National Weather Service

La Crosse, Wisconsin

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Inside this Issue:

2012 Shareholder's Report

National Weather Service, La Crosse, WI

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Moving Toward Weather-Ready Communities

Welcome to the fifth edition of the National Weather Service (NWS) La Crosse Shareholder's Report. This report is intended to highlight the service and information provided by the NWS through the local La Crosse office, as well as our current and planned efforts to enhance those same services. I hope you find this report both informative and useful.

Last year in this space, I asked how we can help you in your critical event decision-making process. During the year, we were faced with a number of critical, high-profile weather events, including a significant supercell on May 22nd that produced tornadoes from northeast Iowa, southeast Minnesota, through the cities of La Crosse and Sparta, and eastward from there. This long-track event had the potential for significant loss of life and disruption to impacted communities.

This scene was played out in much the same manner in Joplin, Missouri that same day, except that tornado was much stronger. In spite of warnings with lead time, 158 lives were lost as the tornado hit a town similar in size to La Crosse.

The NWS Weather-Ready Nation initiative was developed to engage NWS partners and stakeholders in dialogue which leads to real-life actions that save lives.

How can the NWS communicate risk in a way which improves public safety response? How can we integrate social sciences into our warning process? Can we use social media more effectively? What kind of decision support services would be helpful in the various sectors of our communities to protect citizens?

We want to work with communities and businesses alike to identify the information people need and how we can help maximize weather safety and minimize loss of life from weather events.

Now, more than ever, we are working to find ways we can improve the value of the information we provide to the many weather-sensitive sectors of our society, including the general public.

Damage to the Pepsi bottling plant in La Crosse, WI, due to an EF2 tornado that struck the city on May 22, 2011.

I welcome your comments regarding how we can provide better weather information - whenever, wherever and however you need it!

Glenn R. Lussky
Meteorologist in Charge (MIC)
NWS La Crosse, WI

Social Science: Lessons from the 2011 Severe Weather Season

2011 was a year highlighted by multiple, significant tornado outbreaks which cost the lives of hundreds of U.S. citizens. These events led to many questions relating to severe weather warnings and public response. How could so many lives be lost during events which had large warning lead times? How could so many lives be lost at a time in history when so much information is available regarding hazardous weather safety?

Social scientists and operational meteorologists are examining public response to the current warning program more closely. While solutions may not be easy or simple, common behaviors were exhibited by those who survived the tornadoes—they took immediate action to protect themselves from the imminent dangers.

At times, this immediate action was to go to a place of safety. However, it was also clear that the public was utilizing alternative weather information through a variety of sources to confirm that the weather

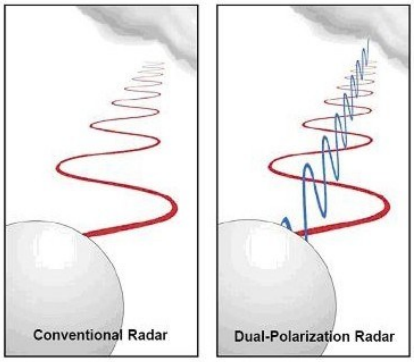
A man watches as a tornado approaches.

(continued on p. 3)

Dual Polarization Radar to be Installed in April

A significant upgrade will be made to the NWS La Crosse Doppler radar this spring, with the incorporation of dual polarization capabilities. This new technology will provide a significant new suite of information through which forecasters can improve public forecasts and warnings.

All radars send out short bursts of energy called pulses. The pulses bounce off objects in the atmosphere (rain, snow, birds, insects, etc.) and reflect energy back to the radar dish.



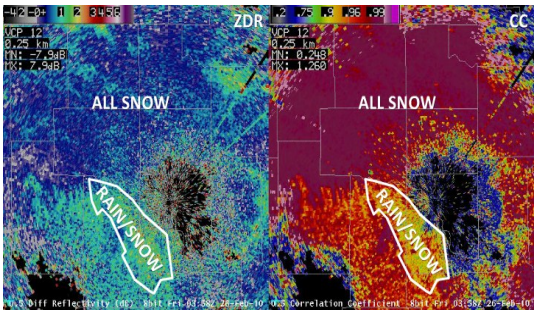
Comparison of the current horizontal radar polarization and the future dual polarization.

