

# Elements



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## THE NEWSLETTER OF THE CANADIAN GEOPHYSICAL UNION

### IN THIS ISSUE

President's Column_____	1	Hydrology Section News_____	17
Call for Nominations: J. Tuzo Wilson		Solid Earth Section News_____	29
Medal, Young Scientist & Meritorious		Western CGU-HS Student Conference_____	29
Service Awards_____	2-3	CGU 2010 Best Student Paper Award Winners_____	30
CMOS/CGU Joint Congress Report_____	4	Ad for Assistant Professor position_____	31
J. Tuzo Wilson Medal 2010 _____	4	CGU Financial Statement_____	32
Young Scientist Award 2010_____	7	Photos from the CMOS/CGU Joint Congress_____	33
Meritorious Service Award 2010_____	8	Officers of the CGU Executive_____	35
Climate Change Letter_____	10	CGU 2011 Announcement_____	36
NRC Questionnaire_____	12		

## LE BULLETIN DE L'UNION GÉOPHYSIQUE CANADIENNE

### President's Column

Colleagues and friends,

A little over a month ago we had a very successful annual meeting jointly with CMOS in Ottawa. This joint congress attracted nearly 800 abstracts and more than 1000 delegates; by far the largest joint congress ever! Highlights of the congress include, among others, the daily plenary sessions, the public lecture, the service, the exemplary work of all volunteers and of course our annual Awards Banquet. It has been an exceptional and rewarding experience working with our CMOS colleagues to organise a successful conference despite two competing elements: the large size of the conference and the limited space available. Rod Blais, Kathy Young, and Sean Carey did an outstanding job in representing CGU in the Scientific Program Committee and the Local Arrangements Committee.

I would like to warmly congratulate all our award winners, whose hard and exemplary work makes us all proud, while at the same challenges us to raise the bar higher and take the podium next year. We take pride of our Tuzo Wilson Medalist Nigel Edwards, the Young Scientist awardee Sean Carey and the CGU Meritorious Service Award recipient Zoli Hajnal for their outstanding achievements and service, and of our many students, the future of our Union, who showed excellence in their

research and captured the numerous student paper awards and scholarships. Administering the CGU awards program is an immense task that was led successfully, as usual, by Hugh Geiger with contributions from the various committees and judges.

There is usually no time to relax between the annual conferences as we're looking forward to next year's Banff meeting to be held jointly with the Canadian Society of Agricultural and Forest Meteorology (CFAM). It seems that we have more joint meetings to come in 2012 (with CWRA) and 2013 (with CMOS), with a possibility of yet another joint meeting in 2014. We can only think of capitalizing on such commonalities between CGU and many other societies to build a bigger and stronger CSGS, the Canadian Societies for the Geophysical Sciences. Over the summer, the three member societies, namely CMOS, CGU and CSSS will work together to identify and ultimately invite potential new members to join CSGS, with an anticipated positive impact on the mission, governance and activities of the CSGS. But let's not forget that the CGU must grow stronger and better with more members joining our Union. This must be everyone's duty; we need to speak to our colleagues, friends and students to become active members of the CGU.

Have a great summer!  
Spiros Pagiatakis

## J. Tuzo Wilson Medal – Call for Nominations

The Executive of the CGU solicits nominations for the J. Tuzo Wilson Medal – 2011. The Union makes this award annually to recognize outstanding contributions to Canadian geophysics. Factors taken into account in the selection process include excellence in scientific and/or technological research, instrument development, industrial applications and/or teaching.

If you would like to nominate a candidate, please contact Dr. Hugh Geiger, Chair of the CGU Awards Committee, Talisman Energy, Calgary AB (Email: HGEIGER@talisman-energy.com). At a minimum, the nomination should be supported by letters of recommendation from colleagues, a brief biographical sketch and a Curriculum Vitae. Nominations should be submitted by February 28, 2011. Additional details concerning the nomination process can be obtained from the Chair of the CGU Awards Committee.

L'exécutif de l'UGC vous invite à suggérer des candidats pour la médaille J. Tuzo Wilson – 2011. L'Union décerne la médaille chaque année "en reconnaissance d'une contribution remarquable à la géophysique canadienne". En choisissant parmi les candidats, on considère les accomplissements en recherches scientifique ou technologiques, aux développements d'instruments, aux applications industrielles et/ou à l'enseignement.

Si vous désirez suggérer un candidat pour cette médaille, s.v.p. contacter Dr. Hugh Geiger, Président du Comité des Prix d'Excellence, Talisman Energy (Email: HGEIGER@talisman-energy.com). Les nominations doivent être supportées de lettres de recommandation de collègues, d'un bref sommaire biographique et d'un Curriculum Vitae. Les nominations doivent être soumises avant le 28 février, 2011. Des détails additionnels concernant le processus de nomination peuvent être obtenus en communiquant avec le Président du Comité des Prix d'Excellence de l'UGC.

### *Past Wilson Medallists*

1978	J. Tuzo Wilson
1979	Roy O. Lindseth
1980	Larry W. Morley
1981	George D. Garland
1982	Jack A. Jacobs
1983	D. Ian Gough
1984	Ted Irving
1985	Harold O. Seigel
1986	Michael Rochester
1987	David Strangway
1988	Ernie Kanasewich
1989	Leonard S. Collett
1990	Gordon F. West
1991	Thomas Krogh
1992	R. Don Russell
1993	Alan E. Beck
1994	Michael J. Berry
1995	Charlotte Keen
1996	Petr Vaníček
1997	Chris Beaumont
1998	Ron M. Clowes
1999	David Dunlop
2000	Don Gray
2001	Roy Hyndman
2002	Doug Smylie
2003	Garry K.C. Clarke
2004	W.R. (Dick) Peltier
2005	Ted Evans
2006	Alan Jones
2007	Herb Dragert
2008	Ming-ko (Hok) Woo
2009	Garth van der Kamp
2010	Nigel Edwards

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## CGU Young Scientist Award – Call for Nominations

The Executive of the CGU solicits nominations for the CGU Young Scientist Award – 2011. The CGU Young Scientist Awards recognize outstanding research contributions by young scientists who are members of the CGU. Both the quality and impact of research are considered. To be eligible for the award, the recipient must be within 10 years of obtaining their first Ph.D. or equivalent degree. The awards are made by the CGU Executive on the recommendations of a special committee struck for this purpose. The selection

committee seeks formal written nominations from the membership, plus letters of support and a current curriculum vitae. Nominations for the CGU Young Scientist Awards may be submitted by CGU members at any time.

If you would like to nominate a candidate, please contact Dr. Hugh Geiger, Chair of the CGU Awards Committee, Talisman Energy, Calgary AB (Email: HGEIGER@talisman-energy.com). The nomination should be supported by three letters of recommendation

from colleagues. Nominations should be submitted by February 28, 2011. Additional details concerning the nomination process can be obtained from the Chair of the CGU Awards Committee.

L'exécutif de l'UGC vous invite à suggérer des candidats pour le prix pour Jeune Scientifique de l'UGC – 2011. Les Prix pour Jeunes Scientifiques de l'UGC reconnaissent les contributions exceptionnelles de jeunes scientifiques qui sont membres de l'UGC. La qualité et l'impact de la recherche sont considérés. Pour être éligible pour le prix, le scientifique doit avoir obtenu son premier Ph.D. ou degré équivalent au cours des dix dernières années. Les prix sont accordés par l'Exécutif de l'UGC sur recommandations d'un comité spécial à cette fin. Le comité de sélection sollicite des nominations formelles par écrit des membres de l'UGC, accompagnées de lettres d'appui et d'un curriculum vitae à jour. Des nominations pour les Prix pour Jeunes Scientifiques de l'UGC peuvent être soumis en tout temps par les membres de l'UGC.

Si vous désirez suggérer un candidat pour cette médaille, s.v.p. contacter Dr. Hugh Geiger, Président du Comité des Prix d'Excellence, Talisman Energy, Calgary AB (Email: HGEIGER@talisman-energy.com). Les nominations doivent être supportées de trois lettres de recommandation de collègues. Les nominations doivent être soumises avant le 28 février, 2011. Des détails additionnels concernant le processus de nomination peuvent être obtenus en communiquant avec le Président du Comité des Prix d'Excellence de l'UGC.

#### *Past Winners*

2005	Shawn J. Marshall, J. Michael Waddington
2006	No winner
2007	No winner
2008	Brian Branfireun, Scott Lamoureux
2009	Gwenn Flowers, Stephane Mazzotti
2010	Sean Carey

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### **CGU Meritorious Service Award – Call for Nominations**

The Executive of the CGU solicits nominations for the CGU Meritorious Service Award – 2011. The CGU Meritorious Service Award recognizes extraordinary and unselfish contributions to the operation and management of the Canadian Geophysical Union by a member of the CGU. All members of the CGU are eligible for this award, although the award is not normally given to someone who has received another major award (e.g. the J. Tuzo Wilson Medal). Nominations for the CGU Meritorious Service Award may be submitted by CGU members at any time. The award is made by the CGU Executive based on recommendations from the CGU Awards Committee, and is based on lifetime contributions to CGU activities.

If you would like to nominate a candidate, please contact Dr. Hugh Geiger, Chair of the CGU Awards Committee, Talisman Energy, Calgary AB (Email: HGEIGER@talisman-energy.com). The nomination should be supported by three letters of recommendation from colleagues. Nominations should be submitted by February 28, 2011. Additional details concerning the nomination process can be obtained from the Chair of the CGU Awards Committee.

L'exécutif de l'UGC vous invite à suggérer des candidats pour le Prix pour Service Méritoire de l'UGC – 2011. Le Prix pour Service Méritoire de l'UGC reconnaît les contributions extraordinaires et désintéressées à l'opération et à l'administration de l'Union Géophysique Canadienne par un membre de l'UGC. Tous les membres de l'UGC sont éligibles pour ce prix, sauf que

normalement, ce prix n'est pas donné à quelqu'un qui a reçu un autre prix important tel que la Médaille Tuzo Wilson. Des nominations pour le Prix pour Service Méritoire de l'UGC peuvent être soumises en tout temps par les membres de l'UGC. Le Prix est accordé par l'Exécutif de l'UGC sur recommandations du Comité des Prix de l'UGC, pour l'ensemble des contributions d'un membre aux activités de l'UGC.

Si vous désirez suggérer un candidat pour cette médaille, s.v.p. contacter Dr. Hugh Geiger, Président du Comité des Prix d'Excellence, Talisman Energy, Calgary AB (Email: HGEIGER@talisman-energy.com). Les nominations doivent être supportées de trois lettres de recommandation de collègues. Les nominations doivent être soumises avant le 28 février, 2011. Des détails additionnels concernant le processus de nomination peuvent être obtenus en communiquant avec le Président du Comité des Prix d'Excellence de l'UGC.

#### *Past Winners*

2004	Ron Kurtz
2005	Ted Glenn
2006	J.A. Rod Blais
2007	Ed Krebs
2008	Patrick Wu
2009	Garry Jarvis
2010	Zoli Hajnal

## CMOS-CGU Congress in Ottawa on May 31 – June 4, 2010

Rod Blais

Under the theme “**Our Earth, Our Air, Our Water: Our Future**”, the CMOS-CGU Congress attracted over 990 registered participants from our multidisciplinary communities. Plenary presentations by Canadian and international experts highlighted our scientific priorities:

- **M. Sideris:** Global Geodetic Observing System and Satellite Gravimetry Contributions to Earth Monitoring.
- **S. Solomon:** A World of Change: Climate Yesterday, Today and Tomorrow.
- **H. Freeland:** ARGO: A Decade of Success, What Have We Learned and What Comes Next?
- **J. Adams:** From Seismological Science to Saving Lives – One Path from Science to Societal Relevance.
- **M. Douglas:** Our Earth, Our Future Arctic: Paleolimnological Perspectives Onwards.
- **R. Feeley:** Ocean Acidification: The Other CO<sub>2</sub> Problem.
- **M. Beland:** Environmental Prediction, Seamless and Earth System Modeling: An Outlook.
- **L. H. Smith:** Hydrologic Impacts of a Shrinking Cryosphere.

A public lecture entitled Our Melting Poles: Where Life on Earth is Changing by **Professor W.F. Vincent** was also most popular and informative. The scientific program was organized into 10 overarching theme categories, 64 dedicated sessions, many of which were multi-part,

resulting in 119 sessions for 650 oral presentations and 150 poster presentations. In addition to a number of Interdisciplinary and Joint Sessions, Hydrology had six sessions. Geodesy had three sessions, Biogeoscience had three sessions and Solid Earth had eight sessions. With fourteen sessions running in parallel throughout the duration of the Congress, participants often had a difficult choice between competing technical sessions and discussions.

The CGU members of SPC included Spiros Pagiatakis, Gail Atkinson, Joe Henton (Geodesy), Sean Carey (Hydrology), Sam Butler (Solid Earth) and Altaf Arain (Biogeoscience). The CMOS members of SPC included Dick Stoddart (Co-Chair), Ian Rutherford and many others. Thanks to everyone's contributions, the technical program was most comprehensive and widely successful.

Next year, we go back to the Banff Park Lodge on May 15-18, 2011, jointly with the Canadian Society of Agricultural and Forest Meteorology (CSAFM). The theme of the 2011 Meeting is ‘**Geophysical Sciences for the Future**’. Comments and suggestions for the Scientific Program are always welcome. More information is available at [www.ucalgary.ca/~cguconf](http://www.ucalgary.ca/~cguconf) with the official Call for Workshop and Session Proposals coming in September, and the Call for Papers in November 2010.

