NEWSLETTER Improved Processes and Parameterisation for Prediction in Cold Regions



APRIL 2010

Coming Events

IP3, DRI and WC²N to hold Joint Reception at CMOS-CGU Joint Congress

On Monday, May 31st, 2010, the three CFCAS funded water research networks, IP3, WC²N and DRI will host an afternoon reception at the Crowne Plaza Hotel in Ottawa prior to the start of the CMOS/CGU Joint Congress June 1–4th. The reception will take place in the Frontenac Room from 5PM to 6PM – everyone is attend (please RSVP welcome to to nadine.kapphahn@usask.ca). The final official meeting of the IP3 network will precede the reception with reports given on scientific outcomes, data management plans

Report on Course Offering

Physical Principles of Hydrology



and wrap-up details for the network along with future plans for post-IP3 research. IP3 science will be presented during the Congress at sessions titled "Improved Cold Regions Hydrology Processes, Parameterisation, and Prediction". Sean Carey will chair Part 1 on Thursday, June 3rd at 1:30PM; three more sessions take place on Friday June 4th, with John Pomeroy chairing Part 2 at 10:30AM, Al Pietroniro chairing Part 3 at 1:30PM and Sean Carey chairing Part 4 at 3:30PM. Abstracts can be accessed from https://www1.cmos.ca/abstracts/ abstracts115/congress_schedule.asp .

The Canadian Society of Hydrological Sciences, in partnership with the University of Saskatchewan, offered a short course entitled "The Physical Principles of Hydrology" at the University of Calgary's Biogeoscience Institute's Barrier Lake Station in the Kananaskis Valley from March 2-11, 2010. The course ran at capacity with 40 participants including water resource managers, forecasters, technicians and grad students. Classroom sessions on the fundamentals of hydrology were supplemented with field sessions at Marmot Creek Research Basin and other local sites.



IPY Early Results Workshop and the Way Forward



On February 16-18th, 2010, approximately 300 people attended the Canadian International Polar Year (IPY) Early Results Workshop in Ottawa. While the workshop focused on the 52 projects directly sponsored by the Canadian IPY Program, Canadians have either led or collaborated on over 115 IPY Science Programs which were Fully Endorsed by the IPY Joint Committee. IP3 and WC²N research was well represented in both presentations and posters at the workshop. The Early Results Workshop is one of a series of IPY events and activities meant to capitalize on the federal investment in IPY science.

The International Polar Year 2007-08 was recognized as a major success. Subsequent to the official observation period (ending on March 1st, 2009); scientific communities from over 60 nations focused not only on the polar regions themselves but on the role polar regions play within Earth systems. Outreach and education programs designed to engage the public in polar heritage have succeeded in raising the awareness of both the science and the polar environments and their peoples.

As the IPY Science programs wind down, knowledge gained from these scientific endeavors is just beginning to emerge. This exemplifies the goals of IPY's as initially visioned by Karl Weyprecht over 130 years ago as being more than individual scientists working in isolation. The strength of IPY was founded on the principle of international and inter-disciplinary collaboration in programs highlighted by the sharing of data. Weyprecht felt this sharing of polar research would result in better understanding of global processes. The Early Results Workshop along with many other events and activities around the world was staged to both look at early information coming from the latest IPY projects but also to look at the opportunities for collaborations between current and future projects and programs that will result in new and valuable knowledge and scientific collaborations.

Fred Wrona's presentation, co-authored by Al Pietroniro and Peter diCenzo, titled "IPY Arctic Freshwater Systems", clearly demonstrated the value of this collaborative approach. The project outline described field studies and lab analysis to assess hydrology and ecology of northern freshwater ecosystems for the pursuits of new knowledge in northern Canada. The presentation demonstrated natural collaborations developed with programs both inside and outside of the IPY Program. The Arctic Freshwater Systems project links with the Arctic Char Project to assess ecological biodiversity; the State of the Cryosphere Project for improved understanding of cryospheric processes in modelling; and the Arctic Weather and Environmental Prediction Initiative for use of its high resolution Arctic meteorological data. International collaborations include The Arctic Council led Biodiversity Monitoring Network and Arctic-HYDRA, while other links include the CFCAS funded IP3 and WC²N networks.

Research priorities highlighted in the "IPY Arctic Freshwater Systems" presentation included:

* Improving our process-level understanding of freshwater and nutrient flows,

- * Developing improved predictive models for freshwater and nutrient flux,

* Developing a unique legacy database of freshwater biodiversity (structure and function) and related environmental information on Arctic freshwater ecosystems (lentic and lotic),

* Developing and providing tools and capacity in northern communities for improved community-based monitoring and assessment of the status and trends of the health and integrity of Arctic freshwater ecosystems.

