

What If They Never Got the Warnings?

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"It is sobering to us to see that tornadoes in the 21st century can still cause so many deaths. We had hoped that through increased warnings, better buildings and increased public awareness, the years of these events had passed."

**Dr. Joshua Wurman, Founder
Center for Severe Weather Research**

For the past two weeks, since the historic April 27 tornado outbreak in the South, meteorologists and representatives of the media have been attempting to answer variations of the question, "If the forecasts and warnings were so good, how is it so many died?"

Various theories have been offered:

- Mobile homes
- The extreme intensity of the tornadoes themselves
- Homes without basements
- Substandard quality of housing
- The fast forward speed of movement of the tornadoes
- Global warming

With the exception of global warming, it is likely all of these played a role.

But, what if significant numbers of people in the path of these tornadoes, through no fault of their own, never received the warning? This report suggests the reason for the unexpectedly high death toll was the line of thunderstorms that swept through the tornado outbreak area twelve hours before the tornado and caused power to be lost to more than 1,000,000 people and – because the power was still out in most of these areas – the warnings were not received or not effectively received in areas populated by well in excess of 700,000 people

Background

Prior to the late 1950's, there were no tornado warnings (described in my book *Warnings: The True Story of How Science Tamed the Weather*) and triple-digit death tolls from tornadoes were

surprisingly common in this era. To cite just a few examples,

- 1936 Tupelo, MS (233, white residents; African-American fatalities were not tallied)
- 1936 Gainesville, GA (203; unknown the extent to which African-Americans were included in the death toll)
- 1947 Woodward, OK (181)
- 1953 Waco, TX (114)
- 1953 Flint, MI (115)
- 1953 Worcester, MA (94)
- 1955 Blackwell, OK-Udall, KS (102)

Since the tornado warning program began in 1957, death tolls – even with a growing population – have been steadily decreasing. As an example, just five days prior to the April 27 tornado outbreak in the South, the Good Friday Tornado in St. Louis reached rare F-4 intensity (upper 2% of all tornadoes in damage capacity) in a densely populated area yet there were no deaths and no serious injuries. This was especially remarkable since, historically, more people have been killed by tornadoes in the St. Louis metropolitan area than any other.

There was a large tornado outbreak in the South less than two weeks before the violent tornadoes of the 27th. On Friday and Saturday April 15-16, 2011, the death toll was about one-tenth of April 27th's and 86% of those (31 of 36) were associated with mobile homes, known to be especially vulnerable. So, the current death toll of 236 in Alabama and the total death toll of 337 is simply stunning in the 21st Century given the state-of-the-art in tornado warning science and warning communications technology.

The April 15 and 16 tornadoes were useful for comparison as densely populated cities were struck (i.e., Jackson, MS, Raleigh, NC) in the same geographic region as on the 27th (Tuscaloosa and Birmingham, AL) and the number of tornadoes was roughly similar (the post-disaster studies are not complete). The earlier tornadoes were also fast moving and some occurred after dark. While the April 27 tornadoes were more violent, the two outbreaks of tornadoes are not dissimilar.

So, what explains the difference between 36 fatalities and 309 (the 24-hour total in Mississippi and Alabama beginning at 7am CDT on the 27th)?

These thunderstorms produced over 100 reports of wind damage and wind speeds of more than 60 mph. There were also a few small tornadoes.



When the morning thunderstorms had departed, media and other reports indicate that at least 262,000 electric “customers” (individual homes and businesses) were without power. The electric utility industry assumes 3-4 people per “customer” which translates to 786,000 to 1,048,000 people. The distribution of these outages, based on media reports is shown below. The numbers are “customers” without power.

