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## FOREWORD

The 49th annual Eastern Snow Conference (ESC) was held in Oswego, New York, on June 3rd and 4th, 1992. The program included oral and poster presentations, and displays of scientific equipment. All of the papers at the conference were reviewed, and the revised papers appear in these proceedings. The ESC is a valuable forum for discussion of recent work on operational, applied, and scientific issues related to snow and ice. The session chairs, reviewers and authors have cooperated with the editors to assure the timely publication of the proceedings. We collect draft manuscripts at the meeting, and ask that all present provide thoughtful, constructive reviews. The chairman of each session coordinates the review of papers in his/her session. If the chairman is also an author of a paper in the session, the responsibility for review of that paper is shifted to another chairman. At least two reviews are obtained for each paper and returned to the authors before August 1. Final camera-ready manuscripts are submitted by the authors in early September. Comments received from the authors concerning the review process were again almost entirely favorable. The clear majority thought that their final manuscripts represented a significant improvement over the draft.

In addition to the review process, the 1992 proceedings include the designation of an Honor Paper Award by the ESC. During the review the referees nominate papers that they consider worthy of this award. The criteria that are applied include:

1. Clarity of the written presentation
2. Originality of the contribution
3. Importance of the work in practice or in basic understanding of snow- and ice-related processes.

Three papers on entirely different subjects received unanimous nominations by the reviewers for consideration as the 1992 Honor Paper. The final camera-ready version of each of these papers was reviewed by a five-person panel having a broad range of backgrounds and interests. The nominated papers were all of high quality, and the point totals assigned by the reviewers were very close. The 1992 Honor Paper Award was presented to J.M. Buttle, A.M. Vonk and C.H. Taylor for their paper entitled "Environmental Isotope Hydrograph Separation During Snowmelt in a Suburban Catchment."

Publication of this year's proceedings was accomplished with the assistance of the Technical Communication Branch, Information Management Division, U.S. Army Cold Regions Research and Engineering Laboratory. This group willingly contributed considerable time and talent to enhance the quality of these proceedings while working under tight deadlines. The editors especially thank Sandra Smith and Edmund Wright for exceptional effort in the final production of this document.

The editors have received inquiries from authors concerning journal publication of papers presented at the ESC and published in these proceedings. We are pleased by this development and consider it a tribute to the quality that is being achieved by the ESC. We request that for journal publication authors expand the reports of their work published in these proceedings. A final journal paper can discuss the same subject and include the parts of the ESC version that remain relevant, but the contents should not be identical. An acknowledgment of the ESC in the final work would be much appreciated and effective for increasing the interest in and vitality of the Conference.

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. The annual meeting of the Eastern Snow Conference is co-sponsored by the American Geophysical Union, the American Water Resources Association, and the State University of New York, Oswego Campus. Publication of these proceedings is made possible in part by Corporate Memberships in the Conference held by:

Hydro Québec  
75 Boulevard René Lévesque  
Montréal, Québec  
CANADA H2Z 1A4

Province of New Brunswick  
Department of the Environment—  
Water Resources  
P.O. Box 6000  
Fredericton, New Brunswick  
CANADA E3B 5H1

Ontario Hydro  
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Toronto, Ontario  
CANADA M5G 1X6

Niagara Mohawk Power Corp.  
300 Erie Blvd. West  
Syracuse, NY 13202  
U.S.A.

We look forward to an outstanding 50th Anniversary meeting in Quebec City, June 1993, that will be held jointly with the Western Snow Conference.

Michael Ferrick  
Editor

Timothy Pangburn  
Associate Editor

PROCEEDINGS OF THE EASTERN SNOW CONFERENCE  
 FORTY-NINTH ANNUAL MEETING, JUNE 3-4, 1992, OSWEGO, NEW YORK

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## THE EASTERN SNOW CONFERENCE

The Eastern Snow Conference (ESC) is a joint U.S./Canadian organization which was founded in the 1940's. It is an association of people interested in research and applied aspects of the study of ice in all its forms, especially snow. The principal activities of the ESC are the organization of an annual meeting, in the U.S. or Canada in alternate years, and the production of the annual Proceedings of the Eastern Snow Conference, which now form more than forty volumes deposited in libraries throughout North America and Europe. The annual meetings are sometimes held in major cities such as Washington, Montreal, Toronto or Boston and sometimes in smaller cities such as Peterborough, Oswego, Portland or Fredericton.

The members of the ESC are a very diverse and, over the years, fluctuating, group. They include professional snow surveyors, engineers and technologists (of various stripes), professors and students, hydrologists and biologists, people responsible for keeping roads clear of snow and rivers free of ice, and others interested in snow and agriculture. The members are drawn from all parts of eastern North America, they live and work in places which extend from Maryland to the high Arctic. The line between the territory of the ESC and its counterpart in the other half of the continent, the equally venerable Western Snow Conference, is not a precise one. Residents of the Mid-west and of the Prairie provinces seem to join one or the other organization on the basis of personal whim such as a preference for Reno, Nevada, over Bangor, Maine, as a desirable meeting place.

In recent years, the annual ESC meetings have included sessions on snow and small mammals, snow and buildings, river ice, permafrost, remote sensing of snow and ice, biology of sea ice, snow and ice on lakes, measuring snow and ice, hydroelectricity and snow and ice, glaciers, icebergs, snow and farming, etc..

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Eastern Snow Conference est une organisation internationale canado-américaine fondée dans les années '40. Elle regroupe des gens qui ont des intérêts communs dans l'étude théorique et pratique de la glace sous toutes ses formes, en particulier sous la forme de neige. Eastern Snow Conference a comme activités principales d'organiser sa réunion annuelle en alternant le site du Canada aux États-Unis, d'en produire les comptes-rendus qui se montent maintenant à plus de quarante volumes que l'on peut trouver dans les bibliothèques de l'Amérique du Nord et d'Europe. La réunion annuelle peut se tenir tout aussi bien dans des villes importantes comme Washington, Montréal, Toronto ou Boston comme dans des plus petites comme Peterborough, Oswego, Portland ou Frédéricton.

