The Four Seasons

National Weather Service Burlington, VT

VOLUME III, ISSUE III

FALL 2016

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Letter from the Editors

Welcome to the Autumnal edition of The Four Seasons, a quarterly newsletter issued by the National Weather Service in Burlington, VT. In this edition we'll take a look back at some of the severe weather we experienced this past summer. We'll also review some of the recent and noteworthy training our staff have attended. We introduce a new forecast point on one of the North Country's major rivers and how this will help us keep the public informed of river flow changes, including the ability to issue warnings. Thanks for reading and we hope you enjoy the newsletter.

2016 North Country Severe Weather Review

-By Brooke Taber

The 2016 severe weather season of May, June, July, and August across the North Country was more active than the previous couple of years and close to normal in terms of warnings issued and severe weather reports. The Weather Forecast Office (WFO) in Burlington (BTV), Vermont issued 49 severe thunderstorm warnings and received 123 severe weather reports.

The Weather Forecast Office (WFO) in Burlington (BTV), Vermont issued 49 severe thunderstorm warnings and received 123 severe weather reports. A severe weather report is defined by damaging thunderstorm winds and/or any measured thunderstorm wind gust of 58 mph or stronger and/or hail 1 inch in diameter or larger. Figure 1 shows the number of warnings issued by WFO BTV from 2010 to 2016, along with the number of severe weather reports received during the months of May, June, July, and August. As you can see by the chart 2011 and 2012 severe weather seasons were very active with 90 and 84 issued respectively and 200 reports.

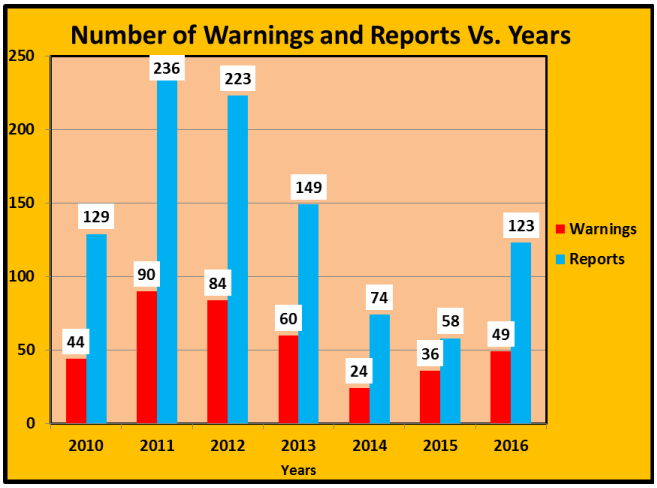

Figure 1. Graph showing the number of warnings and reports vs years.

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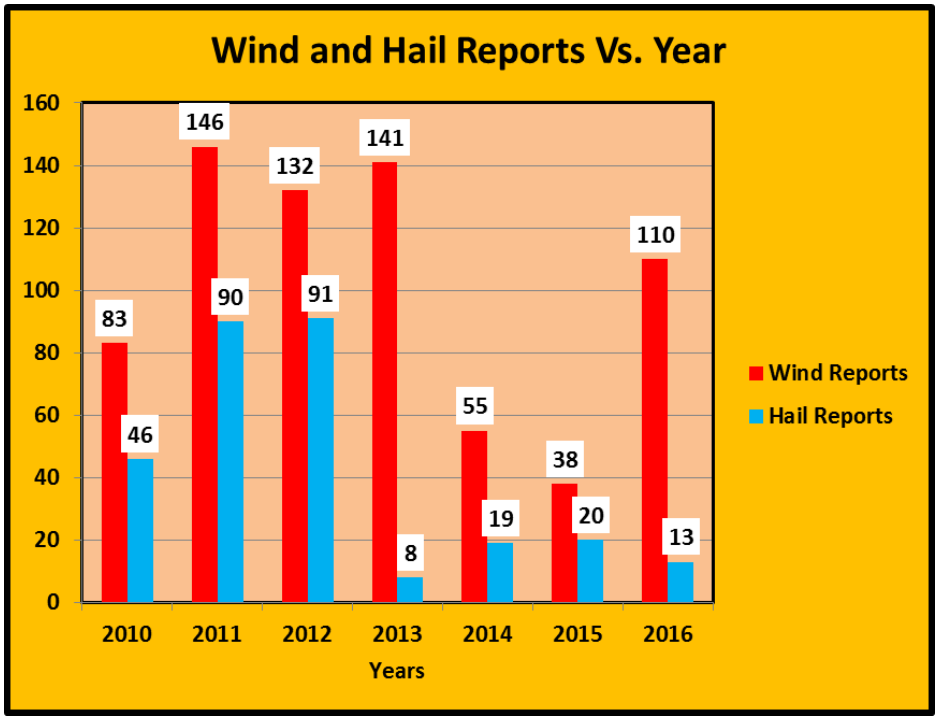

Figure 2: Chart showing wind and hail reports vs year.