The data is then processed to identify how much energy was returned to the radar and how the object was moving. The current NWS Doppler radar transmits pulses horizontally, giving only a horizontal view of the atmospheric particles.

Dual-polarization radars transmit pulses that have both *horizontal and vertical orientation*. The additional information from the vertical pulses will improve many types of short-term (0-3 hour) forecasts and warnings for hazardous weather.

"Improved forecasts based on dual polarization radar will...enhance overall public safety."

Substantial improvements are expected in rainfall estimation, precipitation classification, size of hail, and identification of non-meteorological radar returns. Differentiation between heavy rain and hail should enable improvements in flash flood forecasting. Winter weather precipitation type information will help diagnose potential hazards associated with the various types of freezing or frozen precipitation.



Newer dual polarization fields will help forecasters improve both summer and winter precipitation forecasting.

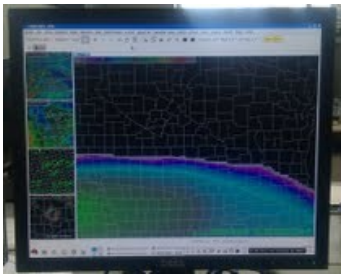
The nationwide upgrade to Doppler radar in the 1990s was a huge technological breakthrough for weather operations. The overall impact of dual polarization radar will also be important, providing improved short-term forecasts and warnings which help the public make better decisions and enhance overall public safety.

During February and March, NWS La Crosse forecasters will be training to use this new technology. Installation is planned for the week of April 16, 2012.

AWIPS II - Infrastructure to Enhance Data Management Processes

The Advanced Weather Interactive Processing System (AWIPS) is the current system used by NWS personnel to manage, view, and interact with a wide variety of weather information. It is also the system used to produce forecast and warning information for the public.

The NWS will be introducing an upgrade to the AWIPS technology during 2012. This upgrade, known as AWIPS II, will include a software package which supports improvements in NWS forecast and public service operations. This new software will be developed in Java, allowing it to run on more platforms than the current AWIPS software.



AWIPS II terminal being used for local configuration and testing.

AWIPS II is based on open source technologies. This will allow the NWS to reduce development time, expand data access and provide better integration and collaboration between the NWS field offices, river forecast centers and national centers. This open source, service-oriented architecture, will also allow the NWS to be more responsive to partner and public requirements for future weather products and services.

Key attributes of AWIPS II include:

- Utilization of non-proprietary software, which enables easier and more cost-effective incorporation of future enhancements and sustainability processes
- Vastly improved collaboration with neighboring forecast offices, emergency managers and interagency partners
- Advanced data management techniques which enable rapid data updates, more robust data manipulation, data mining capabilities, and adaptability to a variety of data types
- Adaptable situational awareness and decision-making visualization that can quickly perform GIS data projections
- Improved GIS operability to more quickly produce warnings and other information through automated text generation

Operational use of AWIPS II at NWS La Crosse will begin this summer. Prior to that time, staff will be training on the new system and its capabilities, as well as configuring it for our office. This system will greatly expand our capacity for generating new types of information and sharing it with users in different formats.

Social Science (continued from page 1)

situation was, indeed, an immediate threat which required personal action. This engagement in the warning process is a good thing.

However, social scientists also found that public *response* during severe weather events (e.g., taking personal safety measures) has also become heavily reliant on personal perception of the situation. Many people did not take action until the tornado hazard was nearby or someone close to them specifically suggested they take protective action. In this regard, the role of cell phones, texting and social media are taking a more prominent role in convincing individuals that the threat is real and action is needed, rather than relying on the warning itself.

Numerous public interviews also noted how people can become desensitized by past tornado warnings which did not personally impact them. This has led some to a false sense of security and an assumption that the current warning won't be any different. However, it only takes one tornado in a warned event to put people at significant risk.

The social aspect of the warning process is, indeed, complex. Meteorologists and social scientists are working together to identify practices which induce the best possible public safety response to critical weather situations.

