

# Tornadoes Impacting Interstates: Service and Societal Considerations



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*The views expressed are those of the authors and do not necessarily represent those of the National Weather Service.*

# Overview

- ✓ Quantify the frequency of tornadoes crossing Interstates in “Tornado Alley”
  - ✓ Occurrences of vehicles/people impacted by interstate-crossing tornadoes
  - ✓ Investigate any additional factors that increased probability for impact
  - ✓ Examine the recommended protective actions for motorists
  - ✓ What can be done to improve message/services to travelers
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# Why Interstate Tornadoes?



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# Why Interstate Tornadoes?

“We’re from Missouri and we get tornadoes. We have a basement but not on the highway.”

*Cassie Barker, Lebanon, MO (KMBC-9 Kansas City)*



# Why Interstate Tornadoes?

## **Motorists on Interstates have increased vulnerability to weather hazards!**

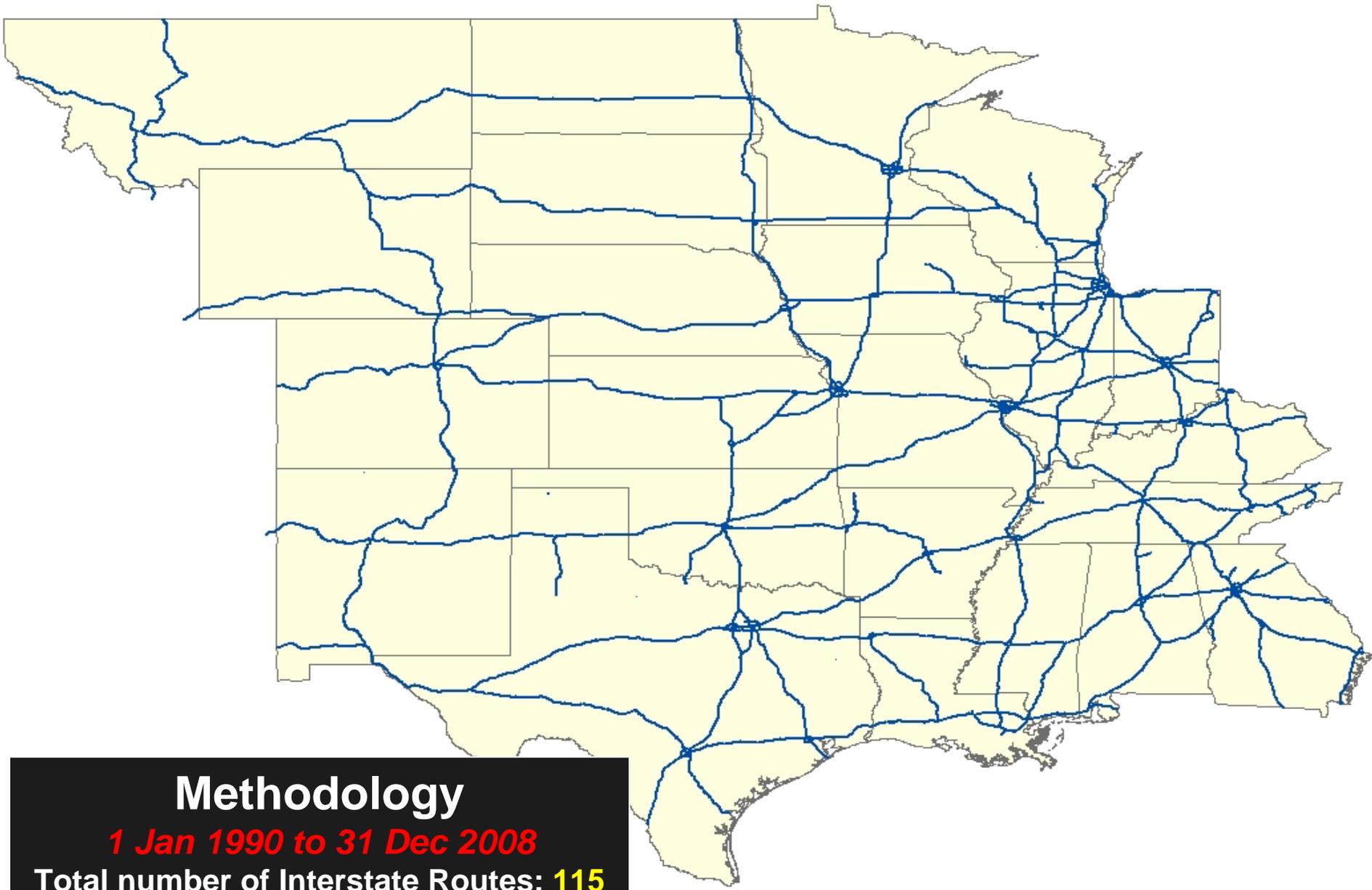
**Motorists lack immediate access to a suitable shelter**