Figure 2, to the left, shows the number of wind and hail reports from 2010 to 2016 across WFO BTV county warning area, which extends from Northern New York into most of Central and Northern Vermont. As you can see the primary severe weather threat across the North Country is strong and damaging thunderstorm winds, that typical cause power outages or tree damage. In 2016 of our 123 severe weather reports, 110 were damaging winds with only 13 reports of hail 1 inch or greater.

Figure 3, below, breaks down the number of severe weather warnings and reports by month in 2016 across our county warning area. The most active month during the 2016 severe weather season was July with 32 warnings issued and a combined 87 hail and wind reports received by our office. Severe weather climatology indicates June and July are typically our most active months, with a majority of our events occurring during the afternoon hours associated with peak heating.

Our data shows two of the more active severe weather days this season were July 18th and July 23rd with 10 and 6 warnings issued respectively. On the 18th we received 24 reports of severe weather with 19 from severe thunderstorm winds and 34 reports on July 23rd with a high concentration of wind

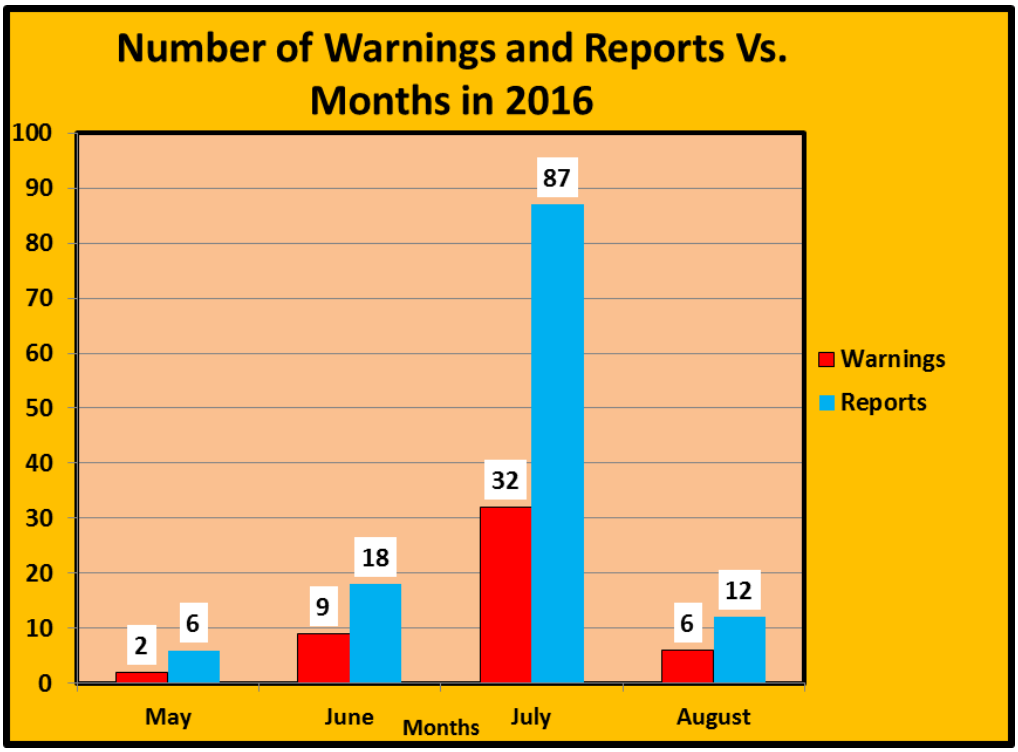

Figure 3: Chart showing warnings and severe weather reports vs. months in 2016.

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reports (33) across the Champlain Valley. On July 18th 2-inch diameter hail was reported in Bradford, VT along with damaging thunderstorm winds across portions of Central Vermont.

Figure 4, to the right, shows the KCXX 1.3 reflectivity (left) and velocity (right) near Danville, VT at 2:51 PM on July 18, 2016, which indicates a bow-like reflectivity structure. This reflectivity structure combined with outbound velocities (pink color) values of 50 to 60 knots suggested damaging thunderstorm winds were possible with this storm. Local law enforcement and the general public reported trees and powerlines down across portions of Caledonia and Orange counties associated with this storm.

