

# Impact of Warnings on Severe Weather Preparedness:

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## Introduction

- Severe weather warnings are critical items issued by the National Weather Service as an alert method for hazardous conditions/situations.
- Effective warnings can help to improve public preparedness.
- Public interpretation of how warnings are communicated and trust of the forecast plays a big role in the effectiveness of warnings.
- Someone's experiences with severe weather impacts how they respond to future weather warnings/alerts.

## Questions Posed:

### Science Questions:

- Are parameters set for severe storm classifications well understood by the public?
- Have improved technologies, such as Numerical Weather Prediction models, made any impact on increasing warning lead times?

### Impacts Questions:

- How does the use of impact-based warnings versus strictly hazard-based criteria affect public response?
- How does past experiences with severe weather impact response to weather alerts/warnings?

## Impacts Results:

- **Past Experiences – Beneficial vs. Harmful:**
  - Constant exposure to outcomes contribute to a better familiarity with the hazards; people may feel that they are more competent, take more risks, and are hesitant to respond to warnings.
  - Experiences with false alarm/near-miss (Fig. 3) weather evacuations appear to not affect perception of risk; many stated that they would make few changes to their future evacuation plans.
- **Boosted Public Understanding:**
  - Impact based warnings help describe what the physical hazard is and how it will impact you, the people.
  - Providing context about impacts themselves can increase likelihood of people taking better protective measures.
- **Mixed Results:**
  - Little change compared to traditional hazards-based warnings. Effectiveness is likely based on how message of warning is communicated. (Fig. 4)