The NWS La Crosse will work with local officials in an effort to apply research and technologies which help develop "weather-ready" communities. In the interim, we encourage all citizens to take warnings seriously. We want to keep you, your family, and friends safe!

This EF4 tornado struck Tuscaloosa, AL on April 27, 2011, killing at least 52.

Use of Social Media at NWS La Crosse

Social media continues to grow and influence how people communicate with one another. In an effort to expand direct communication with our public safety partners and the general public, the NWS La Crosse office joined Facebook in June 2011. Daily posts are added to the NWS La Crosse Facebook page, along with other messages, to keep the information fresh and useful.

We occasionally solicit input or real-time information from the public, making it a medium whereby *anyone* can help us provide the best possible weather information to others. "Like Us!" on Facebook and start connecting in the social media world.

In addition, Twitter has been used to monitor messages from the general public around the region. Various weather related topics or "trends" can be tracked during a specific window in time. While the La Crosse NWS office did not have an official Twitter account in 2011, weather reports can be seen using a hashtag of #wxreport to the Twitter message at any time.

General Aviation Aerial Damage Survey Program

Perhaps the best way to get an overall picture of what kind of damage occurred during a tornado or wind storm is from above the ground. The Civil Air Patrol has worked with the NWS for years in efforts to survey severe weather and tornado damage from the air.

General aviation pilots have also been helpful, providing aerial photos to the NWS following severe weather events. This information can be extremely helpful, especially when dealing with wind and weaker tornado events that impact rural and wooded areas, or are otherwise difficult to survey.

During this past year, NWS La Crosse Aviation program leader Tim Halbach led an effort to identify general aviation pilots who are interested in contributing to the NWS mission in this manner. He developed and provided a presentation regarding aerial surveys to local Experimental Aircraft Association (EAA) events in Winona, New Lisbon/Mauston, Tomah, Rochester and La Crosse.

From interactions at these events, Tim has assembled a group of interested pilots who are willing to assist the NWS with post-event aerial surveys. In this way, the NWS can contact these individuals to let them know where we need information. The pilots, in turn, can provide imagery to the NWS from flights they were already planning to take (i.e., at limited cost to the volunteers and no cost to the NWS).

Aviation focal point Tim Halbach presents aerial storm survey information at a recent talk.

Many thanks to this group of volunteers, who will help us provide the most accurate post-event information we can in a cost-effective manner to the taxpayers!

Scientific Infusion: High-Resolution Computer Modeling

Computer models or simulations have been used by forecasters for decades. They start with a current "snapshot" of the atmosphere which is projected into the future using mathematical equations and known science. The output information is then viewed graphically by forecasters. As computing capability and speed have increased over time, the models have provided greater detail in the forecasts. Not only can they tell us thunderstorms could develop, but they provide insight on the type, life cycle, and severity of the storms.

The High-Resolution Rapid Refresh (HRRR) computer model provides very detailed forecasts out to 15 hours, and is designed to help forecasters with rapidly changing weather conditions. This model is restarted every hour, constantly refreshing its initial "snapshot" and, hopefully, improving forecast accuracy.

"The HRRR produced thunderstorms that were rotating, confirming the threat for significant, damaging weather."

During the morning hours of May 22, 2011, HRRR output provided La Crosse forecasters with a glimpse of how the atmosphere might behave through the evening hours. This included simulating thunderstorm development, movement, and severity. The HRRR-simulated radar picture valid at 5 pm May 22 (Fig.1), produced from the model started at 8 am (e.g., a 9 hour forecast), closely matched the actual radar data from the same time (Fig. 2).

This simulated data was available to forecasters at 10 am, allowing visualization of potential afternoon thunderstorm development. Further, the HRRR produced thunderstorms that were rotating (Fig. 3), confirming the threat for significant, damaging weather. This allowed the meteorologists to provide better detail in their forecasts, and inform partners and the public of higher-end weather threats for the afternoon.

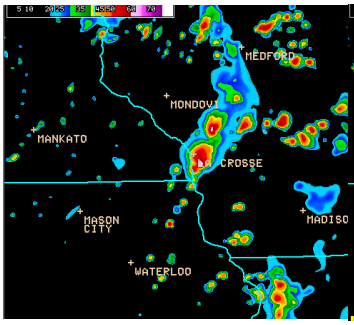


Fig 1. The 9 hour forecast HRRR simulated radar image for 5 pm May 22, 2011.

