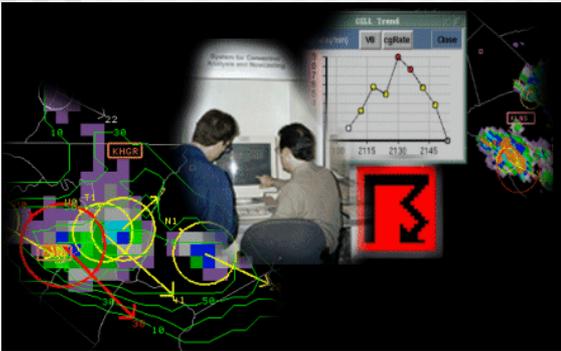


The Role of Effective Communications in the Warning Process



Richard Smith

NOAA/National Weather Service
Fort Worth, Texas



Consider the Following...

- YOU are the Principal at North Weatherville Elementary
- YOU are responsible for the safety of 300 students
- YOU depend on your NOAA Weather Radio for warning information

TORNADO WARNING!

CHASE COUNTY UNTIL 10 AM

AT 910 AM...RADAR INDICATED A POSSIBLE
TORNADO **10 MILES SOUTHWEST OF
WEATHERVILLE** MOVING NORTHEAST AT 30
MPH.

THE TORNADO WILL AFFECT

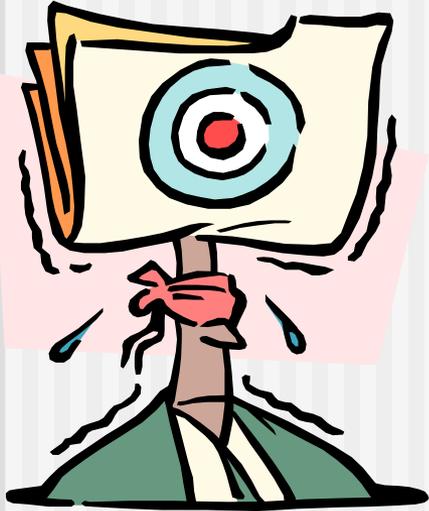
NORTH WEATHERVILLE AT 931 AM

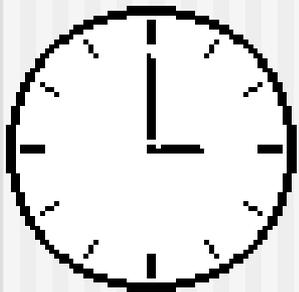
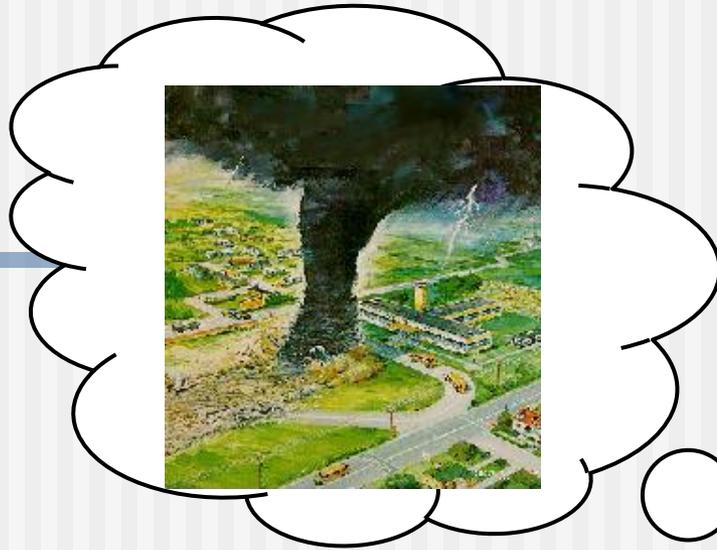
HAILSTONE CITY AT 940 AM

VORTEX VILLAGE AT 948 AM

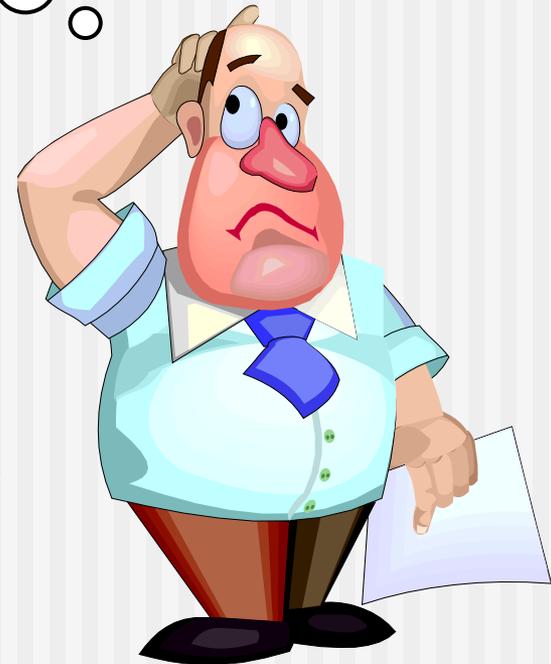


What do you do?