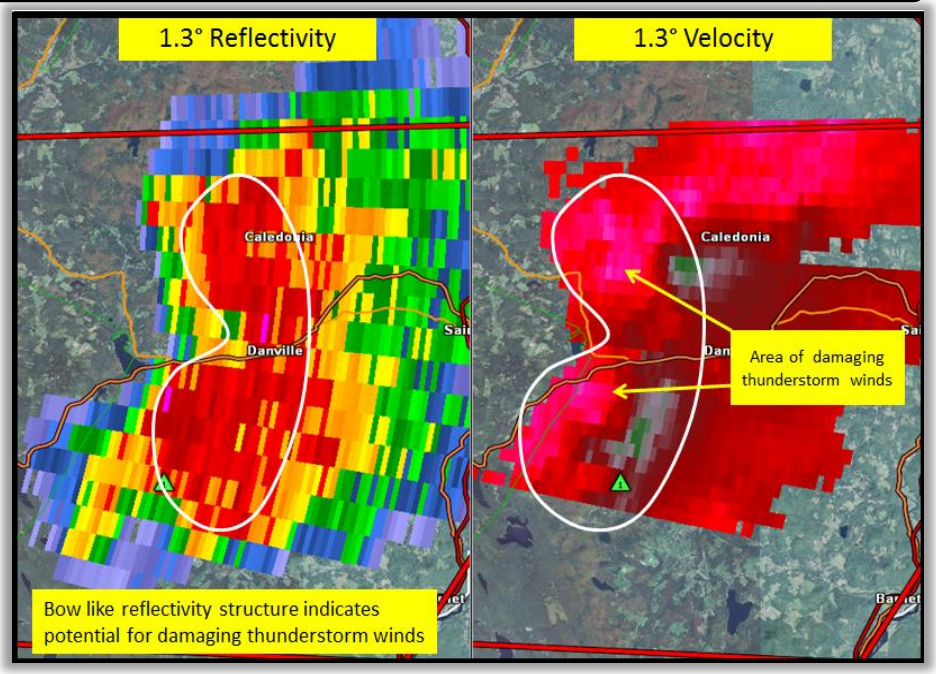

Figure 4: KCXX 1.3 reflectivity (left) and velocity (right) near Danville, VT at 2:51 PM on July 18, 2016.

Figure 5, below, shows a KCXX 4 panel display of echo top (upper left), vertically integrated liquid (upper right), 4.0° reflectivity (lower left), and correlation coefficient (lower right) on July 18, 2016, at 6:18 PM near Chelsea, VT associated with large hail. The echo tops > 40,000 feet indicated storm tops over 7 miles tall into the atmosphere with updrafts strong enough to support large hail. In addition, vertical integrated liquid (VIL) > 70 kg/m² and very strong reflectivity core all pointed to this storm capable of producing severe hail > 1 inch in diameter. VIL is an estimate of the total mass of precipitation in the clouds. The measurement is obtained by observing the reflectivity of the vertically column as obtained by radar. This measurement is usually used in determining the size of hail, the potential amount of rain under a thunderstorm, and the potential downdraft strength when combined with the height of the echo tops. When

