



Hazards Caucus Alliance



Tornadoes: Understanding How They Develop and Providing Early Warning; Part III NWS

Steven Zubrick

Science and Operations Officer

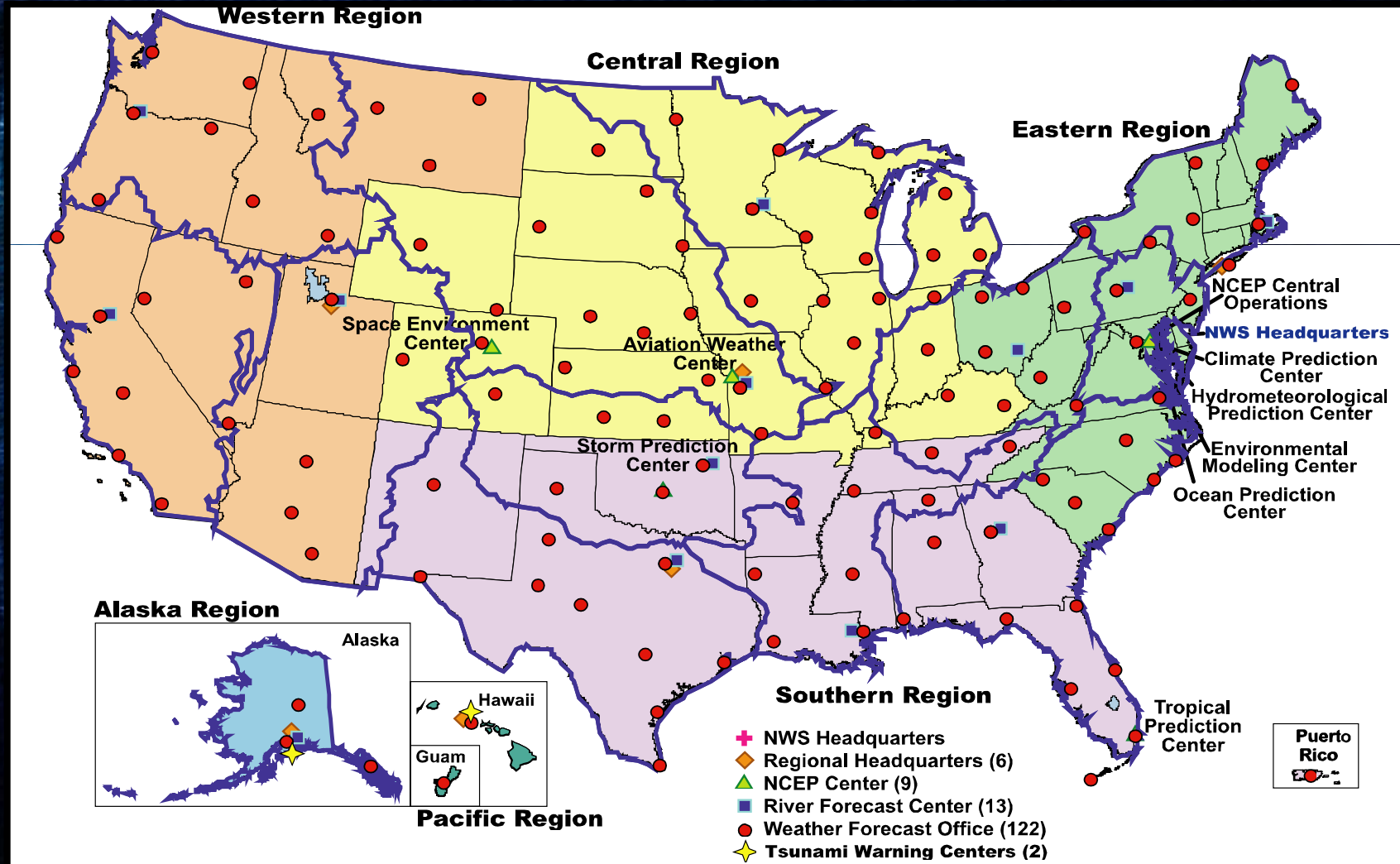
*NOAA National Weather Service
Weather Forecast Office, Sterling, VA*

