

National Weather Service

2015 Shareholders Report



Photo: Wade Bell, Leavenworth, Indiana



Louisville, Kentucky



Welcome

Welcome to the eleventh edition of National Weather Service (NWS) Louisville's Shareholders Report. You are a shareholder in the NWS! This report details the activities of NWS Louisville in our area of responsibility across southern Indiana and central Kentucky during 2015.

From our perspective, 2015 will be remembered for three weeks toward the end of the winter season with plenty of cold and snow. The worst storm struck March 4-5, which is summarized at weather.gov/lmk/march_2015_flood_and_snowstorm.

One month later, on April 3-10, during a lengthy period of severe weather and flash flooding, we provided onsite weather support for a six-alarm fire at the General Electric (GE) plant in Louisville (weather.gov/lmk/April_3_10_2015_SevereEvents).

Our top four highlights of 2015 were:

- Instituting a new online storm spotter class, weather.gov/lmk/onlineskywarn
- Two new educational videos about winter weather, posted on our YouTube channel
- A major upgrade to the computer system we use for forecasts and warnings
- When the Doppler radar at Fort Knox had mechanical troubles during a severe weather outbreak on December 23, Electronics Technician Todd Adkins stayed with the radar and kept it operating until the severe weather threat was over. Todd then fixed the radar on Christmas Day when the needed parts arrived.

The NWS was appropriated \$1.06 billion for Fiscal Year 2015, which was an investment of \$3.30 per American. As the leader of NWS Louisville, I feel it is my duty to report to you how your holdings have fared.

I am grateful to Lead Forecaster and Shareholders Report Editor Tom Reaugh for assembling another exemplary report, and Science and Operations Officer Ted Funk for his thorough review of the document. I welcome your suggestions as to how the NWS can be an even better investment for you.

John Gordon
Meteorologist-in-Charge

Contents

Change in Forecasting Methods to Support Decisions	2
Providing Critical Support for Emergency Management	3
Service Above Self	4
Exploring How Strong Winds Damage Trees	4
Congressman Massie Tours NWS Louisville	5
Winter Storms Slam the Region	6
New Flood Forecast Information	7
Students Gain Valuable Experience	8
Social Media Activities Continue to Grow	8
Hollings Student Conducts Tornado Research Project	9
Resources	10



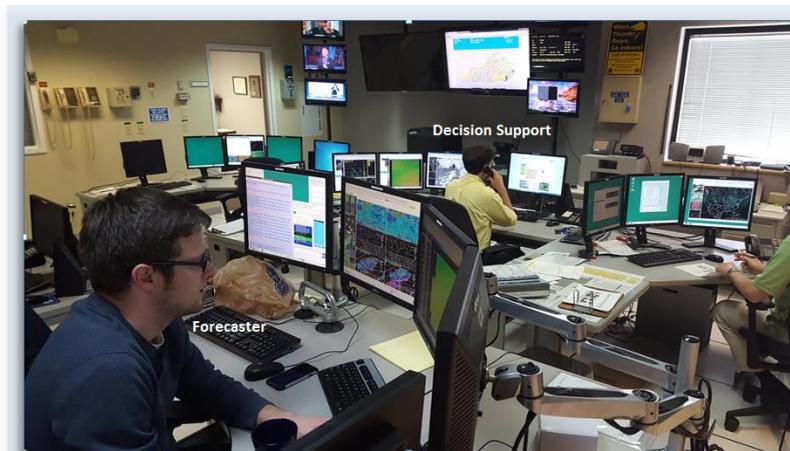
Change in Forecasting Methods to Support Decisions

By *Brian Schoettmer, Forecaster*

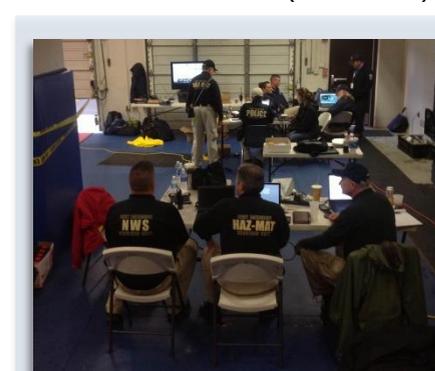
The weather is simply a topic of casual conversation for some, but for others it can be the focus for difficult, critical decisions that affect many people. An unexpected weather event could cost money, time, and possibly lives. In an effort to help our customers, especially those in law enforcement and emergency management, make better weather-related decisions, NWS Louisville is testing operational changes that allow a forecaster to devote more time to supporting those decisions. The end result is more interaction with our partners and customers through telephone briefings, information sharing via our website and social media, and onsite support.

