



**Proceedings of the
60th ANNUAL**

EASTERN SNOW CONFERENCE

**June 4–6, 2003
Sherbrooke, Quebec, Canada**

ISBN 0-920081-25-8

ISSN: 0424-1932

Proceedings of the Eastern Snow Conference

Printed and Bound in the United States of America

FOREWORD

This proceedings volume contains papers presented at the 60th Eastern Snow Conference (ESC) held 4–6 June 2003 in Sherbrooke, Quebec, Canada. The theme of this year’s conference was “Remote Sensing of Snow and Ice—The State of the Art.”

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. This year’s Western Snow Conference (WSC) (<http://www.westernsnowconference.org/>) participants were invited to join the ESC participants in the option of submitting 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 December 2003 issue of the journal. Janet Hardy (Engineer Research and Development Center–Cold Regions Research and Engineering Laboratory [ERDC–CRREL]), John Pomeroy (University of Saskatchewan), Kelly Elder (USDA Forest Service), and Andrew Klein (Texas A&M University) edited this special issue of *Hydrological Processes* dedicated to ESC/WSC papers.

We thank the editors at ERDC–CRREL. Over the years this group has contributed considerable time to this publication and has enhanced the quality of these proceedings.

The 2003 meeting of the Eastern Snow Conference and these proceedings were made possible in part by sponsorship and Corporate Memberships by the following:

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We look forward to seeing many of you at the 61st Eastern Snow Conference meeting in Portland, Maine, USA, 9–11 June 2004. This meeting promises an exciting program with anticipated sessions in “**Engineering Aspects of Snow and Ice**,” “**Nor’Easters**,” and “**Hydrological and Hydro-Chemical Impacts of Snow and Ice**.”

Robert Hellström and Susan Frankenstein
ESC Proceedings Co-Editors
Bridgewater State College and ERDC–CRREL

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*This paper was presented at 60th Meeting but was erroneously not included in initial publication of Proceedings (no page number accreditation). This updated digital version remedies this oversight.

STATEMENT OF PURPOSE

The Eastern Snow Conference (ESC) is a joint Canadian/U.S. 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, as well as 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/U.S. 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.

* * * * *

Le Colloque sur la neige-region est (ESC) est une organisation americano-canadienne fondee dans les annees '40 et dont les membres provenaient a l'origine surtout de l'est de l'Amerique-du-Nord. Actuellement, les membres, qu'ils soient chercheurs, techniciens en enneigement, ingenieurs, techniciens, professeurs, etudiants, ou specialistes des services d'exploitation et d'entretien, viennent non seulement d'Amerique du nord, mais aussi du Royaume Uni, du Japon, et d'Allemagne. Le Colloque sur la neige-region ouest (WSC), aussi une organisation americano-canadienne, est l'homologue de l'ESC pour l'ouest nord-americain. Tous les cinq ans, l'ESC et la WSC organisent des reunions en commun.

Le Colloque sur la neige-region est un forum qui rassemble chercheurs et responsables des services d'exploitation pour discuter des travaux recents sur les problemes scientifiques, operationnels, ou autres dus a la neige et a la glace. Le site de cette reunion annuelle alterne entre les Etats Unis et le Canada. Les participants y presentent les resultats de leurs travaux par des communications orales ou au moyen d'affiches. Ces communications, une fois revues et editees, sont publiees dans les *Annales de l'ESC*. Dans les annees recentes, les reunions de l'ESC ont inclus des sessions sur la physique de la neige, la survie hivernale de la faune, les forces exercees par la neige et la glace sur les structures et les batiments, la glace de riviere, la teledetection de la neige et de la glace, et les processus glaciaires. Les *Annales de l'ESC* sont accessibles dans la plupart des bibliotheques scientifiques d'Amerique-du-Nord et d'Europe. Des copies d'articles peuvent etre obtenues du National Technical Information Service (NTIS) aux Etats Unis et son equivalent au Canada, le CISTI.