Washington, DC

July 21, 2010

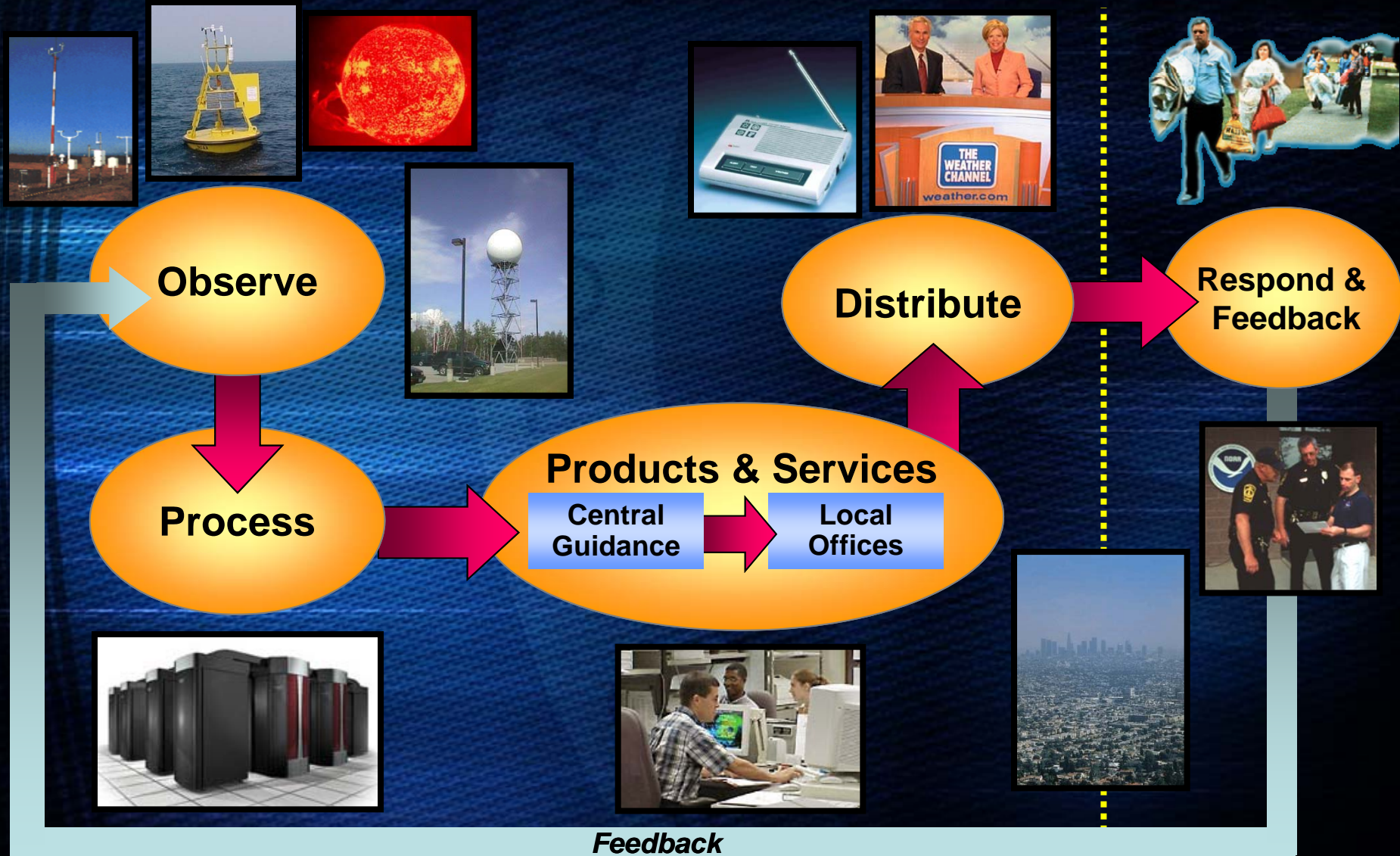


NWS Operations





NWS Operations

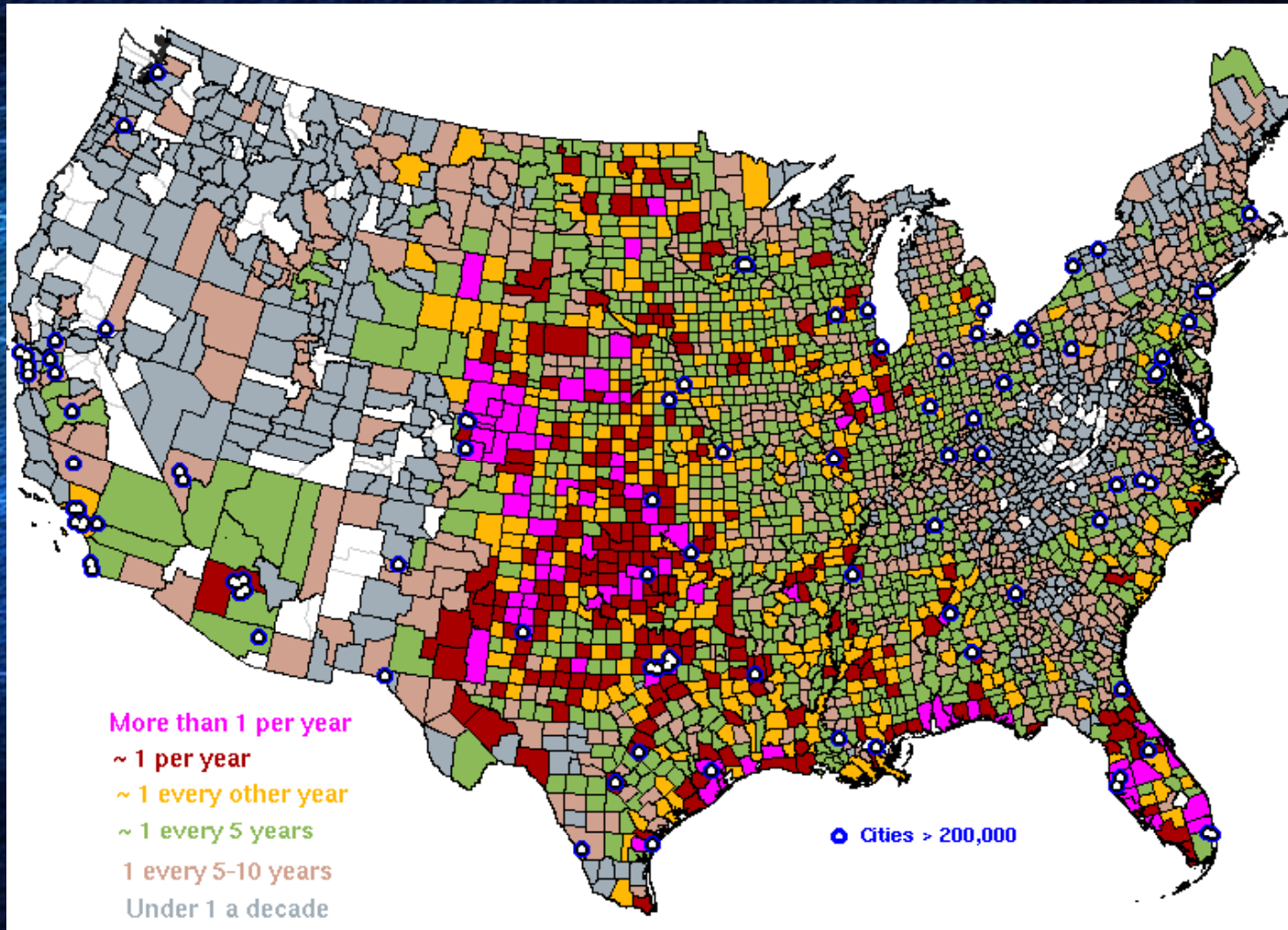




Tornadoes Nationally



Frequency of Tornado Occurrence by County, 1950-2007



