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CMOS
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SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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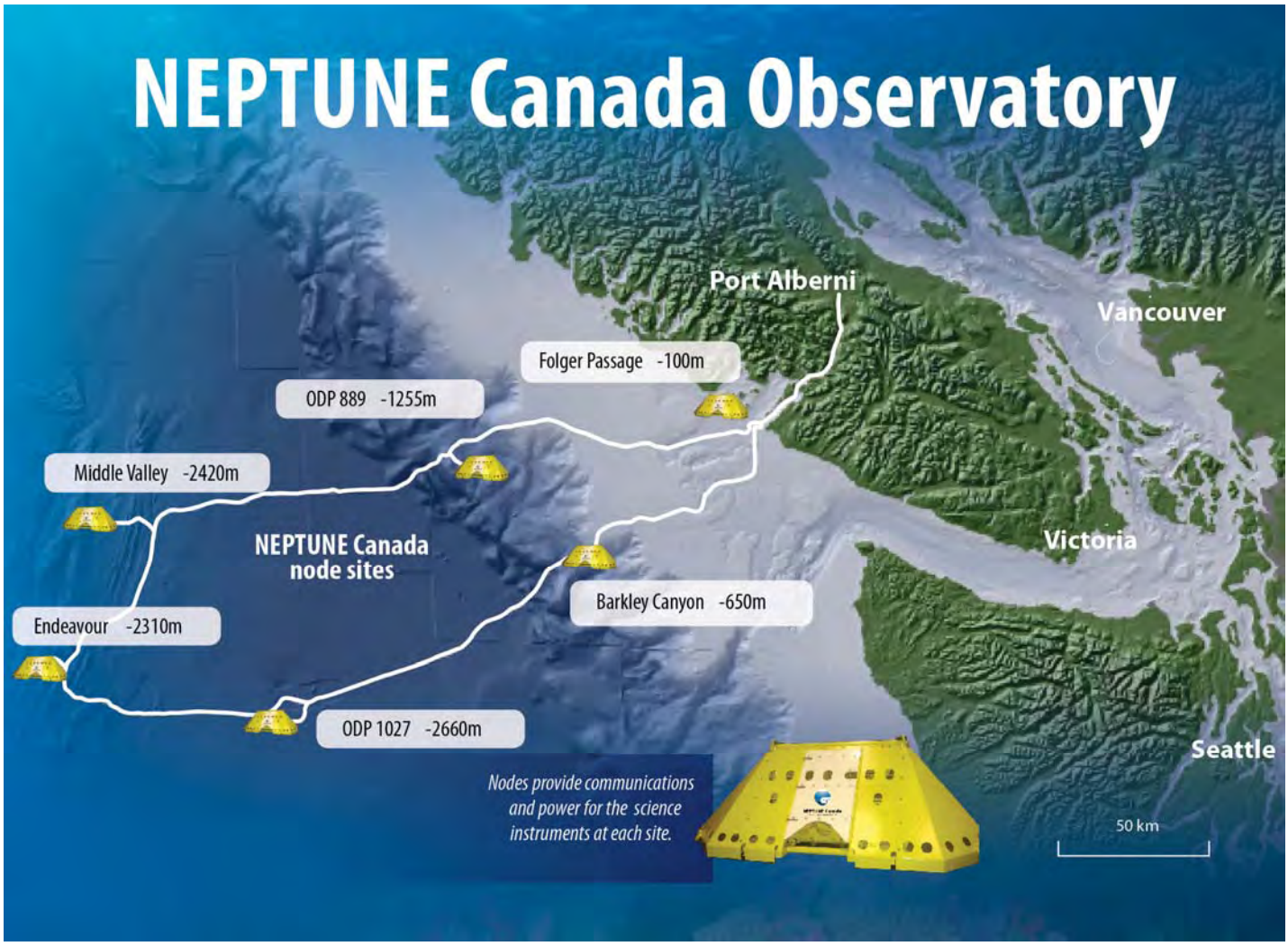

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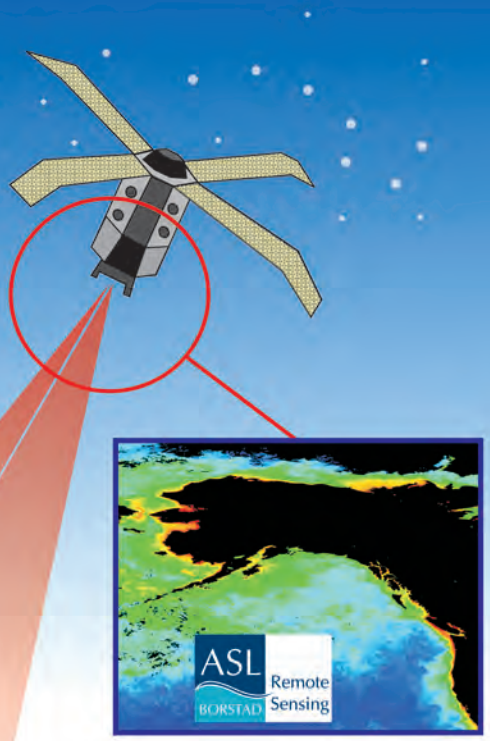

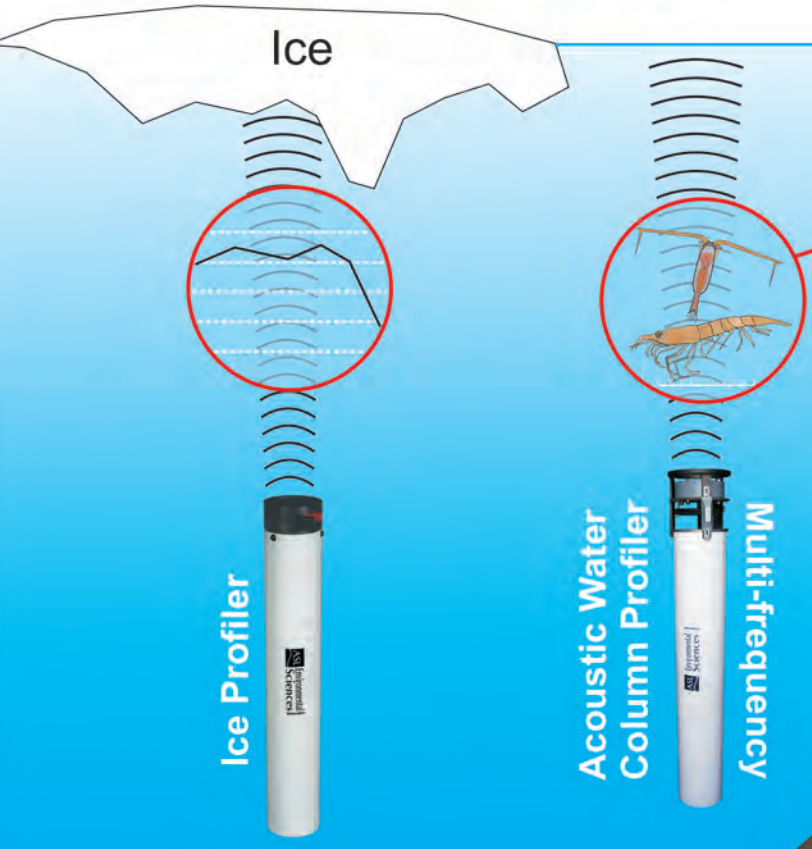

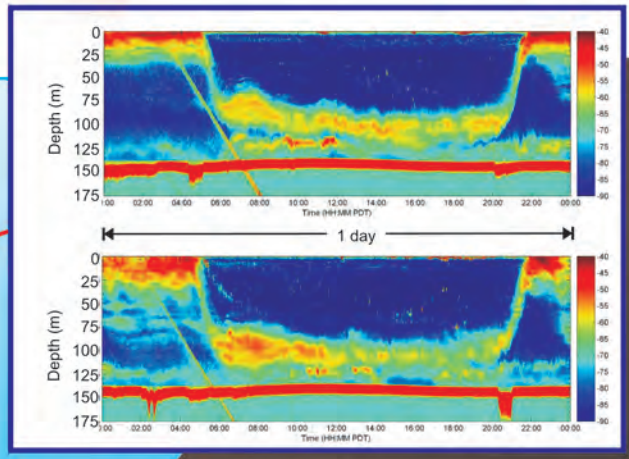

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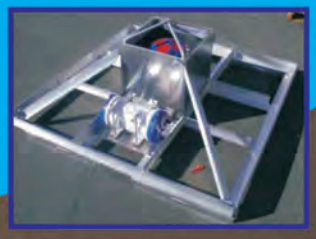

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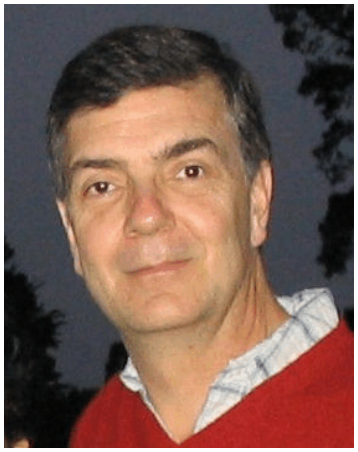
....from the Presidents' Desks

Friends and colleagues:



Bill Crawford
Outgoing CMOS President
Président sortant de la SCMO

We learned early May of the death of Uri Schwarz, the first Executive Director of CMOS, serving from 1982 to 1994, and Executive Director Emeritus since then. I clearly remember his cheerful way of working through any problem that arose and will miss him greatly. We all mourn his passing.

This message will arrive close in time to our annual CMOS Congress, held in Ottawa jointly with the Canadian Geophysical Union. Based on the number of abstracts and sessions, it will be a busy week and a great time to learn of new happenings and to meet new and old colleagues. Our congress chairs, John Falkingham and Dick Stoddart, are busy with final details. Each congress is our major event of the year and we try to move it across the country from year to year. Nathan Gillett and Bill Merryfield of Victoria are well into plans for the 2011 congress, and then we will swing back east to Montréal in 2012.

Congress relies on almost 100 volunteers and CMOS staff to succeed. It is our biggest event as measured by participation, revenue and expenses. It also carries major financial risk. Just one pandemic, terrorism attack anywhere, or even clouds of volcanic dust could leave us with last minute cancellations and major financial loss. During the past years we have built a reserve fund to cover such a loss, allowing CMOS to boldly plan future congresses with a good safety net.

I will pass the President's gavel to David Fissel during the CMOS evening Banquet at congress, as part of a tradition going back to the beginnings of CMOS. Presidents serve on the executive for three years, but only for one year as president; we start a year early as vice-president, and continue another year as past-president. David Fissel will serve as president for a year, and we hope that our incoming vice-president, Norm McFarlane will step up in 2011. Our recording secretary Sophie Johannessen, corresponding secretary Jane Eert and treasurer Rich Pawlowicz will continue for two more years. Finally, my predecessor as president, Andy Bush, will depart the executive in June. I do wish to thank these executives for their work and insight over the past year.

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CMOS Bulletin SCMO
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CMOS Bulletin SCMO
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Cover page: The NEPTUNE Canada observatory, off Canada's west coast, is the world's first regional cabled ocean observatory; the map shows the locations of the 800 km backbone cable route, the nodes and their depths, and the Port Alberni shore station that connects via a 10 Gbsec backhaul line to the data centre at the University of Victoria in Victoria. To learn more, please read the article on **page 89.**

Page couverture: L'observatoire NEPTUNE Canada, au large de la côte ouest du Canada, est le premier observatoire océanique régional câblé au monde; la carte montre les emplacements de la route du câble d'acheminement principal, les noeuds ainsi que leur profondeur, et la station côtière Port Alberni qui le connecte au moyen d'une ligne de retour de 10Gbsec au centre des données de l'Université de Victoria à Victoria. Pour en savoir plus, veuillez lire l'article en **page 89**.

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Canadian Meteorological and Oceanographic Society (CMOS)
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Executive / Exécutif

....from the Presidents' Desks (Continued / Suite)

And now, over to David Fissel….

Bill Crawford,
Outgoing President
Président sortant

Friends and Colleagues:

David Fissel
Incoming CMOS President
Nouveau président de la SCMO

My first wish is to acknowledge the dedication and achievements of Bill Crawford who has served as the CMOS President for the past year. Bill has led CMOS effectively through a variety of important issues. A major accomplishment was leading the way in developing our position statement on climate change, issued prior to the Copenhagen meeting last December. This statement was jointly issued by CMOS along with four other Canadian environmental Learned Societies. Bill will continue to be part of the CMOS executive for another year in his new role as Past-President.

I also look forward to working with Richard Pawlowicz, Jane Eert and Sophia Johannessen on the CMOS Executive for this coming year. Fortunately, Ian Rutherford will continue to serve as the Executive Director in managing the day-to-day operations and in providing keen strategic insights based on his executive director experience, as well as having served as President of CMOS in 1999.

In my role as Vice-President over this past year, I have focussed on membership issues including the retention of existing members and recruitment of new members. CMOS members represent our core strength as an organization. We need to continue to make CMOS relevant and rewarding to meteorologists, oceanographers and others involved in these disciplines, across Canada and globally.

I would like to thank those CMOS members who are actively engaged in our Society through involvement in our governing Council, many national committees, and on the executives of the CMOS Local Centres (as listed on the home page of the CMOS website). The countless volunteer hours provided by these highly qualified and very busy scientists make CMOS an effective and globally respected organization.

I would also like to acknowledge the efforts and dedication of the staff of the CMOS National Office in Ottawa under the direction of Ian Rutherford, CMOS Executive Director. Richard Asselin is Director of Publications and has recently provided the leadership in developing the plans to transition our journal ATMOSPHERE-OCEAN to a more sustainable situation with CMOS. Paul-André Bolduc is responsible for the *CMOS Bulletin SCMO*, including translations and publishing, which has been featuring consistently high-quality contributions. Our office manager is Qing Liao, who handles our membership applications, renewals, address changes, subscription enquiries and keeps our office running smoothly. The national office also benefits from the contributions of others, including Bob Jones, the CMOS webmaster, Dorothy Neale and until very recently, Uri Schwarz, our Executive Director Emeritus, who recently passed away. We owe much to Uri Schwarz in building CMOS through his role as the first Executive Director of CMOS, starting in 1982.

CMOS exists for "*the advancement of meteorology and oceanography in Canada*". Our biggest activity is the Annual Congress which this year, as a joint Congress with the Canadian Geophysical Union (CGU) in Ottawa, will attract several hundred attendees. We thank John Falkingham, Dick Stoddart and the many dedicated CMOS volunteers as well as Spiros Pagiatakis, CGU President and the many CGU volunteers for making this major event possible.

I look forward to working with all of you in CMOS, as well as our many collaborators and affiliates, over this next year.

David Fissel
Incoming CMOS President
Nouveau président de la SCMO

Highlights of Recent CMOS Executive and Council Meetings

Council recommends that CMOS hand over at least some of the publication tasks of ATMOSPHERE-OCEAN to a different publisher, either Taylor and Francis or NRC Press. Council Members voted on their preference during the March teleconference, with a majority choosing Taylor and Francis. A survey about the choice of a new publisher has been sent to all members by email. The members' preference, along with Council's recommendation, will be available as background material for the final decision, which will be made at the Annual General Meeting in Ottawa.

CMOS membership is up this year (about 5% higher than last year as of April). The increase is apparently mainly driven by an increase in student membership.

We need new Chairpeople for the Audit Committee, the Ad hoc Flight Services Committee and the Finance and

Investment Committee.

The Executive has to approve the budget before the formal budget vote at the Annual General Meeting. Next year's budget is very similar to this year's. The most contentious item is the contribution of Congress funds to the national CMOS office. At least $20,000 is built into Congress budgets for the National Office to provide support to the Congress (website, abstract submission, registration, etc.). Because the transfer of ATMOSPHERE-OCEAN to a new publisher has to be voted on at the AGM, the current budget shows A-O running as it does currently and breaking even. The transfer to a new publisher will affect the budget, but not until 2011. Either of the two new options will generate additional revenue and/or time, and they should not represent additional expenses. Council has also voted to move $50,000 into a reserve fund in case of an unsuccessful future Congress, due, for example, to a natural disaster.

There was a member request to publish government research funding in the Bulletin – it should be possible to include NSERC and CFCAS numbers, but government departmental numbers will be harder to obtain. Council will request that the Science Committee take on the compilation of these numbers as a regular task.

Congresses:

2010 Ottawa: The conference abstract book is ready. All exhibit booths have been sold. About 780 abstracts have been received. Plenary speakers and a public lecturer have been confirmed.

2011 Victoria: The Congress theme will be "Ocean, Atmosphere and the Changing Pacific". Promotional posters have been distributed.

2012 Montréal: Accommodation arrangements have been made. There are 975 room-nights booked.

2013 Saskatoon: The 2013 CMOS Congress is tentatively planned to be held in Saskatoon, in partnership with the Canadian Geophysical Union and the Canadian Water Resources Association.

Sophia Johannessen,
Recording Secretary / Secrétaire d'assemblée

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.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **August 2010.** Please send your articles, notes, workshop reports or news items before **July 2, 2010** to the address given on page 42. We have an URGENT need for your written contributions.

Letter to the Editor / Lettre au rédacteur

From: Philip Merilees
Bonita Springs
Florida, USA

Date: April 13, 2010

Subject: Cedric Mann's Obituary

I would be remiss if I did not comment on the career of Dr. Cedric Mann whose obituary appeared in the December 2009 issue of the *CMOS Bulletin SCMO*. I worked very closely with Ced during the period when I was Director-General of Research of the Atmospheric Environment Service from 1984-1987 and he was Director-General of IOS. Many scientists and senior managers at AES were convinced of the importance of doing all we could to promote the interaction of atmospheric and oceanographic research in Canada. We believed this was particularly important for climate issues.

The AES approached the government oceanographic community with these ideas and got a sympathetic response. However, only Ced Mann actually decided to make something happen.

I believe that the vision that Ced and AES management shared about the importance for co-mingling of oceanographic and atmospheric research for climate issues has made much progress as demonstrated by the outstanding research community on climate presently active on Vancouver Island centred in the University of Victoria and the Institute of Ocean Sciences. Ced Mann and AES management of the mid-80s could hardly claim that they made it happen...but a good vision is a powerful force.

ARTICLES

Ice Floes on the Mind

by W. F. "Willy" Weeks[1]

Studying the ice that forms when the sea freezes is an occupation that at first glance would appear a bit limited in scope. However, like many specialties once you get inside the subject, you find that limited scope is the least of your problems. I was introduced to sea ice in 1955 when, during a two-year stint in the US Air Force, I found myself nominally in charge of a field operation focussed on measuring the strength of sea ice with an overall goal of improving estimates of its bearing capacity. In those Cold War days the problem was one of resupplying the radar stations located along the Labrador coast where aircraft runways were rare and the presence of sea ice limited the use of shipping during the long winters. The study site selected was Hopedale, a small native coastal community. The radar site was located near the village on the top of a hill. During the winter the main means of transport between Hopedale and "civilization" (Goose Bay) were helicopters with reciprocating engines in that turbines were not yet in common use. Such engines were not fond of cold weather. In addition, helicopter pilots being intelligent did not like to fly during icing conditions, snow, fog and gale-force winds, all commodities that the Labrador coast had in abundant supply. There were days when you simply did not go outside, much less fly. Just getting to Hopedale was an adventure. Anyway we got there and were able to perform a number of useful preliminary tests. Looking back on it, what we really learned at Hopedale was how to obtain reliable ice property measurements in the field under generally difficult working conditions. In this effort we were ably assisted by several of the locals. They were not very large men but tough and smart. Once they knew what we wanted, we got it. Not only that, they invariably modified our equipment and procedures so they would actually work.

Tales of the goings on at Hopedale during this period would fill a book. Picture one hundred USAF types locked up on a mountain looking down on a community where there were reported to be friendly ladies. We could have given "MASH" serious competition. Here I will simply sketch out a couple of events that if we were sitting in a bar with a few libations could be greatly expanded. The first tale involves the weather. One afternoon Andrew Assur, [later the Chief Scientist at the Army's Cold Regions Research and Engineering Laboratory (CRREL)] and I were working on a set of ice samples in an unheated warehouse located down on the coast. Things were going well when we noticed that the building was beginning to rattle and shake. Opening the door to look out (there were no windows), we discovered that a first-class blizzard had arrived. We immediately decided to secure our samples and try to get back up the hill to the radar site. Although there was a road it soon disappeared under drifting snow. By the time we were part way up the hill, we could barely see as the result of snow plastered on our glasses. Also the gusts of wind were such as to frequently knock us off our feet. Fortunately there was one item that saved us. There was a telephone line that ran along the road. Ultimately we crawled up the hill always making certain that the first person had the next pole in sight before the second person lost sight of the last pole. It was a slow trip. One thing I learned was that crawling the better part of a mile keeps you warm.