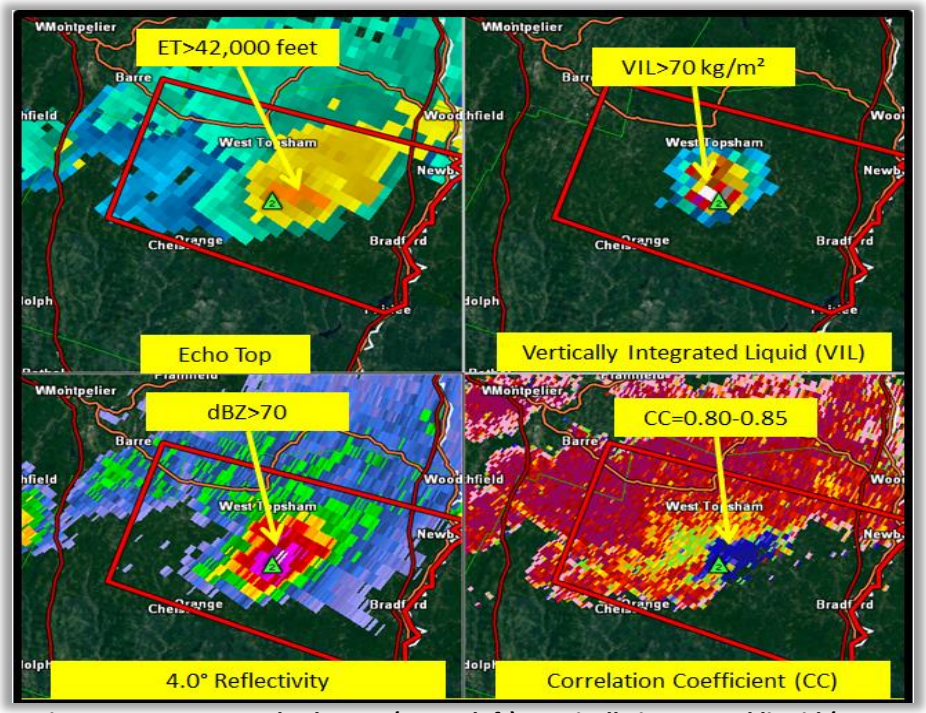

Figure 5: KCXX 4 panel echo top (upper left), vertically integrated liquid (upper right), 4.0° reflectivity (lower left), and correlation coefficient (lower right) on July 18, 2016, at 6:18 PM near Chelsea, VT associated with large hail.

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VIL values quickly fall, it may mean that a downburst is occurring, a result of a weakening of the storm's updraft and the storms inability to hold the copious amounts of moisture/hail within the storm's structure. This means greater potential for the storm to produce damaging winds as the downburst descends to the surface. This very strong storm structure produced 2-inch diameter hail near Bradford, VT at 630 PM on July 18th, along with some damaging winds.

Figure 6, below, shows the KCXX reflectivity cross section near Bradford, VT on July 18, 2016, at 6:28 PM, associated with 2-inch diameter hail. This reflectivity cross section showed the storm top near 50,000 feet with a very strong core of 60 to 70 dBZ between 10,000 and 20,000 feet above the ground. When this well-defined reflectivity core collapsed, trees and powerline damage occurred across Central Orange County, along with very large hail near Bradford, VT. In addition, very heavy rainfall of 1 to 2 inches occurred with this mini-supercell type thunderstorm.

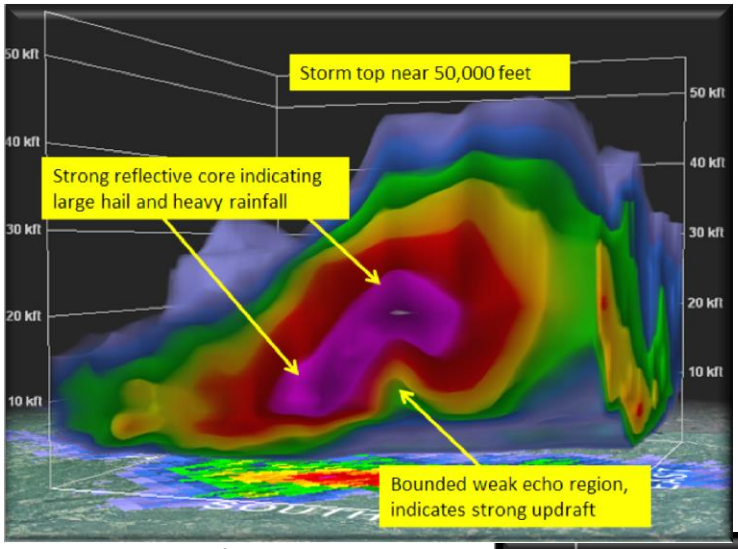

Figure 6: KCXX reflectivity cross section near Bradford, VT on July 18, 2016 at 6:28 PM, associated with 2 inch diameter hail.

On July 23rd another round of severe thunderstorms impacted the North Country with a concentrated area of wind damage across the Champlain Valley. We had 34 reports of trees and powerlines down extending from near Lyon Mountain in Northern New York across the Champlain Valley into Southern Vermont near Springfield. This line of storms caused over 10,000 power outages across the region during the afternoon hours on July 23rd. Figure 7 shows a strongly tilted reflectivity core associated with a descending rear inflow jet. The tilted core is caused by strong 50 to 60 mph northwest winds pushing the reflectivity toward the southeast. This structure combined with a weakening of the reflective field on the backside, indicates very strong winds are likely with this storm. This reflectivity cross section was taken as the line of storms approached Port Kent, NY at 3:20 PM.