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## The 2010 CGU J. Tuzo Wilson Medallist: Nigel Edwards

*Citation, by Gordon F. West*

Nigel Edwards is a Canadian university geophysicist who has made many fundamental and pioneering contributions to applied geophysics over several decades. Especially, he has shown how best to use electromagnetic methods to explore for petroleum, gas hydrates and other important features of the submarine environment – an environment where, initially, the usefulness of electrical and EM methods was completely dismissed. EM techniques such as he has espoused have now become very well recognized internationally, both in academia and industry. In 2005, he was awarded the Hohmann Award for Excellence in Applied Electrical Geophysics in recognition of this. Industry confidence in his work is demonstrated by the fact that EM methods are now being routinely applied in several petroleum marine exploration programs in various parts of the world, and by the very

substantial support he has received from the Game Changer program of Shell International Exploration and Production Inc.

Nigel's research contributions have taken many forms: invention of novel methodology; creating the theoretical foundations for these and other methods; building prototype equipment to demonstrate the feasibility of techniques; carrying out trial field surveys in difficult circumstances; and interpreting the results in geologically meaningful terms. Particularly notable is his demonstration that time-domain electrical surveys carried out on the ocean floor can exploit the high conductivity of sea water to force the EM field into less conductive strata beneath the sea floor in a way that successively "sounds" the subsurface structure. But there are many others, such

as his early work on the magnetometric induced polarization (MIP) method with Harry Seigel, development of the magnetometric resistivity method (MMR), and his recent focus on gas hydrates.

But there is more to Nigel's career than just research results. He has brilliantly mentored about 15 PhD and 17 MSc students and a dozen post doctoral fellows towards successful careers in academic and industry geophysics in many parts of the world. Furthermore, he himself has been able to work very effectively on the international scene, executing several successful collaborations with established scientists in a great variety of countries (Germany, USA, Chile, Australia, etc ).

In my view, Nigel also demonstrates just how much personality matters in University education. His was formed in the British university tradition where initiative is valued and coddling is frowned upon; thus, Nigel is "his own man" and does not automatically "go with the crowd". It's no surprise, then, to hear that he challenges his students to act on their own and to think for themselves, and that he manages to stimulate their curiosity and pass to them his passion for innovation. In

my view, every group needs a prof like Nigel (one is perhaps enough!). But, he is also a generous and concerned mentor and host, very willing to put himself on the line for the welfare of others.

Finally, in his role as the current holder of the J.T. Wilson professorship at University of Toronto, Nigel has been very effective in showing students and the public how essential it will be for Canada and other countries to bring rational scientific thinking to bear if they are going to deal successfully with the questions of global impact such as climate change, resource depletion, environmental degradation, etc. He has done this not by personal exhortation, but by using his extensive network of international contacts to persuade notable experts from abroad to come and speak at the University of Toronto on such topics.

In these ways, it is clear that Nigel Edwards has demonstrated the scientific ability, the perseverance and will, the range of interest, and the energy and flair necessary to merit an award that commemorates J. Tuzo Wilson's multi-faceted and internationally recognized scientific career.

#### *Acceptance, by Nigel Edwards*

Mr. President, Professor West, Fellow Geophysicists, Ladies and Gentlemen.

May I first genuinely and sincerely thank the CGU for this Wilson Medal. I am very proud to receive it. It is an award given by Canadians to a Canadian for work done in Canada!

It was also a very well kept secret. I had no idea that I was being considered for the award. My wife Patricia, who seems to have been in on the plot said absolutely nothing. But she was able to confirm that the email from Spiros, received while we were Australia, was indeed genuine. The CGU had checked with her that I would be back in Canada by today.

Thank you Gordon for your very kind words and thanks also to my other close colleague of 40 years, my current chair, Dick Bailey, for your efforts on my behalf. You have supported my science unselfishly it seems for ever. May I share part of this Medal with both of you.

The Medal must also be shared with my graduate students and research fellows. There are many and I am very proud of you all. You are all part of my extended family of which Patricia is the matriarch! In particular, Katrin Schwalenberg, Ele Willoughby, Reza Mir and Marion Jegen have worked with me for many years. There is also Graeme Cairns who was kind enough to save my life

two years ago through an astonishing and generous gift. May I publicly thank him now.

I am told the Wilson Medalist must spend some time explaining his or her career. My style of research is very much with students so that I have not interacted greatly with others. Indeed, my main field of Marine Electromagnetics was sufficiently small ten years ago that it was difficult to find anyone to interact with. Anyway, here is part of the story viewed not as a history but as the first derivative thereof. It is usually the circumstances which result in bends in a career that are the most interesting!

English is my second language and physics is my second subject. I spoke Welsh until the age of 4 and failed Greek at Monmouth School, a local disaster as my career path had been towards the Civil Service. No doubt I would have been the double of Sir Humphrey Appleby in 'Yes Minister'! What a depressing thought.

I studied Physics and Mathematics at Imperial College and graduated in a year where there were far more jobs than physicists to fill them. I rejected joining Hawker aircraft – they wanted a young physicist to work on a design team of 5 for the jump jet. I had a good degree and was flying with the RAF. Maybe that was a mistake? Anyway, I decided to look around for a PhD supervisor – subject to be decided.

Every now and again you meet a person who is utterly charismatic. Sir Edward Bullard – one of the most distinguished geophysicists of his time – certainly fell into that category. His comment to me at a recruitment interview was, "It is better to be a Big Fish in a small pond than a Big Fish in an ocean". Teddy was greatly revered by his students and many of us when faced with a difficult situation still ask, "What would Teddy have done". He was also a great believer in new instruments to further geophysics.

I signed up with him with no research plan. I was totally lost for a year. Should I do Dynamo theory, Heat Flow, Gravity or EM induction? Bullard was both a theorist and an excellent experimentalist. I actually fell into my thesis topic because of Lawrie Law, a Canadian on leave from the Earth Physics Branch. Bullard suggested we work together to measure geomagnetic variations all over the British Isles. We installed three component magnetometers with some data collected digitally on large rolls of punched paper tape. The paper tape had to be changed every three days which meant a trip from Cambridge to almost Edinburgh once a week each.

It was immense fun. We crashed the departmental mini van on more than one occasion. We became experts on sewage works, the ideal locations for quiet man-made magnetic fields and absence of the general public. The results of the work were published by the Royal Society in 1971 describing the influence of transient induced natural electric currents in sea water on the geomagnetic field.

Near the end of my stay in Cambridge, Tuzo Wilson appeared. Tuzo and Teddy Bullard were close friends – I think Bullard was influential in getting Tuzo into the physics department at Toronto while he was chairman there in the late 1940s. He gave a brilliant lecture and after a very short chat he unexpectedly offered me an Assistant Professorship at Toronto literally on the spot. I was very excited to say the least. Two weeks later a letter from George Garland arrived pointing out that appointments at the University were not made that way and indeed no such position actually existed. However, he had a PDF for me and I was welcome to come to Toronto and work with him which I did.

I continued my geomagnetic studies in Quebec and again had a wonderful time. I spoke French – badly – but with a cultured Parisian accent. I managed to be understood by most from deputy ministers in the Quebec government to fishermen on the North Shore. Again a great time was had by all!

A faculty appointment eventually appeared in a most peculiar way. Following a search and a series of interviews, all likely candidates turned down a job in Exploration Geophysics. They were interviewed in the

worst of February winter conditions and the wives of some residents in the southern US were not at all impressed. I received an extraordinary phone call from the chair of the appointments committee offering me the job, then asking if I knew anything about exploration geophysics and did I have a CV. To be honest, I didn't and I didn't.

I survived the first year of teaching. By calling Gordon, often in the middle of the night, I managed to keep ahead of the class, just.

I published a number of papers on the exploration methods MMR and MIP over a period of almost 10 years but despite strong encouragement from Harry Siegel and Misac Nabighian and a stimulating sabbatical in Australia with Keeva Vozoff, the method never caught on. I seriously considered giving up my academic career, threatening to resign most Wednesdays.

The turning point in my fortunes was again the result of an interaction with Lawrie Law. I was on leave at the Pacific Geoscience Centre in Victoria. Bullard had died and the AGU decided to ask his former students to contribute a paper to a special volume. Lawrie and I had nothing new to contribute and little in progress. But we knew Teddy had always wanted to build electromagnetic instruments to look at the conductivity of the ocean floor. On the spot we conjured up a method called MOSES modified MMR – a cunning low frequency system to probe the electrical section under the sea using a vertical current dipole and a magnetic receiver. We submitted the theory for publication in the special issue. We received the most antagonistic reviews ever – theory without data, no experience in marine science, and they went on and on. But the paper was published, the associate editor was a Canadian, and I thought that was the end of it. To some extent I was satisfied. We had beaten a very conservative, uninspired system. But the story had a different ending. Up stepped Roy Hyndman (Roy seems to have been a major influence on my actions for almost four decades) who pointed out the method might actually work and we could also use ship time at night – no towing seismic air guns and therefore sleep for everyone. With some reluctance, I applied to NSERC for money and received a huge equipment grant and a tripled research grant – quite bizarre. I also received the strong support of the Geological Survey which has continued to this day. The method worked and is still in use worldwide. I had become a marine geophysicist!

A second sabbatical at Scripps produced another breakthrough. Working with Alan Chave and Steve Constable, and in Toronto with Steve Cheesman, I set about understanding marine frequency and time domain EM methods which differ fundamentally from their land based counterparts. The neat physics is the ability of the methods to detect resistive zones such as petroleum and

natural gas. The joint publications that resulted proved to be seminal and were the start of a major effort by Universities (Scripps, Cambridge and Toronto and later Southampton) in studying the electrical character of the seafloor.

Somewhat to my astonishment, the work has led directly to a multi-hundred million dollar industry. Major service companies like EMGS and OHM were set up to carry out surveys using many of our ideas to search for gas and petroleum. I achieved some fame but alas no fortune.

My current research is building towed EM systems to search for gas hydrates, methane and water clathrates that reside beneath the seafloor under conditions of low temperature and 500+ meters pressure of sea water. The systems have been used for several successful surveys off the west coast of BC, New Zealand and Chile. Gas hydrates can be identified on seismic sections by the BSR but EM seems to be the method of choice for their assessment. We also participate in Neptune Canada and have recently installed a system to monitor the formation

and evolution of hydrate zones over a long period of time, maybe many years. Hydrate is a resource of the future and it will be extracted from sandy layers in the sedimentary section using conventional methods in the very near future.

I have to mention the support I have received from the Shell Companies. Much of the equipment for our towed systems was funded by a large contract from Shell as Gordon mentioned. Coincidentally, Shell also funded my PhD through a major scholarship. I am sincerely grateful to the company. All my interactions with them have been extraordinarily positive.

I close by thanking the CGU again for the medal. It is a wonderful boost to my career – even after official retirement age. I hope the work I have done and am doing will justify its award and thereby enhance the reputation of the CGU throughout the world. Remember science is fun and look after your graduate students. Thank you all so very much.

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## **The 2010 CGU Young Scientist Award Winner: Sean Carey**

### *Citation, by Rich Petrone*

On behalf of my co-nominator (Dr. Brian Branfireun), it is my pleasure to read the nomination for Dr. Sean Carey (of Carleton University) for the 2010 Canadian Geophysical Union Young Scientist Award. It is especially enjoyable for me as Sean and I have been friends for about 25 years, and have somehow managed to end up not only working in the same field but also as colleagues. So, I would like to take a few minutes to tell you a bit about Sean and share with you some of the key points from our nomination and his letters of support.

In our opinion there is no doubt as to his merit. In this early stage of his career he has already established an international reputation as a leader in the field of cold region hydrology, particularly focusing on frozen soils and hillslope runoff processes, which draws linkages between mass and energy exchange processes in a range of northern ecosystem types, both natural and impacted. His work is not only making a profound impact on the discipline of cold regions hydrology, but is also informing decision-making about significant water quantity and quality issues in northern communities.

#### Background:

Sean was born and raised in Burlington, Ontario. I have a deep dark secret about Sean's past and it is time that it came out – Sean and I met when we were about 15 in a

local ASTROMY CLUB. Yes, if you had any doubt put it to rest – Sean is an egghead. He will try and hide it but Sean can name more than 3 constellations (from the Big Dipper to Testeclese). Enough of that ... there is more than enough material in Sean's past to embarrass him, and potentially have him indicted in several jurisdictions...

Sean left his telescope in his parent's yard to go on and complete his honours BSc at The University of Guelph in Soil Science. As a senior undergraduate Sean worked as a geomorphological field assistant for Dr. Bill Nickling in the deserts of Baja, California.

It was here that Sean first learned that soil is only interesting as it is a vehicle for water and ice, and that he also really didn't like to sweat (at least not while working); thus, his attraction to hydrology, and cold region hydrology in particular. It was with this interest and at the encouragement of his undergraduate mentors that Sean contacted Dr. Hok Woo at McMaster University about doing a masters project in northern hydrology.

Sean completed his MSc under Hok's supervision doing work in Resolute on heat and moisture flow in permafrost soils. Given the excellent company at McMaster Sean found that he just could not leave and continued to work with Hok towards his PhD. This time Sean did his

research in the mountains of the Yukon where the water runs cold, and beer colder. Sean brought “big city Ontario” to the Yukon (particularly the Capitol Hotel) to look at the influences of slope aspect on active layer development and runoff processes, and quantify just how far the patience of local bar patrons can be pushed.