Previously, two meteorologists would compose the forecast with one person taking the short term period (e.g., today, tonight, and tomorrow), and the other doing the long term forecast (e.g., tomorrow night through Day 7). With recent advances in the tools we use to make the forecast, we now are able to have one meteorologist handle the entire 7-day forecast period most of the time. This frees up the other forecaster to make informational graphics, construct hazardous weather briefings, answer telephone calls, and even travel to a site to help local agencies make decisions. For example, during an

impactful winter storm we may send our Decision Support Specialist to the Kentucky Emergency Operations Center (EOC) in Frankfort where he or she can directly brief state and federal officials. Another example is when we provide onsite support for a major hazardous material (HAZMAT) incident when wind and precipitation information are critical.



Shown here in the operations area of NWS Louisville, Forecaster Kevin Deitsch, left, works on the public forecast for the next seven days. Lead Forecaster Tom Reaugh, center, works as the Decision Support Specialist fielding phone calls and maintaining situational awareness via the monitors at his workstation and those mounted on the office wall.



We provided support at Thunder Over Louisville, Kentucky Oaks and Derby, and the Senior PGA tour as shown here with Toby TenHarmsel, ITO, on the left.

Our decision support position stays busy year-round. Spring, summer, and fall bring numerous outdoor festivals, fairs, and activities, while winter brings ample opportunities to brief school superintendents, state officials, and emergency managers on impending winter weather impacts. Our Decision Support Specialist also spends more time interacting with the public via Facebook and Twitter, including live Q&A sessions before major weather events. In addition, the Decision Support Specialist has more time to focus on aviation forecasting that saves air carriers time and money, and improves the overall flow of the National Airspace System.

Hopefully you've noticed an increase in our interaction with our stakeholders, and we will continue striving to improve our service to you the best we can.

Providing Critical Support for Emergency Management

By Joe Sullivan, Warning Coordination Meteorologist

NWS Louisville continued its strong support of Decision Support Services (DSS) in 2015. In addition to our well-established efforts for scheduled events like Thunder Over Louisville, the Kentucky Oaks, and the Kentucky Derby, NWS staff provided onsite support for the PGA Senior Tournament and Breeders' Cup as well. Even though the weather during those events was relatively benign in 2015, there were still challenges such as Ohio River flooding during Thunder Over Louisville which threatened to severely curtail the waterfront space available for the 600,000 spectators. Fortunately, the river level dropped enough to only minimally affect the viewing area.

During Thunder Over Louisville we deployed not only to emergency management operations on both sides of the Ohio River, but also to the air command center. With dozens of planes performing low altitude maneuvers over the immense crowd in an urban setting, the need for timely, accurate aviation weather support was crucial for public safety. NWS Louisville partnered with the FAA in the command center.

Non-scheduled deployments were of arguably greater significance than our support for public safety at scheduled events. NWS Louisville was at the state EOC in Frankfort for two winter storms and supported emergency personnel during a massive fire in early April at the GE Appliance Park in Louisville. Not only was the GE fire one of the largest in the city's history, but it occurred in the middle of an intense rainfall event that caused flash flooding, washed out roads, and spawned over one hundred water rescues, some near the intense fire.

Given that the GE fire occurred on the 41st anniversary of the 1974 Super Outbreak F4 tornado that devastated Louisville, some in Louisville were left wondering what other disasters are lying in wait for April 3 in future years. Whatever those may be, the region can rest assured that NWS Louisville will provide weather support to help the community plan and respond.



