Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
April 9, 2013

THEME: Marine Forecasting & Services

1. **Marine Weather Prediction and Service Advances at NWS Detroit MI**
   Dr. Greg Mann and Dick Wagenmaker (NOAA/NWS Detroit MI)

   In recent years, the application of oceanographic/hydrodynamics models within the NWS operational environment has allowed for expansion of Great Lakes marine products and services beyond the NWS legacy product suite. For example, wave spectra information can be gleaned from predicted wave height fields – which then allow for the derivation of non-standard wave predictions across the distribution, such as the highest 5th percentile wave and wave return frequency. This information is useful for customers with a need to know the maximum wave they may encounter in the marine environment (e.g. Coast Guard search and rescue operations). This also allows for the derivation of other experimental wave fields. For example, the presence of converging wave trains and wind vectors within the model solution affords the ability to estimate the predicted Great Lakes sea state at any given time, and express it in graphical form as a non-dimensional "chaotic seas index". Last, probabilistic hourly wind information over the marine environment can provide mariners with key information regarding the likelihood of gale or storm force winds being achieved. This information can be extracted from existing NWS deterministic wind and gust forecasts and presented graphically for customers.

2. **Evaluation of Great Lakes Ice Model (GLIM) Real-time Ice Forecasts During the 2012-2013 Ice Season**
   Robert LaPlante (NOAA/NWS Cleveland OH)

   The Great Lakes Ice Model (GLIM) is an experimental numerical forecast model intended to improve the accuracy of Great Lakes ice forecasts and outlooks, open lake forecasts, near shore forecasts and marine weather statements. The GLIM has been under development since 2007 and this presentation is an update of the model since the 2011-2012 ice season. For the 2011-2012 ice season, the GLIM was expanded to run on all five Great Lakes twice per day as part of the Great Lakes Coastal Forecast System (GLCFS) at NOAA/GLERL http://www.glerl.noaa.gov/res/glcfs). Due to the unseasonably warm winter of 2011-2012, little ice developed on the Great Lakes which precluded a comprehensive evaluation of the GLIM. The GLIM is a combination of the Princeton Ocean Model for hydrodynamics and the Combined Ice Ocean Model (CIOM) ice model specifically tailored for operation in the Great Lakes. The combined lake circulation/ice model is run using the latest NWS National Digital Forecast Database (NDFD, http://www.nws.noaa.gov/ndfd) surface meteorological grids as input. Twice-a-day forecasts extend out to 5 days. The GLIM initial conditions are nudged toward a daily NIC ice concentration analysis. The integration of the GLIM and the NDFD forecast elements generates graphics showing surface water temperature, ice concentration, ice thickness, and ice drift. In addition for this ice season, a new derived parameter, Vessel Icing is being produced that predicts icing class potential in five categories from none to extreme using a methodology as described by Overland et al. (1986) and Overland (1990). Nowcasts and forecasts of ice concentration fields are compared to daily ice concentration analyses produced by the NIC.

3. Assessment of a waterspout forecast system

Victor Chung and Wade Szilagyi (EC, MSC, Ontario Region)

Waterspouts are a known marine and aviation hazard. Providing accurate and timely forecasts have always been a challenge. Very often people are notified of a waterspout event after a report is received. In 1994, operational meteorologist Wade Szilagyi from the forecast office in Toronto (RCTO) initiated an intensive investigation on waterspout activity over the Great Lakes. The technique developed, known as the Szilagyi Waterspout Nomogram (Szilagyi 1996), is empirical and based on a large sample of waterspout events which now spans over 19 years. The nomogram has been successfully used by meteorologists for a number of years, but it is cumbersome because forecasters have to manually determine the parameters of the nomogram repeatedly for different points of the domain and for every time step. Therefore, there is a need to automate the nomogram to reduce the diagnosis time. In 2011, a computer algorithm was successfully developed to assimilate the above technique to automatically produce a waterspout index field for a specific domain.

