78th Annual Eastern Snow Conference 2022

Online
1 – 8 June 2022

ISBN: 978-1-7138-6653-4

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2022) by Eastern Snow Conference
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

For permission requests, please contact Eastern Snow Conference
at the address below.

Eastern Snow Conference
C/O Dr. Krystopher Chutko
117 Science Pl-Dept. Geography
Saskatoon, Sk, Canada S7N 5C8

https://www.easternsnow.org/

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

CONTENTS

Foreward xi

Statement of Purpose xiii

Executives for the 78th Eastern Snow Conference xv

President's Page xvii

Life Members xix

Awards xxi

Session #1: ESC General Session

Conductive Heat Flow through Temperate Region Lake Ice 3
LAURA ALVAREZ SALINAS AND LAURA BROWN

Monitoring Freshwater Lake Ice Thickness and Ice Bottom Roughness in Central Ontario 4
NOAH BACAL AND LAURA BROWN

Observationally Constraining a Snow-on-Sea-Ice Model to Estimate Arctic Snow and Sea Ice Thickness with Associated Uncertainties 5
ALEX CABAJ, PAUL KUSHNER, AND ALEK PETTY

Evaluating Fourteen Gridded SWE Products using Airborne Gamma Radiation SWE and Snow Course Transects 6
EUNSANG CHO, COLLEEN MORTIMER, LAWRENCE MUDRYK, CHRIS DERKSEN, CARRIE VUYOVICH, AND MIKE BRADY

How do Microwaves Interact with Freshwater Ice, and Why is it so Important? 7
GRANT GUNN AND JAKE FERGUSON

Comparison of VIIRS and NOAA/Rutgers IMS Snow-Cover Frequency Maps of North America 8
DOROTHY HALL, GEORGE RIGGS, NICOLO DIGIROLAMO, THOMAS W. ESTILOW, AND DAVID ROBINSON

Development of Snow Wetness *In Situ* Data Distribution Survey 14
VICKI JAGDEO, MAHBOUBEH BOUESHAGH, JOAN RAMAGE, MARY BRODZIK, AND ELIAS DEEB

DeepPrecip: A Deep Neural Network for Retrievals of Precipitation 15
FRASER KING, GEORGE DUFFY, LISA MILANI, CHRISTOPHER FLETCHER, CLAIRE PETTERSEN, AND KERSTIN EBELL

Snow Depth on Sea Ice Record from 1955-2019 in the Canadian Arctic and Development Plans for Multi-Satellite Snow Depth Retrieval 16
HOI MING LAM, TORSTEN GELDSETZER, STEPHEN HOWELL, AND JOHN YACKEL

Remote Sensing of Snowscapes and Caribou (*Rangifer tarandus*) Movement in the Northwest Territories of Canada 17
MARIAH MATIAS, JOAN RAMAGE, MARY BRODZIK, AND KRISTEN HEROY

Local Scale Soil-Snow Interaction and the Impacts of Soil on Snow 18
MAHSA MORADI, JENNIFER JACOBS, AND ADAM HUNSAKER

Remote Sensing Methods for Quantifying Snow Water Equivalent at the Bay of Quinte (Ontario) and for Lake Erie Watershed (Ontario) 19
FÉLIX OUELLET AND AGNES RICHARDS

Overview of SnowEx Field Campaign in Northern Alaska, U.S. 20
CARRIE VUYOVICH, SVETLANA STUEFER, HANS PETER MARSHALL, MICHAEL DURAND, KELLY ELDER, DRAGOS VAS, ARTHUR GELVIN, BATUHAN OSMANOGLU, CHRISTOPHER LARSEN, STINE PEDERSEN, DANIEL HODKINSON, AND ELIAS DEEB

Using Unpiloted Aerial Systems Structure from Motion Photogrammetry for Avalanches in Mount Washington, NH 21
CAMERON WAGNER, ADAM HUNSAKER, TIM HOHENEDER, AND JENNIFER JACOBS

Tundra Snow Depth Retrievals from Wideband Radar Observations in Trail Valley Creek 22
WEI WANG, RICHARD KELLY, AND JOSHUA KING

Enabling Low Latency Snow Pit Data 42
PUNEETH YOGANANDA, ROGER DE ROO, RUZBEH AKBAR, AND AGNELO SILVA