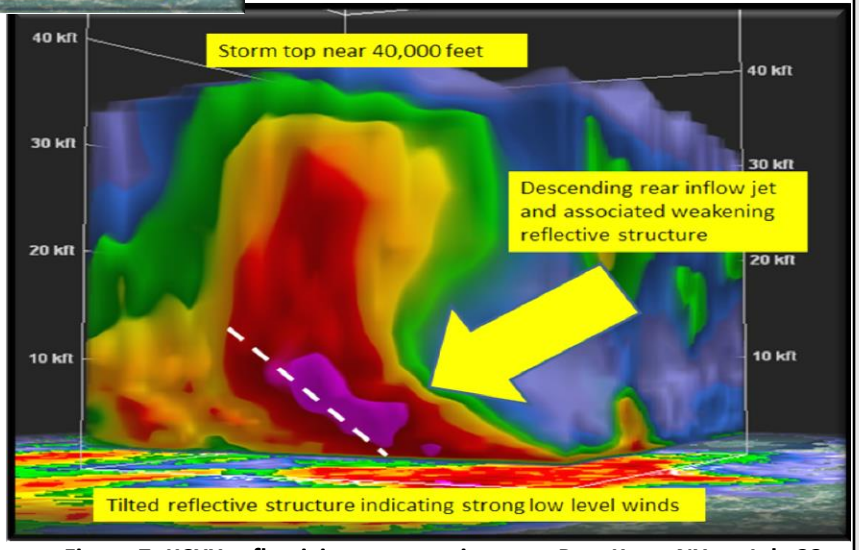

Figure 7: KCXX reflectivity cross section near Port Kent, NY on July 23, 2016 at 3:20 PM.

The final image, Figure 8, shows the KCXX 0.5° reflectivity (left) and velocity (right) on July 23, 2016, at 3:24 PM. The velocity data shows two large and well-defined areas of 50 to 60 mph winds impacting the eastern side of the Champlain Valley. The first enhanced area of damaging thunderstorm winds is associated with an outflow boundary located from near Richmond to Shelburne to Essex, New York. Meanwhile, the secondary area of strong winds was closely tied to the stronger reflectivity located from near Peru, New York to Burlington to Fairfax. The yellow circle shows an area of weak reflectivity, that is correlated with an area of

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50 to 60 mph inbound winds, which produced damaging winds across the Champlain Valley.

In summary, the severe weather season across the North County was near average in terms of the number of warnings issued by our office (49) and reports of severe weather (123) received from May through August. The ratio of wind reports (110) versus hail reports (13) was much higher than the previous couple of years, which was caused by the very warm thermal profiles in the atmosphere. The favorable position of stronger winds at mid and upper levels associated with troughs and cold fronts resulted in damaging winds being the primary threat from thunderstorms in 2016 across Northern New York into Central and Northern Vermont. As we approach the fall months our threat for severe weather decreases from the lack of surface heating and instability, but every couple years we can experience a few stronger storms with damaging winds and hail.

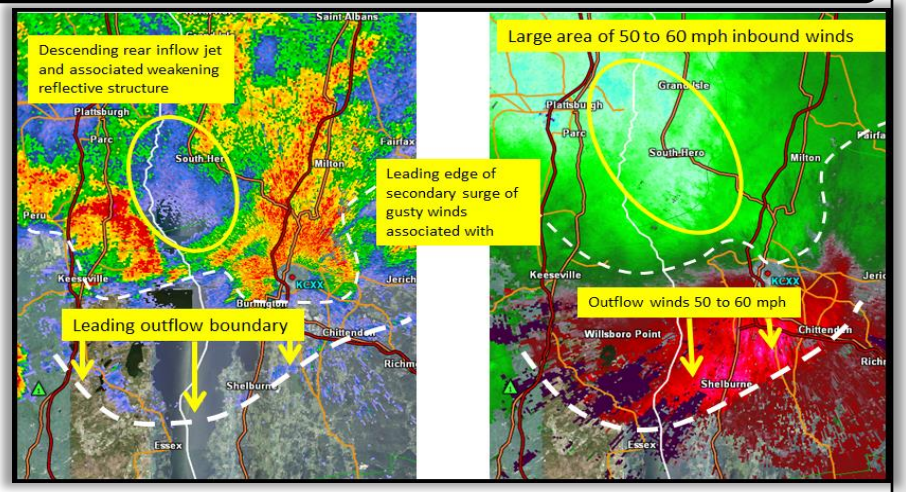
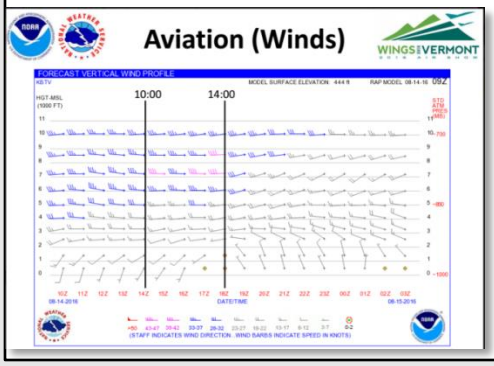


Figure 8: KCXX 0.5° reflectivity (left) and velocity (right) on July 23, 2016 at 3:24 PM.