This presentation clearly demonstrated what many of the IPY organizers including the WMO(World Meteorological Organization) /ICSU (International Council for Science) Joint Committee and many National Committees had hoped would occur during IPY; collaborations occurring between the "program cells" of the IPY Planning Chart; the spaces where some of the most meaningful science would occur. It is hoped that the Early Results Workshop will stimulate more of this collaboration.

The Early Results Workshop is only one of many IPY associated events that are designed to build on the out-

IPY (continued)

put of IPY and other polar science. The workshop "The Lowdown on the Meltdown" in 2008 highlighted some of the results of arctic research contributions to IPY funded through CFCAS. CFCAS is currently sponsoring the upcoming Water Symposium in May 2010 "Canadian Water Security—The Critical Role of Science" which will include the arctic as an important theme.

A draft summary document of IPY results to date will be reviewed at the IPY Oslo Science Conference, June 8th to 12th, 2010. At the same time a major publication focused on education and outreach, another critical IPY objective, will be released, the <u>IPY Polar Resource Book</u>. This document has been written for use by teachers and students in schools around the world and is founded on many of the educational and outreach activities developed by scientists and communicators during the IPY. Many sponsors of IPY and related arctic programs have provided their support because they understand that knowledge of polar and earth systems results in tangible benefits.

IPY plans include a major event to take the new knowledge that IPY has generated to policy makers, science managers, educators, communities, industry and others. Timing has to allow for the majority of results to be available and for much of the analysis and synthesis to occur, consequently, this major conference sponsored by the Canadian Federal Program is now scheduled for Montreal in April 2012.

2007-2008 IPY-AP1 Canada and the International Polar Year IPY International Project Chart identifying Canadian participation in IPY projects Atmosphere Space **Education & Outreach** Earth Land People 0cean Ice Arctic n t e g r а t e d D а t Hydro-termal Ver Systems (173) Areas (284) Canadian through Sea ke (322) participation in IPY projects Both 0 S e r Antarctic 0cean Atmosphere Space Land People Ice Education & Outreach Earth Improved Processes and Parameterisation for Prediction in Cold Regions Page 3



Public Outreach

Canadian Rockies Snow and Ice Initiative Speaker Series

The Canadian Rockies Snow and Ice Initiative Speaker Series in Canmore, Alberta, has seen six successful and well attended presentations over the last several months. The final presentation will take place on May 19th. Shawn Marshall (University of Calgary-Canada Research Chair in Climate Change) will present **Glacier Fluctua-**tions: What Glaciers Tell Us About Climate Change.

All presentations (listed below) have been videotaped and audiotaped and are available on the IP3 Outreach page (http://www.usask.ca/ip3/outreach.htm) and the Friends of Banff Park Radio website (http://podcast.parkradio.ca).

* January 26th Canadian Rockies Snow and Ice Initiative: Creating a "Canadian Davos" in the Bow Valley John Pomeroy (University of Saskatchewan–Canada Research Chair in Water Resources and Climate Change)

* February 10th Environmental Change and Water Resources in the Pyrenees: Facts and Future Perspectives for Mediterranean Mountains

Juan Ignacio Lopez-Moreno (Pyrenean Institute of Ecology–Spanish Council for Scientific Research)

* March 3rd Water Under Glaciers: Why Some Glaciers Flow Fast and What This Means for Their Survival Gwenn Flowers (Simon Fraser University–Canada Research Chair in Glaciology)

* March 24th Research on Snow and Glaciers in the European Alps Matthias Bernhardt (Ludwig Maximilians University, Munich)

* March 24th The Impact of Climate Warming on Snow, Climate, and Streamflow in a North American Mountain Basin

Danny Marks (US Dept. of Agriculture - Agricultural Research Service-Northwest Watershed Research Center)

* April 7th Research, Monitoring, and Warning Services Related to Snow and Avalanches in Switzerland Tobias Jonas (WSL Institute for Snow and Avalanche Research, Davos, Switzerland)



Science Outreach Columbia Basin Trust

Pomeroy (University of Sas-Iohn katchewan) and Jaime Hood (University of Calgary) were invited to present relevant IP3 research at a workshop on February 1st, in Golden, British Columbia hosted by the Columbia Basin Trust. The event was organized through the Western Canadian Cryospheric Network (WC²N) outreach program to share scientific research with the Columbia Basin Trust as a partner in WC²N research. Ten researchers including scientists and grad students representing the University of Northern British Columbia, University of British Columbia, University of Calgary, University of Saskatchewan, University of Victoria and BC Hydro gave presentations on their research relevant to the Columbia Basin Trusts' interests in glacier and streamflow research in the Columbia River watershed. After the workshop, an evening public presentation allowed the sharing of research interests with an audience of close to one hundred people attending at the Golden Civic Centre. Kindy Gosal, Director of Water and Environment for the Columbia Basin Trust co-

