

# **NOAA's National Weather Service**



**Spring Workshop Roundtable**

**March 6, 2010**

# Societal Impacts in the Warning Process



**Spring Workshop Roundtable**

**March 6, 2010**

From the Super Tuesday (Feb 5-6, 2008)  
Tornado Outbreak NWS Service Assessment

Presentation based on material from Dan Niefeld (NWS Omaha), Julie Demuth (National Center for Atmospheric Research), and Kevin Barjenbuch (NWS Salt Lake City)



# NWS Service Assessments

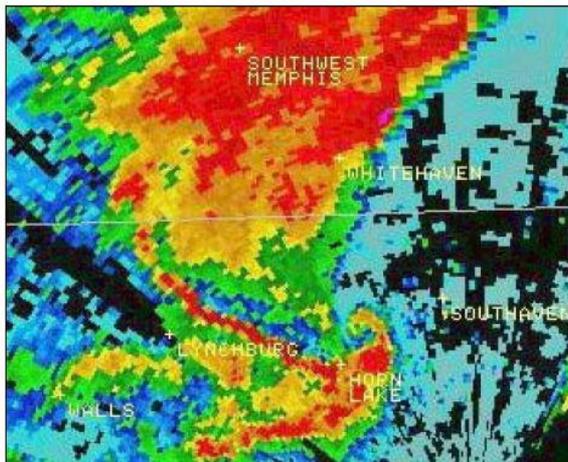
- Conducted to evaluate NWS performance during significant, high-impact events
- Historically primarily *inward, quantitative* assessment of NWS and its partners
- 2008 shift toward including *external, qualitative* assessment of members of public
  - Super Tuesday, Mother's Day, Midwest floods, GA Floods





*Service Assessment*

## Super Tuesday Tornado Outbreak of February 5-6, 2008



U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Weather Service  
Silver Spring, Maryland

<http://www.nws.noaa.gov/os/assessments/index.shtml>

Windows Internet Explorer  
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NWS Service Assessm... x NOAA/National Weather ... Storm Prediction Center National Hurricane Center

NOAA's National Weather Service  
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**Service Assessments**

NWS conducts Service Assessments to evaluate its performance during catastrophic weather events. Assessments are done when one or more of the following criteria are met:

- Major economic impact on a large area or population
- Multiple fatalities or numerous serious injuries
- Unusually high level of public or media interest

Assessment teams, composed of experts in and outside NWS, study what happened and NWS actions before, during, and after the event. Finally, the team recommend changes in NWS procedures, products and services to improve performance.

**Central United States Flooding of June 2008.** Downtown Cedar Rapids, Iowa, Friday, June 13, 2008, as the Cedar River crested more than 11 feet above its previous record. View is upstream. Used with permission. ©2008 Iowa Homeland Security and Emergency Management Division. Photograph by the Civil Air Patrol.

- Central United States Flooding of June 2008
- Mother's Day Weekend Tornado in Oklahoma and Missouri, May 10, 2008
- Super Tuesday Tornadoes: February 5-6, 2008
- Pacific Northwest Storms of December 1-3, 2007
- Tornadoes in Southern Alabama and Georgia, March 1, 2007
- Rogers, MN, Tornado Assessment, September 16, 2006
- Hurricane Katrina, August 23-31, 2005
- West Coast Tsunami Warning: June 14, 2005

2000-2004

- Hurricane Charley, August 9-15, 2004
- Baltimore Inner Harbor Thunderstorm Event: March 6, 2004
- Intense Space Weather Storms, October 19 – November 07, 2003
- Hurricane Isabel: September 18-19, 2003
- Southern California Wildfires: October 20 to November 3, 2003
- Record Tornado Outbreaks of May 4-10, 2003
- Super Typhoon Pongsona: December 8, 2002
- Veterans Day Weekend Tornado Outbreak
- La Plata, MD, Tornado Outbreak: April 28, 2002

