

**Proceedings of the
FIFTY-SIXTH ANNUAL**

EASTERN SNOW CONFERENCE

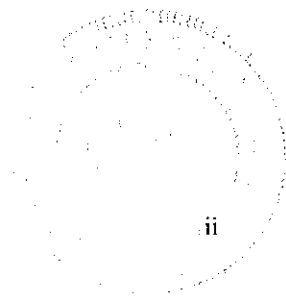
**June 2-4, 1999
Fredericton, New Brunswick, Canada**

ISBN 0-920081-21-5

ISSN: 0424-1932

Proceedings of the Eastern Snow Conference

Printed and Bound in United States of America



FOREWORD

This proceedings volume contains papers presented at the 56th annual Eastern Snow Conference (ESC) held in Fredericton, New Brunswick, Canada, June 2-4, 1998. The ESC is a forum that brings the research and operations communities together to discuss recent work on scientific, applied, and operational topics related to snow and ice. Typical presentations at the conference include studies of the physics of snow and ice, snow removal, meteorological forecasting, river ice control, hydrochemical response of snow melt, and remote sensing of snow and ice. The conference program includes oral and poster presentations, as well as displays of scientific equipment.

Last year's executive committee voted to change the review process and paper format, as well as to include abstracts and extended abstracts along with full papers in the proceedings. The review process is now optional and the format of the papers is a simpler single column. We hope these changes encourage more submissions of both operational and scientific content. This year the proceedings contain 22 full papers, 4 extended abstracts, and 9 abstracts. ESC 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 appear both in these proceedings and in the December 1999 issue of *Hydrological Processes*.

We thank members of the Technical Publishing section at the U.S. Army Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center. Over the years this group has contributed considerable time to this publication and has enhanced the quality of these proceedings. The editors especially thank Edmund Wright (posthumously), Mark Hardenberg, and Donna Valliere for their efforts in the final production of these proceedings.

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 and the American Water Resources Association. Publication of these proceedings is made possible by membership fees and by Corporate Memberships held by:

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We look forward to the first meeting of the new millennium with the 57th ESC meeting, in Syracuse, New York, U.S.A., in May 2000.

Susan Taylor
Editor

Janet Hardy
Editor

**These Proceedings are Dedicated to
Robert B. (Bob) Sykes Jr. — ESC Life Member
1917–1999**

On January 29, 1999, the Eastern Snow Conference lost a Life Member and one of the pillars of the organization with the passing of Bob Sykes. Bob's long involvement in the ESC dates back to 1964, when he was teaching meteorology at the State University of New York College at Oswego following retirement from the United States Air Force. In subsequent years, Bob developed the reputation as one of the founding fathers of lake effect snow forecasting, and was renown for the passion and excitement he brought to the study of snowfall. An eloquent testimonial to Bob's professional career in the military, as a professor, and as a researcher was provided by two of his students, Tom Niziol and Dave Eichorn, in the attached tribute published in the June 1999 edition of the *Bulletin of the American Meteorological Society*. Over the years, Bob was a steadfast supporter of the ESC and strove constantly to keep the organization collegial, caring, and compassionate in all its activities. We all have vivid memories of Bob, his exploits, and his stories (the Land Rover; his knighting by the King of Denmark; the famous 1972 Oswego Meeting of the ESC that Bob organized; the perennial announcement for ESC snowflake plates and invitation to join an expedition to see an eclipse of the sun). Bob brought color, life, caring, and enthusiasm to the ESC and we will miss him. The following contribution from ESC life member, Dr. Austin Hogan (CRREL retired), provides some additional insights into Bob's achievements during his distinguished career in the U.S. Air Force.