COLUMBIA BASIN TRUST

hosted the event with Brian Menounos, lead investigator of WC²N. The evening presentation featured Garry Clarke (University of British Columbia) presenting "Glacier Change in Western Canada: past, present and future" a highlight of computer modelling for glacier extents in Southwest Canada over the next 100 years, and Shawn Marshall (University of Calgary) presenting "What is happening to the glaciers in the Columbia Basin?" giving local weather and statistics on climate change in the Golden region over the last 100 years. As well as statistics on the numbers of glaciers in the Columbia Basin, John Pomeroy (University of Saskatchewan) discussed "Water in the Columbia, Effects of Climate Change and Glacial Recession" emphasizing impacts of glacial recession on glacial water runoff contributions to streamflow. A lively question and answer session followed as an engaged audience showed their appreciation and understanding for the sharing of scientific research ongoing in their region.



Network Collaborations

Assessing Climate Impacts on the Quantity and quality of WAter

The ACQWA project (Assessing Climate Impacts on the Quantity and quality of Water) is a large-scale project initiated and coordinated by the University of Geneva, Switzerland. The goal of the ACQWA project is to assess the impacts of a changing climate, focusing on mountain regions where snow and ice melt form the dominant streamflow component. Dr Martin Beniston, coordinator of ACQWA, was invited to speak at the IP3 Prediction Workshop in Waterloo in March 2009. IP3 was interested in the similar research focus between IP3 and ACQWA and requested to become an Affiliate Member in the ACQWA project, which it was granted this past summer. Further information on the ACQWA project can be found at http://www.acqwa.ch/.



Ongoing Research

Areal snowmelt, snow-cover depletion, and runoff modelling over alpine terrain

Chris DeBeer, a PhD student at the University of Saskatchewan's Centre for Hydrology, studies the spatial variability of snowmelt and areal depletion of seasonal snow-cover, relating them to runoff in the alpine zone above tree-line in the Rocky Mountains. Chris was a co-recipient of the 2009 Western Snow Conference Best Paper Award for the presentation "Alpine Snow Hydrology in the Canadian Rocky Mountains" by Pomeroy, MacDonald, DeBeer and Brown. Chris' work has focused on representing the variability in snowmelt and snowcover depletion within a hydrological model (the Cold Regions Hydrological Model), and testing of this approach in a small (~1 km²) tributary sub-basin within the Marmot Creek Research Basin, Alberta, which is an IP3 research basin. The work has involved detailed snow surveys repeated throughout the late winter and spring periods; monitoring of local meteorological and snowpack conditions at several permanent stations; continuously measuring stream discharge at the basin outlet; and using time-lapse photography to monitor the snow-cover over the basin. The digital photographs were projected orthogonally using a specialized software tool and a high resolution LiDAR digital elevation model of the terrain. Some of the images are shown at right, and from such images the fractional snow-covered area and snow-cover depletion over time could be quantified.

Chris's work has shown that areal snow-cover depletion can be parameterized by disaggre-



Raw and georeferenced time-lapse photographs used for mapping of the snow-covered area

gating the terrain into distinct units corresponding to slope and aspect, and subsequently applying slope-based computed melt energetics to the initial distributions of snow water equivalent (SWE) within these units. The results of this approach were shown to agree reasonably well with observations, both at the point scale and over the individual slopes. This is important since such computations have not been successful before without resorting to highly parameterized, fully distributed methods. This approach also allows the timing and extent of the snowmelt runoff contributing area to be realistically defined, which is essential for accurate simulation of the snowmelt hydrograph. This research has recently been published in the journals *Hydrological Processes* and *Hydrology and Earth Systems Science Discussions.*



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Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

specifications.

Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA) Information in this issue submitted by John Pomeroy, Ian Church, Julie Friddell, Charlene Desrochers, Chris DeBeer and Nadine Kapphahn

IP3 Outreach is available for setting up cold regions model training sessions or meetings between scientists and users for sharing of information. Informational brochures are available for public distribution, including brochures on IP3 research focused in the north, IP3 research in the mountain watersheds, and an overview of the Cold Regions Hydrological Model (CRHM) and its structure and

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