

CGU HYDROLOGY SECTION COMMITTEE REPORTS 2012

Northern Research Basins Committee

**Chair and Canadian Chief Delegate:
Christopher Spence, Environment
Canada, Saskatoon, SK.**

The main activities of the CGU-HS Northern Basins Committee during the last year focused on preparing for the 18th Northern Research Basins Symposium and Workshop in Western Norway, August 15 – 20, 2011. This meeting began in Bergen and involved travel via ship and bus to Loen, Kjenndal, Fjorland, Sognefiord and Voss. The conference theme was **Methods For Measuring, Collecting and Assimilating Hydrological Information in Cold Climates**. Full details of the meeting and the proceedings can be found at www.18thnrb.com.

As outlined in the NRB Mandate and the Canadian NRB Terms of Reference, Canada can send up to 10 delegates invited by the Canadian Chief Delegate (and approved by the CGU-HS Executive). From an original list of 10 invited delegates, only five were able to attend due to schedule conflicts and conference request denials. These include:

Chris Derksen, Environment Canada: Snow
Richard Janowicz, Yukon Territorial
Gov't: Water Management
Dr. Terry Prowse, Environment Canada
University of Victoria: Ice
Kathy Young, York University: Permafrost
Hydrology
Ming-ko Woo, McMaster University:
Permafrost Hydrology

That notwithstanding, the delegates that were able to attend represented the country well. For example, Dr. Terry Prowse of

Environment Canada gave a plenary talk on hydrological aspects of Canadian oil sands development.

Finding delegates able to attend the NRB symposia and workshops is becoming increasingly difficult for several reasons. The structure and location of the meetings, with an emphasis on field excursions in northern landscapes, can result in very expensive registration costs. The NRB competes with other workshops and conferences for the attendee dollar, and so must be competitive in terms of cost and scientific rigor. The current invitation process can limit young scientists from attending, which would inject new participants into the working group. The cost limits many people. After some discussion with previous delegates to the NRB, the Committee will recommend to chief delegates from other member countries the following to perhaps make the NRB more appealing and competitive with other workshops.

- 1) Emphasize the workshop aspect of the NRB; with scientifically relevant and innovative themes.
- 2) Propose that the host country invite one keynote speaker from each member country; this speaker being a well established senior scientist or a upcoming rising promising scientist.
- 3) Perhaps integrate a short course component to assist with technology transfer among member countries.

Canada continues to be responsible for the main NRB websites and NRB listserv; maintained through a contract with Laura Brown of the University of Waterloo. These web sites: www.canadiannrb.com and www.northernresearchbasins.com contain information about the working group, the Canada continues to be responsible for the

main NRB websites and NRB listserv; maintained through a contract with Laura Brown of the University of Waterloo. These web sites: www.canadiannrp.com and www.northernresearchbasins.com contain information about the working group, the Canadian committee, past meetings, links to relevant websites, numerous photos, and the 18th NRB. These two sites need to be updated to include the results of the 18th NRB. Contact Chris Spence at chris.spence@ec.gc.ca for more information.

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:

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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 <http://www.iahs-pub.org/WG15.php> is to coordinate and communicate IAHS's PUB <http://www.iahs-pub.org/index.php> 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 **Putting PUB into Practice** workshop was held May 10 – 14, 2011. The principal aim of the meeting was to make progress towards a crystallisation of 'state of the art' PUB research, in order to facilitate its encapsulation in tools which contribute directly to the solution of real-world challenges in water resources management. The meeting brought together a broad cross-section of researchers, practitioners and toolset developers with interests in this field. By examining a gradient from data-rich to data-poor contexts, and considering the needs of a range of hydroclimatic regions, the workshop participants shared and consolidated knowledge between and across PUB Themes and Working Groups, and the variety of regional efforts and perspectives represented in the movement. As the PUB decade winds down, it is crucial for the Canadian and international PUB movement to focus on information and technology transfer at meetings such as these. Accordingly, the proceedings will be

published as a CWRA monograph in late 2012.

