National Weather Service, Louisville

2009 Shareholders' Report

Inside this issue:

Your Investment in the National Weather Service

John D. Gordon, Meteorologist in Charge

Welcome to the fifth edition of the Shareholders' Report from your National Weather Service (NWS) office in Louisville (LMK). You are a shareholder in the NWS! As a taxpaying citizen of this country, you have invested in the Federal government, of which the NWS is a part. The NWS's parent organization, the National Oceanic and Atmospheric Administration (NOAA), was appropriated $958 million for Fiscal Year 2009. That equates to an annual investment of $3.11 per man, woman, and child in the United States. As the Meteorologist in Charge (MIC) of your investment locally, I feel it is my duty to report to you how your "holdings" have fared.

John Gordon and local dignitaries at the installation of a new "Mesonet" weather station in Grayson County in May. Read more about the Kentucky Mesonet on page 2. *Pictured above, left to right: Senator Mitch McConnell (R-KY), Kentucky State Climatologist Dr. Stuart Foster, Western Kentucky University President Gary Ransdell, John Gordon, and Grayson County School Superintendent Barry Anderson.*

This report details the activities of NWS Louisville and events in its area of responsibility in southern Indiana and central Kentucky during 2009. Since you are both a shareholder and a customer, I hope you find our activities have demonstrated the sort of stewardship you expect from your public servants.

John D. Gordon
Meteorologist in Charge

As always, I look forward to your comments and suggestions concerning how the NWS can be an even better investment for you in the future.

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Kentucky Mesonet

Dr. Stuart Foster, Kentucky State Climatologist

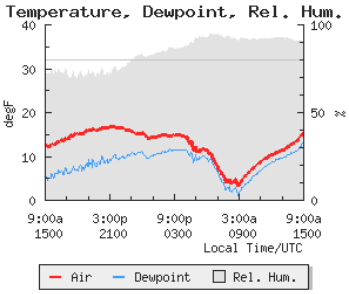
The Kentucky Mesonet is a network of automated weather and climate monitoring stations being developed by the Kentucky Climate Center at Western Kentucky University (WKU) to serve diverse needs in communities across the Commonwealth of Kentucky. Earmark funding for the Mesonet was secured by Senator Mitch McConnell. The Mesonet reflects a partnership between WKU and the NWS.

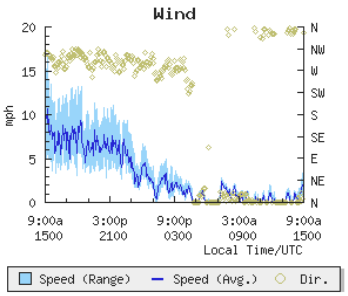
Each Kentucky Mesonet station measures air temperature, precipitation, relative humidity, solar radiation, and wind speed and direction. Observations are taken every five minutes. Data are retrieved and undergo quality assurance checks. Kentucky Mesonet data are then ingested by the NWS and made available to the general public through a website at *www.kymesonet.org*.

The Kentucky Mesonet reached a project milestone in 2009. A total of 25 new automated weather and climate monitoring stations were added, bringing the total number to 45. The Mesonet signed its 50th site agreement, halfway toward a long-term goal of 100 sites.

The quality of data provided by the Kentucky Mesonet is fundamentally related to the quality of the observing sites. Representatives of the Kentucky Mesonet have worked closely with local officials and stakeholders throughout the Commonwealth in an effort to identify available sites of the highest quality possible, while also striving to maximize benefits to local communities. Kentucky Mesonet sites are located in open areas away from buildings, trees, parking lots, and other obstructions in an effort to ensure that the Kentucky Mesonet meets both short-term operational needs and long-term research needs associated with climate monitoring.

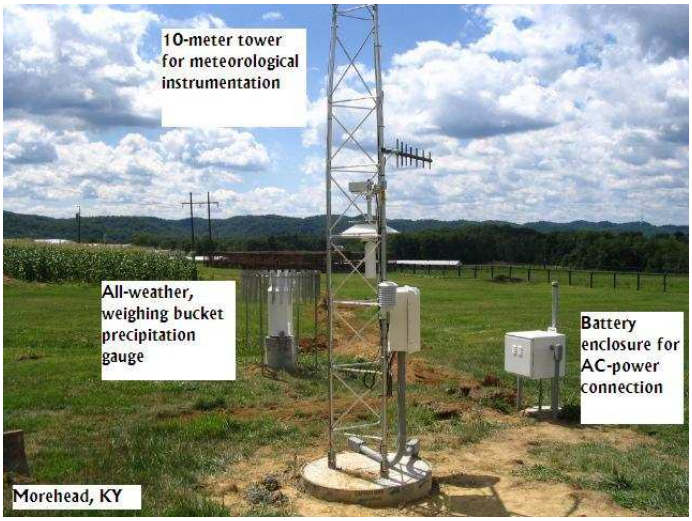
The goal for this year is to add 20 new stations in an effort to expand coverage and fill in gaps, primarily in southern and eastern Kentucky where site identification is much more challenging due to the rugged terrain and high percentage of forested land.





Data are on-line and can be displayed in graphical or tabular format.

The Kentucky Mesonet is an excellent example of a successful federal-state partnership. Since an initial organizational meeting on January 17, 2006, the Kentucky Climate Center and the NWS offices serving Kentucky have worked closely in an effort to build a high quality network to serve the people of Kentucky in communities throughout the state. The data are used heavily by the NWS, and figure prominently in daily weather monitoring. Kentucky is truly fortunate to have one of the nation's few statewide weather observation networks.



Monthly Climatological Summary
Experimental Version
Full Quality Control Not Applied
(5/2009)
KENTUCKY MESONET

Station ID:	PCWN
Relative Location:	Liberty 3 SW
County:	Casey County
***Location:**	Lat: 37.28°; Lon: -84.96°
Elevation:	958 ft.
Observation Day:	Eastern Standard Time

*To Nearest Hundredth

Day	Date	Temperature (°F)				Degree Days		Humidity (%)		Precip (inch)	Wind Speed (mph) and Direction				Solar (MJ/m²)
		Max	Min	Avg	Avg Dwpt	HDD	CDD	Max	Min		Res Dir	Res Spd.	Avg Spd.	Max 3-sec	
FRI	1	71.5	61.6	66.6	60.3	0	2	95	65	0.40	SSW	6.8	7.1	25.1	8.7
SAT	2	63.2	54.3	58.7	54.4	6	0	96	86	0.48	NNE	2.9	3.6	10.5	3.4
SUN	3	58.8	54.2	56.5	54.3	8	0	97	85	0.91	NNE	5.2	5.4	19.4	3.8
MON	4	61.8	52.0	56.9	52.7	8	0	96	67	0.51	NNE	3.7	4.2	14.1	7.0
TUE	5	67.5	56.1	61.8	55.9	3	0	96	67	0.05	SSW	0.9	2.5	9.4	7.0
WED	6	68.3	54.3	61.3	58.0	4	0	97	76	0.26	SSW	3.1	4.9	23.2	5.5
THU	7	74.3	58.0	66.1	60.4	0	1	96	62	2.06	SW	2.7	3.5	24.8	9.8
FRI	8	77.3	55.4	66.3	61.5	0	1	97	61	1.11	SSW	3.0	4.2	30.7	10.7
SAT	9	72.8	54.3	63.6	58.5	1	0	96	36	0.23	WSW	3.9	5.1	16.7	10.8
SUN	10	68.7	46.8	57.8	47.0	7	0	97	35	0.05	NNW	1.5	2.6	14.3	17.5
MON	11	69.4	50.0	59.7	48.6	5	0	96	40	0.05	NNW	1.7	2.7	13.2	14.3
TUE	12	71.5	44.2	57.9	44.9	7	0	97	27	0.00	NE	1.8	2.8	12.2	22.8
WED	13	75.4	49.4	62.4	54.0	3	0	95	51	0.31	SSE	6.4	8.9	24.2	11.9
THU	14	76.0	63.0	69.5	60.5	0	4	96	63	0.15	SSW	4.8	6.2	26.3	12.7
FRI	15	81.4	57.6	69.5	62.0	0	4	97	55	0.04	S	2.0	3.3	22.7	11.7
SAT	16	77.6	60.2	68.9	61.4	0	4	93	57	0.54	SW	3.0	5.3	22.5	11.8
SUN	17	60.1	40.5	50.3	36.0	15	0	94	31	0.00	NNE	6.8	7.1	21.5	18.0
MON	18	64.9	35.8	50.3	34.3	15	0	97	24	0.00	NE	4.4	4.8	20.0	24.1
TUE	19	74.5	36.5	55.5	37.7	9	0	96	18	0.00	NE	2.2	3.1	14.1	24.5
WED	20	79.9	42.0	61.0	45.0	4	0	96	23	0.00	ENE	0.9	2.4	12.8	24.6
THU	21	82.4	47.8	65.1	51.5	0	0	96	30	0.00	E	1.9	2.8	15.3	23.3
FRI	22	83.1	55.2	69.1	57.7	0	4	96	38	0.00	NE	0.3	2.0	11.4	19.8
SAT	23	84.4	59.3	71.9	61.3	0	7	96	40	0.00	N	0.3	2.1	11.8	18.9
SUN	24	79.6	62.5	71.1	63.5	0	6	96	52	0.02	E	1.7	2.3	11.8	11.3
MON	25	81.5	64.1	72.8	64.4	0	8	96	52	0.40	ESE	1.8	3.0	24.5	14.8
TUE	26	79.7	60.1	69.9	64.3	0	5	97	59	0.11	SSW	1.2	2.7	17.2	15.4
WED	27	78.5	64.7	71.6	65.2	0	7	96	60	0.00	S	3.3	3.6	14.2	10.8
THU	28	81.7	64.2	72.9	64.4	0	8	96	52	0.17	SW	3.3	4.4	19.3	15.0
FRI	29	73.9	56.6	65.2	57.4	0	0	95	47	0.28	NW	2.8	3.2	13.7	15.6
SAT	30	77.5	52.5	65.0	58.6	0	0	97	56	0.02	SSW	4.2	4.3	20.2	17.5
SUN	31	79.8	56.3	68.0	55.6	0	3	94	27	0.00	WNW	2.2	3.5	17.6	23.3
Monthly Average		74.1	53.9	64.0	55.2			96	50		S	0.4	3.9	18.0	
Monthly Total						96	65			8.14					445.9

A Quick Overview of Our Activities

Here is a snapshot of our activities in 2009. You can find more information on many of these topics on the pages that follow.