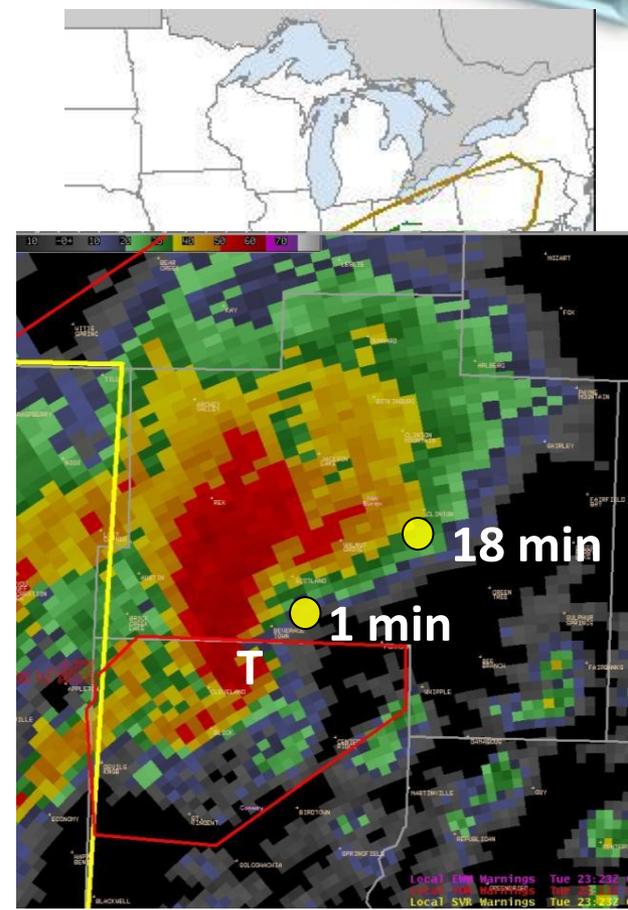
USA.gov  
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[http://www.nws.noaa.gov/os/assessments/pdfs/super\\_tuesday.pdf](http://www.nws.noaa.gov/os/assessments/pdfs/super_tuesday.pdf)



# February 5-6 2008 Tornado Outbreak

- National Weather Service (NWS) predictions
  - Excellent long lead-time info:
    - First outlook issued 6 days prior
    - Day before, outlook mentioned “potentially strong and long-track tornadoes”
  - Mixed quality short lead-time info:
    - Mean official tornado warning lead time of 18 minutes
    - Some problems with timely downstream warnings
    - Uncertainty wording for confirmed tornadoes

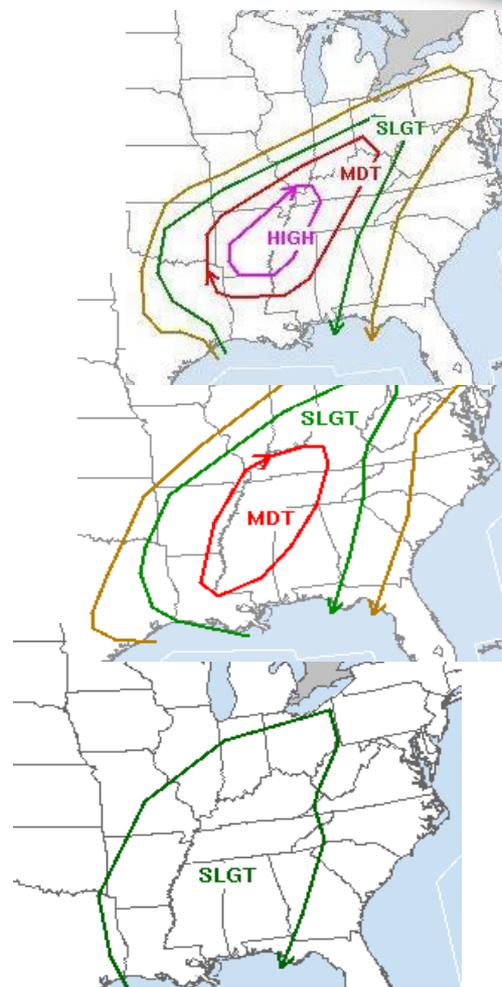




# February 5-6 2008 Tornado Outbreak

- Excellent long lead-time predictions from NWS
  - First outlook issued 6 days prior
  - Day 3, Day 2, Day 1 outlooks zeroed in with slight, moderate, high risk
  - Day 1 outlook mentioned “potentially strong and long-track tornadoes”
  - Tornado watches in place with several hours lead time