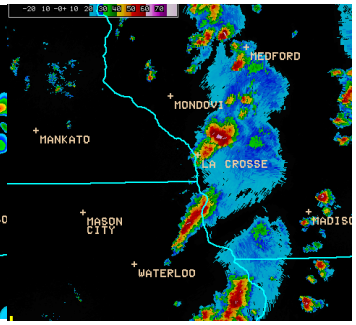


Fig 2. Regional radar image at 5pm May 22, 2011.

The HRRR computer simulations are not always this skillful. However, if the computer model can accurately depict the current weather, it will often have a decent chance of providing useful information to improve the forecast.

In this May 22nd example, the tornado-producing thunderstorm near La Crosse was superbly forecast 9 hours in advance, though the model did not depict the tornadic thunderstorms in northeast Iowa. A need still exists for human expertise and interpretation of these computer simulations.

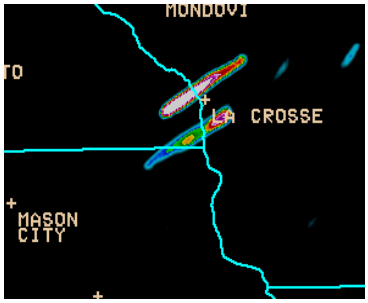


Fig. 3. The HRRR 9-hour forecast thunderstorm rotation for 4-5 pm May 22, 2011.

Science To Service: Providing Details on Precipitation Type Forecasts

Over the past two winters, the NWS La Crosse has been producing probability of weather *type* information internally to assist in the creation of our winter season forecast products. For any given hour out to 7 days, the forecaster establishes a probability of occurrence for any possible weather type, including snow, rain, sleet, freezing rain, rain showers, and thunder. These probabilities are created in a database using computer software over the local geographic area. The area is gridded and broken down into 2 mile by 2 mile squares, each of which hold a unique combination of possible precipitation types.

In December of 2011, the NWS La Crosse began an experimental product which extracts and organizes precipitation type forecasts for customer and partner use. This product provides 6-hour precipitation chance (POP6HR), liquid equivalent amount (QPF6HR), inches of snow (SNOW6HR), and ice accumulation (ICE6HR). In the example to the left, there is a 100% chance of precipitation, 0.72" of liquid is expected with 6 inches of snow and a light icing (.03") from 12 to 6 pm on Saturday December 1, 2007 in La Crosse county (see pink highlighted box). Specific probabilities of precipitation type are also provided, with snow decreasing from 100% (e.g., "+") to 25% from 12 to 6 pm, and sleet and freezing rain increasing by 6 pm.

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WIZ041-011015-
LA CROSSE-
INCLUDING THE CITIES OF...LA CROSSE
308 AM CST SAT DEC 1 2007

DATE                 SAT 12/01/07      \
CST          12 3A 6A 9A 12 3P 6P 9P 12

 POP6HR     |  0  |  87   100 |  89 |
 QPF6HR     |  0  | 0.17  0.72| 0.30|
 SNOW6HR    | 0.0 |  2     6  |  T  |
 ICE6HR     |  0  |  0    0.03| 0.26|

IF PRECIPITATION OCCURS . PROBABILITY
 RAIN        0  0  0  0  0  0  0  0  +
 SNOW        +  +  +  +  +  + 25  0  0
 SLEET       0  0  0  0  0 39  +  12 0
 FRZ RAIN    0  0  0  0  0 27  +  +  +

PERCENT COVERAGE OF: (OUT OF 100)
 THUNDER     0  0  0  0  0  0  0  0  0
 FOG         0  0  0  0  0  0  0  0  0
&&
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Example of the Probability of Precipitation Type product available on the NWS La Crosse web site.

This product can be found on the left side of our Winter Monitor web page at: http://weather.gov/arx/winter_monitor.php under Probability of Precipitation Type. There is also a "key" to describe the details in the product.