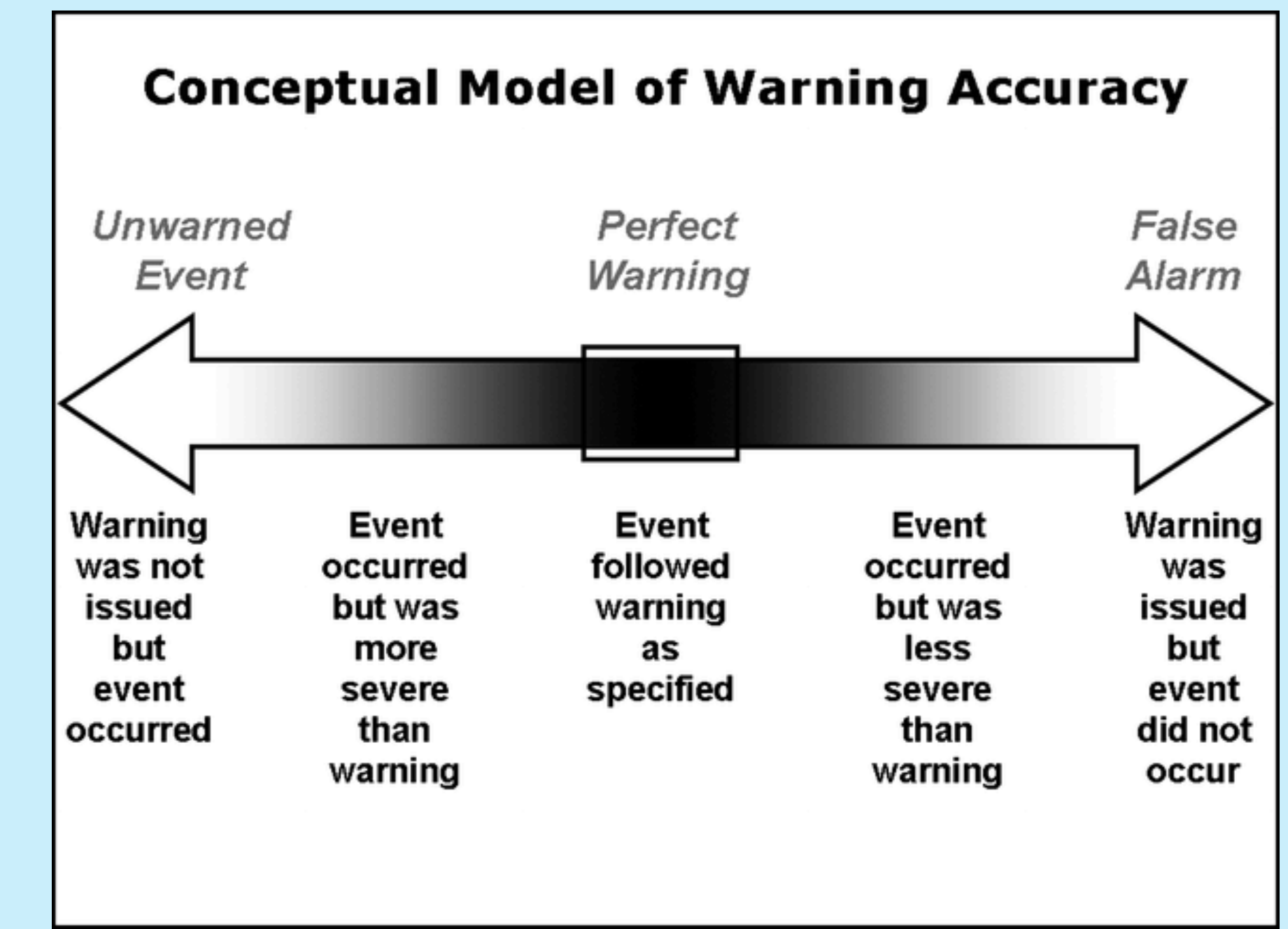


Figure 3: Conceptual Model of Warning Accuracy

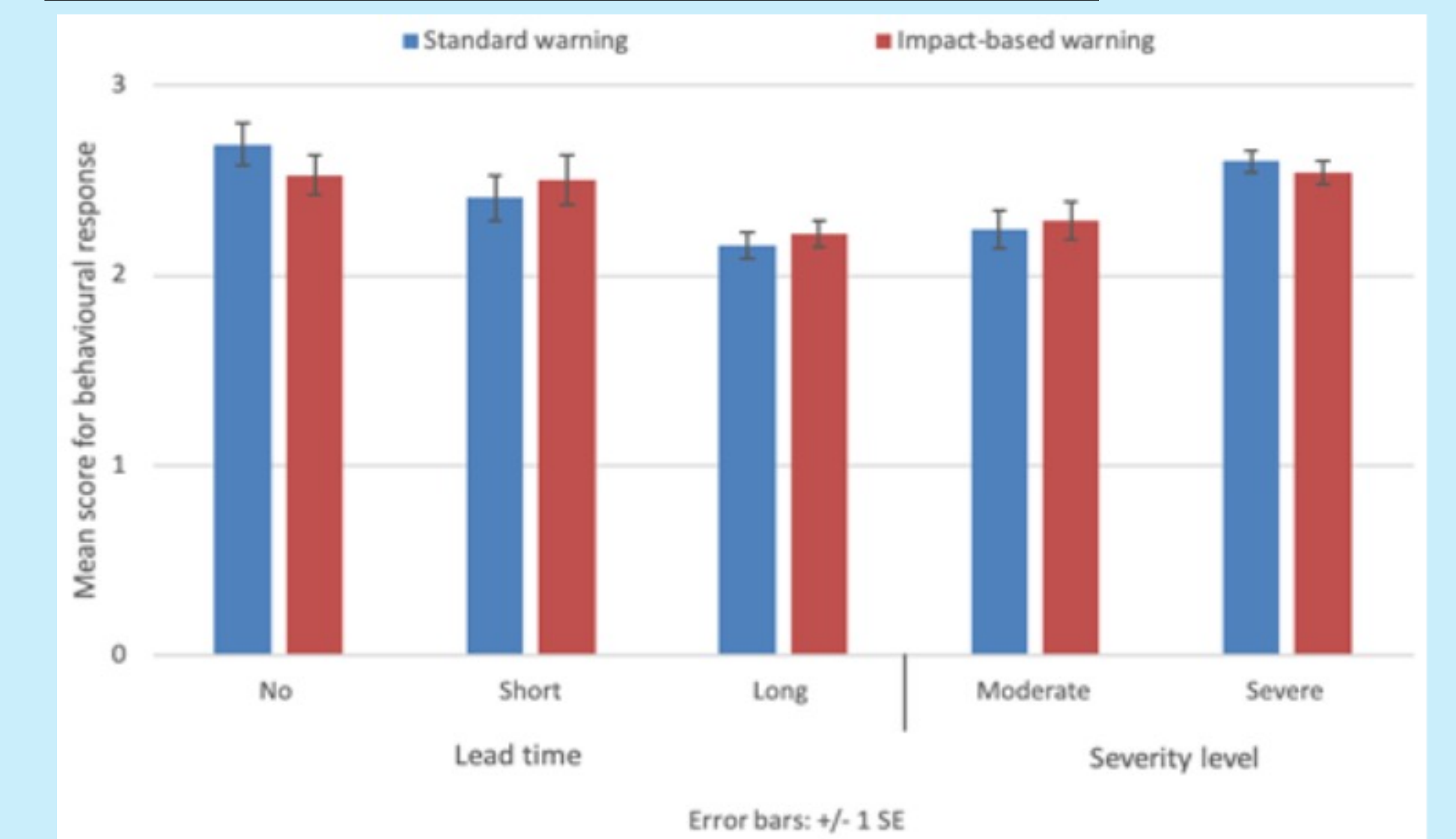


Figure 4: Comparison of Standard Warning vs. Impact Based Warning with difference in lead time

## Science Results:

- **Great Confusion on Meaning of Warning:**
  - Study from The University of Nebraska-Lincoln shows 50% of people surveyed in Mid-South could not accurately describe what a Tornado Warning entailed.
  - Uncertainty is high between Watch vs. Warning.
- **National Weather Service Posts for Understanding Categories: (Fig. 1)**
- **Increased Lead Times With "New" Forecasting Methods:**
  - Warn On Forecast used NWP models to predict storms earlier and allow for increased lead time.
- **Watch to Warning Gap:**
  - Typically a 15 minute lead time – relying on current radar and observations.
  - With Warn On Forecast NWP results – over 1 hour lead time, increasing time for preparedness decision making. (Fig. 2)

LEVEL	CATEGORY	DETAILS	SUMMARY	How many severe storms are possible?	How bad could the worst storms be?	DEFINITIONS
	General Thunderstorm	Although severe weather is not expected, all thunderstorms can produce deadly lightning, gusty winds, and small hail.	No severe thunderstorms expected	None	Numerous	<b>Severe Storm</b> Any storm that contains at least one of the following: Wind gusts of at least 58 mph Hail at least one inch in diameter Tornado
1	Marginal (MRGL)	Some storms could be capable of damaging winds and severe hail. Localized tornado threat could develop.	Isolated severe storms possible	None	Numerous	
2	Slight (SLGT)	Increased confidence that some storms will contain damaging winds, severe hail, and/or tornado potential. <i>A few severe storms could be significant</i>	Isolated to scattered severe storms expected	None	Numerous	
3	Enhanced (ENH)	High confidence that several storms will contain damaging winds, severe hail, and/or tornadoes. <i>Several severe storms could be significant</i>	Scattered to numerous severe storms expected	None	Numerous	<b>Significant Severe</b> Any of the following hazards: Wind gusts of at least 75 mph Hail at least two inches in diameter Tornado of at least EF-2 rating
4	Moderate (MDT)	High confidence that many storms will contain damaging winds, severe hail, and/or tornadoes. <i>Several severe storms likely to be significant</i>	Scattered to numerous severe storms expected	None	Numerous	
5	High (HIGH)	High confidence that an outbreak of storms will contain tornadoes, damaging winds, and/or severe hail. <i>Tornado outbreak and/or widespread damaging winds</i>	Numerous severe storms expected	None	Numerous	