- Worked numerous high impact, hazardous weather events, including an historic ice storm in January, devastating flash flooding in Louisville Metro on August 4, and several tornado events including a deadly May tornado in Madison County. *see pages 16-17*
- Standardized GIS precipitation maps were published to our website every time significant precipitation fell across our area. GIS technology was also used to create temperature and wind speed maps. *see page 8*
- On-site incident support was provided for Thunder over Louisville, the Kentucky Oaks, and the Kentucky Derby. *see page 4*
- Purdue student volunteer August Veron overhauled our heat preparedness webpage *at www.crh.noaa.gov/lmk/?n=noaaexcessiveheat*.
- Forecaster Erin Snavely led the effort to rewrite our station duty manual and streamline office procedures.
- The Louisville office went on the road and teamed up with NWS offices in Indianapolis, Chicago, and Syracuse, Indiana to show students at Western Kentucky, Purdue, and Valparaiso Universities a mixture of science, NWS operations, and to play "Weather Jeopardy." *see page 13*
- Jane Marie Wix was hired as LMK's Student Career Experience Program (SCEP) student and worked full time over the summer.
- Three college students volunteered during the summer. The students, Evan Webb from WKU, August Veron from Purdue University, and Kristen Smedley from Valparaiso University, completed an amazing amount of work. The projects included updating our storm spotter database, website work, a research project with St. Louis University, updating office presentations, and a historical weather poster about the April 16, 1998 Bowling Green hail storm and tornado (see *www.crh.noaa.gov/images/lmk/pdf/April_16_1998_Poster.pdf* and page 13 in this report).
- Hydro Meteorological Technician (HMT) Nathan Foster and Information Technology Officer (ITO) Toby TenHarmsel inserted hundreds of flash flood "hot spots" into our database. Based on research by Lead Forecaster Don Kirkpatrick, these hot spots are locations that flood very easily, and are used in our decision process when issuing flood warnings.
- Partnered with Randy Baker from United Parcel Service (UPS) meteorology and Kentucky State Climatologist Dr. Stuart Foster to organize a media seminar in September. *see page 11*
- We overhauled our station digest webpage at *www.crh.noaa.gov/lmk/?n=our_office*.
- Forecaster Andrea Lammers worked tirelessly to make the software we use to issue severe weather warnings as efficient and user-friendly as possible. *see page 5*
- The fifth annual office beautification day was held in July. The clean-up activities included intensive landscaping, organizing cubicles, painting, and cleaning out the office library, break room, and store room. *see photos on page 18*
- NWS Louisville continued to participate in meteorological conferences, both as attendees and presenters. *see page 11*
- In October John Gordon spoke on hyperthermia deaths in automobiles at the 34th Annual National Weather Association conference held in Norfolk, VA.
- With St. Louis University we collaborated on new research efforts having to do with cool season severe weather and weather patterns that lead to significant winter storms. *see page 12*

With the sun close to the horizon and icy cirrus clouds 25,000 feet overhead, this halo appeared at sunrise over Lexington, Kentucky on November 9, 2009. The photo was sent to us by John Bradshaw, who is a volunteer weather observer for us (see pages 7 and 10 for more information on becoming a volunteer observer). If you have a great weather photo you'd like to share, feel free to e-mail us at w-lmk.webmaster@noaa.gov!

Warning Coordination Efforts in 2009

Building Blocks to the Future

Joe Sullivan, Warning Coordination Meteorologist

"…protection of lives and property, and enhancement of the national economy."

This key phrase within the Mission Statement of the NWS continued to drive our warning coordination program in 2009. In an effort to fulfill our mission, a great deal of time and effort was devoted to exploring new opportunities for interaction with key partners and for embracing new technology to more effectively share information with our constituents.

Partnership with emergency management officials in the 59 counties we oversee remained the backbone of the warning program in 2009. As usual, Mother Nature often dictated the scope and timing of interaction with emergency managers and first responders, such as during damage surveys conducted in the wake of the several tornadoes we experienced. Spotter programs, as well as statewide meetings and conferences like the Kentucky Association of Mitigation Managers meeting at Lake Cumberland in April and the Governor's Emergency Management Workshop in Louisville in July offered the opportunity to work with county officials in a "*before the storm*" environment.

The most innovative activities of the year were with the city of Louisville's Joint Emergency Services Unit (J-ESU). This unique cross-discipline team composed of state, local, and Federal employees serves primarily as a response unit for large scale man-made disasters such as hazardous material (HAZMAT) releases and terrorist activities. Recognizing that even sub-severe weather conditions, such as light snow or gusty winds, can contribute adversely to an already life-threatening event, the J-ESU opened its ranks to three NWS Louisville staff members to serve as onsite weather officers at large-scale events. These three members – the WCM, ITO, and a Lead Forecaster – all completed the requisite training for participation in the J-ESU, including HAZMAT certification. We also provide weather safety and situation awareness training for the team and contribute to team cohesiveness via participation in monthly training. We participated in large scale operational exercises during public events in conjunction with the Kentucky Derby Festival.

The NWS in Louisville sees great potential for using the advances in communication technology to share critical information with others. As cell phones increasingly become total personal communication devices, the opportunity for individuals to send and receive real-time digital data to/from the NWS opens doors for more accurate warnings, improved storm verification, and faster damage surveys. In line with this thinking, a massive overhaul of our storm spotter database was undertaken. Additionally, hardware was purchased and procedures are being developed to further promote greater digital interaction into the NWS office from spotters in the field. As with the ever-changing face of today's communication capabilities, though, no one knows for sure what the future of this digital interaction will look like. However, one thing is certain – the opportunities are limited only by our imagination.

Continued interaction with emergency managers, an improved digital database of spotters, and an increase in the number and types of two-way digital communication are the seeds sown to reap a harvest of abundant information coming into and disseminating from the Louisville NWS office during significant weather events. This will increase the forecasters' knowledge of what is occurring below the storms being tracked on radar, and will ultimately lead to improved and more effective services for meeting our agency's mission of protecting lives and property.


Scott County, KY, February 6, 2008


Scott County, KY, August 4, 2009


Franklin County, KY, February 6, 2008

Above: NWS Louisville conducts several storm surveys every year. We work in tandem with local government and emergency officials to accurately assess the damage. We then take the survey results back to the NWS office and use them in studies and severe weather drills in conjunction with radar data.
Below: NWS Louisville provides critical weather support during HAZMAT incidents, such as the train derailment pictured here. Weather information such as wind speed, precipitation chances, and air temperature is vital for emergency responders and the safety of the public.

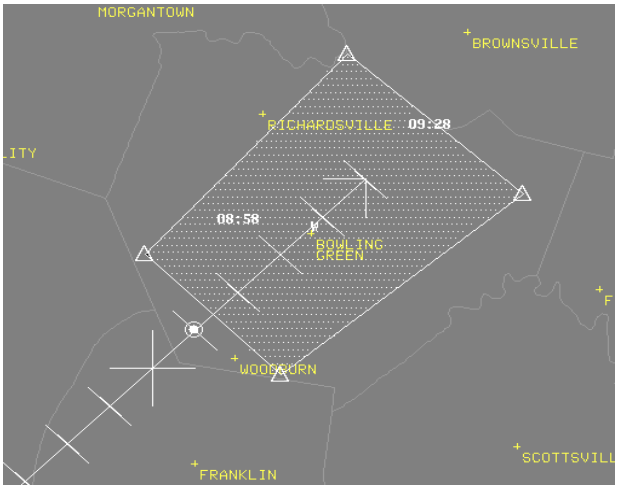

Brooks, KY, January 16, 2007

NWS Warnings Have Gotten Even Better

Andrea Lammers, Forecaster

The NWS uses a software program called WarnGen to disseminate all short-fuse warnings (for tornadoes, severe thunderstorms, and flash floods). WarnGen underwent a major overhaul in 2009 bringing many improvements to our warnings.

