

**OK-FIRST IN THE FIELD:
HOW PUBLIC-SAFETY AGENCIES USE AND APPLY WEATHER DATA**

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1. INTRODUCTION

Since October of 1996, the Oklahoma Climatological Survey (OCS) has been engaged in an outreach and support program for public-safety agencies. This program, known as OK-FIRST (Crawford *et al.* 1998), has provided 65 communities with current and localized weather information. Representatives from local police and fire departments, sheriff's offices, and emergency management agencies have been furnished with "point-and-click" access to a large suite of weather products plus instruction on how to use and apply the data. The participants have regularly accessed the full set of NIDS (NEXRAD Information Dissemination Service; Klazura and Imy 1993; Crawford *et al.* 1999) products from 15 radars, maps and meteograms from 115 Oklahoma Mesonet (Brock *et al.* 1995) stations, and derived products.

The users of OK-FIRST technology have gained access in three phases, beginning in June of 1997. Since that time, the various public-safety officials in the program have made many local decisions based on the time-sensitive information provided by the OK-FIRST system. While many aspects of the program have been documented including usage patterns (Morris and Duvall 1999) and software design (Wolfenbarger *et al.* 1998a,b), *the most significant impact of OK-FIRST has been the accumulation of success stories about the application of real-time weather data to local emergencies.* This manuscript documents the impact of OK-FIRST on local weather situations as assessed by five users (Fig. 1).

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2. SEVERE WEATHER

The most obvious application of local access to data provided by a system like OK-FIRST is that of local warnings to impending severe weather. On the afternoon of 8 June 1998, a supercell thunderstorm formed west of Norman and traveled east and south. By early evening, the storm intensified and spawned a tornado that struck the small town of Wewoka (Fig. 1). Lonnie Rowe, the local emergency management official, monitored the NIDS data available via OK-FIRST. He correctly identified radar signatures like a hook echo and radial velocity couplets associated with the mesocyclone while the storm was still west of town. He had enough time to cycle warning sirens six times. Although several houses were destroyed, no deaths or injuries were reported. A family that lived in one of the severely damaged houses did not receive any of the reports that were issued by the media. Thus, they escaped injury only because of advance notice provided locally. In the words of Lonnie Rowe, "OK-FIRST helped to save lives. Thank God and OK-FIRST".

Another series of tornadoes formed and moved through central Oklahoma five days later. The first of these storms began to develop 85 miles

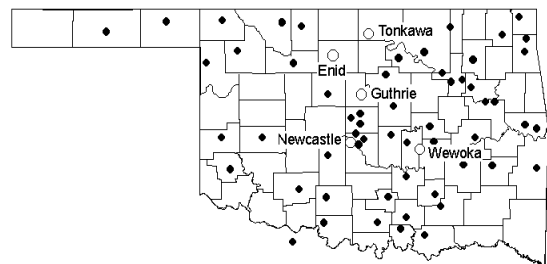


Figure 1. Locations of the trained OK-FIRST users (closed circles). Locations highlighted in the text are denoted by open circles.

west of Guthrie (which is 30 miles north of Oklahoma City). On the previous day, John Lewis, Director of Logan County Emergency Management, obtained the "Day 2 Convective Outlook" issued by the NWS' Storm Prediction Center via a link through OK-FIRST. The outlook indicated a slight risk for severe weather. Thus he periodically checked media reports and local radar data for convective development.

By 5:15 p.m., the NWS had issued a tornado warning for Kingfisher County, some 40 miles west of Guthrie. Logan County spotters were posted and the Emergency Operations Center (EOC) was activated. At 6:00 p.m., spotters reported wall clouds in the rain-free base which was now southwest of Guthrie. Doppler velocities available from OK-FIRST indicated low- and mid-level circulations, while Vertically Integrated Liquid (VIL) values were very high. Twenty-five minutes later, spotters reported some rotation west of Guthrie, and the radar data from OK-FIRST pinpointed the rotation to be eight miles west of Guthrie. At 6:30, the NWS issued a tornado warning, and the warning sirens were sounded. The warning was also rebroadcast on the cable television interrupt system.