The next tale also, in a way, involves the weather at Hopedale. As the result of the deep snow plus the fact that the sea ice was typically thin, the surface of the sea ice was frequently depressed below sea level. This meant that at work you commonly stood in ankle-deep ice water. Now the military-issue cold weather boots at the time were the so-called Mickey Mouse boots with leather soles and uppers made of felt (not to be confused with a somewhat similar-appearing rubber boot that was under development at about this time). Felt plus ice water made for very cold wet feet. Fortunately my local associates, after hearing me complain loudly said "*We can get you a good pair of sealskin boots that will keep your feet warm and won't leak*". Measurements were made and boots were procured that performed exactly as promised. Now let me add a few important facts here. The base commander, a Major, did not like me. For one, I did not report to him. My commanding officer was a Colonel in Boston. Also he had been told by his superiors to give me all necessary support. He particularly did not like my field clothes, an odd hodge-podge of Army+Navy+civilian gear that kept my upper portions reasonably warm while still allowing me to move readily about. Air Force gear was not included which was designed for people sitting comparatively motionless in airplanes. The Major had already informed me that I was a disgrace to the service. I took that as a compliment. When the skin boots arrived he really went ballistic. "Not only are they not regulation, but they stink". In those days the sealskin was cured in urine and chewed. They did not smell bad. Rather a faint sweet smell. Even if they did, it was a vast improvement over numb wet feet. Anyway I was forbidden to bring the boots inside the living quarters. I complied with this request and the boots kept my feet warm until later in the winter when they perished in the Great

[1] Professor Emeritus, Geophysical Institute, University of Alaska, Fairbanks, Alaska, USA

Hopedale Fire.

This brings me to my last tale of Hopedale; the FIRE. Back to the Major. When he sat at his desk and looked beneath its glass top, he saw the following statement "No NEAC commander will survive a major fire", signed General Barcus. The Major was definitely not interested in a fire. Now getting serious for a minute, although fires are generally unfunny, fires in the polar regions are particularly unfunny. As radar sites were commonly comprised of interconnected modules, this meant that if a fire got out of control the complete site could easily be destroyed. Now down on the coast on the pier near where we worked on the sea ice, there was a warm-up shack; a structure put together by the original construction crew. It was tiny, at most 8 by 8 feet, and contained a small stove. We frequently used it for storage; sometimes of quite expensive seismic equipment. However, just prior to the day of the fire, we had moved all our equipment into the warehouse that I mentioned earlier. One afternoon while at work on the sea ice about a half-mile from the pier, we noticed that the shack was aflame. As it was very windy the fire was throwing a long plume of oily black smoke. Furthermore at essentially the same time, a helicopter took off heading back to Goose Bay. This meant that not only had there been a fire but that they will know about it at The Goose which means that General Barcus will know about it down in Newfoundland. Disaster!

How did this conflagration start? I don't know for sure but one of the Hopedale lads who worked for us was a chain smoker given to flicking butts onto the ground. Added to this was the fact that he had recently been in the shack whose wooden floor had, over the years, achieved saturation with spilled arctic diesel fuel. The shack burned to the ground; nothing but ashes remained. My presence was immediately requested by the Major. I won't tell you what he had to say.

Then a miracle happened. A search was made for the paperwork documenting the construction of the shed. It could not be found. Furthermore it appeared to have never existed. When the construction crew put the shed together to keep themselves warm, they forgot to fill out the appropriate paperwork (thanks fellows!). If there was no paperwork, the shed clearly did not exist and if it did not exist it could not possibly have burned down. I had avoided possible draconian punishment like being demoted to Airman lowest-class. The Major was able to keep his job and I am certain that General Barcus was also relieved.

Now you may think that the story ends there. Not so. Please let several months transpire and yours truly return to Boston. My phone rings! A voice says, *"Lieutenant Weeks, this is property manager Moe, I have a problem that you can fix*". This was followed by similar calls from property managers Larry and Curly who had related problems. They had been running projects at obscure locations such as the Sahara and South Pacific, had inevitably lost equipment and were on the look-out for a natural disaster that would allow them to finally get this equipment off their books. The end result of all this was that as far as Hopedale was concerned, there was no fire. As far as the property officers in Boston were concerned there had been a major conflagration, destroying considerable equipment. The end result was that everyone was happy. In that I did not lose any appreciable equipment in the first place, I was always happy. My Colonel was also happy and ultimately I became a Captain.

In the spring, as we were about to pull out of Hopedale making the Major very happy, I received a panic message ordering me to fly to Frobisher Bay, now known as Iqaluit, and from there to immediately proceed on to Cape Dyer on the southeast tip of Baffinland. Why the rush? During the spring of 1956 the DEW line radar site DYE Main was under construction at this location. The problem was that there had been a delay in the arrival of the very large radar antenna required by the site. Furthermore, for reasons beyond me, it was apparently impossible to break the antenna down into small more readily transportable segments. There was only one possible transportation option other than the use of a ship much later during the summer when the fjord would be ice-free. That was to land a heavy aircraft carrying the antenna on the ice in the fjord and then transport the antenna via a sled over the sea ice and up the steep side of the fjord to the actual construction site. Earlier during mid-winter this would have been no problem, but it was spring. The sun was out and the sea ice was getting thinner and warmer by the day. What was needed was someone to say "We can do this safely" and supervise the landing. That is where I came in. Actually I always thought that the real reason I was there was to provide someone to blame when the aircraft and antenna broke through the ice and sank. I dutifully measured sea ice and snow thicknesses and temperatures and calculated salinity and brine volume profiles using the crude transfer functions available at the time. I then conferred by radio with my associate Assur who was at the time in Chicago. He made some additional bearing capacity calculations on the lab computer (a beast about the size of two large refrigerators that one programmed via paper tape using what was essentially machine language). The upshot of all this was that I was told that although he did not like the looks of the numbers, he thought that we could get away with landing the plane but to get it in and out as fast as possible. No lingering for coffee! I passed this on to the site engineer who informed me that he was glad to hear that the landing should be possible as the plane (a C-124 Globe Master, Fig. 1) was already on its way north and would arrive shortly. Land it they did and as soon as it had taxied to the designated parking area I placed a leveling rod beneath the plane to keep track of the deflection resulting from the load. As you might expect, the initial deflection (elastic) was rapid followed by gradual downward creep that appeared to be decelerating but only slightly. Assur had informed me that if the downward creep started to

accelerate it was time to get the plane out of there FAST. I pictured the pilot at his seat ready to dash skyward in an instant. As I peered into my level, I gradually became aware that there was someone standing behind me. It was the aircraft commander having a cup of coffee. "How are we doing?" he inquired. "So far, it looks OK," I responded adding that I would be very happy if he were to get a little closer to his aircraft. Then a rumbling clanking sound caught my attention. It was a D-6 Caterpillar tractor with a very large sled in tow, the antenna transportation system pulling up to the aircraft. This was clearly a factor that we had not considered in our bearing capacity calculations. Once the "Cat" arrived, the deflection profile changed from deceleration to acceleration. I dashed over to the plane, informed the site engineer of the observations and suggested that it would be an excellent idea to load the antenna on the sled, send the D-6 with the antenna on its way up the mountain to the construction site and send the empty C-124 back south NOW. Fortunately this was done promptly. After the plane left, the ice rebounded but not to its original position. I looked for cracks. There was nothing very obvious, but the irregular rutted snow cover made viewing difficult. However, the next morning when I passed the landing area I was surprised to find a large flooded region where the plane had parked. We clearly had been operating under conditions that would have resulted in break-through if the aircraft had remained on the ice for a significant period of time. What would be a significant period of time? I still don't know for certain but I would guess that we would have been OK for at least another hour. If the D-6 had not arrived, the unloaded plane would possibly have been safe overnight. The point I would like to make here is that placing large loads on either sea or lake ice is rarely a cut-and-dried affair and careful monitoring of conditions is always a good idea even if the loading is such that structural damage to the ice sheet is unlikely.

Figure 1: A USAF C-124 parked on sea ice. As the astute viewer will note after noting the distinctive shape of Mount Dundas in the background, this photo was taken at Thule, Greenland where ice property studies and demonstration landings continued the winter of 1956-1957. Although Thule was colder and darker than Hopedale, working conditions were appreciably less taxing.

Once the landing was completed, I rode up to the construction site to await transportation back south. This turned out to be a several day event in that the plane always arrived at 11:00, but the fog invariably appeared at 10:30. The runway was also very interesting. It was very short. It also was not straight but curved and there was a hump in the middle so that a plane on one end of the strip was unable to see a plane on the other end. Furthermore taking off out to sea toward Greenland, the plane literally flew off a very high cliff. Instant airborne! Landing was a very different matter. Scary!

During the wait, I recall one afternoon when the weather was outstanding and a two-hour work break was announced; presumably to celebrate the arrival of a private plane that was loaded with liquid refreshment. I was invited to the Chief Engineer's tent for a joint celebration of the successful landing of the antenna, the good weather, the fact that the construction was on schedule and most important that suitable libations had arrived. The Penny Highlands were in view to the north. Stunning! The Chief Engineer said "*Would you like some music*?" "*Why not*" I responded and the sounds of Beethoven's Ninth Symphony appeared. Being under the influence of this sequence of improbable events with the added effects of Crown Royal, I decided that there might be some future in developing a career psychoanalyzing the many facets of ice in the sea. Although on completion of my tour in the Air Force I returned to teaching conventional Earth Science for five years, I found that I missed the excitement that one invariably found attached to field studies of the behaviour of ice in the sea. In addition, the field was wide open where almost anything you did was new. Therefore in 1962 I joined the Snow and Ice Branch at CRREL where, although working on a wide variety of problems associated with the polar regions, I tried to focus as much as possible on sea ice. I remained there until 1986 when I moved to the Geophysical Institute of the University of Alaska Fairbanks where I served as the Chief Scientist of the Alaska Synthetic Aperture Radar Facility. During this period I was also involved in sea ice field programs in both the Arctic Ocean as well as in the Southern Ocean. Since retiring in 1996 I have amused myself by writing a book *"On Sea Ice"* that is being published by the University of Alaska Press and that attempts to summarize what the research community has learned about sea ice during the 58 years since my first encounter with the material at Hopedale. As the reader will find out; although considerable progress has been made during this period, there are many aspects of sea ice that are still poorly understood and that await your proposed solutions. If you decide to take up this challenge, I am certain that you will not find it dull. Then in 50 more years you can write another book. Besides as Franz Kafka once wrote *"A book is an axe to break the ice floes of the mind*." I close by listing a few general references devoted to sea ice science. As a perusal of these references will clearly indicate, since 1955 there has been a significant increase in the amount of attention given to the many different aspects of sea ice.

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2009 Canadian Regional Weather Stories

by David Phillips

The North

Frozen May 2-4 Weekend…in the South
The Victoria Day long weekend in May was one of chilliest in Yellowknife's weather history. On the Sunday morning, the city saw a record low of -9.6°C. On the same weekend, Aklavik in the Beaufort Delta reached temperatures as high as 18.3°C, leaving residents in the Territory wondering when summer would make its way south. Hardy Yellowknife campers toughed out the holiday weather, with one bemoaning his frozen beer that exploded overnight.

Another Nunavut Heat Wave
Near the end of July, a ridge of high pressure over Baffin Island brought sunny skies and record warm temperatures to parts of Baffin Island and nearby areas, including: Iqaluit 25.4°C; Pond Inlet 21.0°C; and Hall Beach 20.7°C. Iqaluit had three days in a row of record daily high temperatures, while Pond Inlet experienced four days.

Arctic Warming Trend
For the high Arctic Islands, summer temperatures were 1.8 degrees warmer than normal – making it the warmest summer season in 62 years of records dating back to 1948. Since 2000, temperatures at Iqaluit reached into the twenties in nine of ten years (2007 was the exception). In previous decades, days with temperatures at or above 20°C occurred in only three to seven of every 10 years. The year 2009 tied with 2008 for the longest continuous number of days (six days) when the high for the day was in the twenties.

Événements météorologiques régionaux pour 2009

par David Phillips

Dans le Nord

Le week end du 2 4 mai sous le gel – dans le Sud
Le week-end de la Fête de la Reine, en mai, a été un des plus frais de l'histoire météorologique de Yellowknife. Le dimanche matin, la ville a connu un minimum record de 9,6 °C. Durant le même week end, le mercure a atteint 18,3 °C à Aklavik dans le delta de la mer de Beaufort, incitant les Yukonnais à se demander quand l'été finirait par descendre dans le sud. Les braves campeurs qui s'étaient installés à Yellowknife ont fait contre mauvaise fortune bon cœur, un d'entre eux déplorant toutefois que le gel ait fait exploser sa bière durant la nuit.

Une autre canicule au Nunavut
Vers la fin de juillet, une crête de haute pression au-dessus de l'île de Baffin a amené du soleil et des records de chaleur dans certaines portions de l'île de Baffin et les alentours, notamment à Iqaluit (25,4 °C), Pond Inlet (21,0 °C) et Hall Beach (20,7 °C). Les records quotidiens de chaleur ont été battus pendant trois journées consécutives à Iqaluit, et pendant quatre jours à Pond Inlet.

Une tendance au réchauffement arctique
Dans les îles de l'Extrême Arctique, les températures de l'été 2009 étaient de 1,8 degré supérieures à la normale, ce qui en fait l'été le plus chaud en 62 années (depuis 1948). Depuis 2000, le mercure a dépassé les 20 °C neuf années sur dix à Iqaluit (l'exception étant 2007). Lors des décennies précédentes, on n'y bénéficiait de journées d'au moins 20 °C que pendant trois à sept années sur dix. L'année 2009 est arrivée à égalité avec 2008 pour le plus grand nombre de journées consécutives (six journées) où le maximum quotidien a atteint au moins 20 °C.

Final installation and initial operation of the world's first regional cabled ocean observatory (NEPTUNE Canada)

by Christopher R. Barnes[1], Mairi M. R. Best[1], Fern R. Johnson[1], and Benoît Pirenne[1]

Résumé: Dans le nord-est de l'océan Pacifique, au large de la côte de la Colombie-Britannique, NEPTUNE Canada (NC) a complété, à l'été 2009, l'installation de la principale infrastructure immergée et de plus de 60 instruments pour le premier câble régional du monde à l'observatoire océanique. Cela représente un des quelques mégaprojets scientifiques au Canada. C'est le 8 décembre 2009 qu'a commencé le flux de données provenant de l'observatoire. En septembre 2010, les soixante instruments seront installés principalement le long du segment Endeavour qui fait partie de la dorsale océanique. On s'attend que cet observatoire, comme plusieurs autres observatoires similaires planifiés dans le monde, transforme l'océanographie. En introduisant un système d'alimentation perfectionnée et de communication à large bande pour une gamme étendue de milieux océaniques, il sera possible de faire la distinction entre des événements à court et à long terme et de pouvoir les interpréter en même temps. On pourra aussi procéder à des expériences et recevoir en temps réel des données et des images et ainsi travailler avec des équipes multidisciplinaires complexes afin d'instaurer une vaste base de données qui pourra être consultée pour les prochaines 25 années, soit la durée de vie théorique de l'observatoire.

The NEPTUNE Canada Project: from conception to final installation

In the mid-1990s, scientists at the US National Oceanic and Atmospheric Administration (NOAA) first conceived of using decommissioned submarine telecommunications for scientific purposes, by severing the cables at suitable locations and connecting some instruments. However, commercial telecommunication cables were not necessarily located at preferred scientific sites. The concept of a cabled ocean observatory was advanced by scientists, in particular John Delaney (University of Washington) and Alan Chave (Woods Hole Oceanographic Institution), by arguing for the use of new electro-optic cables, highly instrumented, and located at key locations. Through discussions and scientific workshops, a regional scale cabled ocean observatory was selected to cover much of the Juan de Fuca tectonic plate off the coast of Oregon, Washington and British Columbia and the adjoining continental slope and shelf. This is the smallest of the world's 12 main tectonic plates. Other cabled ocean observatories are now being planned in Japan, Taiwan, China, and several in the European Union.

In 2000, a Memorandum of Understanding was signed between the Institute of Pacific Ocean Science and Technology (IPOST; since disbanded) and the University of Victoria (UVic) representing Canada and the University of Washington (UW), Woods Hole Oceanographic Institution (WHOI), Monterey Bay Aquarium Research Institute (MBARI), and NASA's Jet Propulsion Lab (JPL) at Caltech University representing the US. Some basic Science Requirements were established (Table 1).

One important consequence of this technological innovation in the ocean sciences is the new capacity for rapid multidisciplinary collaboration along with a substantial increase in the speed of analysis and documentation (Table 2).

Gigabits of bandwidth
Kilowatts of power
Precision timing
Hundreds, perhaps thousands, of attached devices
3000 m water depth rating
25-year design life
Resilient network, moderate operating costs
Over 60 TB/yr data flow initially
Expandable and extendable: 5 expandable to 10 nodes

Table 1: Science Requirements for the NEPTUNE Canada cabled ocean observatory

NC (www.neptunecanada.ca) received its first major funding ($62.4M) in 2003 for the observatory infrastructure jointly from the Canada Foundation for Innovation (CFI) and the British Columbia Knowledge Development Fund (BCKDF). UVic led the Canadian consortium of 12 Canadian universities, with partners in government departments (Table 3); UVic is required by the granting agencies to both own and operate the observatory.

[1] NEPTUNE Canada, University of Victoria, Victoria, BC, Canada; www.neptunecanada.ca

Using the power and opportunity of the Internet and real-time high bandwidth communications
Promoting large community (team) experiments on complex interdisciplinary problems
Increasing international participation and partnerships
Establishing large interactive databases and time-series
Resulting in rapid e-publication, communication, imagery
Greater inclusion in education and public outreach
Liberating knowledge to the general public and for public policy debates and new roles for the Academy
Partly resolving the issue of the *time* needed to know/understand/debate/resolve critical societal issues

Table 2: Towards a different way of scientific investigation and communication

Participating Canadian Universities:	
Memorial	Guelph
Dalhousie	Waterloo
UQAR (Rimouski)	Manitoba
Laval	Simon Fraser
UQAM (Montréal)	British Columbia
Toronto	Victoria

Participating Federal Government Departments:	
Fisheries and Oceans Canada	Institute of Ocean Sciences; Pacific Biological Station
Natural Resources Canada	Geological Survey of Canada Pacific; GSC Atlantic
Environment Canada	Canadian Climate Centre for Modeling and Analysis
Parks Canada	Pacific Rim National Park
National Defence	MARPAC; Defence Research and Development Canada
National Research Council	Herzberg Institute for Astrophysics

Table 3: NEPTUNE Canada's university national consortium and government partners

In 2003, the National Science Foundation (NSF) formally established the Ocean Observatories Initiative (OOI) in Washington, DC. For the proposals developed by OOI, the term NEPTUNE was replaced by Regional Scale Nodes (RSN) for that component of the US coastal, regional and global observatories. The OOI infrastructure funding was approved in September 2009 ($386M/5 years).

NC received an additional $20M in late 2006, for a total of $78.4M and $20M in-kind infrastructure support. In 2007, NC received interim operating funds ($13.2M) from the Natural Sciences and Engineering Council of Canada (NSERC), CFI and the BC Ministry of Advanced Education, followed by $19.3M/2 years operating funds from CFI in 2010. CANARIE has supported several aspects of the project, noted below. To date, the project has attracted cash and in-kind support totaling $143M.

NC workshops identified the most important sites for scientific investigation. Then a contract was let to Alcatel-Lucent Submarine Networks (A-LSN) to design, manufacture and install the backbone and spur cables, repeaters, branching units, and nodes (power and communications centres that reduce the 10kV DC to 400V DC). The scope of the observatory became an 800km backbone cable hosting five nodes each protected by heavy trawl resistant frames (TRF), with a sixth node at Middle Valley site to be inserted once additional funds are secured. The node sites were located near the coast (Folger Passage), on the continental slope (Ocean Drilling Program (ODP) site 889 and Barkley Canyon), on the abyssal plain (ODP 1027), and at the ocean spreading ridge between the Juan de Fuca and Pacific plates (Endeavour and Middle Valley), in water depths of between 100-2660m (Figure 1).