Source: NOAA/NWS Storm Prediction Center



Fujita Tornado Damage Scale



Enhanced Fujita (EF) Tornado Scale

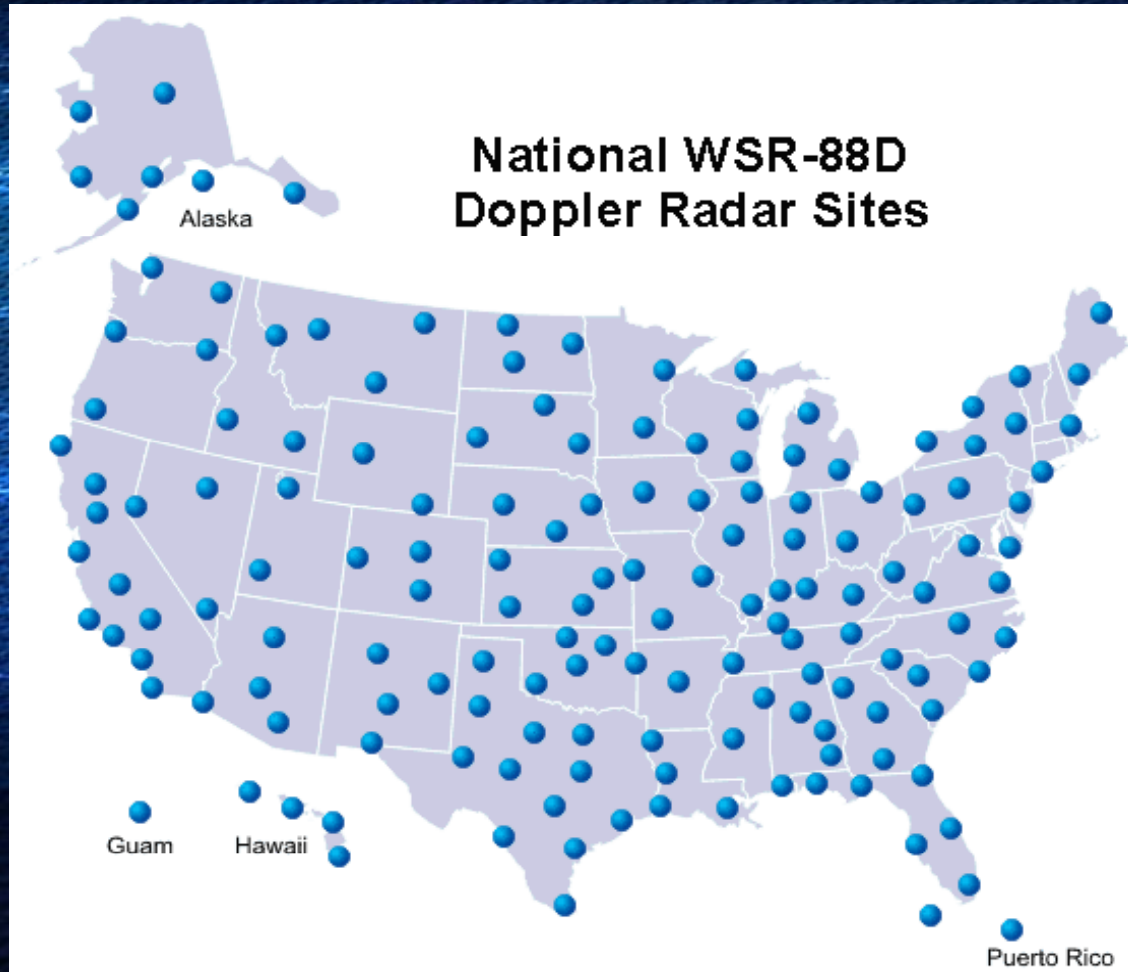
FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200



