Slide 1

What Strategies Do Emergency Managers Use to Meet Their Severe Weather Information Needs?

Daphne S. LaDue, Ph.D.
OU Center for Analysis and Prediction of Storms

Slide 2

Help Me See Better

Slide 3

Many Collaborators on These Projects

Slide 4

Probabilistic Hazard Information Project: Rethinking Paradigms

Moving from deterministic warnings to PHI is a huge paradigm shift

PHI objects march along for ~60 min, updating every ~2 min to act out whatever a forecaster set in motion

How would this new paradigm impact key NWS partners?

Slide 5

Hazardous Weather Testbed Design:
Simulated Integrated Warning Team

Forecasters in HWT working w/PHI

9 forecasters

2015: EMs only
2016: full IWT

Communication via NWSChat & PHI

EMs in another room, using EDD to see PHI output

11 EMs (7 city or county EMs + 1 each: state health, state EOC, national guard, school-university)

TV broadcaster in a third room, using EDD to see PHI output, and streaming his "TV station" to the other rooms

3 broadcasters (east coast, upper midwest, and southeast)

Data
next slide

Slide 6

Hazardous Weather Testbed Design:
Simulated Integrated Warning Team

Data

Data collected:
- Researcher Observations
- EM Action logs
- NWS Chat logs
- Debriefing discussions
- Survey tools

Tested PHI Concept

Warning information for starred location

PHI object

PHI plume

Legacy warning
& PHI plume + warning

PHI Can Provide Pathcast-type Information

How much lead time do you need? For what?

- We included a way to create a social media graphic
- EMs and TV broadcasters used this heavily

- PHI encourages (and allows) frequent updates
  - human factors research is ongoing regarding feasibility of frequent updates

Severe Likelihood

PHI Object & Plume with Popup Box

What NWS products are most difficult to deal with?

Which storms are most important within a line of cells?

Here

Probably not here

What areas within the warning are the most at risk? (Where should I focus my efforts to assess for damage?)

Tested New Formats for Warnings

Current Format for an Advisory

WFODC
HAZARDOUS WEATHER TESTBED NORMAN OKLAHOMA
144 PM CDT THU MAY 26 2016

...SIGNIFICANT WEATHER ADVISORY FOR YOUR COUNTY CONTINUES UNTIL 224 PM CDT...

AT 144 PM CDT...A STRONG THUNDERSTORM WAS LOCATED 9 MILES WEST OF HAVILAND, KS...MOVING NORTH AT 43 MPH.

HAZARD...SMALL HAIL AND/OR STRONG WINDS

IMPACT...PEOPLE OUTDOORS SHOULD SEEK SHELTER IMMEDIATELY. EXPECT MINOR DAMAGE TO TREE LIMBS AND BLOWING AROUND OF LIGHT, UNSECURED OBJECTS. ELECTRICAL APPLIANCES SHOULD NOT BE USED UNLESS IN AN EMERGENCY.

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Proposed Format

BULLETIN - EAS ACTIVATION REQUESTED
Damaging Hail/Wind Likely: Get Prepared
Audience: Public
Source: Hazardous Weather Testbed
Issued: 6/24/2015, 2:39 PM

Alert Level: Get Prepared
What: Severe Hail and Winds
Where: 3 miles northeast of White Plains, GA
When: Between 2:16 PM and 2:36 PM (0 to 0 min. from now)

Forecast Severity: Hail up to 1 inches in diameter and winds up to 60 mph
Forecast Likelihood: High (see hazard graph for more details)
Forecast Confidence: Medium-High
Source: Radar Indicated

Discussion: Strong winds remain the biggest threat for southeastern Greene and northwestern Hancock Counties.

*We added likelihood

Co-Created a Discussion Box

How do you lower your uncertainty?

By the end of each week, discussions contained information such as:
- location,
- trend information, and
- forecaster thoughts about the storm.

Discussion: Update:Radar indicating powerful storm capable of producing 1.5 to 2.5 inches and winds of 50 to 60 mph. Update: Storm is holding on with large hail of 1 to 2 inches in diameter and winds of 50 60 mph. Next town to be impacted will be Watkins within the next 20 to 30 minutes. Update: The

Discussion: This storm continue to indicate tornado potential. Radar history indicates potential for weak to strong tornado...but will continue to monitor. Moving and...making a close approach to Moore in the next 10 minutes.

Discussion: Half dollar size hail reported. Storm still strong and likely to produce 1.5 to 2 inch hail.

The Discussion Box

How do you lower your uncertainty?

The discussion box "brought it all together"

Discussion: Half dollar size hail reported. Storm still strong and likely to continue to produce 1.5 to 2 inch hail.