"Bob Sykes was a great story teller; his stories had great detail but little time compression. The following compresses nearly 35 years of stories to provide an insight to Sykes' career prior to his joining the faculty at Oswego, and his long association with ESC. Sykes joined the Army Air Corps as a lieutenant and meteorologist after graduation from Brown University and prior to U.S. entry into World War II. He was sent to Greenland to support the aerial delivery of airplanes from the United States to Great Britain through lend-lease, although the U.S. was officially "neutral" at this time. The access to build U.S. airfields and meteorological stations was negotiated with the Danish Government in exile, as Denmark had been captured early in the war. The meteorological stations and airstrips were extended northward along both coasts of Greenland to provide havens for aircrews ferrying airplanes through severe high latitude weather. The meteorological skill demonstrated in locating oases of clear air beneath near continuous Arctic stratus is among the greatest achievements of the profession. Sykes was a member of a shipboard party commanded by Colonel Elliott Roosevelt (the president's son) looking for a suitable airstrip site in Sonderstrom Fjord on 7 December 1941. The message notifying them of the Pearl Harbor attack ordered them to radio silence and full wartime alert. They returned to Bluie West (Eriksfjord) without lights. Sykes remained at Bluie West One for the duration of the war, becoming senior meteorologist for Greenland. He guided countless crews to openings in the clouds leading to the refueling station, and then briefed them on the weather ahead of them over the Atlantic. A large fraction of the U.S. Air Force bombers operating from England through World War II arrived there after refueling in Greenland. The Air Force took advantage of Sykes' experience as a polar meteorologist, and he served at several far northern air bases through the remainder of his career. He served as meteorological liaison to the Canadian Meteorological Service, coordinating Arctic soundings with Bloor Street during the continuous airborne bomber alert of the first years of the Cold War. He retired as a Lieutenant Colonel, prior to building his home, the first house on Brown Drive, and starting his second life as Professor and student of snowfall."

Robert Brown Sykes Jr., Weatherman, 1917–1999

Tom Niziol and Dave Eichorn (Bulletin of the American Meteorological Society, 80(6), 1170-1171).

Robert B. Sykes Jr. passed away on 29 January 1999 at Hepburn Medical Center in Ogdensburg, New York. He was revered as one of the "grandfathers" of lake effect snow forecasting around the eastern Great Lakes. As a researcher, he laid the foundation for the understanding of the atmospheric processes responsible for the development of these mesoscale events. As a professor and friend, Bob had the uncanny ability to instill that sense of joy and wonder that observing the weather has to offer.

Sykes was born 29 June 1917. He graduated from Horace Mann Academy and Brown University and received a Master's degree in meteorology from New York University in 1941.

His lifelong vocation and avocation was the weather. He was commissioned in the U.S. Army Air Corps in 1941 and later in the U.S. Air Force where he served through 1946, specializing in arctic weather. He was responsible for the setup of weather stations across Greenland during World War II. After the war, he was knighted by the King of Denmark for meteorological services rendered. He remained in the Air Force with tours of duty at Andrews Air Base and Weisbaden and Heidelberg, Germany, through his retirement in 1961.

After retiring from the air force he moved to Oswego, New York, a mecca for lake effect snow.

Sykes taught meteorology at the State University of New York at Oswego (SUNY Oswego) until 1983. While at the college, he initiated and conducted research projects on lake effect snow. His tremendous dedication to detail was reflected in the hundreds of thousands of weather observations that he recorded by hand during lake effect storms. Some of the data were actually entered into his log books at 15-second intervals during these heavy snowstorms. In the mid-1960s, he single-handedly set up a mesonet network of over 70 observational sites around the eastern half of Lake Ontario to study this phenomenon. As a result of the scientific knowledge gathered from the network, he was one of the first researchers to identify and describe the mesoscale convergence zone that fuels single-banded lake effect snowstorms on the eastern Great Lakes. For many years he broadcast local weather forecasts on WSGO radio across central New York state.

One of Syke's greatest characteristics was his ability to treat weather forecasting as an art as well as a science. He truly enjoyed observing the state of the sky and taught so many students to gather information through all of their senses. Many of his students still recall their days when Sykes would begin class on the roof of the meteorology building overlooking Lake Ontario and teach his students to truly "observe" the weather.