After very literally leaving his mark on McMaster (recent visitors to Mac will notice how much has changed on campus in the past 10 years – more than just for reasons of growth...) Sean completed his PhD and immediately took up his first faculty position at the University of Saskatchewan at the age of 28. However, the person who is constantly reminding us that the “hillslope” is the “universal landform” could only last in Saskatchewan so long. So, in 2004 Sean moved to Carleton University where he is currently an Associate Professor in the Department of Geography & Environmental Studies.

In addition to his professional activities, Sean maintains a busy personal and family life with his spouse Krysha (whom Sean recruited as one of his first field assistants in his PhD work), and children Isla and Declan. The Carey family enjoys spending time together out doors, especially at the family cottage – you can never really take the hydrologist away from the water.

Sean has had a lifelong interest in the natural world in general, interests he is actively nurturing in his children. Sean mastered the technique of being a teenager interested in astronomy and living to tell about, and not living alone; so why not pass it on to the next generation.

In addition to his PhD in hydrology, and his interests in the natural world, Sean is a very well respected “rockologist”, who probably backs up his iTunes library more than his data archive. He is not merely a theorist though, when it comes to his “rockology” – Sean is an avid guitar player, and has played in at least one very successful band in his graduate student days, and is still playing today.

Over Sean’s early research career his research portfolio has already diversified to incorporate research on a variety of topics including an important research thrust on the hydrology and biogeochemistry of industrially-impacted boreal environments.

The importance of his work is evident in a high publication rate for a young scientist, including 38 publications in top-rate journals, with many more pending. His work is highly respected by his peers, with almost 350 citations of his work since the year 2000 and an h-index1 of 11, which shows that his work is not dominated by a few highly cited works, but has a deep and broad impact for a scientist at his stage of career in such a focused area of study.

#### Referee Quotes:

I’d like to wrap up with a few quotes from some of Sean’s letters of support for this nomination that demonstrate the far reaching impact and level of respect he has achieved in a relatively short period of time...

Dr. Doerthe Tetzlaff (University of Aberdeen): “Dr. Carey is one of the “top under-40 catchment hydrologists” working today.”

Dr. Hok Woo (McMaster): “Three words come to mind that feature Sean’s research: breadth, depth and agility.” And “Even when he was a student, I often enjoyed discussions with him as an intellectual equal”.

Dr. John Pomeroy (University of Saskatchewan): “What is particularly refreshing about Dr. Carey’s research is that he is one of the few “dangerously innovative” scientists in Canadian hydrology and that he matches his innovation with careful painstaking studies that have made some substantial advances to our knowledge of cold regions hydrological systems.”

Again, on behalf of my co-nominator (Dr. Brian Branfireun) it is my pleasure to present Dr. Sean Carey with the CGU’s Young Scientist Award for 2010.

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## **The 2010 CGU Meritorious Service Award Winner: Zoltan Hajnal**

### *Citation by Spiros Pagiatakis, CGU President*

It is a real pleasure and honour to nominate Dr. Zoltan Hajnal for the CGU Meritorious award 2010. In 2003 Zoli assumed the responsibility as Chair of the Canadian National Committee for the International Union of Geodesy and Geophysics – CNC/IUGG – initially for a term of four years, but he decided to continue for a second term until 2011.

The CNC/IUGG advises CGU and CMOS on matters related to IUGG. The National Research Council of Canada – NRC – on behalf of the Canadian scientific and engineering community, plays a key role in a number of international S&T networks of strategic importance to Canada. In particular, since 1931, the NRC has been



adhered to 30 international scientific organizations, most of which fall under the International Council of Scientific Unions (ICSU). IUGG is one of these 30 scientific organizations.

Of particular importance to us, the IUGG, comprises eight associations, each responsible for a specific range of topics or themes within the overall scope of its activities. The CNC/IUGG under the leadership of Zoli comprises eight senior and eight junior Canadian national representatives. The CNC/IUGG reports to both, the adhering body (NRC) and the IUGG.

Zoli has played a tremendous role as chair of the committee. Among the many tasks and objectives of the CNC/IUGG is the composition of the Annual Performance Review (APR) to NRC that provides a means for the NRC, ICSU Secretariat, and the Committee on International Science, Engineering and Technology – CISET – to assess the impact of Canada’s international affiliations. Frankly, what this means is that, based on a satisfactory APR, the NRC will continue to pay Canada’s annual dues to IUGG, which currently amount to \$16,750 USD! These dues maintain Canada’s highest level membership (level six) adherence to IUGG. This is a prestigious membership level appropriate for a highly developed country like Canada. Should the APR demonstrate a high level of importance within the Canadian context, and the NRC partners effectively generate multiple beneficial results and outcomes for Canadians with the most pronounced and positive impacts, then NRC will continue to support us.

The importance of Zoli’s work lies in the meticulous collection of information from the eight senior national representatives and other sources for the composition of the APR according to the NRC questionnaire. This task is very challenging and demanding because:

- a) The Canadian national representatives are spread throughout the country
- b) The Canadian national representatives must prepare their input to the Chair of the CNC/IUGG in a timely manner to allow ample time for the preparation of the final APR. The timely collection of information from all institutions in Canada is challenging and time

consuming, often resulting to late or incomplete responses.

- c) The Chair of the CNC/IUGG must always keep abreast of all activities by persistently seeking input from the national reps.
- d) The Chair must collect all information and distil it down to most important and relevant to the NRC’s questionnaire. This requires a global and high level knowledge of all scientific fields represented by IUGG. Very often, the chair needs to request additional information from the national reps and eventually compose the final APR by a specific deadline. Using precise language and underlining what is most important for the purpose of the APR is a very onerous and demanding task. Zoli has been successful in submitting comprehensive and clear reports to NRC that have obtained very high ratings and thus, we enjoy the continued support of NRC. A quick observation of the latest successful APR is a clear and undisputable proof of the tremendous effort it takes to compose it.

Beyond the APR, Zoli has consistently, tirelessly and unselfishly worked to respond to all the other committee tasks by being the strong voice, the representative and the promoter of the Canadian capabilities and competences to the international community. He has been the advocate of our participation to the international assemblies of IUGG and a champion in communicating to us the views and positions of IUGG and its activities.

Lastly, Zoli has been constantly thinking and proposing new ideas and approaches to raise the profile and effectiveness of the CNC/IUGG by enhancing the communication channels with the national representatives and with all contributors across the country. He is vocal, precise and effective in communicating his views to and seeking advice from the CGU executive and all of its members.

Zoli deserves to be recognized by the CGU as one of its invaluable members. The CGU meritorious award is only a small token of our appreciation to his unselfish contributions to the Canadian geophysical sciences and the CGU.

**CLIMATE CHANGE LETTER: In November 2009, the CGU, along with four other organizations, sent the following open letter to the Government of Canada.**

26 November 2009

Dear Parliamentarian,

At the Copenhagen Conference of the Parties to the UN Framework Convention on Climate Change, the eyes of the world will be on Canada. We, the leaders of the following Canadian scientific societies, urge the Government to negotiate an outcome that will rapidly and adequately address climate change.

Current and anticipated impacts of climate change in Canada are well documented. They include loss of summer ice in the Arctic Ocean, reduction of snow-covered period, increased melting of glaciers and permafrost, increased evaporation from lakes and wetlands, more extreme weather, severe urban heat waves, increased forest fires that turn boreal regions into carbon sources, and disruptions in agricultural, forest, and energy production. Major initiatives and changes are needed to adapt to our new climate.

Rigorous international research, including work carried out and supported by the Government of Canada, reveals that greenhouse gases resulting from human activities contribute to the warming of the atmosphere and the oceans and constitute a serious risk to the health and safety of our society, as well as having an impact on all life.

Canada is one of the largest per-capita greenhouse gas emitters. Human activities must be optimized to significantly reduce emissions starting immediately. With vigorous action we can develop more efficient processes that reduce emissions, improve the quality of air we breathe and the water we drink, maintain the integrity of our ecosystems, and open new economic opportunities.

We must act responsibly. We must act now. We must act in concert with other industrialized nations. Our societies stand ready to provide scientific insight and advice.

*This letter was overwhelmingly endorsed by councils or members of the following organizations of scientists:*

*Canadian Meteorological and Oceanographic Society (CMOS),  
Canadian Geophysical Union (CGU),  
Canadian Association of Physicists (CAP),  
Canadian Society of Soil Science (CSSS) and  
Canadian Society of Zoologists (CSZ)*

le 26 novembre 2009

Cher parlementaire,

À la Conférence de Copenhague des parties à la convention cadre des Nations Unies sur les changements climatiques, les yeux seront tournés vers le Canada. Nous, les leaders des Sociétés scientifiques canadiennes suivantes, pressons le gouvernement de négocier un accord qui apportera des solutions rapides et adéquates au problème des changements climatiques.

L'impact actuel et anticipé des changements climatiques au Canada est bien documenté. Il comprend la perte des glaces en été dans l'océan Arctique, la réduction de la période de couverture de neige, l'augmentation de la fonte des glaciers et du pergélisol, l'augmentation de l'évaporation des lacs et des marécages, des conditions atmosphériques plus extrêmes, des vagues de chaleur urbaines sévères, l'augmentation des incendies de forêt qui transforment les régions boréales en sources de carbone, ainsi que des perturbations dans la production agricole, forestière et énergétique. Des initiatives et des changements majeurs sont nécessaires pour s'adapter à notre nouveau climat.

Des recherches internationales rigoureuses, y compris des travaux effectués et financés par le gouvernement du Canada, révèlent que les gaz à effet de serre résultant des activités humaines contribuent au réchauffement de l'atmosphère et des océans et qu'ils constituent un risque sérieux pour la santé et la sécurité de notre société en plus d'avoir un impact sur toute la vie.

Le Canada est un des plus grands émetteurs de gaz à effet de serre par personne. Les activités humaines doivent être optimisées pour réduire de façon significative les émissions en commençant dès aujourd'hui. Avec des actions vigoureuses, nous pouvons développer des processus plus efficaces qui réduisent les émissions, améliorent la qualité de l'air que nous respirons et de l'eau que nous buvons, maintiennent l'intégrité de nos écosystèmes et offrent de nouvelles possibilités économiques.

Nous devons agir avec responsabilité. Nous devons agir maintenant. Nous devons agir de concert avec les autres pays industrialisés. Nos Sociétés sont prêtes à fournir des rétroactions et des conseils scientifiques.

*Cette lettre a été approuvée par une grande majorité des conseillers ou des membres des sociétés scientifiques suivantes :*

*la Société canadienne de météorologie et d'océanographie (SCMO),*

*l'Union géophysique canadienne (UGC),*

*l'Association canadienne des physiciens et physiciennes (ACPP),*

*la Société canadienne de la science du sol (SCSS) et*

*la Société canadienne de zoologie (SCZ).*

# NRC Annual Performance Review Questionnaire – 2009 – CGU Response

*(Abridged version) – submitted by Spiros Pagiatakis, CGU President*

## Section 1: Assessment of the Importance of the International Affiliation

### Is the International Affiliation Important within a Canadian Context?

Yes, the fields of science represented by the IUGG (International Union of Geodesy and Geophysics) are vital components of the Government's S&T Strategy. They cover two of the four areas of focus identified in the S&T Strategy, namely environmental science and technologies and natural resources and energy.

IUGG is a non-governmental, scientific organization, dedicated to the international promotion and coordination of scientific studies of Earth and its environment in space. The current mission is promoting and communicating knowledge of the Earth system, its space environment and the dynamic processes causing change, including the gravitational and magnetic fields, the dynamics of the Earth as a whole and of its component parts, the Earth's internal structure, composition and tectonics, the generation of magmas, volcanism and rock formation, the hydrological cycle including snow and ice, all aspects of the oceans, the atmosphere, ionosphere, magnetosphere and solar-terrestrial relations. *[IUGG detailed structure is omitted]*.

The following statements are quotes from “*Mobilizing Science and Technology to Canada’s Advantage, 2007*”: *[Statements from pp. 7, 8 and 20 are omitted but the responses to the statements are retained]*.

Response: IUGG provides guidance and forum that promote advanced research which directly benefits the quality of our environment and help manage our natural and energy resources. IUGG and its supporting associations provide international information exchange. This is critical for global issues, which also impact Canadian society and its economy. Examples of issues addressed by the IUGG include trans-continental transport of pollutants by winds, water quality, sequestration of greenhouse gases in the ocean and land, remote sensing technologies, impact of changing climate on our ocean, glaciers, water resources, fisheries, agriculture and forests.

*[Statements from p. 11 are omitted but the responses are retained]*

Response: Through IUGG participation Canada has developed satellite remote sensing capabilities in the environmental sciences that are sold or exported around the world. One example is RADARSAT which was partly developed to better assess water resources and sea ice cover. Other examples are Canadian water resource computer models that are used for global consulting activities by Canadian companies. The internationally recognized Weyburn CO<sub>2</sub> Sequestration Project is supported by Canada through of Several Federal and Provincial Government Agencies It is also funded by partners, such as US Department of Energy, several Hydrocarbon producing Companies as well as Universities from Canada, United States, Great Britain, France and Italy. Currently the project is in the second 4 year phase *[Details on the project are omitted]*

Canada hosted the 2009 Joint International Assembly of IAPSO (International Association for the Physical Sciences of the Ocean), IAMAS (International Association of Meteorology and Atmospheric Sciences), and the new IACS, (International Association of Cryospheric Sciences), which are all associations within IUGG. This meeting was held in Montreal 19-29 July, attracting over 2000 scientists from all nations. *[Details on the organizing committee are omitted]*.

