GLOMW Schedule May 2nd to May 5th, 2022

Monday, May 2nd – Marine Forecasting

Session Chair(s) – Greg Mann, Helen Yang

11:00 A.M. to 11:15 A.M. ET	**Introduction and Welcome to the 28th GLOMW** Ryan Rozinskis		
11:15 A.M. to 11:45 A.M. ET	**ECCC-NOAA Tiger Team for Marine Forecast and Service Innovation** Andrew Teakles, Darin Figurskey	ECCC Applied Science - Atlantic Region NOAA – Ocean Prediction Center	
11:45 A.M. to 12:15 P.M. ET	**Upgrades and Improvements to the Great Lakes Wave Modeling System** Andre Van der Westhuysen, Saeideh Banihashemi	IMSG @ NOAA/NWS/NCEP/EMC Marine Modeling and Analysis Branch	
12:15 P.M. to 12:45 P.M. ET	**Operationalizing Marine "Spot" Forecasts to Support USCG Sector Sault Ste Marie** Joseph Phillips, Matthew Walter	NWS Marquette, MI US Coast Guard, Sault Sainte Marie	
12:45 P.M. to 1:30 P.M. ET	**Lunch Break**		
1:30 P.M. to 2:30 P.M. ET	**Keynote Speakers: Kevin Berberich, Jonathan Edwards-Opperman** **The Present and Future of Great Lakes Products and Services at the U.S. National Ice Center** Kevin Berberich, Jonathan Edwards-Opperman	NOAA/NWS/NCEP/OPC/Ice Services Branch	
2:30 P.M. to 2:45 P.M. ET	**Health Break**		
2:45 P.M. to 3:15 P.M. ET	**Lakeshore Flooding Over Western Lake Superior: Forecast and Impact Challenges** Justin Schultz	NWS Duluth, MN	

3:15 P.M. to 3:45 P.M. ET	**Description and Evaluation of NOAA/NOS GLOFS Experimental Ice Forecasting Guidance** Robert LaPlante	NWS Cleveland, OH
3:45 P.M. to 4:00 P.M. ET	**Health Break**	
4:00 P.M. to 4:30 P.M. ET	**Synthetic Aperture Radar Coverage for the Great Lakes: A New Source of Wind and Ice Information** Christopher Jackson, Tyler Ruff, Sean Helfrich	NOAA GOA, NOAA GST, NOAA STAR
4:30 P.M. to 5:00 P.M. ET	**Observations of Wind Using SAR data from RADARSat Constellation Mission Satellites** Scott Lindstrom, Christopher Jackson, Tyler Ruff	UW-Madison CIMSS, NOAA GOA, NOAA GST
	End of Day 1	

Tuesday, May 3rd – Marine Forecasting and Forecasting Winter Weather

Session Chair(s) –Sherry Williams, Ryan Rozinskis

11:00 A.M. to 11:10 A.M. ET	**Introduction** Sherry Williams	
11:10 A.M. to 11:40 A.M. ET	**Lake Erie Ice Rescue 22 February 2021** Kirk Lombardy	NWS Cleveland, OH
11:40 A.M. to 12:40 P.M. ET	**Panel Discussion: Solving Great Lakes Weather Challenges Over The Next 5 Years** Greg Mann, Ron Williams, Peter Kimbell, Benoit Pouliot	NWS, ECCC
12:40 P.M. to 1:30 P.M. ET	**Lunch Break**	
1:30 P.M. to 2:00 P.M. ET	**Updates From the Weather Prediction Center's Winter Weather Desk** Tony Fracasso, Alex Lamers, Greg Carbin	NWS WPC
2:00 P.M. to 2:30 P.M. ET	**Monthly Sea Level Pressure Records: Forecasting Applications** David Roth	NWS WPC
2:30 P.M. to 2:45 P.M. ET	**Health Break**	

2:45 P.M. to 3:15 P.M. ET	**Evaluating the Lake Effect Snow Forecast Capabilities of NOAA's Unified Forecast System** David Wright et al.	University of Michigan
3:15 P.M. to 3:45 P.M. ET	**Collective Lake Disturbances and the Relationship to "Type VI" Lake Effect Snow Events** Nathan Marsili	NWS Northern Indiana
3:45 P.M. to 4:00 P.M. ET	**Health Break**	
4:00 P.M. to 4:30 P.M. ET	**Intense Northwest Territories Snowsquall Event** Brennan Allen, Gary Lee	ECCC ASPC / ECCC PASPC
4:30 P.M. to 5:00 P.M. ET	**Period for Additional Questions**	
	End of Day 2	

Wednesday, May 4th – Summer Severe Weather, Tornadoes and Tornado Warning Improvement

Session Chair(s) – John Boris, Ryan Rozinskis

11:00 A.M. to 11:10 A.M. ET	**Introduction** John Boris	
11:10 A.M. to 11:40 A.M. ET	**S-Band Dual Polarization Radar Evaluation of the Barrie ON Tornado of 15 July 2021** Arnold Ashton, Daniel Liota	ECCC OSPC Toronto, ON
11:40 A.M. to 12:10 P.M. ET	**Lightning Jump Analysis of the Tornadic Storms in southern Ontario on 15 July 2021** Helen Yang, Lisa Alexander	ECCC Toronto, ON
12:10 P.M. to 12:40 P.M. ET	**Impact of Midlevel Shear Orientation on Downdraft Location, Tornado-like Vortex Formation and Storm Longevity in Simulated Supercells** Kevin Gray	University of Illinois
12:40 P.M. to 1:30 P.M. ET	**Lunch Break**	