Radar Network



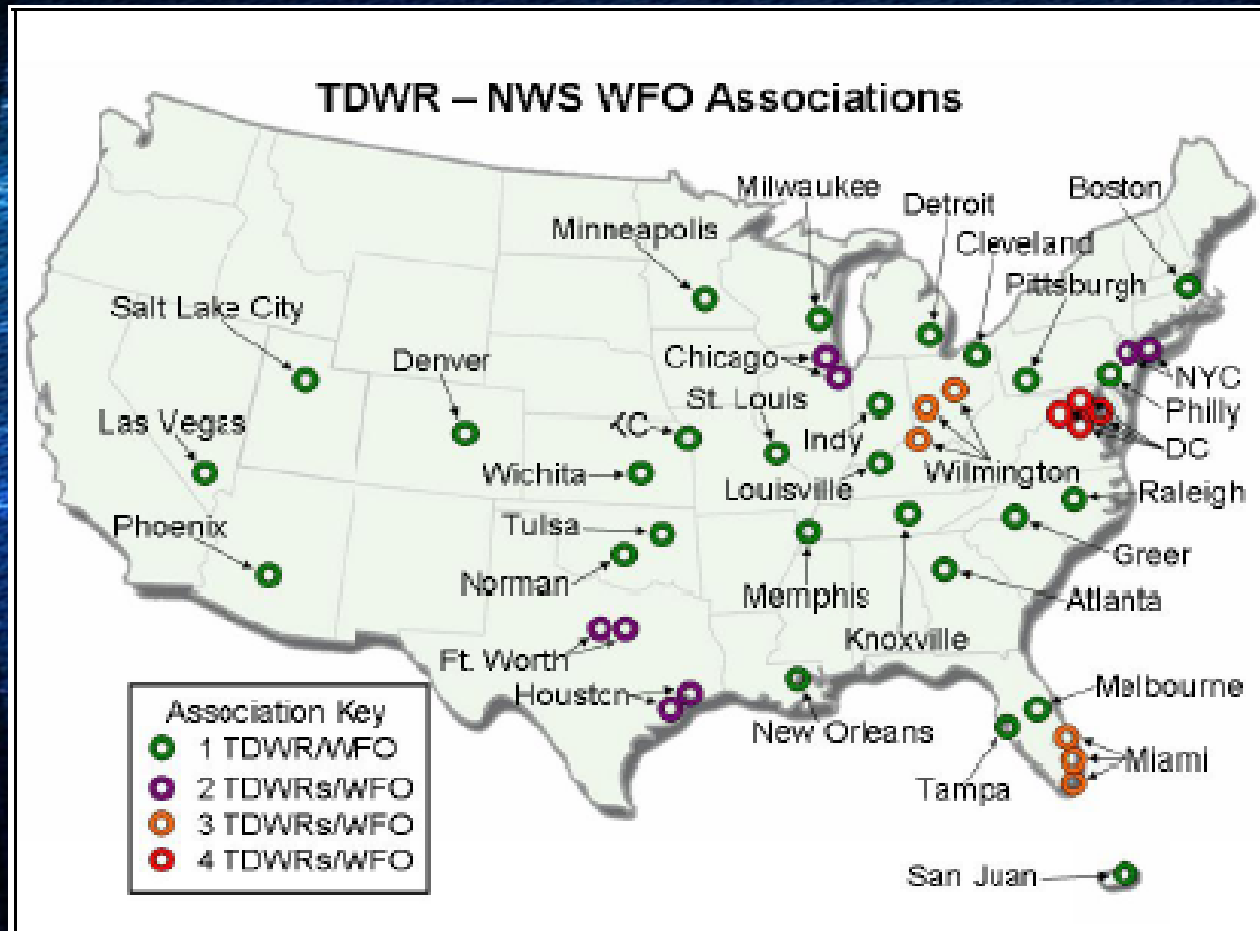
National WSR-88D Doppler Radars





Radar Network

National FAA TDWR Radars



TDWR = Terminal Doppler Weather Radar



Tornado Examples



January 10, 2008
Caledonia, MS



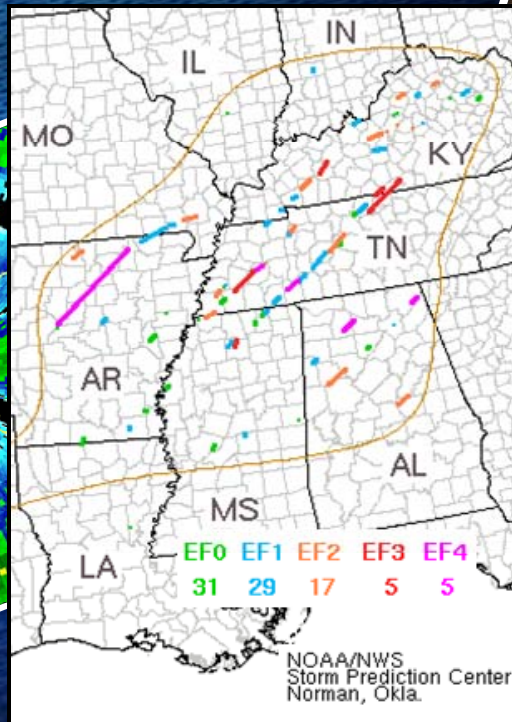
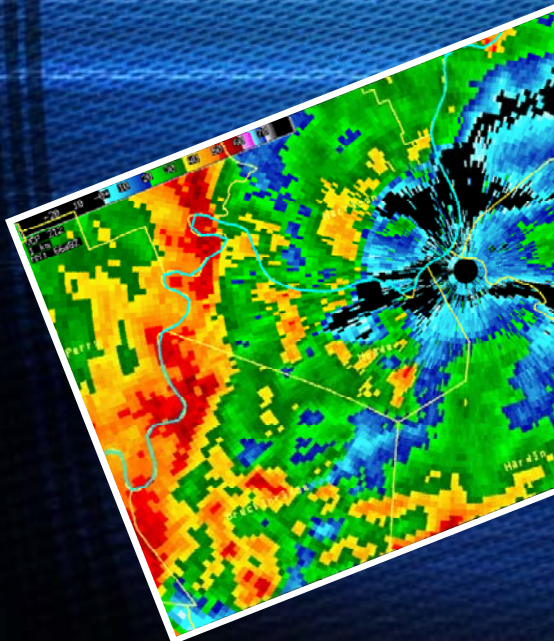
- EF-3 Tornado
- 41 min. lead time
- 2,000 people inside
only 3 minor injuries