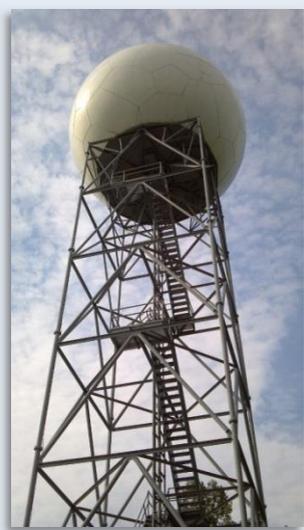
Left: Flooding along the Ohio River in April could have had a major impact on Thunder Over Louisville, but receded just in time for the event.

Right: The Louisville GE fire produced thick smoke over a large area and threatened the safety of nearby residents.



Service Above Self

By **Todd Adkins, Electronics Technician**



At 6:50pm on December 23, the Doppler radar at Fort Knox, one of NWS Louisville's main sources of radar information, began experiencing equipment failures and stopped transmitting data. Electronics Technician Todd Adkins was called in to investigate the problem. After determining a site visit would be required, Todd rushed to Fort Knox and arrived at 8:15pm. In just five minutes Todd was able to restart the radar's data flow. Todd decided to stay with the radar to make sure it would operate normally since there were several Severe Thunderstorm Warnings and a Tornado Watch in effect. Unfortunately, half an hour later the radar experienced the same failure that it had suffered earlier. Because Todd had remained at the radar, he was able to get data flowing once again within a few minutes. Todd sat with the radar until after midnight when the storms finally exited the region.

The necessary replacement parts arrived on Christmas morning. Despite having holiday travel plans, Todd instead went to the Fort Knox radar site to install the new parts. After installation and verifying the integrity of the radar, he returned it to service and came back to Louisville.

Everyone at NWS Louisville is called upon to make sacrifices which often are invisible to the public. Todd fully demonstrated his strong dedication to the mission of this office and agency, and reaffirmed his "service above self" attitude. This is the mindset and character of the entire NWS Louisville team.

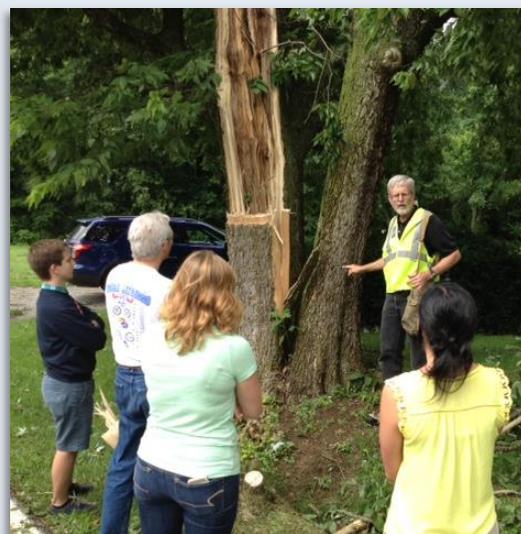
Exploring How Strong Winds Damage Trees

By **Melissa Dye, Student Volunteer**

On June 26, NWS Louisville conducted a storm damage survey in Shelby County with Dr. Bill Fountain, an arboriculture professor and tree expert in the Department of Horticulture at the University of Kentucky. United Parcel Service (UPS) meteorologist Randy Baker and five meteorology students assisted.

Dr. Fountain provided on-the-spot training, diagnosing how tree failure can occur from high winds or a combination of winds and preexisting conditions of the tree such as rot, disease, or a compromised root system.

John Gordon and Dr. Fountain are now on an Enhanced Fujita (EF) Scale subcommittee. They are studying all types of trees, both softwoods and hardwoods, to look at wind speed damage ratings based on the type and condition of the trees. Their goal is to make wind estimates more accurate.



Dr. Fountain explains how trees are damaged during storms, especially when preexisting conditions compromise the tree's ability to withstand strong winds.