1:30 P.M. to 2:30 P.M. ET	**Keynote Speaker: David Sills - We're Not in Kansas Anymore - New Insights on Northern Tornadoes**	
	David Sills	Northern Tornadoes Project (NTP)
2:30 P.M. to 2:45 P.M. ET	**Health Break**	
2:45 P.M. to 3:45 P.M. ET	**A Comparison of Hail Versus Tornado Environments Using Hodographs**	
	Cameron Nixon	Central Michigan University
3:45 P.M. to 4:00 P.M. ET	**Health Break**	
4:00 P.M. to 5:00 P.M. ET	**Panel: Tornadoes Above 40N Science and Service Challenges and Opportunities**	
	David Sills, Richard Wagenmaker, Crawford Luke, Rich Thompson	NTP, NWS, SPC, ECCC
	End of Day 3	

Thursday, May 5th

Summer Severe Weather, Tornadoes and Tornado Warning Improvement, Impact Based Forecasting and Verification and Lessons Learned From Pandemic Impacted Operations

Session Chair(s) – John Boris, Sherry Williams

11:00 A.M. to 11:10 A.M. ET	**Introduction**	
	John Boris	
11:10 A.M. to 11:40 A.M. ET	**Use of the Modified SHERBE Parameter to Identify Tornadic HSLC Low CAPE Environments - An Examination of the Oct 21 2021 Event**	
	Douglas Kahn, Patrick Saunders	NWS Clevelend, OH
11:40 A.M. to 12:10 P.M. ET	**A Historical Look at Tracking Elevated Mixed Layers Through Satellite Imagery: A Northern U.S. and southern Canadian Focus**	
	Christopher M. Gitro, Dan Bikos, Scott Lindstrom, Sheldon Kusselson	NWS Duluth, MN
12:10 P.M. to 12:45 P.M. ET	**Lunch Break**	
12:45 P.M. to 1:15 P.M. ET	**A Statistical Evaluation of NWS Impact-Based Warnings (IBW)**	
	Greg Mann, Richard Wagenmaker	NWS Detroit, MI

1:15 P.M. to 1:45 P.M. ET	**Quantified Impact Verification Efforts at the Ontario Storm Prediction Centre**	
	Ryan Rozinskis	ECCC OSPC Toronto, ON
1:45 P.M. to 2:30 P.M. ET	**Panel Discussion: Impact Based Forecast and Verification**	
	Greg Mann, Richard Wagenmaker, Ryan Rozinskis	NWS, ECCC
2:30 P.M. to 2:45 P.M. ET	**Health Break**	
2:45 P.M. to 3:15 P.M. ET	**The Ontario Storm Prediction Centre During COVID-19**	
	Ryan Rozinskis	ECCC OSPC Toronto, ON
3:15 P.M. to 3:45 P.M. ET	**NWS Operational Response to the COVID-19 Pandemic**	
	Bruce Smith	NWS Central Region Headquarters
3:45 P.M. to 4:00 P.M. ET	**Health Break**	
4:00 P.M. to 4:30 P.M. ET	**Open Forum Discussion: Two Years of Pandemic Impacted Operations**	
4:30 P.M. to 4:45 P.M. ET	**Wrap Up GLOMW 2022**	
	GLOMW Planning Committee	

GLOMW Abstracts May 2nd to May 5th, 2022

Monday, May 2nd – Marine Forecasting

11:00 A.M. to 11:15 A.M. ET

Introduction and Welcome to the 28th GLOMW

11:15 A.M. to 11:45 A.M. ET

ECCC-NOAA Tiger Team for Marine Forecast and Service Innovation

The ECCC-NOAA collaboration is a formal and long-standing cooperation to facilitate collaboration on weather, climate, ocean, and other Earth systems for the enhancement of health, safety, and economic prosperity of both Canada and the United States. The ECCC-NOAA Tiger Team is a working group under the Marine Forecast Project of the ECCC – NOAA Cooperation Steering Committee. Currently, the focus of the Tiger Team is on two key projects related to the development of a dangerous seas product and exploring the use of probabilistic forecast products for the marine community. These pilot projects plan to deliver prototypes over the Great Lakes in the near future, and extend the work afterwards to the open ocean where the environment is more complex. A key aspect to both projects is to gather insights and feedback from the marine forecast community on the development work. The insights and feedback will guide next steps for both projects. The presentation will provide an opportunity to learn more about the ECCC-NOAA Tiger Team, provide updates on our current projects, and discuss next steps towards marine forecast and service innovation.

Andrew Teakles, Darin Figurskey

ECCC Applied Science - Atlantic Region
NOAA – Ocean Prediction Center

11:45 A.M. to 12:15 P.M. ET

Upgrades and Improvements to the Great Lakes Wave Modeling System

Andre Van der Westhuysen1, Saeideh Banihashemi1
1IMSG @ NOAA/NWS/NCEP/EMC Marine Modeling and Analysis Branch