**Few opportunities to change direction of travel or exit off the Interstate.**

**Limited ability to obtain convective “warnings” or unaware/unable to access existing mobile services that provide warning information.**

**Travelers likely unfamiliar with local towns and counties referenced in warnings, even if they have access to warning information.**

**Interstates hold a relatively constant stream of vehicles (*e.g. potential for many eyewitnesses*). May offset some traditional undercounting of rural tornado events.**

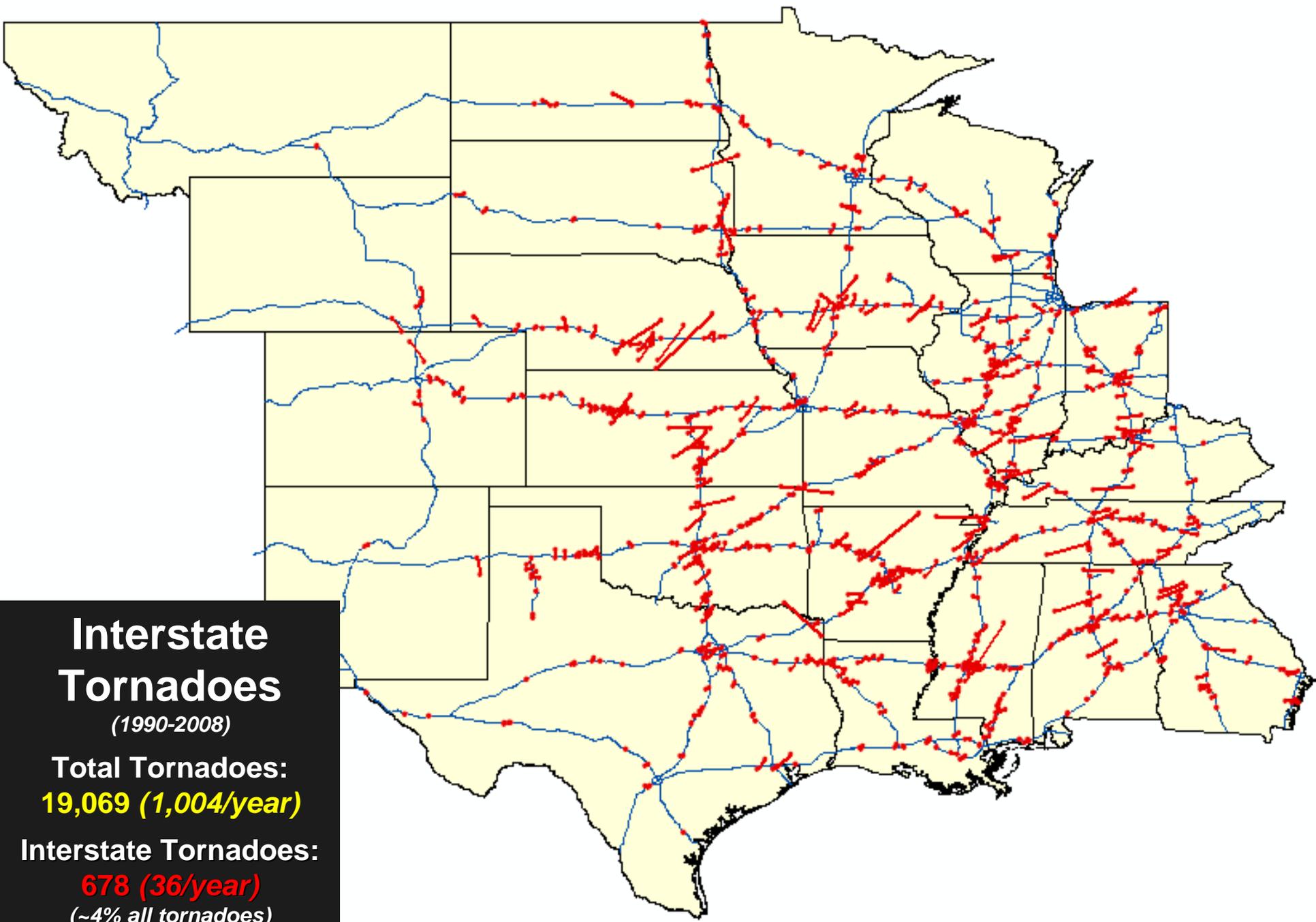