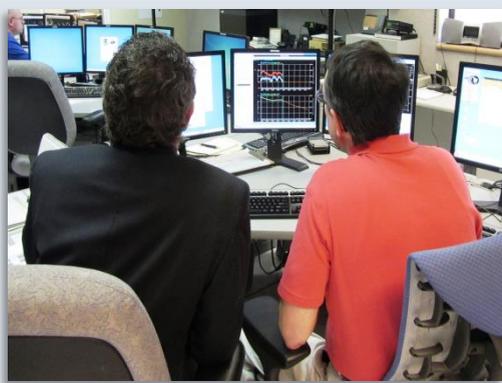
Congressman Massie Tours NWS Louisville

By Mark Jarvis, Lead Forecaster

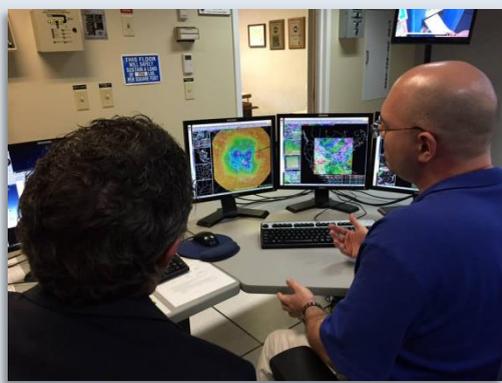
Congressman Thomas Massie (R-KY) visited NWS Louisville on March 31. John Gordon gave Congressman Massie a tour of the office and the Congressman sat down with staff members to learn more about the NWS mission and its state-of-the-art technologies.



Above left, John Gordon shows Congressman Massie the NWS Louisville area of responsibility. Above right, Forecaster John Denman demonstrates the three dimensional capabilities of the NWS Doppler radar system.



Above left, Service Hydrologist Mike Callahan demonstrates hydrological operations. Above right, Science and Operations Officer Ted Funk demonstrates the Weather Event Simulator and explains how NWS forecasters use it for training.



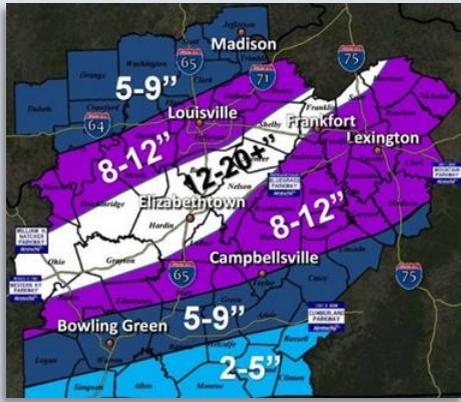
Above left, Lead Forecaster Mark Jarvis shows the different kinds of computer model data that forecasters use to prepare forecasts. Above right, Warning Coordination Meteorologist Joe Sullivan explains the Weather Ready Nation concept and Decision Support Services that the NWS provides to local and state agencies.

Winter Storms Slam the Region

By Zack Taylor, Forecaster

After a slow start to the 2014-15 winter season, Mother Nature made up for it in a big way as several winter storms made an impact on central Kentucky and southern Indiana between mid-February and early March.

The first storm swept in on February 16 and brought widespread 8 to 12 inch snowfall totals across central Kentucky and extreme southern Indiana. A narrow band of 12 to 20 inches fell from Hartford through Elizabethtown to Frankfort.



February 16, 2015 Snowfall

Louisville	10.9"
Lexington	10.2"
Bowling Green	9.6"

In the wake of the storm, the coldest air of the season settled over the lower Ohio Valley. Average daily temperatures from the 17th to the 20th were 25° to 30° below normal. The coldest morning was February 20 with widespread sub-zero readings reported. The mercury dropped to -6° at Louisville International Airport and an astonishing -18° at Lexington's Blue Grass Airport. The deep snow pack and cold temperatures delayed snow removal from roads and caused pipes to freeze. There were widespread school and business closures for much of the week.

As the calendar rolled into March and thoughts turned to spring, a historic winter storm struck the Ohio Valley. A strong low pressure system first brought heavy rain, resulting in rising rivers and minor flooding. As temperatures tumbled during the day on March 4, the rain changed to a wintry mix and heavy snow by afternoon. Intense snow bands set up across central Kentucky for several hours that evening and into the early morning of March 5. For several hours snow rates exceeded 2 inches per hour across central Kentucky. Thundersnow was reported during the evening and overnight.