The Relationship Between Arctic Oscillation and Intense Cyclone Patterns and their Impacts on Summer Precipitation Distribution in the Canadian Arctic 43
XIAOMENG ZUO AND LAURA BROWN

Session #2: *In situ* Measurement of Snow and Solid Precipitation: Advances, Challenges, and Ongoing Issues

What if you put a Phone on a Drone? 47
FRASER KING, RICHARD KELLY, AND CHRISTOPHER FLETCHER

Transfer Function Development for Adjusting Precipitation Observations in Arctic and Maritime Climate Conditions 48
EVA MEKIS, AMBER ROSS, AND CRAIG SMITH

Snow Specific Surface Area: Margins of Error and Best Methods for the IceCube by A2 Photonic Sensors 49
KAITLIN MEYER AND MICHAEL DURAND

Traceability and Catch-Efficiency of the Lambrecht rain[e]H3 Automated Precipitation Gauge for Measuring Precipitation in Canadian Operational Networks 50
AMBER ROSS, EVA MEKIS, AND CRAIG SMITH

Assessing the Impact of Transition from Single Alter-Shielded Geonor T-200B to Double Alter-Shielded Pluvio^{2}L Gauges on Winter Precipitation Measurements in the ECCC Operational Network 57
CRAIG SMITH, AMBER ROSS, AND EVA MEKIS

Session #3: Monitoring and Modeling Cryospheric Change

Spatial Variability of Lake Ice Thickness and Phenology on Sub-Arctic Lakes in Yellowknife, Northwest Territories 61
GIFTY ATTIAH, HOMA KHEYROLLAH POUR, AND ANDREA SCOTT

Diagnosing the Future Hydrology of a Central Asian Glacierized Basin using a Hydrological-Glaciological Land Surface Model 62
OKAN AYGÜN, JOHN W. POMEROY, MARTYN P. CLARKE, AND ALAIN PIETRONIRO

Investigating the Impact of Snow Cover on Permafrost Soil Temperatures in Modern Reanalysis and Data Assimilation Systems 63
TYLER HERRINGTON, CHRISTOPHER FLETCHER, AND ANDRE ERLER

Cryospheric Observation and Modeling for Improved Adaptation in Central Asia (CROMO-ADAPT) 64
MARTIN HOELZLE, MARTINA BARANDUN, CHRISTIAN HAUCK, CHRISTIN HILBICH, JOEL FIDDES, TAMARA MATHYS, ENRICO MATTEA, RODICA NITU, JEANNETTE NOETZLI, ERIC POHL, AND TOMAS SAKS

Comparison and Calibration of a Temperature-Index based Coupled Glacier Mass Balance Dynamic Evolution Model and Applications in Regional Melt Projections 65
AMANDA KOTILA, ANDREW BUSH, AND MONIREH FARAMARZI

Changing Arctic Snow and Ice: *In situ* Monitoring using Digital Imagery 66
BRIANNA LANE AND LAURA BROWN

Projection of Lake Ice Thickness and Phenology under Representative Concentration Pathways (RCP) Scenarios: Great Slave and Great Bear Lakes, Northwest Territories 67
ARIANA MANSINGH, HOMA KHEYROLLAH POUR, AND GIFTY ATTIAH

Comparaison de la Performance de Modèles Empiriques de Bilan de Mass Glaciologique en Réponse au Changement Climatique 68
LISA MICHAUD AND CHRISTOPHE KINNARD

Forward Modeling of SAR Backscatter during Lake Ice Melt Conditions using the Snow Microwave Transfer (SMRT) Model 69
JUSTIN MURFITT, CLAUDE DUGUAY, JUHA LEMMETYINEN, AND GHISLAIN PICARD

Heat Wave Impacts on Glacier Mass Balance, Glacier Runoff, and Salmon in Nooksack River, Washington 70
MAURI PELTO, MARIAMA DRYAK, AND JILL PELTO

Evaluation of Snow Depth Derived from Ground Penetrating Radar on Canadian Subarctic Lakes 71
ALICIA POUW, HOMA KHEYROLLAH POUR, AND ALEX MACLEAN

Improving Lake Ice Simulations in Canada based on Lake Size 72
ALEXIS ROBINSON AND LAURA C. BROWN