The design of a cable loop rather than one or more straight lines from shore has the advantage of redundancy, so even with a cable break data can flow without loss to the shore station. The design also allows for future expansion with additional cable, nodes (up to 10), and instruments.

Power feed equipment at Shore Station: Output 10kV, 8 Amps
Modified telecom branching units
Medium Voltage Converter at each node: Output 400V, 25 Amps
Low Voltage DC-DC Converters at nodes and junction boxes: Output 15, 24, 48V
None of these is directly off-the-shelf

Table 4: Power architecture in the NEPTUNE Canada subsea infrastructure

Figure 1: NEPTUNE Canada cabled ocean observatory showing 800km backbone cable route, node locations, Port Alberni shore station, and Victoria data centre. Also shown in colour on the cover page.

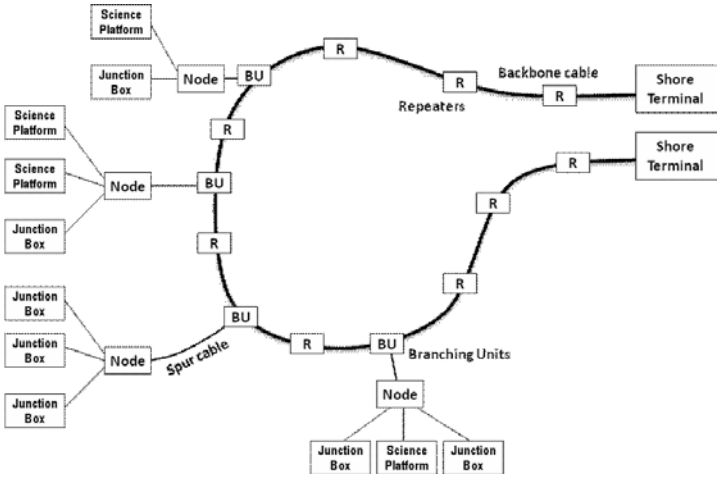

Figure 2: Generalized NC observatory configuration (R=Repeater; BU=Branching Unit).

The architecture is a ring and branch topology (Figure 2; Table 4) that achieves the desired functionality for both power distribution and communications and allows a degree of fault tolerance. The backbone ring, from and to UVic's Port Alberni shore station, is constructed exclusively from components designed and qualified for use in commercial subsea telecommunications systems. It was installed with repeaters, branching units and spur cables over an 11-week period in late 2007 by A-LSN, with over 8 weeks of post-lay burial work using another cable ship. The cable was buried where possible along the two continental shelf transects down to about 1500m to limit the possible interactions with trawl gear and ship anchors.

Specialists from A-LSN, with subcontractor L3 MariPro at Santa Barbara, designed and manufactured the nodes and trawl resistant frames (Figures 4; Table 4). The nodes lie at the end of spur cables up to 20km long, away from the backbone cable. Each node provides six interface ports for connection of science instrument arrays or extensions; each port provides dual optical Ethernet links and up to 9kW of electrical power at 400V DC. Wet mateable connectors link the nodes to the extension cables. Fourteen junction boxes (400V DC stepped to 15, 24, 48 V DC), designed and built for NC by OceanWorks International, Vancouver, BC, support up to 10 instruments each and can be daisy-chained where necessary. They accommodate both serial and 10/100 Ethernet instruments, and provide a variety of voltages.

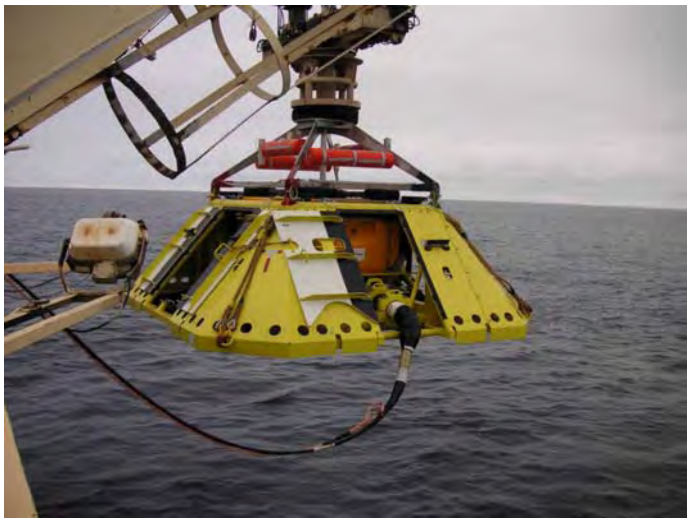

Figure 3: Node being deployed, which controls the communication systems and steps the voltage from 10kV DC down to 400V DC to supply the junction boxes

Figure 4: Remotely operated crawler, developed by Jacobs University, Bremen, Germany, investigating gas hydrates at Barkley Canyon.

Several major technology challenges occurred during the implementation of this innovative subsea network that were eventually overcome: developing the 10kV wet mate connector, the low voltage communications unit, and the medium voltage converter. The nodes were qualified and installed in summer 2009, the junction boxes were successfully manufactured by OceanWorks, and extensive shore station modifications completed. However, the additional time to complete development work and formal qualifications extended the installation of nodes and instruments by over a year into 2009. Final commissioning of the subsea network from September through November 2009 was undertaken concurrently by A-LSN, DMAS/NC, and the navies.

Science themes and early results

The initial science workshops resulted in the definition of the main scientific themes for the NC project (Table 5).

In addition to the node locations and broad research themes above, an initial suite of multidisciplinary team experiments was developed during the early science workshops, supported by international competition through the CFI infrastructure funds as proof of concept. Overall, the NC observatory will investigate a great diversity of Earth/ocean processes, phenomena and events, with instruments deployed in the subsurface (boreholes), on the seabed, and buoyed through all or part of the water column.

Plate tectonic processes and earthquake dynamics
Dynamic processes of fluid fluxes and gas hydrates in the sea bed
Regional ocean/climate dynamics and effects on marine biota
Deep-sea ecosystem dynamics
Engineering and computational research

Table 5: Science research themes

The bench and wet testing of the 130 initial instruments, integration with the junction boxes on research platforms, and DMAS connectivity were completed over a period of a couple of years, with Highland Technologies, Sidney BC, playing a key role for much of this work. More extensive field testing was undertaken using the Saanich node of the Victoria Experimental Network under the Sea (VENUS; www.venus.uvic.ca, also led by UVic) from late September 2008 to mid-February 2009. The platform hosted examples of most of the components of the full deployment in mid-2009 – an extension, an instrument frame, a junction box, and a variety of instruments and their associated whips/cables. Most of the instruments worked well, but others needed adjustments or return to manufacturers for modification. Under an MOU with Ifremer, France, that institution installed a complex package of instruments (Tempo-mini) on the pod, sending over six engineers to assist with deployment.

Instruments were deployed in August/September 2009 at 4 out of the 5 nodes deployed earlier that summer; those at Endeavour ridge had to wait for the next weather window in mid 2010. By late summer 2010, over 130 instruments will be deployed, hosting several hundred sensors. In addition to over a dozen large fixed platforms at 17-2660m water depths, and numerous isolated instruments on extensions, mobile instrument platforms include a tethered ROV crawler (Figure 4) and a 400m vertical profiler (Figure 5).

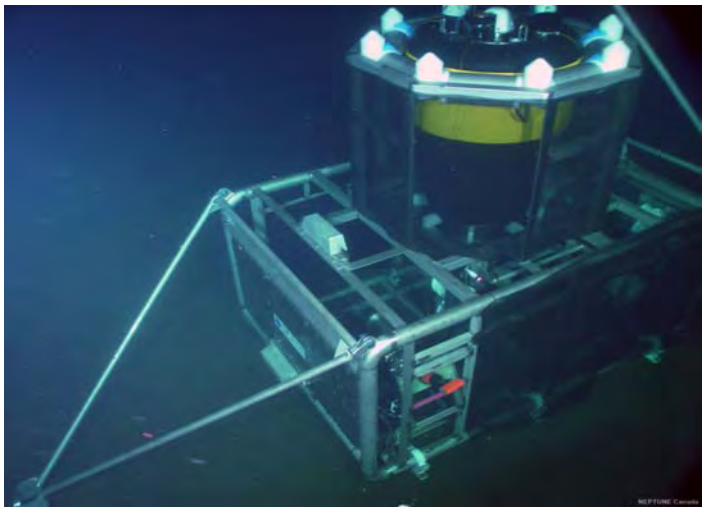

Figure 5: A 400m vertical profiler developed by NGK Ocean (Saitama and Tokyo, Japan) located at Barkley Upper Slope; 10 instruments and a junction box are included in the upper float component.

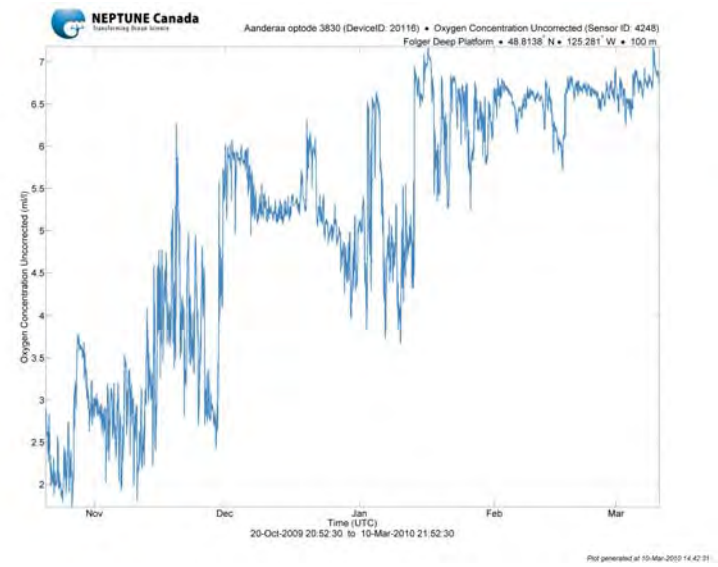

Figure 6: Oxygen concentration values from Folger Passage Deep (at 100m), 20 October 2009 to 10 March 2010, averaged every 15 minutes; plot produced by Reyna Jenkyns (NC).

As the system went public on 8 December 2009, over 80% of the deployed instruments were providing continuous data (e.g. oxygen concentration values from Folger Passage Deep over the past 4 months, Figure 6), and additional instruments were being operated intermittently through technical issues to allow both collection of data and diagnosis of technical problems. NC has worked with CANARIE and Rocketday Arts, Victoria, to redesign the web environment through which the data and information about NC is accessed (www.neptunecanada.ca). This is progressively becoming a Web 2.0 environment that will continue to evolve with new tools and resources to make it fully interactive with the user community and the lay public. With this public release of data, examples of early results include:

Detection of tsunamis – a sensitive array of Bottom Pressure Recorders (BPRs) across the network allowed the detection of the Samoan tsunami triggered on 29 September 2009, by a magnitude 8.1 earthquake (Figure 7). More recently, it has also detected the Chilean tsunami triggered on 27 February 2010, by a magnitude 8.8 earthquake. These data are feeding into models developed at the Institute of Ocean Sciences (Department of Fisheries and Oceans) to aid in tsunami prediction and forecasting (http://www.neptunecanada.ca/news/news-details.dot?id=22802).

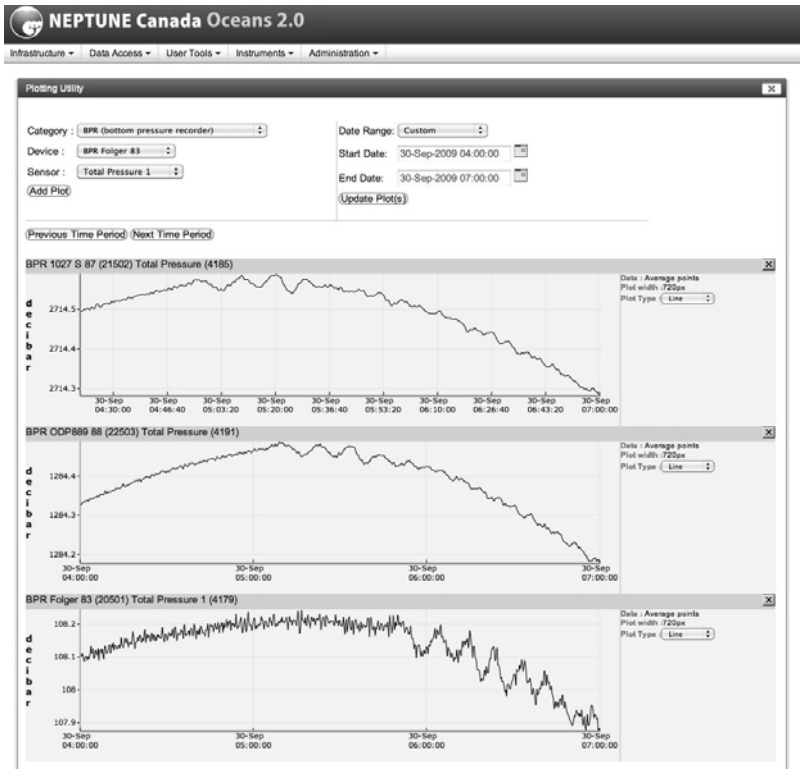

Figure 7: Pressure data from three Bottom Pressure Recorders (BPRs) showing Samoan tsunami waves within a tidal cycle arriving at NC sites on the abyssal plain (upper), continental slope (middle) and coastal shelf (lower) on 30 September 2009.

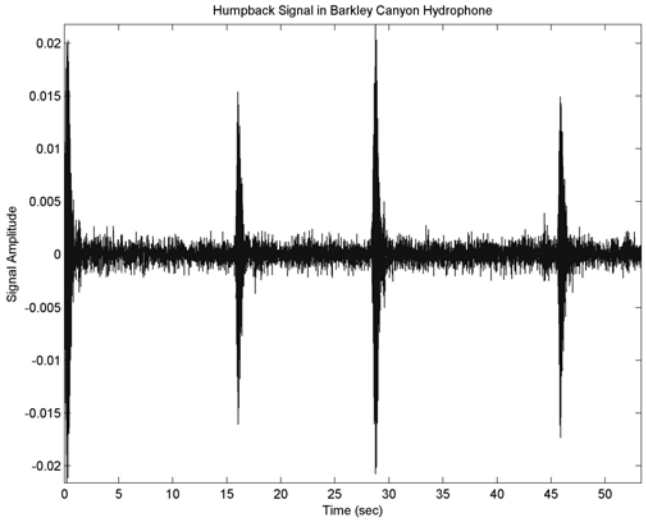

Figure 8: Humpback whale song in Barkley Canyon captured by NC hydrophone on 5 January 2010. Plot by Reyna Jenkyns (NC) in consultation with John Ford (DFO).

Detection of earthquakes – broadband seismometers in the seafloor at the Barkley Upper Slope, ODP 889 and 1027 node areas have detected not only the farther flung earthquakes mentioned above, but also recent large earthquakes in the Queen Charlotte Islands and Haiti. Continuous seismic data coming from the Juan de Fuca plate allows for a much improved understanding of the subduction system that generates the tectonic activity on Canada's west coast. Additional seismometers at Endeavour Ridge will provide valuable data on the constructive margin of this system.

Tracking of spring phytoplankton blooms – Instrument suites in the water column and on the seafloor were designed to capture physical, chemical and biological data on the upper slope and Barkley Canyon region. One scenario where these suites would work in concert is studying the impact of pulses of organic matter delivered through the water column to the benthos during phytoplankton blooms. A preliminary test of this system is being prepared, despite technical challenges that are being addressed with the vertical profiler. Data will include lower water column chlorophyll, benthic plankton samples, hydrophone recordings (Figure 8), video and sonar scans of benthic activity, and porewater voltammetry to assess sediment bacterial activity.

The initial suite of instruments and experiments is only the beginning. An assessment and planning workshop is being held 12-14 April 2010 to discuss early results and a way forward (details on NC website). Additional experiments and instrument suites are already proposed, and in some cases are already funded from national and international sources. Information on using the data, or

proposing additional experiments and instrumentation can be found at www.neptunecanada.ca.

The observatory is designed to facilitate real-time observations and experiments that will establish a vast data archive, allowing interactive participation with both the instruments and the data by the scientists. The observatory is also designed and located to address a wide spectrum of research questions. Experiments will focus on: earthquake dynamics and tsunami hazards; fluid fluxes in the ocean crust and sediments, including gas hydrate deposits; ocean and climate dynamics, including acidification, nutrient fluxes and impacts on biota; deep-sea ecosystems dynamics; and applied engineering and computer science research (Table 5). Scores of scientists have been involved in the design of the experiments and the instrumentation; participation by others is invited. The observatory can be readily expanded in the future through the subsea wet plant, number of nodes, or number and types of instruments as funding allows or as new instruments are added by other researchers and government or commercial partners.

Data Management and Archiving System

The driving concept behind a cable ocean observatory is that it extends the Internet underwater. Some have argued that the observatory therefore only needs to act as an Internet Service Provider to allow unimpeded access to instruments. That view does not work when considering the unique nature of many of the instruments, the need to serve many scientists with often competing requirements, and the size of the investment required to build and operate it. All of these constraints call for a proper management of the infrastructure and for a data archive that will allow many people to access historical data from the various instruments over time rather than having to repeat observations all the time (Figures 9, 10).

The need for a cyber-infrastructure to support NC's underwater assets is therefore critical. The system serves as an interface between users and the cable observatory. It responds to a manyfold mandate:

- collect, index and archive all data produced by the various instruments on the underwater network;
- provide data to users through search and retrieval functions, covering any arbitrary time period, in a 3-D volume of the ocean;
- provide the ability for Principal Investigators of experiment to control and manipulate individual instruments (e.g. to change the data acquisition parameters);
- enable the management of underwater resources (power and network bandwidth);
- allow scientists to collaborate in their exploitation of both the underwater assets and of the archived data.

Started in 2004, the Data Management and Archiving System (DMAS) is being developed close to the stakeholders, in-house, using the Agile development methodology to deliver frequent, incremental versions of the functionality. This approach was first applied to VENUS with data flowing since 2006, and subsequently to NC to establish the system specifications, understand the issues, develop the software, and train operations staff on observatory control and monitoring.

The system in place at present supports the instruments of both VENUS and NC. It has already recorded billions of individual measurements from hundreds of sensors placed on the seabed and archived them in a database management system and/or in a file server. Data are readily available for quick look or for download through intelligent and interactive Web query and visualization screens. Instruments can be pre-configured or re-configured with appropriate screens and the entire data flow system can be managed and monitored from anywhere using similar technologies. Interactive command of specific instruments such as cameras is also facilitated through Web interfaces that will not require any specific software download. Powerful visualization tools for video (and other media) allow for annotation of stream and human or software content contribution to the metadata database. Underwater assets such as instruments, junction boxes and other devices are also managed by DMAS, which keeps a close record of any event occurring to any device, be it in operation under water or under preparation for deployment on shore. For traceability of the data and to guarantee their quality, it is essential that the complete history of any sensor be retained and made available, throughout the lifetime not just of the instrument, but of the entire observatory.

Beyond the base funding available to build DMAS, specific programs, notably from CANARIE Inc. that supports academic networks in Canada, permitted DMAS to adopt a Service-Oriented Architecture (SOA), using Web services to expose the functionality of DMAS' various components. An internal messaging bus allows various functional components to interact through the publish and subscribe paradigm, using Java as a programming language.

More recent additional funding from the same organization is enabling DMAS to include transparent access to other data providers using interoperability techniques. The funding also allows the development of a modern environment for both professional and lay users to perform data access, data processing and experimentation control within a Web 2.0 environment. Users can, through this improved system perform data visualization and analysis on-line with either default or custom processing code, as well as simultaneously interacting with each other. These social networking aspects are within NC's new Oceans 2.0 environment. Further improvements are being brought to

Oceans 2.0 by adding tools to perform software-aided feature detection and classification of sounds in acoustic data streams, and to allow the public at large to help scientists identify content of video recordings. Another project involves the deployment of very small (mini) observatories at schools with access to bodies of water, but with the ability to interact with the instruments and their data. Sharing access to those systems with other schools is clearly another objective.

Another project that was driven by the DMAS team and partners at McGill University involved the preparation of a high-quality underwater HDTV camera that will send a very lightly compressed signal back to shore. This will allow scientists, in particular marine biologists, to perform interactions with automated, repeated surveys of the life forms on the sea floor while enjoying a very high quality imagery, revealing unprecedented details of the seabed for entire seasons.