Other technology and information transfer projects include publishing of a special issue of the Canadian Water Resources Journal on the thematic workshop **Zeroflow: A PUB Workshop on Intermittent Streams** held February 23 - 25, 2011 at the Dinosaur Trail Golf and Country Club, Drumheller, Alberta. The organizing committee included Sarah Boon, University of Lethbridge; Emily Huxter, Environment Canada; Daniel Peters, Environment Canada ; Christopher Spence, Environment Canada ; Ilja Tromp-van Meerveld, Simon Fraser University; Paul Whitfield, Environment Canada.

A final special session on PUB was convened at the 2012 joint conference of the Canadian Geophysical Union and Canadian Water Resources Association. Six papers were submitted on a variety of topics that addressed the PUB themes of catchment classification,

The PUB decade ends in 2012 with the Delft Symposium October 23 – 24 in Delft, The Netherlands. The symposium will report on the scientific achievements that were made during the decade and the insights that were gained. Contributions from all Canadian scientists that have worked on PUB efforts are encouraged to attend to share their conclusions and views on the advances made during the decade and regarding the remaining research questions. The symposium has a general part with invited talks providing a summary of the PUB decade, presentations on the Synthesis report and the PUB manual, as well as a visionary session on the future challenges. More information can be found at <http://pub.iahs.info/meeting2012/>

With the end of the PUB initiative, this joint

committee of the Canadian Geophysical Union and the Canadian Water Resources Association should be dissolved. The committee thanks all those involved over the years for their commitment and efforts. The table below summarizes the activities and publications of Canadian PUB.

Summary of Canadian PUB Activities and Publications

Year	Event	Publication
2004	Prediction in Ungauged Basins: Approaches for Canada's Cold Regions (Yellowknife workshop)	CWRA Monograph
2005	PUB in Mountainous Regions Workshop (Manning Park workshop)	Commentary in CWRJ 31(2)
2007	CGU annual conference session	
2007	CWRA annual conference session	
2007	Low-Flow Prediction in Ungauged Basins (PUB) in Canada (Québec City workshop)	<i>Canadian Water Resources Journal</i> 33(2)
2008	Healthy peatlands for healthy watersheds: processes and tools for analysis (2008 CWRA annual conference session)	<i>Canadian Water Resources Journal</i> 34(4)
2011	Zeroflow: A PUB Workshop on Intermittent Streams (Drumheller workshop)	<i>Canadian Water Resources Journal</i> 37(2)
2011	Putting PUB into Practice (Canmore workshop)	CWRA Monograph (pending)
2012	CWRA/CGU joint annual conference session	

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 (Past 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

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 in the water survey, in understanding of precipitation processes and for regional, national and global networks that serve to build scientific capacity for tracer-based research. Some highlights from 2011-12 include:

The Water Survey of Canada, in cooperation with the University of Manitoba, University of Victoria, and Alberta Innovates Technology Futures, is supporting development of a national pilot network to demonstrate the value in systematic collection of river discharge and analysis for oxygen-18 and deuterium across Canada. Water sampling of several hundred key gauging stations is expected to commence in 2012-13. Further information can be obtained from John Gibson (jjgibson@uvic.ca).

An important precipitation isotope summary was published this year that explores the ability to model the spatial distribution of oxygen-18 isotopes in precipitation across Canada (Delavau et al. 2011). The paper utilizes the Canadian Network for Isotopes in Precipitation (CNIP) database. For more information contact Carly Delavau (umdelav0@cc.umanitoba.ca). Research on

the isotopic labeling of precipitation in the arctic is being conducted by Fred Michel in collaboration with Dr. Feng at Dartmouth college in New Hampshire.