Review of the 2011 Spring Flood

With wet soil conditions and higher-than-normal river levels heading into the winter of 2010-11, extensive winter snowfall raised a strong possibility for a significant spring snowmelt flood. NWS offices across Wisconsin, Minnesota and the Dakotas provided flood potential outlooks already in January, indicating the potential for moderate to major flooding.

Even with a near-ideal spring melt, moderate flooding inundated portions of Pettibone Park near downtown La Crosse

On the Mississippi River, the flood threat was especially high. Early outlooks in January indicated a 50-60% chance that flooding could reach major levels along the river. In February, several meetings were held to develop high water action plans, and many businesses and residents prepared for the coming flood.

Fortunately, nature cooperated with a nearly ideal melt scenario. Little or no precipitation fell across the region during the key melt period. Additionally, temperatures were nearly perfect, with some melting during the day, but re-freezing overnight. This limited the daily runoff and kept the rivers from taking on excessive water over a short time period.

Ultimately, the tributary streams only had minor flooding impacts, while the Mississippi crested from 1 to 5 feet above flood stage. While the flood could have been much worse, the nearly ideal melt, along with excellent preparations, ensured a very manageable flood event for most communities.

Is there a threat for flooding this spring? At the time of this publication, the risk for spring snowmelt flooding is below normal. Weather conditions were dry going into the fall and winter months, with lower water levels and dry soil conditions. Winter precipitation has been near normal, with lower-than-normal water in the snowpack.

"...nature cooperated in 2011 with a nearly ideal melt scenario ..."

Of course, we have several more weeks to go before winter finally gives way to spring, and the eventual outcome may depend greatly on future precipitation events. Your NWS office in La Crosse stands ready to provide you with the latest information, so you can be prepared!

Awards, Recognition and Personnel Changes

May 22, 2011 was one of the most significant tornado events to strike the area in years. During this event, there were 98 miles of tornado track within the NWS La Crosse warning area, including tornadoes that struck the cities of La Crosse and Sparta. This event received little national attention, as it occurred the same day as the Joplin, MO tornado, and there were no fatalities from the local tornadoes.

NWS La Crosse forecasters performed exceptionally well prior to, during, and after this event. The potential risk for severe weather was noted in the Hazardous Weather Outlook on May 19th. Over the next two days, NWS La Crosse personnel added greater detail to the threat, including expected timing of the event.

"During the May 22nd tornado event, there were 98 miles of tornado track...and no fatalities."

A unique contribution prior to this event was the role the local office played in upgrading the "Slight Risk" for severe weather, as issued by the NWS Storm Prediction Center (SPC) in Norman, OK, to a "Moderate Risk" on the morning of May 22nd. The SPC Lead Forecaster noted that a key reason for this upgrade was input from the NWS La Crosse office!

We are honored that the National Oceanic and Atmospheric Administration awarded the NWS La Crosse office with a Unit Citation for exceptional work relating to this event. The citation reads, "In recognition of excellence exhibited by WFO La Crosse, Wisconsin staff during the major tornado outbreak of May 22, 2011, which directly impacted the city of La Crosse."

There is only one personnel change to note since last year's report. In early May, the office welcomed new Meteorologist Intern, Zack Taylor. Zack is a native of North Carolina, where he obtained his B.S. degree in Meteorology. He continued his education in Tallahassee, FL, and finished up his M.S. in Atmospheric Sciences this past spring. We are pleased to have added a talented meteorologist like Zack to our staff!

Our newest staff member: Meteorologist Intern Zack Taylor

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La Crosse, WI

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Our Mission

NWS Mission Statement

"Provide weather, hydrologic and climate forecasts and warnings… for the *protection of life and property* and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by others in the global community."