**“The warning said
the tornado would
be here by 931 am”**



NWR Update



SHORT TERM FORECAST

SCATTERED SHOWERS AND THUNDERSTORMS WILL CONTINUE ACROSS THE AREA FOR THE NEXT COUPLE OF HOURS. SOME OF THE STORMS MAY PRODUCE STRONG GUSTY WINDS...LARGE HAIL AND VERY HEAVY RAIN. AT 920 AM...THE STRONGEST STORMS EXTENDED FROM NEAR HOOTERVILLE TO NEAR WEATHERVILLE.

What now?

- It's 940 AM
- What would you like to know?

Wouldn't this be nice to know...

SEVERE WEATHER STATEMENT

AT 922 AM SPOTTERS REPORTED GOLFBALL SIZE HAIL ALONG HIGHWAY 1 ABOUT 3 MILES SOUTHWEST OF WEATHERVILLE.

RADAR CONTINUED TO SHOW STRONG SIGNS THAT A TORNADO WAS DEVELOPING WITH THIS STORM. THE MOST DANGEROUS PART OF THE STORM WILL TRACK SOUTH OF INTERSTATE 100. PEOPLE IN SOUTH WEATHERVILLE SHOULD TAKE COVER NOW! DESTRUCTIVE HAIL WILL AFFECT AREAS OF WEATHERVILLE NORTH OF THE INTERSTATE.

Wouldn't this be nice to know...

SEVERE WEATHER STATEMENT

AT **922 AM** SPOTTERS REPORTED GOLFBALL SIZE HAIL **ALONG HIGHWAY 1 ABOUT 3 MILES SOUTHWEST OF WEATHERVILLE.**

RADAR CONTINUED TO SHOW **STRONG SIGNS** THAT A TORNADO WAS DEVELOPING WITH THIS STORM. THE MOST DANGEROUS PART OF THE STORM **WILL TRACK EAST ACROSS CHASE COUNTY...GENERALLY SOUTH OF INTERSTATE 100.** PEOPLE IN SOUTH WEATHERVILLE SHOULD TAKE COVER NOW! **DESTRUCTIVE HAIL WILL AFFECT AREAS OF WEATHERVILLE NORTH OF THE INTERSTATE.**

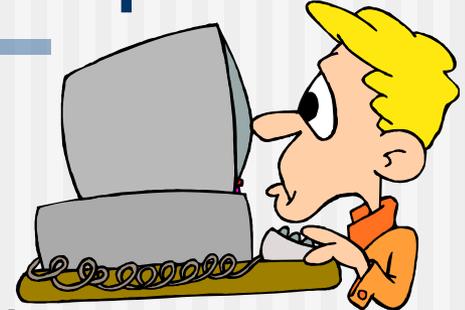
What is Effective?

- “Having an effect; producing a result”
- Effective warnings...
 - Are accurate and timely
 - Are composed to highlight the threat and expected impacts
 - Are aimed at those most at risk

Use Technology to Help...

■ AWIPS/WarnGen

- Issue warnings faster
- Be sure technology does not mean good quality information is lost
- It's still the forecaster's job to
 - Interpret radar/other information
 - Make the warning decision
 - Relay useful information via warnings and statements



Characteristics of Effective Warnings

- Specificity
 - Where, when, what
- Consistency
 - Internal/external
- Certainty
 - The tone of the message
- Clarity
 - Simple words with precise meaning
- Accuracy
 - Timely, accurate and complete info



Specificity

- Provide as much specific, detailed information as possible about
 - The risk
 - Where it is
 - What those in the path can expect

“AT 250PM CIVIL DEFENSE REPORTED MEDIUM SIZE HAIL.”

“AT 217 PM EDT...SPOTTERS REPORTED SEVERE WEATHER 5 MILES NORTH OF RAMHURST...MOVING SOUTH AT 20 MPH.”

Specificity

“AT 621 PM CDT...THE PUBLIC REPORTED A SEVERE THUNDERSTORM 3 MILES SOUTH...”

“AT 356 PM...RADAR AND SPOTTER REPORTS INDICATED A SEVERE THUNDERSTORM...”

