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Southeast U.S. Tornado Disaster Potential

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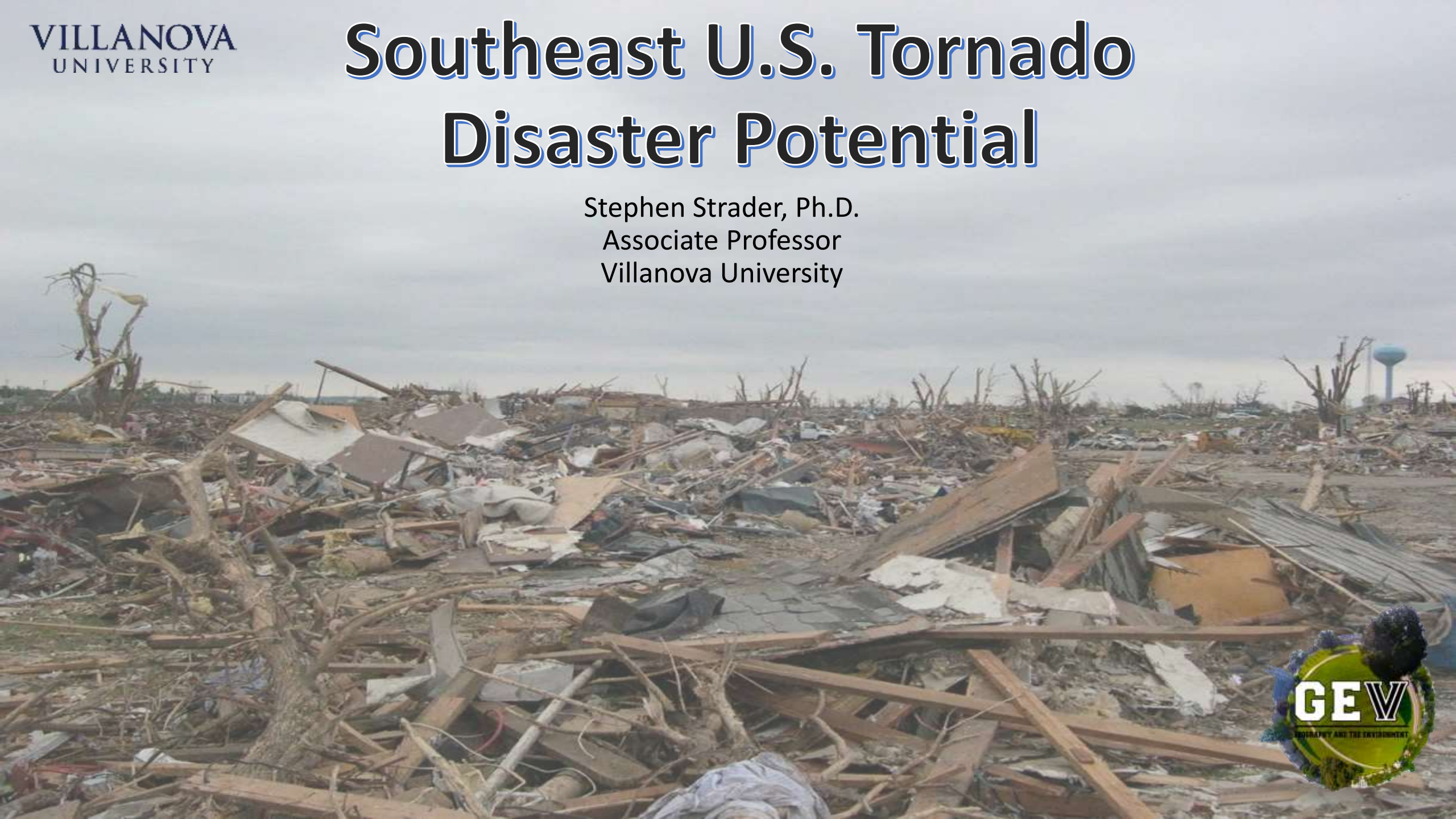
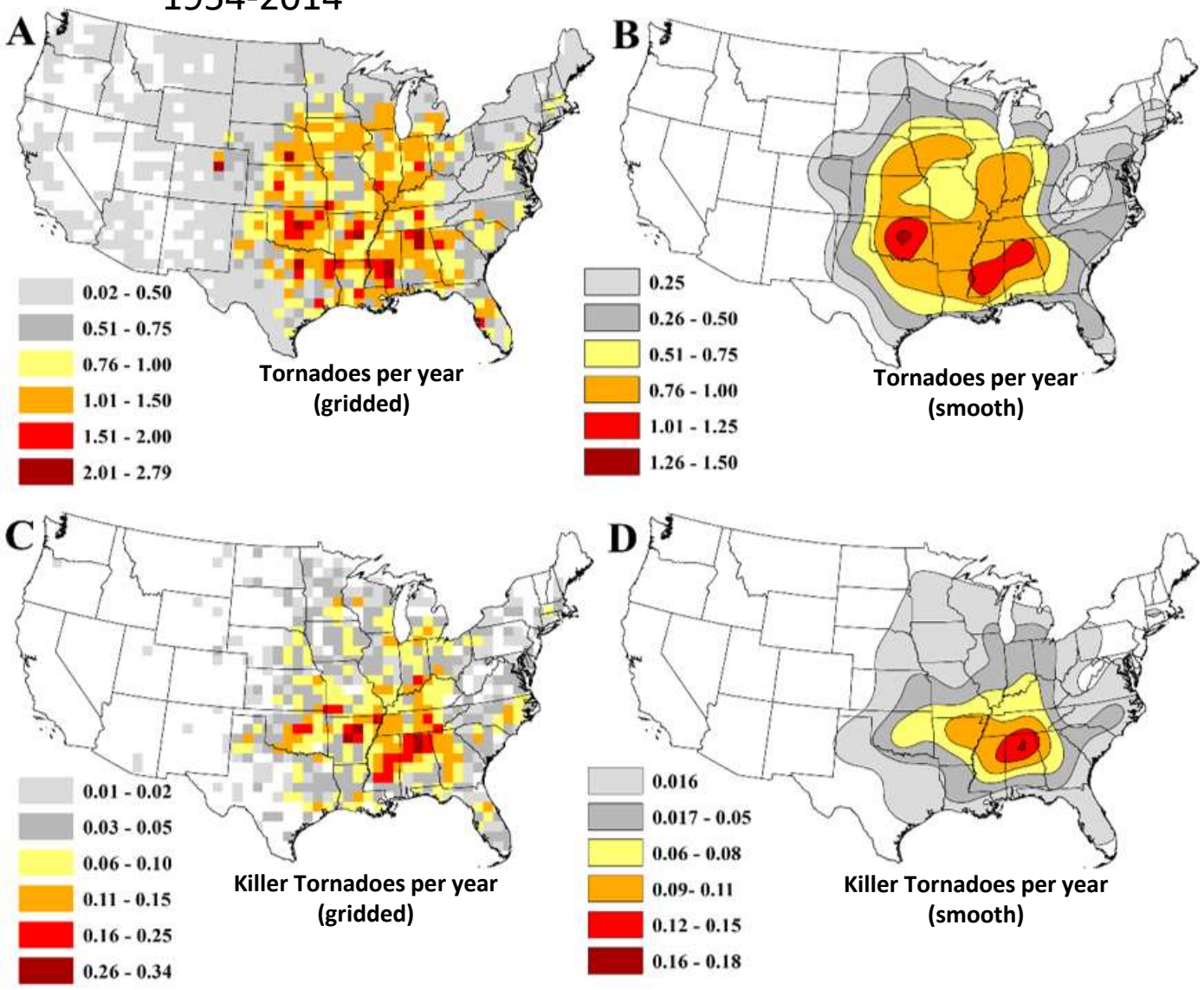
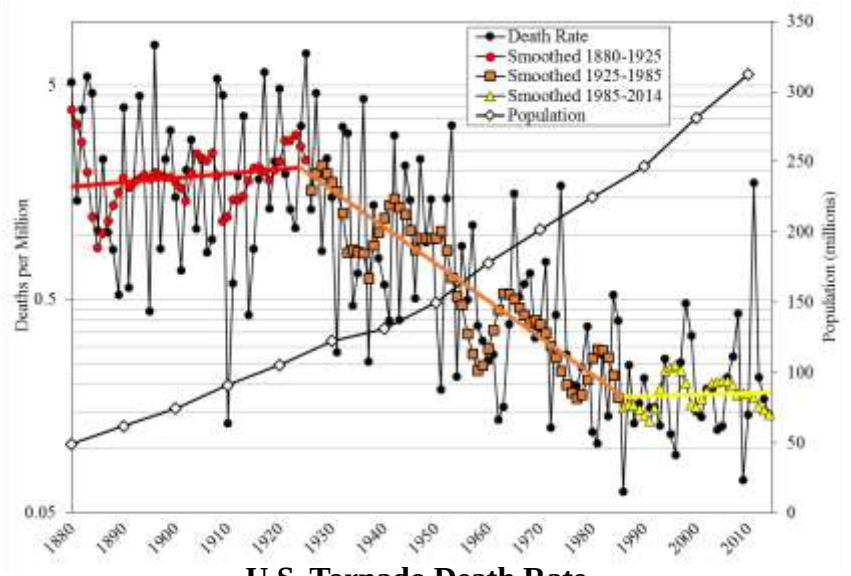