*[Statements from p.63 are omitted but the responses are retained]*

Response: Leadership in public R&D performance requires international collaborations among all three sectors (public, academic, private) at the international level. IUGG provides these collaborations through its meetings and committees. International collaborations enable Canadians to leverage research programs carried out in other IUGG member countries, thus enhancing value for money spent by Canada’s granting councils. An example of how Canada has strategically focussed international science onto its own national concerns is the creation of the International Association of Cryospheric Sciences (IACS). IACS was created by a Canadian (H.G. Jones, U Quebec) who convinced the IUGG council of the need for a new scientific focus on global snow and ice because of the importance of snow, sea ice, glaciers and their change to the planet and to cold regions environmental science, society and industry. IACS is the first new IUGG association in over 80 years. IAPSO supports formal and informal international forums permitting ready means of communication amongst ocean scientists throughout the world. IAPSO establishes commissions to co-ordinate new and advanced international research activities which address the Canadian goal of exploring new approaches to S&T. Similar commission structures are set up by IAHS and IAMAS.

*[Statements from p.86 are omitted but the responses are retained]*

Response: IUGG strengthens Canada's ties to the global supply of ideas, talent and technology. IUGG is the international organization dedicated to advancing, promoting, and communicating knowledge of the Earth system, its space environment, and the dynamical processes causing change. Through its constituent Associations, Commissions, and services, IUGG convenes international assemblies and workshops, undertakes research, assembles observations, gains insights, coordinates activities, liaises with other scientific bodies, plays an advocacy role, contributes to education, and works to expand capabilities and participation worldwide. Data, information, and knowledge gained are made openly available for the benefit of society – to provide the information necessary for the discovery and responsible use of natural resources, sustainable management of the environment, reducing the impact of natural hazards, and to satisfy our curiosity about the Earth's natural environment and the consequences of human activities.

The IUGG supports a critical and highly developed Canadian scientific network. For example, the Canadian Foundation for Climate and Atmospheric Sciences has disbursed or will disburse over \$110M to hundreds of researchers at most universities in Canada over the period 2000-2010. *[Details of research are omitted]*. A growing private sector is turning these advances into commercial products for clients in Canada and abroad.

IGA is a diversified Association of IUGG. Its scientific divisions (Internal Magnetic Fields; Aeronomic Phenomena; Magnetospheric Phenomena; Solar Wind and Interplanetary Field; Geomagnetic Observatories, Surveys and Analyses) provide important and strong support in a number of Canadian *S&T* strategic areas, including Earth and space environment, space weather, natural resources and energy, space communications technologies, among others. In particular, it provides strong support to the *S&T* policy objectives of the Natural Resources Canada (NRCan) and the Canadian Space Agency (CSA).

IAPSO has the prime goal of promoting the study of scientific problems relating to the ocean and the interactions taking place at the sea floor and the coastal and atmospheric boundaries, chiefly insofar as such study may be carried out by the aid of mathematics, physics and chemistry. The expected breakthroughs include important contributions to the understanding of climate change and its impact on the global and regional oceans and fisheries. Canadian scientists have made important contributions to international efforts, for which they were awarded the Nobel Peace Prize. Canadian scientists are also active in various IAPSO Working Groups.

IAMAS Commissions: The International Commission on Atmospheric Chemistry and Global Pollution are highly relevant to Canada since their activities include areas that affect Canada's environment, and through that Canada's industries and thus our national competitiveness.

IASPEI promotes studies of seismic waves propagated in the Earth interior. Over one thousand institutional, academic and private scientists are involved in these investigations. A component of the internationally recognized National LITHOPROBE project was development of a number of special portable recording systems. The instruments were designed and developed by scientists of the Earth Sciences Sector of the GSC. *[Details on the marketing of the technology are omitted]*.

IAHS and IACS members are active in the CGU and CWRA. IAHS commissions include remote sensing, tracers, continental erosion, snow and ice hydrology, water resources systems, coupled land atmosphere systems, water quality, and groundwater. The CGU has a Hydrology Section (~200 members) with committees that largely mirror these commissions and ensure Canadian implementation and coordination of this internationally recognized research. IACS members are involved in keeping an inventory and assessment of the health of Canada's glaciers with particular focus on the western cordillera where glaciers are declining rapidly and the Arctic glaciers that have an important influence on the Arctic Ocean. *[Details on the CWRA are omitted]*.

CGU and CMOS are forming the Canadian Societies for the Geophysical Sciences (CSGS) to improve the internal networking ability of geophysical sciences in Canada. The first meeting of CSGS is planned for Ottawa in 2010 as part of a joint CMOS-CGU Congress. The first CMOS-CGU Congress was held in St. John's, NL, in 2007 and attracted 900 participants.

## **Section 2: Assessment of the Effectiveness of the Supporting NRC Partner/CNC**

### **Does the NRC Partner/CNC ensure the representation, promotion, and protection of Canadian interests in the international scientific community?**

CNC/IUGG effectively represents five autonomous scientific societies in Canada. These societies as well as its members are proactive at various levels to promote and protect Canadian interests in the international scientific community. The societies regularly hold annual meetings within their subject areas or meeting jointly with other

societies within the group. A joint CMOS-CGU Congress is planned to be held in Ottawa in June 2010 with significant effort expended in organizing this during 2009. The theme of the Congress is “Our Earth, Our Air, Our Water, Our Future”. This congress will be attended by over 1000 scientists.

CGU also frequently has joint scientific meetings and workshops with GAC where IUGG related issues are presented and discussed. CGU was co-organizer of the JOINT ASSEMBLY in 2009 in Toronto, with AGU, GAC, MAC, MSA, GS, IAH-CNC, and SEG. Over 5000 delegates participated in the program. IUGG “News Letters” are regularly distributed to members of the CNC/IUGG committee and relevant information is further transmitted to members of their own societies.

The CGU/CNC for IUGG consults closely with the atmospheric and space physics community in Canada through the members appointed by the Canadian Association of Physicists (CAP) and the Division of Atmospheric and Space Physics (DASP). DASP holds an annual workshop meeting, which is attended by active researchers in the atmospheric and space research communities in Canada. *[Details of the workshop are omitted]*. The Canadian atmospheric and space physics community is well represented at IAGA. Several community members have served as members on the IAGA Executive and/or its Division leaders in the past 10-15 years.

Despite the relatively small size of the Canadian atmospheric and space research community, Canadian representation on IAGA has ensured strong protection of Canadian interests in the international geomagnetism and aeronomy community. This is reflected, for example, by the prominent roles played by Canadian researchers in recent IUGG and IAGA Assemblies as main scientific organizers, session conveners, and invited speakers.

The CGU has annual general meetings where the issues relevant to IUGG associations are discussed and reports from CNCs for various associations are presented. There is feedback to chairs of the CNCs at these meetings which is then represented back to the associations of the IUGG. CMOS has similar arrangements for IAMAS and IAPSO. Changes in Canadian science policy and program delivery, e.g. at NSERC, NRC, Environment Canada are reported internationally at IUGG meetings by plenary speakers and others.

A new development in Canada is the Canadian Societies for the Geophysical Sciences, composed of CMOS and the CGU. This will meet every few years and provide a critical mass of IUGG research from solid earth to upper atmosphere and will provide special opportunities for consultation with Canadian scientists in one forum and a strong voice for Canada within IUGG and nationally.

#### **Does the NRC Partner/CNC ensure the promotion of Canadian contributions to international decision making?**

Canada’s significant size, unique natural setting, diversity of climate, topography, hydrology, environment and geology with a framework of very recent to early stages of the Earth, and temperate to cold and wet to arid climates presents an exclusive natural laboratory. The recognition of the immensity of resources also permitted development of scientific methods for practical economic applications. The unique conditions also helped us realize that many of the geophysical phenomena are global in nature, and therefore require collaboration with the international scientific community. Appropriately, Canada was one of the funding members of IUGG in 1919. Throughout the years, the world scientific community also recognized the talent and contributions of the Canadian members of the community. Beyond the major powers, and among the 96 member nations of IUGG, Canada is the only country who elected two Presidents (J.T. Wilson, G.D Garland), three Vice Presidents (J. T. Wilson, G. D. Garland and G. McBean) and one General Secretary (G. D. Garland) to the IUGG Assembly. Most recently, several Canadian delegates were elected to executive positions at the XXIV General Assembly of the IUGG in Perugia Italy July 2-13, 2007 *[List of delegates omitted]*.

#### **Does the NRC Partner/CNC encourage and support Canadian scientists to take advantage of emerging international networking opportunities?**

Canadian scientists are developing productive relationships with their international colleagues through their participation in projects and networks sponsored by the IUGG and its member associations. Because of these contacts, there is significant international participation in projects in the Canadian north associated with the IPY. There is significant Canadian participation in international ocean observing programs such as ARGO (Dr. H. Freeland, co-chair of the Argo Steering Team) and in projects and programs managed by the World Climate Research Program, a joint effort of WMO, ICSU and IOC. There is also significant Canadian participation in PUB and in international working groups of IAHS on hydrometeorology.

For several years starting in 1996, GSC and U. of New Brunswick scientists contributed to seismic investigations, studying water table variations in Botswana. More recently, GSC provided instrumentation and scientific input to aftershock seismic investigations in Iran.

Beginning in 1991 a team scientists from U. Saskatchewan and GSC, helped to initiate and made major contributions to the organization of the CELEBRATION 2000, ALP 2002, DANUBE 2004 active seismic experiments, some which included investigators from 14 countries of Central and Eastern Europe [*Details on participants omitted*].

Canada sponsored the Snow Vegetation Working Group of IAHS-ICSU (1997-2007) which held several workshops, developed special issues of international journals on the topic, promoted the topic in the research of the WCRP and then developed NERC [*Details on project content and participants omitted*].

Canada sponsored the Snow Ecology Working Group of IAHS-ICSU (1991-2002) which held meetings in Canada (Quebec, Waskesiu) and produced a book by Cambridge Univ. Press [*Editorial details omitted*].

Canada is a leader in the international commission on tracers and through the International Atomic Energy Commission (Austria) through the work of J. Gibson (U Victoria) and J. Buttle (Trent U). It leads the use of radioisotope tracers in international studies throughout the world and has proposed these to the WMO (A Henderson Sellers, Geneva) for hydrological and climate change monitoring.

Through the Weyburn project, Canadian scientists are playing a leading role in developing a comprehensive multi-dimensional technology for long-term CO<sub>2</sub> sequestration. [*Details on project content and participants omitted*]

#### **Does the NRC Partner/CNC encourage and support Canadian scientists to take advantage of opportunities to showcase Canadian achievements, technologies, and capacity?**

CGU is hosting major international scientific conferences in Canada jointly with the American Geophysical Union (AGU), in the past, Montreal (1992, 1994 and 2004), recently in 2009 in Toronto. Although CGU is a smaller society than AGU, it enjoys equal billing at these meetings [*Details on AGU Section structure omitted*]. The repeated return of the AGU meeting to Canada is a direct recognition by AGU of the high standard of contributions the Canadian community makes to Earth Sciences. Since the meetings are very international in nature, they also provide the opportunity for better Global exposure of Canadian research. The number of attendees of the AGU meetings fluctuates between 8,000-10,000 participants. A significant number of the participants are from outside of North America.

Canada successfully hosted the joint scientific assemblies of IAMAS, IAPSO and IACS in Montreal 19-29 July 2009). This was IACS' first scientific assembly. The meeting of these three associations in Canada reflects the strong organizational ability of CMOS and CGU in attracting these groups under the auspices of CNC-IUGG and the strong support of NRC in its invitation. This assembly was attended by 1338 delegates, of which 265 were from Canada. Delegates present at the assembly represented 49 countries [*Details on presentations omitted*]

Canadian scientists contribute and actively participate in numerous international projects and meetings. For instance, CGU President Pomeroy presented the AGU Frontier Lecture at Montreal in 2004. Four percent of the AGU membership are Canadian and a recent AGU Hydrology Section president was Canadian (Beckey, UBC). These ~ 2000 individuals represent more than 90 percent of the Canadian community. In IUGG, Canada is strongly represented. Of all the individuals who were elected as executives (see question 3) at the Perugia IUGG Congress, all made presentations at the different sessions. 144 Canadians attended and presented 160 papers at Perugia. Canadians also convened 8 symposia at the IUGG Congress in Perugia [*Details on participant names omitted*].

The significance of the Canadian Scientific research is recognized by the high standard and novelty of presentations of the Canadian delegates. The international participants express their recognitions of the advance level of the Canadian research by electing disproportionately high number of the Canadian presenters to prominent leadership positions.

At the joint assembly of IAMAS-IAPSO-IACS in Montreal in July 2009 (MOCA-09), 265 Canadian researchers attended the meeting to present papers. [*Details on participant names omitted*].

#### **Does the NRC Partner/CNC disseminate important scientific knowledge and information to Canadian stakeholders?**

CGU-CNC/IUGG utilize every modern form of media to disseminate important information to its members and to



inform associated societies about issues of significance. The CGU newsletter, Elements, contains much of this information in its twice yearly serial publication. The CGU website <http://www.cgu-ugc.ca/> also contains a page for CNC-IUGG and reports <http://www.cgu-ugc.ca/cnc-iugg/index.htm>.

As the CNC/IUGG effectively represents five independent autonomous societies, the communications and information distribution channel must consider these aspects. CGU and IAHS related hydrology members and IACS glaciologists always have their annual meeting together. CGU continues to host joint meetings and workshops with one of the other societies. Negotiations are in progress to establish regular cycles of joint conferences with CMOS and their associates.