## Methodology

*1 Jan 1990 to 31 Dec 2008*

Total number of Interstate Routes: **115**

Total number of Interstate miles: **24,009**

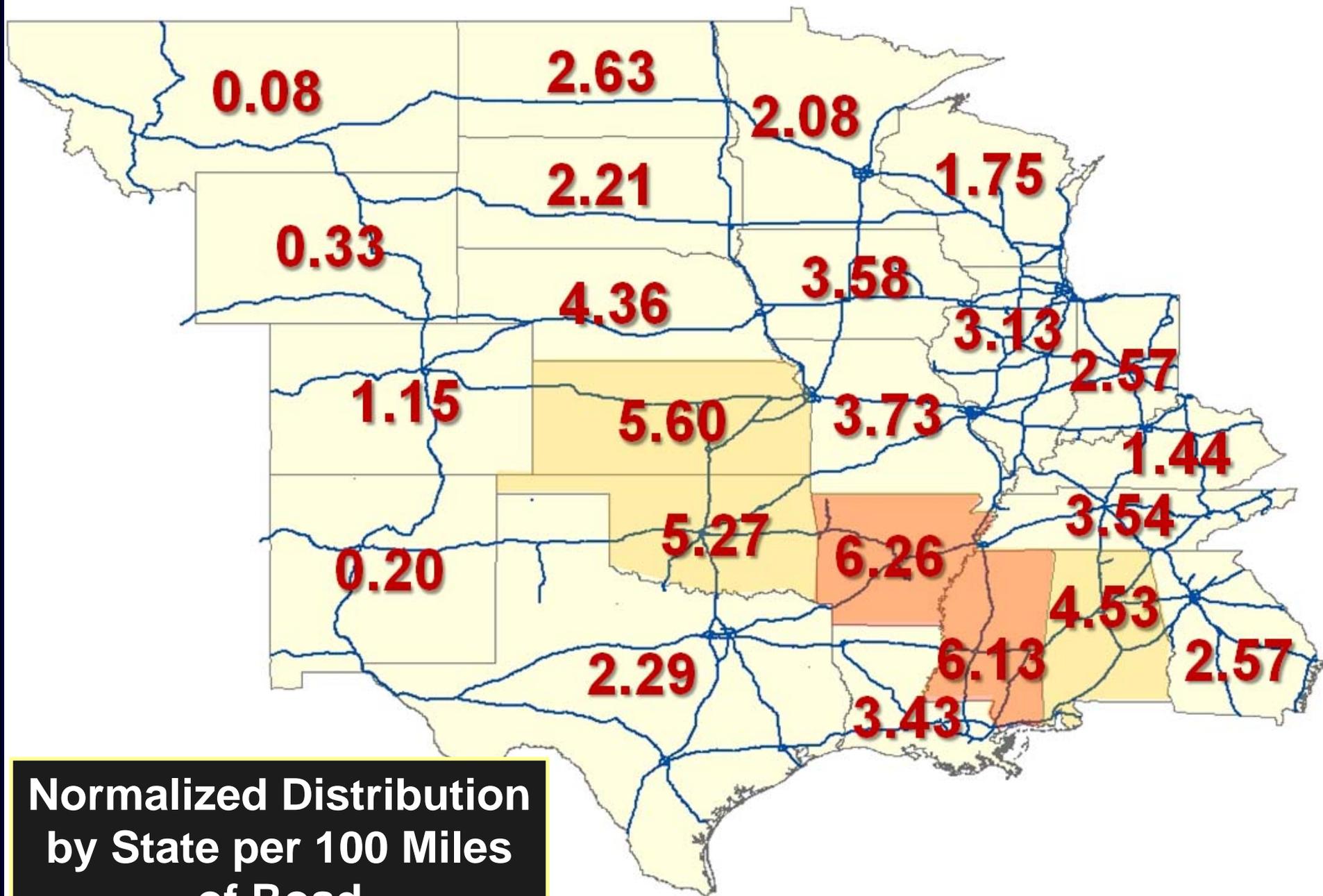


# Interstate Tornadoes

(1990-2008)

Total Tornadoes:  
**19,069 (1,004/year)**

Interstate Tornadoes:  
**678 (36/year)**  
(~4% all tornadoes)



**Normalized Distribution  
by State per 100 Miles  
of Road**

# Motor Vehicle Impacts

**Defined as any motor vehicle “impacted” on an Interstate by a tornado.**

*(Broken windows, body damage, vehicles shifted or blown off the road, vehicle rolled, overturned, tossed, or destroyed.)*