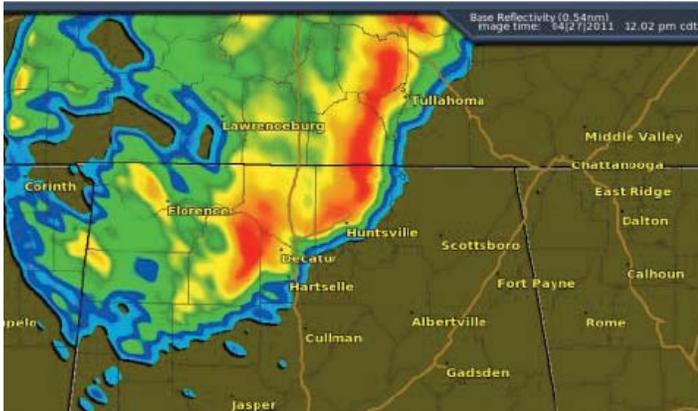


The Power Failures

Twelve hours before the commencement of the violent tornadoes the afternoon of Wednesday, April 27, a line of thunderstorms with extreme straight-line winds and small tornadoes swept across the region. The AccuWeather radar image below shows the line of thunderstorms at 4:49am CDT with the cities of Tuscaloosa and Birmingham highlighted.



A second line of thunderstorms with high winds moved across far northern Alabama at midday which caused some additional power failures and hampered the efforts to repair the morning outages.



While power had been restored in some areas by this time, it was going out in others. Here is a first-hand report from a woman living in Decatur, Alabama (upper part of map) two-and-a-half hours prior to the above image.

Yes, I lost power about 3 pm on the day of the storms. I just sat in the dark while [her husband] called me to give me updates from work. Apparently, the entire town lost power at the same time.
--- Resident of Decatur, Alabama, in an email to author

She went on to report that the power was out during the entire duration of the later tornado outbreak. It was not restored for ten days.

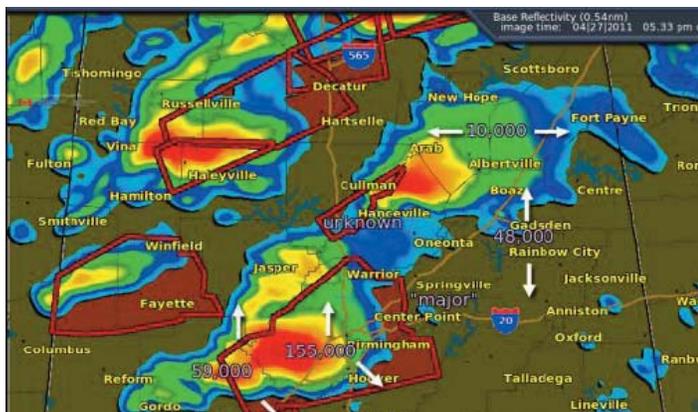
While the exact numbers are less certain than the morning power outage reports, it appears that “thousands” of additional customers lost power in southern Tennessee and northern Alabama due to the midday storms.

Thunderstorms knocked out the Brown’s Ferry nuclear plant prior to the main tornado-bearing thunderstorms. Media reports are unclear as to whether this added to the number of those without power when the primary swarm of tornado-bearing thunderstorms arrived. A tornado knocked down a series of metal electrical transmission towers north of Huntsville plunging even more people into darkness as the thunderstorms approached.

A scary thing happened to Katrina Floyd on the morning of April 27. A thunderstorm swept through her northeast Alabama town of Ider in the early morning hours, uprooting trees and knocking out power and cell signals. She had no access to television, radio, the Internet, or her smartphone. On a day of extreme weather, she had no way to access weather alerts.
*--- Jenny Marder
 PBS.org/newshour*

Three scientific studies (see citations at the end of this report) demonstrate that approximately 90% of the population receives its weather warning information from television. A fourth study involving an outbreak of violent tornadoes in Oklahoma found the “vast majority” of people get their warning information from television and that it is the single most influential media when people are making decisions about sheltering upon receipt of a warning.

The radar image below depicts the tornadic thunderstorms and the tornado warnings (red polygons) in effect at 5:33pm which shows the fast-moving tornadoes starting to move into the areas that had lost power earlier in the day.



As of 3pm, before the devastating tornadoes arrived, more than 180,000 customers in central Alabama were without power. There were at least 60,000 customers out in northern Alabama. This means that more 700,000 Alabamans were without power as the killer tornadoes approached.