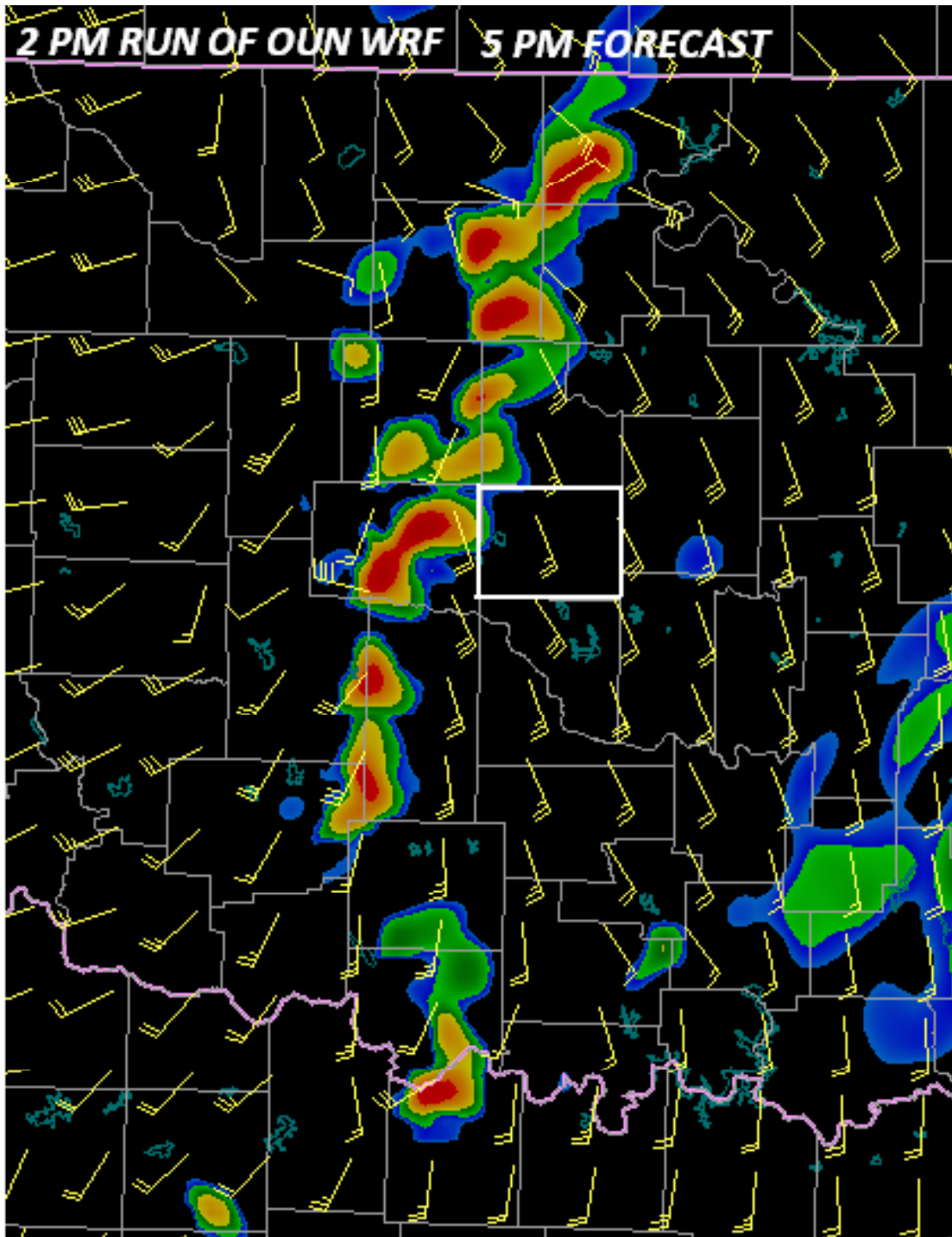
Tornado Examples

February 5-6, 2008 Super Tuesday Outbreak

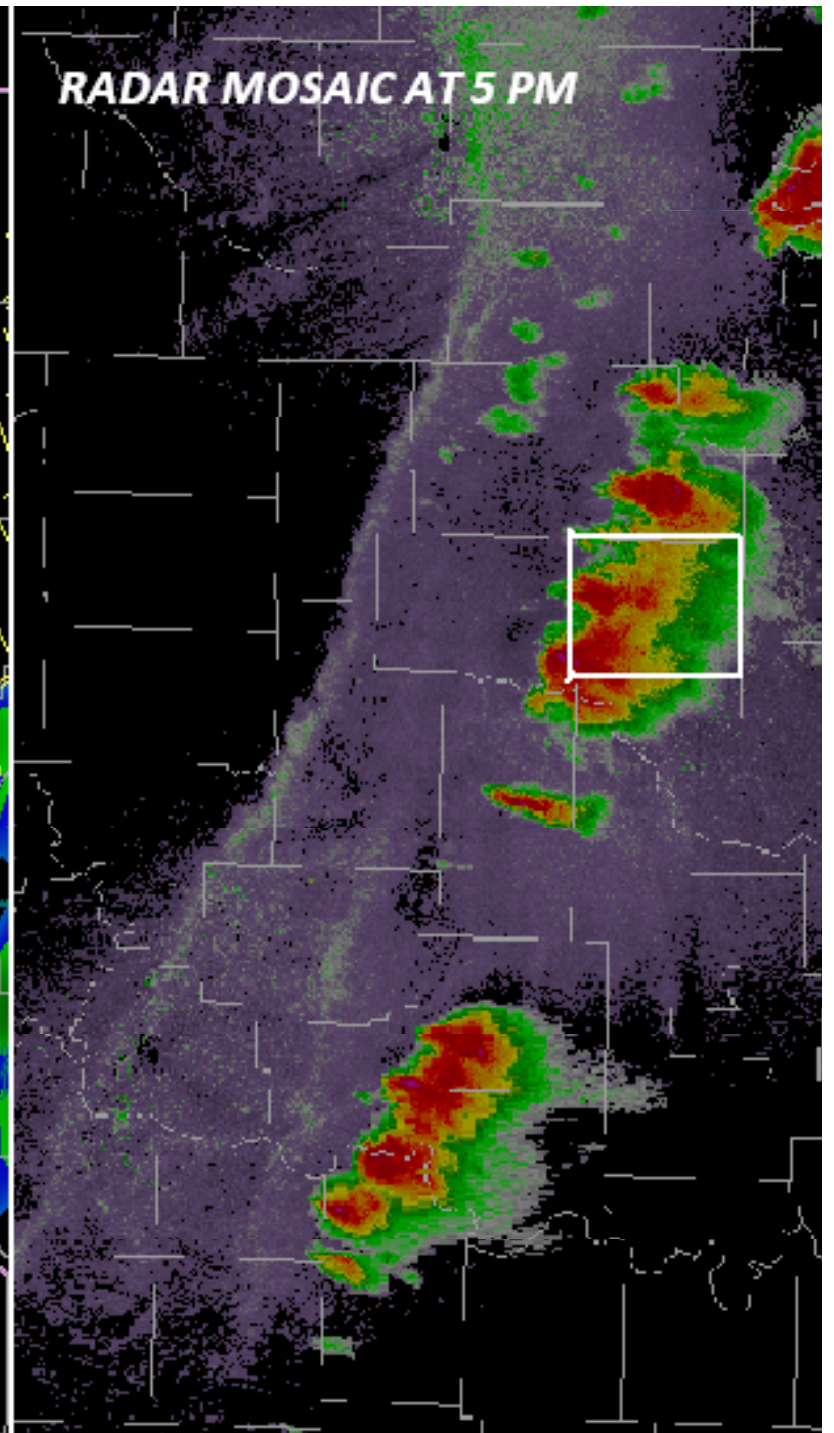
- 63 tornadoes
- 17 minute lead time
- 57 fatalities



