

A National Conversation

Can the Nation do more to save lives from extreme weather?



2011



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- The National Weather Service has been **making a difference in people's lives** for 140 years.
- The timely and accurate weather, water, climate, and environmental information **supports the Nation's social and economic development.**
- NWS offices across the country **help people make life-saving decisions** every day.

High-impact weather, water and climate events can threaten the lives and livelihoods of people in every part of the country.

- The U.S. experiences more severe weather than any nation on earth.
- 90% of all presidential disaster declarations are weather-related.
- No part of our country is immune.
- Despite the great advancements over recent decades in our ability to accurately predict severe weather events, many people continue to take a reactive, rather than proactive stance to incorporating weather forecasts into their decision making.
- Each year, NWS collects some 76 billion observations and issues approximately 1.5 million forecasts and 50,000 warnings across 18 time zones.

NWS Vision & Mission

Building a Weather-Ready Nation

Vision

A Weather-Ready Nation:
Society is Prepared for and
Responds to Weather-
Dependent Events

Mission

Provide weather, water, and
climate data, forecasts and
warnings

- Protect life and property
- Enhance national economy



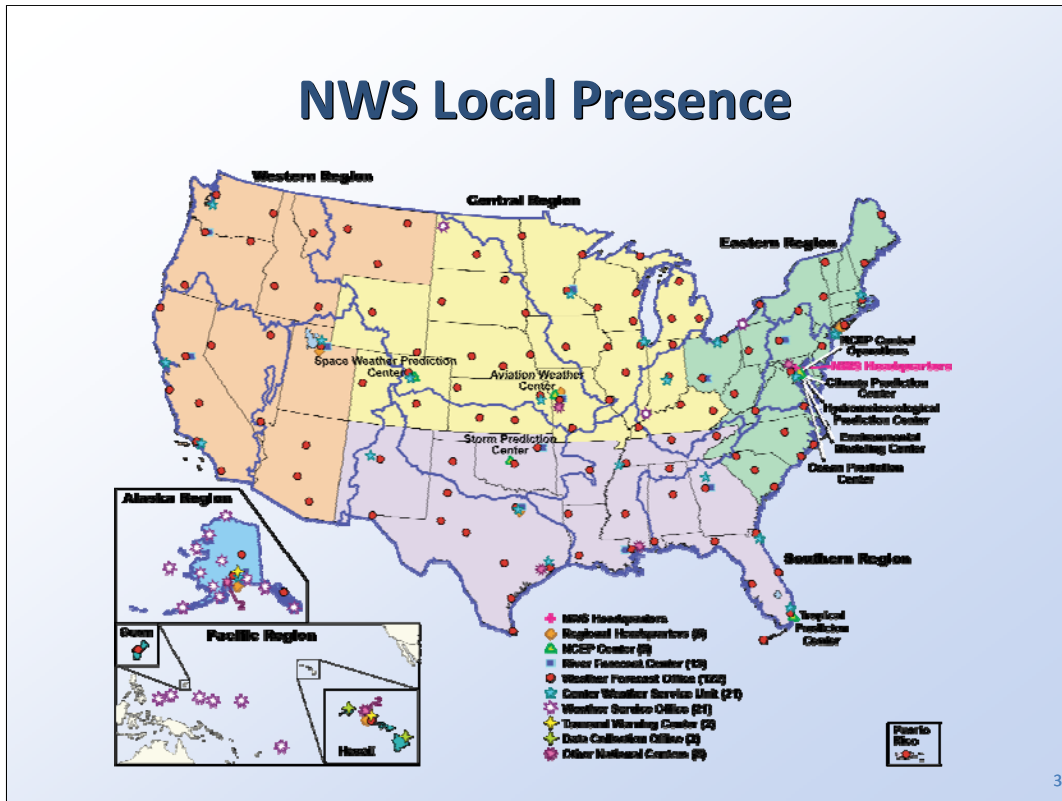
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Typical Year in the U.S.

- 6 Atlantic hurricanes
- 1,300 tornadoes
- 5,000 floods
- Drought and Large Wildfires
- 26,000 severe thunderstorms
- 600 fatalities
- \$14B in losses

- **Transition:** Our mission is and always has been centered around serving the American people to help protect their lives and property.
- Our vision is to Build a Weather-Ready Nation.

NWS Local Presence



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- Each year, NWS collects some 76 billion observations and issues approximately 1.5 million forecasts and 50,000 warnings across 18 time zones.
- We have offices throughout the United States, in the Pacific and in Puerto Rico.
- Local presence means we live in the communities we serve.