Recommendations to Enhance Hydrological Models for Improved Estimates of Climate Impacts on Northern Waters 73
ROBIN THORNE, PHILIP MARSH, DAVID RUDOLPH, CHRISTOPHER SPENCE, OLIVER SONNENTAG, JEFFREY MCKENZIE, AND AARON BERG

Variability in Thermokarst Lake Size, Elevation, and Connectivity in the Western Canadian Arctic 74
ROSAMOND TUTTON, PHILIP MARSH, AARON BERG, RODERICK MELNIK, BEN DEVRIES, AND BRANDEN WALKER

Why do Simulated Trends of Arctic Sea Ice Drift Speed go from Positive in the 20th Century to Negative in the 21st Century? 75
JAMIE WARD AND NEIL TANDON

Multi-Method Approach to Inventorying Rock Glaciers and Features of Interest in Banff and Jasper National Parks, Alberta, Canada 76
MISHELLE WEHBE, PHILIP BONNAVENTURE, AND ROBERT WAY

Session #4: Novel Approaches in Season Snow: Field Measurements, Remote Sensing, Modeling, and Data Assimilation and Analytics

Retrieval of Snow Water Equivalent from SWESARR Measurements in Grand Mesa Colorado, SnowEx 2020 79
MICHAEL DURAND AND BATUHAN OSMANOGLU

Predicting Surface Density using Snow Models and Assimilation for Wildlife Applications 80
MICHAEL DURAND, JACK DECHOW, JESSICA LUNDQUIST, LAURA PRUGH, BEN SULLENDER, CASSIE LUMBRAZO, KATIE BREEN, AND CALUM CUNNINGHAM

Quantifying Volumetric Scattering Bias in ICESat-2 Altimetry over Snow-Covered Surfaces 81
ZACHARY FAIR, MARK FLANNER, CARRIE VUYOVICH, TOM NEUMANN, BENJAMIN SMITH, AND ADAM SCHNEIDER

Using Machine Learning to Estimate Snow Cover from Ground Surface Temperature Measurements 82
ANIKA FORGET, ROBERT WAY, AND ROSAMOND TUTTON

The Airborne Cryosphere-Observing Synthetic Aperture Radar System (CryoSAR): A Snow, Soil, Sea Ice, and Lake Ice Observing System 83
RICHARD KELLY, AARON THOMPSON, ADRIANO META, JIM HODGSON, ALEXANDRE LANGLOIS, ALEXANDRE ROY, LAURA BROWN, AARON BERG, AND CHRIS DERKSEN

Advances in X- and Ku- Band Radar Algorithms for SWE Retrieval by Future Satellite Missions 84
EDWARD KIM, DK KANG, FIROZ BORAH, AND LEUNG TSANG

Spatiotemporal Assessment of Snow Density and Snow Water Equivalent (SWE) using the Cone Penetration Test (CPT) and/or Ground Penetrating Radar (GPR) 85
ADRIAN MCCALLUM

Leveraging Adaptive Viewing to Improve the Efficacy of Space-Borne Satellite Retrievals of Terrestrial Snow 86
COLIN MCLAUGHLIN, BARTON FORMAN, AND LIZHAO WANG

Assimilation of GRACE/GRACE-FO Terrestrial Water Storage Retrievals to Improve Snow Mass Estimates across North America 87
ALIREZA MOGHADDASI AND BARTON FORMAN

Climate Driven Changes in Snowpack: Simulations (1970s to 2020) for the Bay of Quinte, Ontario, Canada 88
AGNES RICHARDS, FÉLIX OUELLET, ÉRIKA BOISVERT-VIGNEAULT, XIAOYUAN GENG, AND ALEXANDRE LANGLOIS

Evaluating Passive Microwave Snowmelt Detection Methods with Ground Snow Observations 89
ANGELA RIENZO AND SAM TUTTLE

An Accurate Global Daily Snow Cover and Albedo Product from MODIS and VIIRS 90
KARL RITTGER, KEITH MUSSELMAN, MCKENZIE SKILES, NED BAIR, MARY J. BRODZIK, MARK SERREZE, STEPHANIE ABEGG, AND WILLIAM KLEIBER

DLR Global SnowPack – Possible Applications of the Near Real-Time Product 91
SEBASTIAN RÖßLER AND ANDREAS DIETZ

An Analysis of Snowpack Temperature, Density, and Cold Content across the US West from the Repurposed USGS RMS Dataset 92
JEFFREY SCHMIDT, GRAHAM SEXSTONE, AND MARK SERREZE