The key elements relating to data flow in the NC observatory include :

- a shore station in Port Alberni, BC, where the power equipment, laser-based communication and data acquisition software are located;

- a 10Gbps network backhaul link from the Port Alberni shore station to the University of Victoria's data centre, mostly funded through a CANARIE award;

- a disaster-recovery site in Saskatoon, SK, where a complete copy of all the data from NC and VENUS are hosted and where a secondary access to many of the services is available.

In summary, NC's data management system is a key element of the infrastructure, an enabling technology that allows not only scientists and lay users to access it but also to contribute to it. DMAS represents a management system for the observatory and a central place to deal with its data, both past and present.

Challenges for the Project

Establishing the NC cabled ocean observatory has proven to be extremely challenging on many fronts. Table 6 shows many of the principal elements that are involved in building such an observatory with the elements arranged in the approximate sequence of encounter.

Future opportunities and applications

With the final installation of the NC observatory infrastructure completed in late 2009, and remaining instrumentation being deployed at the Endeavour site in mid-2010, there will be a wide range of opportunities generated by the project (Table 7). Many will stem from the new knowledge and scientific interpretations of the data and imagery, focused on the main science themes of the project (Table 5) such as ocean/climate change, ocean acidification, recognizing and mitigating natural hazards, non-renewable and renewable natural resources.

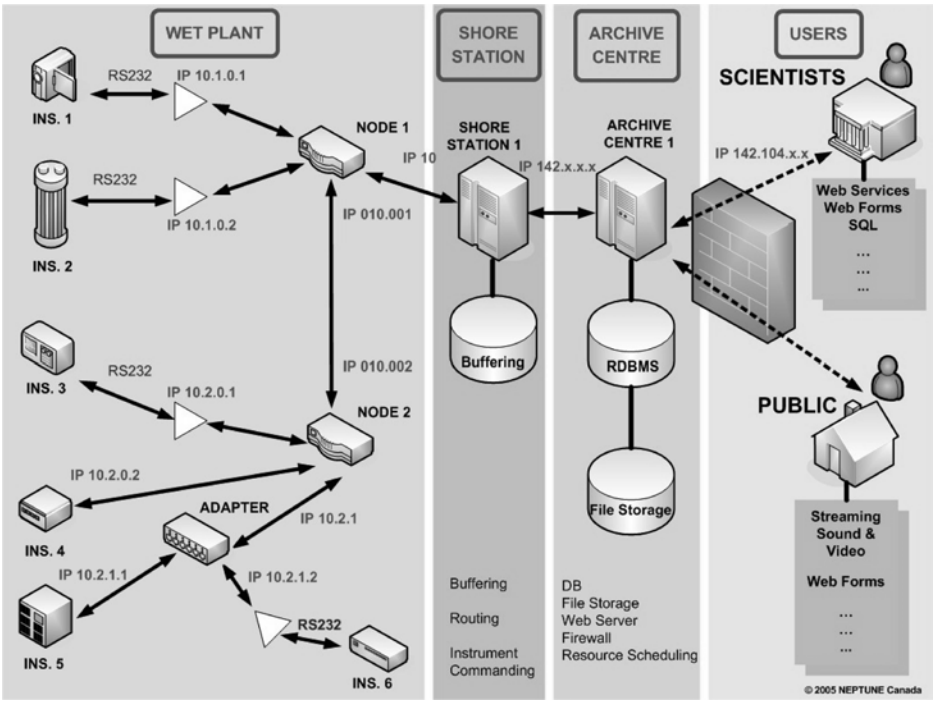

Figure 9: Various elements and structure of the NEPTUNE Canada cabled ocean observatory, showing two-way communications/data flow between the instruments, adapters, shore station, and archive centre and the scientists/public.

Although the NC project was funded on its scientific merits and innovation, the socio-economic benefits to both Canada and British Columbia are substantial. Not only will cabled ocean observatories transform the ocean sciences, there will be a range of applications in various scientific areas of the ocean and related sciences, but also with applications in other sectors such as sovereignty, security, transportation, data services, and public policy (Table 7). There will be ample opportunities for commercialization of particular technologies and data services and products, facilitated by a new Centre of Excellence for Commercialization and Research (www.onccee.ca) recently funded within Ocean Networks Canada (www.networkscanada.ca) that manages the NC and VENUS observatories.

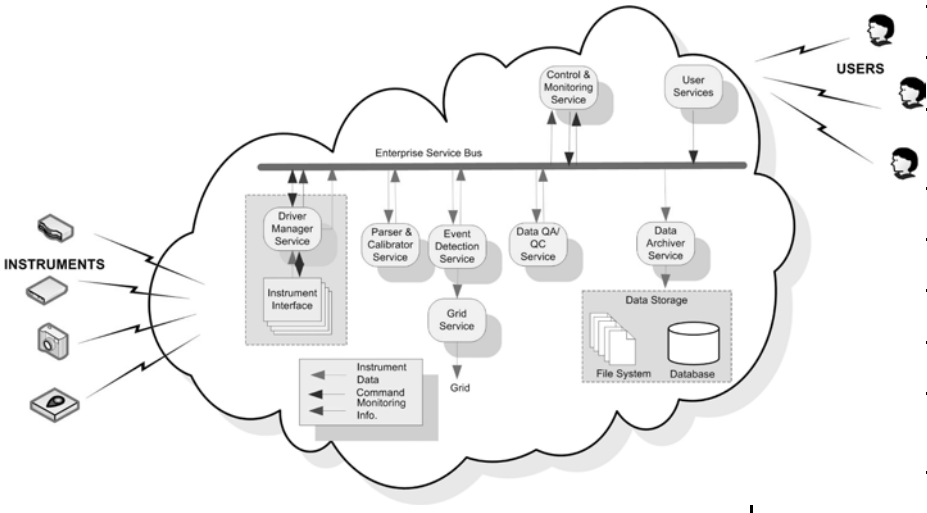

Figure 10: Architecture of the DMAS system: the Enterprise Service Bus implements a publish-and-subscribe model with asynchronous communication between the various elements to be applied to the data.

Vision, articulation, concept	DMAS/Cybersecurity: in-house development, evolving technologies, distributed databases, storage
Science priorities, selected experiments	Education and outreach
Ownership and liability	Special stakeholders: First Nations, fishers, navies
Risk assessment	Communications: science / publication, communities, media, partners
Funding proposals/O&M costs	Partnerships: institutions, funders, foundations, international
Science, engineering and DMAS requirements	Socio-economic benefits
Engineering: network design, power and communications, wet plant, shore station, backhaul	Time, contingency, renewal, expansion costs
Permits and Rights of Way	
Route surveys, node sites, GIS	
Operation / Data Centre	

Table 6: Principal elements in building a regional cabled observatory

Transforming the ocean sciences
Improved understanding of climate change
Comprehending natural hazard processes: earthquakes, tsunamis, slope failures
Understanding ecosystem dynamics
Monitoring ocean pollution/acidification
Sustaining commercial fisheries
Understanding the role of bas hydrates
Industry: ocean technologies, services, data products
Information to public, decision-makers and politicians
Educating the next generation
International partnerships > global networks

Table 7: Applications and future opportunities for the project

Summary and invitation

With the installation of the backbone cable system, instruments, shore station facilities, and the development of a sophisticated DMAS, NEPTUNE Canada has transitioned from the installation into the operational phase, with a staff expanded to nearly 40 members. The project is destined to transform the ocean sciences and to provide a wealth of new research opportunities and socio-economic benefits. Along with several other countries planning cabled observatories over the next decade, the result will be a progressive wiring of the oceans. The observatory is designed to be expandable in its footprint, in the number of nodes and instruments, and provides a magnificent facility for testing prototypes of new technologies monitored and demonstrated in real time. The observatory represents one of Canada's few science megaprojects. NC (neptune@uvic.ca) extends an invitation for new scientific, government and industrial participation in experiments, instrumentation, data services, education and outreach.

Acknowledgements

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REPORTS / RAPPORTS

Progress Report for the SCOR/IAPSO Working Group 127 on "Thermodynamics and Equation of State of Seawater"

by Dan Wright, Rich Pawlowicz, Trevor McDougall and Rainer Feistel

Members of WG127: Trevor J. McDougall, Chair (Australia), Rainer Feistel (Germany), Chen-Tung Arthur Chen (Taiwan), David R. Jackett (Australia), Brian A. King (UK), Giles M. Marion (USA), Frank J. Millero (USA), Petra Spitzer (Germany), Daniel G. Wright (Canada). Associate Members: Rich Pawlowicz (Canada), Steffen Seitz (Germany), Peter Tremaine (Canada)

The SCOR/IAPSO Working Group 127 was formed in 2005 with two primary terms of reference:

1) to examine the results of recent research in ocean thermodynamics with a view to recommending a change to the existing internationally-accepted algorithms for evaluating density and related quantities, and to form new expressions for enthalpy, entropy and potential temperature; and

2) to examine the feasibility of using simple functions of three-dimensional space to take account of the influence of composition anomalies on the determination of density in the ocean.

These goals have now been met and exceeded. A brief summary of developments is given here.

The first meeting of WG127 was held in May, 2006. By the end of that meeting, among other things, we had decided that the Gibbs potential function approach was clearly the best method for improving on EOS-80 and systematically representing the thermodynamic properties of seawater; more properties could be considered, more systematically, consistently and accurately. It was also recognized that a new formulation of the Gibbs function must include additional data sets that hadn't been included in earlier versions, and a standard composition model for sea salt was required to determine a unique formulation of the theoretical limiting-law terms of dilute seawater. Over the next 18 months, WG127 formulated the Reference Composition as a benchmark composition model for Standard Seawater (SSW) (Millero et al., 2008) and reformulated the Gibbs potential function for Standard Seawater (Feistel, 2008).

The new salinity formulation is based on the most accurate available chemical composition analyses for SSW (mostly done in the 60s and 70s). It is linked to Practical Salinity and hence also to historical Chlorinity results; it extends the representation of salinity to allow for arbitrarily large or small concentrations; it is precisely electro-neutral and based on the latest values for atomic weights; and it is SI compatible. Seawater with the Reference Composition is now referred to as Reference-Composition Seawater, or simply Reference Seawater, and its salinity is represented by the Reference-Composition Salinity, or Reference Salinity, expressed in g/kg on the Reference-Composition Salinity Scale (RCSS). Over the concentration range where Practical Salinity is defined, the Reference Salinity can be estimated in terms of Practical Salinity by S_R = (35.16504/35) S_P g/kg. The decision to link Reference Salinity to Practical Salinity recognizes and builds on the important and reliable work done in the 60s and 70s. We also decided that Practical Salinity rather than Reference Salinity must continue to be recorded in national and international data bases to maintain continuity with past practice and reduce the potential for confusion in these central repositories. However, it was agreed that scientific publications should now use salinity on the Reference-Composition Salinity Scale in place of Practical Salinity and that a new representation of dissolved material in seawater was required to deal with composition anomalies – more on this below.

The new Gibbs potential function presented in Feistel (2008) is an empirical formulation that has been carefully verified to reproduce all known reliable data sets on the thermodynamic properties of Standard Seawater within measurement uncertainties. It provides the most accurate representations available to date for density, enthalpy, entropy, heat capacity, sound speed, plus many other thermodynamic quantities. We note in particular that the availability of potential enthalpy (McDougall, 2003) will allow improved representation of "heat" content and transport in the oceans and is expected to be incorporated into the next generation of climate models along with improved representations of salt content and its influence on ocean properties. Importantly, the Gibbs function takes Reference-Composition Salinity expressed on the RCSS as its salinity input. This Salinity Scale must remain fixed over time to ensure the correct representation of dissolved material in the Gibbs function formulation; use of Practical Salinity for this purpose will give incorrect results.

With the Reference Salinity defined and the new Gibbs function formulated and verified, the next major consideration was the proper accounting for the influence of composition anomalies; this has been one of the most challenging aspects of the work of WG127. Previously, under the principle of constant proportions, the composition anomalies had simply been neglected, but now they were the single largest factor limiting the accurate determination of the thermodynamic properties of seawater, particularly the density. It was decided that direct measurements of density provide the most reliable approach to represent the most important effects of composition anomalies and a program was initiated to collect direct measurements of density along with Practical Salinity

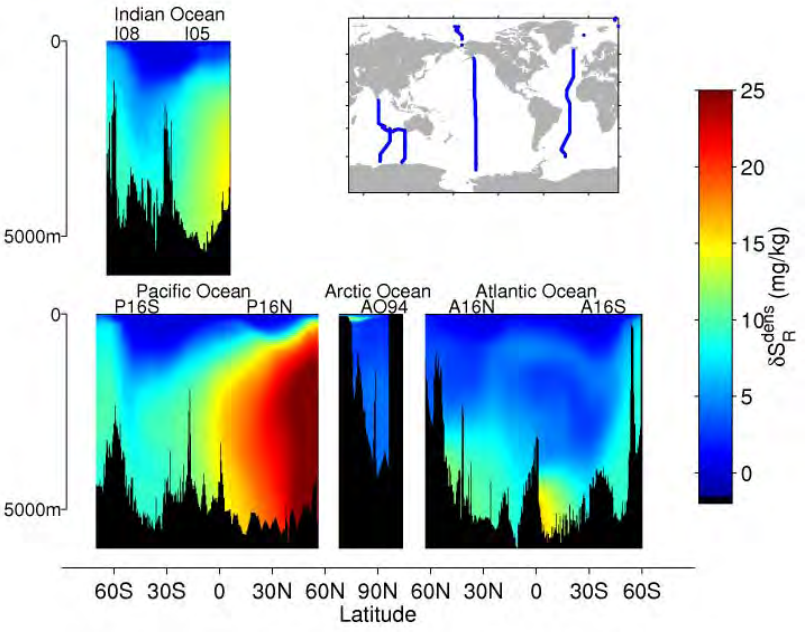

Figure 1: Salinity anomalies predicted using the algorithm of McDougall et al., (2009) along some recent trans-oceanic sections.

and various measures of biogeochemical material dissolved in seawater. The density data were converted to salinity based on an inversion of the expression for density in terms of the Gibbs potential. (At the time, this measure of salinity was simply referred to as Absolute Salinity, but as discussed below, it is more precisely referred to as Density Salinity to distinguish it from other measures of dissolved material in seawater when composition anomalies are present). Based on a small but unprecedented data set consisting of less than a thousand points scattered around the globe, empirical relations between Density Salinity and various measures of biological material in seawater were considered. It was found that anomalies in Density Salinity relative to Reference Salinity could be rather accurately represented using a simple linear regression on the anomalies in silicate relative to the Reference Composition, with different linear relations in each of the ocean basins but all convergent to the same values at the intersection with the Southern Ocean at 30 ºS (McDougall *et al.*, 2009). Since global silicate concentrations can be estimated by interpolation of the global hydrographic atlas of Gouretski and Koltermann (2004), this provided the first global correction of density for the effects of composition anomalies. Figure 1 provides examples of salinity anomalies estimated using this approach.

Accounting for the influence of composition anomalies on the properties of seawater opens exciting new areas of research but also introduces new complications. Indeed, the scariest aspect of the new formulation for the properties of seawater, for both its developers and its users, is probably the addition of new salinity variables that are required to account for these effects. There are now six different salinity variables that we feel oceanographers should be aware of. The first three of these are used to represent the properties of SSW and will be readily accepted within current oceanographic practice:

1) Chlorinity is the historical cornerstone for measures of salinity based on the principle of constant proportions. Simply put, the halide content of seawater is used as a measure of all dissolved material in seawater.

2) Practical Salinity has been the international standard for the representation of dissolved material in seawater for the past three decades. It is based on estimating Chlorinity using conductivity measurements and then scaling the result to give a "salinity" consistent with Knudsen's formula which was based on the relation between Chlorinity and the mass fraction of dissolved material in seawater determined by evaporation experiments. Although Knudsen's formula was known to be inaccurate by about 0.5% even at the time that Practical Salinity was formulated, it was decided to maintain historical continuity by specifying the numerical value of Practical Salinity to agree with Knudsen's salinity at the value of Chlorinity corresponding to 35 ppt. Practical Salinity was, however, defined as a unitless quantity, possibly influenced by this known inconsistency with the true mass fraction of dissolved material in seawater.

3) Reference Salinity has been discussed above. It is expressed as a mass fraction on the RCSS which was determined by Millero et al. (2008) based on the best available estimates of the composition of SSW. For most oceanographic applications Reference Salinity can be thought of as a scaled version of Practical Salinity expressed in units of g/kg, i.e., S_R = (35.16504/35) S_P g/kg. Compared to Practical Salinity, it provides a much improved estimate of the mass fraction of dissolved material in Standard Seawater.

To allow for composition anomalies, three other representations of the dissolved material in seawater have been introduced, each fulfilling a different purpose:

1) Density Salinity, also referred to as Absolute Salinity type 1, is designed to be used with the Gibbs function formulation to provide the best estimate of the density of seawater whether or not it includes composition anomalies. Since it also provides estimates of Conservative Temperature and heat capacity that are accurate to within measurement uncertainties, it is ideally suited for use in numerical modeling studies. An additional advantage of Density Salinity is that it provides a means to establish SI traceability.

2) Solution Salinity, also referred to as Absolute Salinity type 2, is defined as the mass fraction of material in solution and is the most natural extension of Reference Salinity to account for composition anomalies. However, it is not necessarily the most useful measure of salinity since Density Salinity provides more accurate estimates of density which is considered to be the most important thermodynamic quantity to determine precisely.

3) Preformed Salinity is basically the salinity of clean Standard Seawater to which anomalies are added by biogeochemical processes. It is the most relevant representation of salinity if one wishes to model the processes that result in Absolute Salinity anomalies. In particular, although it is natural to consider anomalies from Reference Salinity for field measurements, it is more natural to consider anomalies from Preformed Salinity for theoretical work and in ocean models.

It is important to realize that connections exist between the various forms of salinity discussed above. In particular, the results of Pawlowicz (2010) and Pawlowicz et al. (2010) have contributed both improved understanding and practical formulas for the relations between all of these different salinity variables based on theoretical models of conductivity/salinity/density variations in seawater that result from composition anomalies relative to SSW (as represented by Reference-Composition Seawater).

How might the proliferation of salinities affect the working lives of oceanographers? **DON'T PANIC!** We note that for studies where the influences of composition anomalies are negligible, the only changes necessary compared to past practice will be to replace Practical Salinity by Reference Salinity, S_R = (35.16504/35) S_P, and to use the new library routines discussed below to calculate the required properties of seawater. Even this simple adjustment will provide more accurate seawater properties as a result of using the new Gibbs function formulation. However, TEOS-10 opens the doors to new research opportunities for those interested in pursuing them. The uses of the different salinity variables may be succinctly summarized as follows: Chlorinity is a historical measure, Practical Salinity is well-known to oceanographers and will continue to be measured by oceanographic instruments and stored in data bases (just as we store in situ temperature, not potential temperature), either Reference Salinity or Density Salinity (obtained via Reference Salinity plus an anomaly salinity when the highest precision is required) will be used to calculate all thermodynamic quantities under TEOS-10, and Preformed Salinity will prove very useful in ocean modeling studies. Solution Salinity (and yet another salinity called Added-Mass Salinity) will likely only be used by those oceanographers specifically studying the variable composition of seawater.

Finally, we note that WG127 has developed software libraries that are available via the World Wide Web to assist the community in using the new formulation for the thermodynamic properties of seawater. Three sets of library routines have been developed for this purpose. The most comprehensive set of routines is available from the Sea-Ice-Air (SIA) library (Feistel et al., 2010; Wright et al. 2010). This library includes a broad range of routines dealing with the thermodynamic properties of pure water (liquid, vapour and solid), seawater, and humid or dry air. Properties of both individual components and equilibria between them are considered. The second set of routines focusses on the properties of seawater and is referred to as the Gibbs SeaWater (GSW) library. It is less comprehensive than the SIA library, but is more computationally efficient and inputs and outputs are expressed in terms more familiar to oceanographers. Finally, an ultra-efficient set of routines based on the approach taken in Jackett et al. (2006) has recently been developed to deal specifically with the special needs of numerical modelers (McDougall et al., 2010). Initially the SIA library is being made available in Visual Basic and FORTRAN while the GSW library is available mainly in MATLAB. All of these routines will be made available from the TEOS-10 web site (http://www.TEOS-10.org).