2011: A Year of Extremes

~600 Fatalities



536 Fatalities from
1,475 Tornadoes



Historic U.S. Floods



Pacific Tsunami



4 Million Acres Burned



Devastating Blizzards

Lots of High Impact weather

- Emphasize point these are not isolated events but long duration events that require extensive support during recovery phase as well

Tornadoes

- About 600 fatalities from all severe weather
- 536 fatalities from 1,475 tornadoes
 - 6th deadliest tornado year in U.S. history.
- On April 27 alone, we lost 300 people in the South (Alabama, Mississippi, etc.).
- The May 22 Joplin, Missouri tornado claimed almost 151 lives
 - 7th deadliest single tornado in U.S. history

Floods

Red River / Missouri River / Mississippi River

➤ Wet Winter/Spring

➤ NWS Outlooks & Forecasts

➤ *Communities prepared:*

- **Evacuations, spillways
opened, levies
breached**



2011 FLOODS

Northern States (Montana, North Dakota, Minnesota)

- Spring flooding in portions of the United States has been significant. In fact, for the third consecutive year, there was widespread major flooding.
- Affected North Central states through the mid-West and the northeast.
- Snowpack in the North Central states contains water content was among the highest of the last 60 years.
- The following areas were hardest hit:
 - The Red River of the North, which forms the state line between eastern North Dakota and northwest Minnesota
 - The upper Mississippi River basin from Minneapolis southward to St. Louis
 - Missouri River: The Missouri River forms in Southwestern Montana and drains over 530,000 square miles of the West and Midwest before it flows into the Mississippi at St. Louis, MO. It is the second largest tributary of the Mississippi by discharge.

Southern States (Tennessee, Missouri, Arkansas, Mississippi, Louisiana):

- Epic flooding of Mississippi River
- People and infrastructure severely affected by main stem river flooding and backwater impacts on tributaries.
- This historical flooding along the lower Mississippi River will have major impacts to our economy. Of significance, both agriculture and navigation will be adversely impacted by this historical flood. Crests along the lower MS River are expected to be broad multi-day crests.
- Current forecast projections indicate that major to record flooding will occur along the Mississippi River from Cairo, IL, to the mouth of the Mississippi River.
- The operation of both Bonnet Carre and Morganza Spillways has lowered the crest forecasts on the

Flooding Impacts

- Major to record flooding
- Severe impact on Agriculture, Infrastructure, Navigation, Transportation and Economy
- Estimates upwards of \$10-Billion in losses from Mississippi alone



Total Economic Impacts

- Total economic damage could reach several billion. Why? The Mississippi River runs past farmlands and cities in six states. The flood's greatest damage could come on May 23 when it empties in New Orleans, still recovering from Hurricane Katrina. Here's a rundown of damage so far.
- River barge traffic, transporting billions in crops, are delayed. Riverboat casinos are closed for 6-8 weeks (\$14 million).
- Farmland crop damage could total \$2 billion (Fortunately, farmers usually have crop insurance.)
- Missouri - 130,000 acres, 100 homes and 300 people were flooded, costing \$300 million.
- Kentucky - More than \$5 million in damage. FEMA officials are still estimating.
- Memphis TN - Levees protected the downtown, although 1,300 homes in outlying areas were flooded.
- Arkansas - Flooding could destroy what's left of the \$200 billion catfish industry.
- Mississippi - Damage could total \$800 million.
- Louisiana - 25,000 people were flooded when levees were opened to protect New Orleans. Why? If the Mississippi River flooded the city, it would hit harder than Hurricane Katrina. The flood would have also threatened 10 Louisiana refineries, representing 14% of U.S. operating capacity. (Sources: USA Today, CNN Money)

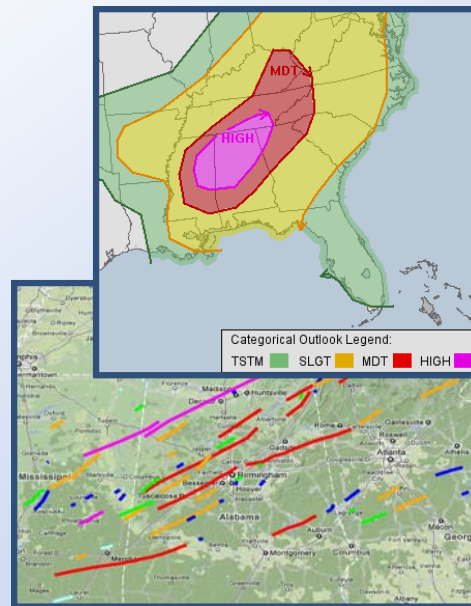
2011 Historic Tornado Year

Year-to-date

- 1,445 tornadoes (preliminary)
- Record was 1,817 in 2004
- 536 fatalities
- 6th deadliest year on record