Modeling Snowpack Bulk Density using Snow Depth, Cumulative Degree Days, and Climatological Predictor Variables 93
ANDRAS SZEITZ AND ROBERT DAN MOORE

Soil Freeze-Thaw Detection using Sentinel-1 SAR Data in Agricultural Fields 94
SHAHABEDDIN TAGHIPOUR JAVI, CHRISTOPHE KINNARD, AND ALEXANDRE ROY

Fine-Scale Characterization of Snowpack Evolution using Unpiloted Aerial System Lidar and SfM Photogrammetry 95
MEGAN VERFAILLIE, EUNSANG CHO, JENNIFER JACOBS, ADAM HUNSAKER, FRANKLIN SULLIVAN, MICHAEL PALACE, ELIZABETH BURAKOWSKI, AND CAMERON WAGNER

Precipitation Phase from Atmospheric Model Improves Snowfall Estimates across Canada 96
VINCENT VIONNET, MARC VERVILLE, VINCENT FORTIN, FRANCOIS LEMAY, MELINDA M. BRUGMAN, AND JULIE THÉRIAULT

Estimating Snow Water Equivalent at the Watershed Scale using Drones in the Arctic Shrub-Tundra 97
BRANDEN WALKER, ROSAMOND TUTTON, AND PHILIP MARSH

An Observing Simulation System Experiment (OSSE) for Snow Mass Estimation over Western Colorado using Adaptive Viewing from Space 98
LIZHAO WANG, COLIN MCLAUGHLIN, BARTON FORMAN, SUJAY KUMAR, PAUL GROGAN, RHAE SUNG KIM, AND MELISSA WRZESIEN

Characterizing the Role of Snow for Liquid Water Storage and Transmission: A Ground-Based Sensing and Modeling Sensitivity Analysis 99
RYAN WEBB, KEITH MUSSELMAN, SIOBHAN CIAFONE, KATHERINE HALE, AND NOAH MOLOTCH

Merging Models with Observations to support Open Science, NASA SnowEx, and Snow Satellite Missions 100
MELISSA WRZESIEN, SUJAY KUMAR, CARRIE VUYOVICH, RHAE SUNG KIM, AND EUNSANG CHO

Evaluation of Three Different Machine Learning Algorithms for Snow Mass Estimation over the Colorado Rockies using Space-Based Passive Microwave Brightness Temperatures 101
BINCHENG YU AND BARTON FORMAN

Session #5: Observation and Modeling of Snow Processes: Integrating Legacy and New Tools to Advance Snow Science

Assessing the Spatial Distribution of Snow Depth in Open and Forested Environments by UAV Lidar 105
VASANA DHARMADASA, CHRISTOPHE KINNARD, AND MICHAEL BARAËR

Simple Snow Temperature Index Models Account for Important Discrepancies between Snow Water Equivalent Products 106
ALEKSANDRA ELIAS CHEREQUE, PAUL KUSHNER, CHRIS DERKSEN, AND LAWRENCE MUDRYK

Improving Snow Analyses for Hydrological Forecasting at Environment and Climate Change Canada (ECCC) 107
CAMILLE GARNAUD, VINCENT VIONNET, ÉTIENNE GABORIT, VINCENT FORTIN, MARCO CARRERA, BERNARD BILODEAU, AND DOROTHY DURNFORD

Complex Precipitation Phase and Impact on Snowpack Evolution in Eastern Canada 108
NICOLAS LEROUX, VINCENT VIONNET, JULIE THÉRIAULT, HADLEIGH THOMPSON, DOMINIQUE DROLET, LISA RICKARD, STEPHEN DÉRY, AND RONALD STEWART

Operational Water Forecast Assessment of a Spatially Distributed Process-Based Snow Model: A Case Study in the East River Watershed, Colorado 109
JOACHIM MEYER, MCKENZIE SKILES, PATRICK KORMOS, ANDREW HEDRICK, ERNESTO TRUJILLO-GOMEZ, AND SCOTT HAVENS

Simulation of Cold Processes in the CMIP6 Land-Historical Simulations 110
LAWRENCE MUDRYK, ELEANOR BURKE, GERHARD KRINNER, NATE COLLIER, CHRIS DERKSEN, AND DAVID LAWRENCE

Sno-Foo Award 111