Specificity

AT 625 PM...SPOTTERS REPORTED BASEBALL SIZE HAIL WITH A SEVERE THUNDERSTORM LOCATED 5 MILES SOUTH OF MANSFIELD

AT 1230 AM... DAMAGING WINDS ALONG THE LEADING EDGE OF A LINE OF SEVERE THUNDERSTORMS EXTENDED FROM NEAR...

PEOPLE TRAVELING EAST ON INTERSTATE 40 BETWEEN EXITS 270 AND 275 SHOULD EXIT AND FIND SUBSTANTIAL SHELTER ...IF POSSIBLE. GOLFBALL SIZE HAIL IS LIKELY WITH THIS STORM.

Consistency

- NWS can do things to promote consistency in warning messages
 - Product-to-product
 - Office-to-office
 - Complete information
 - Can reduce (mis)interpretation by external users

Consistency

...SEVERE THUNDERSTORM WARNING CONTINUES FOR TRAVIS AND WILLIAMSON COUNTIES UNTIL 1100 AM CDT...

AT 1046 AM CDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED SEVERE THUNDERSTORMS ALONG THE NORTHERN WILLIAMSON COUNTY LINE. THESE STORMS ARE DEVELOPING SOUTHWARD TOWARD GEORGETOWN. RADAR INDICATED THE STORMS ARE CURRENTLY BELOW SEVERE LIMITS HOWEVER GUSTY WINDS TO NEAR 50 MPH ARE POSSIBLE ACROSS TRAVIS COUNTY.

Consistency

AT 903 AM CDT...AMATEUR RADIO WEATHER SPOTTERS REPORTED A **BRIEF TORNADO TOUCHDOWN** 8 MILES NORTH OF ATKINSON.

THIS IS AN EXTREMELY DANGEROUS AND LIFE THREATENING SITUATION. IF YOU ARE IN THE PATH OF THIS **LARGE AND DESTRUCTIVE TORNADO**...TAKE COVER IMMEDIATELY.

Certainty

- Difficult to express in all situations
- Some clue as to the confidence level can be helpful for variety of customers



Clarity

- Warnings **MUST** be worded in simple language that can be understood
 - Tailored to your area
 - Be as specific as possible

Clarity

SPOTTERS REPORT AN INCIPIENT TORNADO

REPORTS HAVE BEEN RECEIVED THAT THE PARENT THUNDERSTORM PRODUCED TWO TORNADO FUNNELS

THIS STORM HAS HAD A HISTORY OF PRODUCING A BRIEF TORNADO TOUCHDOWN

A THUNDERSTORM NEAR THE TOWN OF OROVILLE REPORTED LARGE HAIL

NUMEROUS REPORTS OF TORNADOES WERE REPORTED

Clarity

RADAR CURRENTLY SHOWS STRONG WEST WINDS JUST TO THE SOUTHWEST OF MAYBERRY AND NOW EAST OF STORMYVILLE. THESE WINDS ARE ACCOMPANIED BY VERY HEAVY RAIN AND EXPECTED THUNDER AND LIGHTNING AND ARE CONTINUING TO MOVE TOWARD THE EAST AT ABOUT 15 KT. WINDS TO THE NORTH OF THIS AREA ARE FROM THE SOUTHEAST...THIS HAS CAUSED THE RADAR TO ISSUE A MESOCYCLONE ALERT TO THE WEST OF VORT CITY.

Accuracy

- Timely, accurate and complete information
- Simple typos, spelling, incorrect locations

HAIL UP TO 10 INCHES IN DIAMETER HAS BEEN REPORTED WITH THIS STORM

THIS IS A VIOLENT THUNDERSTORM PRODUCING HUGH HAIL!

- Header errors
 - SVR under SVS header, for example

The Warning Response Process

- Hearing
- Understanding
- Believing
- Personalizing
- Confirming
- Deciding and responding

The Warning Response Process

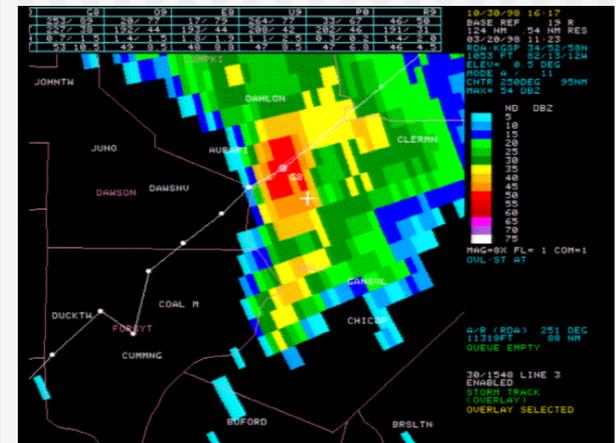
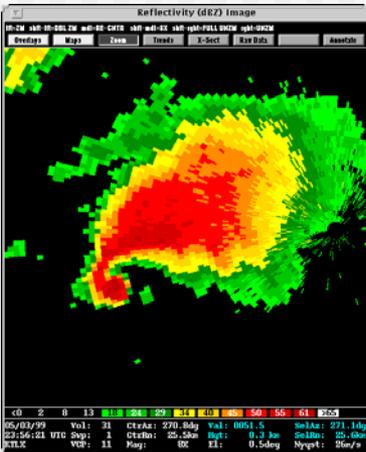
- Hearing
- **Understanding**
- **Believing**
- **Personalizing**
- **Confirming**
- **Deciding and responding**