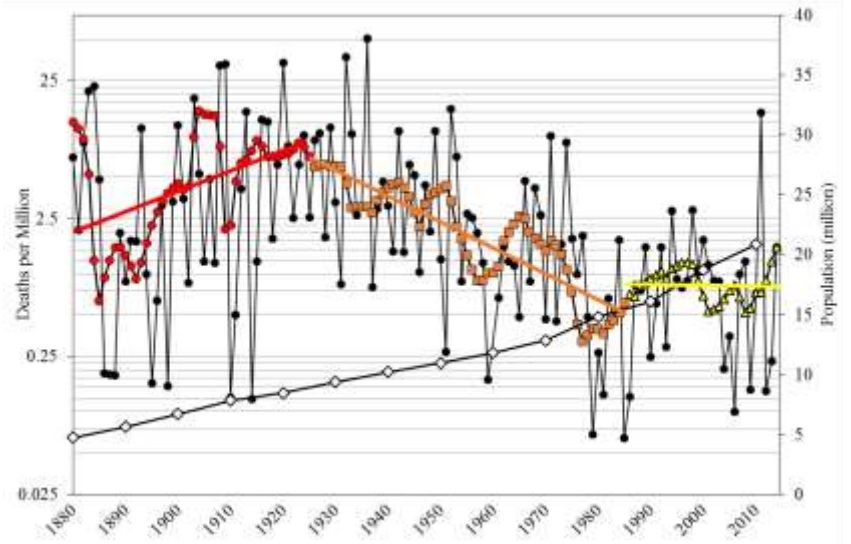
Tornado fatalities

1954-2014





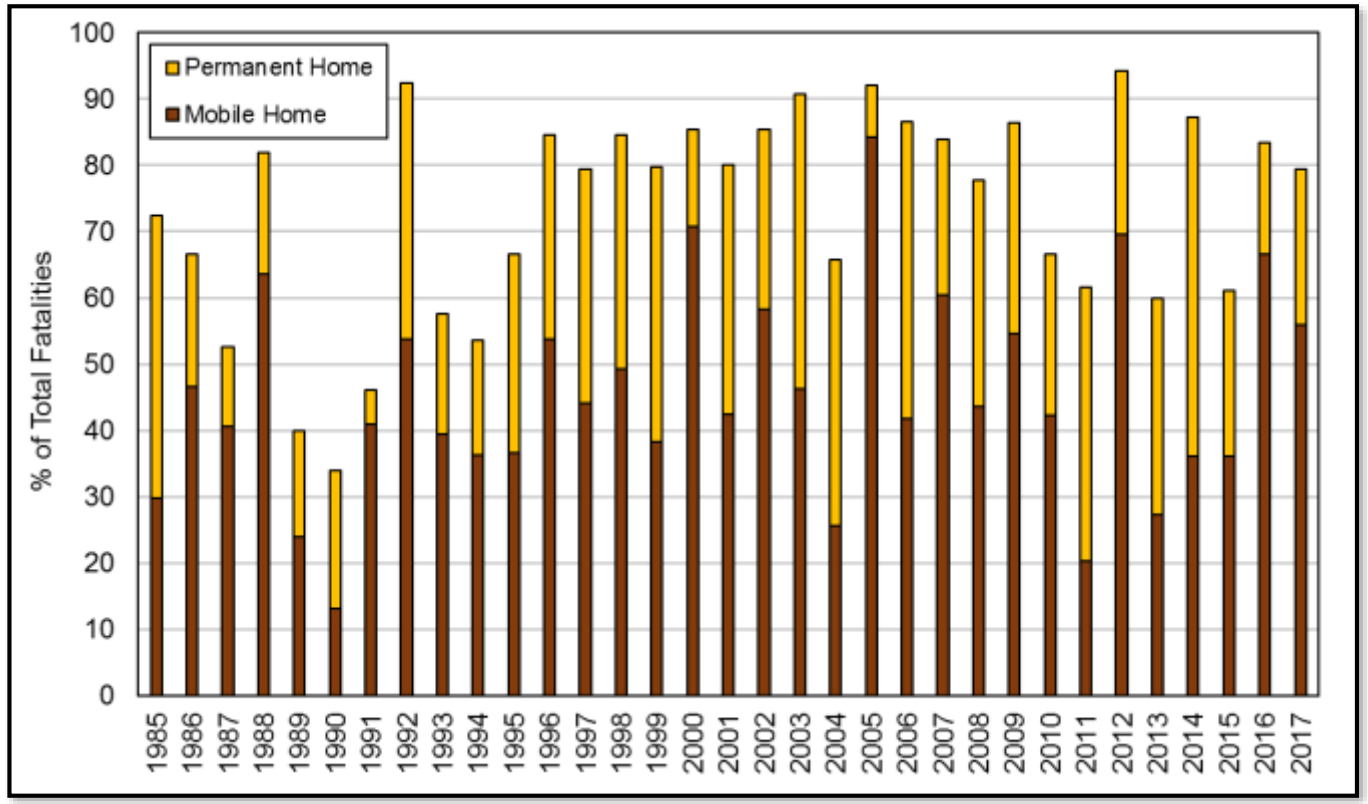
U.S. Tornado Death Rate



Southeast U.S. Tornado Death Rate

Ashley and Strader (2016); *BAMS*

Housing and Tornadoes



MH counts and percentage of total housing stock per state (from ACS 2016).

Area	MH count	% MH
AL	295,722	13.4
GA	384,692	9.3
MS	193,308	14.9
TN	268,466	9.3
U.S.	8,454,133	6.3

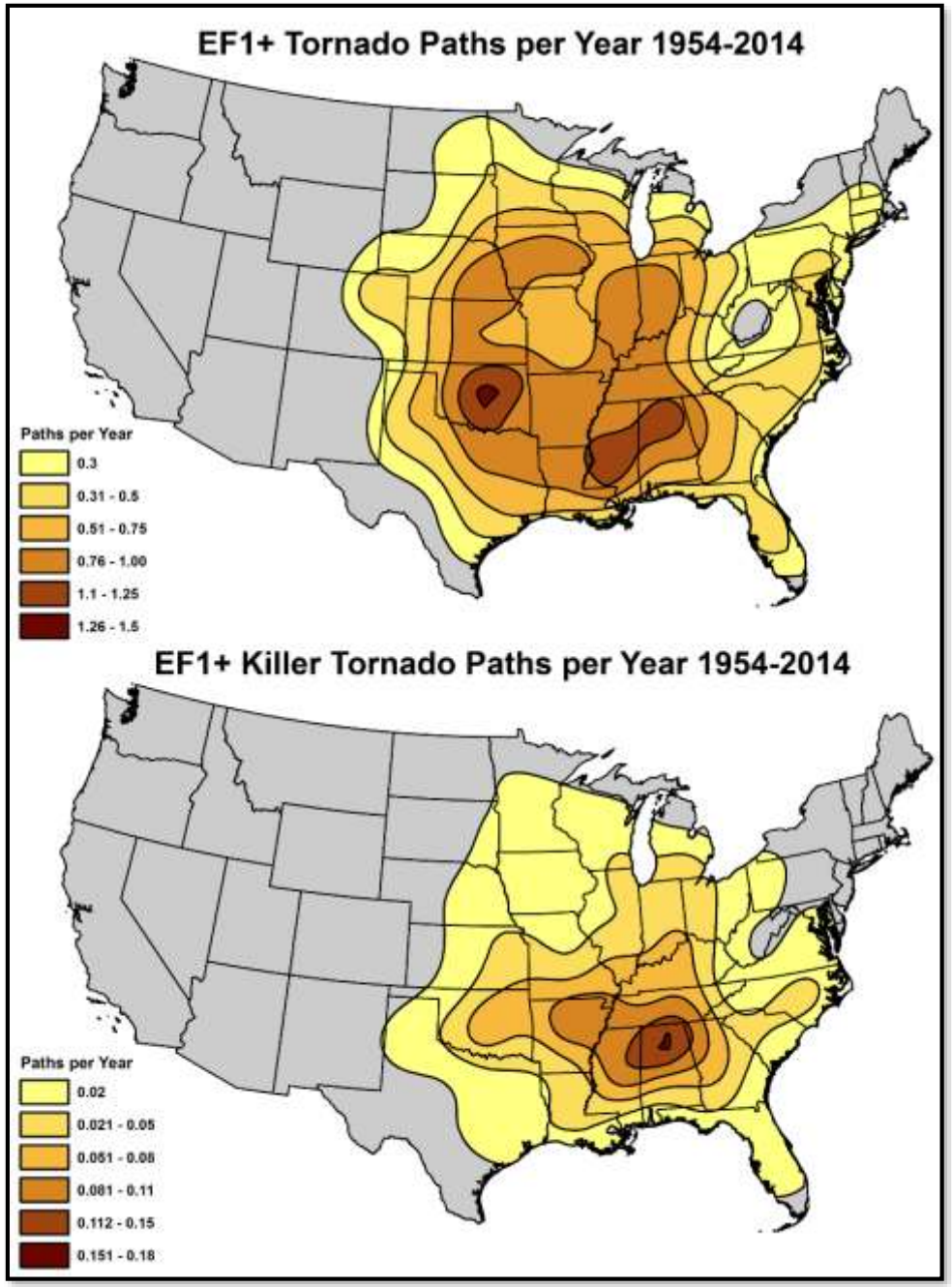
45% of *all* tornado deaths occur in MHs, and this proportion has been increasing over time