Over the past years, the CGU-Hydrology Section (CGU-HS), through the Canadian National Committee for IAHS (CNC-IAHS), has provided a model for other societies and associations. The CNC-IAHS has broadened the responsibilities of the Canadian representatives to the IAHS international commissions and committees. The various commissions and committee reports provide the basis for the Canadian IAHS report <http://www.cgu-hs.ca/> and ultimately the CNC/IUGG report. CGU is encouraging other associations represented within the CNC-IUGG to use the CNC-IAHS model for future quadrennial meetings. To make the model implementation more effective CGU established the Geodesy Section that directly mirrors the International Association of Geodesy (IAG). CGU maintains a website where IUGG related matters. CMOS distributes information on its IUGG activities in IAMAS and IAPSO through its CMOS Bulletin and its web site ([www.cmos.ca](http://www.cmos.ca)).

### **Section 3: Membership Adherence**

#### **Is the level of membership to which the NRC Partner/CNC adheres within the International Affiliation appropriate?**

The level of membership to IUGG should be increased to reflect Canada's effective 'major power' status within IUGG. Canada has hosted more IUGG meetings than any country except the USA. Canada has proposed a new association in the IUGG for the first time in 80 years. Canada remains extremely active in all IUGG associations and has an overwhelming influence in IAMAS, IAPSO, and IAHS and in the World Climate Research Programme. Canada's current membership in IUGG is at level 6 which provides 6 votes for financial matters. Financial voting is by proportion to level of membership. China, Italy and Russia are also at level 6, France is at 7, Germany, Japan and the UK are at 8 and the USA is at 11. Given Canada's substantial influence, we should be at Level 7 which puts it in the "middle-power club" and above the large developing world group that it currently occupies.

### **Section 4: NRC Partner/CNC Feedback**

#### **How can the NRC Secretariat and Ciset better serve the scientific community and NRC Partners/CNCs?**

CNCs would greatly benefit from direct financial assistance in their operations. This would permit travel by correspondents to members associations to joint meetings and would help in planning international events in Canada. Given that IUGG members in Canada are members of many scientific societies there is a special need for CNC-IUGG to have travel funds to meet in Canada between IUGG general assemblies.

Many members of the CNC-IUGG and the CGU were distressed that through this questionnaire Canada seemed to be questioning its membership and participation in IUGG. Canada is a founding member of IUGG (1919) and IUGG is devoted to lofty goals of international scientific development in the geophysical sciences. The nature of questions which seem to be largely focused on "what is in the IUGG for Canada and its economy" are inconsistent with the global values of scientific development for the overall betterment of humanity and understanding and preservation of the world that drive many of the scientists who participate in IUGG, largely on a volunteer basis. It is hoped that Canada develops a more global outlook and altruistic approach to its science and technology policy that is more consistent with the values of IUGG and Canadian scientists. Only by investment in the core principles of science with global application can Canada achieve its potential as a scientific leader in IUGG and other organizations. To do less abrogates our responsibilities to the international community and ultimately will reduce our science to mere application of the ideas of others.





## **HYDROLOGY SECTION NEWS**

### **REPORT OF THE HYDROLOGY SECTION**

*Prepared by Brian Branfireun, President CGU-HS*

Dear Colleagues,

Since the last annual assembly, the Hydrology Section has been busy with a range of continuing and new initiatives. On behalf of the HS Executive, I am pleased to provide you with a summary of the year's business.

2010 Joint Assembly: The CGU Hydrology Section was prominent at the successful CGU-CMOS Joint Assembly in Ottawa, with strong attendance by Section members and a plenary lecture of broad interest. The Annual Woo Lecture was presented given by Laurence C. Smith from UCLA speaking on "Hydrologic Impacts of a Shrinking Cryosphere". The presentation was exceptionally well received by the general joint assembly audience.

The Section was pleased to have strong submissions for both DM Gray Best Student Paper in Hydrology Award, and the Campbell Scientific Best Student Poster Award for this year's meeting. We were grateful that Ian Milne of Campbell Scientific was able to personally present the Campbell Scientific award. The winners are announced elsewhere in this issue of Elements. This year's meeting also saw the inaugural award of the Dr. Don M. Gray Scholarship in Canadian Hydrology (see

separate reports in this issue of Elements), which is to be awarded annually to a doctoral student studying hydrology at a Canadian University. The CGU-HS was very honoured to participate in the development of the Terms of Reference for the Dr. Don Gray Scholarship in Canadian Hydrology (subcommittee of Dr. Brian Branfireun, Dr. Masaki Hayashi and Dr. John Pomeroy) along with the members of Dr. Gray's family.

For 2010, Hydrological Processes has again agreed to support a special issue. Dr. Sean Carey (CGU-HS Vice-President) is coordinating this special issue, and should be contacted directly for further information, or to notify him of your intent to participate in this Special Issue. Please see the CGU-HS website for further information.

Annual Eastern and Western CGU-Hydrology Section Student Conferences: Our section student conferences continue to be a smashing success for our student members. The 2009 Eastern Student Conference was hosted in December by our student colleagues at York University, and the University of Alberta hosted the Western Student Meeting. We look forward to successful student meetings in 2010 in the East and West.

Financial: The CGU-HS finances are in good shape with strong cash reserves. It is apparent that the Section needs to decide on an appropriate reserve balance, and then balance expenses against the sole revenue item from membership. We seek suggestions from the membership for one-time-only and ongoing financial commitments that would benefit the Canadian Hydrological community and the membership of the Hydrology Section.

Other Developments: Communications have received attention over the last year with creation of a listserv to reach all HS members for conference announcements, job postings, training courses, and other matters of Section interest. The Section website was quite actively updated to include links to HS Committees (as available), and updated student/job postings.

I would like to recognize members of the Executive and others for their specific contributions to the successes of the Section and the CGU over the past year. Section V-P Sean Carey is specifically thanked for his considerable effort on the 2010 Joint Assembly organizing committee. I am grateful to Member-at-large Dr. Daniel Peters for his very hard work on the Student Awards and their adjudication. Section Secretary Dr. Sarah Boon has shown considerable leadership and initiative in the development of the Section listserv, as well as the consistent maintenance and improvements to the Section website. Thanks to Section Treasurer Dr. William Quinton for his oversight of Section finances and audits, and special recognition to his designate, Dr. Rich Petrone who stepped in to mind the books while Dr. Quinton was out of the country on sabbatical. Finally, I am grateful to all of the Section members who volunteered their time to review Student Award submissions, and attend sessions to provide feedback and scores on student posters and talks. Without your commitment, it would not be possible to offer the kind of encouragement that these awards offer our student members, who are

the next generation of Canadian hydrologists.

Respectfully submitted,  
Brian Branfireun, President CGU-HS

### **The Dr. Donald Gray Scholarship in Canadian Hydrology**

Created to honour the memory of Donald Maurice Gray BSA, MSA, Ph.D (1929-2005), the Dr. Donald Gray Scholarship in Canadian Hydrology will be awarded annually to a promising doctoral candidate in Don's chosen field of hydrology. The Gray family believes this scholarship is an appropriate tribute to Don's remarkable lifetime achievements and his enthusiasm for academically preparing students to further their studies in the field of Hydrology.

Don made his most significant lifetime achievements in developing Hydrology as a Geophysical Science. Well known as the "Father of Canadian Hydrology" in the scientific community, Don was a dedicated researcher and scientist whose substantial contributions moved the field of hydrology from infancy to its current highly regarded status. During the course of his career Don mentored more than 68 graduate students, brought in millions of dollars in research grants and produced over 132 publications.

Don's substantial contributions to the fields of snow and prairie hydrology meant that he was considered the leader in these scientific fields for much of his career. Seminars on Familiarization with the Principles of Hydrology, much of which Don organized and delivered, trained many of the future Canadian hydrologists and the notes became the basis for the Handbook On The Principles Of Hydrology. Don's international reputation became solidified with the publication of the Handbook Of Snow: Principle, Processes, Management and Use in 1980. This comprehensive book

on snow remains the primary world reference on all aspects of snow.

Internationally, Don aided in the establishment of a Water Resources Management Engineering School near the Arctic Circle at the University of Lulea, Sweden and in the creation of the international hydrology journal *Nordic Hydrology*. He was the Canadian delegate to the UNESCO Working Group on Representative and Experimental Basins and served on the editorial boards of several well-known hydrology journals.

Don chaired the Division of Hydrology at the University of Saskatchewan, Saskatoon from 1965-2001. It was from here that he would train many of Canada's hydrologists while creating a critical mass of research and a reputation for excellence in process understanding, instrumentation, and computer simulations with a special emphasis on the Canadian Prairies and the North.

Don played a highly significant role in brokering the arrangement that led the National Hydrology Research Centre to relocate from Ottawa to Saskatoon by chairing a small committee of Deans who made the recommendation that the University of Saskatchewan form a Research Corporation-now Innovation Place, the largest research park on campus in Canada. It was Don's idea and drive that established the Hydrology Section of the CGU in the early 1990s.

Don inspired excellence and loyalty amongst his colleagues and co-workers and created excitement and belief that Canada should and could have a confident scientific assessment of its water resources and would lead the way for the world in doing so.

As an educator and mentor, Don provided each student his time, expertise and energy to ensure that graduates of his program were highly trained scientists ready to contribute

to the body of knowledge in hydrology. He opened doors to seek out opportunities for graduates and remained a loyal supporter and mentor throughout their careers. The Gray family is proud to be a part of awarding a scholarship that accurately reflects Don's high expectations and recognition of scholastic achievement.

### **The 2010 Recipient of the Dr. Donald Gray Scholarship in Canadian Hydrology**

The announcement of the award and adjudication was fast-tracked this year in order to make the inaugural award at the 2010 Joint Assembly. Even with a very short timeline, eight strong applications were received. Given the specific terms of the award, this is an excellent response. The applications were reviewed and assessed by an independent ad hoc committee of eminent Canadian hydrologists who did not have students applying for the award.

Mr. Kegan Farrick of the Department of Geography, University of Toronto was selected as the inaugural winner of the 2010 Dr. Donald Gray Scholarship in Canadian Hydrology in recognition of his academic achievement, research potential and contributions to the academic and scientific communities. Mr. Farrick postponed his departure to his field site in central Mexico to receive the \$2500 award at the awards banquet. Congratulations Kegan.

For the full terms of the scholarship and the application process, please see the CGU Hydrology Section website [www.cgu-hs.ca](http://www.cgu-hs.ca).

## CGU HYDROLOGY SECTION COMMITTEE REPORTS 2010

Compiled by Sarah Boon, U of Lethbridge

### Northern Research Basins Committee

**Chair and Canadian Chief Delegate: Kathy L. Young, Geography Department, York University**

One of the main activities of the CGU-HS Northern Basins Committee during the last year was the 17<sup>th</sup> NRB meeting. Canada hosted the 17<sup>th</sup> International Northern Research Basins (NRB) Symposium & Workshop in the Eastern Canadian Arctic **August 12-18, 2009**. The symposium/workshop was held on an Inuit owned expedition ship which travelled from Iqaluit to Pangnirtung and then onto Kuujuaq. The conference theme was **Managing Hydrological Uncertainty in High Latitude Environments**.

Scientific sessions included: *Prediction of Precipitation in Ungauged Northern Basins*; *Northern Lake Systems*; *Hydrology & Ocean Interactions*, *Climate*, *Cryosphere*, *Hydrosphere* and *Arctic Hydrology & Uncertainty*. We were pleased to have two guest speakers. Dr. Larry Hinzman, International Arctic Research Institute, University of Alaska, Fairbanks spoke on *The Role of Feedbacks in the Arctic Hydrologic System*. Dr. Robbie Macdonald, Department of Fisheries & Oceans, Environment Canada talked about *Rivers and Lakes in the Ocean-The Other Hydrological Cycle*. The 17<sup>th</sup> NRB delegation also met with community members in Iqaluit and Kuujuaq and held a Community Open House in the Hamlet of Pangnirtung. Similar to previous NRB meetings, time was set aside for field trips and cultural events. Overall, we had about 60 scientists registered from **ALL** circumpolar countries and about 10 guests making this one of the biggest NRB meetings to date. A field book and proceedings of conference papers were made available to delegates at the meeting. Full details of the meeting can be found at

[www.northernresearchbasins.com/17NRB](http://www.northernresearchbasins.com/17NRB)

As outlined in the NRB Mandate and the Canadian NRB terms of Reference, Canadian participation in the NRB meeting is limited to 10 delegates appointed by the Canadian Chief Delegate (and approved by the CGU-HS Executive) to represent Canadian interest in the hydrology of northern areas. Given that Canada hosted this event in 2009, we were allowed to invite other Canadian scientists as observers and their names and affiliation can be found on the website posted above. The Canadian Chief Delegate to the 17<sup>th</sup> NRB meeting was Kathy Young, York U, while

Chris Spence, Environment Canada served as the Deputy Chief Delegate. A slate of 10 official Canadian Delegates was submitted to the CGU-HS for approval in Jan.'09, however, eventually only eight registered:

**Dr. Sean Carey**, Carleton University: runoff processes in sub-arctic environments, member of the 17<sup>th</sup> NRB organizing committee

**Dr. Faye Hicks**, Water Resources Engineering, University of Alberta: northern river ice jams and break-up. Faye is a Full Professor and engineer. She was recently involved in the MAGS project.

**Dr. Scott Lamoureux**, Queen's University: watershed hydrology and geomorphology, high arctic environments, P.I. of an ArcticNet project.