Warnings – piece by piece

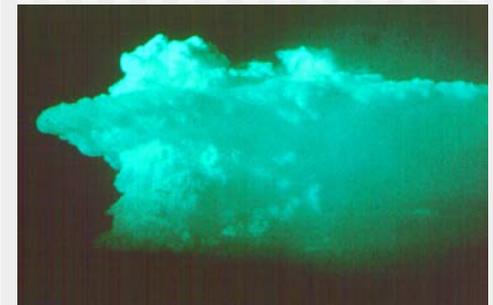


Warning Basis Statements

- DOPPLER RADAR INDICATED A POSSIBLE TORNADO



- DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM



Situation Specific Warnings

- Warning decisions are typically not black and white
- Word choices give sense of **forecaster confidence** (probability??)
 - Media and other partners know what the phrases mean
 - Verification is important
- Some examples....

Situation Specific Warnings

Tornado Warning Examples

RADAR DETECTED A SEVERE THUNDERSTORM WITH STRONG ROTATION. THIS DANGEROUS STORM COULD PRODUCE A TORNADO AT ANY TIME

RADAR INDICATED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING A TORNADO. THE MOST DANGEROUS PORTION OF THIS STORM WAS LOCATED...

DOPPLER RADAR SHOWED A RAPIDLY ROTATING THUNDERSTORM CAPABLE OF PRODUCING A TORNADO

SPOTTERS REPORTED AND RADAR CONFIRMED A TORNADO

Highlight the Threat...



■ Damaging Winds

- RADAR INDICATED DANGEROUS THUNDERSTORMS CAPABLE OF PRODUCING WINDS IN EXCESS OF 80 MPH...
- RADAR INDICATED SEVERE THUNDERSTORMS WITH HURRICANE FORCE WINDS

■ Large Hail

- RADAR INDICATED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING HAIL UP TO GOLFBALL SIZE
- SPOTTERS 5 MILES WEST OF MAYBERRY REPORTED QUARTER SIZE HAIL

Location, location, location

- Where is the storm?
- Where is it headed?

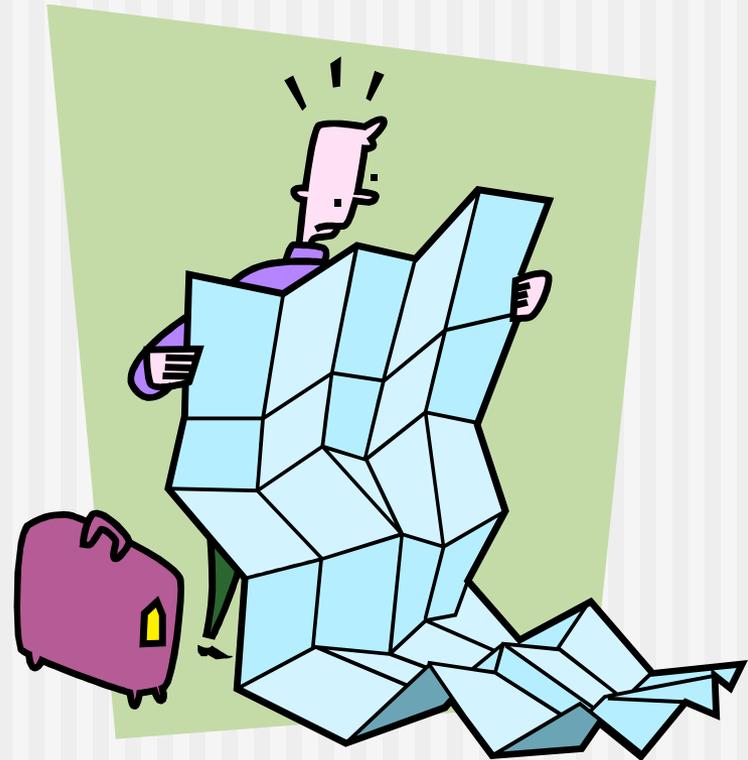


- Do people understand the storm positions and forecasts we provide??