March 4-5, 2015 Snowfall

Louisville	11.9"
Lexington	17.1"
Bowling Green	7.2"

By the next morning many locations reported snow totals in excess of 20 inches. In fact, the highest total of nearly 25 inches in Hardin County was just an inch shy of breaking Kentucky's all-time snowfall record. The storm and its impacts made national news as hundreds of drivers were stranded

for several hours on Interstate 65 near Elizabethtown. Accidents backed up traffic, and snow crews were unable to reach the scene.

During the three weeks from mid-February to early March, several winters' worth of snow piled up. Residents of southern Indiana and central Kentucky would likely agree that this was one of the harshest periods of winter weather in recent memory.

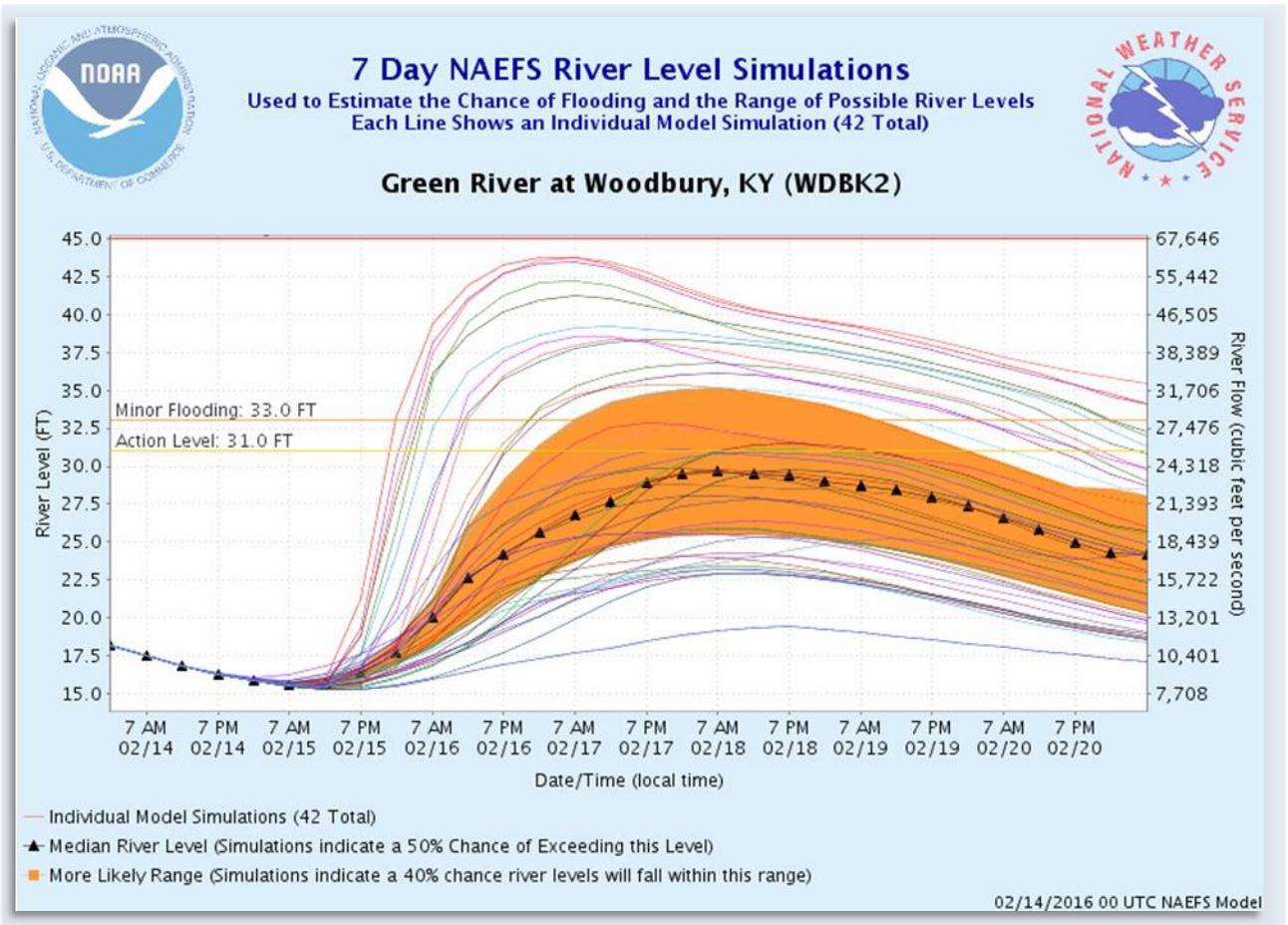


Cars were stranded by snow in central Kentucky on March 5, 2015.