One of the biggest improvements to WarnGen was the addition of a "Precautionary/ Preparedness Actions" section at the end of each warning. This section was added so that the suggested protective actions for each warning could be easily identified. One can always find it on our warnings at *weather.gov* and on NWR. Use the helpful tips to protect yourself and others during times of dangerous weather.



An example of what a severe weather warning looks like on our screens at the NWS. The storm is located at the white dot in the center, with the storm's track plotted as an arrow. The hatched box is where the warning has been drawn.

Another important WarnGen improvement was an enhanced listing of locations in the warnings. The list of cities available for warnings was adjusted to provide a more accurate description of cities in the path of a storm along with an estimated time of arrival. The mile markers of highway rest areas and weigh stations were added to provide travelers a better idea of where a storm is headed in relation to the interstates.

Site-specific dam break warnings were set up in case of a significant dam failure on one of the major dams in southern Indiana and central Kentucky. These dams include Rough River Dam, Nolin River Lake Dam, Green River Lake Dam, Dix Dam, Wolf Creek Dam, Patoka Lake Dam, Taylorsville Lake Dam, and Barren Lake Dam. Each of these sites now has a prewritten warning ready to go, so that the transmission time of a dam break Flash Flood Warning has been greatly reduced. Thus, people in the flood zones for these dams will have more time to take action and seek safe shelter.

With these WarnGen enhancements, severe weather warnings will be timely and effective at saving lives and property in 2010.

Most Warnings in One Event in 2009:

Tornado: 6 on October 9

Flash Flood: 18 on August 4

Severe Thunderstorm: 35 on February 11

Overall: 40 on February 11


Glasgow, KY, June 11, 2009

Harrison County, Indiana and Barren County, Kentucky received the greatest number of severe weather warnings in 2009, with 35 each. Grayson County was put under a Tornado Warning 6 times — more than any other county in NWS Louisville's area of responsibility.

In 2009 your Louisville National Weather Service office, as part of its mission to protect life and property, issued 44 Tornado Warnings, 81 Flash Flood Warnings, and 284 Severe Thunderstorm Warnings.

Eleven tornadoes touched down in 12 counties on 7 different days in 2009.

Making NOAA Weather Radio Better for Our Listeners

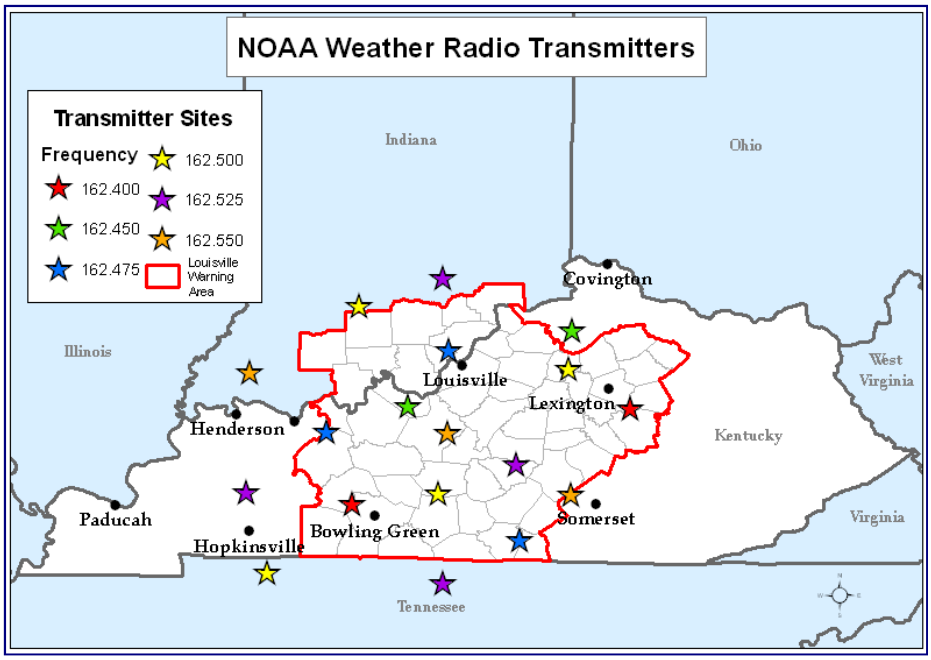
Bill Whitlock, Electronic Systems Analyst

NOAA Weather Radio (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the NWS. NWR broadcasts official warnings, watches, forecasts, and other weather information 24 hours a day.

NWR is an "all hazards" radio network, making it your single source for comprehensive weather and emergency information. In conjunction with federal, state, and local emergency managers and other public officials, NWR also broadcasts warning and post-event information for all types of hazards – including environmental (such as chemical releases or oil spills) and public safety (such as AMBER alerts).

Known as the "Voice of NOAA's National Weather Service," NWR broadcasts from over 1000 transmitters covering all 50 states.

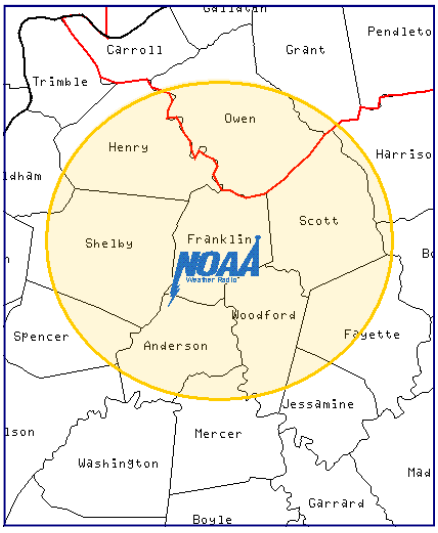
NWS Louisville has been busy collecting data, via drive studies, with a specially designed receiver to determine the geographical coverage of all the NWR transmitters in our County Warning Area (CWA). NWS employees have been driving almost every road in select counties, recording signal strength with a receiver located in the vehicle. The data collected are subsequently processed by a computer program which parses the data and converts it to a KML file for display. The data are also output in comma separated value (CSV) format for GIS processing.



The resulting information is used to determine geographical areas in the CWA that may not be adequately covered by the NWR transmitters. It is also used to determine programming requirements for individual transmitters to ensure the public is properly alerted when severe weather occurs.

Nearly a dozen staff members have performed drive studies in over forty counties across the CWA. The drive study project should be concluded by the end of this summer.

Partly as a result of these drive studies, 2009 saw some big changes in our NWR program. A new 300 watt transmitter was installed in Frankfort to improve coverage in the state capital. The transmitter has specific information for north-central Kentucky. In addition, we created three other new programs specific to Burkesville, Elizabethtown, and Campbellsville. All these changes mean improved service, more specific information, and shorter broadcast cycle times.



A coverage map for the NWR transmitter at Frankfort.

The NWS Wants to Know How Much Rain and Snow *You* Got!

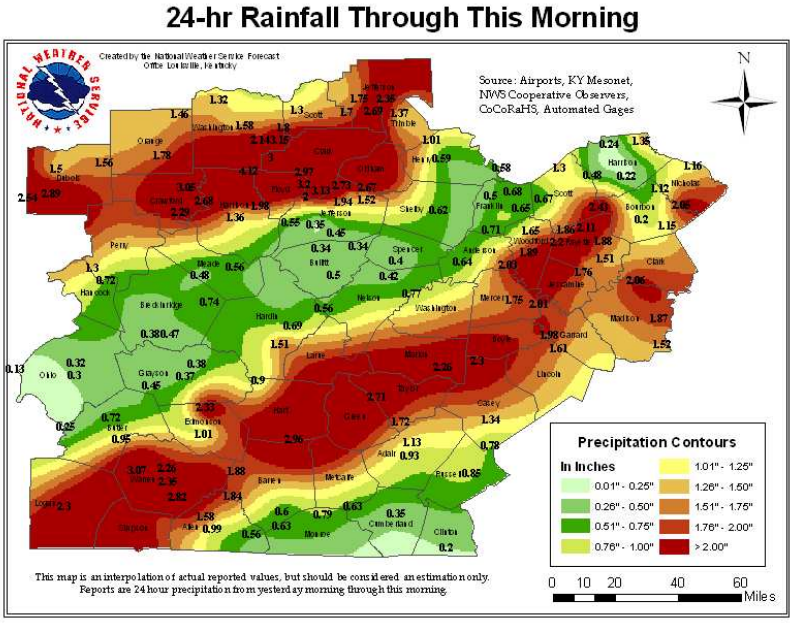
Tom Reaugh, Lead Forecaster

"CoCoRaHS" is an acronym for the Community Collaborative Rain, Hail and Snow Network. CoCoRaHS is a unique, non-profit, community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail, and snow). By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, the aim is to provide the highest quality data for natural resource, education, and research applications.

We use the data every time precipitation falls on southern Indiana or central Kentucky. The data are plotted on maps and are used in our forecasting and warning programs.

As of January 1, 2010, there were about 225 CoCoRaHS volunteers in NWS Louisville's CWA. However, more observers are needed, especially from Hardinsburg south to the Franklin area, and also from Lancaster through Harrodsburg to Jamestown. More observers would also be welcome near Winchester and Carlisle.

Anyone interested in joining can get more information and sign up at the website: *www.cocorahs.org*.



Precipitation maps like these are highly dependent on reports we receive from CoCoRaHS volunteers.

