Proceedings of the
69th ANNUAL

EASTERN SNOW CONFERENCE

5–7 June 2012
Frost Valley YMCA, Claryville,
New York, USA
FOREWARD

This proceedings volume contains papers presented at the 69th Eastern Snow Conference (ESC) held 5–7 June 2012 at the Frost Valley YMCA camp, Claryville, New York, USA. The meeting featured sessions on glaciology, river ice and hydrology, snow and climate, remote sensing, snowpack properties and hydrochemistry as well as a diverse spectrum of posters.

The ESC is a joint United States and Canadian forum for discussing recent work on operational, applied and scientific issues related to snow and ice. It also retains an increasing interest as a symposium where novel approaches to cryospheric science of international significance are presented. The ESC has published an annual series of proceedings since 1952. Typical topics include studies of snow and ice as materials, snow removal, meteorological forecasting, river ice control, snow hydrology, snow chemistry, glaciology, remote sensing of snow and ice, and snow ecology. Membership in the ESC is open to all interested individuals and corporations. Additional copies of the current proceedings and all back issues can be obtained from the Secretary. Additional information about the Eastern Snow Conference may be found at: http://www.easternsnow.org/.

We continue with an optional review process, and authors may submit extended abstracts or full papers to the Proceedings. Participants in the Western Snow Conference (WSC—http://www.westernsnowconference.org/) were invited to join the ESC participants in the option to submit papers relevant to winter hydrology to the international journal, Hydrological Processes. These papers went through a formal journal review, revision, and referee process and many appear both in these proceedings and in the journal. John Pomeroy (University of Saskatchewan), Kelly Elder (USFS, Ft. Collins), and Andrew Klein (Texas A&M University) edit this special issue of Hydrological Processes dedicated to ESC/WSC papers.

We thank members of the Library Sciences and Knowledge Transfer (LSKT) Branch, at the Information Technology Laboratory, Engineering Research and Development Center (ERDC-ITL). Over the years this group has contributed considerable time to this publication and has enhanced the quality of these proceedings. We especially thank Emily Moynihan for her effort on behalf of these proceedings.

The 2012 meeting of the Eastern Snow Conference and these proceedings were made possible by sponsorship and Corporate Memberships by the following:

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We look forward to seeing many of you at the 70th Eastern Snow Conference meeting to be held 4–6 June 2013 at the University of Waterloo Summit Centre for the Environment, Huntsville, Ontario, Canada. The general theme of the meeting will be “Snow and Ice under a Changing Climate”

Alex Langois and Susan Frankenstein
ESC Proceedings Editors
Cartel, Université de Sherbrooke and ERDC-CRREL
This year’s Eastern Snow Conference Proceedings is dedicated to

Austin William Hogan
1936–2013

ESC Life Member since 1997
US Secretary/Treasurer 1994–2001
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STATEMENT OF PURPOSE

The Eastern Snow Conference (ESC) is a joint Canadian/US organization founded in the 1940s, originally with members primarily from eastern North America. Our current members are scientists, snow surveyors, engineers, technicians, professors, students, and operational and maintenance professionals from North America, the United Kingdom, Japan, and Germany. There is a western counterpart to the ESC, the Western Snow Conference (WSC), which also is a joint Canadian/US organization. Every fifth year, the ESC and the WSC hold joint meetings.

The Eastern Snow Conference is a forum that brings the research and operations communities together to discuss recent work on scientific, applied, and operational issues related to snow and ice. The location of the conference alternates yearly between the United States and Canada, and attendees present their work by either giving a talk or presenting a poster. Most resulting papers are reviewed, edited, and published in our yearly *Proceedings of the Eastern Snow Conference*. In recent years, the ESC meetings have included sessions on snow physics, winter survival of animals, snow and ice loads on structures, river ice, remote sensing of snow and ice, and glacier processes. Volumes of the *Proceedings* can be found in libraries throughout North America and Europe, and the papers are also available through the National Technical Information Service (NTIS) in the United States and CISTI in Canada.

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Le Colloque sur la neige-region est un forum qui rassemble chercheurs et responsables des services d’exploitation pour discuter des travaux récents sur les problèmes scientifiques, operationnels, ou autres dus à la neige et à la glace. Le site de cette réunion annuelle alterne entre les États Unis et le Canada. Les participants y présentent les résultats de leurs travaux par des communications orales ou au moyen d’affiches. Ces communications, une fois revues et éditées, sont publiées dans les *Annales de l’ESC*. Dans les années récentes, les réunions de l’ESC ont inclus des sessions sur la physique de la neige, la survie hivernale de la faune, les forces exercées par la neige et la glace sur les structures et les bâtiments, la glace de rivière, la télédétection de la neige et de la glace, et les processus glaciaires. Les *Annales de l’ESC* sont accessibles dans la plupart des bibliothèques scientifiques d’Amérique-du-Nord et d’Europe. Des copies d’articles peuvent être obtenues du National Technical Information Service (NTIS) aux États Unis et son équivalent au Canada, le CISTI.
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THE PRESIDENT’S PAGE

The 69th annual meeting of the Eastern Snow Conference was held at the Frost Valley YMCA conference facility, near Claryville, New York, in the beautiful Catskill Mountains. The area also serves as one of the major water supplies for the 9 million people of the City of New York. Thus, it was fitting that a portion of the technical program of this year’s meeting dealt with the characteristics of the New York City water supply and the role of snow in affecting the quantity and quality of water delivered to the city’s reservoirs.