2 PM RUN OF OUN WRF 5 PM FORECAST



RADAR MOSAIC AT 5 PM





Outlook-Watch-Warning



Preparing the Public for Tornadoes

- Outlooks
- Watches
 - *Tornado*
- Warnings

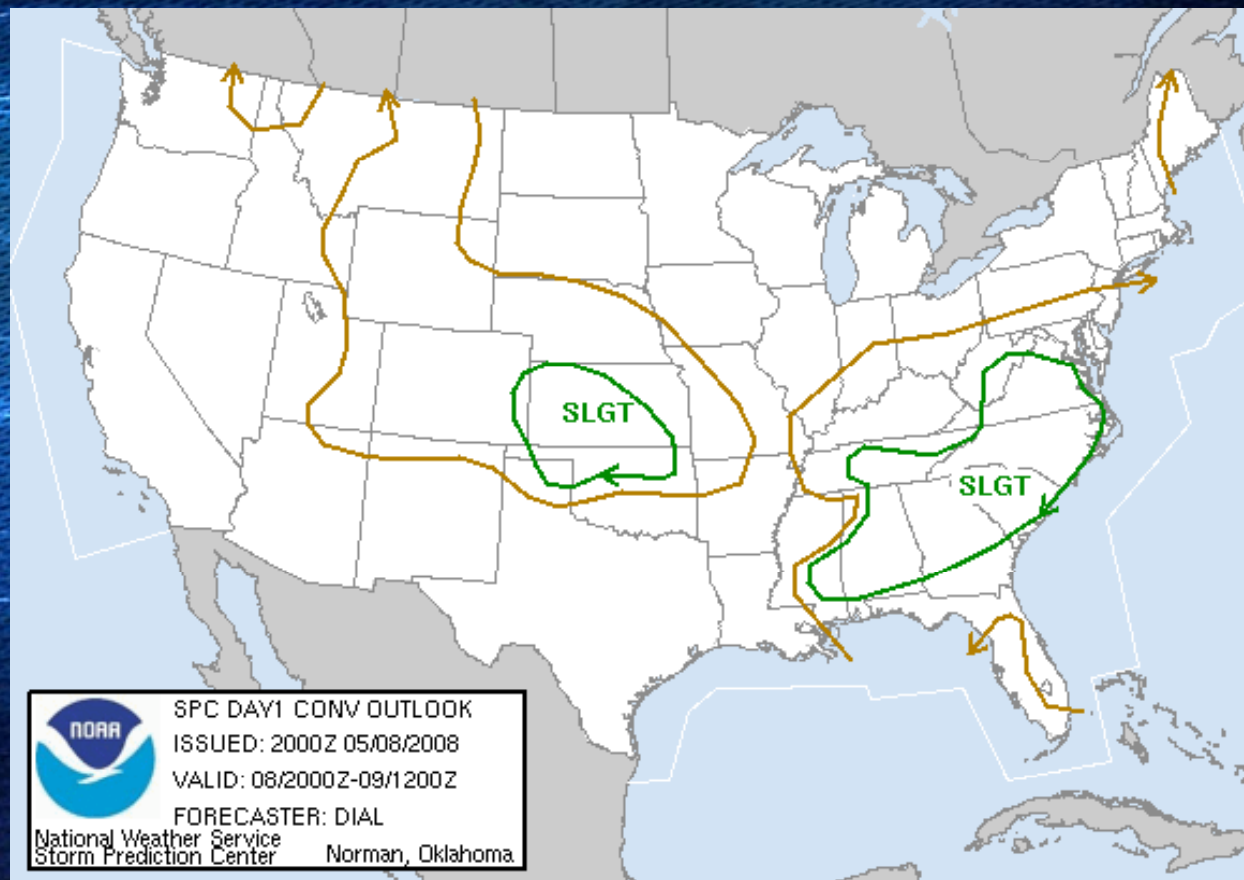




Outlook Phase



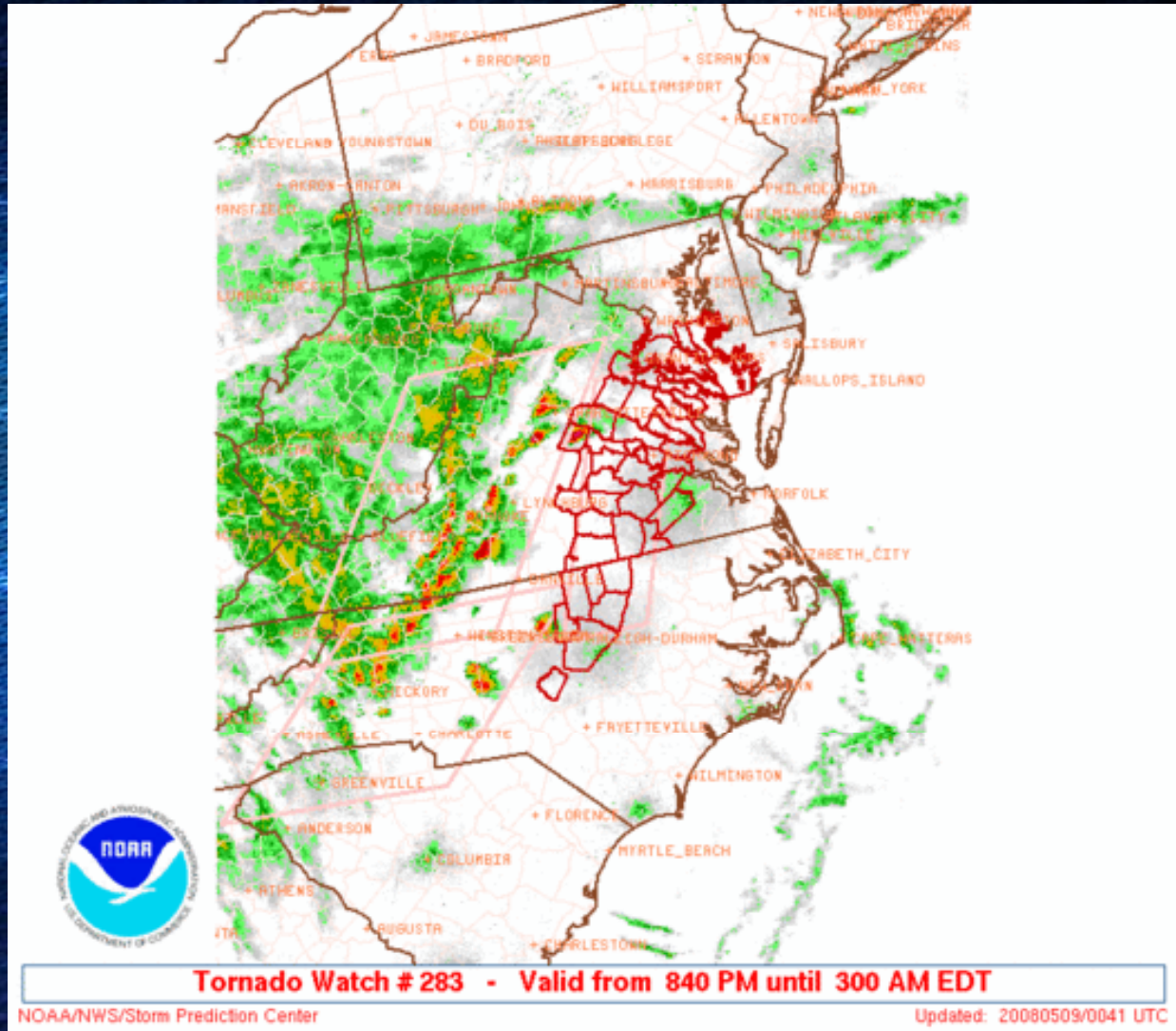
National Weather Service - Storm Prediction Center
Day 1 Convective Outlook
Issued 4:00 PM May 8, 2008





Watch Phase

Storm Prediction Center
Tornado Watch #238





Warning Phase



VAC047-177-179-630-090315-
/O.NEW.KLWX.TO.W.0006.080509T0232Z-080509T0315Z/

BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE BALTIMORE MD/WASHINGTON DC
1032 PM EDT THU MAY 8 2008

THE NATIONAL WEATHER SERVICE IN STERLING VIRGINIA HAS ISSUED A

* TORNADO WARNING FOR...