New Flood Forecast Information

By Mike Callahan, Service Hydrologist

The NWS has introduced a new service on the Advanced Hydrologic Prediction Services (AHPS) webpages for our customers who are concerned about river levels. Derived from the science of Chaos Theory, we now show different scenarios of future precipitation and snow melt forecasts and how they will affect river levels. For example, below are the possible traces for the Green River at Woodbury for a seven day period. These types of graphs are called "spaghetti plots."



Each line on the graph is a different forecast from a computer model. The collection of different forecasts is called an ensemble. In this example there is around a 40% chance that the river could exceed its 33 foot flood stage. However, the median of the forecasts has the river cresting just below the 31 foot action level.

On the same webpage, one can also see the precipitation and snow melt traces that went into making the forecasts.

Ensembles for the next three and seven days are displayed for most forecast points which are linked near the bottom of every AHPS page. In addition, one can look at the entire region to see the chance of flooding. The NWS hopes this information helps officials responsible for short and medium range flood planning.

water.weather.gov/ahps2/index.php?wfo=LMK

Students Gain Valuable Experience

By Melissa Dye, Student Volunteer

During the summer of 2015, NWS Louisville hosted three student volunteers to give them an opportunity to learn more about NWS operations and to contribute to office projects. In addition, the students helped submit storm reports during active weather events and assisted with storm damage surveys. The students went on familiarization trips to Mammoth Cave, Kentucky Mesonet sites, and the Doppler radar at Fort Knox.

University of Louisville junior Christina Andress updated flash flood hotspot maps, detailing the most vulnerable flash flood locations in each county.

Melissa Dye, a senior at the University of Louisville, helped Lead Forecaster Tom Reaugh with a tornado track map project by finding starting and ending latitude and longitude points for every tornado recorded in the area.

Western Kentucky University junior Jessica Dobson helped organize online content for our new website format. She transferred and copied a large amount of code to fit the new requirements of the website redesign.



L to R: Jessica Dobson, Melissa Dye, Christina Andress

Social Media Activities Continue to Grow

By Ron Steve, Lead Forecaster

NWS Louisville continues to expand its presence on multiple social media platforms including Facebook, Twitter, and YouTube. During the 2014-15 winter season we added a Winter Weather playlist to our YouTube channel with short educational videos focused on winter weather safety and science. Upcoming plans in 2016 include adding playlists for floods/flash floods and extreme heat, as well as expanding our severe weather selection.

Facebook and Twitter continue to be invaluable for two-way communication of weather information. Live Q&A sessions remain a great way for NWS forecasters to interact with the community and help the public better prepare for impending weather. Also, we encourage you to share ground truth information and weather-related photos with us on Twitter and Facebook. On Twitter, just mention us, @NWSLouisville, or use the hashtag #kywx or #inwx as applicable. On Facebook, simply post to our timeline. When your reports are posted on social media, we are able to relay critical information to our media and emergency management partners and your fellow citizens who may be in the path of the storm.

Facebook: facebook.com/NWSLouisville/
Twitter: [@NWSLouisville](https://twitter.com/NWSLouisville)
YouTube: youtube.com/NWSLouisville