The domain for the algorithm covers the Great Lakes with a grid size of 0.2° latitude x 0.125° longitude. The algorithm has been tested for a number of cases and results were shown to be satisfactory. In this presentation, a number of waterspout outbreaks occurred over the Great Lakes in the fall of 2012 and will be used to assess the performance of the waterspout forecast system. In addition, a more comprehensive verification statistics will be presented. Finally, plans for using higher resolution model data to assimilate low level convergence fields into the waterspout forecast system will also be discussed.

4. 2012; The Year of The Waterspout

Wade Szilagyi (EC, MSC, Ontario Region)

2012 was a record year for waterspouts over the Great Lakes, with a total of 187+ waterspouts being reported. This smashes the old record of 94+ waterspouts in 2003. There was also the highest one-day total of 30+ waterspouts as well as the longest outbreak period of 7 consecutive days. The frequency of events resulted in extensive media coverage of the phenomenon, including Environment Canada's Top Ten Weather Stories for 2012 Regional Highlights.

Discussions of meteorological factors resulting in such a record-breaking year as well as the use of social media will be discussed.

Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
April 16, 2013

THEME: Winter/Snow

1. **A Composite Study of Snow Squall Environments across Northern New York and Vermont**
   Peter C. Banacos (NOAA/NWS Burlington VT)

   This presentation will examine environmental characteristics associated with 35 snow squall cases collected between 2002 and 2011 in which moderate or heavy snow occurred at Burlington, VT (BTV), Montpelier, VT (MPV), or Massena, NY (MSS). Most of the cases are associated with arctic cold fronts, while others are associated with weaker frontal structures but have strong mid-level synoptic forcing associated with mobile troughs. Five "hybrid" events involve pre-existing lake effect snow streamers emanating from Lake Ontario in strong background flow which interact with a cold front. Based on the 25th and 75th percentile distribution, these snow squalls produced visibility less than or equal to 0.5 statute miles lasting between 16-37 minutes and snowfall amounts between 0.5-2 inches. Despite these modest values, rapidly changing weather conditions with blinding snowfall, falling temperatures and gusty winds often cause a disproportionate amount of traffic accidents and aviation-related impacts. The occurrence of snow squalls is not always well anticipated, and represents a significant winter forecast problem.

   Through the use of archived NAM time-height cross-sections, archived surface and radar observations, and NARR analyses, structural characteristics of these snow squalls will be presented in an effort to increase physical understanding and identify common patterns for forecasters. The occurrence of these events with respect to time of day and time of year will also be shown. The ultimate goal is to update the Wintertime Instability Index (WINDEX; Lundstedt 1993) using a modern multivariable forecast parameter approach. Some preliminary results toward that goal will be shown.

2. **An interactive algorithm to nowcast snow rates from lake-effect snow using both satellite and model data**
   Victor Chung and Guilong Li (EC, MSC, Ontario Region)

   Lake-effect snow is a common winter weather phenomenon when cold Arctic air flows over the warm water bodies, setting up an unstable boundary layer in which convective clouds develop and are carried downstream. Narrow but heavy snow bands from the lake can pose a significant weather hazard to communities downstream, causing airport shutdown and dangerous driving conditions. It has been a challenge to nowcast snowfall amounts from these snow bands due to insufficient observational networks and the narrowness of the bands. To address the issue, we are developing a user interactive algorithm that uses both real-time satellite and model data to nowcast snow rates from lake-effect snow.

   Lines of snow bands identified from a satellite infrared (11 µm) image, in the absence of higher layer clouds, can be considered as snapshots of the time evolution of the cumulus growth from the initial to the mature stage. Then the cloud-top cooling rates along the cloud line during the growth stage over the lake can be derived. These cloud-top cooling rates reflect the underlying dynamic and

thermodynamic forcing that drives the snow squall. Knowing the cloud-top cooling rates, with the use of the model sounding data, the mean parcel vertical velocity and hence the moisture flux can be calculated. Then, the snow rates at different points over the lake under a given snow band can be calculated.