NWS La Crosse Mission Statement

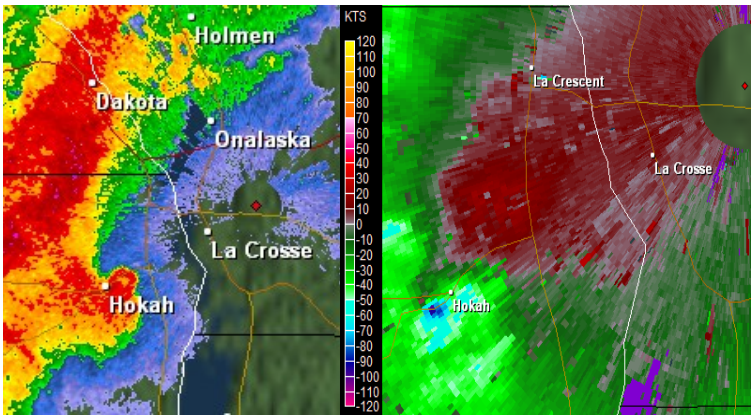
"Dedicated to continuous improvement in the provision of high quality weather-related warning, forecast and educational information for the safety and overall benefit of the citizens we serve."

The Supercell Tornadoes of May 22, 2011

During the afternoon of May 22nd, severe thunderstorms developed ahead of a cold front across southeast Minnesota and northeast Iowa. By late afternoon, the storms shifted into western Wisconsin, and by early evening, into central Wisconsin. These long-lived storms produced large hail, damaging winds, and six confirmed long-track tornadoes.

The tornado damaged this apartment complex as it struck the city of La Crosse.

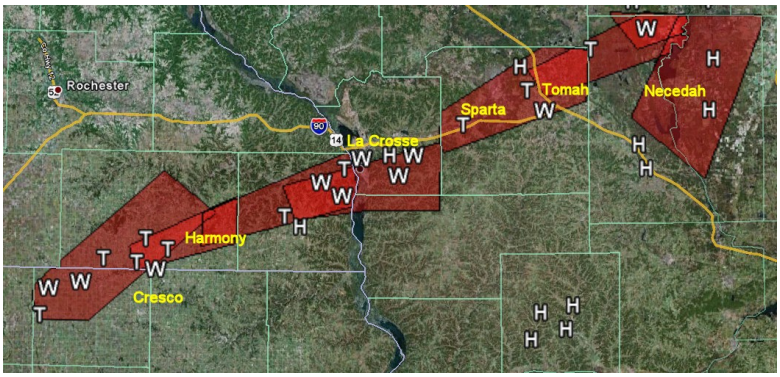
The NWS La Crosse issued 11 Severe Thunderstorm Warnings and 11 Tornado Warnings on May 22nd. Seven of the eleven Tornado Warnings were issued for a severe thunderstorm which moved from northern Howard County (northeast Iowa) northeast into Portage County in central Wisconsin (see map below). Of the 11 tornado warnings issued, 8 had confirmed tornadoes and 2 had funnel clouds. The average lead time, or the time between when a tornado warning was issued and when the tornado first occurred in the warned area, was over 17 minutes. (The national NWS goal for this metric is 12 minutes). Storm surveys following the event identified extensive damage along 98 miles of tornado track from the 6 long-track tornadoes that occurred on May 22nd.



Radar images of the storms approaching La Crosse at 415 pm. Strong rotation is seen on the radar near Hokah, MN (right, bright blues) indicating winds over 80 mph.

One particularly dangerous period during the May 22, 2011, outbreak was the EF2 tornado that struck the south side of the City of La Crosse, Wisconsin. Producing winds to 125 mph, this tornado caused over $15 million in damage to businesses, apartment complexes and homes on its 3-mile path through the city. Remarkably, there were *no tornado fatalities.* Had this tornado occurred on a weekday rather than a Sunday, many of the businesses struck by the tornado would have been active, putting more people at risk.

These tornadoes were slightly more predictable than most that occur in our part of the country, mainly because they were produced by supercell thunderstorms. These thunderstorms (and their tornadoes) are the most extensively researched of all the storm types. Because our science has a more complete understanding of the behavior of these storms, tornado predictability increases when radar indicates supercellular storm characteristics.



Tornado Warnings (shaded areas) and tornado (T), hail (H), and damaging wind (W) reports along the supercell path as it moved through northeast Iowa, southeast Minnesota, and west central Wisconsin. Not all reports are shown.

While supercellular tornadoes do occasionally occur in the Upper Mississippi River Valley, they are much more common across the "Tornado Alley" states to our southwest. This event is a good reminder that these types of strong, long-lived storms can and do occur in our area, and it's important for everyone to be vigilant and take protective action when these events occur!