He was an incredible inspiration to his students, whom he treated as his own children. Bob kept in touch with many of his former students right up to his death, discussing the current weather, the state of weather forecasting as a whole, and the science of meteorology. He had that rare ability to pass on his enthusiasm about the weather and this is one reason why so many of his former students remain in the field of meteorology today.

Sykes was a member of the AMS as well as a charter member of the Eastern Snow Conference, where he presented many interesting and entertaining talks throughout the years. Recently, he was a keynote speaker for The U.S./Canadian Great Lakes Workshop on Operational Meteorology.

Among his other varied interests were exotic woods of the world, classical music, solar eclipses, traveling and photography. He was a member of the Explorers Club and as a youth was an Eagle Scout. Bob was a member of the Church of the Resurrection in Oswego.

Bob married Marie Louise Lips on 20 January 1945. They had four children: Barbara, Robert Bruce, Fred, and Cindy. His wife and youngest daughter predeceased him in 1976 and 1989, respectively. He married Gerda Hagerty in 1982. She passed away in 1984. He is survived by three children, nine grandchildren and many friends.

A scholarship fund has been set up in Bob's name through the meteorology department at SUNY Oswego. For more information about the fund, contact The Oswego College Foundation, Inc., King Alumni Hall, State University of New York at Oswego, Oswego, NY, 13126; e-mail: alumni@oswego.edu.

Edmund Wright

Ed Wright, a 24-year employee of the Cold Regions Research and Engineering Laboratory (CRREL), died this October. Ed's connection with the Eastern Snow Conference began over 10 years ago, when Mike Ferrick and Tim Pangburn, both of CRREL, began editing the ESC Proceedings. Since that time, Ed, along with Sandy Smith and Donna Valliere, took on the major task of producing the Proceedings. This volume was nearly complete at the time of his death.

As an editor he did much more than just give editorial suggestions. He tried to understand and follow the science and emphasized the importance of simplicity and clarity. He helped work each paper into shape. When approached last year about simplifying the formatting procedures (i.e., the single-column format), he discouraged any changes toward a less professional look, but reluctantly accepted our desire for a simple format. Dedication, hard work, a commitment to excellence, and the ability to meet deadlines in support of the technical staff are the traits of a professional. Both the ESC and CRREL owe Ed a very large THANK YOU. With his gentle demeanor, Ed seemed unconcerned about being known, but did successfully strive to be worth knowing. He will be remembered and greatly missed.





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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), also 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. All 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-région est (ESC) est une organisation américano-canadienne fondée dans les années '40 et dont les membres provenaient à l'origine surtout de l'est de l'Amérique-du-Nord. Actuellement, les membres, qu'ils soient chercheurs, techniciens en enneigement, ingénieurs, techniciens, professeurs, étudiants, ou spécialistes des services d'exploitation et d'entretien, viennent non seulement d'Amérique du nord, mais aussi du Royaume Uni, du Japon, et d'Allemagne. Le Colloque sur la neige-région ouest (WSC), aussi une organisation américano-canadienne, est l'homologue de l'ESC pour l'ouest nord-américain. Tous les cinq ans, l'ESC et la WSC organisent des réunions en commun.

Le Colloque sur la neige-région est un forum qui rassemble chercheurs et responsables des services d'exploitation pour discuter des travaux récents sur les problèmes scientifiques, opérationnels ou autres dus à la neige et à la glace. Le site de cette réunion annuelle alterne entre les Etats 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 Etats Unis et son équivalent au Canada, le CISTI.

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1998-1999

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* Deceased 01/29/1999

THE PRESIDENT'S PAGE

The 56th Eastern Snow Conference in Fredericton, New Brunswick, was from all accounts an unqualified success, and one of the best attended ESC meetings in recent years. The executive should be encouraged by several notable features of the Fredericton meeting: 1) the wide diversity of presentations (what the ESC is all about), 2) a noticeable increase in the presence of the operational community, and (3) a strong contingent of student presenters who incidentally gave some of the best presentations. The fine facilities at the Lord Beaverbrook Hotel also contributed, and the local arrangements committee (Jim Devenney, Fred Harriman, Darryl Pupek, Bill Richards, Pat Tang) did a superb job. Special recognition is also given to New Brunswick Environment for providing the registration package satchels, and to New Brunswick Power (and tour leader Fred Harriman) for the post-conference guided tour of Mactaquac Dam.