Our Website Has Something Different Every Day

Angie Lese, Lead Forecaster

The NWS Louisville website, *weather.gov/louisville*, supplies taxpayers with an enormous amount of freely available weather information at the click of a mouse. From historical weather, to current conditions, to the forecast for anything from the following week to the next twelve months, it's all on the website. No monthly dues, user accounts, or passwords are necessary to access the data!

In 2009 our website underwent a few changes. The menu along the left side of the page was greatly simplified and made to be nearly the same among all weather offices. With the continuity this brings to the many NWS offices' websites, our customers can expect to find information in approximately the same place at each site.

Also, the webpages were center-justified on the screen. Although this is a different look from the formerly left-justified pages, all the great information our users have come to expect is still there at their fingertips.

weather.gov/louisville

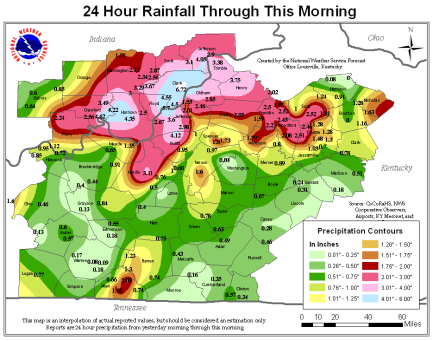
Mapping Taken to a Whole New Level

Nathan Foster, HMT

Maps have always been integral to the weatherman's profession. We use maps to show forecasts, current conditions, and historical events. Since his arrival here in 2007, HMT Nathan Foster has brought the art and science of Geographical Information Systems (GIS) to NWS Louisville, and has enabled us to present large amounts of data to the taxpayers, via our website, with colorful and easily understood maps.

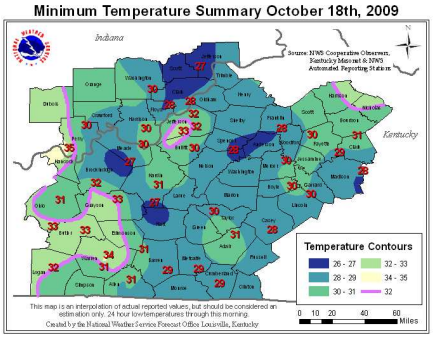
Precipitation

LMK continued to utilize GIS in 2009 to help taxpayers better visualize their weather and climate. This powerful mapping tool is now being used regularly to display more than 100 precipitation reports we receive every day. Forecasters use the maps to help understand which areas may be more vulnerable to flooding from any further rain. In this example from a flash flood event on September 20 (image at right), it was obvious which counties were hit hardest across southern Indiana and northern Kentucky, and thus which areas needed Flood Warnings and required vigilant monitoring for any additional water problems.



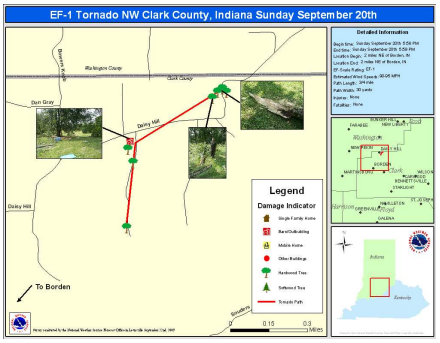
Temperature

GIS was used in 2009 to help determine the first freeze across the area. This map from October 18, when the coldest air mass of the fall season up to that point came into the region, shows the areas which did and did not reach freezing that morning. Only the far western portion of our area and the Louisville Metro showed temperatures above freezing. This information is extremely valuable to agricultural institutions, and also to forecasters tasked with determining where to issue subsequent freeze watches and warnings.



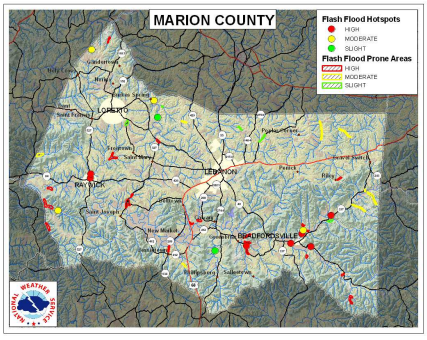
Damage Surveys

Following a tornado event, the NWS conducts surveys of storm damage to determine path length and strength of the tornado. Conveying this information to the public quickly and understandably has been a challenge prior to utilizing GIS. The Louisville office has devised a way, utilizing a sophisticated GPS unit, to make the collection of storm damage information easy. This information can be transferred from the field back to the office and a map can be created within minutes of the survey. This example from September 20 shows the amount of detail that can be added to the map.



Flash Flooding

We completed a GIS project which aids forecasters in flash flood decision making. Emergency managers were asked to provide a list of roads in their county that are most vulnerable to flash flooding. Each county's responses were mapped and entered into a geographic database with such information as stream name, which roads are flooded, and a vulnerability ranking. This information is quickly added to Flash Flood Warnings, telling the public exactly which specific locations will see flooding.



River Stages and Forecasts at a Glance

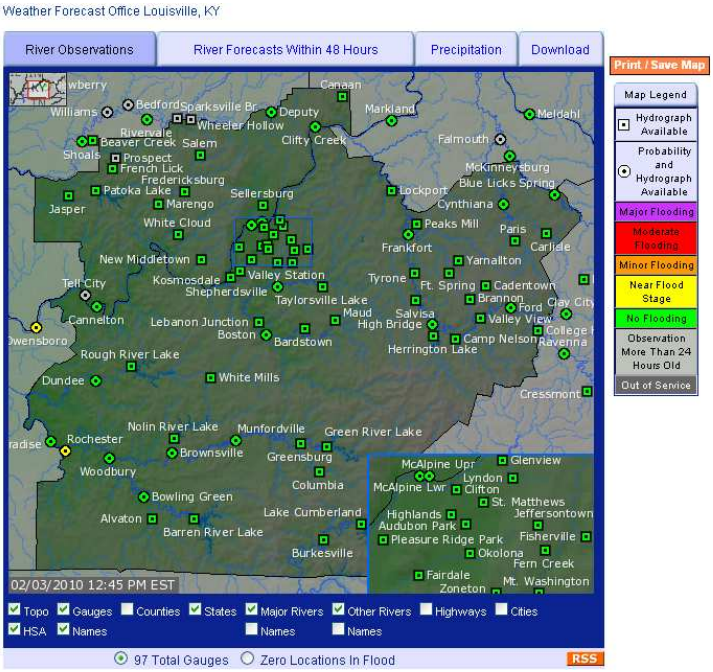
Mike Callahan, Hydrologist

At our Advanced Hydrologic Prediction Services (AHPS) webpages you will find one-stop shopping for all your river information needs. Any flood advisories, statements, and warnings that are in effect will appear here.

We diligently maintain a continuous watch over 13 river gauge locations in Indiana and 59 in Kentucky. At these locations you can see current and recent past water levels, flood crest history, low water history, elevation information, and a map of the location of the gauge. At many of the locations you can see a forecast of water levels for the next few days, photographs of the area around the gauges, and critical water levels for that point. At a few locations there are also links to water temperatures and normal stream levels.

In addition, there are links on every page to precipitation return frequencies, observed data plots using Google Earth's KML format, maps of observed and future precipitation, drought information, flow and velocities on the Ohio River, seasonal outlooks, and much more.

In 2009 we greatly increased the amount of data on these pages and will continue this trend in 2010. In the future, flood inundation maps at particular points will also be provided.



On our AHPS page you can see every river gauge across the region at a glance. The icons are color coded according to how high the streams are. Clicking on an icon will take the customer to a page with all the information available for that site.

To access all of this valuable information, start at *weather.gov/ahps* to get the national picture and then click anywhere on the map to see the local view.

Severe Hail Criterion Raised to One Inch

The NWS conducted a demonstration in the Great Plains for four years, using a hail size criterion for the issuance of Severe Thunderstorm Warnings of 1" in diameter, rather than the historical 3/4" threshold.

The public and other partners of the NWS had expressed concerns that 3/4" was too small to justify the many Severe Thunderstorm Warnings issued on that basis. Research conducted by Texas Tech University showed that significant property damage didn't begin until hail reached at least an inch in diameter.

So, the criterion for severe hail in the NWS is now one inch. The wind criterion remains at 58 mph.

Dime/Penny	0.75 inches
Nickel	0.88 inches
Quarter	1.00 inches
Half Dollar	1.25 inches
Ping Pong Ball	1.50 inches
Golf Ball	1.75 inches
Hen Egg	2.00 inches
Tennis Ball	2.50 inches
Baseball	2.75 inches
Tea Cup	3.00 inches
Grapefruit	4.00 inches
Softball	4.50 inches

The Backbone of the Nation's Climate Data

Mike Crow, Observation Program Leader

The NWS Cooperative Observer Program (COOP) is truly the nation's weather and climate observing network of, by, and for the people. More than 11,000 volunteers take observations on a regular basis, most of them daily.

The COOP was formally created in 1890. The network provides observational meteorological data, usually consisting of daily maximum and minimum temperatures, snowfall, and 24-hour precipitation totals required to help define the climate of the United States and to help measure long-term climate changes.

COOP observers also give observational meteorological data in near real-time to support forecast, warning, and other public service programs of the NWS.