The conference had participants from the United States and Canada, as well as from Europe. We had a very successful technical program, consisting of 27 oral presentations and 23 poster presentations. As always, one of the highlights of the conference was the large number of excellent student presentations. The following students received awards that were presented at the annual banquet:

- The Don Wiesnet award for the ESC Student Paper competition was given to Elizabeth Burakowski (University of New Hampshire) for her paper “Putting the Capital ‘A’ in CoCoRAHS: An experimental program to measure albedo using the Community Collaborative Rain Hail and Snow (CoCoRAHS) Network.”
- The Robert Miller Award for Best Poster Presentation was given to Jonathan Sugg (Appalachian State University) for his paper “Satellite and surface perspectives of snow extent in the southern Appalachian Mountains.”
- The Campbell Scientific Canada Award for the paper demonstrating innovative technical expertise in data collection was given to Andrew Kasurak (University of Waterloo) for his paper “A simple in-situ sensor for snow grain size.”

The high quality of these and the other student presentations augurs well for the continued success of the ESC. Thanks to the judges of these awards for their hard work in evaluating a large number of excellent submissions in arriving at their decisions. I also take this opportunity to thank the following for making the 69th ESC such a great success:

- Glen Horton (NY Department of Environmental Protection) and Allan Frei (City University of New York) of the local arrangements committee for their hard work in organizing a great meeting.
- The Frost Valley staff for making our stay there such an enjoyable one.
- Robert Hellström (Bridgewater State University) for setting up and running a highly interesting and engaging technical program.
- The ESC secretary-treasurers Miles Ecclestone and Derrill Cowing for their efficient handling of conference registration and the ESC finances and Mary Jean Cowing for taking the minutes of the pre- and post-conference meetings of the ESC Executive.
- The ESC’s webmaster, Andrew Klein (Texas A&M).
- The ESC’s sponsors: Campbell Scientific, Geonor, Bridgewater State University, and the US Army Engineer Research and Development Center–Cold Regions Research and Engineering Laboratory (ERDC-CRREL).
- The editors of the ESC Proceedings (Robert Hellström, Alex Langlois, Susan Frankenstein, Del Levia) and the editor of ESC Special Issue of Hydrological Processes (Richard Kelly).
- Ben Snyder, Director of Natural Resources and Environmental Science at Frost Valley, who conducted the field trip to the long-term acid and mercury deposition site and the US Geological Survey’s stream gage on Biscuit Brook, which flows through the Frost Valley facility.
- The 2011–2012 ESC Executive for their support and for their dedication to the ESC, particularly Past-President Mauri Pelto.

At the annual ESC banquet, I had the pleasure of announcing that Peter Adams (professor emeritus, Trent University) was made a lifetime member of the ESC in recognition of his long-standing scientific and administrative contributions to the ESC and particularly his outstanding efforts in fostering student research in snow and ice and their participation in the ESC. ESC Past-President Mauri Pelto presented the coveted Sno-Foo Award to Don Pierson of the New York Department of Environmental Protection (a former graduate student of Peter Adams) for his outstanding efforts in being included in the list of authors on every single paper at the conference that was related to the New York City water supply, and for his creativity in avoiding completion of a comprehensive examination as part of his PhD studies (namely, doing his PhD in Sweden rather than North America). The highlight of the banquet was the keynote
talk by David Robinson of Rutgers University and the New Jersey State Climatologist, “Hemispheric to regional dimensions of snow covered extent.” The ESC is very grateful to David for a very entertaining and informative presentation.

On a sadder note, I also took an opportunity at the banquet to dedicate the 69th ESC to Austin Hogan, whose extensive contributions to the ESC span his initial attendance in at the ESC 1966, when he was at the State University of New York at Albany, through his research while at ERDC-CRREL and into his retirement from that agency. Austin was ill at the time of the meeting, and sadly passed away on January 7, 2013. All of us in the ESC who knew Austin were impressed by the outstanding quality of his research related to snow and ice, by his eagerness to engage in discussions (scientific or otherwise), and by his commitment to the ESC. As someone pointed out to me, Austin made it a habit of always offering to give a presentation in the last session of the technical program (preferably the last presentation). My hope is that the precedent Austin set for us becomes an ESC tradition, such that there will be a fierce competition to give the last presentation on the last day of the conference. Perhaps we can begin the tradition at the 70th annual meeting, to be held at the Waterloo Summit Centre, Huntsville, Ontario, in 2013. I look forward to seeing you there.

Jim Buttle