The Wings Over Vermont Airshow took place in Burlington on August 13th and 14th, 2016. Forecasters at the National Weather Service in Burlington helped support that event. Beginning with the practice run on Friday and lasting right through Sunday, we participated in the morning briefing, which was designed to give an overview of the day's events. This briefing brought together a host of different partners, including the Thunderbird pilots, Vermont Air National Guard, Burlington International Airport official, the FAA and the U.S. Coast Guard. We also worked closely with state and city emergency management to ensure no hazardous weather could be expected for event-goers. We were available to answer questions and coordinate how best to contact and communicate the weather hazards of each day, such as the timing of a wind shift as depicted on the image below. An updated safety briefing was issued each afternoon.

Saturday August 13th proved to be the most impactful from a weather safety perspective. A stubborn area of overcast low clouds, with bases of around 500 feet or lower, produced severely-degraded flying conditions not just for viewing the planes but would have put the Thunderbird pilots at risk given the mountainous terrain. We were in close contact with the Emergency Operations Center with phone calls each hour to update officials on current and expected weather conditions. As the day unfolded it became more likely that these low clouds would stick around and never break. Those conditions led to no flying taking place on Saturday. Sunday offered much better conditions for the Air Show with abundant sunshine.



It was a privilege and pleasure to work with our partners to ensure the safety of all those involved. Overall, a great experience!

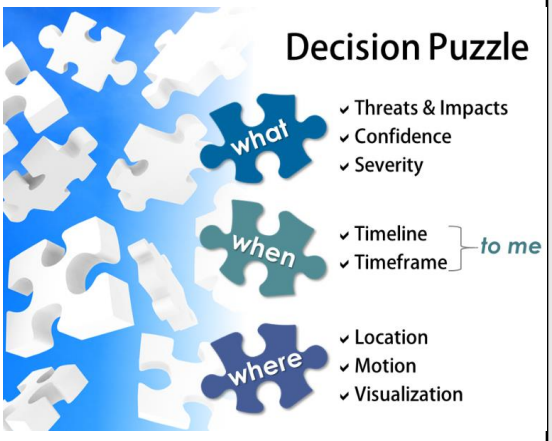
Impact Decision Support Services Boot Camp

-Kimberly McMahon

Effective IDSS
- ✓ Get the right info...
- ✓ to the right people...
- ✓ in enough time...

This past July, I had the privilege to travel to Kansas City, MO for training on how best to serve National Weather Service customers and partners to meet their needs. You may have heard the term "Decision Support Services" or DSS for short. At the heart of DSS is the combination of creating a high quality forecast and communicating this information effectively to decision makers. This is a vital part of our job as we need enable our partners to make the most informed decisions with regard to public safety possible.

The main focus of this class was communication and knowing how to operate in the intense and sometimes unpredictable environment when being deployed to support an incident such as a wild fire, tropical storm or other significant event where weather may be a factor in safety. During these types of events, the National Incident Management System is utilized throughout the nation, in order to maintain continuity regardless of jurisdiction. In other words, whether one of our meteorologists are deployed to a wild fire out in California, or to help with tropical storm flooding in the Carolinas or assist in planning and safety for the Papal visit in New York City, there will always be a common structure of departments, people and resources. Being familiar with this system helps everyone adjust quickly to their duties and their teams.



During these incidents, we as meteorologists have the information of any weather threats that may impact those working out in the field, such as during a large scale rescue operation. The National Weather Service personnel need to be able to communicate those threats and impacts in a way that is actionable for the people making decisions. An example would be how the sun and heat will rise throughout the day, making it unsafe for rigorous activity. The decision makers can then take the information we provide and take action to keep people safe.

One day of training was dedicated to a simulation of major river flooding that would effect evacuation and rescue teams. This simulation or exercise included briefing for daily operations and planning, on the spot briefings for pilots and emergency managers, as well as communicating with the media and politicians. As one of the participants stated, "On camera interviews and media/press-conference briefs were also conducted which made the whole experience seem quite real." The simulation was a culmination of a week's worth of class, clarifying risk communication with concepts such as "Bottom line up front," effectively communicating hazards, impacts and specific actions that can be taken to enhance safety.