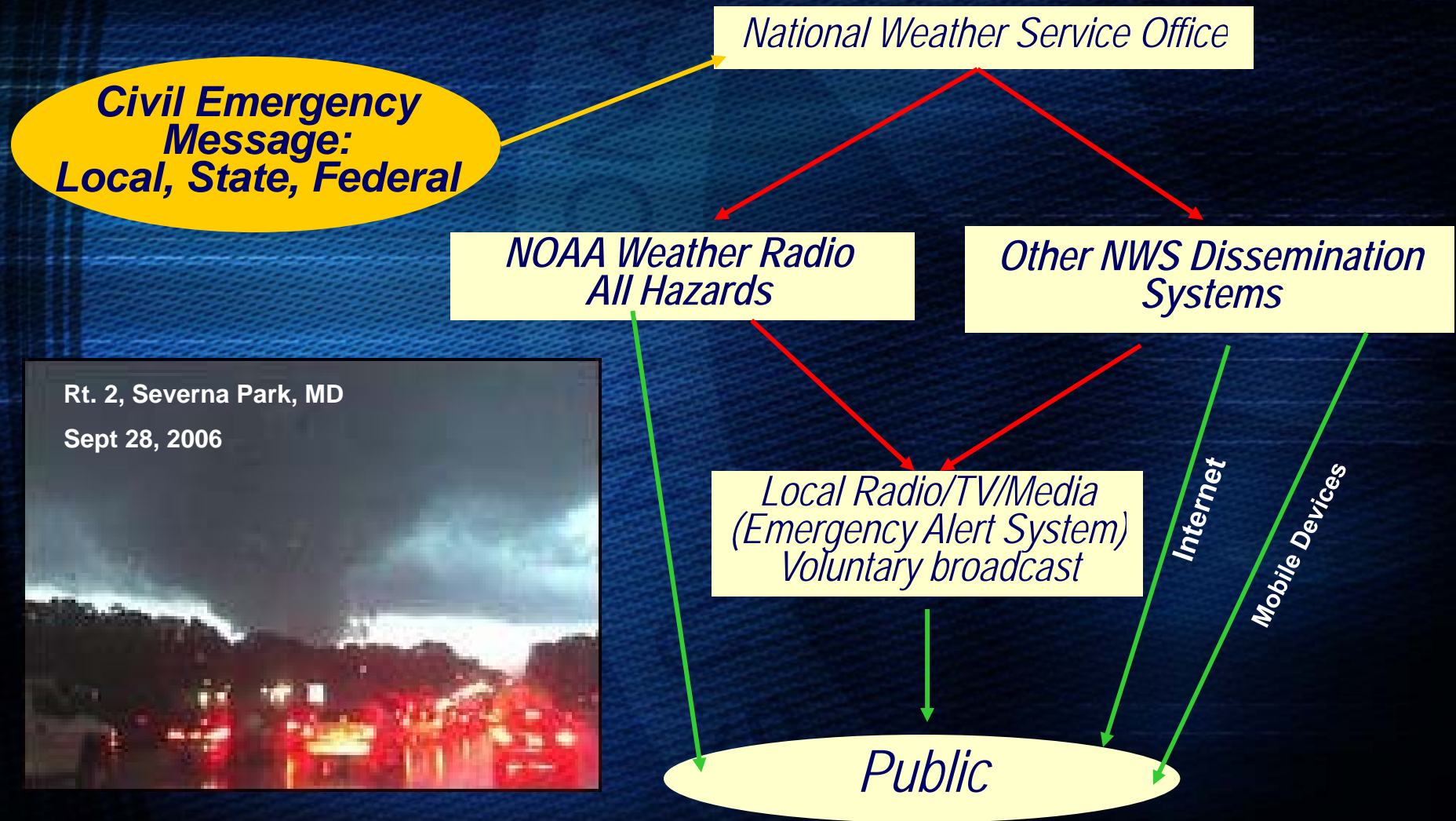
CITY OF FREDERICKSBURG IN CENTRAL VIRGINIA
SPOTSYLVANIA COUNTY IN CENTRAL VIRGINIA
CULPEPER COUNTY IN NORTHERN VIRGINIA
STAFFORD COUNTY IN NORTHERN VIRGINIA

* UNTIL 1115 PM EDT

* AT 1027 PM EDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A
DEVELOPING TORNADO 17 MILES SOUTHWEST OF STAFFORD...MOVING
NORTHEAST AT 22 MPH.



NOAA All Hazards Warning System





How Public Receives Warnings



- NOAA All Hazards Weather Radio
- NOAA Weather Wire Service (NWS) (satellite-based)
- Emergency Managers Weather Information Network (EMWIN) (satellite-based)
- Internet (<http://weather.gov>)
 - Common Alerting Protocol Format
- Emergency Alert System (broadcast media - TV & Radio)
- Sirens (for persons outdoors; not indoors!)
- Mobile Devices (cell phone, Blackberry, etc.)
- Satellite (e.g., XM radio)



National Oceanic and Atmospheric Administration
National Weather Service
WORKING TOGETHER TO SAVE LIVES

Site Map News Organization

Local forecast by "City, ST"

Warnings Current... Observations Radar Satellite Snow Cover Surface Weather... Forecasts Local Aviation Marine Hurricanes Severe Weather Fire Weather Climate... Forecast Models Numerical Models Weather Safety Weather Radio Hazard Assmt... Education Information Center Past Weather Glossary Publications... Careers Contact Us FAQ Comments...

Public Private Coordination Helps Provide Timely Warnings of Severe Weather
Years of cooperation and coordination among NOAA National Weather Service forecast offices, state and local public protection agencies, and the media paid dividends as waves of severe weather swept across parts of Kansas and Missouri this week. Officials at the Missouri State Emergency Management Agency said that a long-standing partnership of SEMA, the NOAA National Weather Service and Missouri Rural Electrical Cooperatives helped provide early warnings. Details...

Warnings and Forecasts National Maps Radar Rivers Satellite

Click on Map for Local Information
National Weather Service
Current Watches, Warnings, Statements, and Advisories

Flash Flood Warning
Severe Thunderstorm Warning
Flood Warning
Severe Weather Statement
Severe Thunderstorm Watch
Flood Watch
Flood Statement
Special Weather Statement
Hazardous Weather Outlook

Small Craft Advisory
Marine Weather Statement
Short Term Forecast
24 Hour Loop | 12 hour Loop