April Tornadoes

- 875 tornadoes—record month
- 300 on April 27 alone
- 361 fatalities



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Year-to-date

Tornadoes

- Year-to-date
 - 1475 tornadoes (preliminary)
 - Record was 1,817 in 2004
 - 536 fatalities
 - 6th deadliest year on record
- April Tornadoes
 - 875 tornadoes—record month
 - 300 on April 27 alone
 - 361 fatalities
- Many violent tornadoes happened on April 27th, and they were on the ground for a long time in densely populated areas. It will probably go in the record books for the most tornadoes reported in a single day. Warnings were timely and accurate. The image shows a rare “high risk” area from the NOAA/NWS/ Storm Prediction Center early on the morning of the 27th, outlining the area hardest hit that evening. The reason we did so much better than the “super outbreak” of 1974 was the INVESTMENT in both technology AND people (a well trained work force). The modernization paid off.
- Accurate Outlooks & Timely Warnings
 - Issue hazardous weather outlooks up 5 days in advance
 - Tornado watches hours in advance
 - Average tornado warning lead time: 24 minutes (national average 14 minutes)

2011 Historic Tornado Year

➤ May 22, Joplin EF-5 tornado

- 151 fatalities
- Deadliest single tornado since modern record keeping began in 1950
- 7th deadliest in U.S. history

➤ Early Warning

- Outlooks: 5 days before
- Watches: Hours before
- Warnings: 24 minutes



- May 22, Joplin, MO EF5 tornado
 - 151 fatalities
 - Deadliest since modern record keeping began in 1950
 - 7th deadliest in U.S. history
 - The Joplin tornado is the deadliest single tornado since modern recordkeeping began in 1950.
 - The deadliest tornado on record in the U.S. was on March 18, 1925. The “Tri-State Tornado” (MO, IL, IN) had a 291-mile path, was rated F-5 based on a historical assessment, and caused 695 fatalities.
 - The EF-5 Joplin tornado had winds in excess of 200 mph, was $\frac{3}{4}$ of a mile wide, and had a track lasting six miles.

NWS Modernization *Enabled Successes*

1970s...



1990s-Present



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- Capabilities and results have come a long way in the last few decades

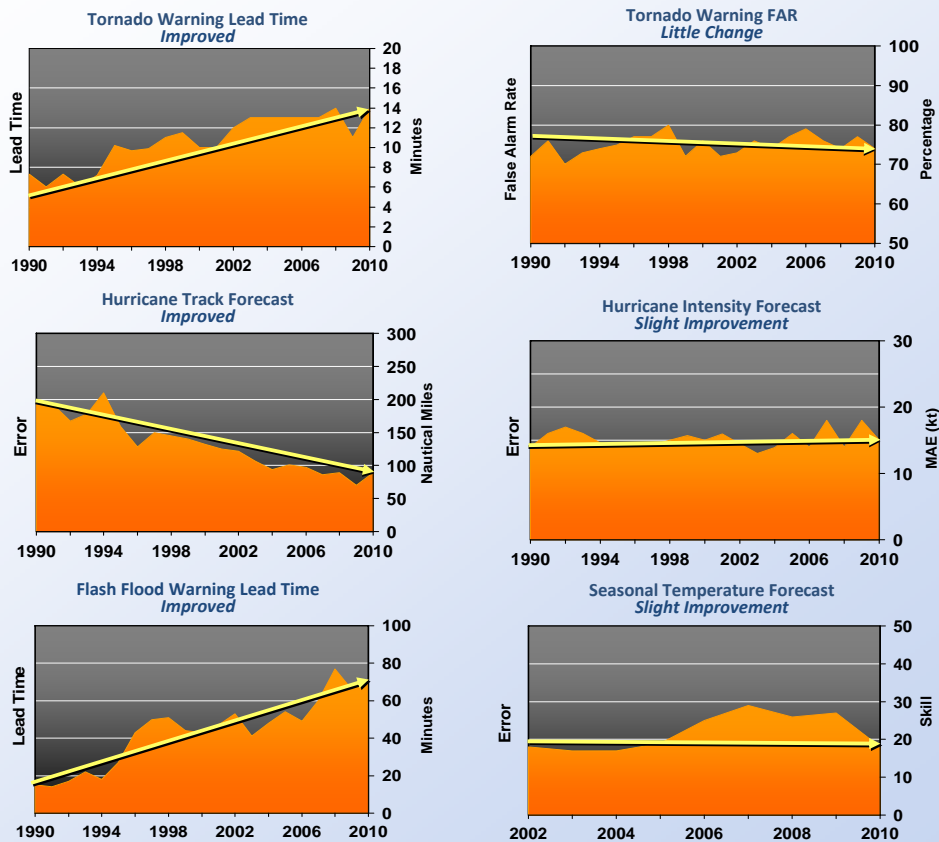
1970s...