After the snow band penetrates inland, the snow rates can vary significantly depending on a number of factors including surface convergence, instability, moisture, and boundary layer winds. Since snow rates over the lake near the shoreline have been previously calculated, the inland snow rates are estimated by comparing the cloud top temperatures at different point of the snow band over the land with the cloud top temperature at a point near the shoreline.

The idea of this nowcasting algorithm is that forecaster first identifies snow squalls using both satellite and radar imageries and the algorithm will then estimate the snowfall intensity. This algorithm offers an innovative way to nowcast snow rates from lake-effect snow and results from this algorithm can improve snow depth monitoring in areas where snow observations are not available. In this presentation, the science of the algorithm will first be described. Then, several lake-effect snow events occurred downwind of Lake Huron in Dec 2010 and in Jan 2012 will be used to demonstrate how this algorithm performs. More works are underway to improve the algorithm's accuracy and to broaden its applications.

3. The Predictability of Convective Mode in Lake-Effect Snow Events

Michael Jurewicz (NOAA/NWS Binghamton NY) and Justin Arnott (NOAA/NWS Gaylord MI)

At times, lake-effect snow bands undergo changes in structure, typically related to the diurnal heating cycle. Cellular structures are most commonly seen during the afternoon and evening, while organized bands are observed during the late night/morning period. However, there have been notable exceptions to this timing; indicating there are other factors at play. The goals of this study are to identify these environmental factors, and then provide tools to assist in the forecast process.

Radar imagery, as well as North American Mesoscale (NAM) and Rapid Update Cycle (RUC) model soundings were examined over the Central and Eastern Great Lakes regions. It was found that shear and instability parameters (bulk speed shear in the mixed layer and CAPE), quantified within the BUFKIT sounding program, can be combined to accurately forecast convective modes in lake-effect snow situations. Subsequent work has indicated that lake-effect snow bands may be sensitive not only to the magnitude of the shear, but also to the depth over which the shear occurs.

Based on research results, forecasters can use BUFKIT soundings to provide specific timing of any changes in mode. Since organized banding normally produces much heavier snow accumulations, this should add confidence to the ability to better forecast snowfall amounts.

4. Forecasting the Inland Extent of Lake-Effect Snow Bands

Michael Jurewicz (NOAA/NWS Binghamton NY) and Joe Villani (NOAA/NWS Albany NY)

Much research has been devoted to better understanding and forecasting of lake-effect snow (LES) bands. However, one aspect not well studied has been the extent of inland penetration. The foci of this project are to: identify atmospheric parameters that influence inland extent; and to develop operational forecast techniques.

LES events in the Eastern Great Lakes region since 2006-2007 were examined. Different parameters were analyzed to see which ones most strongly correlated to inland extent. The best correlated parameters included the existence of a multi-lake connection, mixed-layer stability (represented by lake-air temperature differentials), 0-1 km speed shear, and capping inversion heights. In general, an environment favorable for greater inland extent was characterized by a strong, well-aligned flow, and only conditional instability (moderately to extremely unstable environments produced more diffuse banded structures, which did not penetrate far inland). LES bands that featured a multi-lake connection had a much greater tendency to progress farther inland, versus those without one.

Based on these results, an algorithm was developed to give forecasters an approximation of inland extent. This application has initially shown promising results at NWS Forecast Offices in Albany, NY and Binghamton, NY. Future enhancements to this application may include a graphical component to provide a better visual aid.

Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
April 23, 2013

THEME: Winter/Snow, Nowcasting, Tornado

1. **A Cold Pool Microscale Effect Resulting from Nocturnal Winter Season Radiational Cooling**
   David Zaff (NOAA/NWS Buffalo NY)

During the winter, the Watertown, NY Automated Surface Observing System (KART ASOS) station occasionally shows extreme drops in temperature under radiational cooling conditions. These events occur with a fresh snow pack on clear winter nights with light winds. For example, on 19 February 2007, the temperature dropped from -19 C to -31 C between 04Z and 05Z with a minimum temperature of -38 C occurring near 12Z. Closer inspection using one minute ASOS data showed the temperature dropping by 7 C in two minutes.

