A Detailed Climatology of Central North Carolina Tornadoes

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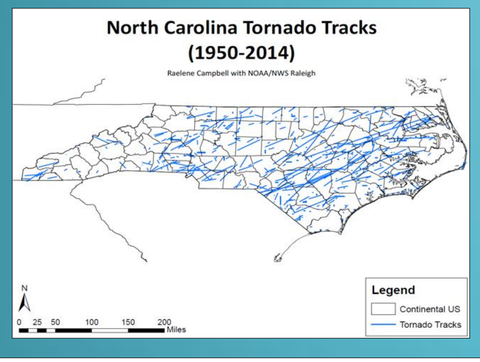
Motivation

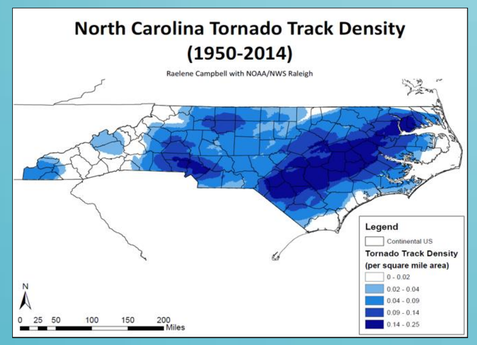


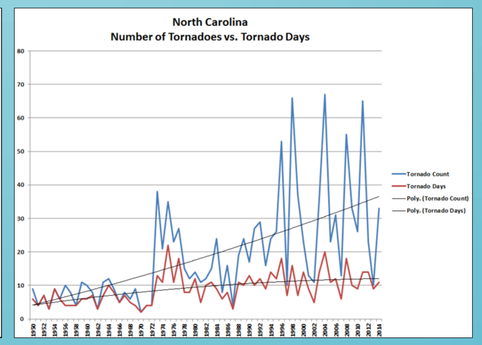
- Experience shows that the occurrence, frequency, and intensity of tornadoes varies across North Carolina (NC).
- A better understanding of the occurrence, distribution, and impact of tornadoes should lead to improved preparedness activities as well as better watches and warnings.

Methodology

- Gathered tornado events from 1950-2014 from the Storm Prediction Center (Schaefer and Edwards, 1999) and the National Centers for Environmental Information.
- Quality controlled the data for errors, inconsistencies and missed events.
- Categorized events based on the time of day the tornado occurred (following Ashley et al. 2008):
  - Day – anytime between sunrise and sunset LST
  - Evening - anytime between sunset and midnight LST
  - Overnight – anytime between midnight LST and sunrise
- Any tornado that occurred in the evening or overnight was considered nocturnal.
- A significant or strong tornado was an event rated as EF2 or greater.
- Utilized ArcMap 10.3 for spatial analysis of data
- Also used Excel, GR2Analyst, and Hurrevac.

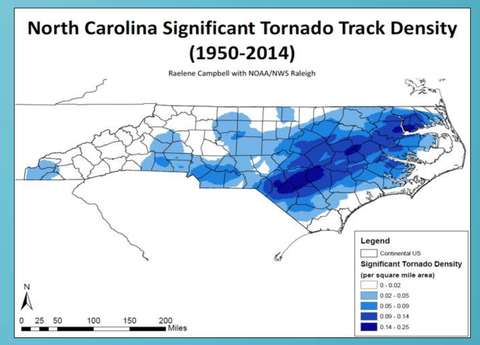
North Carolina Tornadoes

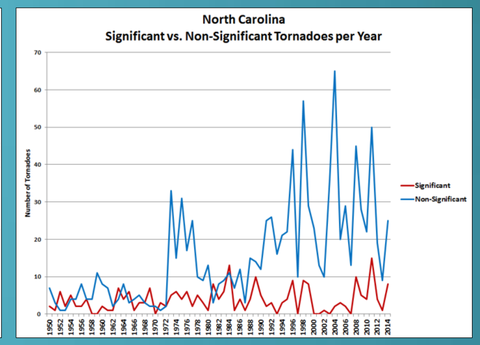




- 1,247 tornadoes and 595 tornado days were observed across NC from 1950-2014.
- Tornado density is greatest in the Coastal Plain & Sandhills with a secondary max in the Western Piedmont
- The number of tornadoes observed has increased significantly in recent decades. This is known as tornado inflation which likely results from improved observations and communication.