A local COOP station

Local Highlights in the COOP Program:

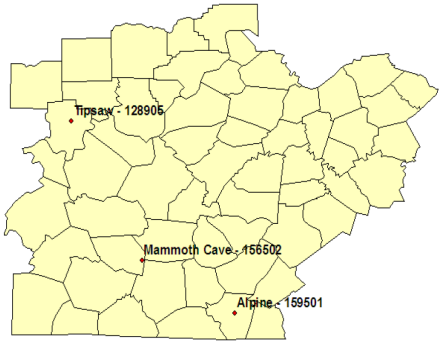
- A new cooperative observing station was opened near Edmonton in Metcalfe County. Currently the station provides precipitation data only, but temperature equipment will be installed this spring.
- Mammoth Cave National Park completed 75 years of service in providing weather observations.
- There are currently 19 paperless cooperative observing stations in the Louisville CWA. These stations enter temperature, precipitation, and other weather data online, instead of submitting paper forms. This process provides an additional quality control check, allows the NWS to have quicker access to data, and saves postage and paper.
- If you are interested in serving as a Cooperative Weather Observer, please contact Mike Crow at mike.crow@noaa.gov.

Fire Weather

Joe Ammerman, Lead Forecaster

NWS Louisville produces fire weather forecasts during each spring and fall fire weather season. These forecasts are mostly for planning purposes but are used for both planned and unplanned burns. We also write specialized forecasts for "spot requests" when a fire official needs a forecast for a certain location at a set time.

In 2009 we fulfilled 40 spot requests, 36 of which were for planned burns. Two forecasts were for wildfires, and two were for hazardous materials fires.



NWS Louisville writes fire weather forecasts for southern Indiana and central Kentucky, including the locations shown above. See our website at *www.crh.noaa.gov/lmk/?n=fireweather*.

NWS Actively Shares Scientific Ideas

As the nation's foremost meteorological organization, the NWS continues to be a leading source of important weather and science research. Not only do local meteorologists participate in several conferences, seminars, and workshops each year, we also share what we've learned with other weather offices, the media, and our customers.

In May, Lead Forecaster Angie Lese traveled to the Indianapolis NWS office (IND) to give a presentation on mentoring. IND was hosting a Mentorship Seminar and starting a local mentoring program for incoming summer students. The day-long seminar included presentations about the mentor-mentee relationship, goal-setting, and our qualifications as mentors. Mentoring incoming students is not only a great way to develop young minds, but it can also be a rewarding experience for the mentor as it develops personal leadership skills. Discussions during the seminar sparked new ideas for our local leadership meetings that we hold quarterly.

In April, Angie spoke at the 13th Annual Severe Storms and Doppler Radar Conference in Des Moines, IA on the subject of Hurricane Ike's effects in the Ohio Valley in September 2008.

Angie is a local leader in weather research. Currently, she is working on a project with the Warning Decision Training Branch (WDTB) in Norman, OK. The WDTB is in charge of developing training materials for the NWS, specializing in developing presentations to improve our forecast and warning techniques. Angie is helping develop a portion of the severe weather section within their Advanced Warning Operations Course. This training will explain the latest forecasting techniques and will develop our skills in making warning decisions.

Science and Operations Officer (SOO) Ted Funk was an invited speaker at the annual Ohio State University Severe Weather Symposium in April. Ted spoke on the February 5-6, 2008 severe weather outbreak in central Kentucky, concentrating on storm evolution and warning philosophy during a rapidly changing tornadic environment.

NWS Louisville is part of a community which includes the SOOs from the NWS offices in Kansas City, St. Louis, Springfield (MO), Central Illinois, Indianapolis, Paducah, and Jackson (KY). The community holds periodic conference calls and annual meetings to discuss common forecast, warning, and training concerns and needs. Such interaction facilitates an effective means for improved science sharing with forecasters at their respective offices.

Forecaster Mark Jarvis takes questions from the audience after giving a presentation.

Forecaster Mark Jarvis traveled to Chicago in November to attend the College of DuPage's Severe Weather Symposium. The symposium was focused on the latest techniques for severe weather forecasting, effective use of remote sensing such as mobile Doppler radars, and highlighting some of the preliminary results of a recent large-scale tornado research study. Severe weather experts gave several presentations focusing on the development of tornadoes based on new data collected during the study. Several presentations by forecasters from NOAA's Storm Prediction Center focused on the importance of which severe weather techniques work best during severe weather events.

The local television, radio, and print media are crucial partners with the NWS. In September we hosted a seminar at the weather office that was attended by several meteorologists from the local media markets, the Kentucky State Climatologist, and a UPS meteorologist. We discussed the Kentucky Mesonet (see page 2), fog

...continued at the bottom of page 13...

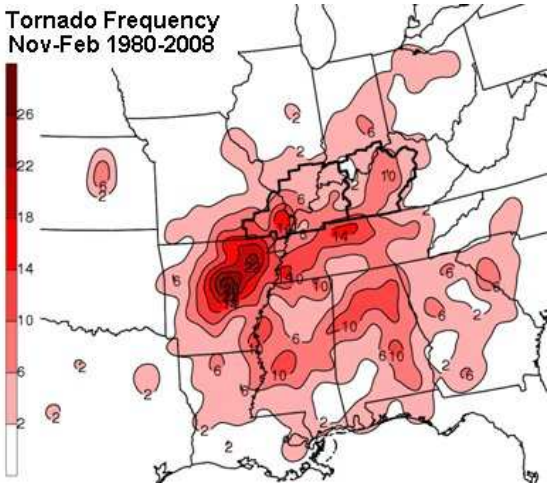
NWS Louisville Embarks on Major Research Studies

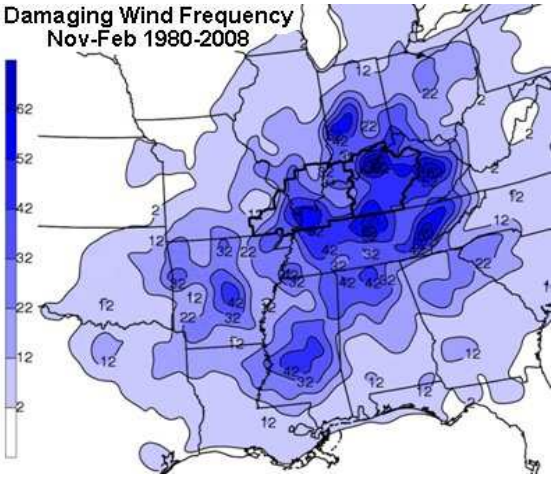
Ted Funk, Science and Operations Officer

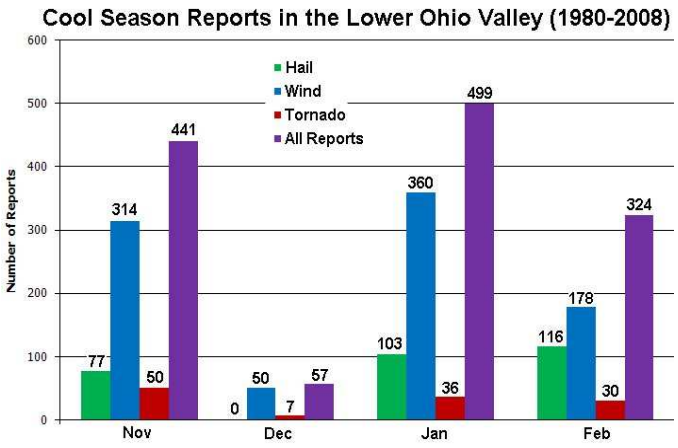
In 2009, NWS Louisville renewed our long-standing professional relationship with the Earth and Atmospheric Sciences Department of Saint Louis University (SLU) in St. Louis. We concentrated on two projects: 1) the development of cool season (November through February) severe weather patterns across the lower Ohio Valley, and 2) determination of different weather patterns and atmospheric processes associated with accumulating snow in central Kentucky and southern Indiana.

The first project was undertaken to address the relative maximum in severe weather outbreaks in winter, a time of year not normally associated with damaging winds, tornadoes, or hail. While spring remains our peak season for severe storms, November through February can also be a time for significant severe weather (see image below). For example, on February 5-6, 2008, nineteen tornadoes along with widespread straight line wind damage pummeled central Kentucky. Also, on January 29, 2008 and January 2, 2006, thunderstorms produced several tornadoes over central Kentucky and southern Indiana.

The images to the right show that winter tornadoes are most common over Arkansas and Tennessee, but wind damage is still very common across Kentucky during this time of year. The large array of data produced in this study was designed to increase our awareness and understanding of such events, and then to pass this knowledge onto you, our customers, through accurate forecasts and warnings.







The second collaborative effort is to determine distinct weather patterns that can produce significant snow in our area. For example, in one common pattern, low pressure and an accompanying cold front are located well to our east, while temperatures at the surface and around 5000 ft above the ground are below freezing. In the mid-levels of the atmosphere (around 18,000 ft) the winds are from the southwest, which helps transport moisture. Still higher up, around 30,000 ft, the jet stream helps create a conducive environment for cold, moist air to produce snow.

As with our cool season severe weather research, this snow study will increase our understanding of the discrete patterns and processes which bring snow to our area. In turn, we'll pass this knowledge on to you to help keep you safe during hazardous wintertime snow and ice.