**Mr. Richard Janowicz**, Yukon Gov't: cold regions hydrology and operational water resources, member of the 17<sup>th</sup> NRB organizing committee

**Dr. Terry Prowse**, University of Victoria: cold regions hydrology with special focus on river ice, lake ice and snow. Terry also holds a Canada Research Chair.

**Dr. William (Bill) Quinton**, Wilfrid Laurier University: sub-arctic hydrology. Bill holds a Canada Research Chair, and is a member of the 17<sup>th</sup> NRB organizing committee

**Dr. Chris Spence**, NWRI: sub-arctic hydrology and Deputy Delegate, Canadian NRB

**Dr. Kathy L. Young**, York University: high arctic environments and Chief Delegate, Canadian NRB

At the end of the meeting, delegates were invited to submit their papers to the peer reviewed journal ***Hydrology Research***, for a ***special 17<sup>th</sup> NRB edition***. The review process is still ongoing but Canadian delegates and observers submitted six manuscripts among other circumpolar countries:

Boucher, J.L. and Carey, S. *Exploring runoff processes using chemical, isotopic and hydrometric data in a discontinuous permafrost catchment.*

Endrizzi, S. and Marsh, P. *Observations and modeling of turbulent fluxes during melt at the shrub-tundra transition zone 1: point scale variations.*

Janowicz, R. *Observed trends in the river ice regimes of northwest Canada.*

Prowse, T. and Brown, K.G. *Hydro-ecological effects of changing arctic river and lake ice covers: a review.*

Woo, M.K. *Cold ocean-seas and northern hydrology: an exploratory overview.*

Young, K.L. and Labine, C. *Summer hydroclimatology of an extensive low-*

*gradient wetland: Polar Bear Pass, Bathurst Island, Nunavut, Canada.*

The 18<sup>th</sup> NRB meeting will be hosted by Norway in August 2011, and preliminary details can be found at [www.northernresearchbasins.com](http://www.northernresearchbasins.com) Dr. Chris Spence, Environment Canada will take over the position of Chief Delegate for Canada. Information about Canadian NRB activities can be found at [www.canadiannrb.com](http://www.canadiannrb.com) or contact Chris Spence for more details: Chris.Spence@ec.gc.ca.

**Canadian National Committee  
for the IAHS Prediction in Ungauged Basins  
Initiative (CNC-PUB)**

**Chair:** Christopher Spence, Environment Canada, Saskatoon, SK S7N 3H5, chris.spence @ec.gc.ca

**Vice Chair:** Paul Whitfield, Environment Canada, Vancouver, BC V6C 3S5, paul.whitfield@ec.gc.ca

**CWRA Members at Large:** Taha Ouarda, Institut national de la recherche scientifique, Québec, QC G1K 9A9 taha\_ouarda@ete.inrs.ca

Al Pietroniro, Environment Canada, Saskatoon, SK S7N 3H5 al.pietroniro@ec.gc.ca

**CGU-HS Members at Large:** John Pomeroy, Centre for Hydrology, University of Saskatchewan, Saskatoon, SK S7N 5C8 pomeroy@usask.ca (CGU-HS)

Robert Metcalfe, Renewable Energy Section, Ontario Ministry of Natural Resources, Peterborough, ON K9J 7B8 robert.metcalfe@ontario.ca

**Objective and Roles**

The objective of CNC-PUB is to coordinate and communicate IAHS's PUB program in Canada.

The roles of the CNC-PUB are defined as follows:

- Liaising with water resource managers and government agencies in the development of programs supportive of the PUB initiative,
- Supporting PUB working group implementation and funding in Canada,
- Supporting outreach of working group scientific progress,
- Encouraging technology transfer from working groups,
- Reporting to CGU-HS and CSHS on Canadian PUB activities and
- Reporting to IAHS on Canadian PUB activities through CNC-IAHS and the PUB SSG.

**Progress on Issues and Objectives**

The Improved Processes, Parameterization and Prediction in Cold Regions (IP3) initiative is into its final year of funding by the Canadian Foundation for Climate and Atmospheric Sciences. IP3 is registered as a cold regions working group with the international PUB initiative ([http://pub.iwmi.org/UI/Images/PUB\\_WG16\\_IP3%20in%20Cold%20Regions.pdf](http://pub.iwmi.org/UI/Images/PUB_WG16_IP3%20in%20Cold%20Regions.pdf)). More information on IP3 specifically can be found at [www.usask.ca/ip3](http://www.usask.ca/ip3).

**Future Meetings and Activities**

There are some who wish to continue pursuing a model intercomparison project as was proposed at the 2007 IUGG. Progress has been slow within CNC-PUB to pursue this idea within Canada, but the Canadian community, especially the practicing hydrologists, has been keen. One possibility is to apply for an NSERC strategic workshop grant to help our community design a research plan.

Subsequent to the prediction of low flows in ungauged workshop and special issue, a workshop on intermittent streams is planned for Lethbridge in February 2011. In more arid regions of Canada, streams contain water only during restricted periods of the year. Improving the measurement, prediction and management of water flux and availability in intermittent systems is important to economic and environmental sustainability in certain areas of Canada. This workshop will bring together scientists and managers who are engaged in understanding these systems, how they respond to changes in climate and land-use, and in transferring this understanding to predictions in ungauged basins. Workshop sessions will provide the opportunity to engage the participants in defining the shortcomings in present understanding and data, and develop the research questions necessary to meet management needs for the future. A special issue of a journal will be produced to capture the invited papers, and the synthesis of the workshop sessions. This volume should support the growth of collaborative work on these systems.

Some effort should be made to highlight Canada's contributions to the PUB initiative as we enter the last few years of the programme.

**Committee on River Ice Processes and the Environment**

**Chair:** Faye Hicks, PhD, PEng., FCSCE

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**Secretary:** Dan Healy, Ph.D., P.Eng.  
AMEC Earth & Environmental  
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**Treasurer:** Martin Jasek, M.Sc., P.Eng.  
BC Hydro, Operations  
Burnaby, British Columbia

**CRIPE Members:**

Spyros Beltaos, Normand Bergeron, Raymont  
Bourdages, Brian Burrell, Shawn Clark,  
Evan Freisenhan, Joe Groeneveld, Chandra  
Mahabir, Mike Morris, Wes Penner

**International Members:**

Steven Daly (US Army CRREL, United States),  
Mikko Huokuna (Finland), Hung Tao Shen  
(IAHR)

**Affiliate Members:**

RW Carson, Kersi Davar, Terry Prowse

**About CRIPE:**

CRIPE derived from a Working Group that was established in 1975 by the Associate Committee on Hydrology (ACH), itself funded by the National Research Council of Canada (NRCC). This working group evolved into a permanent Subcommittee of ACH in 1981. Severe budget cuts at NRCC forced the discontinuation of the associate committees in the early nineties. In 1995, the former River Ice Subcommittee of ACH joined the Canadian Geophysical Union, as a Committee of the Hydrology Section.

**CRIPE Mandate and Objective:**

Initially, the Committee's work focused on the hydraulic aspects of river ice phenomena, as a means of elucidating the effects of the ice cover on flow characteristics. This scope was gradually expanded to include additional issues of concern, such as ice formation, ice jams, winter operation of hydro-plants, environmental aspects of river ice, and climatic variability and change. The main objectives of the Committee are:

1. To identify specific high-priority topics for research and development and promote the undertaking of relevant research programs;
2. To facilitate information dissemination and exchange of ideas among practitioners, researchers, and resource managers; and
3. To encourage the incorporation of pertinent lectures or courses in undergraduate and graduate studies at Canadian Colleges and Universities.

**Meetings and Activities:**

One of the main Committee activities is the sponsorship of workshops and short courses and the publication of Proceedings. The first river ice workshop was held at Burlington, Ontario, in 1980, and the most recent workshops took place in Hanover, New Hampshire, in 2005, Quebec City in 2007, and Saint John's in 2009. Another ongoing activity is the initiation and leadership of Task Forces to work on specific problems and publish their findings. From time to time, the status of knowledge on particular topics is reviewed and research needs are identified. Liaison with river ice work abroad is maintained through formal and informal links.

**2009 Annual Meeting**

The 2009 annual meeting was held on June 14<sup>th</sup>. In addition to attending to administrative duties, the committee discussed various task force initiatives including: numerical modeling of ice jams, fish and ice, climate and ice jams, River Ice Formation book, and potential for a comprehensive training workshop.

**2010 Technical Meeting**

The committee usually meets every other year to discuss technical initiatives. This year's meeting will be held May 27<sup>th</sup> in Edmonton, Alberta. The meeting will focus on the topic of river ice formation.



## **15<sup>th</sup> Workshop, Saint John's, Newfoundland. June 2009**

The 15<sup>th</sup> Workshop of the Committee on River Ice Processes and the Environment was held in Saint Johns in June 2009. A total of 66 participants attended the workshop. There were 31 papers (9 by Students) and 6 posters (3 students) presented at the workshop.

Topics covered included:

- River ice measurements
- Freeze-up and Frazil
- River ice processes and the environment
- River ice hydraulics
- Ice and river regulation
- Ice jams and breakup forecasting
- Ice and infrastructure
- Remote sensing

In addition to these topics, a special discussion (moderated by Brain Morse) was held on the *state of knowledge of river ice processes and the environment – developing a vision for the future*.

In the past, the areas of research presented at CRIPE workshops were largely been focused on the physical aspects or river ice processes. Research areas presented have since expanded to include interesting topics relating to river ice ecology and fish habitat. More recently, there have been a number of papers focused on geomorphology.

The workshop was hosted and organized by C-CORE and the University of Alberta. A special thanks is extended to workshop sponsors: BC Hydro, Manitoba Hydro, Taiga Air Services Ltd., AMEC Earth & Environmental, Hoskin Scientific, Campbell Scientific, ASH Hydrotechnical Engineering Inc., KGS Group, and HATCH.

Workshop Proceedings are available online at [www.cripe.ca](http://www.cripe.ca).

### **2009 CRIPE Awards**

Three awards were presented at the 15<sup>th</sup> Workshop: the Bernard Michel Award, the Gerard Medal, and the Kersi Davar Award.

#### **Bernard Michel Award**

The Bernard Michel award is the most prestigious award presented by CRIPE. The award is presented

on occasion to only the most deserving recipients. It honors those who have made outstanding career contributions towards the advancement of river ice science and engineering.

The third recipient of the Bernard Michel award was presented at the 15<sup>th</sup> Workshop to Dr. Spyros Beltaos.

#### **Gerard Medal**

In 1992, the Committee established the Gerard Medal, to honour and remember the many contributions to river ice science by the late Professor Robert (Larry) Gerard who passed away in 1991. The Gerard Medal is awarded biennially to the author(s) of the best paper presented at the preceding River Ice Workshop.

The 2009 Gerard Medal was awarded to: A. Tuthill, K. White, C. Vuyovich and L. Daniels for their paper entitled "*Ice Jams, Contaminated Sediment, Dam Removal, and Bridge Scour on the Clark Fork River, Montana*".

#### **Kersi S. Davar Award**

CRIPE has introduced a new award to recognize outstanding contributions to practical applications in river ice engineering and science. The award will be presented once every two years.

The first recipient of the award was presented at the 15<sup>th</sup> Workshop to Keri S. Davar.

## **16<sup>th</sup> Workshop, Winnipeg, Manitoba, Sept. 2011**

The 16<sup>th</sup> Workshop of the Committee on River Ice Processes and the Environment will be held in Winnipeg, Manitoba in September 2011.

### **Committee on Isotopic Tracers**

#### **Committee Members**

**Jean Birks** (Chair), Alberta Innovates- Technology Futures, University of Waterloo

**Tom Edwards**, University of Waterloo

**John Gibson**, Alberta Innovates- Technology Futures, University of Victoria (President IAHS International Commission on Tracers)

**Claude Hillaire-Marcel**, GEOTOP-UQAM

**Bernhard Mayer**, University of Calgary

**Fred Michel**, Carleton University

**Tricia Stadnyk**, University of Manitoba

**Brent Wolfe**, Wilfrid Laurier University

We are pleased to welcome three new members to the committee: Bernhard Mayer (University of Calgary), Brent Wolfe (Wilfrid Laurier University), and Tricia Stadnyk (University of Manitoba). Drs. Mayer and Wolfe have been active in the Canadian isotope hydrology community for many years and have been significant contributors to the Isotope Tracer Committee activities in the past. Dr. Stadnyk has been an active student participant and is now establishing her own research group at the University of Manitoba. We look forward to their continued participation and to their fresh input towards committee activities.

### Background

The CGU - HS Committee on Isotopic Tracers was established in 1997 to support and facilitate information exchange between isotope specialists and hydrologists both within Canada and internationally, and to address issues of importance to isotopic investigations including integration within broadly-based hydroscience research programs. Recognizing and supporting promising applications of isotopic tracers, promoting cooperative research, providing information resources, and articulating research and educational needs to government agencies, universities, and the general hydrology community are the fundamental aims of the Committee.