- 1974-era radar from Louisville showing imagery from April 4, 1974, tornado outbreak
- View of the electronic computer complex at the National Meteorological Center
- Visible satellite image of U.S. from April 3, 1974 (taken by Applications Technology Satellite 3)
- Traditional WFO instrument shelter (Stevenson Screen)

1990s...

- Louisville NEXRAD (KLVX) imagery from February 5-6, 2008 Super Tuesday Tornado Outbreak
- IBM supercomputers used for climate and weather forecasts
- View of AWIPS monitor
- ASOS instruments

Services Improved But More To Do



- Our services improved during the 1990s, but there's much more left to do.
- While our tornado warning lead times doubled, we've done very little to reduce the false alarm rate. We know from accounts in Alabama and Missouri that people had grown accustomed to hearing tornado warning sirens and not taking action.
- Hurricane track forecast accuracy has improved but hurricane intensity forecasts have not.

A Changing World

- **Growing population and demographic trends**
- **Frequency of high-impact weather**
- **Technological dependence**
- **Water availability and quality**



Increasingly Weather-Sensitive Nation

The Tough Questions We Must Ask

➤ What more can we do to save lives?

- *Better prepared communities...*
- *Warnings get to every American...*
- *Motivate people to take action...*

➤ How can we build our capabilities to realize goal to save more lives?

- *Better observations and models...*
- *More boots on the ground...*
- *Public preparedness...*
- *Social and behavioral sciences...*



- Why is extreme weather happening now? Tie to historically greater severe weather in waning La-Nina years.

Q: Does this outbreak represent a “super cycle of weather,” that is more than we expected, or more than normal?

- This April and May have been especially active due to unusually strong jet stream moving strong low pressure systems eastward across the country and coming in contact with very moist and unstable air masses.
- Dr. Harold Brooks (NOAA Research Scientist with OAR) estimates that an event of the April 25-28 magnitude occurs only a few times per century.
- The tornado activity during April was consistent with emerging research that La Nina conditions result in active tornado seasons over the Central and Eastern United States. May is the annual peak in U.S. tornado activity.

Q: Do we know of any linkage between tornado activity and climate change?

- Although there is some research ongoing, there is no known direct linkage between tornado frequency and intensity and climate change.
- Has our current severe weather warning paradigm – warn on detection – reached a plateau of performance?
- Do we need to move to a warn on forecast paradigm – providing probabilistic, neighborhood scale warnings with an hour lead time
- Where we need to go?
- Severe Weather
 - “Warn on Forecast” – probabilistic severe weather forecasts with one hour lead time
 - Neighborhood scale warnings with greater precision
- Water
 - Improved probabilistic short and long term forecasts
 - Real time inundation mapping
- Technology
 - Improved dissemination – ensuring every American gets warnings when and where they are needed
 - Behavioral and social science to ensure that messages are actionable

Challenges:

Our Partnership is More Vital Than Ever!

- **High operational tempo past 6 months**
 - *Numerous long duration threats across the country*
 - **Blizzards affecting up to 100 million people**
 - **Weeks of tornado outbreaks**
 - **Months of floods**
 - **Months of wildfires requiring multiple week deployments**
 - *NWS working before, during, and after events*
 - *Personnel deploying and redeploying to other regions, long shifts*
- **Continuing high-impact events**
 - *June 1 start of expected above-normal hurricane season*

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Fair weather staffing against increased and continuing high operations tempo

Increasing emphasis on decision support will change way resources are allocated

Need to balance equitable levels of warning services across entire nation against increased needs of communities at greater risk due to extreme weather and population density

Summary

- **Our work together has saved lives**
- **Nation faces increasing risks from high-impact weather**
- **Significant science and technology challenges remain**
- **What can we do together to serve the people more effectively?**



NWS Strategic Plan

Building a Weather-Ready Nation

NWS Strategic Goals:

- GOAL 1: Improve [weather decision services](#) for events that threaten lives and livelihoods
- GOAL 2: Deliver a broad suite of improved [water forecasting services](#) to support management of the Nation's water supply
- GOAL 3: Enhance [climate services](#) to help communities, businesses, and governments understand and adapt to climate-related risks
- GOAL 4: Improve [sector-relevant information](#) in support of economic productivity
- GOAL 5: Enable [integrated environmental forecast services](#) supporting healthy communities and ecosystems
- GOAL 6: Sustain a [highly-skilled, professional workforce](#) equipped with the training, tools, and infrastructure to meet our mission

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Strategic Plan Goals:

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