Students Have a Great Experience at the NWS

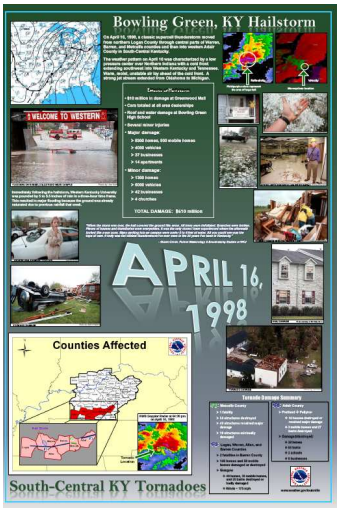
In 2009 the NWS offices in Louisville, Indianapolis, Chicago, and northern Indiana participated in the Fifth Annual College Road Show. Representatives from the NWS offices traveled to various universities in the region to present students a mix of meteorology, information on NWS operations, and career guidance. One of the most advantageous things a student can do is to spend a summer working at an NWS office. In 2009 NWS Louisville had students from Valparaiso, Purdue, and Western Kentucky universities.

August Veron from Purdue updated and created several web pages, including our 1937 Flood page (*www.crh.noaa.gov/lmk/?n=flood_37*) and our weather safety page (*www.crh.noaa.gov/lmk/?n=weathersafetyrules*).

Kristen Smedley from Valparaiso spent the majority of her time involved in updating operations documents which improved office efficiency. This included updating our spotter database and putting the data into Google Earth. Kristen also created a master list of road department phone numbers for our area of responsibility.

Evan Webb, from Western Kentucky University (WKU), led the effort to create a weather poster about the storms of April 16, 1998 (see right). Evan also worked on categorizing all significant snow events in our area since 1980 as part of a heavy snow project with St. Louis University.

Jane Marie Wix, also from WKU, contributed by working at the HMT desk, where she sent out a variety of climate and river products to NWR and the website. Jane Marie worked alongside the forecasters as she answered customer phone calls and, in the event of severe weather, issued many of the local storm reports the office received.



Evan Webb, Jane Marie Wix, August Veron, and Kristen Smedley collaborated on this historical weather poster, which is available on our website.

Effective Leadership Is Key

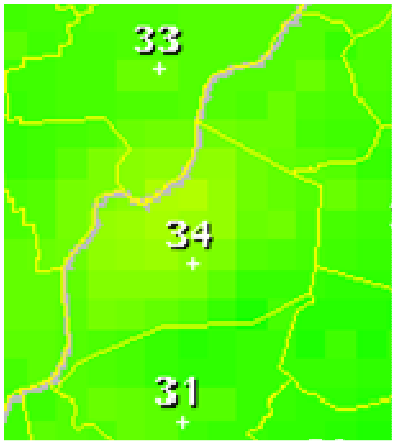
Leadership is a vital concept at NWS Louisville, and forms the foundation for productive teamwork, progress, innovation, and service. In an attempt to practice and enrich our leadership skills, NWS Louisville holds periodic meetings to discuss leadership-related topics, including role playing and team exercises. Ted Funk conducted a full-day leadership seminar for the office in January. We're even starting a small in-house scholarship fund to some day help one or more meteorology students at nearby universities. Ultimately, our vision in all of this is to be principled servant leaders to each other and to provide you with the highest quality of service we can.

NWS Actively Shares Scientific Ideas

...continued from page 11...

forecasting, severe weather, and the quality of NWS products and services.

Lead Forecasters Ryan Sharp and Tom Reaugh, along with volunteer Dave Schneider, are investigating temperature patterns across NWS Louisville's CWA. There can be large temperature differences across the region, such as at night when rural areas can get quite a bit colder than urban locations. The image to the right shows how much temperatures can vary across just one metropolitan area, with warmer temperatures in yellow and colder areas in green. We hope to discover exactly how temperatures behave, leading to more accurate forecasts.



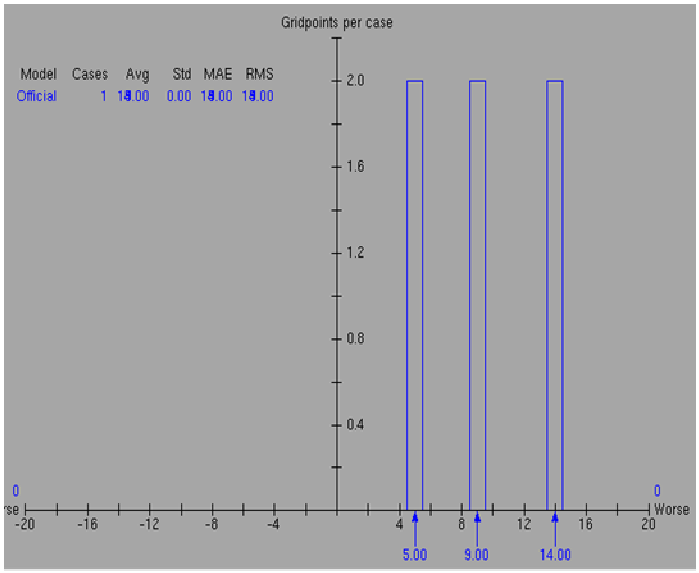
We Track and Verify the Accuracy of Our Forecasts

John Denman, Forecaster

In recent years, all NWS forecast offices have placed increasingly greater emphasis on forecast verification. In particular, we have increased our efforts to verify our temperature forecasting skills. New software in each forecast office can track errors for individual cities over a specified period of time, and also highlight forecaster and computer model biases.

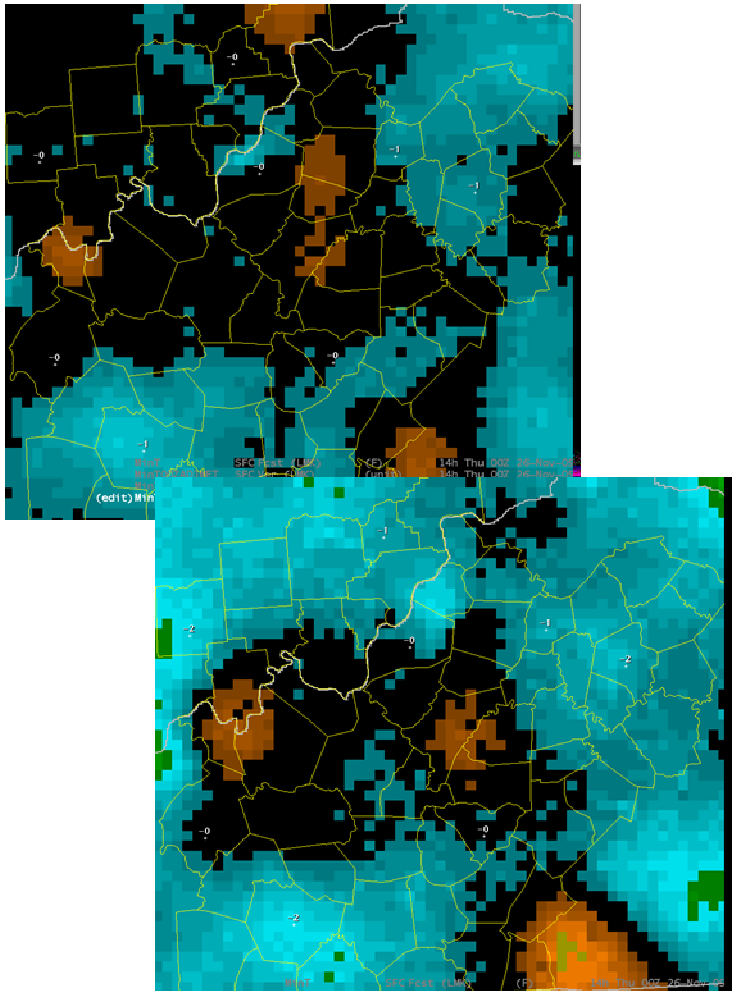
Our goal is to improve on temperature guidance provided by various computer models. By using our personal knowledge of local climate we can more accurately forecast high and low temperatures for specific locations such as Louisville or Frankfort. Both of these cities have localized climates that may lead to temperatures that vary significantly from nearby areas (see table below left).

The examples shown below illustrate only a small portion of the various programs we use to verify our accuracy and improve our forecasting.



You may remember that we experienced some much cooler than normal weather this past July. On the 18th, for example, high temperatures were from 10 to 15 degrees below normal. The image above shows that we had a warm bias for Lexington in our high temperature forecasts made during the previous week. Note how our warm bias increases the farther back in time each forecast was made before the 18th. This image shows a 5 degree warm bias 24 hours in advance, a 9 degree warm bias in the forecast made 3 days in advance, and a 14 degree warm bias made 5 days in advance. By reviewing old forecasts, we hope to improve temperature forecasting for anomalously cold or warm situations.