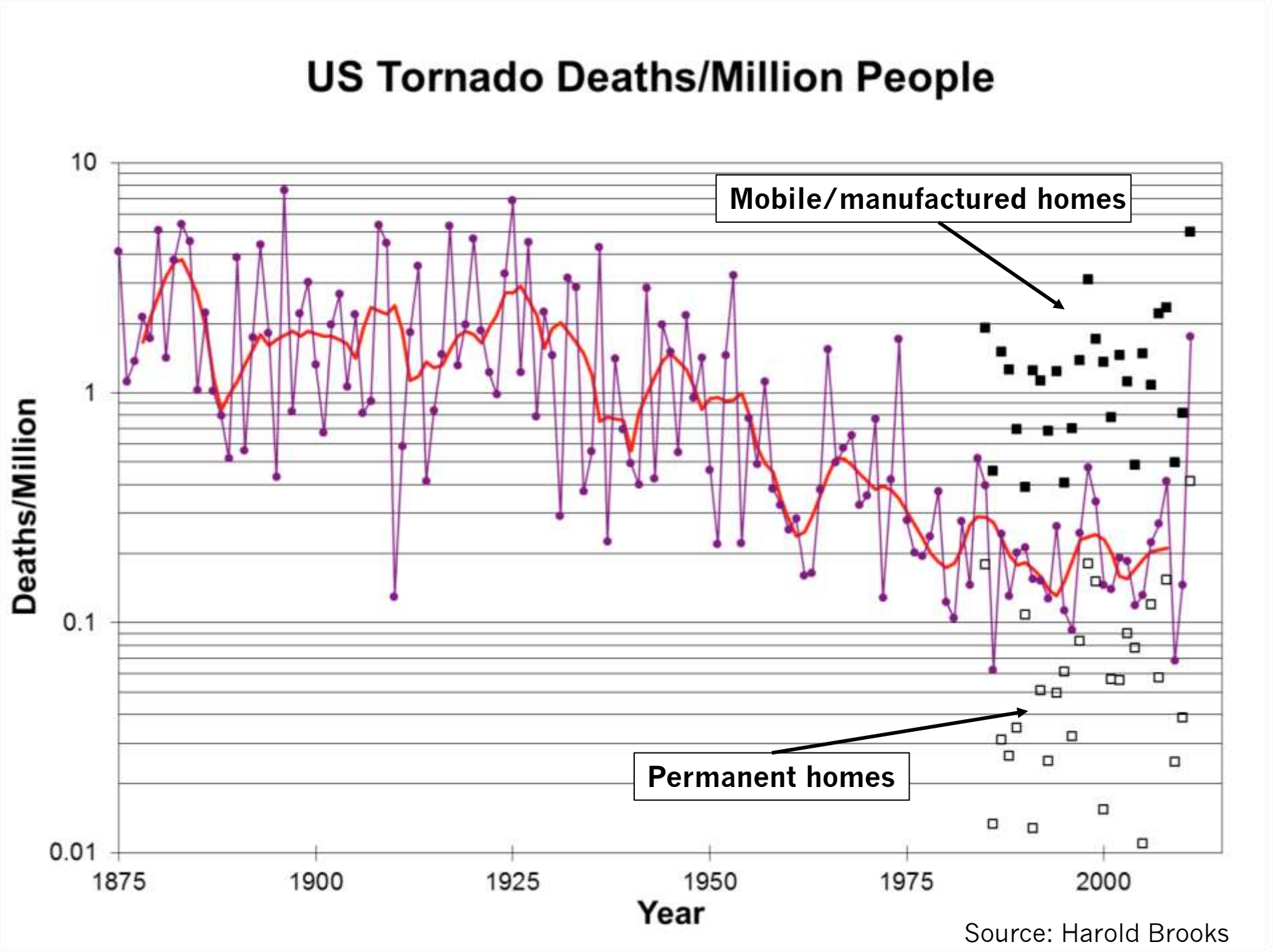
Strader and Ashley (2016); *WCAS*

Tornado Fatalities and Housing Relationship

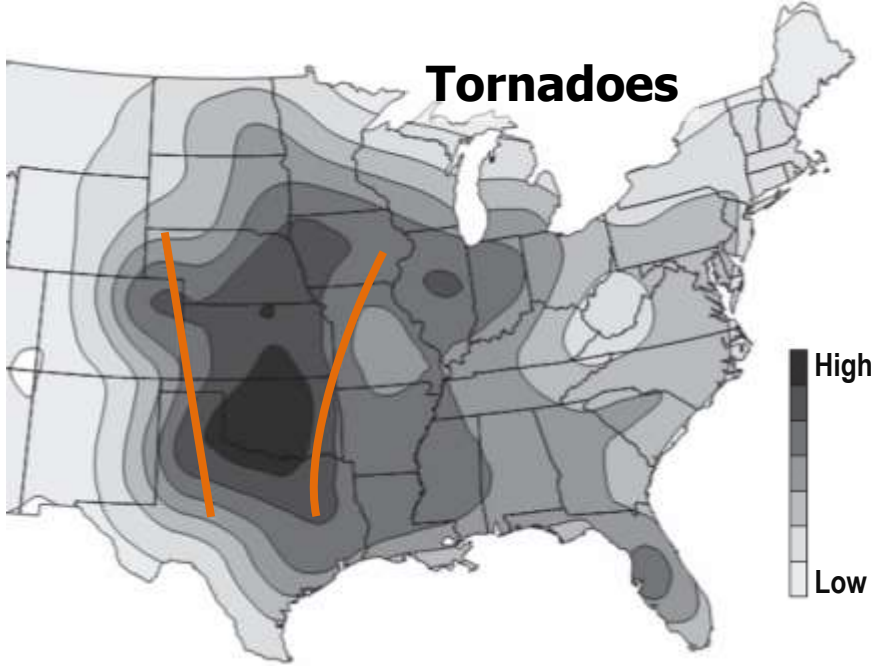
54% of all housing fatalities occurred in MHs although MHs represent around 6% of the entire U.S. housing stock (Census 2017)

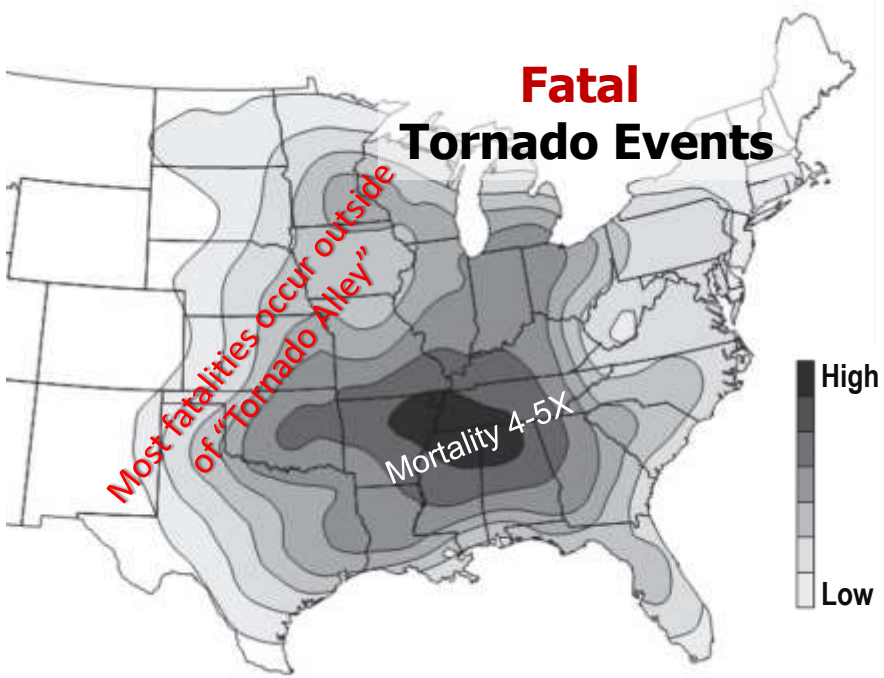
Strader and Ashley (2016); *WCAS*





Source: Harold Brooks





Ashley (2007) *WAF*

Why?

high hazard risk

nighttime events

mobile home density

population density

Self-efficacy

forest cover

high storm speeds

high-precipitation storms

haze and low cloud bases

education

poverty

warning distribution systems

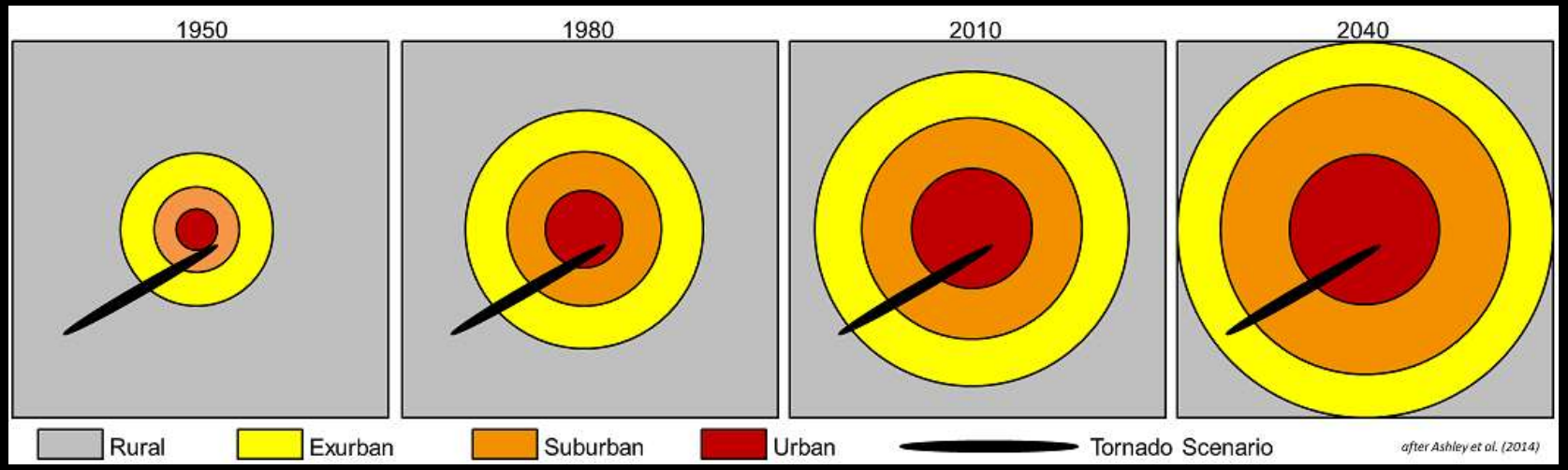
coping styles

weak construction/lack of basements

The 2013 Moore, OK tornado moves through a neighborhood that was – not so long ago – undeveloped.