Jean Birks is leading the Canadian contribution to an International Atomic Energy Agency sponsored research program on “Use of Environmental Isotopes in Assessing Water Resources in Snow, Glacier, and Permafrost Dominated Areas under Changing Climatic Conditions”. In addition to describing the value of synoptic river surveys for large northern rivers (e.g. Yi et al. 2009), Canada is participating in a pilot study for testing the representativeness of snow lysimeters, snow cores, and Frisbee samplers. For more information contact Jean Birks (jean.birks@albertainnovates.ca).

Isotopic tracers methodology for estimating water yield to ungauged lakes has been incorporated within Environment Canada’s Oil Sands monitoring plan (see Environment Canada 2011). This strategy has previously been used by the Regional Aquatic Monitoring Program (RAMP) and by Environment Canada’s Acid Rain program to better understand site-specific hydrologic conditions across Canada (Gibson et al. 2010a,b). For more information contact John Gibson (jjgibson@uvic.ca) or Jean Birks (jean.birks@albertainnovates.ca).

Isotope tracers will be widely featured at the upcoming Goldschmidt Conference: Earth in Evolution to be held in Montreal during June 24-29 2012. Two sessions that will be convened by members of the isotope tracer committee including: 22c. Applications of emerging geochemical and isotopic analytical techniques for integrated water resource management and environmental monitoring, and 14e. New developments in understanding natural and anthropogenic water contaminants in the Athabasca oil

sands region. Both sessions will highlight advances made in use of isotopic tracers. For more information contact Yi Yi (yyi@uvic.ca).

Alberta Innovates Technology Futures and the Canadian Water Network are sponsoring an Oil Sands Water Research Colloquium on Surface and Groundwater Management in the Oil Sands Industry to be held June 6, 2012. The session will include discussion of isotopic and geochemical methods for fingerprinting water sources. For more information contact Jean Birks (jean.birks@albertainnovates.ca).

A special session will be held at the next Geological Society of America 2012 ANNUAL MEETING to be held in Charlotte, North Carolina, November 4-7 2012, co-sponsored by CGU committee on isotopic tracers, entitled “Biotracers, Mineralogical and Geochemical Properties of Circum-Arctic Sediment Sources and Runoff towards the Arctic Ocean (TS 123)”. A large community is presently planning a drilling program in the Arctic Ocean in order to set up a robust geological history of the basin. One critical issue is to link detrital sediments to circum-Arctic sources using mineralogical, elemental and isotopic tracers as well as biotracers. Geoscientists with experience in surficial deposits, bedrock, major rivers and estuarine systems in surrounding lands, on ocean margin- and deep sediments are invited to contribute with reviews and new information about the mineralogy, geochemistry and biological/organic content of such potential sediment sources and their variability through time. Applications to issues such as changes in continental erosional rates and mechanisms are also welcome. For information contact Dennis Darby (ddarby@odu.edu) or Claude Hillaire-Marcel (chm@uqam.ca).

One important new research program underway is NSERC Discovery Frontiers Program: ADAPT: Arctic Development and Adaptation to Permafrost in Transition (PI Vincent; 2011-2016). This multidisciplinary and multi-faceted research program broadly addresses the fundamental research question: "What are the implications of rapid environmental change in Canada and the circumpolar North caused by thawing permafrost conditions?" Co-PI Brent Wolfe's (WLU) research will identify linkages among hydrological processes, limnological conditions and greenhouse gas exchange in thermokarst lakes. This is important because climate-driven alterations to lake-water balances (e.g., greater evaporation due to longer ice-free seasons, changes in precipitation regimes, accelerated permafrost thaw and more frequent lake drainage events) may influence limnological properties and hence greenhouse gas evasion rates. Research will utilize water isotope tracers and other approaches in present and past hydroecological studies of thermokarst lakes located in the subarctic discontinuous permafrost region in Nunavik and the continuous-discontinuous permafrost region in the western Hudson Bay Lowlands. For further information contact Brent Wolfe (bwolfe@wlu.ca)

References cited:

Delavau, C. Stadnyk, T., Birks, S.J., 2011. Model based spatial distribution of oxygen-18 isotopes in precipitation across Canada. submitted to the Canadian Water Resources Journal. Aug. 16, 2011.