Location, location, location

- Use well-known locations
 - Larger cities, county seats
 - Interstate/other major highways
 - Mile markers/exits
 - Landmarks
 - Lakes, parks, etc



Location, location, location

- What can we do to help travelers and others who are geographically challenged?



WarnGen's locations

THE SEVERE THUNDERSTORM WILL BE...

2 MILES SOUTH OF ROCKVILLE AT 904 PM

2 MILES SOUTH OF ASPEN HILL AT 912 PM

OVER FAIRLAND...3 MILES NORTH OF CALVERTON AT 922 PM

AT 301 PM CST...DOPPLER WEATHER RADAR INDICATED A SEVERE THUNDERSTORM 162 MILES NORTH OF SALEM OR 155 MILES NORTH OF MOKO... MOVING NORTHEAST AT 40 MPH.

AT 301 PM...RADAR INDICATED A SEVERE THUNDERSTORM OVER SOMERSET...OR ABOUT 3 MILES NORTHEAST OF SOMERSET...

THIS STORM IS EXPECTED TO REMAIN MOSTLY IN RURAL AREAS.

Call to Action Statements

- Designed to give last minute advice to those in the storm's path
- OLD STYLE
 - Give all possible impacts and lots of generic safety rules
 - Only a few statements used for each warning type

Call to Action Statements

■ NEW STYLE

- Focus on impacts expected with THIS storm
- Focus on quick, targeted safety information for those in immediate danger
 - General statements about complicated subject
 - Cannot spell out every possible safety rule
 - Focus on the MAIN threat

Call to Action Statements

THIS TORNADO IS WRAPPED IN RAIN – IF YOU WAIT UNTIL YOU SEE OR HEAR IT COMING IT MAY BE TOO LATE TO GET TO A SAFE PLACE. TAKE COVER NOW!

THIS STORM SHOWS STRONG ROTATION AND MAY PRODUCE A TORNADO AT ANY TIME. DO NOT WAIT...GO TO A SAFE PLACE NOW! PUT AS MANY WALLS BETWEEN YOU AND THE OUTSIDE AS POSSIBLE.

GET TO A SAFE PLACE NOW! STAY AWAY FROM WINDOWS AND OUTSIDE WALLS. PUT AS MANY WALLS BETWEEN YOU AND THE OUTSIDE AS POSSIBLE.

Call to Action Statements

DESTRUCTIVE WINDS CAN BE EXPECTED. IF YOU CANNOT GET UNDERGROUND... GO TO AN INTERIOR ROOM ON THE LOWEST FLOOR OF A STURDY BUILDING. AVOID WINDOWS!

DAMAGING WINDS MAY OCCUR UP TO ! **! MILES AHEAD OF THE RAIN. GO TO A SAFE PLACE UNTIL THE STORMS HAVE PASSED.**

A TORNADO WATCH IS ALSO IN EFFECT. TORNADOES CAN DEVELOP SUDDENLY FROM SEVERE THUNDERSTORMS.

Mixed Messages in Call to Action Statements

TORNADO WARNING

HAIL UP TO ONE AND A HALF INCHES IN DIAMETER HAS BEEN REPORTED WITH THIS STORM. IF YOU ARE IN THE PATH OF THIS STORM...**PUT YOUR CAR IN A GARAGE** AND MOVE TO A SUBSTANTIAL SHELTER.

IF YOU ARE CAUGHT OUTSIDE...SEEK SHELTER FROM THE WEATHER IN A STRONG BUILDING. **STAY INSIDE AWAY FROM WINDOWS** UNTIL THE STORM HAS PASSED

“This is a Dangerous Storm”

- These CTA's are over-used
 - THIS IS A DANGEROUS STORM...
 - THIS IS AN EXTREMELY DANGEROUS AND LIFE THREATENING SITUATION
- Strongly worded advice should be reserved for situations that deserve special attention

“Tornado Emergency!”

- Very effective in May 3 1999 tornado in OKC metro area
- Used a couple of times since



...THIS IS A TORNADO EMERGENCY FOR FORT WORTH...

AT 625 PM SPOTTERS AND RADAR CONTINUE TO DETECT A TORNADO AT INTERSTATE 35 AND RIVERSIDE. THE TORNADO CONTINUES TO MOVE SOUTHEAST AT 25 MILES PER HOUR. DAMAGE HAS OCCURRED IN DOWNTOWN FORT WORTH AS THIS TORNADO MOVED ACROSS THE AREA.

“Tornado Emergency!”

- Used again in June, 2000
- Perryton, TX



THE NATIONAL WEATHER SERVICE IN AMARILLO HAS ISSUED A

TORNADO WARNING FOR...
OCHILTREE COUNTY IN THE TEXAS PANHANDLE

UNTIL 530 PM CDT

AT 454 PM CDT...A TORNADO WAS REPORTED 1 MILE WEST OF PERRYTON.