Expanding Bull's Eye Effect

- To understand how tor disaster potential has evolved, it is necessary to appreciate the character and trends of land-use dynamics through time and **how those development patterns contribute to changes in exposure**
- **"Expanding bull's-eye effect"**
  - Argues that targets—i.e., humans and their possessions—of geophysical hazards are enlarging as populations grow and spread



- **It is not solely the pop magnitude that is important in creating disaster potential, it is how the pop, and its affiliated built environment, is <u>distributed across space</u> that determines how the underlying disaster components of risk and vulnerability are realized**

Revisiting Nocturnal Tornado Vulnerability and Its Influence on Tornado Mortality

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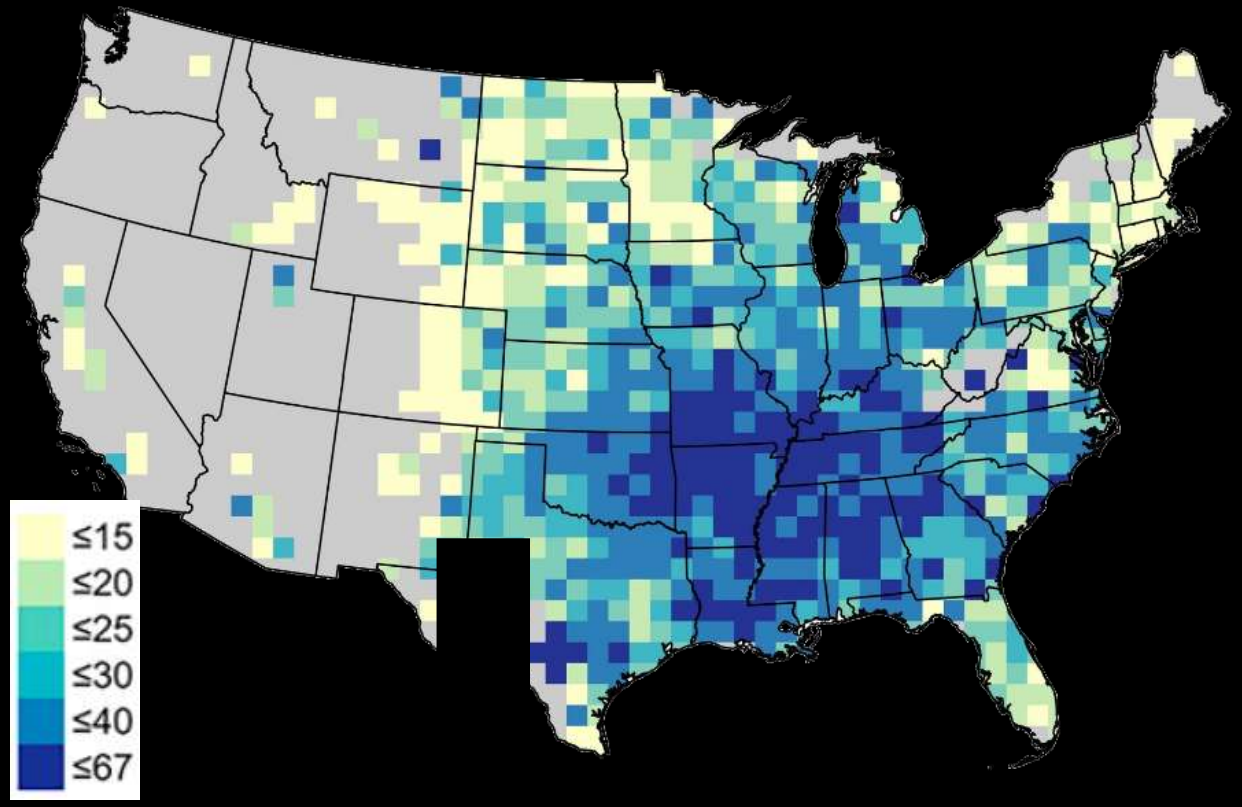
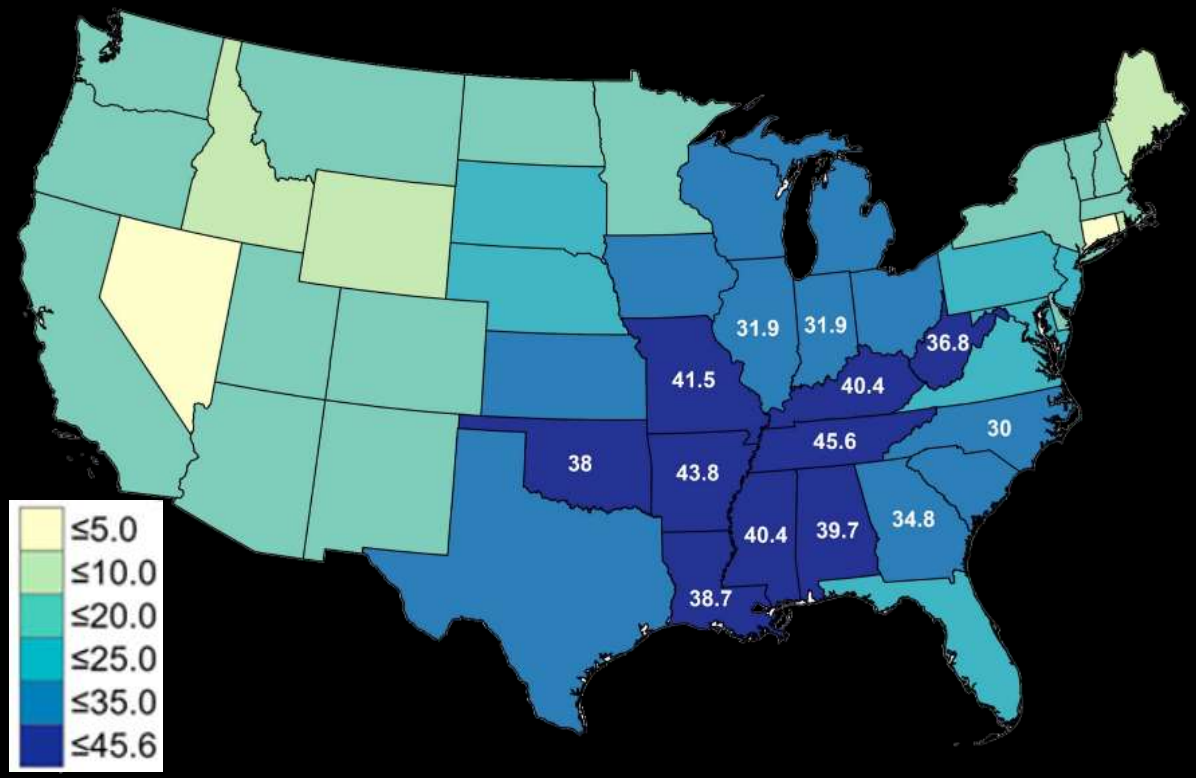
[2]*Northern Illinois University, Department Earth, Atmosphere, and Environment, DeKalb, Illinois*