### Objectives and Activities

The long-term objectives of the committee are to:

- promote and advance the understanding and application of isotopic tracer techniques in hydrology and related sciences
- initiate and participate in research and education programs, maintain contact with relevant organizations, report on national and international research activities, information sources, isotope monitoring networks, and databases
- establish working groups and/or subcommittees to assess specific, high-priority topics for research, monitoring and/or development, and
- disseminate current research and important findings to the scientific community via discussion, meetings and conferences, and publications

### Progress on Issues and Objectives:

Tracer committee members continue to be active in the promotion and advancement of the understanding and application of isotopic tracer techniques in hydrology and related sciences. Of particular interest are the application of isotope tracers for the evaluation of hydrological and hydroclimatic models and the organization of regional, national and global

networks that serve to build scientific capacity for tracer-based research. Some highlights from 2009 include:

Isotope Tracer Committee supported meetings and workshops included:

- Special Session: “*Recent Advances and Breakthrough in the Use of Stable Water Isotopes as Tracers of Climate and Climate-Driven Hydrologic Changes*”, Joint Assembly, The Meeting of the Americas, 24-27 May 2009, Toronto, Canada
  - This session invited contributions on recent advances and breakthroughs in the understanding and use of stable water isotopes as tracers of past and ongoing climate and climate-driven hydrologic change. Topics included spatio-temporal mapping and analysis of precipitation isotope fields, associated isotopic-hydrologic variability, investigation of circulation-dependent variability in the “isotope thermometer” and other aspects of isotope climatology, isotope-enabled hydrologic and general/regional circulation modelling, hydrologic-circulation model linking and data-model comparison. The session included 9 presentations and we are particularly pleased with the number of high-quality student presentations that were made. We were fortunate to have Uli Schotterer from the Oeschger Climate Centre in Bern as our invited speaker.
- Special session, “*Isotope tracers in hydrology*”, Joint IAHS and IAH International Convention, “Water: A Vital Resource Under Stress; How Science Can Help”, 6-13 September 2009, Hyderabad India.
  - This session included presentations highlighting isotope tracing for obtaining information about water balance, hydrodynamics and hydrological processes, including groundwater recharge, as an indicator of water resources sustainability.
- Dr. Mayer co-chaired a special session of interest to the isotope tracer community at Geocanada 2010 Working with the Earth, 10-14 May 2010, Calgary, Canada. The session was titled “*Advances in Stable Isotope Geochemistry in Energy and Environmental Research*”.

### Other and ongoing committee activities:

- Maintenance of the Tracer Committee web-site [http://www.science.uwaterloo.ca/~jjgibson/gibson\\_files/isotope.html](http://www.science.uwaterloo.ca/~jjgibson/gibson_files/isotope.html)



- Support of IAEA/WMO Global Network of Isotopes in Precipitation and Large Rivers Program.
- Liaison and support for expanding national isotope monitoring/science networks (Canada: Canadian Network for Isotopes in Precipitation, United States: USNetwork for Isotopes in Precipitation).
- We are pleased to announce that Christophe Sturm (University of Stockholm) will be a visiting scientist at AITF Victoria/ University of Victoria. Dr. Sturm is the developer of the stable water isotope-equipped regional climate model REMOiso and has research interests that include modelling the terrestrial carbon cycle.

#### **Applications of Isotopic Tracer Techniques:**

The trend in Canadian isotope tracer research has recently been towards sustained long-term monitoring of precipitation and river discharge to enable better characterization of spatial and temporal variability in isotope signatures and their underlying causes.

A number of large-scale research programs using water isotope tracers to better characterize past and present hydrological processes are currently underway in Canada including:

- the Mackenzie River Basin as part of the Global Energy and Water Cycle Experiment and the IAEAs Coordinated Research Project (CRP) on Large River Basins,
- the St. Lawrence River also as part of the IAEA CRP Large River Basin project,
- the Peace Athabasca Delta, Slave River Delta, Old Crow Flats, and Wapusk National Park are all large-scale field programs in which researchers are using water isotope tracers to characterize the water balance of modern lakes as well as using isotopic archives to evaluate changes in hydrology over the last millennium,
- the Grand River Basin is the location of an intensive campaign sampling groundwater, river water and precipitation providing the first basin-wide isotopic sampling within the Great Lakes catchment,
- Nelson River Basin will be the location of a new 4-year isotope sampling program in which the isotopic composition of rivers, lakes, wetlands, snow, baseflow, precipitation and evaporation will be used to improve the hydrological modelling of the basin using isoWATFLOOD.

A significant milestone for Canadian isotope hydrologists was achieved this year with the acceptance of isotope mass balance (IMB) modelling

as a method for obtaining site-specific hydrology necessary for critical loads of acidity assessments for acid sensitive lakes. The first application of IMB models for this use was in the Fort McMurray area where the method was tested as part of the Cumulative Environmental Management Association Acid Sensitive Lakes Program (Bennett et al., 2008). The application of this isotope-based runoff information in critical loads models (Bennett et al., 2008; Gibson et al., 2010a, 2010b; Scott et al., 2010) is a technical innovation, and this approach is now being widely applied in surveys across Canada as supported by federal and provincial environment agencies and the Canadian Council of Ministers of the Environment Acid Rain task group. These surveys have included over 1300 lakes in British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario.

Bennett, K.E., Gibson, J.J., McEachern, P.M. 2008. Water yield estimates for critical loadings assessment: comparisons of gauging methods versus an isotopic approach. *Can. J. Fish. Aquat. Sci.*, 65: 83-99.

Gibson, J.J., Birks, S.J., Kumar, S., McEachern, P., Haziwinkler, R. (2010a) Interannual variations in water yield to lakes in northeastern Alberta: Implications for estimating critical loads of acidity. *Journal of Limnology*, 69 (Suppl. 1): 126-134.

Gibson, J.J., Birks, S.J., Jeffries, D.S., Kumar, S., Scott, K.A., Aherne, J., Shaw, P. (2010b) Site-specific estimates of water yield applied in regional acid sensitivity. *Journal of Limnology* 69 (Suppl. 1): 67-76

Scott, K.A., Wissel, B., Gibson, J.J., Birks, S.J. (2010) Limnological characteristics and acid sensitivity of boreal headwater lakes in northwest Saskatchewan, Canada. *Journal of Limnology*, 69 (Suppl. 1): 33-44.

#### **Dissemination**

Tracer Committee members have been actively promoting the use of isotope tracer techniques in hydrology through refereed publications, meetings and conferences, as well as supporting the training of highly qualified persons. The next update to the committee website will include links to some recent publications. Other dissemination highlights include:

- "Report on isotope hydrology in Canada 2003-2007" was prepared by Birks and Gibson (with contributions from B Mayer, JF Helie, WM Buhay, ID Clark, TWD Edwards, K Higuchi, L Huang, and D Chan) to give an overview of

recent progress in isotope tracer hydrology and related research.

- There is open access to the Journal of Limnology where some of the above-mentioned papers describing the use of isotope-based site-specific estimates of water yield for regional acid sensitivity assessments.  
[http://www.jlimnol.it/JL\\_69\\_supl1/JL\\_69\\_supl1.htm](http://www.jlimnol.it/JL_69_supl1/JL_69_supl1.htm)

#### **Planned activities**

- Melbourne, 2013: Isotope tracing of water balance, hydrodynamics and hydrological processes (ICT, Co-conveners: John Gibson (Canada), Michael Stewart (New Zealand), G.M. Zuppi (Italy), D.Cendon (Australia))

#### **CNIP Subcommittee:**

Operation of CNIP continued during the past year, with sampling conducted by the Meteorological Service of Canada and analyses supplied by the Environmental Isotope Laboratory, University of Waterloo. The network consists of 19 stations distributed across Canada (spanning almost 40° of latitude and 70° of longitude) collecting weighted monthly precipitation samples for  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$ . The majority of CNIP sampling sites are meteorological stations operated by the Meteorological Service of Canada and the Canadian Air and Precipitation Monitoring Network (CAPMoN) with analyses conducted by the Environmental Isotope Laboratory, University of Waterloo. The CAPMoN networks primary use is for monitoring non-urban air quality to establish spatial and temporal trends in atmospheric pollution (e.g. ozone, particulate, smog, acid rain). In addition, CNIP also includes 3 stations where daily precipitation samples are collected for  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  analyses. This valuable dataset marks the first time that both the southern and northern regions of the country have been simultaneously sampled, and currently consists of a nine-year dataset for the entire country. This partnering between CNIP and CAPMoN has benefited both parties by creating a comprehensive dataset that includes geochemical as well as isotopic characterization of precipitation chemistry providing additional tracers to constrain source areas and transport history. Between January 1998 and January 2010 over 6000 precipitation samples were received at the Environmental Isotope Laboratory at the University of Waterloo, approximately 5000 of which have already been analyzed.

#### **Meetings and Activities**

- Birks, S.J. Edwards, T.W.D. Neelmoy, N.C. Gibson, J.J., Drimmie, R.J., Michel, F. and McTavish, D., Isotope climatology of Canada: Insights from the first decade of CNIP operation (1997-2007), Joint Assembly, The Meeting of the Americas, 24-27 May 2009, Toronto, Canada.
- The CNIP subcommittee continued to participate in the International Atomic Energy Agency Co-ordinated Research Projects Geostatistical analysis of spatial isotope variability to map the source of water for hydrology and climate studies (Birks, SJ). The final meeting was on March 15-19, 2009 in Vienna and considerable progress was made towards the objectives of developing geostatistical techniques for mapping precipitation isotope fields that we plan to apply to the CNIP dataset.
- Maintenance of the CNIP subcommittee web-site, [http://www.science.uwaterloo.ca/~jjgibson/gibson\\_files/cnip.html](http://www.science.uwaterloo.ca/~jjgibson/gibson_files/cnip.html)
- Maintenance of the CNIP web-site, <http://www.science.uwaterloo.ca/~twddedwar/cnip/cniphome.html>
- Liaison and support for expanding national isotope monitoring/science networks (Canada: Canadian Network for Isotopes in Precipitation, Canadian Geophysical Union Committee on Isotope Tracers and CNIP Subcommittee, Manitoba Network for Isotopes in Precipitation, United States: USNetwork for Isotopes in Precipitation, Australia: GNIP, OzFlux, Bureau of Meteorology, CSIRO, ANSTO)

#### **Wetland Hydrology Committee**

**Chair:** J.M. Waddington, School of Geography and Earth Sciences, McMaster University, [wadding@mcmaster.ca](mailto:wadding@mcmaster.ca)

**Vice-Chair:** J.S. Price, Department of Geography, University of Waterloo

#### **Meetings and Activities**

Several members of the Wetland Hydrology Committee (WHC) attended a special "Peatlands and Carbon" conference in Prague in September, 2009. The theme of this conference was Peatland Carbon Cycling and Hydrology. The conference was hosted by PeatNet, which is a NSF based organization based in the United States. Plenary presentations were made by Nigel Roulet and Mike Waddington.

Peatnet also hosted a meeting "Reclamation and Restoration of Boreal Peatland and Forest

Ecosystems: Toward a Sustainable Future" earlier this year in Edmonton on 25-27, 2010. There was a special focus on impacts of mining activity in the boreal zone, especially oil sands extraction, and on reclamation and restoration. There were several hundred attendees, including many industry representatives.

Wetland hydrology figures prominently in both the Western and Eastern CGU-HS student conferences. Over ten presentations at the 2009 Eastern conference at York University were wetland hydrology related.

### **Progress on Issues and Objectives**

As was stated two years ago the WHC has maintained a web site with Canadian wetland hydrology researcher project and contact information. This web site was in need of serious updating. However, the NSF funded Peatnet organization has developed a similar research contacts website for wetland and peatland researchers and several WHC members have posted their contact information to this site. We have encouraged our members to post their information on that web site. However, funding for the Peatnet organization is drawing to a close so it may be necessary to once again develop our own web site. Discussion of developing a Canadian Peatnet equivalent has also started.

The Society of Wetland Scientists recently added a new chapter for peatland scientists. Given the large number of Canadian wetland hydrologists that conduct research in peatland ecosystems, the SWS will also be a good outlet for Canadian hydrology research.

### **Future Meetings and Activities**

Several members of the WHC met at the 2010 CGU/CMOS meeting to discuss future meetings. In 2008 our group invited Kevin Bishop from Sweden to make a keynote presentation on the linkages of wetland and forest hydrology and watershed nutrient cycling. Given the success of that special session with over 30 papers were received (12 oral and 19 poster) and because the CGU annual meeting remains the largest gathering of Canadian wetland hydrologists each year, we plan to organize a special session at the 2011 CGU meeting in Banff on wetland hydrology. Dr. Paul Morris (PDF at McMaster University) has volunteered to lead this initiative. The session may be cross listed with Biogeosciences and focus on the coupling of wetland hydrology and biogeoscience processes.

Preparations are underway for the International Symposium on Responsible Peatland Management and Growing Media Production, Québec City, Canada, 13 – 17 June, 2011. Dr. Nigel Roulet will be giving a keynote address on "Peatlands, Climate Change and Carbon: things we should be thinking about for the management of peatlands in a changing world."

### **Erosion and Sedimentation Committee**

**Chair:** Peter Ashmore, Department of Geography, University of Western Ontario, London, ON, N6A 5C2; pashmore@uwo.ca

**Members:** Dr. Dirk DeBoer, University of Saskatchewan; M. Conly, Environment Canada (CWS), Saskatoon; Dr. M. Church, University of British Columbia; Dr. A. Roy, Université de Montréal; Dirk DeBoer (IAHS-International Commission on Continental Erosion Canadian Delegate)

**Objectives:** the scientific advancement and practical application of knowledge of erosion, transport and deposition of sediment in fresh water systems - topic coverage similar to that of the IAHS Commissions on Continental Erosion some aspects of Water Quality.

- i) communication of current research via discussion, meetings, conferences and publications;
- ii) identification and promotion of high priority research topics in the Canadian context;
- iii) promotion and encouragement of the transfer of knowledge and technology in the field of interest.