Wave conditions affect various stakeholders on the Great Lakes, ranging from commercial tanker and barge operators to recreational boaters and beachgoers. Wave conditions can change rapidly due to changing winds, making it crucial to have accurate wave forecast guidance with a rapid refresh rate. The Great Lakes Wave Model (GLWU) currently provides guidance with hourly cycles to 11 Weather Forecast Offices (WFOs) in the Great Lakes region. The model is forced by wind fields from the National Digital Forecast Database (NDFD) for consistency between the atmospheric and wave forecasts. In the upcoming GLWUv2 upgrade, the smaller Lake Champlain (WFO Burlington) will be added to the system, the WAVEWATCH III model core will be updated to include an implicit unstructured mode and improved numerical efficiency (Abdolali et al., 2020), and the resolution of the sea ice concentration analysis in the five Great Lakes will be increased from 5 km to 500 m. This paper presents the inclusion of Lake Champlain into the modeling system and the validation of the extended system for recent events. The results of this validation study show the accuracy of the updated model against data and buoy observations on the newly-generated mesh including Lake Champlain. The new WAVEWATCH III unstructured mesh implementation is found to be computationally efficient and scalable, allowing it to be run on a large number of computational nodes. In addition, we will present exploratory work into establishing new guidance fields characterizing dangerous seas, with application to the Great Lakes. Various aspects of the wave state are considered in this characterization, including the significant wave height, mean steepness, directional spread, whitecap coverage and whitecap breaker height. These features are combined with thresholds to identify wave states that could be considered dangerous for each of three classes of marine users, namely small craft, barges and tankers.

References

Abdolali, A., A. Roland, A. van der Westhuysen, J. Meixner, A. Chawla, T. J. Hesser, J. M. Smith, M. Dutour Sikiric, 2020. Large-scale hurricane modeling using domain decomposition parallelization and implicit scheme implemented in WAVEWATCH III wave model. Coastal Engineering, 157, 103656.

	Andre Van der Westhuysen, Saeideh Banihashemi	IMSG @ NOAA/NWS/NCEP/EMC Marine Modeling and Analysis Branch

Operationalizing Marine "Spot" Forecasts to Support USCG Sector Sault Ste Marie

Joseph Phillips, NWS Weather Forecast Office Marquette and
CDR Matthew Walter, US Coast Guard Sector Sault Sainte Marie

12:15 P.M. to 12:45 P.M. ET

The NWS is evolving it's service model and shifting to an impact-based decision support services approach to better support partners, such as emergency managers and safety officials, with key weather information. These services often include tailored forecasts to aid partner decisions when weather could impact the lives and livelihoods of the American people. One product often utilized in this capacity is a compilation of requested forecast parameters for a specific site, commonly referred to as a "spot". This product has been utilized for years by the fire weather community to provide on-scene prescribed and wildfire management teams forecast conditions for their specific location of interest. While the "spot" product has been traditionally utilized by the fire weather community, it's usage by the Great Lakes maritime sector has not yet been fully normalized. Since its inception, the US Coast Guard has made minimizing the loss of life, injury, and property damage or loss a priority. They have a rich history of rendering aid to persons or property in distress in the maritime environment. A 2020 Memorandum of Understanding between the USCG and NWS addresses the relationship between their missions of protecting life and property and the management of marine weather information. This agreement encourages the usage of "spot" forecasts to support US Coast Guard operations during extraordinary circumstances. This presentation seeks to highlight how the NWS Weather Forecast Office in Marquette and US Coast Guard Sector Sault Sainte Marie have worked to operationalize "spot" forecasts in anticipation of prolonged search and rescue operations.

Joseph Phillips, Matthew Walter	NWS Marquette, MI US Coast Guard, Sault Sainte Marie

12:45 P.M. to 1:30 P.M. ET — **Lunch Break**

Keynote Speakers: Kevin Berberich, Jonathan Edwards-Opperman
The Present and Future of Great Lakes Products and Services at the U.S. National Ice Center

1:30 P.M. to 2:30 P.M. ET

The U.S. National Ice Center (USNIC) is a tri-agency organization comprised of personnel from the National Oceanic and Atmospheric Administration (NOAA), U.S. Navy, and U.S. Coast Guard with a mission to provide global to tactical scale ice and snow products, ice forecasting, and other environmental intelligence services to the United States government. USNIC produces a daily analysis of ice conditions across the Great Lakes in conjunction with the Canadian Ice Service.

The NOAA component of USNIC recently transitioned from the National Environmental Satellite, Data, and Information Service (NESDIS) to the National Weather Service (NWS) as the Ice Services Branch (ISB) of the Ocean Prediction Center. As part of this transition, ISB is working to align its products with the rest of the NWS and evolve products and services via end user engagement. This past ice season there was an increased demand and resultant preparation and delivery of Decision Support Services (DSS) for the mariner within the Lakes. This trend in request for services is expected to continue. The USNIC is also investigating the potential for more ice forecasting products while seeking potential opportunities to integrate marine, weather and ice information.

Kevin Berberich, Jonathan Edwards-Opperman	NOAA/NWS/NCEP/OPC/Ice Services Branch

2:30 P.M. to 2:45 P.M. ET — **Health Break**

Lakeshore Flooding Over Western Lake Superior: Forecast and Impact Challenges

Justin Schultz, justin.schultz@noaa.gov
National Weather Service Duluth, Minnesota

5027 Miller Trunk Highway
Duluth, MN 55811

2:45 P.M. to 3:15 P.M. ET

Lakeshore flooding has become an increasing threat across western Lake Superior over the last several years. The average water level of Lake Superior surpassed the long-term average in 2014 and has remained above this average until August 2021. In fact, Lake Superior missed setting the all-time water level record by 1.1 inches in October 2019. The anomalously high water levels of Lake Superior has supported this increased threat for lakeshore flooding. We have found that over the last several years, the Lake Superior water level generally peaks during the autumn months, due to the runoff of rainwater from convective-season precipitation. This coincides with the time of the year when potent autumn mid-latitude cyclones develop across the Midwest states. Moreover, winds over the open waters of Lake Superior are usually their strongest during the autumn months due to steeper low-level lapse rates from colder air masses translating over the relatively warmer waters. With all of this said, there remains challenges to forecasting lakeshore flooding, particularly regarding the magnitude of the winds and the duration of the flow over Lake Superior that would support building waves. This research offers a deeper dive into the meteorological factors that lead to lakeshore flooding, including analysis of wind rose plots during the autumn months at Sky Harbor airport, located near the shoreline of downtown Duluth. In collaboration with the National Oceanic and Atmospheric Administration's Office for Coastal Management, we also study the impacts of lakeshore flooding on local infrastructure, particularly for the shoreline of Duluth, MN/Superior, WI, and along the North Shore and South Shore regions.