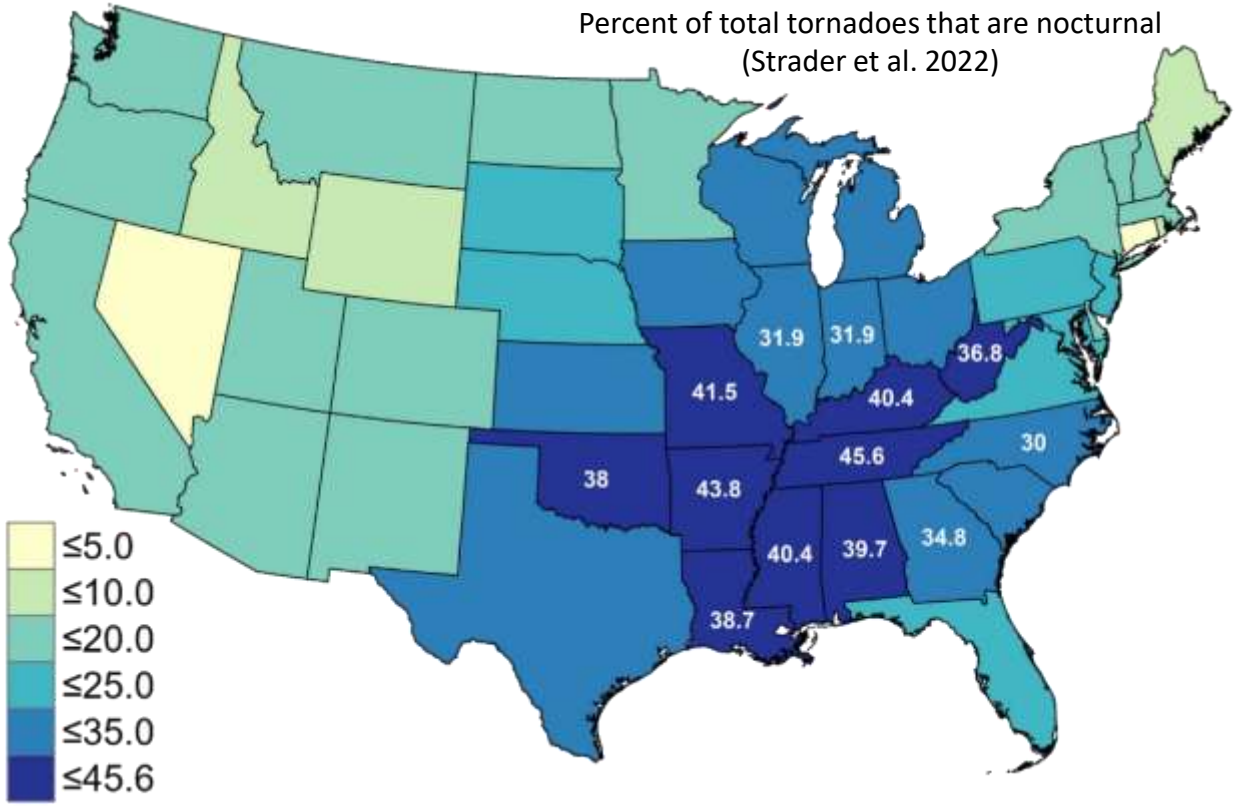
Percentage Nocturnal Tornadoes

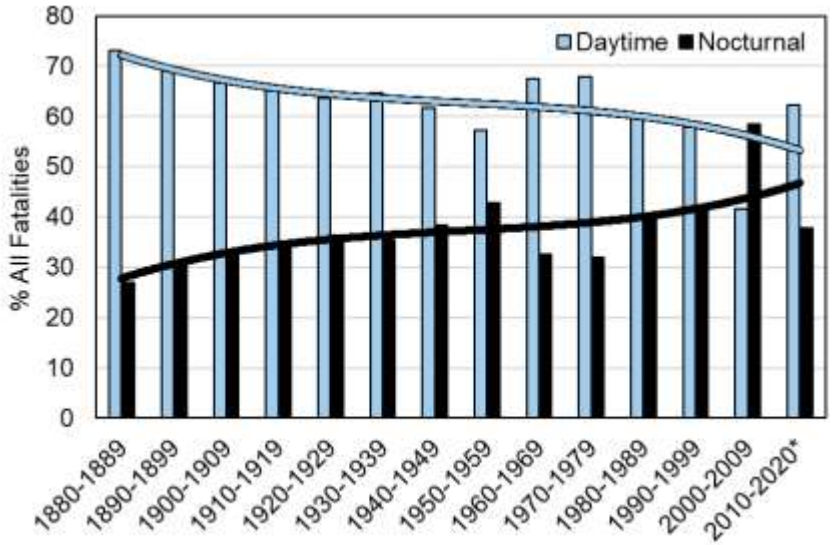
Nocturnal Tornado Problem

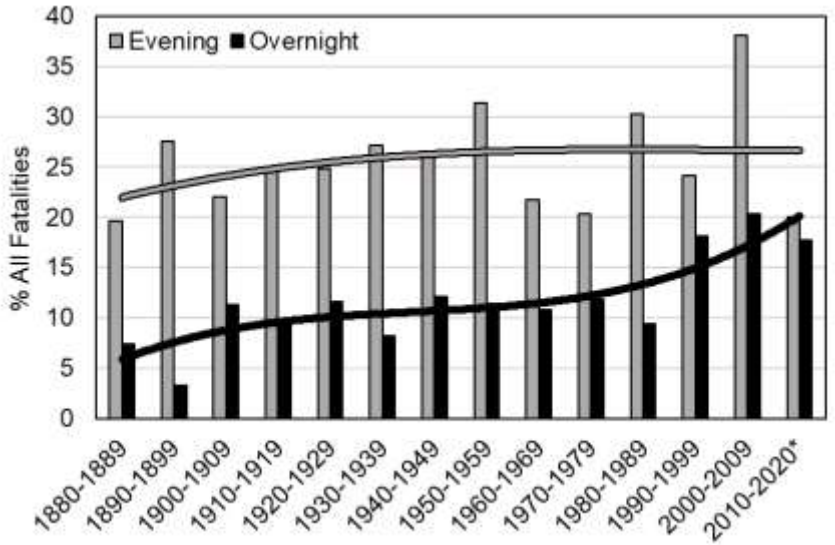
Ashley et al. (2008)

- **Overnight** (local midnight to sunrise) tornadoes are ***2.5 times*** more likely to result in a fatality

- Strader et al. (2022)
  - Update to Ashley et al. (2008)
  - Still 2.5x more deadly





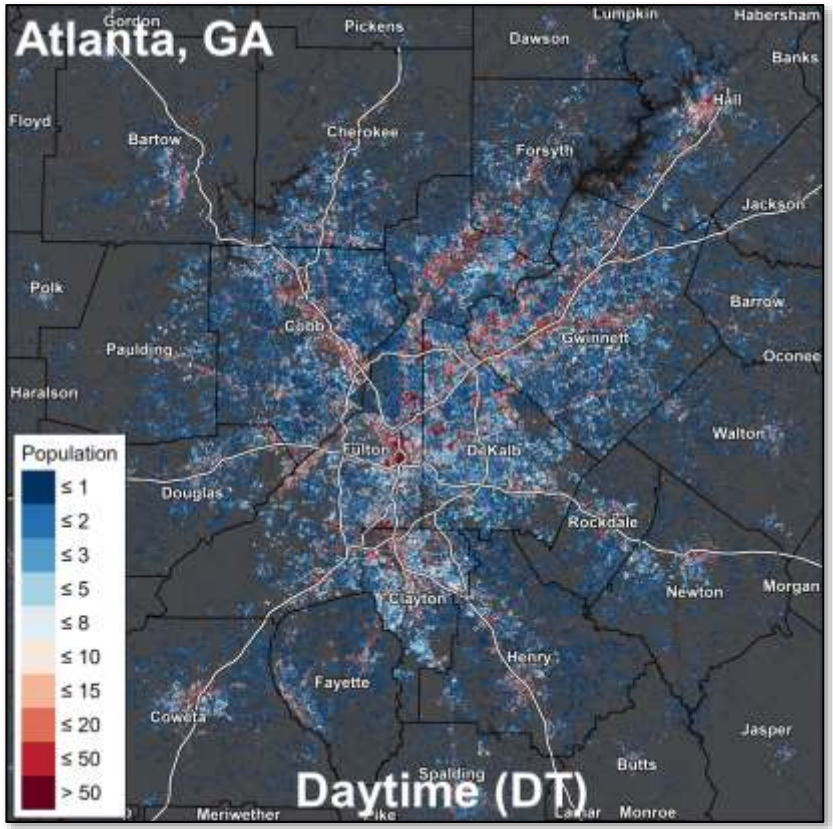


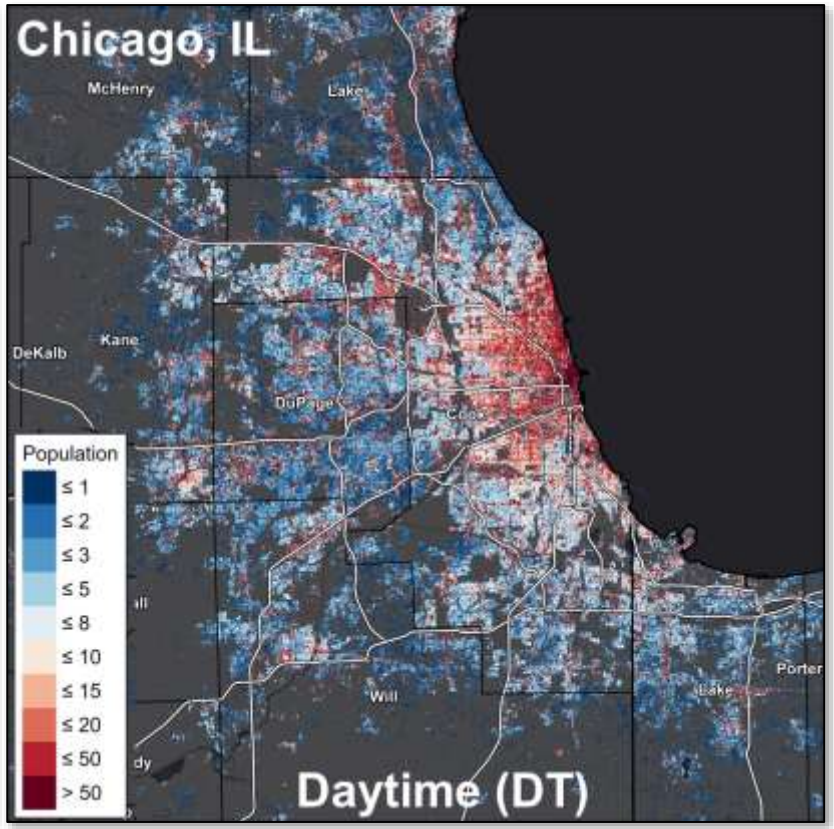
Tornado fatality counts, percentage of all tornadoes, and percentage of nocturnal tornadoes from 1880 to 2020 by light condition.

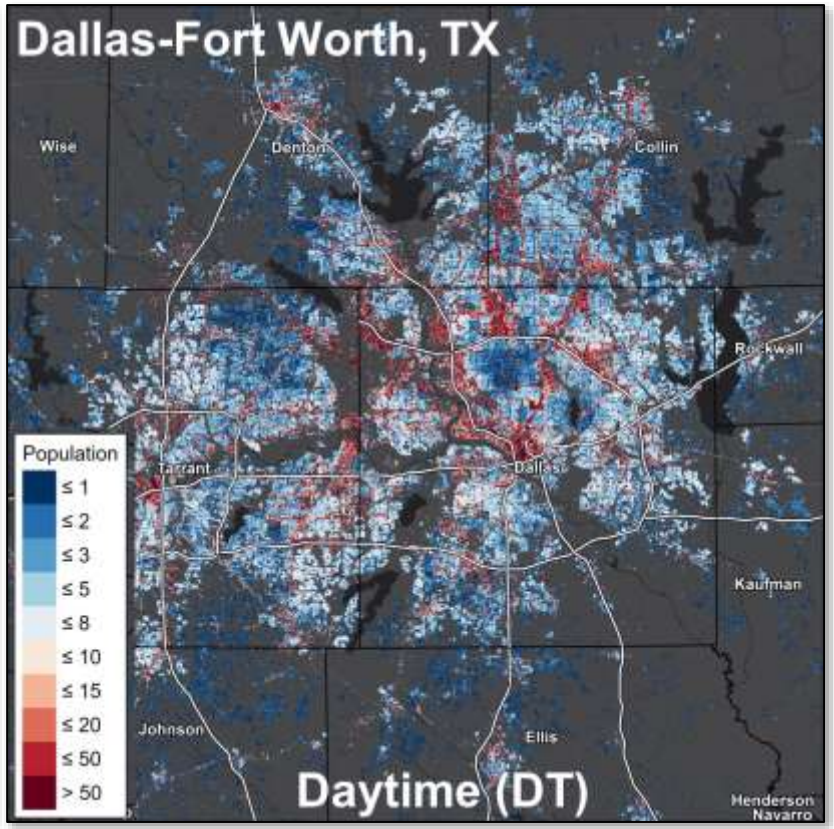
Tornado Light Condition	Count	% All	% Nocturnal
Daytime (DT)	13,147	66.2	-
Nocturnal (NT)	6,701	33.8	100.00
Evening (EVE)	5,008	25.2	74.7
Overnight (ONT)	1,693	8.5	25.3
Total	19,848	100.0	-

Population is non-stationary!