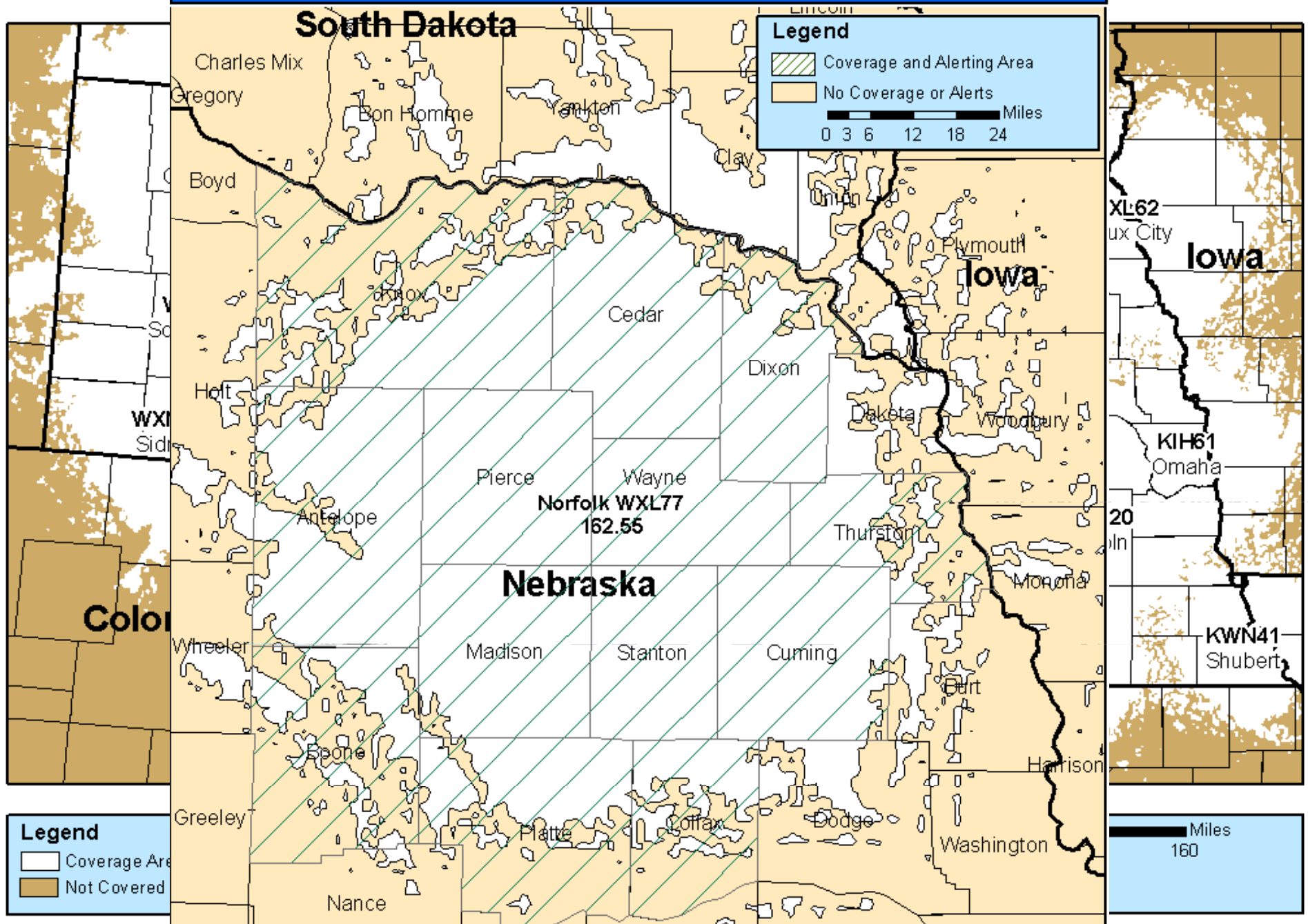
NOAA All Hazards Weather Radio



- Government-operated network provides direct warnings to the public
- 1,013 transmitters nationwide cover over **98%** of the population
- Entry point into **E**mergency **A**lert **S**ystem
- Alert operates 24 x 7
- Able to reach you when you most need it
- Low cost receiver units
- System tested weekly



NOAA Weather Radio - WXL77 162.550 MHz

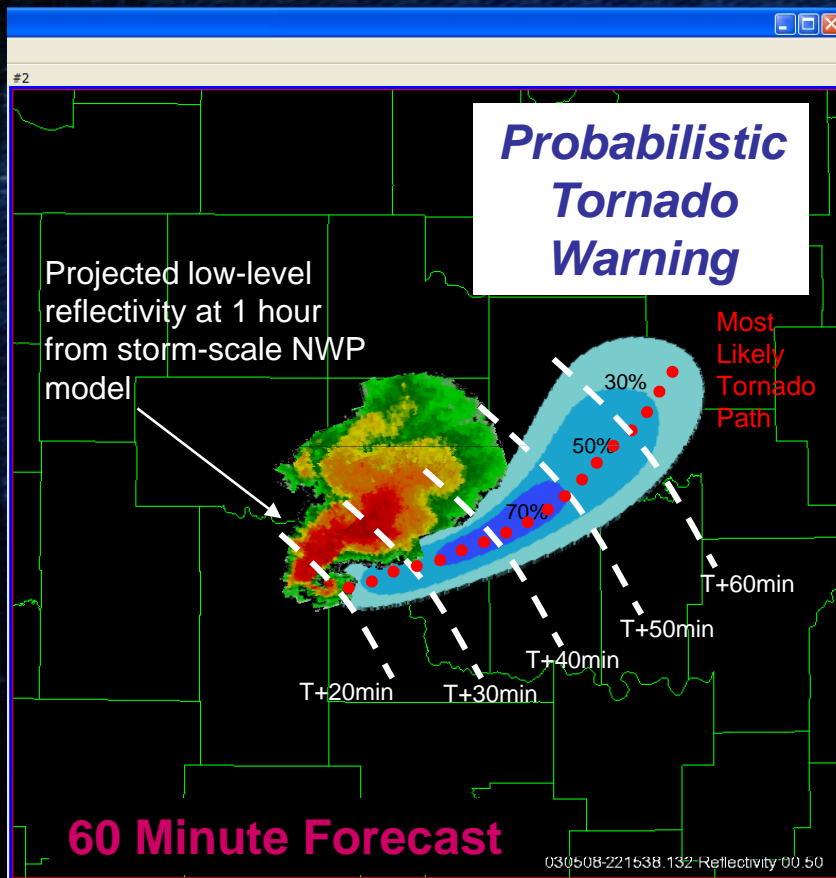




Where We're Headed



Storm-scale Model Forecast at 60 min



Severe Weather Services

- *Improved Science & Tech:*
 - Radar enhancements
 - Model enhancements
 - National mesonet
- *Improved Services:*
 - Longer lead times for tornadoes and severe thunderstorms
 - Decreased warned areas and false alarms



Where We're Headed



Communicating Forecast Confidence

- *Explicit information on the certainty of a forecast to aid in decision making*
 - Confidence levels and probabilities
 - Educate users on how to interpret information for decision making





Working Together to Achieve Success



- U.S. severe weather among world's worst
- U.S. needs the world's best Weather Service
- Partnerships with emergency managers essential