Justin Schultz — NWS Duluth, MN

Description and evaluation of the NOAA/NOS's Great Lakes Ocean Forecast System (GLOFS) experimental ice forecasting guidance

Robert LaPlante
NOAA/NWS Cleveland, OH

3:15 P.M. to 3:45 P.M. ET

Prediction of ice formation and evolution over the Great Lakes during the cold season is important to commerce, the public, and decision support services. The NOAA/NOS has developed a new version of the Great Lakes Ocean Forecast System which produces ice forecasting guidance. This presentation will provide a brief description of the GLOFS and evaluation efforts of ice forecasting guidance.

Robert LaPlante — NWS Cleveland, OH

3:45 P.M. to 4:00 P.M. ET — **Health Break**

Synthetic Aperture Radar Coverage for the Great Lakes: A New Source of Wind and Ice Information

Christopher Jackson (Global Ocean Associates), Tyler Ruff (GST), Sean Helfrich (NOAA STAR)

4:00 P.M. to 4:30 P.M. ET

Launched in 2019, the Canadian Space Agency's Radarsat Constellation Mission (RCM) provides regular coverage (1x-2x daily) of the Great Lakes with its synthetic aperture radar instrument. This fine (100 m) resolution imagery is useful in determining the presence and location of lake ice as well as weather related phenomena such as lake surface winds, convection cells and gravity waves. The briefing will present an overview of the RCM and its Great Lakes coverage along with examples detailing the kinds of information that is of potential use to forecasters. It will also discuss how the imagery and products can be obtained in near-real time from NESDIS' Center for Satellite Applications and Research.

Christopher Jackson, Tyler Ruff, Sean Helfrich — NOAA GOA, NOAA GST, NOAA STAR

Observations of Wind Using SAR data from RADARSat Constellation Mission Satellites

Scott Lindstrom, UW-Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS)
Christopher Jackson, Global Ocean Associates / NOAA
Tyler Ruff, Global Science and Technology / NOAA STAR

4:30 P.M. to 5:00 P.M. ET

How does a forecaster get wind observations over the Great Lakes? Synthetic Aperture Radar (SAR) data gives high spatial-resolution (albeit limited in space and time) observations that can help a forecaster understand the relationship between observed satellite (ABI) features and wind. Three RADARSat Constellation Mission (RCM) satellites (in addition to Sentinel) will be described, and the website that contains the observations that can be used to view the (usually) twice-daily observations. Several case studies from the CIMSS Satellite Blog will be shown as well to up your confidence in applying this useful data source to your morning/evening analysis.

Scott Lindstrom, Christopher Jackson, Tyler Ruff — UW-Madison CIMSS, NOAA GOA, NOAA GST

End of Day 1

Tuesday, May 3rd – Marine Forecasting and Forecasting Winter Weather

11:00 A.M. to 11:10 A.M. ET — **Introduction**

11:10 A.M. to 11:40 A.M. ET

Lake Erie Ice Rescue 22 February 2021

Kirk Lombardy
NOAA/NWS Cleveland, OH

Substantial ice cover developed over Lake Erie and along the shoreline late in January 2021 into the first half of February. Shelf ice was anchored to the south shore from the islands east to New York. There was a high likelihood of ice floes breaking off from the shelf and drifting into open waters on both 21 & 22 Feb 2021 due to the expectation of strong southwesterly winds overspreading the lake and fracturing the ice. Ten people ventured about a half a mile out onto the ice at Edgewater Beach in Cleveland. An ice floe broke off causing the people to become trapped on the ice. Rescue efforts took place during the afternoon of 21 Feb 2021 by the United States Coast Guard and Cleveland Fire and Rescue. This presentation will show how the forecasters at the National Weather Service office in Cleveland, Ohio recognized the potential threat to people and began alerting the public and Coast Guard officials through social media and decision support briefing packages.

Kirk Lombardy — NWS Cleveland, OH

11:40 A.M. to 12:40 P.M. ET — **Panel Discussion: Solving Great Lakes Weather Challenges Over The Next 5 Years**

Greg Mann, Ron Williams, Peter Kimbell, Benoit Pouliot — NWS, ECCC

12:40 P.M. to 1:30 P.M. ET — **Lunch Break**

1:30 P.M. to 2:00 P.M. ET

Updates From the Weather Prediction Center's Winter Weather Desk

Author: Tony Fracasso
Co-Authors: Alex Lamers, Greg Carbin
NOAA/NWS/Weather Prediction Center

The Weather Prediction Center (WPC) plays an integral role in communicating the multi-faceted hazards associated with winter storms. This presentation will discuss the current suite of WPC products related to winter weather, how they integrate into the forecast process, and plans for the future. Included in the list of products will be: 1) The Winter Storm Severity Index (WSSI), which provides a graphical representation of anticipated overall impacts to society due to winter weather. 2) Probabilistic WSSI. This season, WPC started an experimental version of the WSSI that displays the data in a probabilistic manner out to day 7 (168 hours) using WPC's in-house Winter Storm Ensemble (WSE). 3) Winter Storm Outlook (WSO). WPC has continued the experimental WSO product, which extends to day 4, showing areas that may exceed local winter storm warning criteria as determined by the local Weather Forecast Offices (WFOs). 4) Winter Weather Outlook (WWO). Covering the days 4-7 period, this product depicts the probability of a "plowable" (generally 2-3") snow.