Les membres d' Eastern Snow Conference représentent un grand nombre de domaines reliés à la neige et la glace. On y retrouve des spécialistes des relevés de neige, des ingénieurs et des techniciens, des professeurs et des étudiants, des hydrologues et des biologistes, des gens ayant la responsabilité d'entretenir les chemins en hiver ou de contrôler la glace en rivière, d'autres ayant quelque intérêt dans la neige et l'agriculture. Tous ces membres viennent de l'est de l'Amérique du Nord et peuvent y habiter de Maryland, U.S.A., à l'Arctique. D'ailleurs la ligne qui sépare le territoire d' Eastern Snow Conference à son pendant de l'ouest la vénérable Western Snow Conference est assez diffuse. Les habitants du centre-ouest américain ou des Prairies peuvent choisir de rallier une ou l'autre organisation sur une base très personnelle comme de préférer d'aller à Reno, Nevada, plutôt que Bangor, Maine, pour leur colloque annuel.

Dans les dernières années, aux réunions annuelles d' Eastern Snow Conference on a tenu des sessions sur la neige et les petits mammifères, la neige et le bâtiment, la glace de rivière, le pergélisol, la télédétection de la neige et de la glace, la biologie de la glace marine, la neige et la glace lacustres, la mesure de la glace et de la neige, l'hydroélectricité et la glace et la neige, les glaciers, les icebergs, la neige et l'agriculture, etc.



EASTERN SNOW CONFERENCE OFFICERS  
1991-1992

PRESIDENT

Timothy Pangburn  
U.S. Army—CRREL  
72 Lyme Road  
Hanover, New Hampshire 03755-1290

VICE-PRESIDENT

Terry Prowse  
NHRI  
11 Innovation Blvd.  
Saskatoon, Saskatchewan S7N 3H5

PAST-PRESIDENT

Nabil Elhadi  
Department of the Environment—  
Water Resources  
P.O. Box 6000  
Fredericton, New Brunswick E3B 5H1

SECRETARY/TREASURER

John Metcalfe  
161 London Road  
Newmarket, Ontario L3Y 7A7

ASSISTANT SECRETARY

Donald Dunlap  
12 Seaman Street  
New Brunswick, New Jersey 08901

EDITORS

Michael Ferrick and Timothy Pangburn  
U.S. Army—CRREL  
72 Lyme Road  
Hanover, New Hampshire 03755-1290

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## THE PRESIDENT'S PAGE

The 49th Eastern Snow Conference in Oswego, New York, was an unqualified success. The significance of holding the meeting in Oswego was the 20th anniversary of our very eventful snow-bound meeting in 1972. The particulars of the 29th annual meeting are described in the paper entitled, *The February 1972 Eastern Snow Conference Weather Experience, Oswego, New York*, by R.B. Sykes, Jr. and J. Ferlito in this proceedings. On a personal note I would especially like to acknowledge Bob Sykes, who was the local arrangement committee chair for both the 29th and 49th annual meetings of the Eastern Snow Conference. Bob has exceptionally served the conference and the science of meteorology throughout his career. One of the themes of the conference this year was "Lake-Effects Snows." The papers presented within this theme and by a panel discussion held on this subject show that the "perspicacious" mentorship provided by Bob Sykes to the scientific community has never been more evident. On behalf of the Eastern Snow Conference, I would like to thank Bob for his long-standing service and friendship.

In addition to Bob, many thanks go out to the other members of the local arrangements committee and the executive committee chairmen and members. Of particular note was the excellent program that Dr. Terry Prowse, National Hydrology Research Institute (NHRI), Saskatoon, and his staff put together. And finally, I would like to thank this year's authors, presenters and members who made this Eastern Snow Conference a stimulating scientific and technical event.

As you will notice, the proceedings have changed to a double column format beginning this year. We have continued our review procedure of papers, which is described in the Editor's Page of this proceedings. The editors welcome any comments and suggestions from the membership dealing with the review procedure. As a result of this review, the Honor Paper Award was given to the excellent paper entitled, *Environmental Isotope Hydrograph Separation During Snowmelt in a Suburban Catchment*, by J.M. Buttle, A.M. Vonk, and C.H. Taylor.

The research committee continued to cultivate student involvement by reaching an increasing number of U.S. and Canadian universities. It was decided that the student papers be reviewed by the general membership in addition to the Research Committee. This year the Research Committee judged that D.W. Cline of the Department of Geography, University of Colorado, should be the recipient of the Student Paper Prize for his paper, *Modeling the Redistribution of Snow in Alpine Areas Using Geographic Information Processing Techniques*.

The Snow Survey Committee distributed the Snow Survey schedule to the five regional centers in Canada and the United States. The committee is reviewing inclusion of remotely sensed snow data in its yearly presentations. The Equipment Committee, in addition to its normal duties, is working toward preparation of equipment displays for the 50th Eastern Snow Conference. It was decided that the Steering Committee conduct a review of the "duties of officers" of the Eastern Snow Conference. This review is proceeding and any comments or suggestions from the membership are welcome.

Preparations for the 50th Anniversary Meeting of the Eastern Snow Conference in 1993 are well under way. The 50th Conference will be a joint meeting with the Western Snow Conference in Quebec City, 7-10 June 1993. Members of the Western Snow Conference have generously worked with us to plan what is hoped to be an exceptional 50th Anniversary occasion. We'll look forward to seeing you all there.

Timothy Pangburn  
President  
Eastern Snow Conference