Figure 1: Understanding Severe Thunderstorm Outlook Categories, NWS

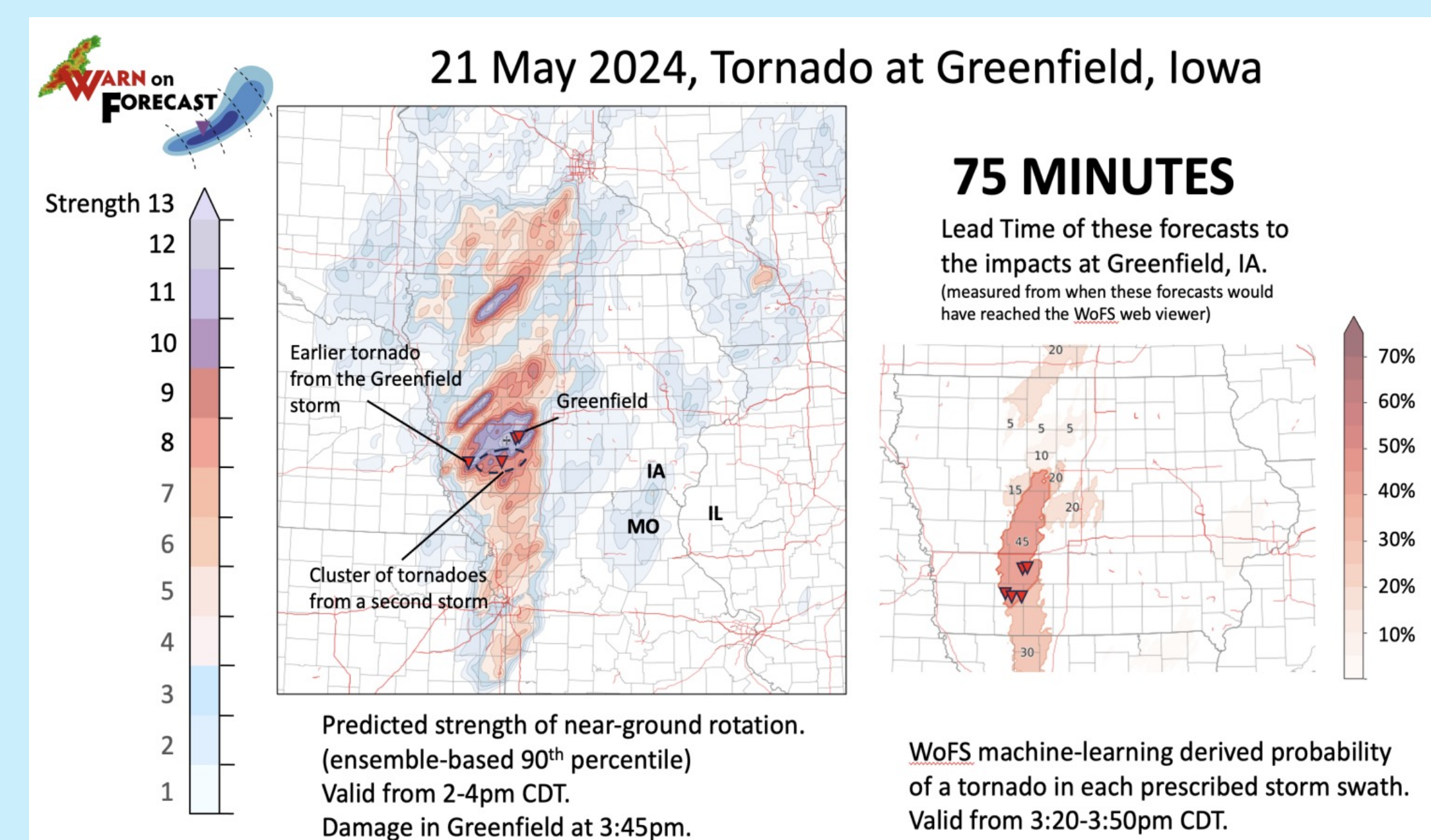


Figure 2: Warn On Forecast Lead Time Project NSSL Simulation Results

## Conclusions

- Confusion found within the general public over watch vs. warning.
- Continued efforts to revamp forecasting methods to increase lead time for severe thunderstorms and tornadoes.
- Impacts Based Warnings can help better explain hazards but have not been as effective as initially intended.
- An increased tendency to follow future warnings are affected by both an increase in information and an increase in understanding of one's vulnerability of the hazard.

## References

- (1) Barnes, L. R., Grunfest, E. C., Hayden, M. H., Schultz, D. M., & Benight, C. (2007). False Alarms and Close Calls: A Conceptual Model of Warning Accuracy. *Weather and Forecasting*, 22(5), 1140–1147
- (2) Kox, T., & Thielen, A. H. (2017). To Act or Not To Act? Factors Influencing the General Public's Decision about Whether to Take Protective Action against Severe Weather. *Weather, Climate, and Society*, 9(2), 299–315
- (3) Lussenden, H. B. (2014, July). *GEOGRAPHIC DIFFERENCES IN EMERGENCY MANAGEMENT DECISION-MAKING: A CASE STUDY OF SEVERE WEATHER IN THE MIDWEST*.
- (4) NOAA. (2024, May 29). *THE WARN-ON-FORECAST SYSTEM: A Weather Forecasting Moonshot – NSSL News*. Noaa.gov
- (5) Potter, S., Harrison, S., & Krefit, P. (2021). The benefits and challenges of implementing impact-based severe weather warning systems: Perspectives of weather, flood, and emergency management personnel. *Weather, Climate, and Society*, 13(2)
- (6) University of Nebraska-Lincoln. (2024, May 9). *Take cover! Survey shows tornado warnings widely misunderstood*. ScienceDaily.