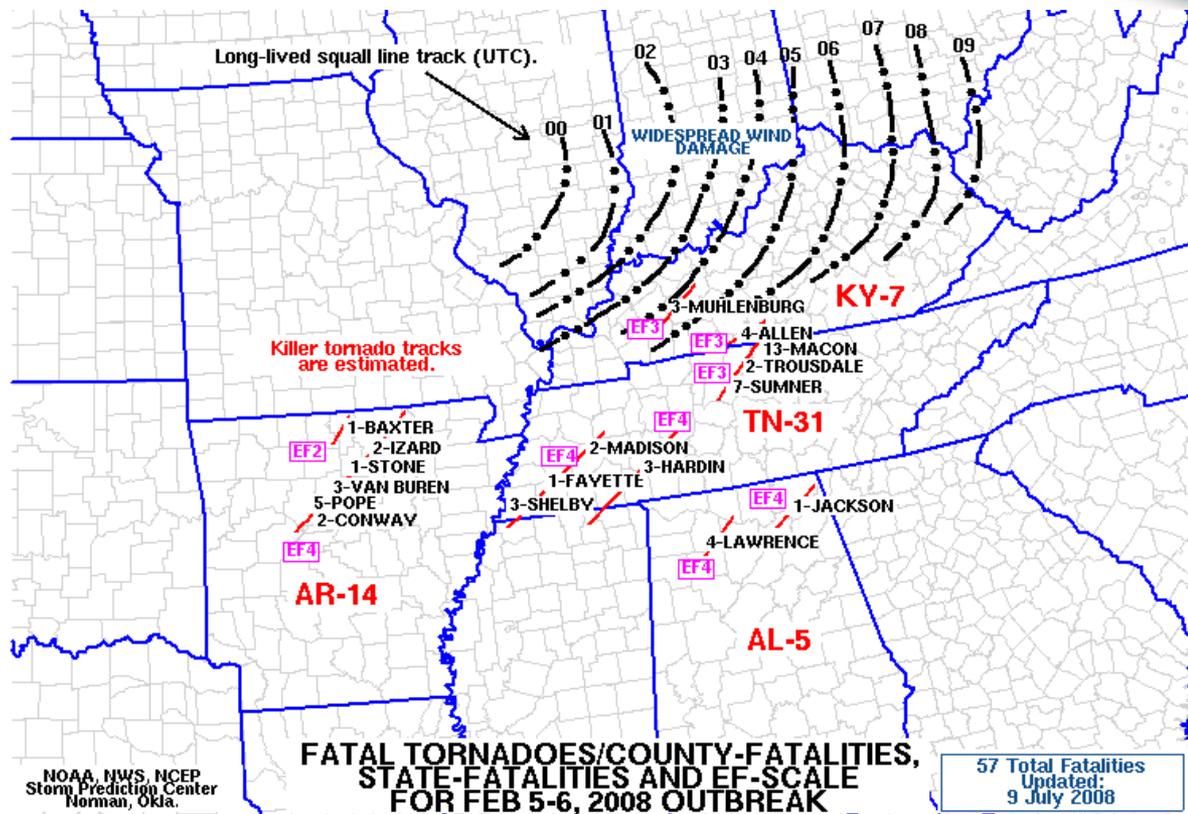
***Initial performance numbers looked great!***





# Impacts of the Tornado Outbreak

- 87 tornadoes
  - 5 EF-4 tornadoes
  - 1 tornado had a 123-mile long path
- 57 fatalities
  - most since May 31, 1985
  - 13<sup>th</sup> overall
- 350+ injuries
- \$520M damage





# Why?

- This was a well-warned event, with good information, so...
  - Why did so many people die?
  - What questions do we have about what members of the public understand, think, do, want, ... etc.? How do we go about addressing these questions?
  - What could we (the weather community) do differently? Better?
  - How will continuously changing technology affect the how we analyze weather and communicate that information?



***These are physical and social science questions!***



# Why?

- This was a well-warned event, with good information...
  - ... why don't people do what they're "*supposed*" to do ... to make the "*right*" decision?