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THE PRESIDENT'S PAGE

The 60th annual meeting of the Eastern Snow Conference (ESC), held in Sherbrooke, Quebec, Canada, held true to the expanding scope and size of the organization: the conference featured 26 oral presentations, 11 poster papers, 68 regular attendees, and 14 student attendees. This year's theme, "Remote Sensing of Snow and Ice—The State of the Art," led the participants through sessions focused on the status of remote sensing in general, snow and soil interface issues, glaciers, forest impacts, and an insight into the validation process using ground-truth data. The traditional close-of-conference field trip led a large contingent to the Bombardier Museum in Granby, Quebec, to view the progression of over-the-snow vehicles that have played such an important role in snow sciences.

The preparations that go into making a conference of this style are rather extensive, taking months of coordination, communication, and planning. ESC Vice President and Programme Chair Miles Ecclestone and Local Arrangement Chair Hardy Granberg (with considerable support from committee members Ross Brown and Paul Gagnon) made every effort to plan a conference that would be true to the ESC tradition, complete with a much appreciated look into the local culture with a special presentation of Quebec music at the banquet. Special thanks are due to these very supportive individuals.

An uncompensated Executive that consists of many committees and their respective Chairs, who do all of the "behind the scenes" work that allows the organization to function smoothly, direct the ESC as a whole. Our most visible products are the *Proceedings*, co-edited by Robert Hellström and Susan Frankenstein, and our increasing Web presence, facilitated by Andrew Klein. The *Proceedings* are a significant resource and their professional appearance is a credit to the organization. Similarly, our Web page continues to mature as a valuable communication tool, directory of information relative to the conference, and the consistent preparation of oral and poster papers. As in the past, there will be a special issue of *Hydrological Processes*, co-edited by Janet Hardy, John Pomeroy, Kelly Elder, and Andrew Klein. Their efforts will continue to bring the work of the ESC to a broader audience.

The Research Committee is responsible for, among other things, the selection of the winner of the Wiesnet Medal, our prized student award. Over the years, the ESC has made a continued and increasing effort to involve the student population in research. Chris Derksen, Chair, with members Mauri Peltó, Newell Hedstrom, and Steve Fassnacht, had the difficult task of determining the best student paper. The five entrants in this category presented interesting research and put excellent effort into the preparation of their papers. The research committee awarded the Wiesnet to Alexandre Langlois, University of Sherbrooke, for his paper titled "Validation of the Snow Cover Variation of the Canadian Regional Climate Model (CRCM) Using Passive Microwave Satellite Data," a topic clearly related to the theme of the conference. Interesting students in the gathering of field data is becoming increasingly important. The Campbell Scientific Award to the student who shows innovation in the use of instrumentation in his or her work was awarded to Ryan Smith, Trent University, for his paper "Winter Net Ecosystem Exchange of CO₂ from the Mer Bleue Bog Peatland."

The Steering Committee, Susan Taylor, Chair, with team members Claude Duguay and Janet Hardy, continue to offer much-sought-after advice and direction, and our Treasurers, Derrill Cowing and Miles Ecclestone, carefully guide our income and expenses. Their continued efforts are much appreciated by all. Miles, unfortunately, also had the courage to submit his recent difficulties in accomplishing a field programme to the Sno-Foo awards committee. Needless to say, when the heretofore "anonymous" entry was awarded to Miles he was in a state of mild disbelief.

The ESC also depends heavily on the generous support of our corporate sponsors: Hydro-Quebec, Geonor, Campbell Scientific Canada, New Brunswick Environment, the U.S. Army Engineer Research and Development Center—Cold Regions Research and Engineering Laboratory, and CARTEL/University of Sherbrooke. We are grateful for our sponsors' full range of support. Thanks also go to the Members of the ESC who work hard to complete the research that we see in the presentations, be they students or researchers with many years of experience. The sharing of information and experience between these two groups can only enhance our efforts in the future.

Ken Rancourt
60th President
Eastern Snow Conference