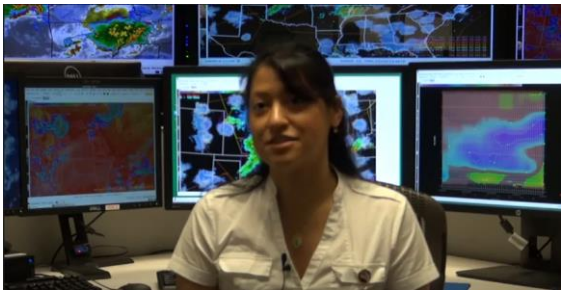
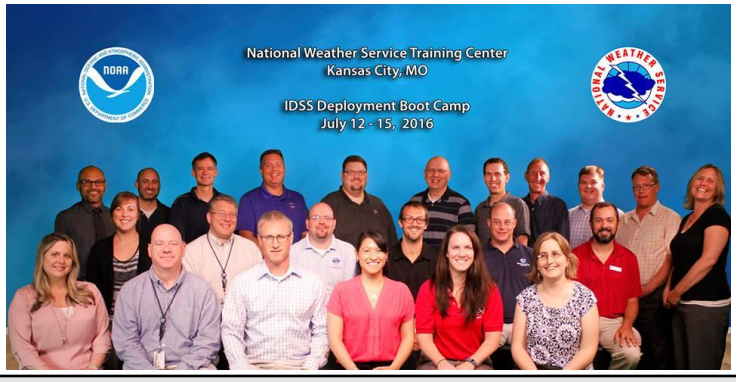


Image above from practice media interview during training simulation.



River Forecasts Begin for Winooski River at Waterbury Vermont

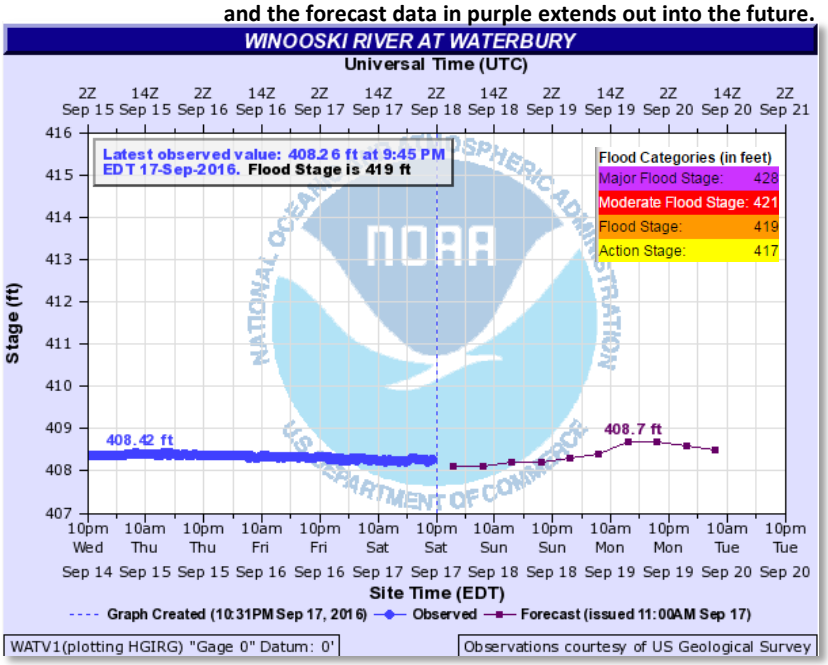
-Gregory Hanson

Waterbury Vermont has a new tool to aid in flood preparedness and resiliency. On August 29 the National Weather Service (NWS) began issuing forecasts for the Winooski River at Waterbury Vermont. Predictions of water levels extending out three days are updated once daily during normal and low flow conditions, and more frequently as conditions warrant during high water or flooding. These new forecasts are possible based on work by the US Geological Survey (USGS) in cooperation with the Vermont Agency of Natural Resources.

"We are pleased to begin river forecasts for the Winooski at Waterbury," said Andy Nash, Meteorologist in Charge at the National Weather Service in Burlington. "River forecasts increase our capability to warn of impending floods and provide sound information for local emergency managers and responders to make critical decisions". Mr. Nash went on to note that river forecasts will be useful during quiet periods: "Recreationists such as paddlers and anglers benefit from daily river level forecasts, as well as other interests such as dam operators and power companies".