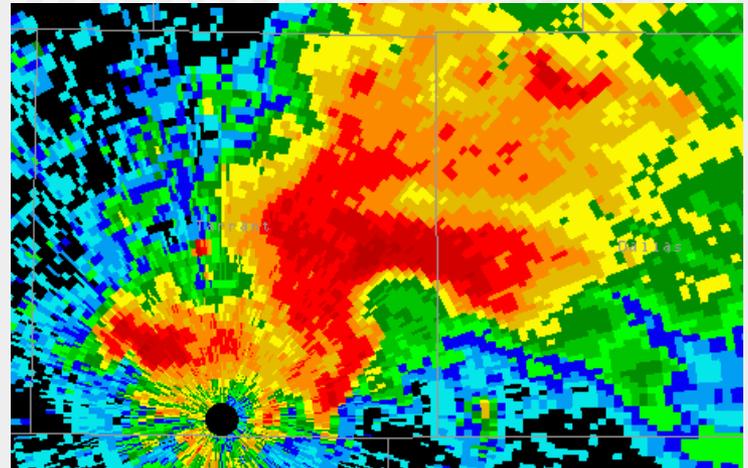
THIS IS A TORNADO EMERGENCY! TAKE COVER NOW!

A DETAILED STATEMENT WILL BE ISSUED SHORTLY.

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Pathcasts

- WarnGen makes it easy
 - BUT!!
 - Are we that good???
 - Are we exceeding our abilities???



Pathcasting Cautions

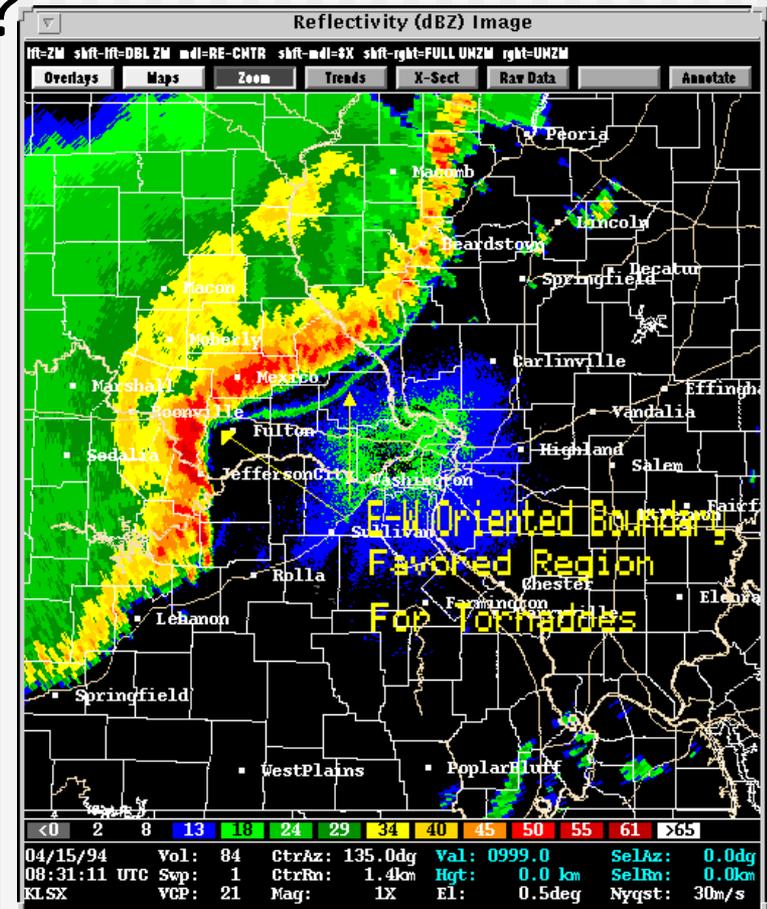
- Too much detail?
 - * **THE TORNADO WILL BE NEAR
HUTCHENS ELEMENTARY SCHOOL BY 715 AM
MAGNOLIA GROVE GOLF COURSE BY 725 AM
LOTT AND COLEMAN DAIRY ROADS BY 730 AM**

 - * **SEVERE THUNDERSTORM WILL BE NEAR
GREEN HILLS MALL AT 1220 PM
VILLAGE MALL AT 1220 PM
ONE HUNDRED OAKS MALL AT 1225 PM
HARDING MALL AT 1225 PM
HICKORY HOLLOW MALL AT 1225 PM**