***We get frustrated when we put "good" weather information out there and people don't make the "right" decisions!***



# The “Right” Decision ... in a Tornado

- Why might someone not take shelter from a tornado?
  - 
  - 
  -
- *What is the “right” decision?*
- *Is there a “right” decision?*
- *How and why do decisions get made?*



# Integrating Social Science Research

- The task - To *try* to understand why so many people died and the details of those fatalities
  - Age, gender, warning received, warning source, warning heeded, shelter sought, structure where they died, availability of safer shelter
- An opportunity - To gather empirical information about people's *actual* warning response behaviors
  - What info people had, how they interpreted it (knowledge)
  - How people perceived the situation & info (perceptions)
  - What decisions people made (decision-making)

***Highly interdependent, iterative process***



# Some of the Questions

- When did you first realize there was a threat of a tornado?
  - How did you learn about the threat? What were you thinking after you received that information? What did you do next?
- Have you ever been in a similar type of extreme-weather situation in the past?
  - Did anything from that experience influence what you did during this event? Have you ever been warned about an extreme weather event in the past that did not occur?
- Think back over the entire tornado event, from the time you learned there was a tornado threat through when the tornado actually occurred.
  - Do you feel that any of the information you received was unclear? Is there any other information you would have liked to have had?



# Findings: People's Knowledge

- People get information from multiple sources, multiple times
  - Majority via television
  - Also commonly from other people (family, friends, neighbors, co-workers)
- Tornado sirens are useful, but...
  - Misconceptions about sirens as a warning device
  - Misconceptions about what sirens mean



# Thoughts from the Survey Team

- Things we've learned
  - Communication Key → pre-event conference calls, NWS chat for before and during an event
  - Siren policies that varying widely by city, county
  - NWS, emergency managers, broadcasters handle tons of info
  - We all seem to have assumptions of our individual roles as team members
  - We are governed by policy and software (*& budget*)



# Findings: People's Personalization

- People often seek confirmation of the threat; a single source of info will not necessarily spur protective action
- Many people recognize a risk exists, but believe that their personal risk is less or that they aren't at risk at all (optimism bias)



# Thoughts from the Survey Team

- Things we've learned
  - NWS can and does tailor their warnings and call-to-action statements
  - Broadcasters' visuals can help people personalize risks
  - Should what we communicate change according to the urgency of the threat? How can we do this effectively?
  - Trust and previous experience play a role
  - Some (many?) of us assume that people will learn about the warning and take immediate protective action



# Findings: People's Decision-making

- Decision-making is NOT a singular event ... it happens numerous times and ways
  - Part of people's gathering and interpreting weather information to evaluate the risk
  - Seeking additional information is a decision!
- Decision to shelter
  - Vast majority of people (survivors and victims) who received warning heeded it and sought shelter in best location available to them
  - BUT ... less than half of people had a basement, storm cellar, or safe room to shelter in
    - Nearly 2/3 of victims were in mobile homes; additional 15 in houses, 4 in warehouse, 1 in vehicle



# More Thoughts from the Survey Team

- Things we've learned
  - NWS, emergency managers, broadcasters are integrating information about who is at risk, where, when ... and this changes daily!
  - We are driven in our mission to save lives!



# Generalized Misconceptions Discovered

- The longer the lead time on a watch, the better
  - Public, Media, EMs all complained about excessively long and large watches
- If people are inside the polygon, they know it, and will take appropriate action (more on this coming up in our next topic)
  - Extremely complex message to convey to the public
  - Take appropriate action... what does that even mean? It varies with each individual and their circumstances and location
  - Really confusing during the Super Tuesday event, but it's gotten better (TV stations were not able to display polygons, but now most can...)
- The concept of “lead time” is extremely arbitrary, and again varies with each individual.
  - If more lives are to be saved, a LOT more needs to be studied during the time between the Tornado Warning issuance and the time the individual sought shelter



# Things to Ponder...

- What if the Super Tuesday Tornado outbreak happens in Central or Southeast Illinois ??? How would it go ???
- How do the different actors - NWS Forecasters, Broadcasters, Emergency Managers - in the information chain perceive their roles and the roles of others?
  - Is TEAMWORK the mindset?
  - Does this affect what info they convey? How?
- Does the “public” trust their source of weather info?
- Is there such a thing as too long of lead time?
- What else can we tell them that would make a difference?