River forecasts were developed at the NWS Northeast River Forecast Center (NERFC) in Taunton MA, a regional center of expertise in water forecasts. Hydrologists at the NERFC utilized flood studies done by the USGS in 2015 that created flood inundation maps for Waterbury. These river simulations were adapted and improved so that daily forecasts of river flows are predicted as part of the Winooski River system. The result is the forecast for Waterbury that is integrated with existing forecasts for the Winooski River at Montpelier and Essex Junction VT. Forecasts will continue to originate with the NERFC, and be disseminated by the NWS Office in Burlington, Vermont.

Example of observed and forecast river levels for the Winooski River at Waterbury, VT. The blue line is observed data for the previous 3 days, and the forecast data in purple extends out into the future.



Forecast information for the Winooski River at Waterbury and other locations are available at the website www.weather.gov/btv/rivers. A graphic and text display shows past observed river levels and future forecasts, including in times of flood how long it will take the river to reach flood stage, how high the river will rise, and how long the flood will last.

Flood stage for the Winooski at Waterbury is set at 419 feet when the river spills its banks into low-lying fields near Waterbury Village and downstream to Richmond. Moderate flooding begins near 421 feet when Rowe Field in Waterbury floods and water approaches lower parking lots in the Waterbury State Office Complex. An elevation of 428 feet is considered major flooding, when water floods homes and businesses in Waterbury Village, and is equivalent to the Federal Emergency Management Agency's (FEMA) 1 Percent Annual Chance Flood. The community was hit hard by Tropical Cyclone Irene on August 28 and 29 2011, when the river rose to nearly 430 feet. The flood studies by the USGS were a direct result of FEMA support following the flooding from Irene in 2011.

Experiences at the Hazardous Weather Testbed

-John Goff

This past June, John Goff, Lead Meteorologist at the NWS in Burlington had the opportunity to attend a special flash flood operations course at the Hazardous Weather Testbed (HWT) in Norman, OK. During the one-week course forecasters from around the NWS were tasked to evaluate, and give feedback on new and existing tools designed to enhance situational awareness for potential flash flooding episodes. To help facilitate the process, forecasters worked pseudo-operational shifts each day, focusing on regions of the country where elevated risks of heavy rainfall and flash flooding were more likely. Using the varied tools, flash flood warnings were issued internally, then evaluated for accuracy and compared with real NWS warnings the following morning. Through this process, a better understanding of each tool's strengths and weaknesses was gained and enabled forecasters to provide more concrete feedback on their effectiveness.

The GFS Prediction Probability Tool is an exciting new capability likely to be incorporated into real-time NWS operations in the next few years. The application uses the GFS model to give probabilities of a flash flooding report in or near 0.25 x 0.25-degree grid cells across the nation from the current time, out to 6 hours. In general, the product is intended to save time by highlighting potential areas in which heavy precipitation and resultant flash flooding are more likely. This will potentially lead to better forecasts and predictions of flash flooding episodes.

Another tool which showed great promise was the Multi-Radar Multi-Sensor (MRMS) Maximum Precipitation Return Period (MPRP) product. Now that's a mouthful!

Forecasters gather at the HWT for a morning pre-operations flood threat briefing before beginning their day.

During typical flash flooding episodes, the forecaster must gauge, to the best of his or her ability the amount of rainfall occurring across a particular threat area during a given amount of time. Extreme precipitation return periods are likely to overwhelm small streams and infrastructure – think Tropical Storm Irene or a flash flooding event you remember. The MRMS MPRP product allows the forecaster to quickly assess the maximum level of threat over any given time period (1 hour, 3 hours etc.) in an output gauged in return periods. For example, a heavy precipitation event with a 50 year return period would be potentially much worse than one with just a 3 year return period.

As a whole, the HWT course was a valuable experience for all attendees. In addition to having the opportunity to work with other forecasters from across the NWS, attendees were able to give thoughtful feedback (positive or negative) on a variety of flash flooding tools designed for the operational environment. Through these types of research to operations (R to O) efforts, the science of meteorology and hydrology will advance – in turn leading to more accurate warnings and ultimately saving more lives.

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Volume III, Issue III

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We Need Your Storm Reports!

Please report snowfall, flooding, damaging winds, hail, and tornadoes. When doing so, please try, to the best of your ability, to measure snowfall, estimate hail size, and be specific as to what damage occurred and when. We also love pictures!

For reports, please call:
(802) 863-4279
Or visit:
http://www.weather.gov/btv/stormreport

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