Pathcasting Cautions

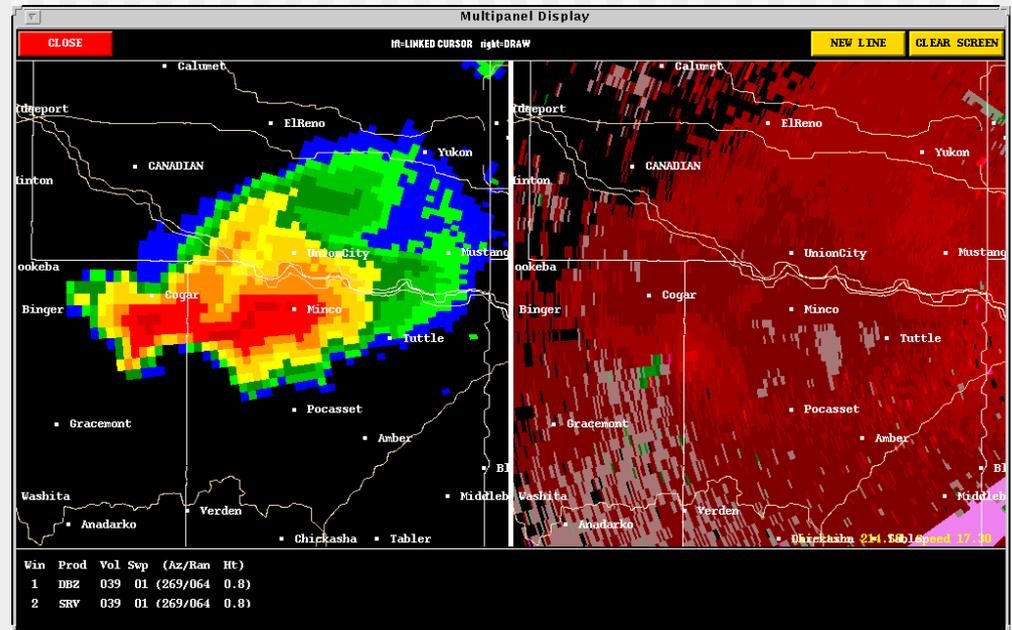
■ WHAT are you tracking?

- Gust front
- Leading edge of precipitation
- High reflectivity gradient
- High reflectivity cores



Pathcasting Cautions

- WHAT are you tracking?
 - Tornado location
 - Mesocyclone
 - Leading edge of precipitation
 - Large hail core
 - Gust front