## 113 Vehicle Impact Tornadoes

*Accounts for 17% of Interstate tornadoes*

*(~ 1 in 5 tornadoes struck vehicles based on the “existing” record)*

*Impacted Vehicles:*

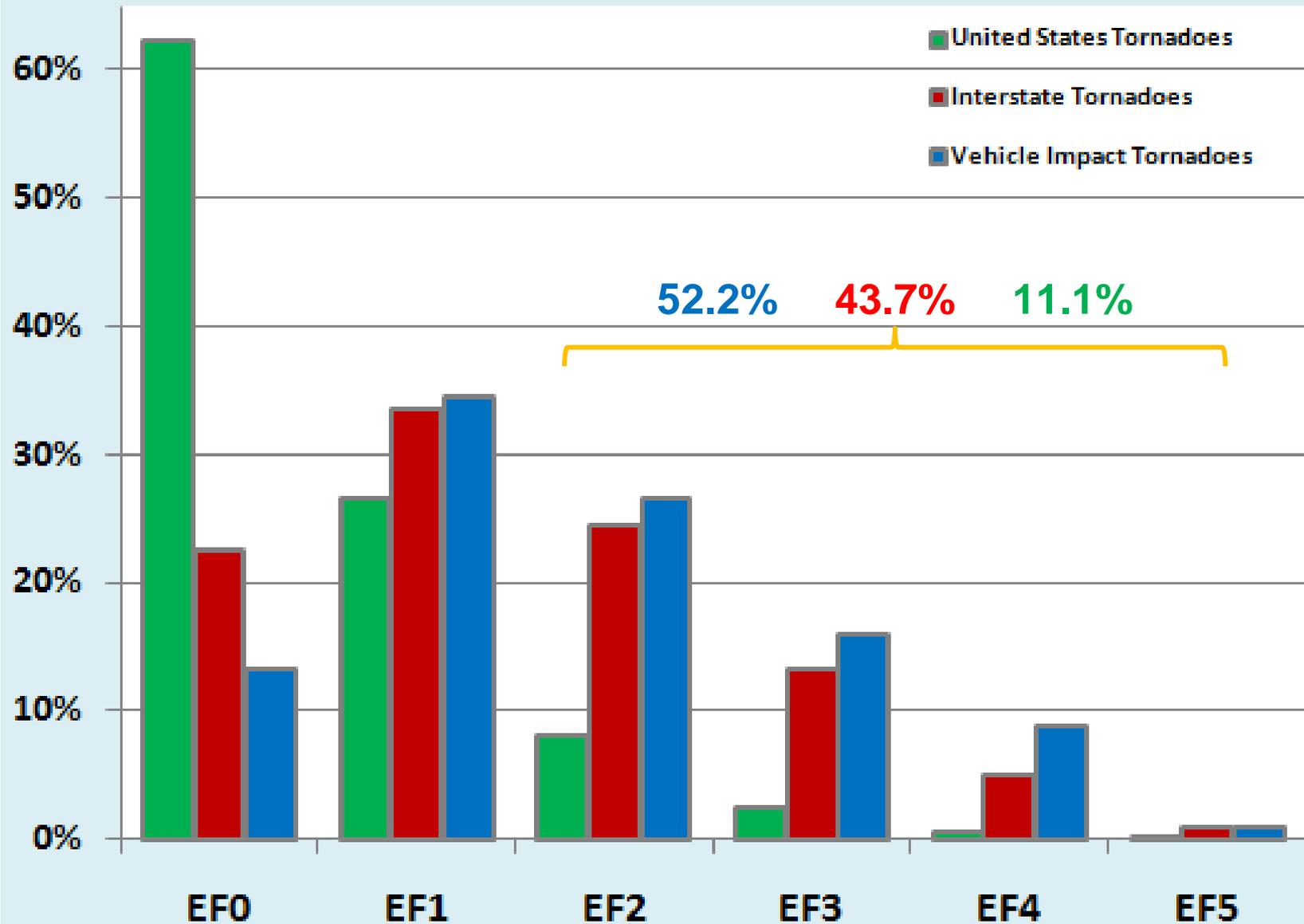
**311 Total Vehicles**

**181 Semi-trailer Trucks**

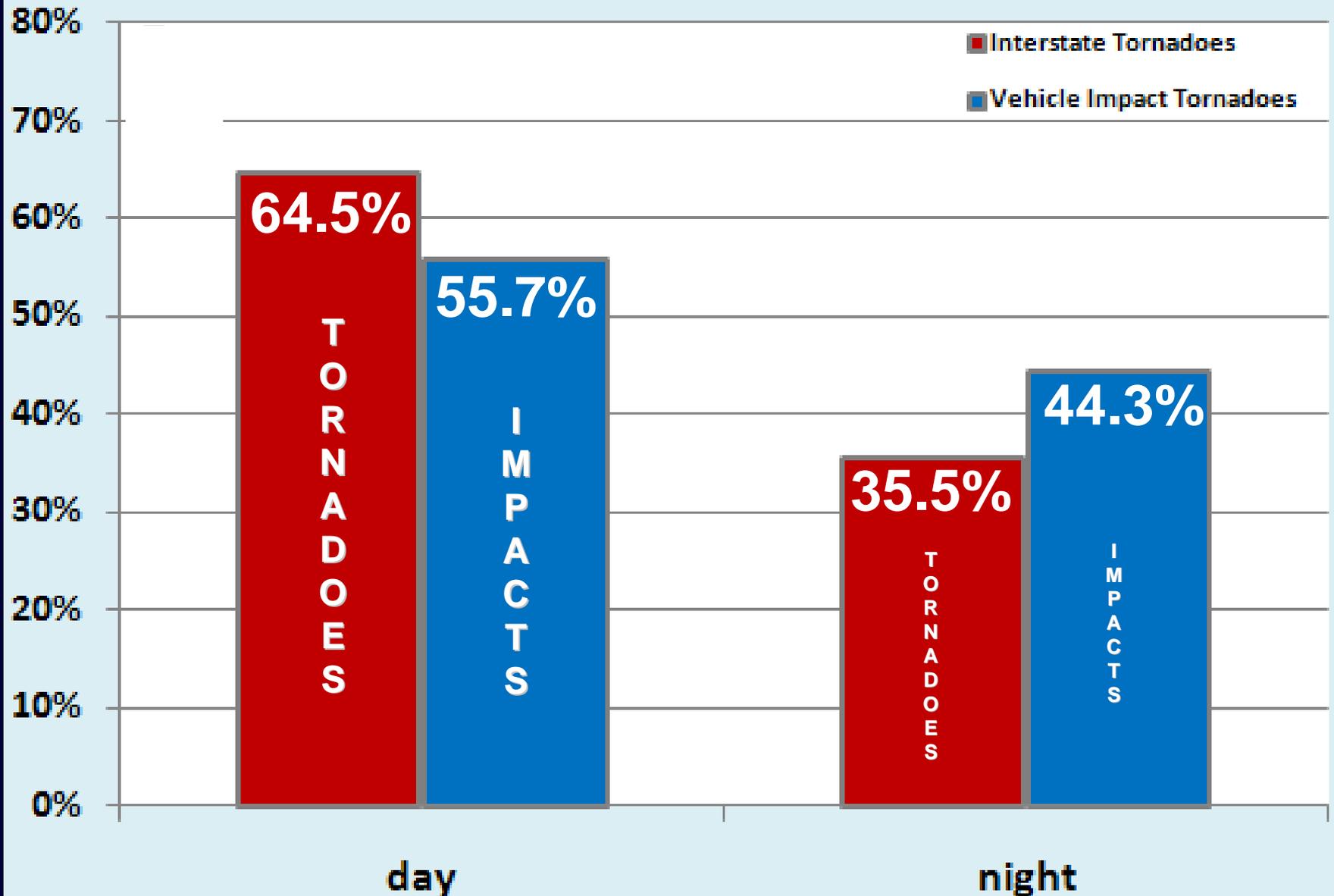


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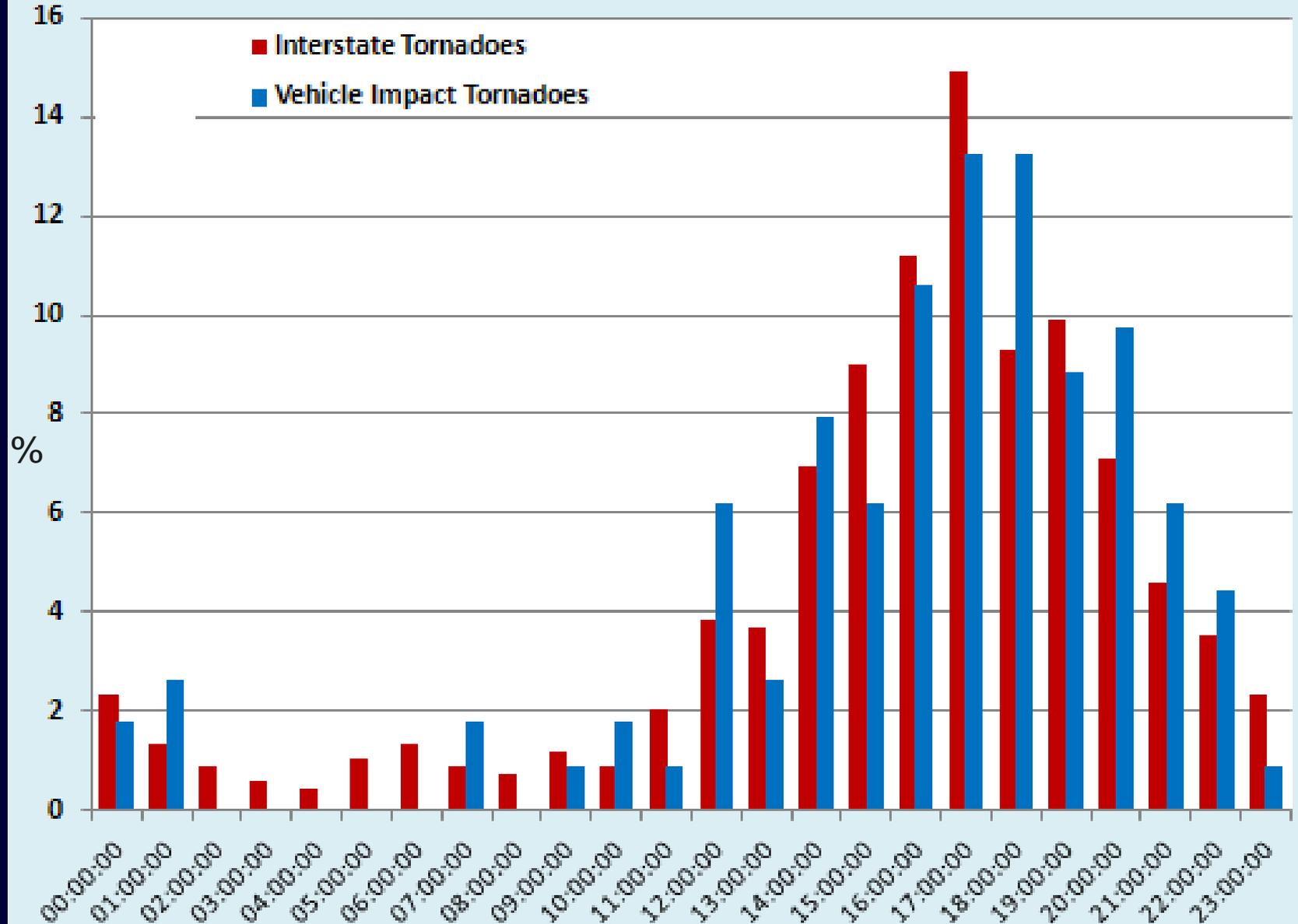
# EF-Scale Distribution



# Time of Day Tornado Distribution



# Hourly Tornado Distribution



# Interstate Killer Tornadoes

8 tornadoes resulted in 9 direct fatalities on the interstate.

Arkansas	3/1/97	F4	day