This year's executive reflects the strong presence of women scientists in snow studies with Dorothy Hall (NASA) moving to President, Mary Albert (CRREL) to Vice-President, and Suzanne Hartley (Morehead State University) remaining on as Chair of the Research Committee. Janet Hardy (CRREL) will take over from Susan Taylor (CRREL) as Editor of the ESC Proceedings. Susan has looked after the Proceedings for six years, and deserves special recognition for the outstanding job she has done. John Pomeroy was nominated as Chair of the Steering Committee and will be responsible for the technical program for ESC 2001, which is planned to be held in Ottawa in association with the Canadian Geophysical Union. John recently won a university faculty position in Wales, but is committed to maintaining his ESC involvement. As John put it, "I will be closer to eastern North America in Wales than I was at Saskatoon." Austin Hogan has agreed to stay on for an additional year as U.S. Secretary-Treasurer, but we need to look for a replacement after ESC 2000. Miles Ecclestone was unable to attend the meeting due to family illness, but agreed to act as Canadian Secretary-Treasurer for an additional year. Our thanks to both Austin and Miles for the important work they do keeping us in the black! Bert Davis was unanimously voted (in absentia) to serve another term as Chair of the Technical Committee to continue his efforts to gain more corporate sponsors and greater involvement from the operational community. I have moved over to play a sideline advisor's role as past-president, but not before the "field work Mafia" foisted the Sno-Foo award on me for the dubious distinction of never having dug a snowpit or snowshoed a snow course. This marks the first year the Sno-Foo award was given for NOT doing something!

The 1999 Student Paper Award and Wiesnet Medal were won by Stephan Brettschneider from the Université du Québec à Chicoutimi for his paper on the "Study of Ice Surface Breakdown using Ultra-High Speed Photography". This paper presented results of an innovative approach to document and understand the process of arc propagation on ice surfaces associated with insulator flashover during atmospheric ice accretion events. Suzanne Hartley reported that the four papers submitted for this year's Award were of a very high quality, and that the research committee was unable to decide on a runner-up. The committee therefore recommended that all three papers be accorded runner-up status and receive special mention: Chris Derksen (U. Waterloo), Danielle DeSève (U. Québec) and Steven Fassnacht (U. Waterloo).

It was a great honour and pleasure for me at the ESC banquet to award Austin Hogan life membership in the ESC for his outstanding dedication and service. Austin has a long history with the ESC, and played a crucial role in keeping the organization alive during the 1990s. Thank you Austin for your enthusiasm and unflagging support. Austin is the first new Life Member since this award was created in 1993, and it was agreed by the Executive that life membership would be reviewed annually by a past president in consultation with other past presidents, and reported on at the post-conference executive meeting. It was a pleasure to see Life Members Art Eschner and Hilda Snelling at the meeting, but we missed the distinctive voice and personality of Life Member Bob Sykes who sadly passed away in early 1999. Bob was a real pillar of the ESC, and has rarely missed a meeting since his first involvement with the organization in the 1960s. This proceedings volume is dedicated to the memory of Bob who brought so much colour and life to the ESC over the past three decades.

The 57th Eastern Snow Conference (ESC) will be held in Syracuse, New York, 17-19 May 2000. This year's theme is "Snow and Ice: Properties, Processes, Problems & Prospects" and I hope to see you there in Profusion! Please consult the ESC website at <http://www1.tor.ec.gc.ca/crysys/esc/> for announcements and travel information.

Lastly, thank you all for being such a great group of people to work with.

Cheers,
Ross Brown
56th President, Eastern Snow Conference



Remote Sensing Studies of Snow and Ice

