... The Weather*, by Keith C. Heidorn, Vol.34, No.3, page 100.

6) *Climate Change in Prehistory: the End of the Reign of Chaos*, by William J. Burroughs, Vol.34, No.4, pages 134-135.

7) *Climate Change in Africa*, edited by Pak Sum Low, Vol.35, No.3, pages 93-94.

At the time of his passing Pat was in the process of reviewing *The Chronologers' Quest: The Search for the Age of the Earth* written by Patrick Wyse Jackson.

Patrick Spearey

Patrick Spearey was born on 11 October 1931 at High Wycombe in the United Kingdom and received his secondary school education at Reading Grammar School. Following graduation in the summer of 1949, he joined the UK Meteorological Office and received training at its London Office. In February 1950 he joined the RAF for his two years of then obligatory national service. This included a six-month tour of duty from February to August 1951 observing weather conditions at Car Nicobar Island in the Indian Ocean. He then returned to RAF Tengah on Singapore Island for the final period of his national service where he was employed providing operational weather services for air strikes during the Malayan emergency. Following his release from the RAF early in 1952, he resumed his career with the UK Met Office and was posted to its Hendon Office.

Pat met his future wife, Margaret Addison, a teacher from Toronto, in Hampstead when she was on a year's sabbatical in the UK. Visiting Margaret in Toronto, he noticed a Federal Government employment advertisement in the Toronto Globe and Mail. It was the only occasion that particular agency ever advertised for meteorological personnel. Pat applied and was accepted. He married Margaret in October 1959 and joined the Federal Public Service the following month for specialized meteorological duties. Highlights of his career included four-year tours of duty in the Washington area in the US and at Cheltenham in the UK. He retired in 1993.

Aside from his passionate interest in meteorology, Pat's interests included gardening - he was an active member of the Ontario Delphinium Society - transportation and reading.

CMOS wishes to acknowledge and thank Pat for his valuable contributions to the *CMOS Bulletin SCMO* over the years. I also wish to extend heartfelt sympathy to his family including his wife, Margaret, his children, Susan and John, and grand-children, Brayden and Cole.

Paul-André Bolduc, Editor CMOS Bulletin SCMO
with the kind assistance of Bob Jones and Dave Nowell

400e anniversaire de la ville de Québec

Carte commémorative
"Voyages et explorations de
Samuel de Champlain"

Mai 2008

Inspirée des cartes compilées par Champlain, la carte commémorative, préparée par le Service hydrographique du Canada, intègre des images représentant les divers talents de Champlain, que ce soit comme explorateur, hydrographe, cartographe, illustrateur, ethnographe, auteur ou navigateur.

La carte comprend les éléments suivants :

- Tracés des voyages et explorations effectués par Champlain de 1603 à 1615;
- Mention des 23 traversées de l'Atlantique effectuées par Champlain;
- Noms des Premières nations du temps de Champlain;
- Anciens toponymes utilisés du temps de Champlain et toponymes actuels;
- Routes canotables empruntées par les Premières nations;
- Annotations de faits historiques tirés des Œuvres de Champlain;
- Identification des sites cartographiés par Champlain;
- Première carte détaillée de Québec publiée dans le récit de voyage de Champlain en 1613 (*Voyages du Sieur de Champlain Xaintongeois, capitaine ordinaire pour le Roy, en la marine (1604-1612)*);
- Illustration de la première habitation de Québec tirée des récits de voyages de Champlain;
- Extrait de la carte de la Nouvelle-France de 1612, illustrant des fruits et légumes pour montrer l'intérêt de Champlain pour l'agriculture;
- Illustration de couples Innus et Abénaqui tirée de la carte de 1612 (*Carte géographique de la Nouvelle Franse faictte par le sieur de Champlain Saint Tongois capitaine ordinaire pour le Roy en la marine*). Champlain ajoute les portraits de peuples indiens pour illustrer ses propos descriptifs dans ses récits;
- Illustration d'une femme Huronne-Wendat tirée des récits de voyages de Champlain publiés en 1619 (Voyages et découvertes faites en la Nouvelle France, depuis l'année1615 jusques à la fin de l'année 1618);
- Extrait du *Traitté de la marine et du devoir d'un bon marinier,* publié en annexe de son dernier récit *Voyages de la Nouvelle France occidentale, dicte Canada faits par le Sieur de Champlain* en 1632;
- Illustration de la dernière carte de Champlain publiée en 1632.

La carte est imprimée recto-verso en version française et anglaise aux dimensions de 84 cm X 119 cm. La carte commémorative "Voyages et explorations de Samuel de Champlain" est disponible auprès des dépositaires autorisés de cartes marines du Service hydrographique du Canada partout au Québec.