It has been shown that during the winter season under radiational cooling conditions, cold air drains into pools within the depressions of the landscape creating a strong microscale inversion. This hypothesis was tested at KART during the 2010-2011 winter season via COMET Partners project between the National Weather Service, Buffalo, NY and Buffalo State College. Ten extreme cooling episodes were examined. A variety of sensors and surveys were used to determine that the cause of these events was not solely due to an area depression, but due to the immediate and local landscape together with radiational cooling. This presentation will cover some of the 2010-2011 events and explain how the COMET Partner project developed its conclusion.

2. **Meso-Analysis Project**
   Claude Landry (EC, MSC, National Capital Region)

This presentation will describe a promising system that was developed a few years ago (that could be implemented in a near future) that provides some benefits for nowcasting on the grid and developing a diagnostic/prognostic for low cloud. The goal of this system is to generate an analysis of cloud cover, precipitation type, and convection for these two applications. First, the use of observations at points such as METAR and SA feeds a kriging system that outputs a field with values at every point of the grid. Then, this field is improved by the use of radar, satellite and lightning data. The resulting field will be forecasted using the winds of the numerical model for nowcasting purposes. Numeric models do not handle low cloud in the fall in Canada particularly well: prognostic rules for day 1 and 2 will be developed with this meso-analysis as initial conditions.

3. **The 26 July, 2012 twin tier severe weather and tornado outbreak: Part I: Environmental characteristics**
Michael Evans (NOAA/NWS Binghamton NY)

Environmental characteristics are examined from a severe weather outbreak over southern New York and northern Pennsylvania. The large-scale pattern on 26 July featured zonal mid-level flow and large shear, with New York and Pennsylvania on the southern edge of the strongest flow aloft. Very unstable air and an elevated mixed layer was located over Pennsylvania, while less unstable air with low lifted condensation levels was located to the north, across central New York. At the surface, low pressure was located over Lake Ontario, with a trough extending to the south, across New York and Pennsylvania. High resolution model forecasts were inconclusive on the preferred convective mode, indicating the development of either broken lines or clusters of storms.

A short study comparing environmental features on the 26th, to factors associated with other recent, high-impact warm-season convective lines, is shown. Many similarities between the environment on the 26th, and previous environments are indicated, including a west-southwest flow aloft with modest height falls, and surface low pressure located over the Great Lakes. Large convective available potential energy (CAPE) downstream from the line was present for all events, along with strong shear primarily in the lowest 3 km of the atmosphere.

4. **The 26 July, 2012 twin tier severe weather and tornado outbreak: Part II: Radar analysis**
Michael Evans (NOAA/NWS Binghamton NY)

A major severe weather outbreak struck the southern tier of New York and the northern tier of Pennsylvania on 26 July, 2012, including seven confirmed tornadoes. In this presentation, the structure of the storm associated with several of these tornadoes is shown, by examining data from the Binghamton, New York WSR-88D radar.

A broken line of convective storms initially developed over western New York and Pennsylvania during the early afternoon on the 26th. A supercell storm developed along the northern end of the line over southern New York around 1900 UTC and moved east, producing 4 EF-1 tornadoes from 1930-2015 UTC. The storm produced tornadoes as a pronounced inflow notch developed on its northeast side. Rotational velocity values associated with the storm were modest, averaging around 25 kts across a distance of 1.5 nm throughout the period when the storm was producing tornadoes. Spectrum width values generally trended upward to near or above 20 kts around the time of tornadogenesis. Dual-polarization-based products around the time of a tornado near Elmira indicated the development of a Zdr arc near the inflow region of the storm, and a separation between maxima of Zdr and Kdp.

Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
April 30, 2013

THEME: Research (Lightning), Fire, Social Media, Winter/Snow

1. New EC Research Initiatives in the Great Lakes Region

David Sills (EC, S&T, Ontario Region)

A number of new research initiatives are being undertaken in southern Ontario over the next several years. This science 'showcase' will supplement Environment Canada's efforts to provide safety and security services for the 2015 Pan American and Parapan American Games. The Games will be held in the 'Greater Golden Horseshoe' area around Toronto and will attract approximately 11,000 athletes and support staff from 41 countries as well as 250,000 visitors.

