Proceedings of the
71st ANNUAL
EASTERN SNOW CONFERENCE
3-5 June 2014
Appalachian State University, Boone
North Carolina, USA
CONTENTS

Foreword.......................................................................................................................................................... v
Statement of Purpose .......................................................................................................................................... vii
Executives for the 71st Eastern Snow Conference ........................................................................................... viii
President’s Page .................................................................................................................................................. x

Weisnet Medal for Best Student Paper
Spatiotemporal Snowfall Trends in Central New York
JUSTIN J. HARNETT, JENNIFER M. COLLINS, MARTIN A. BAXTER, AND DON P. CHAMBERS ................. 3

David Miller Award for Best Student Poster
Improvements to ASTER elevation models for applications in Glaciology
LAURA THOMSON AND LUKE COPELAND................................................................................................. 15

Campbell Scientific Prize for Best Canadian Student Paper
Radar observations of seasonal snow in an agricultural field in S. Ontario during the 2013-2014 winter season
AARON THOMPSON, RICHARD KELLY, AND ANDREW KASURAK ....................................................... 23

Oral session #1: Remote Sensing of Snow and Ice
An operational snow covered area mapping algorithm for MODIS snow products
MORRISS, B.F., OCHS, E., DEEB, E.J., NEWMAN, S.D., DALY, S.F., AND GAGNON, J.J. ......................... 34

Poster session #1: Snow Measurement, Modeling, and Runoff
An Indirect Method for Predicting Road Surface Temperature in Coastal Areas with Snowy Winters
JASON COVERT AND ROBERT HELLSTRÖM ................................................................................................. 40

Coming soon to a website near you! Resources for ESC researchers
MILES ECCLESTONE, GRAHAM COGLEY and PETER ADAMS .................................................................. 47

Oral session #2: Snow in the Appalachian Mountains
Relationships between meteorological factors and societal impacts associated with winter storms in the
Southeast United States: Preliminary results from Atlanta, GA
JACOB RADFORD, CHRIS FUHRMANN, CHARLES KONRAD ....................................................................... 62
Oral session #3: Snow hydrology

Stable Water Isotope (O and H) Evolution of a Boreal Snowpack
KRYSepH J. CHUTKO, APRIL JAMES, AND BRITTANY RUNDLE ................................................................. 70

Flood Monitoring during the Snowmelt Period using Remotely Sensed MODIS Snow Products:
Case Study of the Nechako Reservoir, Canada
GINO-KARL MARCIL, MÉLANIE TRUDEL AND ROBERT LECONTE ............................................................... 75

Poster session #2: Precipitation, Climatology, and Impacts of Snow

Precipitation and Snowfall Trends in NYC Watersheds and Northeastern United States of America
SONI M. PRADHANANG, DONALD C. PIERSON, MARK S. ZION AND ELLIOT M. SCHNEIDERMAN ............ 94

Winter in New France: a constant battle (1535-1763)
JERRY TOUPIN ............................................................................................................................................. 100

Oral session #4: Methods, Techniques, and Models

Synthesis of Best Practices in Snow and Ice Removal
SOUHAIL ELHOUAR, YASSER KHODAIR, YOON-SI LEE, AND TIM PETERS ........................................................... 106

Oral session #5: Snow & Ice in Mountain Regions

Evaluating development of annual mass balance-accumulation area ratio relationship using annual and transient values
MAURI PELTO ...................................................................................................................................................... 112

Tracking Seasonal Appalachian Snow Cover with MODIS Daily Snow Cover Product
GEORGE RIGGS AND DOROTHY K. HALL ........................................................................................................ 121

Sub-regional Snow Cover Distribution across the Southern Appalachian Mountains
JOHNATHAN W. SUGG, CHRISTOPHER M. FUHRMANN, L. BAKER PERRY, DOROTHY K. HALL, AND CHARLES E. KONRAD II ................................................................................................................ 130

Snow probability for snow covered area detection
AHMET EMRE TEKELİ, İBRAHİM SÖNMEZ AND ERDEM ERDİ ........................................................................ 144

