Do We Know Our Own Tornado Season? A Psychological Investigation of Tornado Risk Perception in the Southeast U.S.

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Zoom Link (12/12/2020 8:00 – 9:15am): https://cmu.zoom.us/j/95936031592?pwd=TXA5eHMyQTVmdkkveVFYZE1aOWhXZz09

Abstract

We investigated perceptions of tornado risk, operationalized as judgments of tornado likelihoods. We present here a subset of the findings reported in Broomell et al. (2020) summarizing judgments of tornado likelihood associated with different seasons and storm system types. We surveyed a representative sample of Southeast residents and a sample of tornado experts. We find that public judgments deviated from the experts in systematic ways, revealing potential knowledge gaps among the public.

Introduction

- We investigate residents' tornado risk perceptions focusing on likelihood judgments in the Southeast U.S. (SE), which differs from the Great Plains.

Meteorological Data

- The Great Plains
  - Single peaked season in summer.
  - Mainly isolated supercell tornadoes.
- The Southeast
  - Double peaked season in late spring and winter.
  - Tornadoes associated with many different storm systems.

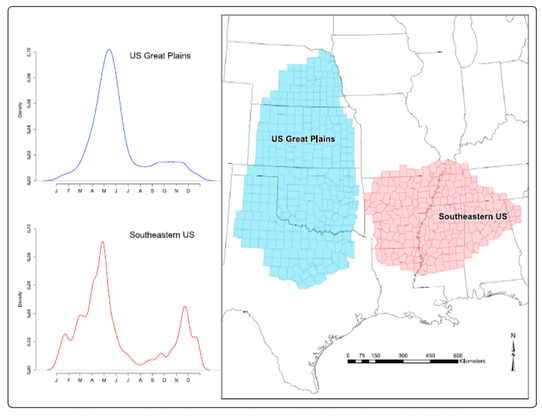


Figure 1 in Long, Stoy, & Gerken (2018)

Cognitive-ecological theory

- The theory of global-local incompatibility (Broomell, 2020) predicts highly variable and inaccurate judgments of tornado likelihood due to highly variable and non-representative personal experiences.

Research Questions

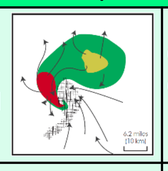
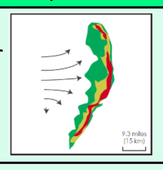
- How does the public judge the tornado likelihood?
- How do these judgments compare with tornado experts' judgments?

Methods

- We surveyed:
  - 33 meteorologists with expertise in tornadoes, *judging the Southeast*
  - 1050 Residents of the Southeast, *judging where they live*
- The ***dependent variables*** are judgments of tornado likelihood for:
  - tornado season (Composition of Spring, Summer, Fall, Winter)
  - storm system type (Composition of Supercell, QLCS, Cyclone)

Example Elicitation Prompt for Storm System Type:

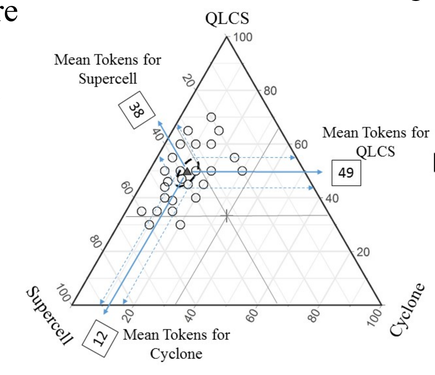
Suppose that there were a total of 100 tornadoes where you live produced by these three storm systems. How many tornadoes do you believe were produced by each of the following types of storm system, given your expectations about tornadoes?

Storm System	Isolated Supercell 	Quasi-linear Convective System 	Tropical Cyclone 
Number of Tornadoes	X_1	X_2	X_3

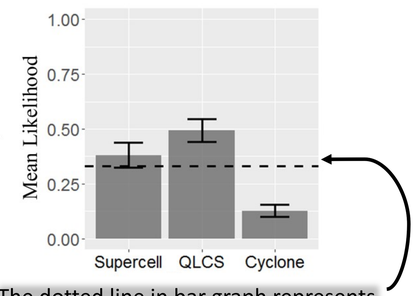
Displaying Compositional Variables

- Compositions are a collection of measures with a constant sum.
- X_1, X_2, and X_3 represent likelihoods that sum to 1.

Ternary plot of mean expert likelihood judgments for storm type. Dotted circle is 95% confidence region