The formulation discussed above is referred to as the International Thermodynamic Equation of Seawater - 2010 (TEOS-10). In September 2008 the seawater Gibbs function of Feistel (2008) was endorsed as a release (IAPWS, 2008) of the International Association for the Properties of Water and Steam, so establishing TEOS-10 as the world-wide standard for seawater in the engineering profession. In June 2009, it was approved by the International Oceanographic Commission as the official replacement for the previous international standard known as EOS-80. A major compendium of information on the thermodynamic properties of seawater, including the background and details of TEOS-10, is being published by the IOC as IOC *et al.* (2010). This manual is available from the TEOS-10 web site.

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Dalhousie University

The Lloyd's Register Educational Trust funded Chair in

Modelling and Prediction of Marine Environmental Extremes

Dalhousie University in Halifax, Nova Scotia, Canada is searching for an exceptional researcher to fill a new Chair in *Modelling and Prediction of Marine Environmental Extremes*. The Chair will be a tenure-track joint appointment in the Department of Oceanography and the Department of Mathematics and Statistics, at the level of Assistant or Associate Professor. The Chair will be funded by The Lloyd's Register Educational Trust (The LRET)* for the first five years; after this time the Chair will transform into a regular faculty position at Dalhousie University.

The Chair will focus on modelling and prediction of extreme events that occur in the ocean and atmosphere. It is anticipated that extensive use will be made of coupled atmosphere-ocean-ice models covering scales of variability from tens of kilometres to global. Possible research foci include ensemble prediction of strong mid-latitude storms and associated changes in extreme sea levels, currents and sea ice, as well as improving understanding of natural modes of variability (e.g., the Madden Julian Oscillation) that extend predictability of the coupled system. In addition to extending the range of useful forecasts of extreme marine events, the Chair will also explore the use of advanced statistical methods in assessing the impact of climate change on the frequency of marine extremes.

The Chair will be invited to lead a new international network on marine extremes, funded by The LRET and involving ocean and atmospheric researchers from Australia, Brazil, Canada and the UK. The Chair will be provided with start-up funds by the university and full support for a postdoctoral fellow for 5 years. The Chair will be eligible to apply for additional funding for infrastructure from the Canada Foundation for Innovation, and research grants from, for example, the Natural Sciences and Engineering Research Council of Canada.

Applications should include a full curriculum vitae with a complete list of publications, a summary of research interests, a statement of teaching philosophy and experience, self-identification of status in Canada (Canadian/permanent resident of Canada, or not), and a list of five internationally recognized referees. (Candidates should arrange for at least 3 referees' letters to be sent under separate cover to the address given below.) Required qualifications include (i) a Ph.D. and postdoctoral experience in a relevant field, (ii) an excellent record of relevant research accomplishments and collaboration (iii) experience and demonstrated effectiveness in the teaching and/or supervision of undergraduate and/or graduate students. Consideration of applications will begin on 31 May, 2010, although the search will remain open until the position is filled. The application should be sent to: The LRET Search Committee, c/o Jackie Hurst, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4J1 (jackie.hurst@dal.ca).

All qualified candidates are encouraged to apply; however, Canadians and permanent residents of Canada will be given priority. Dalhousie University is an Employment Equity/Affirmative Action employer. The University encourages applications from qualified Aboriginal people, persons with a disability, racially visible persons and women.

* The Lloyd's Register Educational Trust (The LRET) is an independent charity working to achieve advances in transportation, science, engineering and technology education, training and research worldwide for the benefit of all. To learn more, visit: www.lr.org/LRET

CLIMATE CHANGE / CHANGEMENT CLIMATIQUE

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

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

Climate Change – Three Strikes Against

by John Stone[1]

Note: The following talk was given on April 15th, 2010, to the Ottawa Centre members at their regular luncheon meeting.

Some of the institutions that we have relied on to support action on climate change have recently suffered some weakening, hopefully not permanently, but they require an honest and constructive examination and some much needed institutional innovation in order to fit them for the tasks ahead. This talk is really about the interplay between science and public policy. It will be in the nature of some cautionary tales from which, hopefully, we can learn some lessons.

Strike 1

Let me start with saying a few words about the Intergovernmental Panel on Climate Change (IPCC). It recently celebrated its 20th Anniversary. Over this period the science has matured to the state where the IPCC has concluded that climate change is unambiguous and that the warming we have observed is very likely due to human actions – primarily the burning of fossil fuels. Compared to the situation in 1988 the science is now well established; we have defined the "problem" and now I believe we must focus our efforts on innovative "solutions". Furthermore, the political engagement is stronger. Twenty years ago only a few leaders such as Margaret Thatcher recognized the threat of climate change. It was only with the 2nd IPCC Assessment that OPEC nations realized the implications for their economies. Now climate change features in almost all international "Summit" meetings. Moreover, climate change is now regarded as more than an environmental issue. It is now seen equally as a development issue, an energy security issue, a technology issue, etc… Indeed, the more ways it can be framed, the broader will be the coalition of interests ready to tackle it. Finally, the IPCC no longer has the stage to itself. There now seems to be an endless stream of reports from governments, NGOs and international bodies.

The IPCC clearly has done its job in assessing the state of knowledge. However, given the lack of action, this is obviously not sufficient. Furthermore, governments have demonstrated that they are "comfortable" with the status quo – they now know what to expect from the IPCC. Well, that was until ClimateGate and the recent attacks on the IPCC. It started when the computer systems at the University of East Anglia in the UK were illegally broken into and e-mail exchanges involving scientists at the Climate Research Unit posted on the Internet. For once the allusion to the Watergate burglary seems appropriate. This incident occurred just before the high profile Copenhagen climate change meetings. Selected extracts of the e-mails were used by some in the climate change denier community to sow doubt on the scientific basis and hence further slow progress on actions to address the threat of climate change.

Two public inquiries have been established to look into this incident. One of these, under the aegis of the Royal Society and looking into the scientific quality of the CRU's research, issued its report earlier this week. The report was very positive; the only suggestion they had was that the CRU scientists seek closer collaboration with the statistics community. There was also a public hearing by the UK House of Commons Science and Technology Committee which essentially exonerated the scientists involved and concluded that the fundamental scientific basis for the threat of climate change has not been undermined. What the incident did show was that scientists are human after all and subject to the same occasional frustrations that afflict us all.

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

Admittedly, some of the e-mails were unfortunate and some of the scientists involved have since admitted to some regrets. The media responses however clearly got out of hand and apart from deliberate misinterpretations showed a dismal lack of understanding of how science is conducted, its norms and the language scientists use. One hears expressions of concern in terms of belief rather than knowledge. The blame for this should not be placed entirely on the media; scientists themselves have to see this as part of the need for a greater effort to secure public ownership of the science.

As if ClimateGate were not enough to undermine public confidence in the science of climate change we have since had a series of allegations of errors in the IPCC's Fourth Assessment Report. Again the climate change deniers, aided by the media, have had a field day. Many of the claims have since been shown to have been unsubstantiated and/or exaggerated. In a recent programme on Canadian television discussing how the media have treated this issue, most of the journalists interviewed admitted that what genuine mistakes have been identified were trivial and did not undermine the key IPCC conclusions. Nevertheless, as polling results show, these incidences have undermined public confidence in both the science and the IPCC. There are clear lessons to be learnt for what I call "public science" – the substance and process of advancing and communicating science that has unavoidable implications for society, the economy and the environment.

ClimateGate showed that scientists, like many other communities, can act in a tribal manner – reinforcing each other's points of view and circling the wagons when attacked. Furthermore, some of them behaved in a manner that seemed arrogant but this was likely a human response to what they considered to be unwarranted attack. The incidence also showed quite clearly that although the scientists involved in the IPCC had stepped down from their academic towers they were, with a few exceptions, totally unprepared to respond to the attacks from the climate change denier sect and the media. Even the IPCC has found itself struggling to respond adequately and has been forced to issue clarifications of its conclusions. For the first time its procedures will be reviewed not by governments but by an international science body, the Inter-Academy Council.

Scientists must not be complacent, we cannot take scientific authority for granted; we are being challenged to demonstrate our objectivity and thoroughness in order to secure public trust. As Mike Hulme and Jerome Ravetz argued in a recent BBC on-line article, we are being forced to make science more democratic.

Strike 2

Let me now switch to talk about the recent Copenhagen climate change meetings – the second strike. Although ClimateGate occurred just before the Copenhagen climate change meetings - itself an interesting coincidence - this incident did not seem to affect the discussions. In fact science was not really a discussion point in Copenhagen.

Copenhagen was an almost impossible event to orchestrate. Despite an almost continuous round of meetings, including at least five in 2009 in Bonn, Bangkok and Barcelona, this proved elusive. Unfortunately, many national leaders came expecting to sign off on a new legally binding treaty and not to enter into negotiations. They had clearly been poorly briefed by their officials since it had been clear for some months that the negotiations were at an impasse that only those with ultimate political authority could resolve. The last two years of negotiations showed that the positions of national governments were far apart and entrenched.

It is questionable if any consensus could come out of a gathering of almost 200 sovereign countries on a subject that has such deep consequences for their societies, economies and ecosystems. Perhaps the existing process had reached a "tipping point" and at some stage was bound to fail; perhaps it could not bear the weight of expectations, perhaps it is just too complex an issue.

What we ended up with was a document referred to as the Copenhagen Accord. The process is as important as the substance. It was crafted through an initiative led by the US President Barack Obama when he arrived on the last day of the Conference and involved the largest developing country emitters: China, India, Brazil and South Africa (the carbon powers). In effect, a parallel process was set up. The European Union, who could have objected to the process quietly, accepted the "deal". A few of the smaller developing countries such as small island states and those from Africa did object but the proposal effectively splintered the G-77 bloc of developing countries even more. As a result delegates ended up "noting" the Accord. Strictly speaking, this means it is not an official UN document and with no clear pathway for turning it into an internationally legally binding treaty.

The countries that brokered the text reflect a world in which the balance of power has significantly changed in the last 20 years. Indeed, the fact that the two major players were the US and China reflects what we have begun to see in international economic terms: that these two superpowers have to somehow get on together.

Furthermore, it was sadly obvious that there was a lack of trust. This lack of trust, amplified by sensitivities to a perceived absence of transparency and inclusiveness, may be the most important factor that bedevilled the Conference. Thus, what has suffered immeasurably as a result of Copenhagen is the UN/FCCC itself. It will continue, at least in its present form for a while, but it will have to change if it is going to be a useful multilateral mechanism into the

future. This is likely to be difficult because many of the negotiators have invested so much of their time in the existing process and will not readily admit to its failure.
Many seasoned observers have suggested that like the French Revolution, it is probably too soon to declare a verdict on the place of the Copenhagen Conference of the Parties in the history of our civilization. But it is clear that the Conference created deep divisions between countries. These will have to be addressed sympathetically: the issue will not go away and more delay will raise the costs and the risks to all. The lack of trust was seen recently in the first formal negotiating meeting after Copenhagen. Although there will be at least three further meetings before the next Conference of the Parties in Cancun this December, according to the UN climate convention chief Yvo de Boer, prospects of finalising a new binding agreement on climate change by the end of the year are "slim".

Strike 3
Now we come to the final "strike" and appropriately focus on the United States. It is probably safe to say that the United States holds the key to achieving progress (especially as the EU seems to have lost its sense of confidence).

The US Senate, which is responsible for all international treaties, did ratify the Framework Convention on Climate Change but refused to pass the Kyoto Protocol voting overwhelmingly, in a 95-0 vote, that the sense of the Senate was that the United States should not be a signatory to any protocol that did not include binding targets and timetables for developing nations or would result in serious harm to the economy of the United States. This vote gave cover to President George W. Bush – and incidentally provided partial justiification to the Canadian government of Stephen Harper to walk away from its Kyoto commitments in a move that seriously threatens the strength of any international accord.

The new Administration of Barack Obama has promised to "mark a new chapter in America's leadership on climate change that will strengthen our security and create millions of new jobs in the process". What is significant in this promise is that he framed climate change not as an environmental issue but one of security - a key concern of Americans since September 11, 2001 – and the reference to jobs is not unimportant either.

However, the US does not have a Parliamentary system and the US Constitution does not give absolute power to the President. The President's party nevertheless does have a majority in the House of Representatives which crafted and passed by a slim majority the 1,200- page American Clean Energy and Security Act otherwise known as the Waxman/Markly Bill in recognition of its two sponsors. Note again the title of the Bill mentions security, this time more specifically in terms of energy. The Bill sets a target for the US to reduce its emissions by 17% below 2005 levels by 2020. This was the target that President Obama took to Copenhagen (and incidentally was later adopted by the Canadian government). The Senate has introduced its own Bill sponsored by Barbara Boxer and John Kerry which passed the Environment and Public Works Committee (Republican members on the Committee stayed away). The Bill was still stuck in the Senate at the time of the Copenhagen meeting which is why the President could only refer to the House Bill targets.

Unless a Bill is passed in the next few months, the US political system will be preoccupied with the mid-term elections in which the Democrats could lose their majorities in the House and the Senate and all Bills will die with the new Session of Congress. It may not be until after the next Presidential election that new Bills would be introduced - in other words 2013! President Obama is facing the same problems he had in getting a health care Bill through Congress.The system has essentially become dysfunctional and any progressive political action has become almost impossible.

The solution may again reside in how the climate change issue is framed which is the main point I want to make with this example. Climate change is not simply an environmental issue but equally one of security and energy (which were in the titles of the House Bill) as well as technology (particularly in competition with rapidly developing countries like China) and jobs (a key concern as the US struggles to get out of the recent recession). The broader the issue is framed, the more likely it will be that there would be a large enough coalition of interests that some version of a climate change Bill will pass. This is expected to be reflected in a new Senate Bill being promoted by Senators Kerry (Democrat), Graham (Republican) and Libermann (Independent) called the Clean Energy Jobs and American Power Act. This Bill is expected to be introduced next month.

Thus, to conclude, we have three strikes against us at the moment: an undermining of the science, a failure of intergovernmental negotiation, and a stalled legislative process in the US. None of this is necessarily permanent. If the science is well established it may be possible to deny but not to hide it. A large portion of the public is simply confused and their opinions can be influenced one way or another. Scientists have to do a better job of explaining what we know and what we don't know. Climate change is a "wicked" problem, there are no simple answers. What answers we come up with have to be resilient to progress in our scientific understanding and more importantly to what we learn from our mistakes. We may have three strikes against us but we are not out. To quote President Obama: "*Now is the time to confront this challenge once and for all. Delay is no longer an option. Denial is no longer an acceptable response. The stakes are too high. The consequences are too serious*".

The *ClimateGate* Investigations and Some Climate Update Snippets

by G.S. Strong

The email controversy at the Climate Research Unit (CRU) of the University of East Anglia (referred to as *ClimateGate* by climate skeptic blogs and media) resulted in the initiation of at least three official investigations in the UK. All three panels have accepted evidence from the public, including the skeptic community. It is clear that they have been unable to confirm any case against CRU or its scientists. Two of these investigations have filed final reports, and both found virtually all allegations groundless, as summarized in the following.

Report from House of Commons Science and Technology Committee, 31 March 2010
The House of Commons committee has completely exonerated both the CRU and its director Dr. Phil Jones, from any wrong-doing. The committee report states that:

1) "*Professor Jones's actions were in line with common practice in the climate science community*"; there was "*no case to answer*" regarding Jones' "*alleged attempt to hide the decline*".

2) The use of "*phrases such as 'trick' or 'hiding the decline' were colloquial terms used in private e-mails and the balance of evidence is that they were not part of a systematic attempt to mislead*".

3) The committee "*found that Prof. Jones had no case to answer over allegations of dishonesty and his scientific reputation was intact*".

The full 61-page report can be found at:
http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/387/387i.pdf).

Report of the International Panel set up by the University of East Anglia, 14 April 2010
This committee was formed to investigate the integrity of the science itself. It was headed by Geologist Lord Ernest Oxburgh and included six other academics from around the globe, including Kerry Emanuel, professor of meteorology at the Massachusetts Institute of Technology, and Huw Davies, former president of the International Association of Meteorology & Atmospheric Science. The panel focussed on eleven peer-reviewed representative publications by CRU scientists covering a period of more than twenty years, and were selected on the advice of the Royal Society.

Their main conclusions included:

1) There was "*no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit, and had it been there we believe that it is likely that we would have detected it*."

2) They "*agreed with the CRU view that the authority for releasing unpublished raw data to third parties should stay with those who collected it*".

3) While this panel recommended that CRU work more closely with professional statisticians in future, they also indicated that better statistical methods would not necessarily have produced significantly different results.

This 9-page report is available at: http://www.uea.ac.uk/mac/comm/media/press/CRUstatements/SAP.

A third independent review is being headed by Sir Muir Russell (see http://www.cce-review.org/).

Climate Snippets -

1) A report by NCAR scientists Trenberth and Fasullo (*Science*, 15 April 2010) states that "*current observational tools cannot account for roughly half of the heat that is believed to have built up on Earth in recent years*". They warn that satellite sensors, ocean floats, and other instruments are inadequate to track this 'missing heat', which may be building up in the deep oceans or elsewhere in the climate system. This has sparked some new research efforts in this area.

2) The Canadian Wildlife Service is reporting that migratory birds are now arriving in Canada's north a month or more earlier than normal and finding not enough food available (*Nunatsiaq Online*, 25 April 2010).

3) Work in Japan and Australia has revealed that a deep-ocean current is carrying frigid water rapidly northward from Antarctica along the edge of a giant underwater plateau (R. A. Lovett, *NatureNews*, April 25, 2010).

4) 50 years of data show that the Devon Island ice cap, one of the largest ice masses in the Canadian High Arctic, is thinning and shrinking, and this has accelerated since 1985 (S. Boon, *Arctic Journal*, Arctic Institute of North America, March 2010).

5) A new study claims that Lake Agassiz spilled into the Mackenzie drainage basin (rather than eastward into the North Atlantic Ocean) approximately 13,000 years ago, likely triggering the Younger Dryas cold interval (Murton et al., Nature,1 April 2010).

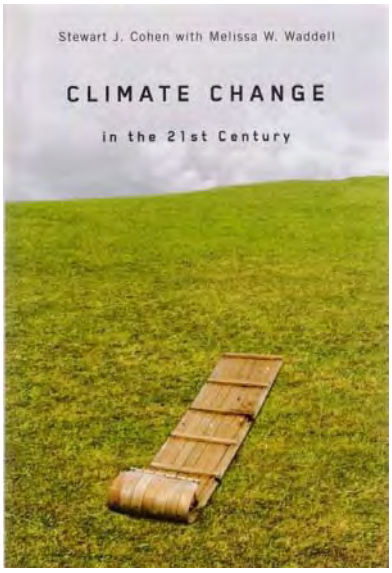
BOOK REVIEWS / REVUES de LITTÉRATURE

Climate Change in the 21st Century

by Stewart J. Cohen with Melissa W. Waddell

McGill-Queen's University Press, 2009
pp.392, 12 tables, 109 diagrams.
ISBN 978-0-7735-3326-4 (cloth), CDN$95.00
ISBN 978-0-7735-3327-1 (paper), CDN$32.95.

Book reviewed by John Hollins[1] [2]



This book is based on a series of lectures for a graduate course given by Stewart Cohen at the University of British Columbia during more than a decade. It draws on a wide range of materials provided to the author by leaders in many facets of global warming, in both the natural and the social sciences. In one sense, it is a textbook that could readily be used by anyone giving lectures in this domain. In another sense, it is a reference work, with a wealth of citations.

Members of CMOS will not be surprised to learn that this book begins with a history of climate research and a chapter on the atmospheric aspects of climate change. These set the scene for the following chapters that address everything from assessment of impacts and potential for adaptation, through economic and social aspects, to climate change in the context of other environmental issues.

The tone of this book is balanced, analytical, and rational; there is not a whiff of the emotion that has been a feature of reporting on the Conference of the Parties in Copenhagen and the reactions of various parties. For the community of professional scientists in atmospheric and oceanographic disciplines working on, or concerned about global warming, this volume offers a broad perspective on the other disciplines that have to be engaged in the development of sound policies and programs to address the fundamental issues identified by them.

The concluding chapter acknowledges that "the global-warming story is woven from a combination of theories, observations, scenarios, and arguments, many of which remain contentious". Despite the uncertainties inherent in understanding the complex biophysical systems being affected by human activities, the book summarizes the aspects that are patently clear: the chemistry of the atmosphere is being altered by human activity; the radiative consequences are beyond doubt; climatic patterns during the past century, while not linear, are real; the cost of extreme events related to weather has been increasing; and there is scientific consensus on some of the scenarios of biophysical impacts.