Poster session #3: Remote Sensing of Snow and Ice

The Recessions of the Pasterze Glacier, Austria, using Satellite Imagery from 1972 to Present related to increased Minimum Air Temperatures
KLAUS J. BAYR, DOROTHY K. HALL, BRIAN JONES ..................................................................................... 148

Session #6: Snow & Ice in the Tropical Andes Mountains

From glaciers to the desert: Assessing hydrologic change and social vulnerability across a tropical Andean waterscape
BRYAN MARK, MICHEL BARAER, KYUNG IN HUH, MARK CAREY, ADAM FRENCH, JEFF BURY, KEN YOUNG, JEF MCKENZIE, ALEX EDDY, ALFONSO FERNANDEZ AND OLIVER WIGMORE ........................................................................ 157

Sno-Foo Award.................................................................................................................................................. 167
FOREWARD

This proceedings volume contains papers presented at the 71st Eastern Snow Conference (ESC) held 3-5 June 2014 at the Appalachian State University, Boone, North Carolina, 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 were invited in the option to submit papers relevant to winter hydrology to the international journal, Hydrological Processes, although no special issue for ESC was planned for 2014. The ESC special issue committee is currently investigating alternate journals in which we hope to have a special issue for ESC 2015.

We thank members of ESC executive committee (M. Ecclestone, B. Perry) for outstanding effort in publishing ESC 2013 proceedings, while being heavily involved in the 2014 edition. Over the years, the proceedings committee has contributed considerable time to this publication and has enhanced the quality of these proceedings.

The 2014 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 72nd Eastern Snow Conference meeting to be held 4–6 June 2015 at Jouvence Centre de Villégiature, Orford, Québec, Canada. The conference will be organized by the Université de Sherbrooke, with a general theme of the meeting being: “Snow remote sensing and measurements”

Alex Langlois
ESC Proceedings Editor and 2014 President
CARTEL, Université de Sherbrooke
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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L’ESC 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 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 71st annual meeting of the Eastern Snow Conference was held at the Appalachian State University, in Boone, North Carolina. Nestled in the Blue Ridge Mountains of North Carolina, the Appalachian State University offers fantastic scenery whilst promoting leading edge research efforts, a fundamental mission to the University.

The conference had participants from the United States and Canada, as well as from Europe. We had a very successful technical program, consisting of 33 oral presentations and 28 poster presentations. As always, one of the highlights of the conference was the large number of excellent student presentations. The following students received awards at the annual banquet:

- The Don Wiesnet award for the ESC Student Paper competition was given to Justin Hartnett from Syracruse University. Runner-ups: Jacob Radford from the University of North Carolina at Chapel Hill, and Melissa Wrzesien from the Ohio State University. Both Jacob and Melissa received free registration for ESC 2015.
- The Robert Miller Award for Best Poster Presentation was given to Laura Thompson from the University of Ottawa.
- The Campbell Scientific Canada Award for the paper demonstrating innovative technical expertise in data collection was given to Aaron Thompson from the University of Waterloo.

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 71st ESC such a great success:

- The overall ESC executive and long lasting members who are always more than happy to contribute and help in any possible;
- The local arrangements committee with Baker Perry, Christopher Fuhrmann, and Dorothy Hall. The ESC acknowledges the tremendous support from Amy Sanders and Courtney Cooper who helped make ESC a great success in 2014.

As president of the ESC, I also had the pleasure of introducing Dr. Barry Goodison as a lifetime member of the ESC in recognition of his long-standing scientific and administrative contributions to the ESC and particularly his outstanding career as a snow scientist. Dr. Mauri Pelto also presented the coveted Sno-Foo Award to Dorothy Hall for an apparent aversion to direct contact with snow and ice on the MODIS website…as well as on a presentation in an international snow conference. The highlight of the banquet was the keynote talk by Nolan Doesken from the Colorado State University entitled: ‘For the love of snow’. The ESC is very grateful to Nolan for a very entertaining, historical and informative presentation.

The ESC 2104 was an outstanding success, and it seems to me that the quality of research (especially students) is increasingly impressive which is great for the snow community. On this note, I hope the ESC success will continue in Orford for the 2015 edition. It will be organized by the Université de Sherbrooke and being on the local committee for 2015, I hope to see you all there at the great Jouvence venue.

Alexandre Langlois, 2014 ESC President