EXPOSURE changes throughout a 24-hr period

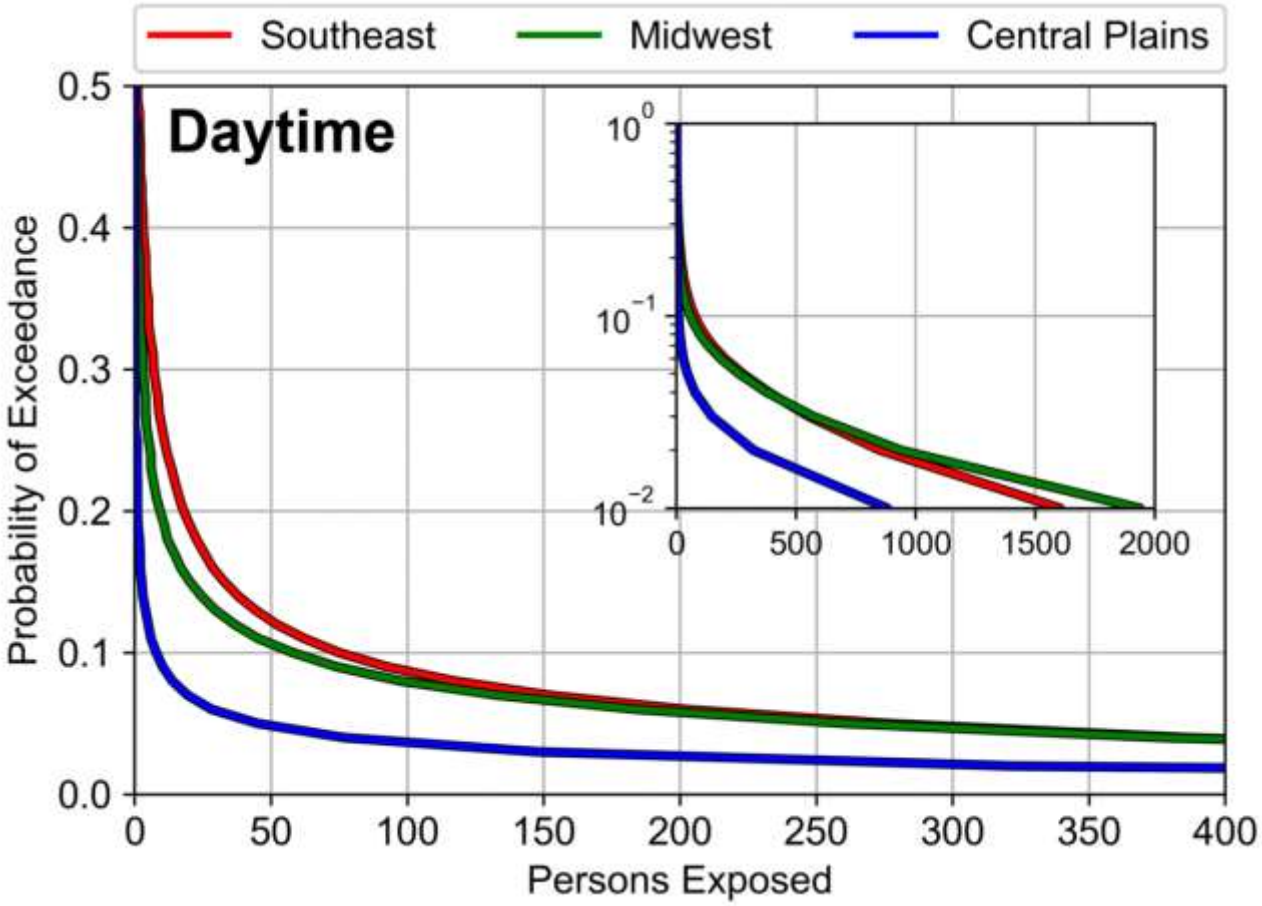


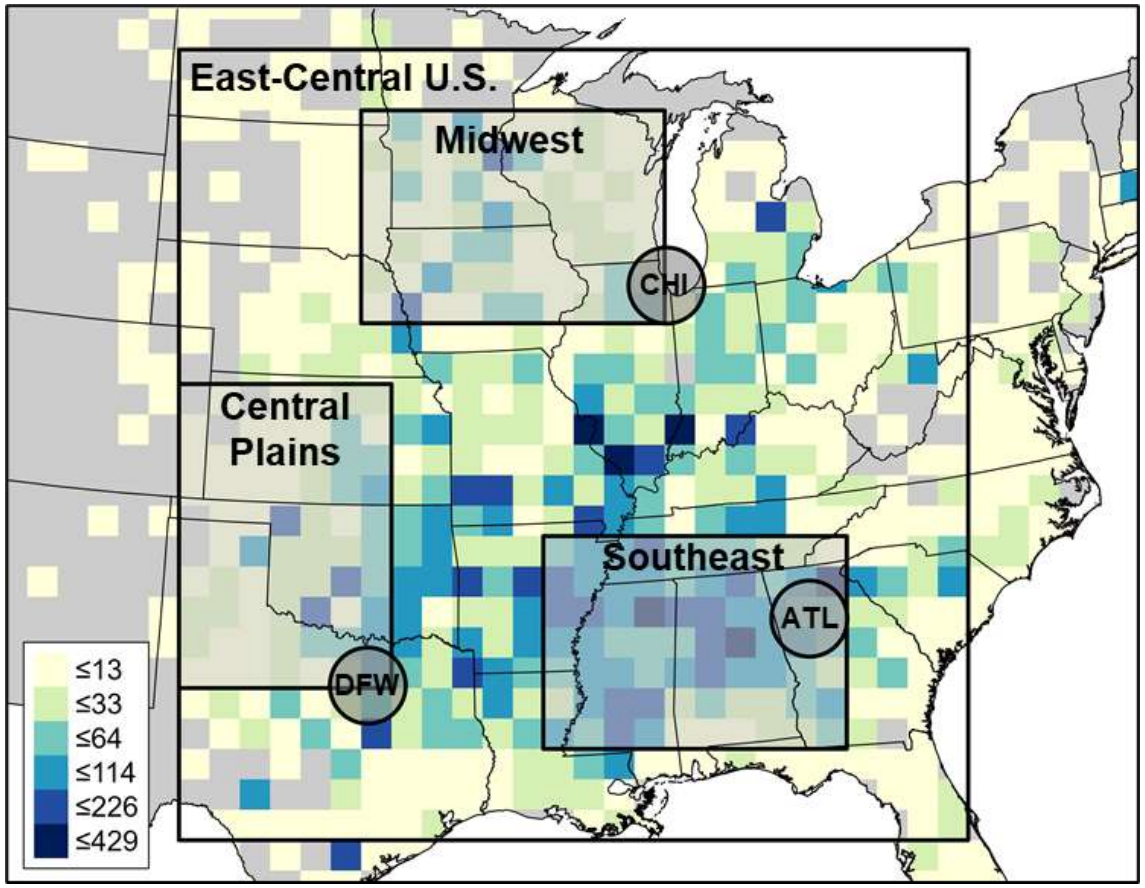




LandScan Data; Oak Ridge National Lab

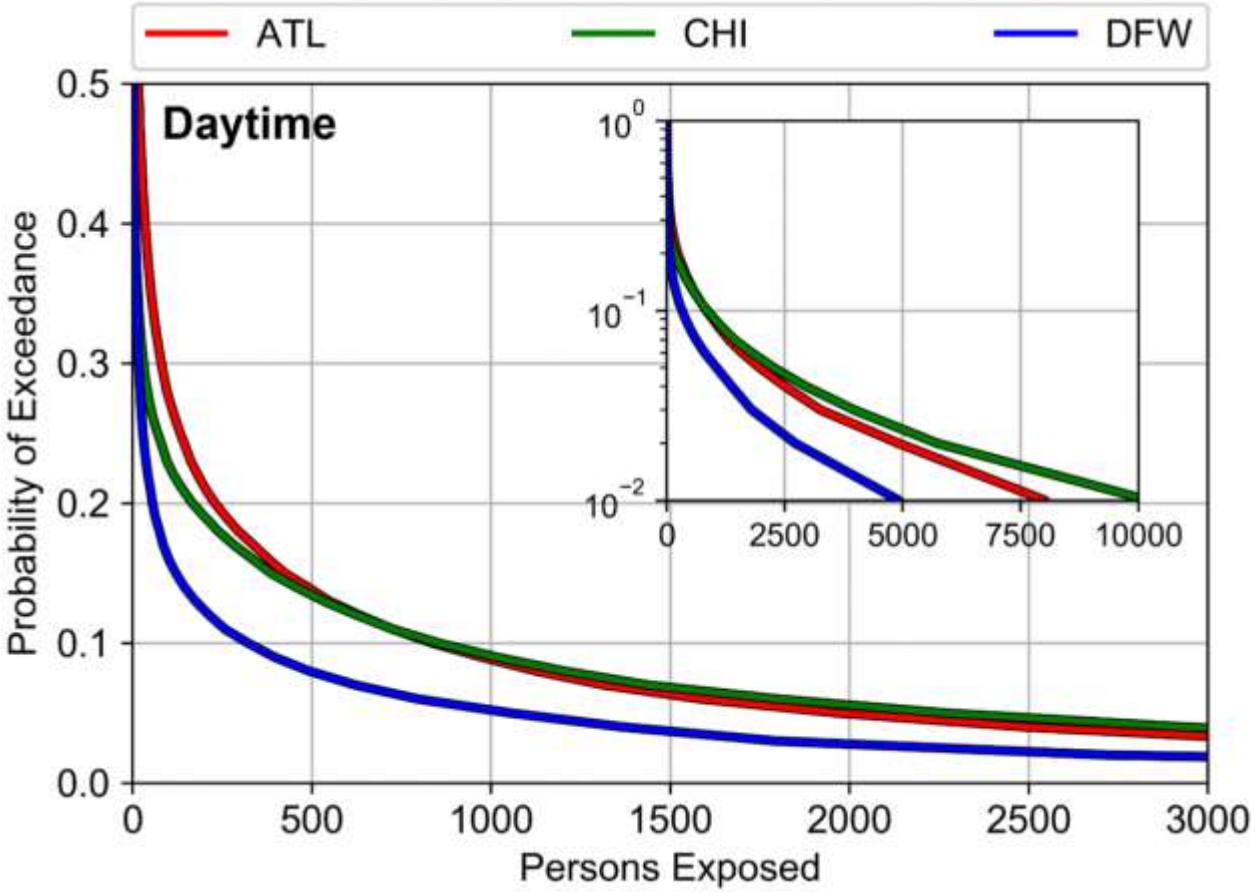
Daytime-Nocturnal Simulations – Subregions