The book quotes an observation by Kenneth Hare: "*We (natural scientists) desire to export our convictions, but the buyers are reluctant*". A quarter of a century later, some members of CMOS probably feel the same way. Members already know the material drawn from their disciplines in the opening chapters of this book, but the later chapters may offer them insights about the reluctance of the buyers.

[1] CMOS Ottawa Office, Ottawa, ON, Canada.

[2] Stewart Cohen and John Hollins were both members of the organizing committee for the international conference, *Our Changing Atmosphere: Implications for Global Security*, in Toronto in 1988.

Canada's Weather : The Climate that Shapes a Nation

by Chris St. Clair

Firefly Books Ltd, 2009, ISBN-13: 978-1-55407-338-2,
pp.226, CDN$29,95.

Book reviewed by Rob Haswell[3]

Canada's Weather : The Climate that Shapes a Nation is billed as a "book for all seasons" by its publisher, Firefly Books and in that regard it certainly delivers. The bright yellow hardcover with a stick on hologram of lightning screams "school textbook" but I urge you to follow that old adage and not judge this book by its cover.

Once you crack open the cover, this book comes alive with some great photos and graphics and does a wonderful job

[3] Fox 6 - Milwaukee, USA. Chairperson, CMOS Weathercaster Committee

of telling the story of a nation and its near obsession with weather. You begin with a beautifully written foreword by well known climatologist, David Phillips, that focusses on our fascination with weather and how it shapes us as Canadians and sets the stage nicely for the rest of the book.

The first chapter is a bit of an echo of the foreword as it again talks about the Canadian obsession with weather but adds some wonderful photos and Canadian weather trivia.

The text then moves on to a thorough overview of how the weather works with the appropriately titled chapter "How the Weather Works". St. Clair starts with the very basics like the water cyle and earth's orbit as it relates to the seasons and then moves into some more intricate synoptic and mesoscale phenomena later in the chapter. With the exception of one or two omissions or perhaps simply over-simplifications like the lack of transpiration in the water cycle, the chapter is very well put together and clearly explains many of the most asked questions about aspects in the study of meteorology.

Happily the clear and concise weather explanations don't stop with this chapter but instead continue into what I feel is the strongest and most engaging part of the book - chapter 3 "The Seasons". This chapter is easily the longest at over 100 pages and breaks down Canadian weather not only by season but also by region. This is a wonderful way to show the incredible diversity of Canadian weather. It begins with Spring and a fantastic photo of a perfect "double bow" over the Magdalen Islands of Quebec and details such regional phenomena as lake-breeze convergence and upsloping snow. As it continues through Summer, Autumn and Winter, we get some great explorations of things like the Northern Lights; Alberta Clippers; Chinooks and storm surge among others. All of the scientific discussion is supported by strong, if somewhat less-than-cutting edge, graphics and great photos ranging from majestic icebergs off Newfoundland to great nostalgia, like a quartet of young Canadians playing street hockey on a cold Manitoba afternoon.

The chapter that follows - "Weather Watching", is also very compelling and takes a look at how we as professionals monitor, measure and forecast the weather for the second largest nation on the planet. It's a nice look at both the physical equipment ranging from the basic anemometer to the less commonly known Campbell-Stokes recorder as well as a look at the data we analyze every day. It goes on to include a bit of weather broadcast history with a look at Canada's TV meteorologist, Percy Saltzman, and a look at the modern weather studios at The Weather Network.

Chapter five takes a look at the harsh reality of Canadian weather by looking at several of the nations worst weather related disasters. The chapter seems oddly organized sorting the disaster stories in no particular order and starting with the Okanaha Mountain Park fire - a disaster that affected the fewest people and smallest geographic area. I think ordering these events by the number of people affected would have made more sense in a book that focusses on the "people" side of the weather.

My overall impression of Canada's Weather : The Climate that Shapes a Nation is very positive. While its school book cover is a negative for the average reader it certainly would make an excellent teaching source and a great addition to school libraries across the country. The book reminds me of the The Weather Book produced by USA Today which was first published in the early 90s. It's wonderful that Canadian weather watchers and school kids alike will now have an all-Canadian source to begin their weather education.

Atmospheric Thermodynamics Elementary Physics and Chemistry

by Gerald R. North and Tatiana L. Erukhimova

Cambridge University Press, 2009, 267 pages, Hardback, US$70, ISBN 978-0-521-89963-5

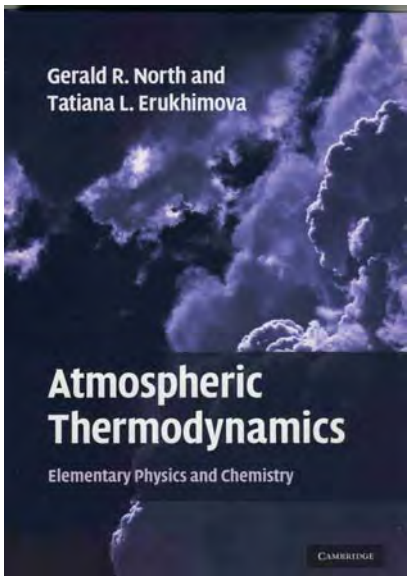
Book reviewed by Henry Leighton[4]

This book is based on lecture notes for a course taken by second and third year students at Texas A&M University and is intended as a text for atmospheric science students.

It starts off with a chapter that, after spending a few pages on units, introduces the ideas of thermodynamic systems and equilibrium. The second chapter presents the ideal gas law but mostly focusses on an introduction to kinetic theory including pressure, velocity distributions and molecular fluxes. The following chapter is devoted to the First Law and adiabatic processes, and introduces enthalpy. Chapter 4 deals with the Second Law, entropy and Gibbs energy. The next four chapters apply the framework developed in the first part of the book to the atmosphere. Chapter 5 introduces measures of the water vapour content of the

[4] Professor, McGill University, Montréal, QC, Canada

atmosphere, the Clausius-Clapeyron equation, lifting of an unsaturated air parcel, and it then goes on to apply the theory developed in chapter 4 to the homogeneous and heterogeneous nucleation of water drops. The following chapter introduces dry and moist adiabatic processes, and the vertical stability of the atmosphere for unsaturated and saturated air parcels. In chapter 7 the ideas developed in chapter 6 are illustrated and expanded with the use of skew T – log p diagrams. Chapter 8 is an introduction to atmospheric chemistry, touching on photochemistry, elementary chemical kinetics, reaction rates and solutions. The final chapter is a lead-in to atmospheric dynamics, starting with some basic vector analysis and ending with derivations of the continuity equation and the thermodynamic equation.



The book is designed to find the middle ground between advanced rigorous treatments of thermodynamics and general meteorology texts which by necessity usually only give a very condensed treatment. For the most part the authors are successful in achieving this goal. The book stands out for its very clear explanations of the concepts and the derivations, and the many worked examples embodied in each chapter that illuminate the theory. The derivations are easy to follow and are complete so students will not have to struggle with filling in missing steps. The chapter on thermodynamic charts is especially well done, including about 20 figures containing thermodynamic charts or portions of the charts to illustrate their uses (e.g. stability and CAPE). However, I am sure that instructors of a course based on this book would appreciate having access to electronic copies of these figures in this chapter. At the end of each chapter there are many problems with answers given in an appendix, a list of the symbols and abbreviations used in the chapter, and a list of other books that complement the material in the chapter.

I intimated that I did not find that the authors were completely successful in finding the balance between elementary text and advanced text. In my opinion the authors were in some places too inclined to explain mathematical details and physical concepts that the readers of this book must be expected to know. To be specific, I was surprised that the authors felt it necessary to include a discussion of basic SI units, to include a table of unit prefixes (nano = 10^{-9} etc), conversions to SI units and relationships between SI units in the first chapter. Students taking a course based on this book must have seen all of this in earlier courses. The tables containing this information could have been relegated to an appendix, and in fact many of the tables are duplicated in full or in part in the first appendix making their presence in the first chapter redundant. Similarly, I found a "Physics refresher" section in the same chapter on vertical motion of a particle and a "Calculus refresher" on the exponential function not only unnecessary but detracting from the flow of the chapter. On the other hand the very clear discussion of thermodynamic systems in this chapter will be appreciated by students. Chapter 2 has some of the same problems as the first chapter. Why is it necessary to define pressure and force units yet again? In an attempt to be overly clear the authors wrote out that "[distance per unit time] = [velocity]" within the body of an equation expressed in words, in such a way as to make the overall equation meaningless. Definitions of velocity or stating $\sqrt{2} = 1.1414$ don't belong in a book of this level. However, I was pleased to find that the following chapters for the most part avoided the earlier problems and were presented at an appropriate level.

In summary, North and Erukhimova's book provides a sound basis for subsequent undergraduate courses in atmospheric science. Equally importantly, they have created a very readable text and taken great care to make the subject as accessible as possible.

Adaptive Governance and Climate Change

by Ronald D. Brunner and Amanda H. Lynch

American Meteorological Society
ISBN: 978-1-878220-97-4, 424pp. 2010, paperback
Distributed by the University of Chicago Press, US$35

Book reviewed by Madhav Khandekar[1]

This is one of the latest books on the most intensely debated scientific issue of our time, *climate change.* The book came out soon after the well-publicized Copenhagen meeting in December 2009, organized by the UNFCCC (United Nations Framework Convention on Climate Change) and the IPCC (Intergovernmental Panel on Climate Change). The Copenhagen meeting ended without any substantive agreement on reducing the greenhouse gases (GHGs) which have been identified by the IPCC and its adherents as responsible for recent warming of the earth's surface and subsequent climate change.

The book provides an alternative to the IPCC's approach (on climate change) by suggesting an adaptation strategy, something that is now discussed by many scientists and policymakers. The first two chapters of the book provide a

background on the UNFCCC and the IPCC and the ultimate objective to get an international agreement on GHG reduction. The emergence of *adaptive governance* in recent years at local and regional levels is described as an outgrowth of UNFCCC's unsuccessful attempts to come to terms with developed vs developing nations on GHG targets. The adaptive governance approach is characterized as a 'bottoms up' approach to climate change rather than the 'top down' approach taken by UNFCCC and its ongoing process of negotiating world-wide GHG targets. This approach is further exemplified in chapter three using a case study for Barrow Alaska (located west of the Beaufort Sea at lat ~71N), a small community of a few thousand permanent residents. The climate change impact in Barrow & the North Slope is identified primarily through an intense storm of October 1963 and several other subsequent storms. This chapter, the longest in the book, discusses how the local and regional government initiatives helped develop adaptation strategies to minimize extreme weather impacts. The next chapter of the book provides a framework for developing adaptive governance as a decentralized approach to climate change with community-based initiatives. The last chapter (five) provides a rationale for developing this theme and further summarizes alternative approaches like low carbon technology (e.g., solar electric power plants, wind turbines), geo-engineering (e.g., albedo enhancement by stratospheric sulpher injection) and related initiatives developed in recent years. The last few pages of the chapter are devoted to latest developments on emission targets, failure at Poznan (Poland) meeting in December 2008 on securing any agreement, impact of global economic melt-down and slow recovery, changes in political landscape in the US and subsequent changes in the US Climate Change Action Plans, leading up to the Copenhagen meeting. The book does not discuss the outcome of the Copenhagen meeting nor the failure of negotiations at the meeting due to refusal by developing nations (primarily Brazil, China and India) to go along with any GHG reduction targets being imposed by the western nations.

The book presents a refreshing look at the climate change issue and how to cope with future climate change impacts. This is a significant departure from the IPCC's mitigation approach, which has been stymied so far, due to lack of political will and many other socio-economic parameters. The concept of a simple adaptation strategy is now gaining traction and this book provides a useful background on how this can become more effective and more acceptable in future. It is instructive to note a couple of commentaries on the book: **1.** Prof Judith Curry, climate scientist, Georgia Institute of Technology USA: "*In the wake of Copenhagen, this book couldn't be more timely for those genuinely concerned about climate change and disappointed with the outcome of climate policies to date"* **2.** Prof Mathew Auer, International Environmental Policy, Indiana University USA: "*Brunner & Lynch [book] offer a persuasive alternative to the 'big science, big politics' formula for combating global climate change"*

Besides the example of climate change at Barrow Alaska, the book also provides examples of other locations and regions where climate change impacts are being tackled at local levels. In the Pacific Islands, the PEAC (Pacific ENSO Application Center) informed local decision-makers about impending drought from the intense 1997-98 El Niño and initiated suitable action on minimizing the drought impacts. In Melbourne Australia, amid continuing drought, city officials and other professionals initiated action to make major amendments to local water policies. In Nepal, melted ice water from several glaciers caused significant accumulation of water in a nearby lake. The Government of Nepal, with the support of international donors, initiated a project in 1998 to lower the lake level by drainage, so as to prevent it from bursting and creating catastrophic loss of water and damage to property. These and other examples in the book are primarily geared towards documenting 'global warming' impacts as identified by the IPCC. The reality of recent climate change is however, far more complex and does not conform to IPCC projections. In the Canadian Atlantic Provinces, the mean temperature has been declining for the past 25 years or more and the last ten years have witnessed heavier winter snow accumulation in many locales there. In the conterminous US, the sea-board States in southeastern US as well as some of the mid-western States have witnessed heavier winter snow accumulation in recent years. The past winter saw unusually heavy snow accumulation in Washington, the US Capital, which was paralyzed for almost a week in January 2010, with so many roads clogged with snow! There are many other examples in other regions of the earth which show glaring disparity between IPCC projections and climate reality of the last ten years or more. A discussion on the climate change reality and appropriate adaptive initiatives tailored to specific climate change impacts would have been a useful addition to the book.

Notwithstanding the above minor exclusion, the book is a welcome addition to the plethora of books and documents on environment and climate change that are available at present. This book should be on a "must read" list of decision-makers at various levels of government in Canada. Further, the book could provide a valuable guideline at future national and international meetings on climate change and emission targets. The book's main message that *it is time to take a closer look at adaptation strategy (Plan B)* should now become the new mantra for coping

with future climate change.

[1:] Madhav Khandekar is a former Research Scientist from Environment Canada and was an Expert Reviewer for the IPCC 2007 Climate Change documents. Khandekar has been in the weather & climate sciences for over 52 years and he continues his research interest at present on climate change issues and impacts on interannual variability of Indian/Asian Monsoons.

Les bases de la prévision numérique du temps

par Jean Coiffier

Cours et manuels No. 18, 2009, École nationale de la météorologie, Météo-France, ISBN 978-2-11-097446-4, ISSN 0240-8996, 255 pages, Couverture souple, 42 € (http://comprendre.meteofrance.com/pedagogique/publications/collections/cours_de_meteorologie/cours_de_meteorologie?page_id=2811&document_id=20861&portlet_id=46724)

Commentaire par René Laprise[5]

Cet ouvrage a pour but d'enseigner aux étudiants des sciences de l'atmosphère les techniques couramment employées pour développer les modèles de prévision du temps. L'emphase est mise sur la description des équations de la dynamique et des schémas numériques de discrétisation, mais on y traite aussi brièvement des paramétrages de l'effet d'ensemble des processus physiques de sous échelle, ainsi que des techniques d'analyse objective, d'assimilation des données et de vérification des prévisions. L'auteur est un expert sur le sujet car il a dédié sa carrière à développer des modèles numériques de prévision du temps à Météo-France.

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[5] Directeur, Centre ESCER pour l'Étude et la Simulation du Climat à l'échelle Régionale Professeur, Dép. Sciences de la Terre et de l'Atmosphère, Université du Québec à Montréal Montréal, QC, Canada

Le premier chapitre brosse un tableau de la courte histoire de la prévision numérique du temps; il nous rappelle que la première prévision remonte à 1950 et décrit les fulgurants avancements des 60 dernières années. Le second chapitre décrit les différentes simplifications qui ont été employées pour alléger les équations et accélérer leur intégration sur ordinateur, ainsi que les diverses coordonnées et projections couramment utilisées. Les chapitres 3 et 4 décrivent respectivement les schémas de discrétisation spatiale selon les méthodes des différences finies et selon les méthodes Galerkin, éléments finis et méthode spectrale. Les chapitres 5 et 6 étudient les effets numériques de quelques discrétisations spatiales et stencils de maillage, ainsi que les schémas d'avance temporelle tels les schémas explicite, semi-implicite et semi-lagrangien, dans le cadre dynamique le plus dépouillé possible, soit les équations de fluide barotrope et en eau peu profonde. Les chapitres 7 et 8 décrivent des formulations de modèles baroclines, hydrostatiques et non hydrostatiques, suivant différentes coordonnées et schémas numériques. Le chapitre 9 fait un survol des paramétrages des processus physiques de sous échelle, et finalement le chapitre 10 traite de l'assimilation des données et conclu avec quelques perspectives pour l'avenir. Depuis la parution du livre, l'auteur a développé une annexe additionnelle où il décrit la formulation de modèles non hydrostatiques pleinement élastiques, en particulier les modèles français AROME et américain WRF; cette annexe fera partie des prochaines éditions du livre.

Ce livre vise la clientèle des étudiants de niveau Maîtrise ou Doctorat en sciences de l'atmosphère, et il suppose une connaissance préalable de la dynamique de l'atmosphère et de ses types d'ondes. Les chercheurs en modélisation, que ce soit en prévision du temps, en climat ou en océanographie, y trouveront une référence fort utile car ce livre fournit des explications détaillées sur les formulations algébriques de plusieurs modèles; ce type d'information est souvent très difficile, voire impossible, à trouver. Le texte réfère fréquemment aux références originales des travaux de chercheurs et le livre comporte une abondante bibliographie sur le sujet.

Le style d'écriture est sobre, le vocabulaire précis, les développements mathématiques méticuleux et bien détaillés. En adoptant systématiquement l'approche de complexité incrémentale, traitant initialement de formulations simplifiées, puis successivement de problèmes de plus en plus complexes, l'auteur a définitivement donné une vocation pédagogique à son livre. Les quelques répétitions que cette approche inévitablement engendre, loin d'être un défaut, seront grandement appréciées par les étudiants qui y trouveront une révision très profitable des concepts qui servira à valider leur compréhension du sujet.

Les modèles numériques deviennent de plus en plus des instruments indispensables dans le domaine des sciences de l'environnement; ce livre permettra à tout étudiant ou

chercheur d'avoir une vue générale sur la modélisation numérique de l'atmosphère et d'apprendre à en maîtriser les techniques. Quoiqu'il soit bien intéressant d'avoir un ouvrage d'une telle qualité en français, une version en langue anglaise permettrait à un plus grand public d'en tirer profit.

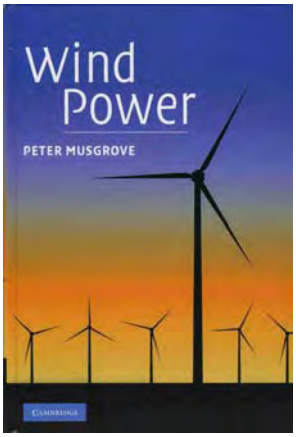
Wind Power

by Peter Musgrove

Cambridge University Press, 2010, 323pp.
Hardback 978-0-521-76238-0, $95.00
Paperback978-0-521-74763-9, $34.99

Book reviewed by Richard Asselin

With a background as an engineering professor, the author joined England's Wind Energy Group in 1988 and became Head of Development of National Wind Power in 1991, a wind farm development company, from which he retired in 2003.



The book starts with an Overview of wind power and our energy needs, followed by 9 additional chapters: The first windmills; Seven centuries of service; Generating electricity: the experimental years, 1887 to 1973; The evolution of the modern turbine, 1973 to 1990; Progress and economics in Europe, 1973 to 1990; UK progress, 1973 to 1990; Development and deployment, 1990 to 2008; and The future: from marginal to mainstream. It is clear, from this outline, that the subject is power, not wind. Indeed, there are three appendices: The power output from wind turbines; The performance of traditional windmills; and Wind characteristics (which is all in three pages!).

The book is well documented, with 50 pages of notes, about 250 references and a 4-page index. It is amply illustrated with about 100 figures and tables, including photos of all types of windmills, drawings of internal working parts, sketches from ancient documents, various statistical or engineering measurements as well as simplified models.