Without power, people could not use their televisions or internet. Local radio stations, in some cases were off the air due to the extended power outage. Other stations had to reduce power or sign off at sunset

that evening (per FCC rules, this was normal operating procedure for those stations). In at least some areas, there was no operative cell coverage other than text messaging.

The map below shows the number of fatalities in counties that are reported to have experienced one or more tornadoes on the 27th (a county without a number did not report tornado damage).



There appears to be a correlation between counties with widespread power failures from earlier storms and deaths.

I use the term “appears” because, according to a conversation with a member of the post-storm survey team, this issue has not been evaluated. Multiple attempts to reach the head of the survey team have thus far been unsuccessful.

The Theory

Television is, by far, the preferred and most influential means of receiving storm warnings. Without electricity, televisions and the internet do not work. Given enough time, the backup batteries at cellular telephone towers exhaust themselves of power as do the batteries on individual cell phones. So, the usual systems for receiving the warnings would be, at best, disrupted. In some areas, especially in rural regions without power, the warnings may not have been available through any routine source due to local radio stations signing off at sundown. Tornado sirens are less widely used in the South than in “Tornado Alley.”

Without electricity, how were people to get the warnings of the violent afternoon and evening tornadoes?

My theory is that the extended loss of electricity prevented hundreds of thousands of people from receiving warnings in the customary manner and, in many cases, the warnings were unavailable. If the warnings were not received, it would account for the “pre-warning era” level of fatalities.

In the meantime, what preliminary lessons might this theory offer for future tornado safety?

- An inexpensive battery extender for your cell phone is a cost-effective investment.
- One hour of backup power for home computers is likely not enough. If you are using a computer for critical storm information a cell card as well as Wi-Fi is recommended.
- A NOAA weather radio with an extra set of fresh batteries taped to the radio might be an excellent investment for individuals.
- For businesses, it highlights the importance of not relying on local media for storm warning information as those might be affected by the same hurricane or tornado that threatens the business. A multi-office source from outside the region offers better protection.
- For medium and large businesses, an investment in a satellite telephone may be wise. These typically cost less than \$2,000 along with a monthly voice/data plan. In the event of an extended power outage, the satphone could be used to call a commercial weather provider (the National Weather Service does not take calls from individual businesses) to receive weather updates and to request warning calls be made by satphone until power is restored.

Summary

It is impossible, at this time, to know exactly the role the premature (i.e., before the thunderstorms bearing the violent tornadoes) power failures played in this event. We urge the meteorological profession in general, and the National Weather Service in particular, to study this issue carefully so the validity of this theory can be determined. Otherwise, there is a risk of learning the “wrong lessons” from this tragic event.

Scientific Citations

Hammer, Barbara, Thomas W. Schmidlin, 2002: Response to Warnings during the 3 May 1999 Oklahoma City Tornado: Reasons and Relative Injury Rates. *Wea. Forecasting*, 17, 577–581.

Brown, Sheryll, Pam Archer, Elizabeth Kruger, Sue Mallonee, 2002: Tornado-Related Deaths and Injuries in Oklahoma due to the 3 May 1999 Tornadoes. *Wea. Forecasting*, 17, 343–353

Schultz, David M., Eve C. Grunfest, Mary H. Hayden, Charles C. Benight, Sheldon Drobot, Lindsey R. Barnes, 2010: Decision Making by Austin, Texas, Residents in Hypothetical Tornado Scenarios*. *Wea. Climate Soc.*, 2, 249–254 [note: Austin study]

Powerpoint of Denver and Austin (comparison) study results by Dr. Eve Grunfest, available via Google search: www.google.com/search?client=safari&rls=en&q=the+warning+project+denver+austin&ie=UTF-8&oe=UTF-8



Mike Smith is a board-certified consulting meteorologist and a Fellow of the American Meteorological Society. He is founder of WeatherData, Inc. which became part of AccuWeather in 2006 and where he now serves as Senior Vice President and Chief Innovation Executive of AccuWeather Enterprise Solutions. **Warnings: The True Story of How Science Tamed the Weather** is Mike's first book. It is the acclaimed story of how scientists unraveled the mystery of tornadoes, hurricanes, and other violent storms and constructed a system to save lives.



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