Very high-resolution NWP modelling will be undertaken in the area with horizontal grid spacing down to 250 m. The installation of around 50 fixed and mobile surface stations will enhance the existing operational surface station network and be used for forecasting and nowcasting as well as validation of the NWP models. A 3D total lightning system is being installed to evaluate its potential for the more accurate and timely prediction of summer severe weather. The lightning system will also be run through winter seasons in order to study lightning associated with lake-effect snow. Finally, two Research Support Desks running the interactive Convective Analysis and Storm Tracking (iCAST) prototype will provide the foundation for a real-time demonstration of the next generation forecast and warning process at Environment Canada.

2. Support Services provided by NOAA/NWS Marquette for the Duck Lake Fire

Michael Dutter, Kari Fleegel and Jason Alumbaugh (NOAA/NWS Marquette MI)

The Duck Lake fire occurred in late May and June 2012 in Luce County, Michigan. This was a devastating fire that consumed over 21,000 acres and was the 3rd largest fire in Michigan history. The fire was initiated by a lightning strike on 20 May 2012, and quickly grew into a large and dangerous fire on 23-24 May due to strong south winds ahead of a low pressure system. This prompted the Michigan State Emergency Operations Center to be activated and NWS Marquette was asked to provide detailed weather support for the fire throughout the entire event. Due to the excellent collaboration and coordination with Upper Michigan Fire Officials over the years, NWS Marquette quickly responded by developing a specific decision support page for the fire containing detailed information on weather conditions near the fire, as well as a one stop page for fire related impacts for the general public. In addition to the web page, NWS Marquette provided detailed spot forecasts for three locations in the fire zone (tail, head and middle) twice daily. This support was used significantly through the event and was praised by fire officials. This presentation will discuss the meteorological conditions which helped cause the fire. In addition, decision support activities provided by NWS Marquette related to the fire will also be discussed.

3. **Increasing Your Social Reach on Facebook**
Erik Heden (NOAA/NWS Binghamton NY)

In the spring of 2010, the National Weather Service began to explore the application of Facebook as a tool to expand the reach of NWS information at field offices and national centers. Based on positive results from this exploration, Facebook was expanded to all 122 National Weather Service offices in the summer of 2011. As a tool, Facebook can be very effective at educating users, disseminating messages, and allowing for a wider audience. Facebook can also provide an important source of incoming information during significant weather events. This presentation will review the implementation of Facebook at the National Weather Service office in Binghamton, NY, including results and best practices that have been learned over the last year. Case studies from a tornado outbreak in July 2012 and Hurricane Sandy will be shown to illustrate how social media can be used to both disseminate and receive weather information before, during, and after an event.

By executing these learned best practices, the Facebook page of the Weather Forecast Office in Binghamton, NY has become one of the most "liked" pages of the 122 forecast offices nationwide, despite having a relatively small population.

4. **The Challenge of Land Breeze Snow Squalls: A Study of the Jan 25th 2013 Lake Ontario Snow Squall**
Arnold Ashton (EC, MSC, Ontario Region)

Great Lakes snow squall convection appears in a variety of modes, dependent on such factors as air-water temperature contrast, boundary layer wind shear, diurnal influences and the convergent effects of irregular shorelines. There is a small percentage of snow squalls which form in the vicinity of very cold high pressure centres initiated by strong diabatic heating over the water and enhanced by land breeze convergence. They are born over the water but often drift onto shoreline areas due to a light boundary layer steering flow.

These meso-beta squalls present the greatest forecasting challenge due to their shallow depth, slow movement, irregular shape and poor depiction on most numerical models. However, mesoscale models have improved somewhat in suggesting the formation and evolution of these squalls.

Over the course of most winters the heavily-populated ‘Golden Horseshoe’, which wraps around the west end of Lake Ontario, experiences one or more land breeze snow squalls, often with significant accumulations. Given the region's large population base, the sudden arrival of one of these snow squalls usually has significant impacts.