Tony Fracasso, Alex Lamers, Greg Carbin — NWS WPC

The Monthly Sea Level Pressure Records and Their Use in the Forecasting Process

David Roth, Weather Prediction Center, College Park MD

2:00 P.M. to 2:30 P.M. ET

WPC maintains a repository of maps that track monthly high and low sea level pressure records over North America dating back into the 1870s, depending on the location. These products can indicate when in the calendar year extreme weather is more likely (e.g. unusually strong arctic highs or deep extratropical cyclones, tropical cyclones and their remnants). Preferred tracks for major storms stand out in the monthly low sea level pressure extreme maps across the continent. The records can be used, in conjunction with standardized anomalies, to determine the rarity of such events for any month of the year, and can aid in the determination if storms during the medium range period – 3 days or so – are plausible or implausible. The maps can be used to create a storm history for NWS County Warning Areas, as was done by the Wilmington, NC forecast office. The monthly pressure records maps were embraced by climatologists across the Plains/Midwest during the record high pressure event of January 7, 2015, and are being used to help determine state pressure records, in coordination with stateclimatologists and NCEI, as was done in Colorado in the wake of the March 2019 cyclone.
The Monthly Sea Level Pressure website: https://www.wpc.ncep.noaa.gov/research/roth/SLPrecords.html

David Roth NWS WPC

2:30 P.M. to 2:45 P.M. ET **Health Break**

Evaluating the Lake-Effect Snow Forecasting Capabilities of NOAA's Unified Forecast System (UFS)

David Wright1, Christiane Jablonowski1, Ayumi Fujisaki-Manome1,2, Lydia Gilbert1, Philip Chu3, Greg Mann4, Eric Anderson5, Bryan Mroczka3, Brent Lofgren3,
1. University of Michigan, Department of Climate and Space Sciences and Engineering, Ann Arbor, MI
2. Cooperative Institute for Great Lakes Research (CIGLR), Ann Arbor, MI
3. NOAA Great Lakes Environmental Research Lab, Ann Arbor, MI
4. National Weather Service, Detroit/Pontiac, MI
5. Colorado School of Mines, Golden, CO

2:45 P.M. to 3:15 P.M. ET

This presentation will evaluate the current forecasting skill of the Unified Forecast System's Short-Range Weather Application (UFS-SRW) in simulating lake-effect snowfall over the Great Lakes region. Results presented will show the advancements made by asynchronously coupling the Finite Volume Community Ocean Model (FVCOM) hydrodynamic model to the UFS-SRW for recent case studies over the region. Forecast sensitivities will be discussed with respect to various updates made to physics packages available in the UFS-SRW. Comparisons will also be made between the UFS-SRW simulations, observations, and other operational model forecasts to display the UFS-SRW modeling framework's ability and limitations in representing lake-effect precipitation. In addition, experimental configurations with 1 km grid spacing over the Great Lakes domain will be presented to show improvements in snow band representation gained by horizontal resolution changes.

David Wright et al. University of Michigan

Collective Lake Disturbances and the Relationship to "Type VI" Lake Effect Snow Events

3:15 P.M. to 3:45 P.M. ET

A type of lake effect snow event was investigated by Lashley and Hitchcock (2014) which did not fit into any pre-existing lake effect snow types. These "Type VI" events were characterized by mesovortex development over central or northern Lake Michigan with an adjoining dominant single band trailing back to the northwest

of the mesovortex. These Type VI mesovortex events have been associated with some of the more impactful lake event snow events across northwest Indiana and southwest Lower Michigan. Through the use of analogs and composites of subsets of Lashley and Hitchcock's Type VI event climatology, a strong connection can be made to synoptic regimes characterizing Collective Lake Disturbances (CoLDs) and those that support the development of Type VI lake effect events and their associated mesovortex development. The WRF-ARW model was used to simulate one of these more impactful Type VI events from January 22-23, 2014, with an emphasis on the simulation of the mesovortex development stage across northern Lake Michigan. Results of the model simulation suggest the enhanced baroclinicity associated with this CoLD event helped to generate strong horizontal vorticity near the lake/ice interface just northwest of Grand Traverse Bay through a geostrophic adjustment process. The subsequent tilting of horizontal vorticity into the vertical appears to have played a substantial role in mesovortex development for this Type VI event. Additional sensitivity runs of the WRF-ARW were conducted to determine the influence of the ice cover initializations on the location and strength of the mesovortex development.

Nathan Marsili — NWS Northern Indiana

3:45 P.M. to 4:00 P.M. ET — **Health Break**

Intense NWT Snowsquall Event October 27 2019

Brennan Allen1 and Gary Lee2

Previously Prairie Storm Prediction Centre1 & Canadian Meteorological Aviation Centre West2

4:00 P.M. to 4:30 P.M. ET

On October 27th, 2019, an arctic air-mass originating from the Arctic Ocean was ushered into the Northwest Territories by an upper shortwave trough. The two great lakes in the region, Great Slake Lake and Great Bear Lake, were still relatively warm and ice free for the time of year. The combination of instability from the shortwave and arctic air moving over the lakes generated a strong lake effect event over the southern shores of the lakes. Unfortunately, due to the sparse population of the territories only one report was obtained with Fort Resolution reporting 3 inches of snow in 50 minutes at 1750Z. This snowsquall event may have had hazardous impacts to public, marine and aviation clients, and "was well forecasted" by both the PASPC and CMAC with lead-time guidelines met. Nevertheless, challenges remain regarding providing effective impact based decision support meteorology to the sparsely populated Canadian arctic, especially for lake or ocean effect snow.