Throughout the book, Musgrove is tedious in his proofs and his analyses of the engineering characteristics and performance of the machines. He carefully reviews the early attempts to scientifically measure the power and energy delivery of mills, especially the power coefficient (the fraction of the wind power that is extracted by the mill). He shows that power of individual mills has increased from about 300 W at the beginning to 3.5 MW now, and that the power coefficient has increased from about 0.005 for the earliest vertical axis Persian mills, to 0.05 for early European horizontal axis mills, and to 0.45 currently achieved by the biggest modern turbines (the theoretical maximum attainable power factor is shown to be 0.59). Early European mills had rotors of about 13 metres whereas the largest turbine has a diameter of 130 metres. These detailed descriptions are a bit long, but interesting form the point of view of the history of mankind's technological developments.

There are discussions about all the mechanical aspects of the mills, from the orientation of the axis of rotation, upwind or downwind placement of the blades, number of blades, speed of rotation, system of orientation, gearing of the transmission, speed control, shapes of blades, material composition, types of towers, etc. There are fewer details about electricity generators, which can be AC or DC, independent or grid connected, using synchronous or induction generators, of fixed or variable speed. This engineering helps to understand the complexity of the process of power extraction from the wind.
Although failures of the early Asian or European mills were never recorded (only successes have been documented), there is a good description of successes and failures in modern times, especially in attempts to scale up earlier models. Some of the failures are indeed humbling!

There are interesting comparisons of the energy output from humans and mills (as well as from early steam engines), for the purpose of grinding wheat, pumping water etc. For instance, a man is said to be able to generate about 60 W on a continuing (8 hours of work) basis. The energy generated by a person is about 175 kWh per year, whereas the average American consumes about 11,000 kWh per year. These calculations may not be that useful, but certainly put things in perspective.

Throughout the book, careful attention is paid to the economics of energy generation, such as capital, operation and maintenance cost of mills, cost per kWh, payback period, return on investment and impact of government incentives. The author offers considerable discussion on the efficiency of various legislative and financial incentives that have been employed in all countries in order to favour the development of wind power. In particular, he deplores the ineffective legislative approach of the UK, compared to the system of fixed feed-in price used in Denmark, Holland, Spain and Germany, or the Production Tax Credit used in the USA. The effectiveness is shown by means of graphs of installed capacity over time for the top 10 countries (among which Canada does not figure).

There is a review of the wind energy potential in the world and in a number of countries, indicating that it is a very significant resource. The significance of the adverse effects,

such as noise and visible pollution are discussed and presented as minimal. The problem of intermittency is discussed in terms of its fossil energy cost and economic cost (i.e. when the wind is not blowing, gas turbines have to be turned on). From this analysis, the author concludes that up to 50% of the electrical energy use in the UK, European countries and USA (and probably most countries) could be economically generated by wind power at a cost comparable to the current cost of electricity, but with the additional benefit of a significant reduction in the uses of fossil fuels and CO_2 emission.

I find the mixture of historical, mechanical, hydrodynamic, economic and societal considerations very interesting. The book is factual, easy to read and reasonably unbiased, for example in discussing the nuclear or photovoltaic alternatives. This book is a comprehensive source for anyone who simply wishes to become informed on wind energy, or planning environmental or conservation strategies, and would be a good primer for those contemplating commercial developments. The only weakness that I found is in the description of the spatial-temporal characteristics of the wind, which are summarized in 3 pages at the end of the book. This is very simplistic for a meteorologist, but is apparently sufficient for a wind turbine engineer or wind farm operator.

I certainly feel much better about wind power after reading this book, and in a position to appreciate the initiatives of the Quebec and Ontario governments (and probably others also) in respect to wind power. There are already hundreds of thousands of mills around the world, generating a non-negligible proportion of the electricity. Turbines are being built by thousands of companies in several countries, including developing countries such as China and India. Canada seems to have missed the boat as far as development is concerned.

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

2010-01) *Remote Sensing for Biodiversity and Wildlife Management, Synthesis and Applications*, Steven E Franklin, McGraw-Hill, Hardback, 2010, ISBN 978-0-07-162247-9, pp. 346.

2010-02) *Integrated Regional Assessment of Global Climate Change*, Edited by C. Gregory Knight, Jill Jäger, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-51810-9, pp.412, US$125.

2010-04) *Challenged by Carbon, The Oil Industry and Climate Change*, Bryan Lovell, Cambridge University Press, Paperback, 2009, ISBN 978–0 521-14559-6, pp.212, US$30.

2010-05) *Measuring Global Temperatures, Their Analysis and Interpretation*, Ian Strangeways, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-89848-5, pp.233, US$115.

2010-07) *Ocean Circulation, Wind-Driven and Thermohaline Processess*, Rui Xin Huang, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-85228-9, pp.791, US$85.

2010-09) *Climate Change and Small Pelagic Fish*, Edited by Dave Checkley, Jürge Alheit, Yoshioki Oozeki and Claude Roy, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-88482-2, pp.372, US$155.

2010-11) *The Climate Crisis, an Introductory Guide to Climate Change*, David Archer and Stefan Rahmstorf, Cambridge University Press, Paperback, 2010, ISBN 978-0-521-73255-0, pp.249, US$30.

2010-13) *Water Resources and Environmental Issues, Introduction*, Karrie Lynn Pennington and Thomas C. Cech, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-86988-1, pp.457, US$65.

2010-16) *Controlling Climate Change*, Bert Metz, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-76403-2, pp.359, US$125.

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

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

2010-20) *Beyond Smoke and Mirrors, Climate Change and Energy in the 21st Century*, by Burton Richter, Cambridge University Press, Paperback, 2010, ISBN 978-0-521-74781-3, pp.226, US$30.

2010-21) *Turbulence in the Atmosphere*, by John C. Wyngaard, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-88769-4, pp.393, US$75.

A-O Abstracts Preview

Avant Première des résumés de A-O

The following abstracts will soon be published in your next ATMOSPHERE-OCEAN publication.

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

Trends in Canadian Surface Temperature Variability in the Context of Climate Change

by JESSICA K TURNER and J. R. GYAKUM

Abstract
Much of the previous work on trends in temperature extremes has considered anomalies relative to a fixed base period climatology. Calculated in this way, trends toward more extreme warm events and less extreme cold events will be found if the mean temperature is warming. In this study we calculate anomalies relative to a 30-year running mean in order to examine trends in surface temperature variability and extremes separately from changes in the mean. The difference between trends calculated relative to a running mean and those calculated relative to a stationary mean will depend on the magnitude of the trend in the mean.

Monthly trends in the positive, negative, and absolute values of daily minimum and maximum temperature anomalies at 158 stations across Canada are presented. The slopes of the trends and their significance are calculated using non-parametric methods. Trends are strongest in winter and early spring. Decreasing variability is found in the west and northeast, with the greater part of this reduction due to less intense cold anomalies. Regions of increased variability exist in the Prairies during winter and in the Atlantic Provinces in early spring. In general, the trends in variability are small compared to the mean temperature trends, implying that while the mean of the temperature distribution at Canadian sites is warming, the variance shows little change.

Résumé
Une grande partie des travaux précédents sur les tendances dans les extrêmes de température ont pris en considération les anomalies par rapport à une climatologie basée sur une période fixe. Calculées de cette façon, on trouvera des tendances vers plus d'événements de chaleur extrême et moins d'événements de froid extrême si la température moyenne augmente. Dans cette étude, nous calculons les anomalies par rapport à une moyenne mobile de 30 ans dans le but d'examiner les tendances dans les extrêmes et la variabilité des températures de surface indépendamment des changements dans la moyenne. La différence entre les tendances calculées par rapport à une moyenne mobile et celles calculées par rapport à une moyenne stationnaire dépendra de l'ampleur de la tendance de la moyenne.

Nous présentons les tendances mensuelles dans les valeurs positives, négatives et absolues des anomalies de températures minimales et maximales quotidiennes à 158 stations au Canada. Les pentes des tendances et leur signification sont calculées à l'aide de méthodes non paramétriques. C'est en hiver et au début du printemps que les tendances sont les plus fortes. Nous trouvons une variabilité décroissante dans l'ouest et dans le nord-est, la majeure partie de cette réduction étant due à des anomalies froides moins intenses. Il existe des régions de variabilité accrue dans les Prairies durant l'hiver et dans les provinces de l'Atlantique au début du printemps. En général, les tendances dans la variabilité sont petites comparativement aux tendances dans la température moyenne, ce qui implique que même si la moyenne de la distribution des températures aux sites canadiens augmente, la variance affiche peu de changement.

Simulating Wind Channelling over Frobisher Bay and its Interaction with Downslope Winds during the 7-8 November 2006 Wind Event

by DANIEL DEACU, AYRTON ZADRA and JOHN HANESIAK

Abstract
Previous observational studies have identified wind channelling over Frobisher Bay induced by pressure fields associated with cyclones as the main cause for the occurrence of strong and sustained surface winds at Iqaluit. The wind event of 7-8 November 2006, when a surface cyclone moved over the Labrador Sea, is representative of many such occurrences. Our simulations of the event with the Global Environmental Multiscale – Limited Area Model (GEM-LAM 2.5-km) show an almost simultaneous development of wind channelling over Frobisher Bay and of downslope winds over the lee slopes of Hall Peninsula, as well as their interaction. The winds are caused by the passage of the same cyclone, but they advect different air masses. The channelled wind is initiated by a barrier jet generated as a result of the low-level blocking of northeasterly winds by steep orography near the head of the bay. Later, it intensifies, while being driven primarily by large-scale pressure gradients. The cross-bay development of the channelled wind against the downslope wind over the lee slopes of Hall Peninsula explains the shift in surface wind direction and the high surface wind speeds recorded at Iqaluit. Some of the findings are also supported by data from radiosondes launched at Iqaluit. A short sensitivity

study shows the beneficial effect of a distributed orographic drag parameterization on the near-surface winds. The impact of using a modified Lenderink-Holtslag mixing length and of increasing the vertical resolution near the surface are also addressed.

Résumé
Des études observationnelles précédentes ont identifié la canalisation du vent dans la baie de Frobisher produite par les champs de pression liés aux dépressions comme la cause principale de vents de surface forts et soutenus à Iqaluit. L'événement de vent survenu les 7 et 8 novembre 2006, lorsqu'une dépression en surface s'est déplacée au-dessus de la mer du Labrador, est représentatif de bon nombre de ces situations. Nos simulations de l'événement avec le GEM-LAM 2,5 km (Modèle global environnemental multi-échelle à aire limitée) montrent l'apparition presque simultanée d'une canalisation du vent dans la baie de Frobisher et de vents descendant les pentes sous le vent de la péninsule Hall ainsi que de leur interaction. Les vents sont causés par le passage de la même dépression mais ils advectent des masses d'air différentes. Le vent canalisé est amorcé par un courant-jet de barrière résultant du blocage à basse altitude des vents du nord-est par les pentes escarpées qui bordent le fond de la baie. Plus tard, il s'intensifie, principalement sous l'effet des gradients de pression à grande échelle. La formation du vent canalisé en travers de la baie au-dessus du vent descendant les pentes sous le vent dans la péninsule Hall explique le changement de direction du vent de surface et les vitesses élevées du vent de surface enregistrés à Iqaluit. Certains résultats sont également confirmés par des données de radiosondes lancées à Iqaluit. Une courte étude de sensibilité montre l'effet favorable d'une paramétrisation distribuée du frottement orographique sur les vents près de la surface. Nous étudions aussi l'effet de l'utilisation d'une longueur de mélange de Lenderink-Holtslag modifiée et d'un accroissement de la résolution verticale près de la surface.

Modelling Stratification and Baroclinic Flow in the Estuarine Transition Zone of the St. Lawrence Estuary

by RACHEL D. SIMONS, STEPHEN G. MONISMITH, FRANÇOIS J. SAUCIER, LADD E. JOHNSON and Gesche Winkler

Abstract
This paper presents a hydrodynamic study of the St. Lawrence Estuary's estuarine transition zone, a 100 km region where fresh water from the river mixes with salt water from the estuary. The circulation of the estuarine transition zone is driven by strong tides, a large river flow, and well-defined salinity gradients. For this study, a three-dimensional hydrodynamic model was applied to the estuarine transition zone of the St. Lawrence Estuary and used to examine stratification and density-driven baroclinic flow. The model was calibrated to field observations and subsequently predicted water level elevations, along-channel currents, and salinity with mean errors of less than 9%, 11%, and 17% respectively. The baroclinic density-driven currents were distinguished from the tidal barotropic currents by using principal component analysis. Stratification and baroclinic flow were observed to vary throughout the estuarine transition zone on tidal and subtidal spring-neap time scales. On a semi-diurnal tidal time scale, stratification was periodic, and baroclinic flow was represented by pulses of sheared exchange flow, suggesting that neither buoyancy forcing nor turbulent mixing is dominant at this scale. On a subtidal spring-neap time scale, stratification and baroclinic flow varied inversely with tidal energy, increasing on weak neap tides and decreasing on strong spring tides.

Résumé
Cet article présente une étude hydrodynamique de la zone de transition estuarienne de l'estuaire du Saint-Laurent, une région de 100 km où l'eau douce du fleuve se mélange avec l'eau salée de l'estuaire. La circulation de la zone de transition estuarienne est le résultat de fortes marées, d'un débit fluvial élevé et de gradients de salinité bien définis. Pour cette étude, un modèle hydrodynamique tridimensionnel a été appliqué à la zone de transition estuarienne de l'estuaire du Saint-Laurent et utilisé pour examiner la stratification et l'écoulement baroclinique dû à la densité. Le modèle a été étalonné en fonction d'observations faites sur place et il a ensuite prévu les niveaux d'eau, les courants le long de l'estuaire et la salinité avec des erreurs moyennes inférieures à 9 %, 11 % et 17 % respectivement. Les courants barocliniques dus à la densité ont été distingués des courants de marée barotropes par une analyse des composantes principales. Il est apparu que la stratification et l'écoulement baroclinique varient dans toute la zone de transition estuarienne aux échelles de temps des marées et des cycles vive-eaux mortes-eaux. À l'échelle de temps des marées semi-diurnes, la stratification était périodique et l'écoulement baroclinique était représenté par des impulsions d'écoulements d'échanges cisaillés, ce qui suggère que ni le forçage par la flottabilité ni le mélange turbulent ne sont prédominants à cette échelle. À l'échelle de temps des cycles vives-eaux mortes-eaux, la stratification et l'écoulement baroclinique variaient inversement avec l'énergie de la marée, s'accroissant lors des faibles marées de mortes-eaux et diminuant lors des fortes marées de vives-eaux.

IN MEMORIAM

Mike Miayke

1929 — 2009

Michio (Mike) Miyake, Canadian oceanographer, Quaker and peace activist, died in Victoria of a heart attack on 29 November 2009, a few weeks before his 80th birthday. Mike studied the boundary layers of the atmosphere and ocean, and their interaction through turbulent motions and fluxes of momentum, heat and moisture. He became a faculty member of the Institute of Oceanography at the University of British Columbia in 1967 and moved to the Institute of Ocean Sciences in Sidney BC in 1976. He retired from IOS in the early 1990s, after which he divided his time between his consulting company with activities in international ocean science and being a peace activist.

Picture of Mike in May 2009 near his home in Victoria. Taken by David Rodenhuis who was a graduate student with Mike in Seattle and is now with the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria.

Mike Miyake was born in Hiroshima, Japan on December 24, 1929 — the youngest son of a successful western clothing manufacturer. At the age of 15 Mike led an 11-boy team working in an ammunitions factory outside of the city, which is where they were when the bomb was dropped on 6 August 1945. They walked back to the burning city as black rain fell on them; he eventually found his mother and sister, but his father perished in the fire. In 1950 he obtained a bachelor's degree from Kumamoto University in Japan and worked a short time as a broadcast engineer. With the aid of American Quakers who came to help rebuild Hiroshima, he emigrated to the United States in 1951 where he initially went to high school to improve his English, then attended Guildford Friends (Quaker) College for 1 year, and then to Swarthmore University where he met his first wife Susanna, who died of cancer in 1995. When his money ran out, he worked for a while before attending Drexel University in Philadelphia, the first coop education programme in the US, where he received a bachelor's degree in electrical engineering. He then moved to the University of Washington in Seattle, earning Master's and PhD degrees, combining his electrical engineering skills with his strong interests in the physics of the atmosphere and oceans. During this time he met Bob Stewart, who became his close friend and mentor, first at UBC and then at IOS.

We were graduate students with Mike in the late 60s and early 70s. He had boundless energy and enthusiasm for his research and mounted many field campaigns, involving instrumented platforms on land and sea and in the air on both planes and balloons released from ships and airplanes. Working with Mike was an exciting, and at times chaotic, experience. These experimental campaigns were logistically complex and they usually succeeded because of Mike's energy, 'can-do' attitude, intuitive insight, and force of will and persuasion. He was highly creative and intuitive, often having crazy ideas that remarkably worked out to be right in the end. Mike especially enjoyed being involved in large multinational cooperative experiments, such as the Barbados Oceanographic and Meteorological Experiment (BOMEX) in the Caribbean, the Storm Transfer and Response Experiment (STREX), and the Mixed Layer Experiment (MILE) in the Northeast Pacific. As graduate students, we met and worked with many scientists from other countries and cultures, an enriching experience that we have maintained throughout our own careers. During this time, he also hired conscientious objectors from the Vietnam War as research assistants for short periods, helping them while they became established in Canada. A few years ago, his Christmas letter included a picture of Mike and his second wife Yushiko demonstrating for peace in front of the United Nations headquarters in New York City.

Mike's interests in science did not end with his retirement, and right up until his last few months, he would phone every few months with some new idea that he was exploring or that he wanted us to think about pursuing ourselves. Usually these ideas involved making a positive difference for the environment and humankind. Mike was like no one else we have ever known, and he was a strong and positive influence in our scientific and personal lives. Mike is survived by his wife Yushiko Miyake (of Tokyo), and his daughters Joanna (of Ft. St. John, BC) and Dorothy (of Leeds England) and their families.

Prepared by Ken Denman with input from Gordon McBean and Grace Kamitakahara.

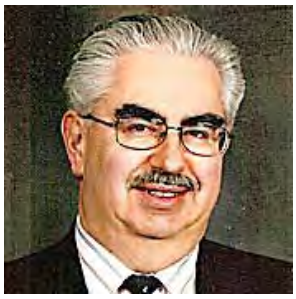
Keith Greenaway

1916 — 2010

GREENAWAY, Keith Rogers CM, CD, JMN, D.Sc.Mil, LLD Brigadier General (Retired). Keith Greenaway was born in Woodville, Ontario on 8 April 1916 and died peacefully in Ottawa 11 April 2010. He was the son of the late Hanna Rogers and Wesley E. Greenaway. Keith had a distinguished 31-year RCAF/CF career accumulating over 8,000 hours flying time with about 6,000 hours flown on experimental, test and exploratory tasks, mostly in Canada's far northern regions. A world-renowned expert for his work in the field of arctic air navigation, he had to his credit several ground-breaking books, numerous articles and scientific literary contributions as well as the development of navigational aids and techniques for use in high latitudes. In recognition of his exemplary service he received many awards including the 1950 President's Prize of the Royal Meteorological Society (1950); the Thurlow Award from the US Institute of Navigation (1951); the McKee Trans-Canada Trophy (1952); and, the Massey Medal (1960) from the Royal Canadian Geographic Society. In 1971 he was awarded the Johan Mangku Negara (JMN) Medal by the Malaysian Government in recognition of his service to the Government of Malaysia. In 1973, he became a premier member of the Canadian Aviation Hall of Fame and in 1976 was appointed a Member of the Order of Canada (CM). An Honorary Doctorate of Military Science degree was conferred upon Keith by Royal Roads Military College in 1978 and an Honorary Doctorate of Laws degree by Carleton University in 2004. Upon his retirement from the military in March 1971, Keith served as a consultant with the Interdepartmental Advisory Committee on Northern Development and also was appointed Senior Scientific Advisor to the Department of Indian Affairs and Northern Development for three years. To raise awareness of Canada's vast northern region, he founded an Arctic tour program in 1977 for High Commissioners and Ambassadors accredited to Canada and over the next quarter century he devoted countless volunteer hours to this highly-regarded initiative.