- PHI: Its use iterated each week (2015, 2016) toward:
  - forecaster's thinking, including gut feelings
  - whether storms strengthening, weakening, or holding steady
  - storm reports (connected directly to the storm warning/advisory object)
  - time stamps so that updates are clearly indicated
- About small differences between forecasters:
  - EMs don't fear inconsistencies; they embrace them
  - Adapting to individuals is an important aspect of competence in their job

Discussion box: critically important

Used and developed — by participants — EVERY week of the 2015 and 2016 PHI projects

The human adds critically important information.

"Every tornado starts as a rainstorm. Every single one. And knowing which one the forecaster thinks is most likely to produce a tornado...[is] extremely valuable information."

When missing, EMs *"didn't like it at all. I was missing the expertise."*

The discussion resolved situations where multiple objects affected an area; clarified what was

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Tornado Recovery and Action Council of Alabama Report

The southeast US has seen higher growth in mobile home stock than other parts of the US

STORM SHELTERS & SAFE ROOMS

RECOMMENDATION: Increase the number of storm shelters available to the public, and publicize their locations so people know where to go when severe weather approaches.

There aren't enough storm shelters, and people often don't know about them. This became clear during the April 27 tornadoes. Later, people in affected areas consistently said they would have sought safe haven away from homes that lacked below-ground basements or reinforced safe rooms — two of the best options for sheltering in place — but didn't know where to go.

Shelters in Alabama Post 4/27/2011

What NWS products are most difficult to deal with?

Most northern Alabama counties have 13–15 shelters, within ~30 min drive from most areas in county

Feb 2, 2016, Alabama
About 150 people packed the shelter (96 ppl capacity)

http://www.al.com/news/index.ssf/2016/02/community_tornado_shelter_abso.html

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During a VORTEX-SE Event
March 31, 2016

How much lead time do you need? For what?

Morning, in central AL EOC:
- **11am** Morning weather briefing from NWS attended by: Fire Dept., Schools, Mayor
- Decisions made for that county:
  - No change to buses; they finish normal routes by 5p
  - Close daycares and schools at 5p
  - Cancel all evening school activities, many of which are outdoors

Afternoon, in northwestern AL EOC:
- **3:20p** Neighboring county EM called; they talked 1-2 times/hr until weather cleared
- **3:29p** Preschool asked EM if they should close early
- **3:30p** Watched TV station weather update
- **4:18p** Cell near Smithville MS in same track as 2011 Hackleburg tornado

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During a VORTEX-SE Event

What NWS products are most difficult to deal with?

- **5:07p** EM used ThreatNet to draw out long storm projections
- **5:57p** Tornado Watch issued
  - EMs anxious to see counties
- **6:13p** NWSChat activity picks up
- **6:13p** First areas of storm rotation noted by NWS are not affecting this county
- **7–8p** Storm with broad, anticyclonic circulation moves through county
- **7:41p** Storms still to west; EM watching radar and monitoring everything
- **8:13p** EOC falls quiet, mood lowers; weather threats mostly gone

How do expectations interact with EM readiness?

Storms appear to be affected by the Tennessee River

Storms often appear to turn and follow the river, or become tornadic after crossing

EMs (and many others) have come to believe the "river" may aid tornado formation

Wilson Lake:
- Maximum Depth: 90 feet

Wheeler Lake:
- Maximum Depth: 57 feet

1.43 miles

1.60 miles

Source: http://www.wheelerlake.info/

Follow Along:

goo.gl/S2Pm8m

Findings: Key Information Sought

EMs:
- **timing to a location** (speed, direction)
- **maximum severity** expected
- *Also:*
  - whether storm was weakening, strengthening, or holding steady
  - warning level used to sound sirens
  - actions taken on sub-severe storms or before warnings were issued, depending on situation

TV broadcasters:
- **what/where/when**
- *Also:*
  - probability of severe, own radar assessment, reports
  - NWS forecaster confidence important
    - broadcasters are building trust with viewership, want to know quality of information they are passing along
  - severity
    - decision to use crawl vs. cut-in
    - they pass this along

What lead time do you need to prepare for weather events?

dzaras@ou.edu

Do different actions require different lead times? What are those actions?

Examples:

_____ min/hrs to deploy storm spotters

_____ hours to open EOC and move FD equipment

_____ min to alert community, open storm shelters

goo.gl/S2Pm8m

What kinds of weather are most difficult to prepare for?

dzaras@ou.edu

Examples:

Quick spin-up tornadoes

Microburst winds

Winter weather

goo.gl/S2Pm8m

What do you do to lower your uncertainty about upcoming high-impact weather?

dzaras@ou.edu

Examples:

Ask questions

Look at weather data

Watch Weather Channel or Local TV or...?

goo.gl/S2Pm8m