Brennan Allen, Gary Lee — ECCC ASPC / ECCC PASPC

4:30 P.M. to 5:00 P.M. ET — **Period for Additional Questions**

End of Day 2

Wednesday, May 4th – Summer Severe Weather, Tornadoes and Tornado Warning Improvement

11:00 A.M. to 11:10 A.M. ET — **Introduction**

11:10 A.M. to 11:40 A.M. ET

S-Band Dual-Polarization Radar Evaluation of the Barrie, Ontario Tornado of July 15 2021

By Arnold Ashton and Daniel Liota

Environment and Climate Change Canada (ECCC) is well underway in the renewal of its national radar network from C-band to S-band polarimetric radars. On June 28 2021 the newly installed King City S-band radar went live. On July 15th 2021, a prominent EF2-rated tornado tore through southern Barrie, one of ten tornadoes that struck Southern Ontario that day. There were 11 injuries but no fatalities, with insurable losses reaching $100M. The timely radar installation just prior to a major tornado outbreak provided an excellent initial evaluation of the new S-band dual-polarization products as well as the improved temporal scan strategy (six-minutely). In this talk, several dual-polarization products will be examined over the course of the supercell thunderstorm which spawned the Barrie tornado, and compared to other nearby supercells. This assessment suggests promising results for assisting with improved tornado alerting lead-times in the future.

Arnold Ashton, Daniel Liota — ECCC OSPC Toronto, ON

11:40 A.M. to 12:10 P.M. ET

Lightning Jump Analysis of the Tornadic Storms in southern Ontario on 15 July 2021

Helen Yang and Lisa Alexander

On 15 July 2021, six storms produced ten tornadoes rated from EF-1 to EF-2, with nine in southern Ontario and one in southwestern Quebec. Lightning jumps can be used as an aid to predicting severe weather. Given flash data from the Canadian Lightning Detection Network (CLDN), the 2-sigma lightning jump algorithm was applied to these storms post-event. The Barrie and Udora storms that sprung two and three tornadoes, respectively, each had multiple lightning jumps lasting from 2 to 19 minutes per jump. The first jump of the Barrie storm occurred 41 minutes prior to the first tornado touchdown, while the first jump of the Udora storm preceded its first tornado by 35 minutes. Occasionally a lightning jump would follow right after merging of cells, based on radar reflectivity; the merged cell showed a flash rate significantly higher than a simple sum of flash rates from the individual cells prior to the merge. In order to address the limited in-cloud flash detection efficiency of the CLDN in applying the lightning jump algorithm, the effect of reducing the flash rate threshold was examined in this study as well. The other four storms showed very low flash rates and thus no jump was observed. These storms had lower MUCAPE, higher effective bulk shear, and a drier layer of -10°C to -20°C isotherms, when compared to the Barrie and Udora storms. Results of this study suggest that in environments conducive to lightning production, lightning jumps can be used in conjunction with other guidances to improve tornado warning lead times.

Helen Yang, Lisa Alexander — ECCC Toronto, ON

12:10 P.M. to 12:40 P.M. ET

Impact of Midlevel Shear Orientation on Downdraft Location, Tornado-like Vortex Formation and Storm Longevity in Simulated Supercells

Meteorologists have a good understanding of environments favorable for significant tornadoes: Large values of convective available potential energy, little convective inhibition, large deep-layer shear, and significant clockwise hodograph curvature in the low-levels. We use an idealized model initialized in such an environment to investigate the impact of midlevel shear orientation on supercell longevity, and thus the time period in which tornado-like vortices (TLVs) may be produced.

Environments with the 3-6 km shear vector backed produce supercells that last longer while environments with the shear vector veered produce supercells that dissipate earlier, often as a result of outflow surges. The supercells initialized in environments with a backed 3-6 km shear vector also produce more TLVs, which are often preceded by outflow surges. The shear vector orientation dictates where precipitation loading and downdraft formation occur within a supercell, and thus also dictates where outflow surges occur relative to the updraft. When the shear vector is veered, outflow surges occur more to the north or northeast of the updraft, which are more likely to disrupt the updraft. Disruption is caused by tilting of the low-level updraft and separation of the dynamic upward perturbation pressure gradient acceleration from lift along the forward and rear-flank gust fronts. Furthermore, an analysis of trajectories emanating from downdraft surges indicates no significant thermodynamic differences between outflow surges that result in storm demise and those that precede the formation of TLVs.

Future work includes expanding the trajectory analysis to investigate the large values of streamwise vorticity often present behind outflow surge boundaries and how outflow surge air reingested by updrafts impacts the strength of the low-level mesocyclone and thus the potential for TLV formation.

Kevin Gray — University of Illinois

12:40 P.M. to 1:30 P.M. ET — **Lunch Break**

Keynote Speaker: David Sills - We're Not in Kansas Anymore - New Insights on Northern Tornadoes

The Northern Tornadoes Project (NTP), founded in 2017 by Western University and ImpactWX, aims to better detect tornado occurrence throughout Canada, improve severe and extreme weather understanding and prediction, mitigate against harm to people and property, and investigate future implications due to climate change. Which, taken together, is quite a tall order for a country that is the second largest in the world and has most of its population huddled for warmth along the US border.