On the morning of January 25 2013, a retreating Arctic high pressure centre spawned a particularly intense snow squall over Lake Ontario which drifted into the heavily populated region just east of Toronto in the afternoon. It resulted in a sudden visibility reduction to 200 metres or less, snowfall rates up to 7 cm per hour and a roughly 70 multi-vehicle collision on Highway 401 which closed the highway for several hours. There were no fatalities but several serious injuries.

This case will be examined in some detail, highlighting the squall's evolution, model predictions, and the Ontario Storm Prediction Centre's forecasts. Finally, forecast suggestions will be presented to improve their predictability.

Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
May 7, 2013

THEME: Impact-Based Warning

1. **Impact-Based Warning (IBW) Initiative in NWS Central Region**
   Dick Wagenmaker and Dr. Greg Mann (NOAA/NWS Detroit MI)

   In an effort to address key findings from NWS service assessments for the southeast U.S. April 2011 tornado outbreak and the EF-5 tornado that struck Joplin, Missouri, the NWS Central Region identified a group of five forecast offices to implement a suite of experimental impact-based warning (IBW) convective products. These enhancements attempt to take an evolutionary step toward enhancing risk communication and focus on impact-based information in NWS warnings. For this project, the warnings themselves were stratified into categories which distinguish extreme cases from base convective warnings. Additional enhanced wording was included to convey information about associated impacts, specific hazards expected, and recommended actions. This represents the first significant evolution in NWS Tornado Warnings in many years - and in 2013 will be expanded to all Central Region NWS offices. The presentation will address several aspects of the IBW project including: 1) Tornado warning re-engineering and design; 2) Verification results from the 2012 demonstration; 3) Social science evaluations of warning impacts; and 4) Future directions of the IBW concept.

2. **Impact Based Warning System and Decision Support Activities for Winter Weather at NOAA/NWS Marquette, MI**
   Michael Dutter and Justin Titus (NOAA/NWS Marquette MI)

   Upper Michigan arguably sees as much snowfall as any location in the contiguous United States east of the Rocky Mountains with many locations near Lake Superior receiving more than 500 cm of snow annually. As such, communities, public officials and residents of the region tend to handle the snowfall quite well. Schools infrequently cancel for snow days, department of transportation officials are well prepared for heavy snow, and the general public "just deals with" the frequent days when several centimeters of snow falls.

   With that said, it has been noted that impacts vary significantly during system snowfall events with very high liquid water content (i.e. Snow to Liquid Ratios < 20:1) compared to the more traditional lake effect snow events with low liquid water content. To quantify the impacts related snowfall, the Marquette NWS has collected Michigan State Police incident data and correlated that database to 6 hourly meteorological data from the Marquette NWS Office. The information learned from this research has allowed our office to modify our winter weather warning and advisory system for much of Upper Michigan, and has helped the office tailor decision support services to best help our customers and partners. This presentation will focus on the methodology and implementation of the NWS Marquette Winter Weather Warning/Advisory system. In addition, examples of specific winter weather decision support services will be discussed and demonstrated.

Great Lakes Operational Meteorology Workshop 2013
Science Presentations via Webinars – Abstracts
May 14, 2013

THEME: Aviation Forecasting and Services, Flood

1. **Experimental Aviation Grids at National Weather Service Marquette, Michigan**
   Steven Fleegel (NOAA/NWS Marquette MI)

   In early 2012, the National Weather Service office in Marquette, Michigan began creating Aviation Weather Grids (Ceiling Height and Visibility) on an experimental basis. These forecast grids are created every 3 hours through 60 hours via a consensus of available model data. They are available for the forecasters to look at in the Graphical Forecast Editor (GFE) and within AvnFPS, and can be valuable in the TAF development process. This presentation will show a general overview of the data available to the forecasters, along with a brief case study and verification.