EOC staff monitored live, continuous coverage of the lowered wall cloud by the Oklahoma City network television stations. Their coverage of the developing tornado was spectacular; but, for the most part, the EOC staff did not observe the stations indicate *where* it was. The media broadcasted the initial tornado touchdown live as spotters reported it at 6:43, thirteen minutes after the first public warning. One asset of the OK-FIRST system during this event was the real-time psychological conviction that the warnings being issued were correct.

On this same day, another round of storms spawned a series of tornadoes and moved through northern Oklahoma City. An amusement park on the city's northeast side sustained some damage. While the local media focused coverage there, another supercell formed southwest of Oklahoma City, west of the town of Newcastle. Doug King monitored the situation using OK-FIRST at his EOC. He noticed rotation in the storm and began the process of notifying first-responders and of opening emergency shelters, some seventeen minutes before a tornado warning was issued by the NWS. Thus, the town was ready and in a position to respond.

Finally, as these storms impacted central Oklahoma, other severe storms moved into Kay County in northern Oklahoma. The Kay County storms produced winds in excess of 70 miles per hour and hail to the size of golfballs. While the news

media focused their attention on storms affecting the more populated areas in central Oklahoma, local officials like Charles Conaghan in rural areas such as Tonkawa had to rely on OK-FIRST to provide timely information about their areas.

A similar scenario occurred on 4 October 1998. On this day, Oklahoma set a new national record for the number of tornadoes (20) in one state in one day in October. This severe weather event also produced serious flooding in several areas of the state. No deaths were attributed to the storms across the state, and storm-related injuries were few. While tornadic storms moved across the southern portions of the Oklahoma City metropolitan area (where local OK-FIRST participants used the system to properly position storm spotters; Crawford *et al.* 1999), other significant storms were occurring around the state. Some of the local media markets exclusively concentrated on the metropolitan area where they have more viewers. With OK-FIRST deployed around the state, rural areas of the state were no longer disadvantaged.

3. FLOODING

Heavy rains affected areas upstream of Guthrie on 15 March 1998. Logan County Emergency Management used estimated rainfall accumulations available via NIDS to anticipate that flooding conditions might develop. Oklahoma Mesonet data confirmed the radar rainfall amounts. However, as the rate of rise of Cottonwood Creek (southwest of Guthrie) increased, normal Internet connections failed. Yet, redundant dial-in connectivity at OCS enabled Emergency Management to remotely obtain stream-gauge information at Cottonwood Creek. (OCS collects and disseminates stream-gauge data for the Oklahoma Water Resources Board at five locations around the state including Cottonwood Creek). At the same time, the NWS was receiving data from stream gauges operated by the United States Geological Survey. However, this data was often hours old by the time the data became available to the NWS. Thus, during the next few days, some creek forecasts were inaccurate, as local measurements exceeded crest forecasts. As a result, the public became confused between information released by the EOC and by the NWS. Once the Logan County officials recognized the source of the information discrepancy, local information was passed to the Norman NWS office. Thereafter, the NWS, news media, and city officials released coordinated, consistent, and credible flood warning information to the public.

4. FIREFIGHTING

In December of 1997, the Logan County Emergency Manager detected a wind shift in Oklahoma Mesonet data. NIDS data from the Oklahoma City WSR-88D, in clear-air mode, also clearly showed the wind shift line. After tracking the wind shift, he projected a precise arrival time at the scene of a large grass fire. He also coordinated his work with an NWS forecaster for confirmation. Finally, the information was passed to the Incident Commander (IC), giving him about 45 minutes lead time.

With southerly winds ahead of the advancing wind shift, the IC had most of the fire equipment along the north-end exposures. With the advance warning, the IC refueled, rewatered, and repositioned brush pumpers near structures at the southeast edge of the fire. When the sudden wind shift occurred, equipment was in place to protect two rural houses and several outbuildings. Had the wind shift occurred without warning, and had the equipment not been repositioned, response time to the new head of the fire would have been five to ten minutes after the occurrence of the wind shift. The exposures on the southeast flank of the fire would certainly have been threatened.