Much of the world's research on tornadoes has been conducted well across that US border, particularly the Plains region (that includes the aforementioned Kansas). A research focus on the tornadoes that affect the northern half of the continent was overdue. It has long been known that intense thunderstorms develop in large parts of Canada well away from urban areas, but due to a lack of public reports little has been learned about the occurrence of tornadoes there. A study in 2013 estimated that perhaps only about half of tornadoes that occur in Canada are verified and documented. NTP has begun to fill in these gaps in our knowledge. The Project has documented tornadoes from Vancouver Island to Newfoundland, and as far north as Fort Smith, NWT (the first damage survey in Canada north of 60N).

1:30 P.M. to 2:30 P.M. ET

Some other notable achievements: NTP uncovered Quebec's largest tornado outbreak (twice!), found Canada's widest tornado (2440 m in NW Ontario), set a record for the number of E/F2 tornadoes in one season in Ontario (16), documented Canada's first EF4 tornado (the highest-rated tornado in the world in 2018), and has assembled the world's largest database of very high-resolution forest damage imagery (now being used by US scientists to study tornadoes!).

NTP is also creating important historical tornado databases, including an Ontario database going all the way back to Canada's first known tornado in 1792, and a new national 30-year tornado climatology running from 1991 to 2020. Using the long-term Ontario database, it was found that tornadoes have been gradually occurring later in the year in southern Ontario – a trend that is not seen in the neighbouring US states of Michigan and New York, and is not easily explained.

Other NTP activities include partnering with Instant Weather to develop a community radar processor and viewer, instigating changes in local building practices, and undertaking an independent assessment of tornado warning performance in Canada. The success of NTP has led to the launching of a similarly ambitious Northern Hail Project in January 2022.

David Sills — Northern Tornadoes Project (NTP)

2:30 P.M. to 2:45 P.M. ET — **Health Break**

2:45 P.M. to 3:45 P.M. ET	**A Comparison of Hail Versus Tornado Environments Using Hodographs** Hodographs are valuable sources of pattern recognition in severe convective storm forecasting. Certain shapes are known to discriminate between single cell, multicell, and supercell storm organization. Various derived quantities such as storm-relative helicity (SRH) have been found to predict tornado potential and intensity. Over the years, collective research has established a conceptual model for tornadic hodographs (large and ``looping'', with high SRH). However, considerably less attention has been given to constructing a similar conceptual model for hodographs of severe hail. This study explores how the hodograph differs between the environments of severe hail and tornadoes, and if the hodograph can be used to anticipate maximum hail size. The Storm Prediction Center (SPC) storm mode dataset is used to assess the near-storm environments of 8,958 tornadoes and 7,256 severe hail reports. Composite hodograph shapes and shear indices are assessed for each hazard, and clear differences are found between the kinematics of hail-producing and tornadic supercells. The sensitivity of common thermodynamic variables on the hodographs was also examined, with buoyancy and moisture found to influence the shape associated with the hazards. Self-organizing maps are also used to assess the variety of hodographs responsible for hailstorms. With this analysis, we hope that the establishment of "classic" environmental archetypes will become more commonplace in hail potential and size forecasting. Cameron Nixon — Central Michigan University
3:45 P.M. to 4:00 P.M. ET	**Health Break**	
4:00 P.M. to 5:00 P.M. ET	**Panel: Tornadoes Above 40N Science and Service Challenges and Opportunities** David Sills, Richard Wagenmaker, Crawford Luke, Rich Thompson — NTP, NWS, ECCC	
	End of Day 3	

Thursday, May 5th

Summer Severe Weather, Tornadoes and Tornado Warning Improvement, Impact Based Forecasting and Verification and Lessons Learned From Pandemic Impacted Operations

11:00 A.M. to 11:10 A.M. ET — **Introduction**

11:10 A.M. to 11:40 A.M. ET

Use of the Modified SHERBE Parameter To Identify Tornadic HSLC Environments - An Examination of the Oct 21, 2021 Event Over OH/PA

Douglas Kahn
Patrick Saunders
NOAA/NWS Cleveland

The majority of EF1 or greater tornadoes and significant wind events that occur in the cool season from November through March result from high shear, low CAPE (HSLC) environments (Sherburn et al. 2016). Severe convection occurring in these HSLC environments pose a considerable forecasting and nowcasting challenge especially from the Ohio Valley south into the Mississippi Valley. On October 21, 2021, a potent upper-level trough and associated surface cold front moved across the Great Lakes region. A broken line of low-topped thunderstorms developed along the cold front during the afternoon hours in a HSLC environment. These storms would go on to produce 19 tornadoes, 8 of which were in the NWS Cleveland forecast area. The event overachieved expectations from both hi-resolution models and local and national center forecasts. A post-mortem of the event revealed several meteorological parameters that may have helped increase confidence for a high impact event. One of these parameters includes the Modified Severe Hazards in Environments with Reduced Buoyancy (Modified SHERBE or MOSHE).

This presentation will investigate the underlying environmental conditions of the storms, with a specific focus on utilizing the Modified SHERBE. Origins of the SHERBE and Modified SHERBE will also be discussed, in addition to circumstances where it may or may not prove useful. Satellite and surface observations will also be analyzed, to serve as additional nowcasting tools for similar, future events.