Location	Average Low Temperature in August 2009
Louisville International	67.0°
Frankfort	63.2°
Lexington	64.3°
Bowling Green	65.9°



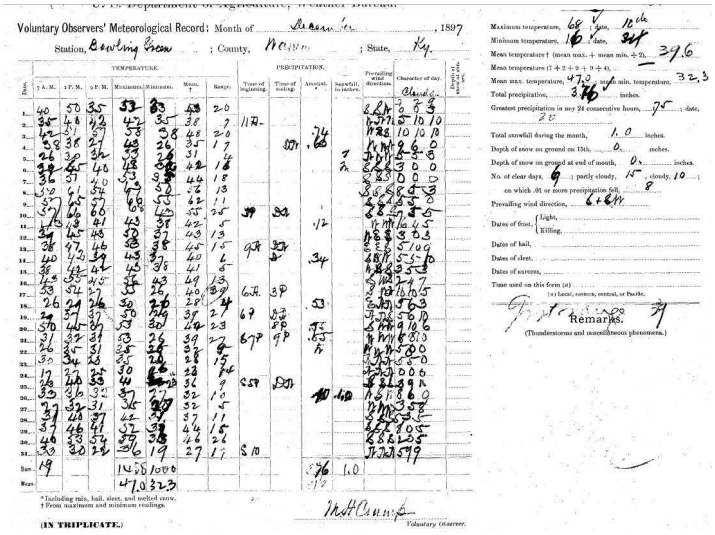
We use software to verify how our temperature forecasting compares to a specific computer model run over a period of days. Above are a couple of images that show our errors in forecasting high temperatures 2 days in advance. Both images show errors for our high temperature forecast averaged over the entire month of August 2009. Orange areas show where our forecast was too warm and the blues and greens show where we were too cool. Our official forecast (top image) shows overall less bias than the forecasts from of one of our computer models (bottom image).

Accuracy Is Imperative in Historical Weather Data

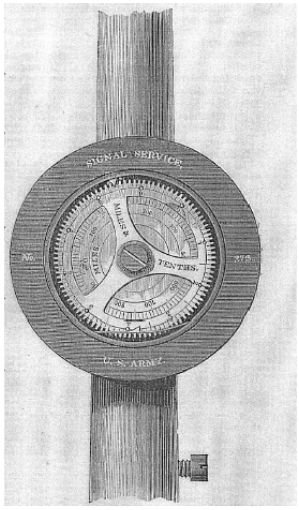
Tom Reaugh, Lead Forecaster

Historical weather data have come to the forefront in recent years as the study of global climate change has increased dramatically. Climate researchers must have accurate data on which to run their studies.

Weather information has been recorded in central Kentucky since the middle of the 19th Century. At the NWS we have engaged in a multi-year effort to sift through over 135 years of daily weather data at Louisville, Bowling Green, Frankfort, and Lexington. We have spent many hours examining records of temperatures, precipitation, and snow depth to verify that the information we include on our climate products is accurate. Over the course of the research we were able to uncover and fix several errors in our local database. While most of the errors were quite small and may not have even been noticed by many, we are proud to strive for the most complete, accurate, and useful database of historical weather information available in central Kentucky and southern Indiana.


Voluntary Observers' Meteorological Record: Month of March, 1897
Station, Bowling Green ; County, Warren ; State, Ky.
(IN TRIPLICATE.)

An example of a hand-written weather observer's form. This one was completed by volunteer observer Col. Malcom H. Crump in December 1897 at Bowling Green.



A drawing of an anemometer from an 1880 meteorological handbook.

Observer Barbara Thomas records a weather observation at Louisville in January 1981.

Kentucky State Fair

Stephanie Dunten at the fair, August 2008

Each August NWS Louisville staffs a booth at the Kentucky State Fair for the entire length of the festivities. We give out hundreds of brochures on all sorts of weather topics including tornadoes, hurricanes, and snow storms. A staff member is on-hand to answer all your weather questions, and to provide guidance to youngsters interested in a career in meteorology. The biggest hit among weather fans, though, is our amazing tornado machine! Come see our mini tornado spin wildly in its case the next time you're at the fair!

Weather fans at the fair

Ice Storm Cripples the Ohio Valley

Andrea Lammers, Forecaster

The Ohio Valley Winter Storm of 2009 will always be remembered as one of the most devastating winter storms to ever hit southern Indiana and central Kentucky. Record breaking amounts of ice in addition to up to 10 inches of snow fell over the area causing widespread power outages for weeks.


Central Kentucky January 27, 2009

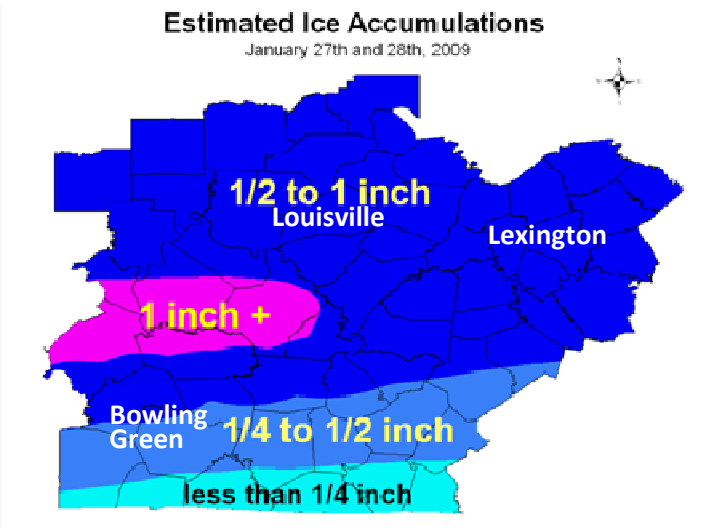
The Ohio Valley winter storm was caused by warm, moist air that was transported north from the Gulf of Mexico above a cold air mass which sat over the Ohio Valley. Moisture falling through a warm layer of air aloft and then cold air at the surface resulted in a wintry mix January 26-28.

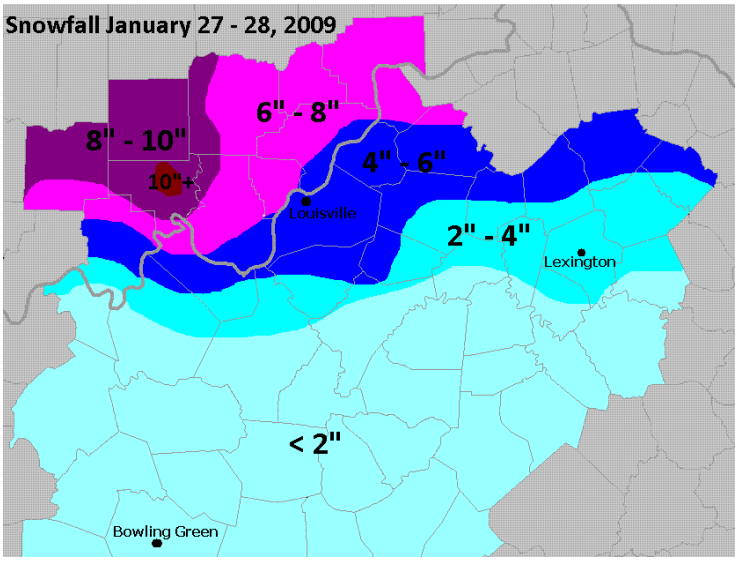
The devastating ice storm caused Kentucky's largest power outage on record, with 609,000 homes and businesses without power. Property damage was widespread, with remarkable damage to trees and power lines weighed down by the ice. In the Louisville metro area, 205,000 lost power and restoration efforts took up to 10 days. Storm damage in Kentucky alone totaled more than $50 million with the Louisville metro area suffering approximately $2.1 million. Tragically, at least 31 people died in Kentucky and southern Indiana due to the effects of this storm.

The NWS office in Paducah lost power and most of its employees were unable to make it in to work. NWS Louisville took over Paducah's workload, issuing many of their forecast products for them for a full week after the storm.

Despite the disastrous impacts of the historic storm, NWS Louisville dampened the storm's effects by alerting customers a full week in advance of a possible winter storm in the Hazardous Weather Outlook. The high likelihood of the major winter storm was reiterated in a Special Weather Statement (SPS) 72 hours in advance.

NWS Louisville also stressed the devastating impacts of this storm through numerous lines of communication.





Several detailed conference calls were conducted with emergency managers, media, utility companies, and schools to greatly enhance their situational awareness and preparatory decision making. Weather graphics containing detailed precipitation data were posted to the web for easy customer access. Live chat software was used to instantly send crucial information back and forth between us and the media. Numerous Area Forecast Discussions and SPSs were issued to convey the seriousness of the situation.


Munfordville, KY, January 27, 2009

Nature's Fury in 2009

Flash Flood

Ted Funk, Science and Operations Officer

Persistent thunderstorms over the Louisville metro area produced tremendous rainfall rates and amounts, resulting in flash flooding on August 4. Amounts up to 6 inches fell within two hours in central Louisville, with 5 inches in 90 minutes from 7:45 to 9:15 am. Officially at Louisville International Airport, 4.53 inches of rain broke the record, which had stood since 1879, for the most rain in a single day in August.

At 9:35am a Flood Emergency was declared for Louisville and its southern Indiana suburbs. Flood waters rose rapidly around the University of Louisville, the downtown public library where thousands of books were destroyed, Churchill Downs, and nearby neighborhoods, with water several feet deep in places. Nearly 200 people were rescued by emergency workers from the tops of cars and houses. About 50 people were rescued by boat from a University of Louisville office building. Massive flooding also occurred in New Albany, where numerous cars were set afloat. Fortunately, there were no known fatalities or injuries, though property loss was estimated at $45 million.