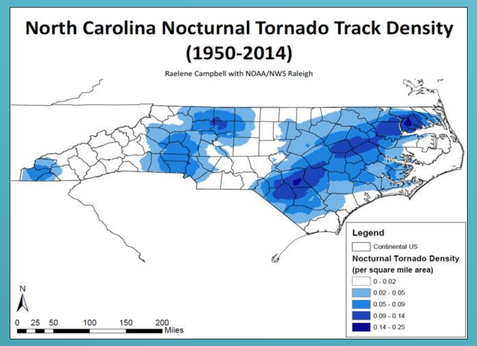
Significant Tornadoes

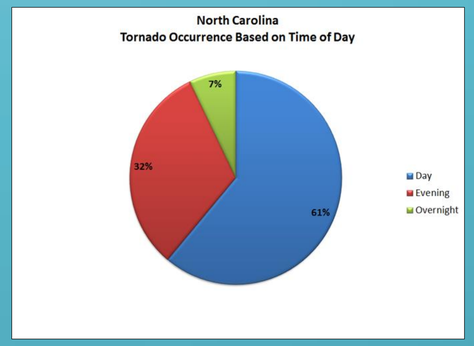




- Significant tornadoes most frequently occur in the Sandhills and Coastal plain of eastern NC.
- While significant tornadoes account for only 19.6% of all NC tornadoes, they are responsible for 96.9% of all tornado related fatalities.
- The number of significant tornadoes has remained steady while non-significant tornadoes has tripled.

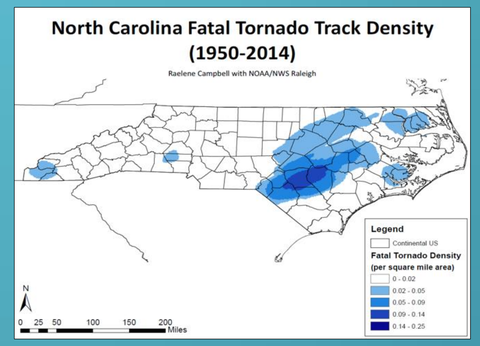
Nocturnal Tornadoes

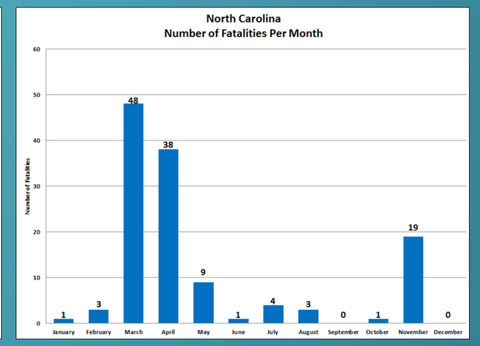




- While only 38.9% of all NC tornadoes are nocturnal, they are responsible for 74.2% of all tornado fatalities
- The Western Piedmont has a disproportionate number of nocturnal tornadoes.
- Many nocturnal tornadoes are also significant tornadoes.

Fatal Tornadoes





- There have been 127 deaths directly related to tornadoes in NC since 1950.
- The highest density of fatal tornadoes occur across the Sandhills and Coastal Plain of eastern NC.
- Most fatalities occur in the spring months (March & April) with a secondary maximum in November.

Conclusions

- The Coastal Plain and Sandhills of eastern NC experience the greatest number and the strongest tornadoes with a secondary frequency maximum across the Western Piedmont.
- The fatality risks associated with tornadoes in NC are disproportionately large from significant and nocturnal tornadoes and during the months of March, April, and November.

Future Work

- Communicate results with emergency managers and the public to improve tornado preparedness.
- Add synoptic and mesoscale patterns and parameters associated with each tornado to categorize events further (high shear low CAPE, EML, etc.)
- Examine radar data to categorize tornadoes by convective mode.

Selected References

- Ashley, W.S., A.J. Krmenec, and R. Schwantes, 2008: Vulnerability due to Nocturnal Tornadoes. *Wea. Forecasting*, **23**, 795–807.
- Locklear, C.B., 2008: A Severe Weather Climatology for the Raleigh, NC County Warning Area. NWS ER Technical Memorandum, 101.
- Schaefer, J. T., and R. Edwards, 1999: The SPC tornado/severe thunderstorm database. Preprints, 11th Conf. Applied Climatology, Dallas, TX, Amer. Meteor. Soc., 215-220.

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