2. **The Chicago Aviation Initiative: More Than Meets the Eye**
   Mike Bardou (NOAA/NWS Chicago/Romeoville IL)

   During the early days of 2010, planning began to enhance aviation services within the local Chicago airspace. This was part of a larger initiative, known as the Golden Triangle Initiative (Chicago, New York and Atlanta making up the corners of the triangle), with a goal of reducing weather related flight delays at major air traffic hubs. This was a significant undertaking, which included adding staff, cross training forecasters to work at both the Weather Forecast Office (WFO) and Center Weather Service Unit (CWSU), issuing more frequent Terminal Aerodrome Forecast (TAF) updates, adding details to the Aviation Forecast Discussion, and making efforts to better understand user needs. As these efforts were underway, focus was given to performing significant event analysis to gain a greater understanding of weather impacts on aircraft operations and attempt to determine how users perceived or interpreted the suite of products and information available. Data gleaned from these post mortems has become the basis for a process of continuous evaluation and evolution to ensure that customer needs are being met and that the forecast message is understood. In addition, this process also focuses on building the knowledge and awareness that forecasters need in order to provide accurate information that is relevant to the customer. This presentation will highlight this process of evaluating the various interrelated program components and illustrate how fundamental concepts such as communication can enable a more thorough understanding of user needs, provide users with a more thorough understanding of key products, and build valuable relationships which can drive the future evolution of services. These concepts extend beyond the busiest airport and aviation weather information in general, and can serve as a basis for enhancing other program areas in an effort to build a Weather Ready Nation.

3. **Semi Automating Forecasts for Canadian Airports in the Great Lakes Area**
George Isaac (EC, S&T, Ontario Region)

Forecasting weather for airports in the Great Lakes Area is a considerable challenge. Factors such as sudden wind shifts, high winds, reduction in visibility, low ceilings, wet or ice covered runways, precipitation of various types, and the sudden onset of convection are just a few of the problems to be considered. For several years now, short term forecasts for aviation related variables have been developed under a project entitled the "The Canadian Airport Nowcasting Project (CAN-Now)." Several new innovative nowcasting schemes have been produced which blend numerical weather prediction model data and surface observations. Tests were conducted at Toronto International Airport (CYYZ) and forecasts were also produced for all of CYYZ's alternates, including some south of the border. Some specialized equipment such as a microwave radiometer and a vertically pointing radar were also installed at Pearson and tested for their usefulness. Currently what was learned within CAN-Now is being applied to semi-automating Terminal Area Forecasts (TAFs) with forecasts out to longer lead times. The problems associated with these semi-automated schemes, which are still under development, will be presented. Some verification scores for short term predictions of aviation related variables will be shown. These semi-automated weather forecasts, when fully developed and then used and modified effectively by aviation forecasters, should allow decision makers at airports such as pilots, dispatchers, de-icing crews, ground personnel or air traffic controllers to make plans with increased margins of safety and improved efficiency.

4. **Assessment of the Major June 2006 and September 2011 East Coast Flash Flood Events from an Integrated Water Vapor Satellite Imagery Perspective**
Christopher M. Gitro (NOAA/NWS Binghamton NY)

The two costliest flash flood events in the history of the Binghamton, NY Weather Forecast Office (WFO) county warning area are compared in an effort to assist forecasters with recognizing favorable patterns for historic flooding across central New York and northeastern Pennsylvania. In June 2006, significant flooding impacted much of the Mid-Atlantic region as a continuous supply of deep tropical moisture moved north from the subtropical Atlantic ahead of a slow-moving cold front. Rainfall totals up to 38.1 cm (15 in.) occurred during a 3-day period. In September of 2011, tropical moisture associated with the remnants of Tropical Storm Lee resulted in major flooding from rainfall totals approaching 30.3 cm (12 in.). Combined, both events produced over $2-billion worth of damage with multiple counties in both New York and Pennsylvania officially declared federal disaster areas.

It will be shown through presentation of integrated water vapor satellite products that both events were associated with well-established atmospheric rivers, which allowed for the uninterrupted supply of deep tropical moisture into the areas of flooding. These events demonstrate the utility of using these products operationally to identify the development of high moisture content airstreams prior to significant flash flooding.