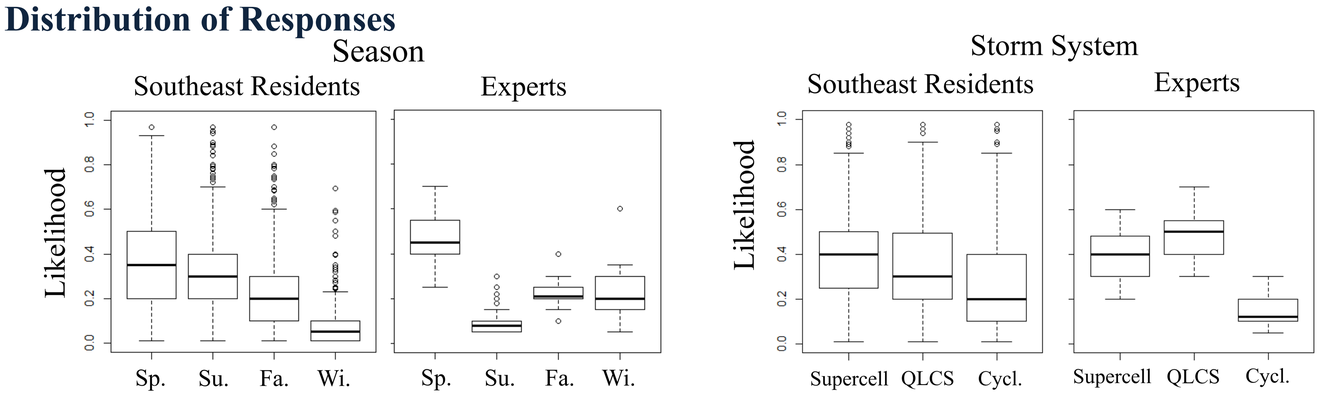
We display compositional means in a bar graph. Error bars represent 95% confidence



The dotted line in bar graph represents uniform likelihood for all outcomes.

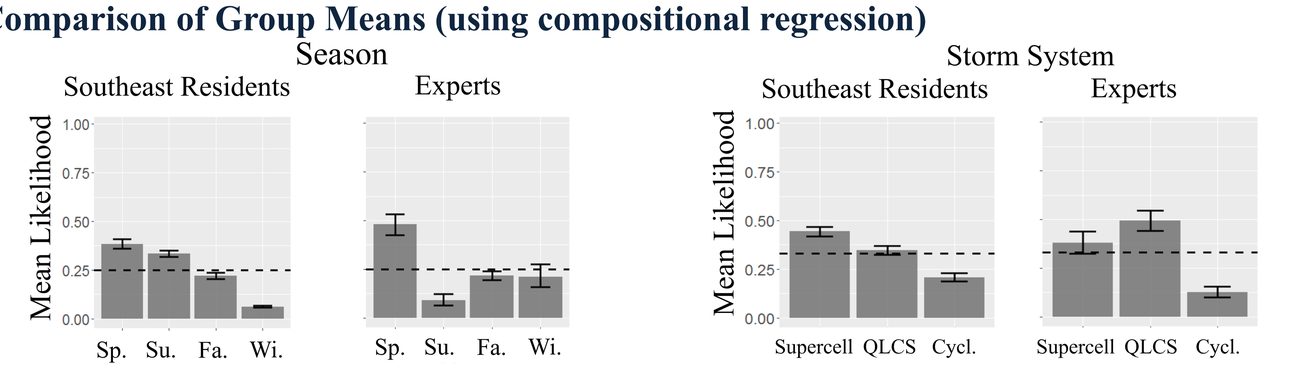
Results

Distribution of Responses



- There is large variance in the Southeast resident judgments of likelihood.

Comparison of Group Means (using compositional regression)



- Relative to experts, southeast residents significantly overestimate summer tornadoes, and underestimate winter and QLCS tornadoes.

Regression Analysis of Distance Between Public and Expert Samples

- Dependent Variable: The compositional distance between each Southeastern resident's judgment and the mean expert judgment.

	Season Distance		Storm System Distance	
Design Variables	Est.	Std. Err.	Est.	Std. Err.
Intercept	1.26	0.04	1.11	0.04
Covariates and Demographics				
Birth Year	0.01	0.01	0.00	0.01
Sex (1=Female)	-0.01	0.02	-0.01	0.02
Education	-0.03*	0.01	-0.01	0.01
Children (1=Yes/No)	-0.03	0.02	0.00	0.02
Tenure (years)	0.00	0.01	0.00	0.01
Look at Radar (1=Yes/No)	0.02	0.03	-0.05	0.03
Know Location (1=Yes/No)	0.00	0.03	-0.01	0.03
Political Affil. (low=Liberal)	0.00	0.01	0.02*	0.01
Proportion Explained Variance	0.06		0.01	

Discussion

The Role of Psychology in Hazard Mitigation

- Global-local incompatibility suggests that local environments may play a large role in likelihood judgment for tornadoes.
- We modelled tornado judgment using this framework, revealing highly variable risk perceptions that may be, on average, mis-calibrated for tornado warnings.

Implications for Risk Perception and Communication

- Risk communications may not agree with local observations.
- SE citizens may not be prepared for issues associated with winter tornadoes.
- Demographics are not strongly related to judgments differing from experts

Future work should investigate how these judgments effect protective decision-making.

References & Acknowledgements

Broomell, S. B., Wong-Parodi, G., Morss, R. E., & Demuth, J. L. (2020). Do We Know Our Own Tornado Season? A Psychological Investigation of Perceived Tornado Likelihood in the Southeast United States. *Weather, Climate, and Society*, *12*(4), 771-788. https://journals.ametsoc.org/wcas/article-abstract/12/4/771/354456/Do-We-Know-Our-Own-Tornado-Season-A-Psychological?redirectedFrom=fulltext

Funded by the National Oceanic and Atmospheric Administration under award number: NA160AR4590218.