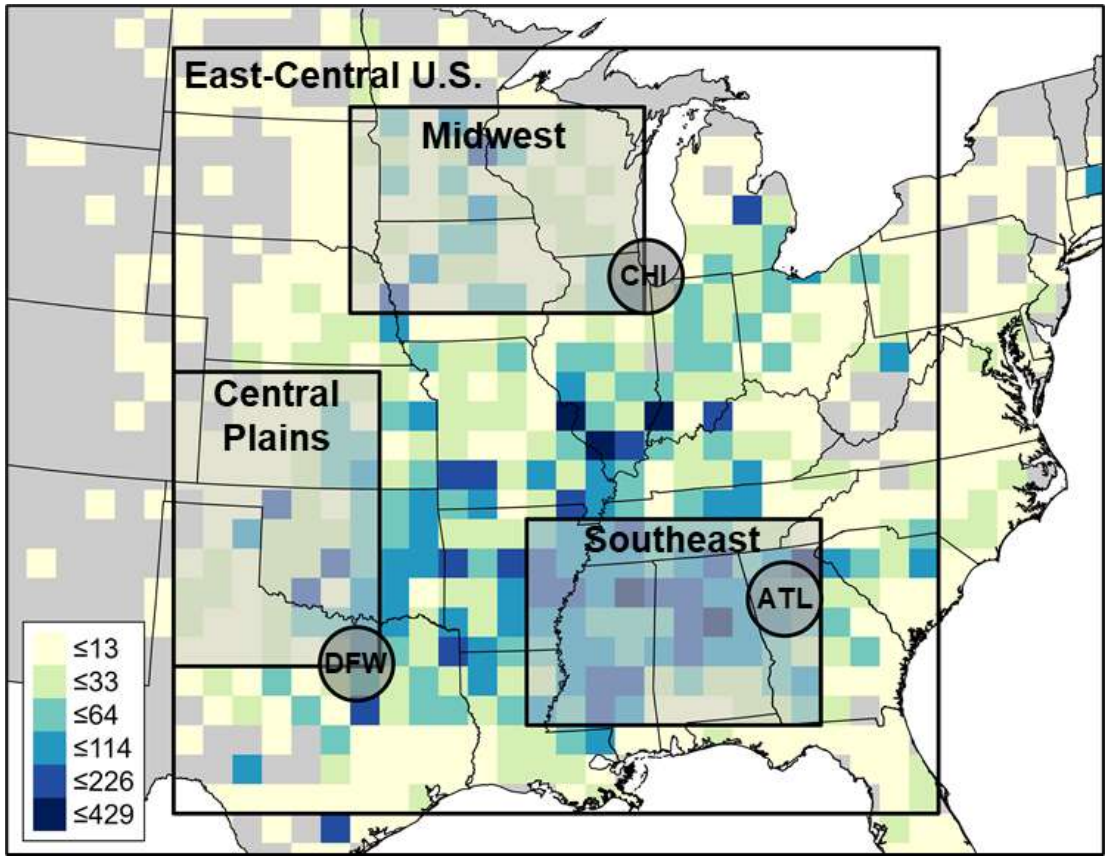




90th percentile nocturnal tornado impacts in the **Southeast** are more than ***2x greater*** than the other regions

Daytime-Nocturnal Simulations – Metropolitan Regions

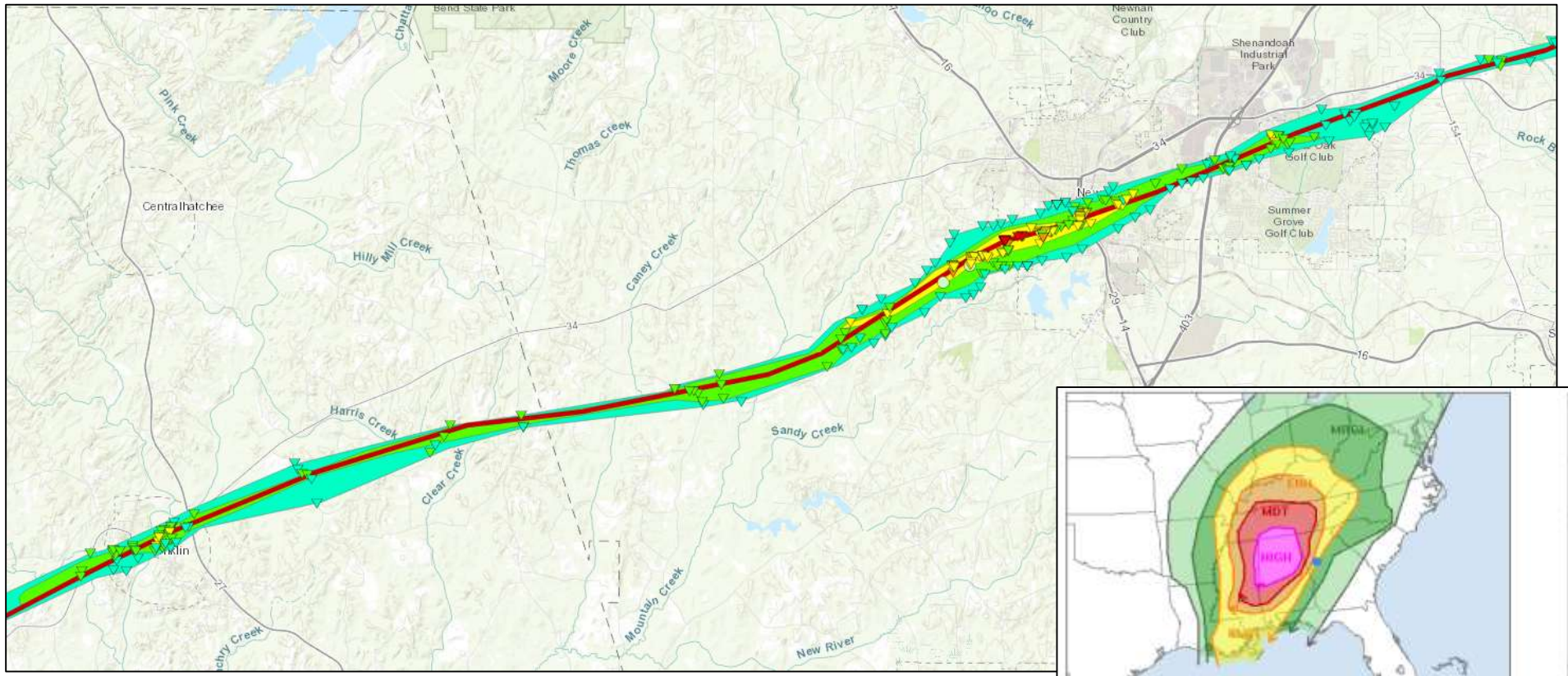




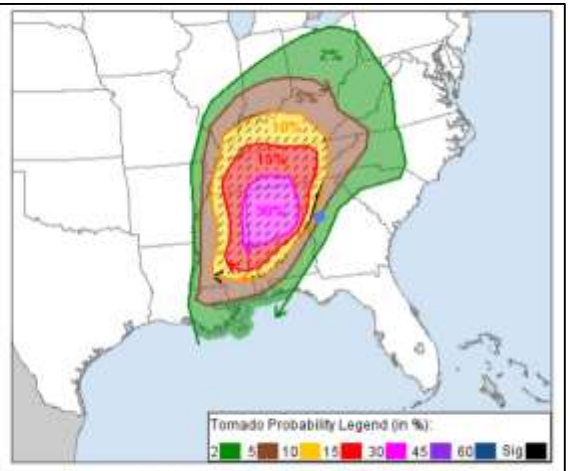
Atlanta –> Nocturnal 90th percentile impacts ***2x greater*** than daytime impacts