Environment Canada, 2010. Integrated Monitoring Plan for the Oil Sands: Expanded Geographic Extent for Water Quality and Quantity, Aquatic Biodiversity and Effects, and Acid Sensitive Lakes

Component, F. Wrona, P. diCenzo, K. Schaefer (eds.), Ottawa, Canada, p. 70.

Gibson, J.J., Birks, S.J., McEachern, P., Hazewinkel, R., Kumar, S., 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, 2010 - DOI: 10.3274/JL10-69-S1-13.

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 surveys in western Canada. *Journal of Limnology* 69 (Suppl. 1) 67-76, 2010 - DOI: 10.3274/JL10-69-S1-08.

Yi, Y., Gibson, J.J., Helie, J.-F., Dick, T.A., 2009. Synoptic and time-series stable isotope surveys of the Mackenzie River from Great Slave Lake to the Arctic Ocean, 2003 to 2006. *Journal of Hydrology* Volume 383, pp.223-232, doi:10.1016/j.jhydrol.2009.12.038.

Recent publications in the field:

A number of recent contributions have been published that describe application of isotopic tracers in hydrologic studies. These include:

Azcurra, C.S., Hughes, C.E., Parkes, S., Hollins, S.E., Gibson, J.J., McCabe, M.F., Evans, J.P., 2011. A comparison between direct and pan-derived measurements of the isotopic composition of atmospheric waters. 19th International Congress on Modelling and Simulation, Perth, Australia, 12-16 December 2011, <http://mssanz.org.au/modsim2011>.

Buhay WM, BB Wolfe and A Schwalb. 2012. Lakewater paleothermometry from

Deep Lake, Minnesota during the deglacial-Holocene transition from combined ^{18}O analyses of authigenic carbonate and aquatic cellulose. *Quaternary International* 260: 76-82.

Hughes, C.E., Stone, D.J.M., Gibson, J.J., Meredith, K.T., Sadek, M.A., Cendon, D.I., Hankin, S.I., Hollins, S.E., Morrison, T.N., 2012. Stable water isotope investigation of the Barwon-Darling River system, Australia. IAEA Tecdoc 1673, pp. 95-110, International Atomic Energy Agency, Vienna, Austria, ISBB 978-92-0-126810-5.

MacDonald LA, AM Balasubramaniam, RI Hall, BB Wolfe and JN Sweetman, 2012. Developing biomonitoring protocols for shallow Arctic lakes using diatoms and artificial substrate samplers. *Hydrobiologia* 683: 231-248.

MacDonald LA, KW Turner, AM Balasubramaniam, BB Wolfe, RI Hall and JN Sweetman. 2012. Tracking hydrological responses of a thermokarst lake in the Old Crow Flats (Yukon Territory, Canada) to recent climate variability using aerial photos and paleolimnological methods. *Hydrological Processes* 26: 117-129.

Mayer, B. & Wassenaar, L., I. (2012): Isotopic characterization of nitrate sources and transformations in Lake Winnipeg and its contributing rivers, Manitoba, Canada. – *Journal of Great Lakes Research*, published on-line on March 10, 2012.

Nightingale, M. & Mayer, B. (2012): Identifying sources and processes controlling the sulphur cycle in the Canyon Creek watershed, Alberta, Canada. – *Isotopes in Environmental & Health Studies*, 48(1): 89-104.

McGowan S, PR Leavitt, RI Hall, BB Wolfe, TWD Edwards, T Karst-Riddoch and SR Vardy. 2011. Interdecadal declines in flood frequency increase primary production in lakes of a northern river delta. *Global Change Biology* 17: 1212-1224.

Wiklund JA, RI Hall and BB Wolfe. 2012. Timescales of hydrolimnological change in floodplain lakes of the Peace-Athabasca Delta, northern Alberta, Canada. *Ecohydrology* 4: (in press).