Thomas Gerald Ostry

1950 — 2010



THOMAS GERALD OSTRY November 4, 1950 - April 13, 2010. After a brief illness, it is with profound sadness we announce the passing of Thomas on Tuesday, April 13, 2010. He is sadly missed by his wife Anne. Tom was born and raised in Winnipeg's North End, graduating from St. John's High School in 1968. He graduated from the University of Manitoba with a Bachelor of Science Honours Degree in Physics. He worked at Environment Canada as a meteorologist for over 37 years, working one year in Regina, 11 years in Toronto and the last 25 years in Winnipeg. He enjoyed his job immensely and was well recognized for his work. Tom was truly a family man and was very grateful for the arrival of his daughter Diane. He was a caring, loving and helpful father who took pride in his daughter's endeavours. Tom and Anne shared many interests. One of their passions was taking pictures at a variety of events providing great memories for their family and friends. They both enjoyed volunteering for M.T.C. and supporting their church and numerous events in the Ukrainian community. One of Tom's favourite memories was the time spent with the entire family skiing in Fernie, BC. He loved having the whole family together, sharing ski stories, eating great food and having a blast taking up skiing at the tender age of 54. Tom enjoyed skill testing and challenging games. He loved organized adventure-based games and was an avid bridge player who looked forward to his frequent bridge nights with his buddies. He was also a faithful Blue Bomber fan and shared season tickets with his father for many years. But most of all Tom was a kind and gentle soul who was well liked and will be greatly missed by family and friends. He had a generous heart and extended a helping hand whenever needed. He made us all smile with his quick wit and his sense of humour.

To CMOS Members,

It is with great sadness that we learned of Uri Schwarz's death, Sunday morning, May 2, 2010, in hospital in Ottawa.

We knew that his health problems had prevented him from going out for the last couple of months but were not aware that his health had deteriorated to the point where he had to be hospitalised about a week or so ago, so this news came as a great shock to all his CMOS friends and colleagues here in Ottawa and across the country. His friend Averill Craig came from Montréal to look after him and comfort him while in hospital and was with him all this

past week and during his final hours in palliative care. He was lucid and joking and being Uri almost right up until the end.

A service to celebrate his life will be arranged at a time and place still to be determined.

Uri Schwarz

1920 — 2010

SCHWARZ, Uri (Erich) Peacefully at Queensway Carleton Hospital, Ottawa, on Sunday May 2nd 2010, aged 89. Born in Vienna, Austria on 22 July 1920, son of Ernst and Stefanie Schwarz (nee Teller). His wife, Jetti Flora Deen, predeceased him in 1997. In 1938, following the Anschluss of Austria with Germany, he left to study in Italy, and then moved to Palestine where he studied at the Technical University, Haifa. With the outbreak of WWII, he joined the

RAF where he trained as a meteorologist and served in Egypt and in Persia. After the war he joined the Palestine Meteorological Service and, with the establishment of the State of Israel, the Israeli Air Force and subsequently the Israeli Meteorological Service, in charge of aeronautical meteorology. In 1957 he joined the International Civil Aviation Organization working first at its HQ in Montreal, and then in the European Regional Office in Paris, returning to Montreal as Chief of the Meteorology Section in 1967. After retiring from ICAO in 1982 he moved to Ottawa, where he became Executive Director of the Canadian Meteorological and Oceanographic Society. Although he retired from that activity in 1994, he was appointed Executive Director Emeritus (an honour of which he was very proud) and he continued to work for CMOS on a part-time basis until a few months before his death. A kind, thoughtful, charming man who spoke English, German, Dutch, Hebrew, Italian and French, he could pun in several languages and loved to write limericks for any occasion. Uri will be very much missed by his friends and former colleagues in Israel, Montreal and Ottawa, and particularly by his relatives in the United States, Holland and Germany: David and Jane Balton (Becca and Tim), Ruth Balton (Billy), Sylvia Deen and Jan Ruijter, Vicky Fitzgerald, Susie Schoenwiese, as well as by his long-time friend in Montreal, Averill Craig. A celebration of his life to be held in Ottawa, will be announced at a later date. In Memoriam donations to a Charity of Choice appreciated.

Messages of Condolence

From Bill Crawford
We learned early May of the death of Uri Schwarz, the first Executive Director of CMOS, serving from 1982 to 1994, and Executive Director Emeritus since then. I clearly remember his cheerful way of working through any problem that arose and will miss him greatly. We all mourn his passing.

From David Fissel
We owe so much to Uri Schwarz in building CMOS through his role as the first Executive Director of CMOS, starting in 1982.

From John Merrick
It's too bad we can't really know the background hidden behind the charming and humble personages whom we call colleagues in order that we can appreciate their history and contributions. I hope he wrote a memoir - even if it was only short and for his family's private consumption.

From Ian Rutherford
Uri actually wrote a little book on his early life. It was shared with very few people because it is very personal. All that I can tell you is that it covers his childhood and growing up in Vienna, being forced to leave first Austria, then later Italy, his life in Palestine, his career in the RAF, etc., up until becoming a forecaster at Tel Aviv airport. These are all things just touched upon in the nice obituary written by Averill Craig. It is too bad that he never wrote about his later career and how he came to settle in Canada. He was a wonderful writer in English, not his native tongue but one of which he certainly was a master.

He was a remarkable and wonderful man and many will miss him!

From Geoff Strong
Despite Uri's age, I still find this sad. I remember getting encouragement from Uri at my very first CMOS Congress in 1974. And he was so easy to speak with after that. I'm guessing he was a dear friend for all of you in Ottawa.

De Richard Asselin
Lorsque j'étais président en 1982, j'avais reconnu la difficulté de faire fonctionner la Société avec seulement les membres élus du Conseil et de l'Éxécutif. J'avais alors lancé un appel afin de trouver un directeur général. Quelle chance nous avons eu de recevoir la candidature de Uri qui offrait ses services! Uri était un homme plaisant, simple, dévoué, compétent et expérimenté. C'est à lui que nous devons notre Société moderne qui est capable de donner suite à des dossiers et de prendre des initiatives. Uri nous a servi pendant plus de 25 ans. Ce n'est qu'en 2009 qu'il a finalement transmis ses responsabilités pour maintenir les dossiers comme Projet Atmosphere et les assurances à des plus jeunes. Merci Uri!

SHORT NEWS / NOUVELLES BRÈVES

Environment Canada Awards Local Climate Observer for Excellence During 25 Years of Service

COWICHAN LAKE, BRITISH COLUMBIA – March 18, 2010) - Canada's Environment Minister, The Honourable Jim Prentice, today recognized Ian Cairns as the recipient of the Morley K. Thomas Award in appreciation for excellence in climate observing at the Cowichan Lake Research Station of the B.C. Ministry of Forests and Range. Mr. Cairns was presented with the award this week by Pat Wong of Environment Canada's regional office.

"*We depend on dedication of individuals like Ian Cairns to help build a comprehensive climate history in Canada. We extend a huge thank you to Mr. Cairns and the B.C. Ministry of Forests and Range for continuing an important tradition*," said Minister Prentice.

Every morning and evening since 1981, Mr. Cairns has collected climate information and recorded temperatures ranging from -15.0 degrees to +38.0 degrees. With the support of his employer, B.C. Ministry of Forests and Range, his monthly reports to Environment Canada have helped create a valuable record of climate at the Cowichan Lake Research Station that spans back 60 years.

Each year, Environment Canada presents certificates and awards to individuals and families who have reached milestones as climate observers. Climate observers across Canada are usually volunteers who record high and low temperatures twice daily as well as other weather characteristics such as the amount of snow or rain that has fallen. They are important contributors to a comprehensive climate record of more than 200 million observations dating as far back as 1840. The archive, maintained by Environment Canada, is available at www.weatheroffice.gc.ca.

The Morley K. Thomas Award was created and named after one of Canada's leading climatologists in 1982 when he retired from Environment Canada. Morley K. Thomas was the principal architect of the Canadian Climatological Program and Canada's foremost authority on both the practical and scientific aspects of climatology, publishing over 70 books and articles, including the Climatological Atlas of Canada, the Bibliography of Canadian Climate and, with F.K Hare, Climate Canada.

Environnement Canada rend hommage à un observateur météorologique local pour l'excellence de son service pendant 25 ans

COWICHAN LAKE, C. -B. -- le 18 mars 2010 -- Le ministre de l'Environnement du Canada, l'honorable Jim Prentice, a décerné le prix Morley K. Thomas à M. Ian Cairns en reconnaissance de son excellent travail d'observation climatique effectué à la Station de recherche du lac Cowichan, du ministère des Forêts et du Territoire de la Colombie-Britannique. M. Pat Wong, du bureau régional d'Environnement Canada, a remis cette semaine ce prix à M. Cairns.

"*Nous sommes tributaires du dévouement de personnes comme M. Ian Cairns pour établir une histoire exhaustive sur le climat du Canada. Nous remercions sincèrement M. Cairns, et le ministère des Forêts et du Territoire de la Colombie-Britannique qui poursuivent une importante tradition*", a déclaré M. Prentice.

Tous les matins et tous les soirs depuis 1981, M. Cairns recueille des données sur le climat et consigne des températures variant de -15 °C à +38 °C. Avec l'appui de son employeur, le ministère des Forêts et du Territoire de la Colombie-Britannique, il transmet des rapports mensuels à Environnement Canada, et ses rapports ont servi à constituer des archives considérables sur le climat à la Station de recherche du lac Cowichan, qui couvrent une période de plus de 60 ans.

Chaque année, Environnement Canada présente des certificats et des prix aux personnes et aux familles qui se sont distinguées dans le domaine de l'observation climatique. Des observateurs de partout au Canada sont généralement des bénévoles qui consignent les températures minimales et maximales deux fois par jour, ainsi que d'autres données météorologiques, comme les accumulations de neige ou de pluie. Ils contribuent considérablement au maintien d'archives exhaustives sur le climat comportant plus de 200 millions d'observations enregistrées depuis 1840. On peut consulter ces archives, gérées par Environnement Canada, à l'adresse http://www.meteo.gc.ca/.

Le prix Morley K. Thomas a été créé et nommé en l'honneur de l'un des plus renommés climatologues au Canada en 1982, lorsqu'il a pris sa retraite d'Environnement Canada. M. Morley K. Thomas a été le principal concepteur du programme climatologique canadien et l'une des sommités les plus respectées sur les aspects pratiques et scientifiques de la climatologie. Il est l'auteur de plus de 70 livres et articles, dont *Climatological Atlas of Canada*, *Bibliography of Canadian Climate* et, en collaboration avec M. F.K Hare, *Climate Canada*.

Hazards and Disasters

Photo of the signing ceremony in China. Note Dr. Gordon McBean, Chair of the Scientific Committee, in the back row, third from left.

A Letter of Cooperation to establish the International Programme Office of the Integrated Research on Disaster Risk (IRDR) program has been signed by the program's sponsors and Chinese counterparts. The IRDR co-sponsors — the International Council for Science (ICSU, the parent of SCOR), the International Social Science Council (ISSC) and the United Nations International Strategy for Disaster Reduction (UN ISDR) — signed the agreement in Beijing in February. The China Association for Science and Technology (CAST) will provide annual financial support to the office for 10 years. The office will be located in the new headquarters of the Center for Earth Observation and Digital Earth (CEODE) of the Chinese Academy of Sciences (CAS), situated on the edge of Beijing.

On March 25, 2010, Dr. Jane Rovins (USA) has been appointed as Executive Director of the new IRDR programme. The programme's co-sponsors — ICSU, the International Social Science Council (ISSC) and the United Nations International Strategy for Disaster Reduction (UN-ISDR) — made the appointment following an extensive international search.

Dr. Rovins is currently Associate Professor at the American Military University, where she gives graduate and undergraduate courses on risk analysis, mitigation and disaster management. She is also a Senior Planner with a private-sector company providing hazards mitigation and emergency management training. She has worked for the Federal Emergency Management Agency (FEMA) on mitigation and responses to events such as Hurricanes Katrina and Ivan. She has lived and worked in West Africa, Latin America and the Asia-Pacific region, and developed a workplan for the ASEAN Regional Forum on disaster preparedness and relief adopted in July 2009. She holds a PhD in International Development and Disaster Management from the Tulane University Law School, New Orleans.

Dr. Rovins will take up her post at the end of May. One of her first tasks will be to establish the International Programme Office for IRDR, which will be located in Beijing at the Center for Earth Observation and Digital Earth (CEODE) of the Chinese Academy of Sciences.

A priority activity of the Scientific Committee for IRDR has been establishing working groups for the planning and implementation of the programme's first three years. A workshop organised by one of the working groups was held in Toronto, Canada, in February to develop a template for the case study approach to past disaster events that is being adopted by IRDR. The findings from the group will be on the agenda of the third meeting of the Scientific Committee scheduled for 14–16 April in Paris.

New Fellow of the AGU

Robie Macdonald

The Chair of CNC-SCOR, Robie Macdonald, FRSC, has this year been elected a Fellow of the American Geophysical Union. During his 35-year career with the Department of Fisheries and Oceans, he has worked on pathways for freshwater, organic carbon and contaminants in the ocean. This work, conducted predominantly in coastal British Columbia, the Arctic, and Hudson Bay has been published in over 200 articles, a number of which are, of course, in the AGU journals. In 2004, together with Rudy Stein, he co-edited a foundation book on the organic carbon cycle in the Arctic Ocean. This work assembled an international team to synthesize this topic with the objective of producing an Arctic-wide budget for sediments and organic carbon. This budget has proved enormously useful as a starting place for constructing budgets for other substances like mercury, manganese, iron and persistent organic pollutants, and as a model for producing budgets in other regions. A large focus of Robie's work during the past decade has been to bring together the climate change and contaminants communities working in the Arctic. To initiate this process, he wrote a paper in 2005 together with Tom Harner and John Fyfe that set out the reasons why climate variability matters to contaminant pathways. This paper has instigated numerous programs, some under IPY, which are now bearing fruit and producing results that verify many of the connections proposed in the

review. His background as an ocean scientist has led him to focus not on the toxicology of contaminants, but rather on the ways in which contaminants provide elegant aquatic pathway tracers.

Robie, recognized as a strong interdisciplinary scientist, has conducted his work in collaboration with top scientists in fields spanning physical oceanography to geochemistry to paleo-limnology. He is a fellow of the Chemical Institute of Canada, the Royal Society of Canada, a Fellow International of the Explorer's Club, and has been awarded several top prizes including the Canadian Meteorological and Oceanographic Society President's Prize (2000), the Head of the Public Service Award for Excellence in Policy (2002; co-recipient), and the RSC's Miroslaw Romanowski Medal (2005).

New DFO Assistant Deputy Minister

Siddika Mithani

Dr. Siddika Mithani has been appointed the Assistant Deputy Minister, Oceans and Sciences, for Fisheries and Oceans Canada. Dr. Mithani previously held the position of Associate ADM, Health Products and Food Branch at Health Canada. She brings to DFO her experience in leadership and managing science, policy and regulatory initiatives at the national and international levels. She brings knowledge and expertise in the areas of safety, efficacy, quality and risk management principles in the health and industry sectors as well as risk management in complex regulatory science programs.

Dr. Mithani is a recipient of the Queen's Medal for her work in the area of developing and implementing regulations for clinical drug trials in Canada, and has been extensively involved in difficult food and nutrition files. She holds a Bachelor of Science degree in Pharmacy and a Ph.D. in Psychopharmacology from the University of Aston in Birmingham, England.

Nouvelle Sous-ministre adjointe au MPO

Siddika Mithani

La Dre Siddika Mithani a été nommée au poste de sous-ministre adjointe, Océans et Sciences à Pêches et Océans Canada. La Dre Mithani a occupé le poste de SMA associée, Direction générale des Produits de santé et des Aliments à Santé Canada. Elle apporte au MPO son expérience en leadership et gestion dans le cadre des sciences, des projets en matière de politiques et de règlements, tant au niveau national qu'international. Elle apporte comme bagage des connaissances et expertises dans le domaine des principes de gestion de la sécurité, de l'efficacité, de la qualité et des risques dans les secteurs de la santé et de l'industrie, ainsi que dans la gestion des risques des programmes réglementaires des sciences.

La Dre Mithani a obtenu la Médaille de la Reine pour ses travaux sur l'établissement et la mise en place de règlements pour les essais de médicaments au Canada et elle a participé à plusieurs dossiers difficiles d'alimentation et de nutrition. Elle détient un diplôme de bachelier ès sciences en pharmacie et un doctorat en psychopharmacologie, obtenu à l'université d'Aston (Birmingham, Royaume-Uni).

2010 Canadian Hydrographic Conference

June 21-23, 2010
Québec City, Québec, Canada

The 2010 Canadian Hydrographic Conference will be held in Québec City, June 21-23, 2010. Under the theme, *Hydrography : A science, technology and people dedicated to the maritime world*, the conference will be an opportunity for the international hydrographic community to meet and share knowledge and experiences during the various workshops, sessions and demonstrations that are planned.

Scheduled to coincide with World Hydrography Day, the opening of the CHC2010 will serve to raise public awareness about the different facets of hydrography. The organising committee has put together a program of complementary activities that are sure to make your stay in Québec City – designated a World Heritage Site by UNESCO - most enjoyable. You could also join in as Québecers celebrate Québec's National Holiday, on June 24.

Le Prix Alcide-Ouellet 2009 remis à Christian Pagé

Le Centre de Montréal de la SCMO est heureux d'annoncer que le Prix Alcide-Ouellet 2009 a été décerné à CHRISTIAN PAGÉ, PhD. Le Prix Alcide-Ouellet a été créé en 1991 par l'Association professionnelle des météorologistes du Québec (APMQ), aujourd'hui dissoute. Le Centre de

Montréal a pris la relève en 2008 de l'APMQ. Pour son édition 2009, le comité de candidature a sélectionné CHRISTIAN PAGÉ pour sa remarquable implication dans la diffusion conviviale de l'information météorologique.

Christian Pagé a mis au point et maintient toujours les sites web suivants :

■ http://meteocentre.com/ donne accès sur une seule page à toutes les informations météorologiques disponibles : observations (surface, altitude, radar, satellite, foudre), analyses, sorties de modèles et prévisions pour le Québec;

■ http://meteoalerte.com/ permet aux observateurs bénévoles d'entrer des observations météorologiques en temps réel;

■ http://meteocentre.com/forums/ donne accès à un forum de discussions sur la météorologie;

■ les sites http://meteocentre.com/toulouse/ et http://meteocentre.com/reading/ sont des clones de météocentre pour la France et le Royaume-Uni respectivement.

Christian est diplômé du baccalauréat en physique (1992), de la maîtrise en sciences de l'atmosphère (1994) et du doctorat en sciences de l'environnement (2006) de l'UQAM. Il a travaillé de nombreuses années (1992-2006) à l'UQAM dans l'équipe de recherche de Peter Zwack ainsi qu'à l'université McGill avec Isztar Zawadzki. Avec le soutien du groupe des sciences de l'atmosphère et du centre ESCER de l'UQAM, il a mis en route et développe, encore actuellement, un site web et un forum de discussion sur la météorologie afin d'offrir un espace de discussions entre les météorologues et le grand public, de même qu'une interface permettant au grand public de partager en temps réel des observations météorologiques. Après un stage post-doctoral à Météo-France à Toulouse (2006-2008), portant sur le développement d'un prototype permettant l'envoi en temps réel de données météorologiques à bord des avions, il occupe actuellement un poste de chercheur au Centre Européen de Recherche et Formation Avancées en Calcul Scientifique (CERFACS) à Toulouse sur l'élaboration de scénarios climatiques régionalisés.

Depuis 1991, date de sa création, jusqu'à 2004, le Prix Alcide Ouellet a été décerné annuellement par l'APMQ. Le Prix est nommé en l'honneur du pionnier bien connu de la météorologie au Québec, l'inoubliable chroniqueur météo à l'émission CBF - Bonjour de Radio-Canada, décédé en 1989. Le prix Alcide-Ouellet vise à souligner la contribution d'une personne ou d'une institution au rayonnement de la profession en météorologie au Québec.

Conference on Advances in the Atmospheric and Oceanic Sciences

A celebration of the 50th Anniversary of McGill's Department of Atmospheric and Oceanic Sciences

This notice is for the attention of alumnae, associates and current students of the McGill University Department of Atmospheric and Oceanic Sciences (formerly Meteorology). The Department will be holding a one-day conference and dinner on Friday, September 24, 2010 to celebrate the Department's 50th anniversary. The conference will consist of invited presentations by former faculty, students and associates. To round out the celebration there will be an excursion to some Eastern Townships wineries and an apple cider producer on the following day, Saturday, September 25. Please visit our web site mcgill50@meteo.mcgill.ca for more details and registration information.

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