Arkansas	11/27/05	F3	night
Georgia	12/15/07	EF1	night
Illinois	4/19/96	F3	night
Illinois	6/1/99	F3	day
Oklahoma	5/3/99	F5	day
Oklahoma	5/3/99	F4	night
Wisconsin	8/27/94	F3	night



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- ~ **7%** killer tornadoes per vehicle impact tornadoes
  - ~ **1%** killer tornadoes per all interstate tornadoes
- (88% killer tornadoes EF3 or greater intensity)*
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# Interstate Killer Tornadoes

Were there specific circumstances that enhanced threat?



Fatality Location	Mitigated?
2 deaths under overpass	Outside of vehicles
2 deaths from debris inside vehicle	Body below windows?
1 death in semi at a rest area on Interstate	Was driver asleep?
1 death in the sleeper portion of a semi	No seat belt, asleep?
1 death in van with person ejected	No seat belt?
1 death from vehicle thrown upside down	---
1 death semi rolled down 15m embankment	---

# Recommended Protective Actions



# Recommended Protective Actions

## **NWS and ARC Joint Statement – Summer 2009**

*If you are caught outdoors, you should seek shelter in a basement, shelter or sturdy building. If you cannot quickly walk to a shelter:*

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- **Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.**
- **If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:**
  - **Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.**
  - **If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.**
- **Your choice should be driven by your specific circumstances.**

# Recommended Protective Actions

## NWS and ARC Joint Statement – Summer 2009



➤ If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:

- Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
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➤ Your choice should be driven by your specific circumstances.