Wolfe BB, EM Light, ML Macrae, RI Hall, K Eichel, S Jasechko, J White, L Fishback and TWD Edwards. 2011. Divergent hydrological responses to 20th century climate change in shallow tundra ponds, western Hudson Bay Lowlands. *Geophysical Research Letters* 38, L23402, doi:10.1029/2011GL049766.

Wolfe BB, TWD Edwards, RI Hall and JW Johnston. 2011. A 5200-year record of freshwater availability for regions in western North America fed by high-elevation runoff. *Geophysical Research Letters* 38, L11404, doi:10.1029/2011GL047599.

Yi, Y., Gibson, J.J., Cooper, L.W., McClelland, J.M., Holmes, R.M., Peterson, B., Isotopic signals (^{18}O , ^2H , ^3H) of six major rivers draining the Pan-Arctic watershed, *Global Biogeochemical Cycles*, 26, GB1027, doi: 10.1029/2011GB004159.

Recent graduate thesis focused on isotopic tracers:

Chao, J. Major ion and stable isotope geochemistry of the Bow River, Alberta, Canada. MSc (Geoscience, University of Calgary).

Jasechko, S., 2011. Stable isotope mass balance of the North American Laurentian

Great Lakes, M.Sc. Thesis (Earth Sciences Univ. Waterloo).

Light (Dobson) E. 2011. Characterizing the present and past hydrology of shallow ponds in the Churchill area using isotopic methods. MSc (Geography and Environmental Studies WLU). Recipient of Wilfrid Laurier University Gold Medal for Academic Excellence.

Proemse, B. C. Tracing Industrial Emissions in the Athabasca Oil Sands Region Using Stable Isotope Techniques. PhD (Geoscience, University of Calgary).

Tattrie, K., Groundwater surface water interactions in a wetland rich low relief Boreal environment. M.Sc. Thesis (Geography Univ. Victoria).

White J. 2011. Characterizing current and past hydroecological conditions in shallow tundra ponds of the Hudson Bay Lowlands. MSc (Biology Univ. Waterloo).

Wiklund J. 2012. Lakes of the Peace-Athabasca Delta: Controls on nutrients, chemistry, phytoplankton, epiphyton and deposition of polycyclic aromatic compounds (PACs). PhD (Biology Univ. Waterloo).

Erosion and Sedimentation Committee

Chair: Peter Ashmore, Department of Geography, University of Western Ontario, London, ON, N6A 5C2, Email: 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 of E&S topics at CGU-HS sessions, including 2011 meeting.
- Reciprocal membership arrangement and affiliation between CGU and Canadian Geomorphology Research Group has resulted in several sessions at other national conferences.
- Currently developing initial suggestions for sessions at CGU 2012 with CWRA and with CGRG (who are planning their annual meeting at CGU in 2012) on topics in the general area of hydro-geomorphology, and watershed and channel restoration.

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M. Conly, Environment Canada (CWS),
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Dr. M. Church, University of British
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Dr. A. Roy, Université de Montréal

Dirk DeBoer IAHS-International
Commission on Continental Erosion
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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;
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- iii) promotion and encouragement of the transfer of knowledge and technology in the field of interest.

Meetings & Activities

- Continued representation of E&S topics at CGU-HS sessions.
- 2012 meeting includes sessions HRW 9 and 10, "Biogeomorphology- interactions between riparian ecosystems, aquatic ecosystems and stream channels" and "Fluvial responses to environmental change".
- Co-sponsor with CGRG of sessions R1 and R2: "Hypothesis-driven science: linking field observations to earth-surface processes" and "Advances in fluvial and glacial geomorphology".
- Reciprocal membership arrangement and affiliation between CGU and Canadian Geomorphology Research Group has resulted in sessions at other national conferences.

- Phil Owens (UNBC) is member of ICCE scientific committee for meeting in Chengdu "Erosion and sediment yields in the changing environment", October 2012.
- Mike Stone (Waterloo) is incoming ICCE President.
- Committee meeting at CGU 2012 conference will consider new leadership and members, and future directions for the Committee.