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## FOREWARD

This proceedings volume contains papers presented at the joint Eastern Snow Conference (ESC) and Canadian Geophysical Union – Hydrology Section (CGU-HS) held 17–19 May 2001 in Ottawa, Ontario, Canada. The theme of this special joint session was “Snow and Ice: Principles, Processes, Management and Use.” This meeting marked the 20-year anniversary since the publication of the *Handbook of Snow: Principles, Processes, Management and Use*, a landmark reference text that was edited by last year's recipient of the CGU J. Tuzo Wilson Award, Dr. Don Gray.

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/>.

The CGU-HS brings together scientists from all branches of hydrology to achieve the following objectives: promote hydrology as a geophysical science; advance the understanding and application of hydrology and related sciences; initiate and participate in research and education programs in hydrology; promote national and international cooperation among scientific and engineering organizations working in hydrology; and disseminate research results and knowledge to the public through scientific discussion, meetings and conferences, publications and other means of information and technology transfer. The next meeting of the CGU-HS will be held jointly with the Canadian Society of Soil Science 18–21 May 2002 in Banff, Canada. To learn more about the Canadian Geophysical Union, visit <http://www.cgu-ugc.ca/>.

We continue with an optional review process and authors may submit extended abstracts or full papers to the Proceedings. This year we designed a template to ease the creation of camera-ready manuscripts. We hope these changes encourage more submissions of both operational and scientific content. This year's ESC/CGU-HS participants were also invited 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 December 2001 issue of the journal. Janet Hardy, John Pomeroy (University of Wales in Aberystwyth), R. Dan Moore (University of British Columbia) and Ming-ko Woo (McMaster University) edited this special issue of *Hydrological Processes* dedicated to ESC/CGU-HS papers.

We thank members of the Technical Communication Branch, Information Management Division, at the Engineering Research and Development Center, Cold Regions Research and Engineering Laboratory (ERDC-CRREL). Over the years this group has contributed considerable time to this publication and has enhanced the quality of these proceedings. We especially thank Gioia Cattabriga, David Cate, and Mark Hardenberg for their efforts on behalf of these proceedings.

This joint meeting of the ESC/CGU-HS and these proceedings were made possible by sponsorship and Corporate Memberships by:

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We look forward to seeing many of you at the 59th Eastern Snow Conference meeting, in Stowe, Vermont USA on 5–7 June 2002. This meeting promises an exciting program with the theme of “Snow and Ice Impacts on Operations: Theory and Applications.”

Janet Hardy and Susan Frankenstein  
ESC Proceedings Co-Editors  
ERDC-CRREL

## 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 is also a joint Canadian/U.S. organization. Every fifth year the ESC and WSC hold joint meetings.

The Eastern Snow Conference is a forum that brings the research and operations communities together to discuss recent work on the 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 session 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 organization 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, le members, 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 d nord, mais aussi du Royaume Uni, du Japon, et d'Allemange. Le Colloque sur la niege-region ouest (WSC), aussi un organization americano-canadieene et l'homologue de l'ESC pour l'ouset nord-americain. Tous le cinq ans, l'ESC et al WSC organisent de reunions en commun.

Le Colloque sur la neige-region et 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 resultants de leurs travaux par des communications orales ou au moyen d'affiches. Ces communications, une fois revues et editees sont publiees das les Annales de l'ESC. Dans les annes recentes, les reunions d 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 le structures et les batiments, la glace de riviere, la teledetection de la neige et de la glace, et les processus glaciaires. Les annals de l'ESC sont accessibles dans la plupart des bibliotheques scientifiques d'Amerique-du Nord et d'Europe. Des copies d'articles peuvent entre obtenues du National Technical Information Service (NTIS) au Etats Unis et son equivalent au Canada, le CISTI.

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## THE PRESIDENT'S PAGE

The 58<sup>th</sup> Annual meeting of the Eastern Snow Conference in Ottawa was a resounding success! The ESC was delighted to hold its 58<sup>th</sup> Annual Conference jointly with the Canadian Geophysical Union Hydrology Section this year in Ottawa. Together with the CGU-HS and Committee on River Ice Processes in the Environment, and aided by co-sponsorship from the International Glaciological Society, we held the joint meeting: 'Snow & Ice: Principles, Processes, Management and Use'. This year marks two decades since the publication of the *Handbook of Snow, Principles, Processes, Management and Use* edited by Don Gray and Dave Male, and so it was appropriate to revisit those topics as the theme of this year's conference.

ESC Program Chair, John Pomeroy, did a terrific job of organizing the meeting. This year's Eastern Snow Conference sessions contained 73 oral presentations and 34 poster presentations, filling three days. ESC papers were drawn from across eastern and western Canada and USA (including Alaska), Japan, England, Wales, Norway and Switzerland. For the first time, the ESC hosted over 100 presentations. Amongst the various groups presenting snow and ice papers in Ottawa (ESC, HS, CRIPE, the CGU Climate System History & Dynamics session and the CGU President's Plenary Session) there were over 150 presentations – likely to have made Ottawa 2001 the largest broadly-based snow and ice science meeting anywhere this year.

The ESC executives worked long and hard for this meeting. ESC Proceedings Editors Janet Hardy and Susan Frankenstein have done a great job of organizing the papers for these Proceedings. ESC Editors for the special issue of Hydrological Processes, Janet Hardy and John Pomeroy, have put in many hours obtaining quality peer reviews and coordinating revisions for the papers that will make up the volume of the journal, which will be distributed within six months of the meeting. ESC Secretary-Treasurers Miles Ecclestone and Austin Hogan have done a commendable job of manning the financial helm of our organization. And last, but not least, ESC Past-President Dorothy Hall provided much sage advice that was helpful in planning and executing this meeting.

Student participation has always been strong in the Eastern Snow Conference, and this year was no exception. Andrew Klein chaired the student paper competition. The submissions were strong and all are to be congratulated on their progress and commitment to snow and ice. The winner of the ESC Weisnet Medal was Changiz Tavakoli of the Département des Sciences Appliquées, Université du Québec à Chicoutimi (UQAC), Chicoutimi, Québec for the paper 'Dynamic Modelling of Flashover Process on Ice-covered Insulator Surface' with co-authors I Fofana and M Farzaneh. Congratulations to Changiz and his co-authors for superior research.

Each year the ESC participants contrive to select an unwitting soul to receive the honours of the Sno-Foo award, which is best described by its motto: "To err is human, but to forget it would be divine." This year's awardee, Brenda Toth, gracefully accepted the award for her snowmobiling misadventures. We applaud Brenda for being a good sport.

Two participants at the meeting deserve special mention. Professor Julian Dowdeswell, Director of the Bristol Glaciology Centre, University of Bristol, UK was the ESC Invited Speaker. He delivered the talk; *Arctic Ice Masses: Past and Present Form and Flow*, which included thought provoking new research from the Circumpolar Arctic. Professor Peter Adams, MP, a snow hydrologist, glaciologist and former ESC President provided an extremely insightful Banquet Speech on the prospects for our sciences and what must be done to promote them from the perspective of Parliament Hill in Ottawa.

The 58<sup>th</sup> Eastern Snow Conference enjoyed international participation with many interesting presentations on a variety of topics in snow and ice, lively discussions, and the usual abundance of camaraderie and good humour. To all, thank you for your contributions toward a very successful conference!

Mary R. Albert  
58<sup>th</sup> President  
Eastern Snow Conference