Forecasting and Resilience: Severe Thunderstorms

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Background (Climatology)

- Severe thunderstorms in US-any tornado, hail>=1 inch, winds>=58 mph (50 kts) (SPC)
- Severe thunderstorms anywhere, but particularly between the Rockies and Appalachians
Significant (F2 or greater) Tornado Days Per Century (1921–1995)
Tornado Occurrence (Krocak and Brooks 2020)

Tor days within 25 miles/year

A York, NE  C Lubbock, TX  E Bayou Chene, LA  G Orlando, FL
B Columbus, OH  D Hedley, TX  F Hattiesburg, MS
Diurnal Cycle At Different Times of Year

York, NE

Columbus, OH

Lubbock, TX

Hattiesburg, MS

Orlando, FL

- Probability $\times 10^{-4}$
- Time (UTC)

**Legend**
- Blue: February 15
- Green: May 15
- Pink: August 15
- Brown: November 15
Annual Cycle by Every Hour of the Day

Hedley, TX

Bayou Chene, LA

Total Threat=0.684
Strongly Peaked
Any time
Spread out
Warm season, daytime

A York, NE
B Columbus, OH
C Lubbock, TX
D Hedley, TX
E Bayou Chene, LA
F Hattiesburg, MS
G Orlando, FL
Currently, forecasts begin “Day 8” (SPC)
- >=1 day are for coverage within 25 miles of a point on the day

Watches (SPC)
- Conditions are favorable for storms within area
- ~State-size, 6 hours

Warnings (Local Forecast Office)
- This storm is severe or will be
- 300 sq mi., 45 minutes
SPC Day 1 Outlook and Prelim. Reports Valid: 1200 UTC 04/29/2022 to 1200 UTC 04/30/2022

Tornado Probability Legend (in %):
- 2
- 5
- 10
- 15
- 30
- 45
- 60
- Sig

SPC DAY 1 TORNADO OUTLOOK
ISSUED: 0549Z 04/29/2022
VALID: 1200Z Fri 04/29 - 1200Z Sat 04/30
Preliminary Subjective Verification
NOAA/NWS Storm Prediction Center, Norman, Oklahoma
Tornado Watch # 158 - Valid from 335 PM until 1100 PM CDT

NOAA/NWS/Storm Prediction Center

Updated: 20220429/2041 UTC
Research towards future

- 1-3 months
  - Currently hope for ~February-March in some conditions

- 2-4 weeks “Target of Opportunity skill”

- Probabilistic warnings

- “Useful” forecasts
  - Test products with users (EMs, broadcast, public)
  - Revise
Resilience with forecasts

- Primarily life protection from tornadoes
- Some kinds of property protection from non-tornadic
Tornado resilience

- Life protection comes from knowing safety guidance and getting information to use it

- Better building
  - Can we incentivize better construction (hurricane clips, straps to foundation, in-residence shelters)?
  - Adding ~2% to cost of building dramatically improves life protection and reduces property damage
  - The manufactured house problem
    - Old mobile homes are very dangerous
    - When new manufactured homes fail, tend to fail from ground up
Hail protection

- Mostly property

- Roofing?
  - Better shingles protect to ~golf balls

- Glass (buildings and auto)
How to be resilient

- Understanding of threat occurrence
  - “Peaked” regions probably are easier to get response
  - SPC has tools and we can make those more usable

- Using forecasts
  - Fixed property is hard to protect, obviously
  - Removing vulnerable things from threat

  - Saving lives—protection and building better