Sherburn, K, 2016: Composite Environments of Severe and Nonsevere High-Shear, Low-CAPE

Douglas Kahn, Patrick Saunders — NWS Clevelend, OH

11:40 A.M. to 12:10 P.M. ET

A Historical Look at Tracking Elevated Mixed Layers Through Satellite Imagery: A Northern U.S. and southern Canadian Focus

Christopher M. Gitro
Duluth, MN Weather Forecast Office
Dan Bikos
CIRA/Colorado State University
Scott Lindstrom
CIMSS/University of Wisconsin-Madison
Sheldon Kusselson
CIRA/Colorado State University

Elevated mixed layers (EMLs) have long been known to result in significant severe weather episodes across North America. The horizontal advection of steep mid-level lapse rates due to strong boundary-layer heating over elevated terrain has recently experienced renewed focus in the operational forecast setting. This study will look back at some of the more historic severe weather events that have impacted the international border area with attention placed on EML-specific satellite signatures that forecasters can use operationally to better track and understand EMLs as they advect away from their source regions. A few events that will be looked at include the Edmonton "Black Friday" tornado of 1987, the Boundary Waters-Canadian Derecho of 1999, and the 2007 F5 Elie, Manitoba tornado. Additional discussion will focus on improved, present day EML tracking techniques from both GOES-R series and polar-orbiting satellites.

Christopher M. Gitro, Dan Bikos, Scott Lindstrom, Sheldon Kusselson — NWS Duluth, MN

12:10 P.M. to 12:45 P.M. ET — **Lunch Break**

A Statistical Evaluation of NWS Impact-Based Warnings (IBW)

Dick Wagenmaker, Greg Mann PhD
National Weather Service Detroit MI
Cody Ledbetter,
National Weather Service Sterling VA
Amanda Bowen,
National Weather Service Anchorage AK
Jenna Lake,
National Weather Service Pittsburgh PA
Aaron Treadway
National Weather Service New Braunfels TX

12:45 P.M. to 1:15 P.M. ET

In 2012, the National Weather Service (NWS) Central Region launched a demonstration called Impact-Based Warnings (IBW) in five Weather Forecast Offices (WFOs) in Kansas and Missouri. Based on the findings from this demonstration, IBW was expanded in 2013 to all 38 WFOs in Central Region, and in 2014 to 46 WFOs across the continental United States. IBW spread to all WFOs by 2018.

A key concept from IBW is to provide focus to the tornado warning program by emphasizing advance alerts for high impact events (significant to violent tornadoes). This presentation will detail findings from two internal NWS studies showing distinct skill in warning for these specific high impact events versus warnings for weak tornadoes. Also shown is the estimated IBW relationship to fatality and injury per tornado event, per tornado segment, and per exposed population - all of which detail an overall reduction in tornado morbidity.

In addition, the presentation will address tornado warning trends in the legacy verification system. In the last 15 years, a steady improvement has occurred in tornado warning Critical Success Index (CSI) and in False Alarm Ratio (FAR). In each case, NWS statistics currently occupy historical bests. However, Probability of Detection (POD) has shown a notable overall decline. Study results indicate much of the POD variance can be traced to increased usage of Severe Thunderstorm Warnings for EF0 tornadoes and less usage of Tornado Warnings). From an impact standpoint, this implies the POD decrease is relatively harmless, and also implies that the legacy verification system needs to better reflect such trends.

Greg Mann, Richard Wagenmaker — NWS Detroit, MI

1:15 P.M. to 1:45 P.M. ET

Quantified Impact Verification Efforts at the Ontario Storm Prediction Centre

Within the Meteorological Service of Canada (MSC) and forecast offices around the world, there are growing efforts to change the way we forecast. Forecast efforts have evolved and a forecast stating what the weather will be is one component of the forecast. Another important forecast component is what the weather will do. In order to aid forecasters into moving into this direction there are efforts within the MSC and the Ontario Storm Prediction Centre (OSPC). One of many projects at the OSPC is a quantified impact verification. This pilot project began in the summer of 2020 and has evolved since then. Work had already begun at the Quebec Storm Prediction Centre (QSPC) and this work was used as a basis for work done at the OSPC. Several performance indicators are used to quantify this verification including the Heidke Skill Score (HSS), Probability of Detection (POD), False Alarm Ratio (FAR) and Critical Success Index (CSI). The results of this verification have focused on relating impacts back to the weather element that was forecast to result in these impacts. Several conclusions have been reached about the warning program within the MSC. From this work, there are also several other ideas for future methods of verification and use of the data produced.

Ryan Rozinskis — ECCC OSPC Toronto, ON

1:45 P.M. to 2:30 P.M. ET

Panel Discussion: Impact Based Forecast and Verification

Greg Mann, Richard Wagenmaker, Ryan Rozinskis — NWS, ECCC

2:30 P.M. to 2:45 P.M. ET

Health Break

2:45 P.M. to 3:15 P.M. ET

The Ontario Storm Prediction Centre During COVID-19

On March 11th, 2020 the World Health Organization declared COVID-19 a pandemic. The Meteorological Service of Canada MSC had to adapt quickly for the health and safety of all staff and to maintain forecast operations. Many changes to operations were applied over the course of hours and many remain in use today. Many of these changes have become challenges to overcome, however, many others have been positive and have been very beneficial to operations. There are many lessons that can be learned from this new way of working and this new way of working also highlights the most important parts of forecast operations. The Ontario Storm Prediction Centre (OSPC) has adapted well throughout the pandemic and many important lessons have been taken away from this experience.

Ryan Rozinskis — ECCC OSPC Toronto, ON

3:15 P.M. to 3:45 P.M. ET

NWS Operational Response to the COVID-19 Pandemic

No abstract provided yet.

Bruce Smith — NWS Central Region Headquarters

3:45 P.M. to 4:00 P.M. ET

Health Break

4:00 P.M. to 4:30 P.M. ET

Open Forum Discussion: Two Years of Pandemic Impacted Operations

4:30 P.M. to 4:45 P.M. ET

Wrap Up GLOMW 2022