International Arctic Change 2008 Conference

Québec City, Canada, 9-12 December 2008 - The ArcticNet Network of Centres of Excellence of Canada and its national and international partners are welcoming the international arctic research community to Québec City for the International Arctic Change 2008 Conference. Coinciding with the pinnacle of the International Polar Year and the 400th anniversary of Québec City, Arctic Change 2008 invites researchers, students, policy makers, and stakeholders from all fields of arctic research and all countries to address the global challenges and opportunities brought by climate change in the circumArctic. With over 600 participants expected to attend, Arctic Change 2008 will be the largest transsectoral international arctic research conference ever held in Canada. The conference will be held at the Québec City Convention Centre from 9-12 December 2008. Detailed information on session format, conference topics, and the conference venue is available at: http://www.arctic-change2008.com

---

CMOS Accredited Consultants
Experts-Conseils accrédités de la SCMO

Gamal Eldin Omer Elhag Idris, C.Chem., MCIC

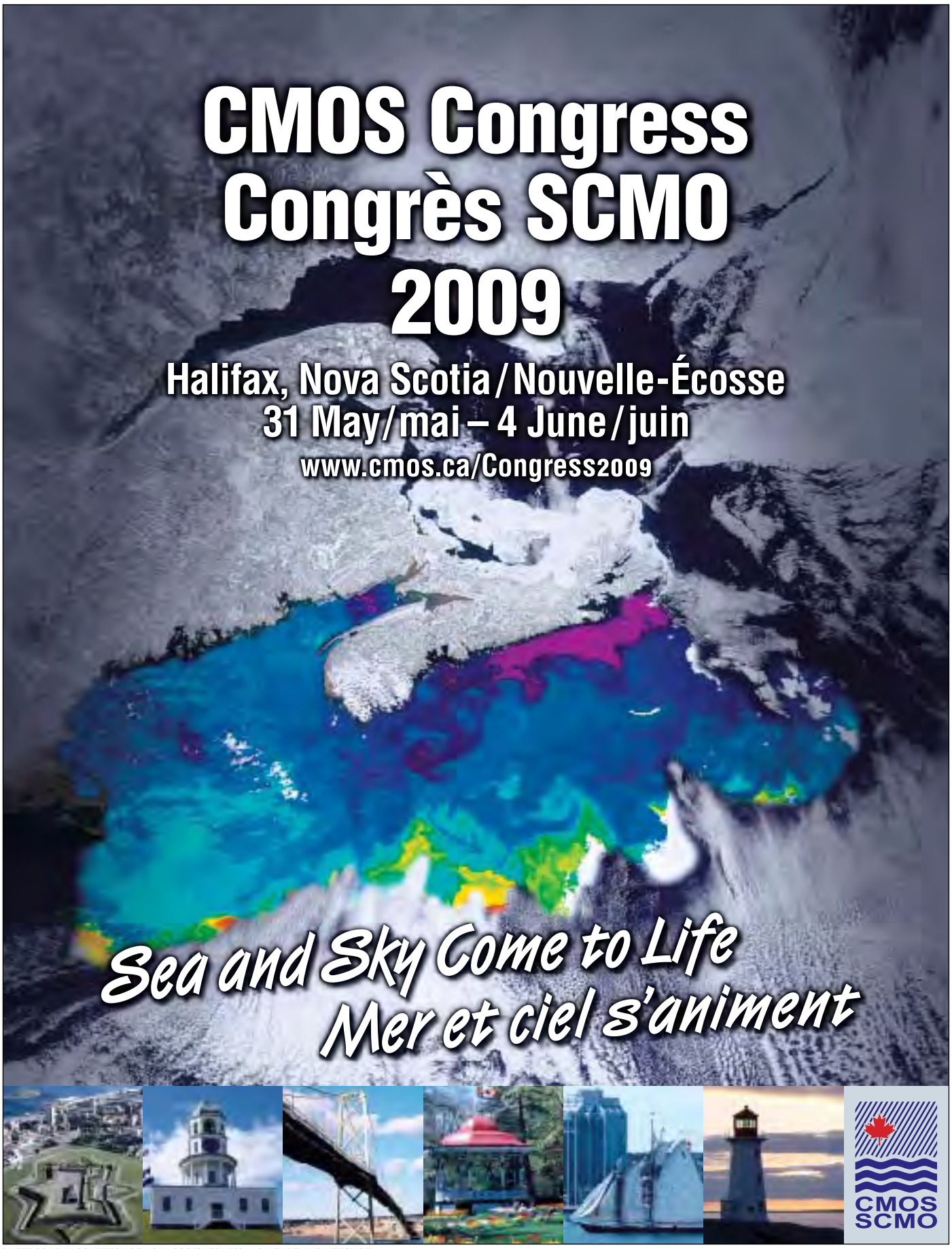
Chemical Oceanography,
Pollution Control and Water Technology

211-100 High Park Avenue
Toronto, Ontario M6P 2S2 Canada
Tel: 416-516-8941 (Home)
Email; omer86@can.rogers.com

Douw G. Steyn

Air Pollution Meteorology
Boundary Layer & Meso-Scale Meteorology

4064 West 19th Avenue
Vancouver, British Columbia,
V6S 1E3 Canada
Tel: 604-822-6407; Home: 604-222-1266



PHOTOGRAPHY COURTESY OF NOVA SCOTIA TOURISM, CULTURE AND HERITAGE.

OUR PEOPLE, YOUR DATA

notre personnel, vos données

CAMPBELL SCIENTIFIC
CANADA CORP.

www.campbellsci.ca