### **Meetings & Activities**

- Continued representation at CGU-HS sessions.
- Reciprocal membership arrangement and affiliation between CGU and Canadian Geomorphology Research Group has resulted in several sessions at other national conferences jointly between the two groups including several sessions at 2008 CGU conference jointly (for the first time) with CGRG including a full day special session on sediment transport and landform dynamics with several invited speakers. Ashmore was a member of the program committee and helped coordinate sessions between the two organizations.
- Active participation at Joint Meeting in Toronto (May 2009) including : CGU sponsored session

on Bi-national Principle and Practices in stream Restoration, and Hydrology section sessions on Models and Measurement of Sediment Transport and Advances in Measurement of Sediment Transport.

- Plans for E&S sessions at CGU 2011 being developed.
- At 2011 meeting we will decide on new committee members and revise the focus and direction of the committee.

**Canadian National Committee for the International Association of Hydrological Sciences, (CNC-IAHS)**

The current executive of CNC-IAHS is:

**Senior Representative and Chair:** Dan Moore, UBC

**Junior Representative and Secretary:** Bill Quinton, Wilfrid Laurier University

**President, CGU-HS:** Brian Branfireun, University of Toronto

**Vice-President, CGU-HS:** Sean Carey, Carleton University

**President, CMOS:** David Fissel, ASL Environmental Sciences Ltd.

**Delegated by President, CWRA:** Chris Spence, Environment Canada

**Delegated by President, CNC-IAH:** Garth van der Kamp, Environment Canada

**Member-at-large, CGU-HS:** Masaki Hayashi, University of Calgary

The Canadian National Representatives to IAHS Commissions are:

**International Commission on Surface Water (ICSW):** Don Burn, University of Waterloo

**International Commission on Groundwater (ICGW):** Masaki Hayashi, University of Calgary

**International Commission on Water Quality (ICWQ):** Brian Branfireun, University of Toronto

**International Commission on Continental Erosion (ICCE):** Dirk de Boer, University of Saskatchewan

**International Commission on Coupled Land-Atmosphere Systems (ICCLAS):** Rich Petrone, Wilfrid Laurier University

**International Commission on Remote Sensing (ICRS):** Al Pietroniro, Environment Canada

**International Commission on Water Resources Systems (ICWRS):** Slobodan Simonovic, University of Western Ontario

**International Commission for Snow and Ice Hydrology (ICSIH):** Sean Carey, Carleton University

**International Commission on Tracers (ICT):** John Gibson, Alberta Research Council

Canadians continue to play a key role by holding executive positions in IAHS and its commissions:

Gordon Young	IAHS President
John Pomeroy	President, International Commission for Snow and Ice Hydrology; Working Group, Prediction in Ungauged Basins
John Gibson	Past President, International Commission on Tracers
Al Pietroniro	Past President, International Commission for Remote Sensing; Working Group, Hydrometeorological Projects
Claude Duguay	Vice President, International Commission for Remote Sensing

A major activity of CNC-IAHS over the next year will be the compilation of reports on progress in Canadian hydrology, to be submitted to IAHS at the Quadriennial Meeting of IUGG in Melbourne, Australia, 27 June - 8 July 2011.

Canadian contributions to IAHS sessions to be held at the Melbourne meeting are as follows:

John Pomeroy	Co-convenor, J-HW03, <i>Impacts of changing climate, snow and ice on mountain hydrology</i>
Phil Marsh	Co-convenor, H02, <i>Cold regions hydrology in a changing climate</i>

We encourage all members of the Canadian hydrology community to become members of IAHS. Membership is free. You can register on-line via the following link:

<http://iahs.info/>

## SOLID EARTH SECTION NEWS

*Prepared by Kristy Tiampo, President, CGU-SES*

The inaugural year of the Solid Earth Section was focused on organizational and recruitment activities, culminating in a very successful annual meeting in Ottawa this spring. The Section hosted eight sessions with approximately seventy abstracts. These included twenty-six student presentations,

from which the Section awarded its first student award for the best presentation. We are pleased to announce that this award was won by Catherine Alexandrakis of the University of Calgary for her poster entitled "Precise seismic wave velocity modeling of the outermost core."

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### **Western CGU-HS Student Conference, University of Alberta, Jan 30, 2010.**

The 9th annual Western CGU-HS Student Hydrology Conference was held on Jan 30, 2010 at the University of Alberta. The conference was a great success, bringing together 52 students and faculty from the University of Alberta, University of Lethbridge, University of Calgary, and University of Saskatchewan. This year's line up 21 presentations were particularly strong;

stimulating much discussion during and after the meeting at one of our U of A student pubs. Thanks to all the students and staff who came out, and a special thanks to Jocelyn Howery and Pablo Piña for leading the charge with coordinating the meeting.

Uldis Silins



## CGU 2010 Best Student Paper Award Winners

A number of awards were presented in recognition of outstanding performance in scientific research and presentation by students. Each of the awards comes with a monetary prize. The awards were announced and presented at the Awards Banquet at the recent 2010 CMOS-CGU Joint Congress in Ottawa. To be considered for an award, the student must be the first author and presenter of the paper

(visit <http://www.cgu-ugc.ca> for details). The winners are listed below.

The CGU component of the organizing committee of the Congress and the CGU Executive Committee would like to sincerely thank all the judges of the student papers for their careful evaluations of the student presentations.

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### ***CGU Best Student Paper (all fields of geophysics – oral presentations).***

**Winner:** Panagiotis Vergados (Dept. of Physics & Astronomy, York University). A new technique in retrieving Total Electron Content and second-order ionospheric delays in radio occultation experiments using GPS (co-author: Spiros Pagiatakis).

**Honourable Mention:** Hilary Dugan (Dept. of Geography, Queen's University). The impact of permafrost disturbances and sediment loading on the seasonal mixing of two High Arctic lakes (co-authors: Scott Lamoureux, Melissa Lafrenière, Ted Lewis).

### ***D. M. Gray Award for Best Student Paper in Hydrology (oral presentation):***

**Winner:** Katie Burles, Dept. of Geography, University of Lethbridge. Snow melt energy balance in a burned versus healthy forest stand, Crowsnest Pass, Alberta, Canada (co-author: Sarah Boon).

### ***Campbell Scientific Award for Best Student Poster in Hydrology:***

**Winner:** Laura Brown (Interdisciplinary Centre on Climate Change, University of Waterloo). Modelling lake ice thickness - a comparison of measured and simulated ice thickness from the 2008-2009 ice season in Churchill, Manitoba (co-author: Claude Duguay).

### ***Geodesy Section Award for Best Student Paper in Geodetic Research & Education (oral presentation):***

**Winner:** Panagiotis Vergados (Dept. of Physics & Astronomy, York University). A new technique in retrieving Total Electron Content and second-order ionospheric delays in radio occultation experiments using GPS (co-author: Spiros Pagiatakis).

### ***Solid Earth Section Award for Best Student Paper:***

**Winner:** Catrina Alexandrakis (Dept. of Geoscience, University of Calgary). Precise seismic-wave velocity modeling of the outermost core (poster, co-author: David Eaton).

## **Assistant Professor Limited Term Position**

The School of Earth and Ocean Sciences (SEOS) at the University of Victoria invites applications for an Assistant Professor position (Limited Term) for up to one year, commencing in Fall 2010. SEOS is an interdisciplinary School with an Earth System focus that offers a range of undergraduate and graduate programs. The successful candidate will contribute to teaching and assist students in the Earth Science undergraduate program in any/all of the following areas: geochemistry, hydrogeology and field school. A Ph.D. in Earth Science is required at the time of appointment and teaching experience is desirable.

Applicants should submit a letter of application, a CV, a one-page statement of teaching experience and philosophy, and the names and contact information (addresses, fax, email) for three academic references. Applications should be sent to Dr. Kathryn Gillis, Director, School of Earth and Ocean Sciences, University of Victoria, P.O. Box 3065, STN CSC, Victoria, B.C. V8W 3V6, Canada: fax: 250-721-6120; e-mail: [seos@uvic.ca](mailto:seos@uvic.ca). Review of applications will begin on **7 Sept 2010**, and continue until a suitable candidate is identified. Information about the department can be found at <http://www.seos.uvic.ca/>.

The University of Victoria is an equity employer and encourages applications from women, persons with disabilities, visible minorities, Aboriginal Peoples, people of all sexual orientations and genders, and others who may contribute to the further diversification of the University. All qualified candidates are encouraged to apply; however, in accordance with Canadian Immigration requirements, Canadians and permanent residents will be given priority.

# Canadian Geophysical Union

## Financial Statement 2006-2009

	Year Ended December 31			
	2009	2008	2007 restated*	2006
<b>REVENUES</b>				
Annual scientific meeting	-	-	-	15,066
Membership dues	7,182	3,709	4,222	4,149
Joint Assembly Conference	27,262	-	-	-
Grants	10,000	4,500	4,500	4,000
Interest Income	1,927	2,836	2,529	2,188
Advertising	982	1,450	-	-
Other				1,260
	<b>47,353</b>	<b>12,495</b>	<b>11,251</b>	<b>26,663</b>
<b>EXPENSES</b>				
Annual Scientific Meeting	-	-	-	19,499
Annual Scientific Meeting - Net	8,535	9,004	18,772	-
Awards	500	500	800	2000
Executive travel	-	3,365	970	1,483
Program allocations	3,560	3,025	-	-
Miscellaneous	2,829	2,397	2,507	1,064
Newsletter - Elements	4,729	3,598	2,920	2,081
Professional fees	2,732	2,777	1,750	1,750
Publications	-	9,866	-	-
Secretariat	4,403	5,035	5,822	2,500
Website	634	1,810	-	-
	<b>27,922</b>	<b>41,377</b>	<b>33,541</b>	<b>30,327</b>
<b>DEFICIENCY OF REVENUES OVER EXPENSES FROM OPERATIONS</b>	19,431	(28,882)	(22,290)	(3,664)
Hydrology Section - Net	(1,436)	(2,513)	(1,306)	(593)
<b>DEFICIENCY OF REVENUES OVER EXPENSES</b>	17,995	(31,395)	(23,596)	(4,257)
Net assets at beginning of year	86,169	117,564	141,160	145,417
<b>NET ASSETS AT END OF YEAR</b>	<b>\$104,164</b>	<b>\$ 86,169</b>	<b>\$ 117,564</b>	<b>\$ 141,160</b>

\*The comparative financial statements for 2007 have been restated to reflect an additional \$12,523 in expenses relating to the 2007 Annual Scientific Meeting that were paid in 2008.



### CGU 2010 Award Winners

(Source: CMOS-CGU 2010 Ottawa Congress web site photo collage,  
<http://www.scmo.ca/congress2010/photos.html> )



Left to Right: Spiros Pagiatakis (CGU President), Nigel Edwards, Gordon West



Left to Right: Spiros Pagiatakis (CGU President), Rich Petrone, Sean Carey, Hugh Geiger (Awards Committee Chair)



Left to Right: Spiros Pagiatakis (CGU President), Zoltan Hajnal, Hugh Geiger (Awards Committee Chair)



Left to Right: Spiros Pagiatakis, Panagiotis Vergados, Patrick Wu (Geodesy Section President)



Left to Right: Hilary Dugan, Spiros Pagiatakis (CGU President)



Left to Right: Katie Burles, Spiros Pagiatakis (CGU President), Daniel Peters



Left to Right: Brian Day (President, Campbell Scientific, Canada), Laura Brown, Spiros Pagiatakis (CGU President), Daniel Peters

## OFFICERS OF THE 2010-11 CGU EXECUTIVE COMMITTEE

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CGU WEB SITE ADDRESS : <http://www.cgu-ugc.ca>

***Editor's Note:*** ELEMENTS, the newsletter for the Canadian Geophysical Union, is published and distributed to all CGU members twice each year; one Summer issue and one Winter issue. We welcome submissions from members regarding meeting announcements or summaries, awards, division news, etc. Advertisements for employment opportunities in geophysics will be included for a nominal charge (contact the Editor). Notices of post-doctoral fellowship positions available will be included free of charge.

***Submissions should be sent to the Editor:***

Prof. E.S. Krebs, Dept. of Geoscience, University of Calgary, Calgary, Alberta, Canada,  
T2N 1N4. Telephone: (403) 220-5028; Fax: (403) 284-0074; Email: [krebes@ucalgary.ca](mailto:krebs@ucalgary.ca).

Electronic submission is encouraged.



# ANNUAL MEETING / RENCONTRE ANNUELLE

under the theme

## Geophysical Sciences for the Future

May 15-18 Mai, 2011

Banff Park Lodge

Banff, Alberta

[www.ucalgary.ca/~cguconf](http://www.ucalgary.ca/~cguconf)

### ... CGU / UGC ...

#### SESSION PROPOSALS

Solicited in

Geodesy.....Géodésie

Hydrology.....Hydrologie

Biogeosciences.....Biogéosciences

Solid Earth.....Physique des systèmes terrestres

#### PROPOSITIONS DE SESSIONS

Sollicitées en

Geodesy.....Géodésie

Hydrology.....Hydrologie

Biogeosciences.....Biogéosciences

Solid Earth.....Physique des systèmes terrestres

#### WORKSHOP PROPOSALS / PROPOSITIONS POUR ATELIERS

Student Awards / Bourses: Best Papers & Travel

Field Trip / Excursion: Columbia Icefield, May 15 Mai, 2011

For more information, contact: Rod Blais, University of Calgary, [blais@ucalgary.ca](mailto:blais@ucalgary.ca)