5. OTHER DIVIDENDS

OK-FIRST has been used during other high-impact events. The City of Guthrie held the first of what they hoped would be annual bluegrass festivals in October of 1997. The success or failure of this event would considerably impact the economy of the area for possibly years to come. The highlight of this event was an outdoor performance by Vince Gill. Since 30,000 tickets had been sold for the event, much advance time would be required if the concert had to be moved to an alternate location.

Numerous light to moderate rain showers passed over the Guthrie area during the day of the festival. The Police Chief and event managers became more than casually interested in the radar information available from OK-FIRST. By 5:00 p.m., the managers asked for a forecast through midnight. After coordinating with the Norman NWS office, a short-term forecast was prepared that indicated no heavy rains were anticipated for at least three hours. Light showers, though, were quite possible. The show manager decided to keep the show outdoors at the football stadium.

The five-hour show began at 7:00 p.m, as a solid storm cell was beginning to develop near Dallas,

TX. By using the radar data available via OK-FIRST, the storm was projected to move over Guthrie around midnight if it did not dissipate. The police department and show manager were notified. By 8:30, it appeared that the storm would approach Guthrie at 11:30, but two light showers would pass over the festival sooner. At 10:00 p.m., it was clear from the radar data that the main storm had accelerated and intensified. The police department was advised that the show manager might want to adjust his schedule so as to be finished at 11:00 p.m. The light showers passed, and the show continued. But Vince Gill missed his encores; he completed his scheduled finale exactly at 11:00, just as the heavens opened and set the crowd running for their cars.

6. NETWORKING AND OUTREACH

Through these types of scenarios, local officials have gained credibility. For example, Mike Honigsberg, the Director of Garfield County Emergency Management in Enid, was newly appointed in October of 1996. He received his OK-FIRST training in June of 1997. Since credibility must be earned, this new emergency manager had to gather his resources from scratch. After receiving access to OK-FIRST, he began speaking to various county and city officials, civic clubs, and private individuals to convince them that he had training to warn the public during severe weather outbreaks. After several bouts of severe weather, the local radio station began to call the emergency management office for live, over-the-air reports from the "OK-FIRST Radar System", and the spotter network.

The weather commander from Vance Air Force Base was so impressed by the OK-FIRST system that they asked Garfield County Emergency Management to act as a backup system if their WSR-88D (KVNK) went down. Later, an exclusive partnership was forged to better protect both the county and the air force base.

Credibility also has been achieved by the local public safety official through educational outreach activities. Charles Conaghan, the emergency manager in Tonkawa, took the fifth grade class of Tonkawa Elementary School on a tour of his EOC and a monitoring station on a nearby river. The teachers and students were impressed by the amount and use of hydrological information that was available. Before OK-FIRST, this local official did not have fingertip access to this information, which is made possible via links to NWS and the USGS.

Mike Honigsberg (a volunteer emergency management director) started a Junior Garfield

Emergency Management Team (Painter and Ratzlaff 1999) with a teacher in the EARTHSTORM (McPherson and Crawford 1996) Project. These middle school students have kept the emergency manager informed of the location of the dryline in the spring through their analysis of Oklahoma Mesonet data. They transmitted Mesonet maps to him via FAX to keep him updated and aware of approaching weather conditions while he was at work. Thus, he had extra eyes to help him when he needed them. In turn, the students have gained confidence by helping to protect the public.

After obtaining his OK-FIRST system, Charles Conaghan was asked by his local officials, "Is this OK-FIRST system going to be a toy or a tool?" At one city council meeting, these same local officials were taking some criticism from citizens. During the discussion, the local elected officials told the citizens that Charles Conaghan had access to vital information through OK-FIRST. This answer satisfied the city council and the citizens. After several experiences with the system, the local officials have regarded the OK-FIRST system as a tool.

7. SUMMARY

As a direct result of deployment of the OK-FIRST system around the state of Oklahoma, many lives have been affected by the ability of local officials to anticipate severe and changing weather conditions. While the direct impact can never be quantified, these and other examples continue to lend credible evidence that informed and trained local officials can better protect their constituents. As telecommunications technology improves, these stories likely will be replicated many times over.

8. ACKNOWLEDGEMENTS

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