# Support Services and Technologies



**TORNADO WARNING**  
**I-80...MM 248 TO MM 256**  
**UNTIL 430 PM CDT**



Interstates are crucial points of reference to both travelers and local residents

# NWS Support to Interstate Travelers

**Mile markers (MM) are the universal language!**

*Initial tornado warnings (2005-2008) for confirmed Interstate tornadoes*

**161** Interstate Tornadoes

## Warnings

**145** Tornado Warnings

**16** No Tornado Warning

## Mile Markers / Interstates

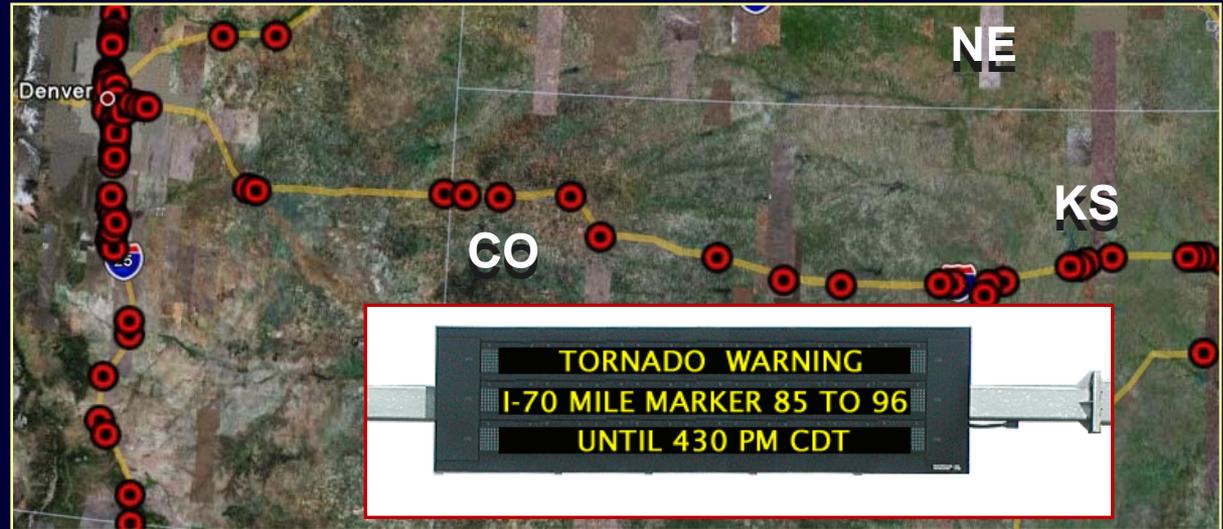
**114** No MM / Interstate Mention

**22** MM Mention

**9** *Interstates mentioned in text*

**Only 21% tornadoes with reference to  
Interstates mentioned in TOR warnings**

# Future Tools - Collaboration Possibilities



**Dynamic Message Signs**

**511 Service**

**Media/DOT Radio Broadcasts**

**Law Enforcement Road Closures**

**Cell Phones/Graphical Tools**



# Conclusions and Future Work

- Motorists traveling on interstates (other roadways) have **increased vulnerability** to weather hazards
- Interstates and mile markers serve as **important references** in disseminated warning information
- Multi-agency collaboration and future technologies may help **lessen casualties/damage**
- **Paradigm shift**: New “last-resort” safety training
- **Paper** to summarize results and recommendations

## Thank You!

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