Louisville, KY, August 4, 2009

Killer Tornado

On May 8 widespread thunderstorms moved across central Kentucky producing tree damage and heavy rain. The storms rapidly intensified as they "bowed out" while moving into Garrard and Madison Counties. This resulted in a narrow axis of intense straight-line winds up to 80 mph, and a tornado which produced up to EF2 damage (estimated winds of 90-120 mph) in eastern Garrard County and EF3 damage (estimated winds of 120-140 mph) in parts of Madison County. Unfortunately, two people were killed and several were injured south of Richmond as numerous homes were damaged or destroyed.


Madison County, KY, May 8, 2009

Arrivals and Departures

In April, Senior Meteorologist Jim Maczko was promoted to Warning Coordination Meteorologist at NWS Jackson, KY.

In December, Forecaster Liz Stoppkotte was promoted to Assistant Mesoscaler Forecaster at the Storm Prediction Center at Norman, OK.

In April, Forecaster Erin Snavely joined the Louisville forecast staff. Erin came here from NWS Lake Charles, LA where she was an intern for a year and a half. While at Lake Charles she was a mentor for teachers and engaged in many outreach activities. After earning a Bachelor's Degree in Mechanical Engineering at Rice University, Erin earned her Master's Degree in Meteorology at St. Louis University, where she conducted research on cold season heavy rainfall in the Midwest. Since arriving at NWS Louisville, she has commenced research of snow climatology patterns in the Ohio Valley and will also be participating in the StormReady program.

Electronics Technician Todd Adkins joined NWS Louisville this past May. Todd was trained in electronics while serving as an aviation electronics technician in the United States Marines. After completing his military commitment, Todd worked in the NWR program as a contracted regional field technician for four years. In September 2004, he was hired as an electronics technician at NWS Chicago. After stints in Cleveland and Paducah, Todd and his family are glad to be in Louisville and are looking forward to their future here. Todd and his wife are natives of eastern Kentucky but have several family members living in the Louisville area.

Lead Forecaster Ryan Sharp arrived at Louisville in July. He came here from NWS Tampa where he served as a forecaster since 2003. He graduated from Florida State University with a Master's Degree in Dynamic Meteorology as well as bachelor's degrees in both meteorology and physics. In Tampa, Ryan served as the leader of the tropical cyclone program, which explored the use of innovative webinar services to provide weather briefings to emergency managers as well as media partners.

Former NWS Louisville student workers Andy Boxell and Stephanie Dunten both found employment with the NWS in 2009. Andy is now a Meteorological Intern at NWS Chicago, and Stephanie is enjoying her work as a Meteorological Intern at NWS Wichita.

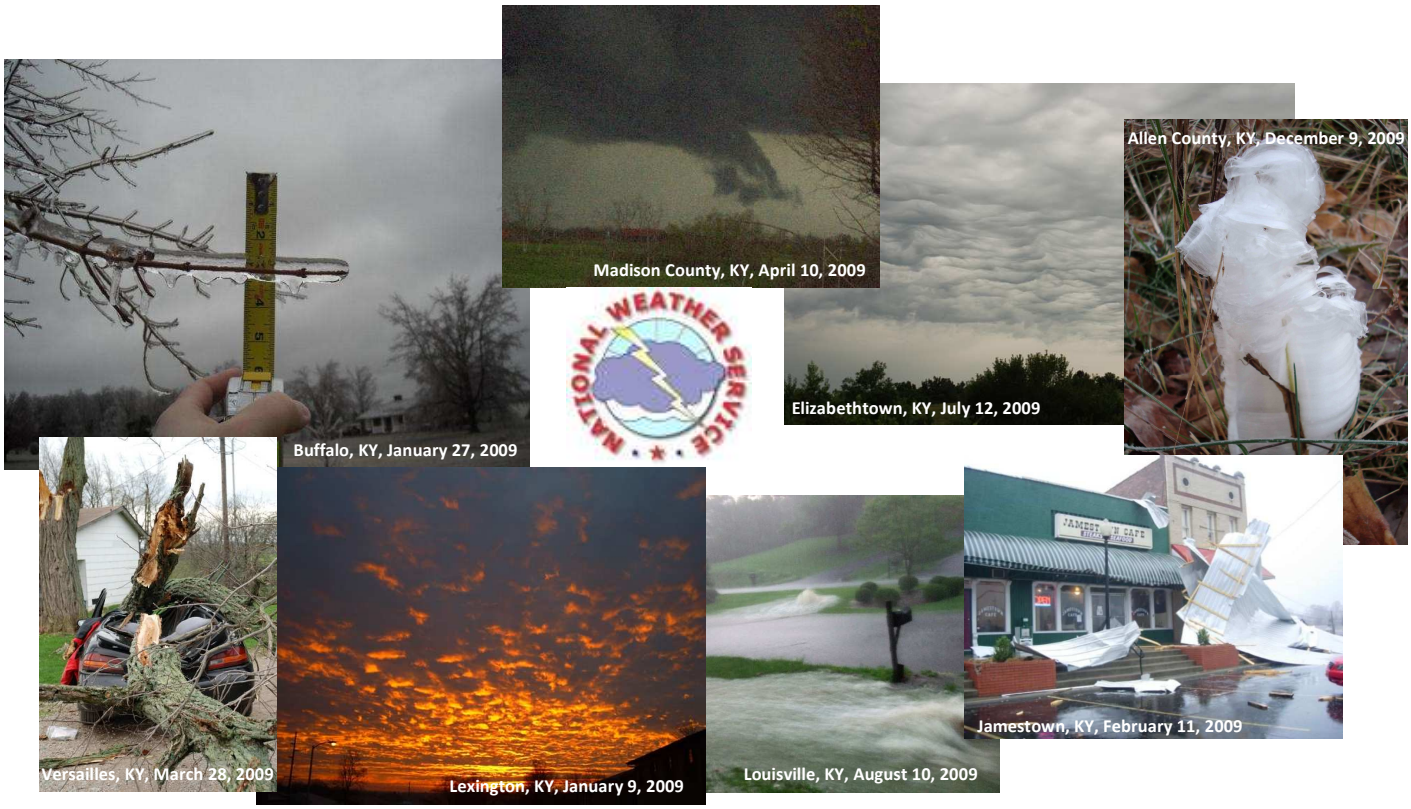
Above: Staff members pitch in to spruce up the office. Below: Having a good time at the summer office party.

Electronics Technician Joe Schuering retired after 11 years at NWS Louisville. Joe enjoys traveling and hopes to see much of the country from his motorcycle and RV during his retirement.

Goals for 2010

We are a dynamic, active office. Some of our planned activities in 2010 include:

- Decrease tornado warning false alarm rate by 10%
- Redefine and refocus short term forecast philosophy
- Complete NWR signal strength drive surveys for remainder of CWA
- Improve low temperature and fog forecasting
- Improve forecaster proficiency to issue river flood products
- Complete an official station duty manual
- Complete research projects with St. Louis University
- Partner with the structural engineers, media, and Civil Air Patrol and other aviation groups for more detailed damage surveys
- Work with Kentucky Emergency Management Association and Kentucky State Parks to make all state parks StormReady
- Develop online spotter training and quiz
- Complete various GIS projects



Helpful Links

Your Local National Weather Service in Louisville

weather.gov/louisville
weather.gov/lexington
weather.gov/bowlinggreen

Any of the above links will take you to the Louisville NWS office. Click on the map to get your forecast!

Current Watches and Warnings

www.crh.noaa.gov/hazards/lmk

Severe Weather Forecasts

www.spc.noaa.gov/

Radar

radar.weather.gov/Conus/full_loop.php

Click on the map to get a local view

Graphical Forecasts

www.weather.gov/forecasts/graphical/sectors/kentucky.php

Long Range Forecasts

www.cpc.ncep.noaa.gov/

Past Weather Data

www.weather.gov/climate/index.php?wfo=lmk

Safety Rules

www.crh.noaa.gov/lmk/?n=weathersafetyrules

Listing of Products We Issue

www.crh.noaa.gov/lmk/?n=productguide

Outreach Materials

www.crh.noaa.gov/lmk/?n=outreach

Rain and Snow Reporting

www.cocorahs.org

One-Stop At-a-Glance Weather

www.crh.noaa.gov/lmk/?n=one_stop_weather

One-Stop At-a-Glance Winter Weather

www.crh.noaa.gov/lmk/?n=one_stop_weather_winter

One-Stop At-a-Glance Climate Page

http://www.crh.noaa.gov/lmk/?n=one_stop_climate

Activity Planner

forecast.weather.gov/wxplanner.php?site=lmk

River and Lake Information

www.crh.noaa.gov/ahps2/index.php?wfo=lmk

Current Observations

www.crh.noaa.gov/lmk/?n=currentweather

Kentucky Mesonet

www.kymesonet.org/

Kentucky Emergency Manager Briefing Page

www.crh.noaa.gov/lmk/?n=em_briefing

Submit a Report to the NWS

espotter.weather.gov/

Forecast Discussion

www.crh.noaa.gov/product.php?
site=lmk&product=AFD&issuedby=LMK