Hollings Scholar Conducts Tornado Research Project

By Kevin Deitsch, Forecaster

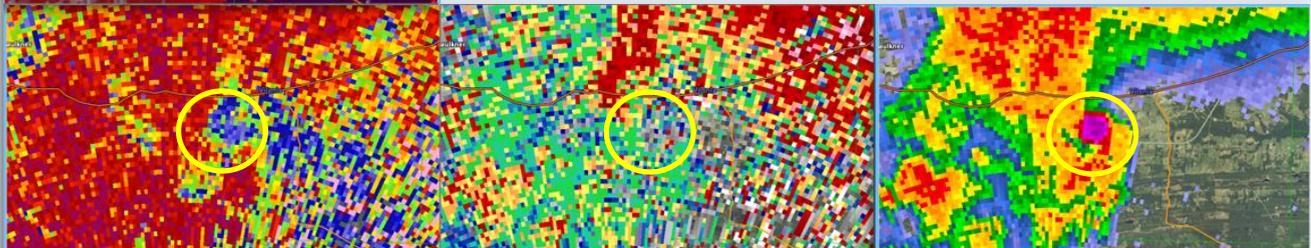
This past summer, NWS Louisville was privileged to host an Ernest F. Hollings scholar. The Hollings Scholarship is awarded to top sophomore college students enrolled within disciplines specific to the National Oceanic and Atmospheric Administration (NOAA). Once selected, the students then choose locations within NOAA to compose a 9-week summer research project. NWS Louisville is very fortunate to have had three students over the past two summers assist us with local research projects. Brian Greene from the University of Illinois was the student selected to come to NWS Louisville in 2015. Brian worked with Forecasters Kevin Deitsch and Zack Taylor, and Science and Operations Officer (SOO) Ted Funk. The project investigated past radar signatures that were associated with tornadoes.

Over 150 tornadoes were examined in the study dating back to 2012. Radar parameters known as spectrum width (SW), correlation coefficient (CC), and normalized rotation (NROT) were examined. SW is a measure of the chaotic nature of winds in a specific area of a storm. Given that a tornado has very strong winds turning in many directions, SW values tend to be high in tornadic storms. CC is a dual-polarization radar parameter that shows how similar a storm's hydrometeors (rain or hail) are. Hail stones tend to differ in size and be mixed with rain, resulting in low CC values, whereas a storm with all rain will have high CC values. Debris from a tornado can also sometimes be seen by radar and will have low CC values given differing sizes of the debris (leaves, trees, boards, etc). Finally, NROT is an algorithm developed by Gibson Ridge, a private radar software company, that quantifies the strength and depth of rotation in a thunderstorm. The stronger and deeper the rotation within a thunderstorm, the better chance it has of producing a tornado.

Brian meticulously collected these radar variables for each tornadic case, recording values for the minutes leading up to the tornado, during the tornado, and minutes after the tornado lifted. The trends in the values collected were designed to help lead to improved tornado warnings. The data not only will help NWS forecasters potentially gain lead time on tornado warnings, but should also assist in the recognition of a tornado already on the ground and how strong it may be. Ultimately, these data will be crucial to improved tornado warning services at NWS Louisville as forecasters will have the ability to compare real-time radar data with the values and trends discovered in this study, aiding in the identification of tornado formation, strength, and dissipation.



Top left: This velocity radar image shows tight rotation where the green and red colors are close to each other. Bottom left: CC is displayed, with low values (blue) where the suspected tornado is occurring. Bottom center: SW shows chaotic flow in the storm. Below right: Base reflectivity, with the tornado indicated by reds and purples.





weather.gov/Louisville
weather.gov/Lexington
weather.gov/BowlingGreen



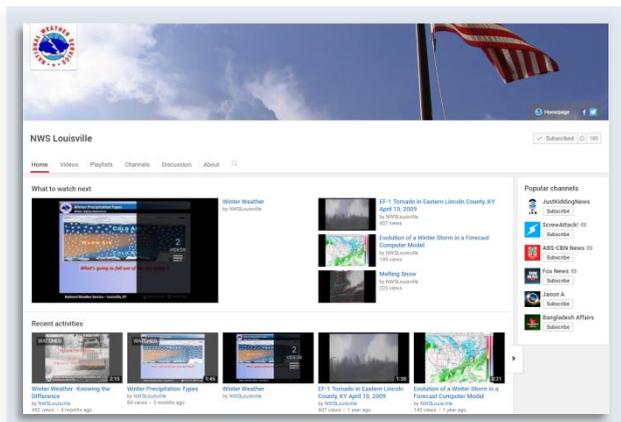
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**Briefing Slides Before
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