Newnan, GA EF4 Tornado

- No fatalities!
  - Strange, odd… frankly we were lucky



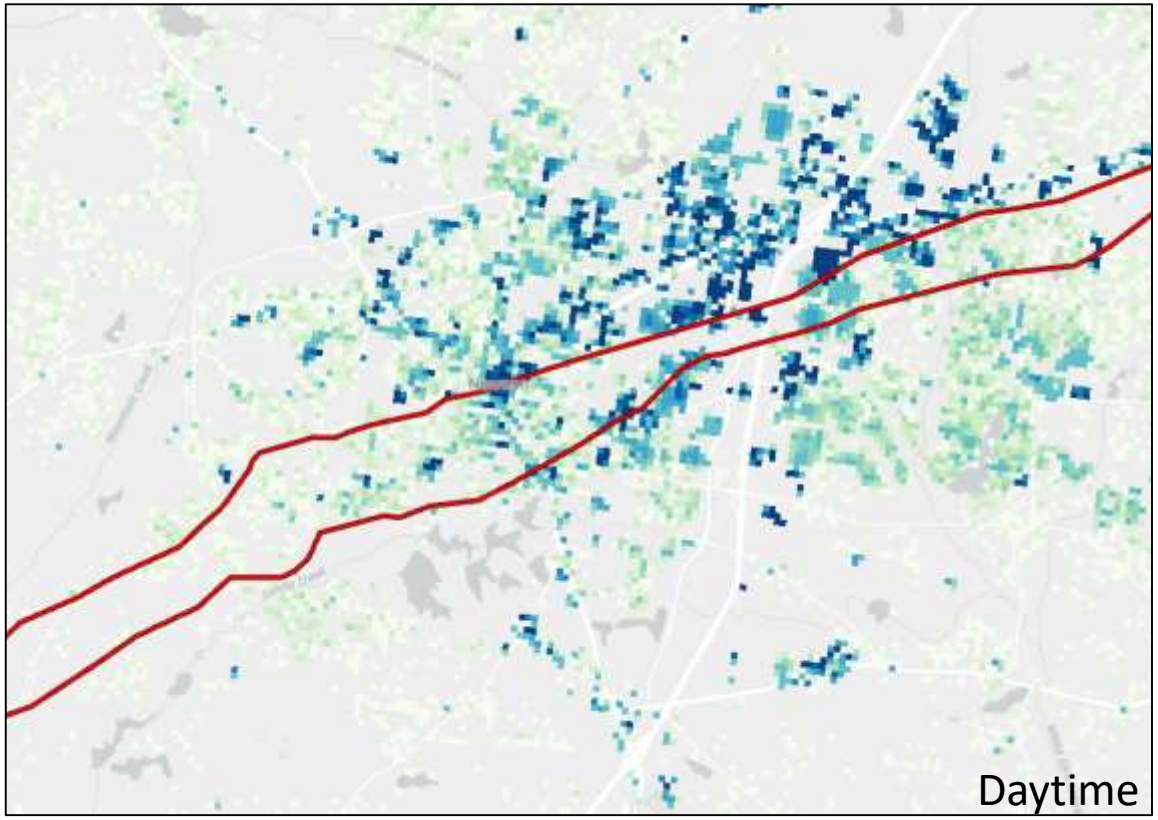
SPC Day 1 Categorical Outlook

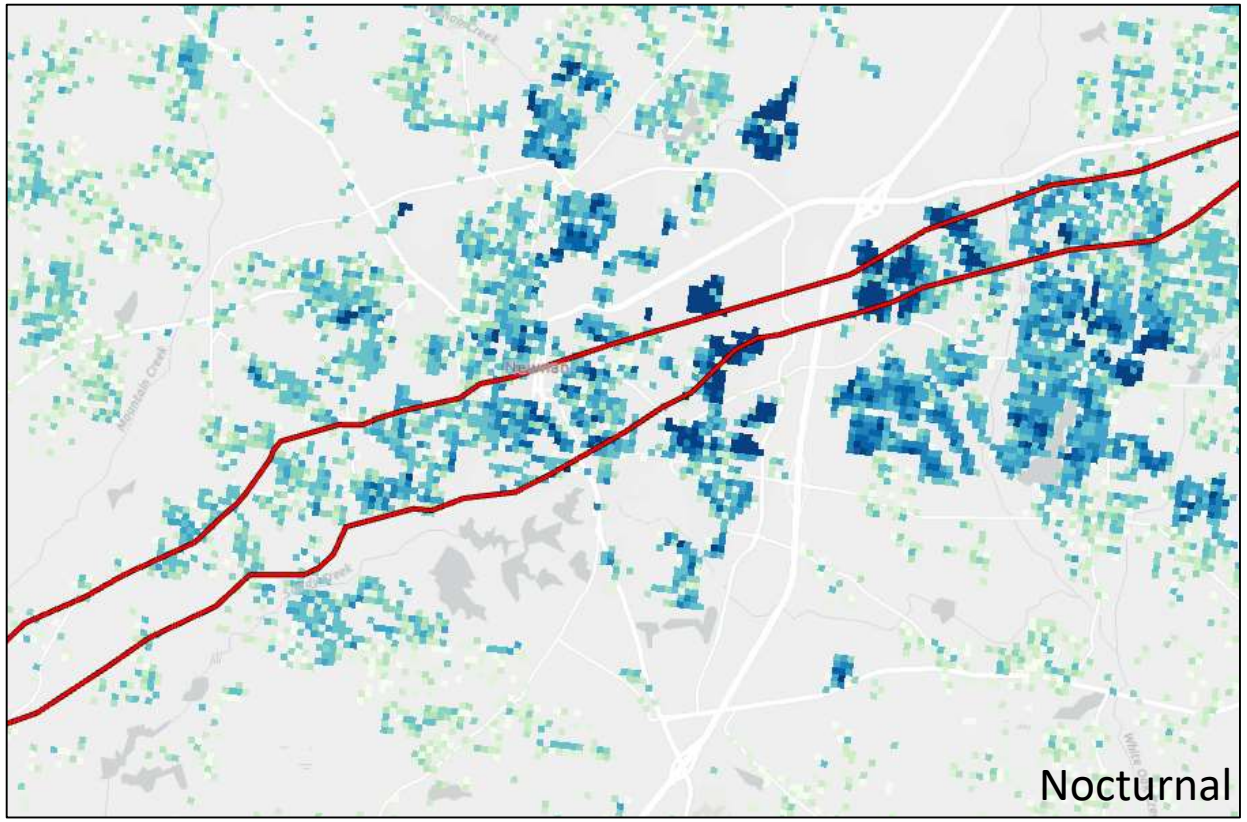


SPC Day 1 Tornado Probability

Exception to the Rule?

- Daytime ~ 9,300 People Exposed
- Nocturnal ~ 11,800 People Exposed





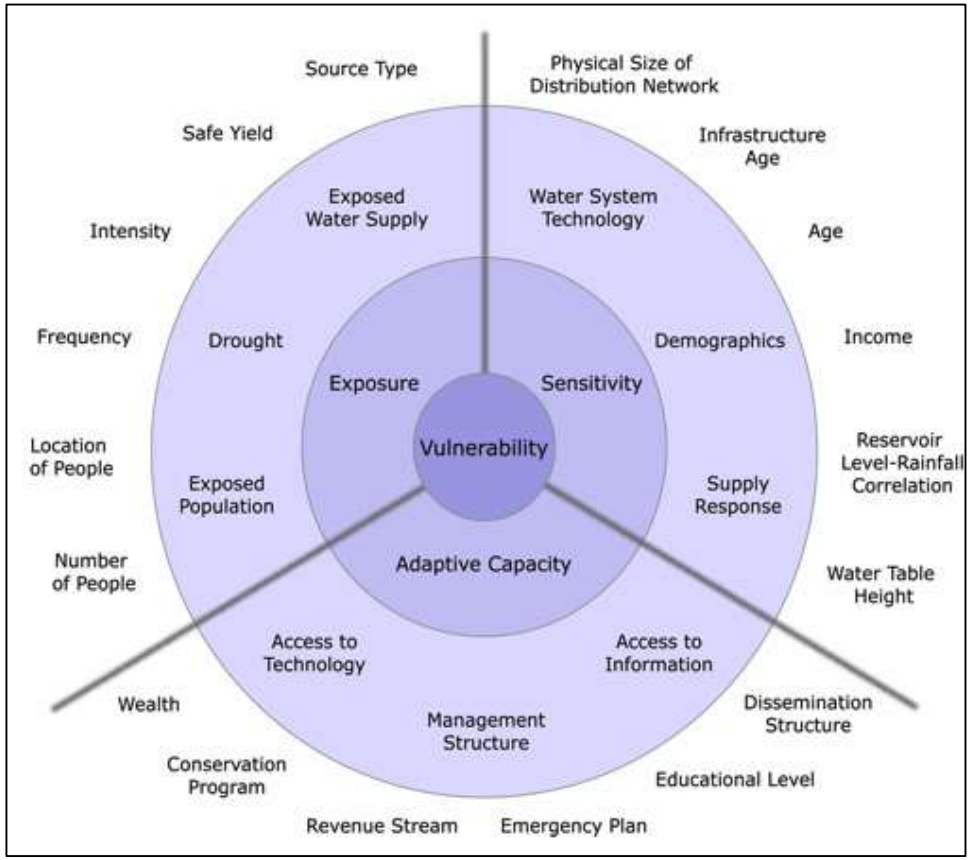
My guess….

- Very few mobile/manufactured homes in the path of the tornado
  - Where there were MHs, the tornado was weaker (<EF2)
- EF4 damage was limited to smaller areas
- Large portion of the tornado damage path through forested areas with lack of homes
  - 75% of damage path area was undeveloped
- Exposure was relatively lower in areas with high social vulnerability
- EF4 damage homes seem to be built recently (Construction quality?)

More of an exception to the rule

So now what?

- Local emergency managers should be aware of differences in exposure in daytime vs. nighttime → influences preparedness, response, and recovery
- NWS forecasters should continue to highlight the importance of overnight events, especially in the Mid-South → NOAA Weather Radio!



Disaster ~~Recovery~~
Resiliency

Thank You

Questions?

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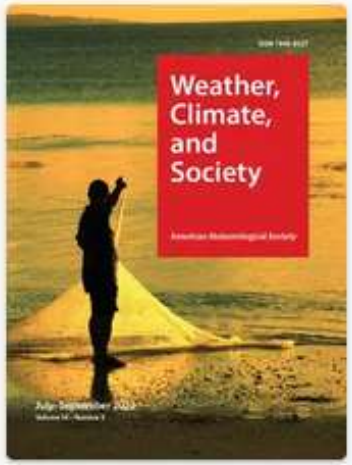

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