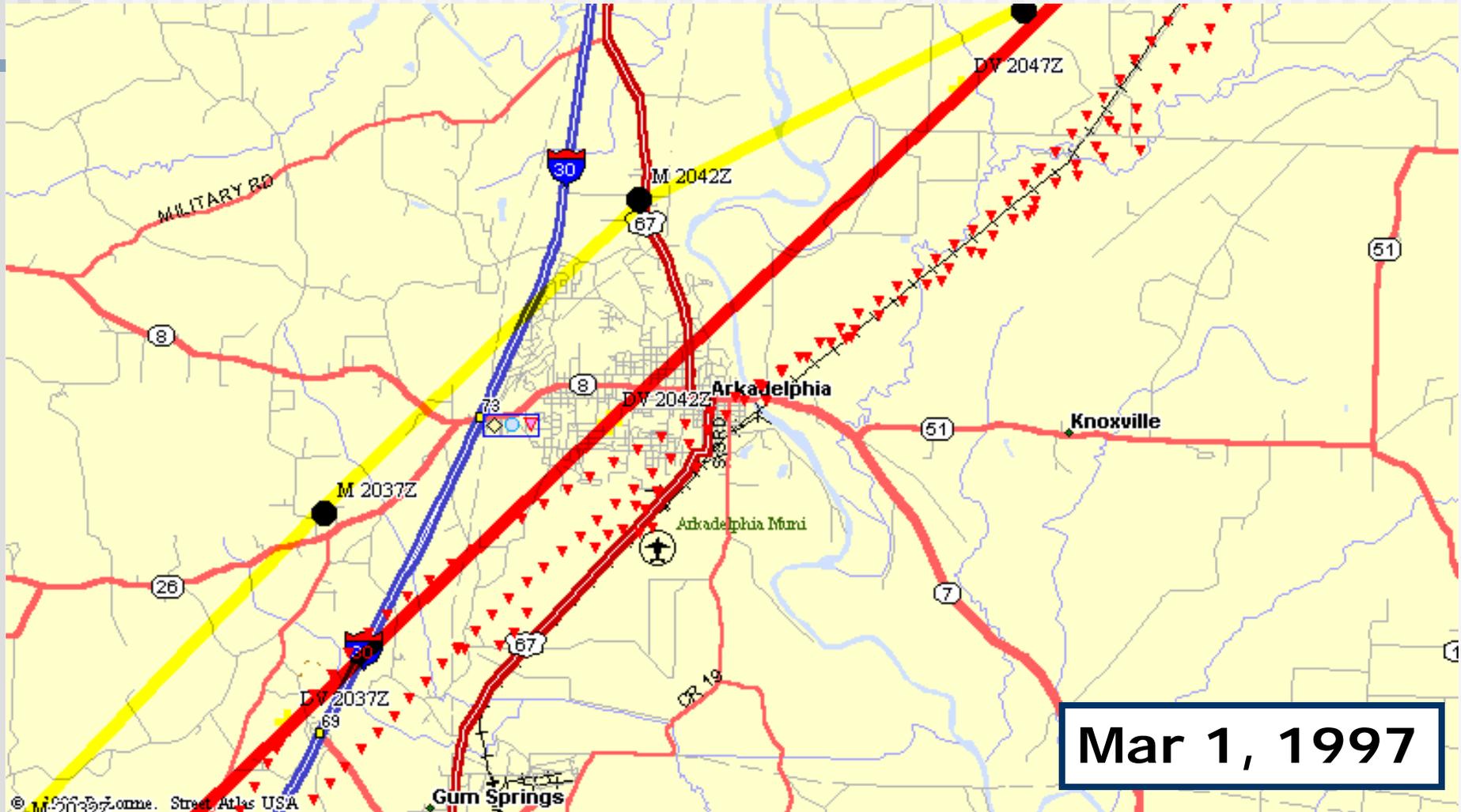
Pathcasting Cautions

- Technological Limitations
 - Radar resolution and range
 - Background map inaccuracies
 - Large and/or irregularly shaped cities
 - Radar algorithm time differential

Pathcasting Cautions

- Meteorological Concerns
 - Erratic storm motion – speed/direction
 - Storm interactions – splits, mergers
 - Mesocyclone uncertainties
 - Multiple threats from a single storm
 - Tracking tornado arrival time may expose people in path to large hail, damaging winds, flooding rains

The Dangers of False Precision



Making Pathcasts more effective (realistic)

- Only forecast short distance ahead in initial warning with frequent updates
- Use range of arrival times based on storm type/threat/motion
- Simply mention towns in path for the valid period of the warning – more precise updates via the SVS

Severe Weather Statements

- Warning Update
 - New position
 - Spotter reports
 - Threat update
 - Warning plans
 - Highlight the **most important** information!



Severe Weather Statements

AT 748 PM CDT...HAM RADIO SPOTTERS REPORTED THE TORNADO HAS LIFTED ONE MILE SOUTHEAST OF PANHANDLE. NEVERTHELESS...THIS SEVERE STORM IS STILL CAPABLE OF PRODUCING A TORNADO. PEOPLE IN CENTRAL AND EASTERN CARSON COUNTY SHOULD TAKE COVER IMMEDIATELY.

THE SEVERE THUNDERSTORM HAS WEAKENED BUT IS STILL CAPABLE OF PRODUCING QUARTER SIZED HAIL.

IF ROTATION CONTINUES TO INCREASE A TORNADO WARNING MAY BE ISSUED FOR CHILDRESS COUNTY.

THE MOST DANGEROUS PART OF THE STORM WILL CONTINUE TO TRACK ALONG AND JUST SOUTH OF HIGHWAY 6 AND WILL BRING GOLFBALL SIZE HAIL TO LAKE WAWASEE.

The NOW as a bridge...

WATCH



WARNING

"I thought there was only a 30% chance of rain today – why a watch??"

"It's sunny here – why is there a watch?"

"When will the storms begin?"

The Need for Customer Input...

- "...occasional surveys should be carried out by behavioral science groups and aimed at evaluating the effects of forecasts and warnings on individual user reactions."
- FROM THE PALM SUNDAY, 1965 DISASTER SURVEY REPORT

Conclusions

- The gap between **what we know** and **what we are telling** people is growing
- Effectively communicating severe weather information is **vital** to the NWS's success
- **MUCH more input** is needed from customers and partners on what THEY consider to be an effective warning
- Put yourself in the customer's shoes

References

- **Writing Statements and Warnings**
Tom Magnuson, NWSTC, May, 1994
- **Clear and Effective Communications**
Carter Estes, NWSTC, Sep 1995
- **WSOM C-40 Severe Local Storm Operations**

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Denis S. Mileti, Nov 1996

- **Communication of Emergency Public Warnings: A Social Science Perspective and State of the Art Assessment**

Mileti and Sorensen, Aug 1990

<http://emc.ornl.gov/EMC/PDF/CommunicationFinal.pdf>

Comments?

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