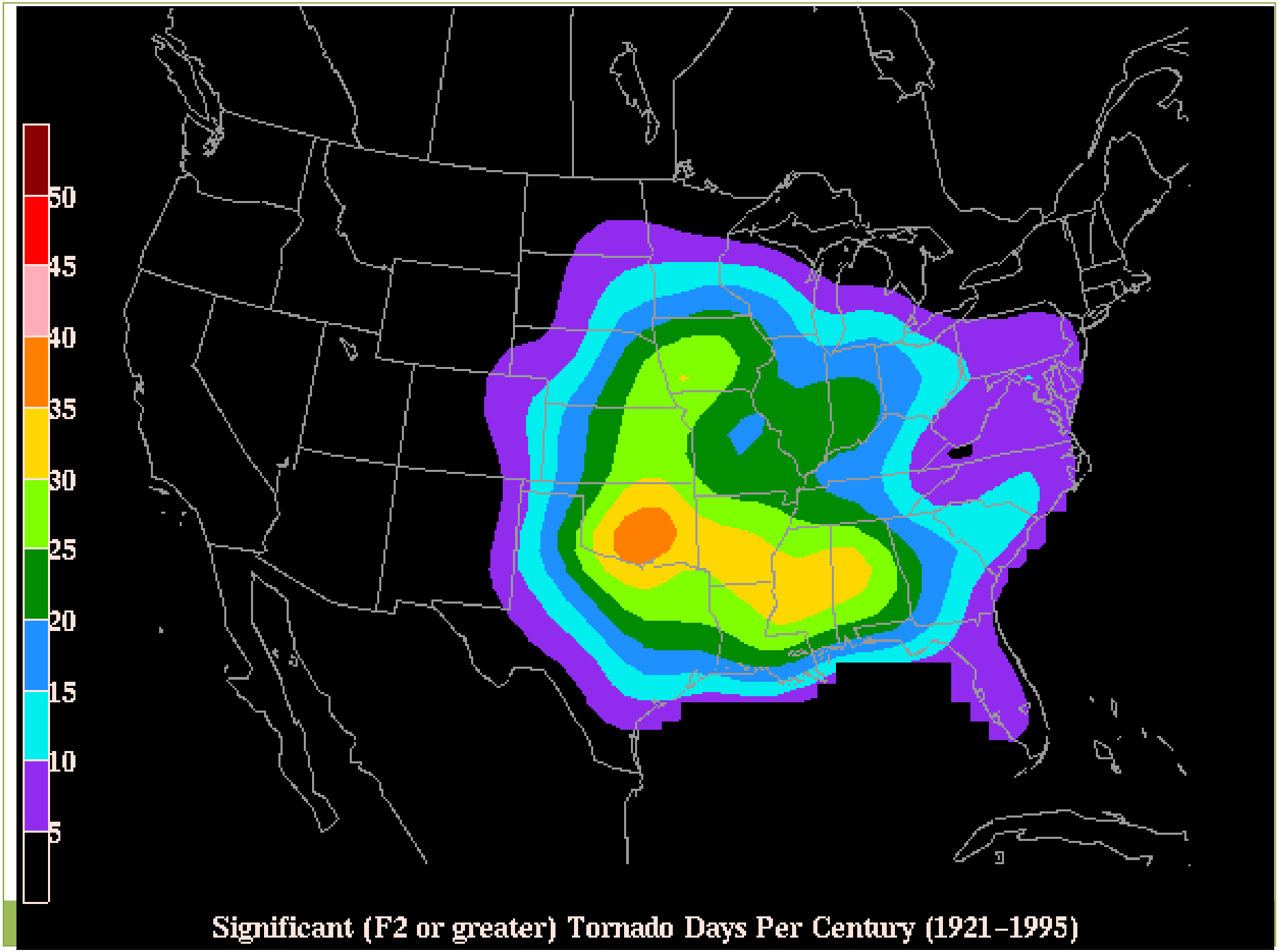
Forecasting and Resilience: Severe Thunderstorms

HAROLD E. BROOKS
NOAA/NATIONAL SEVERE STORMS LABORATORY

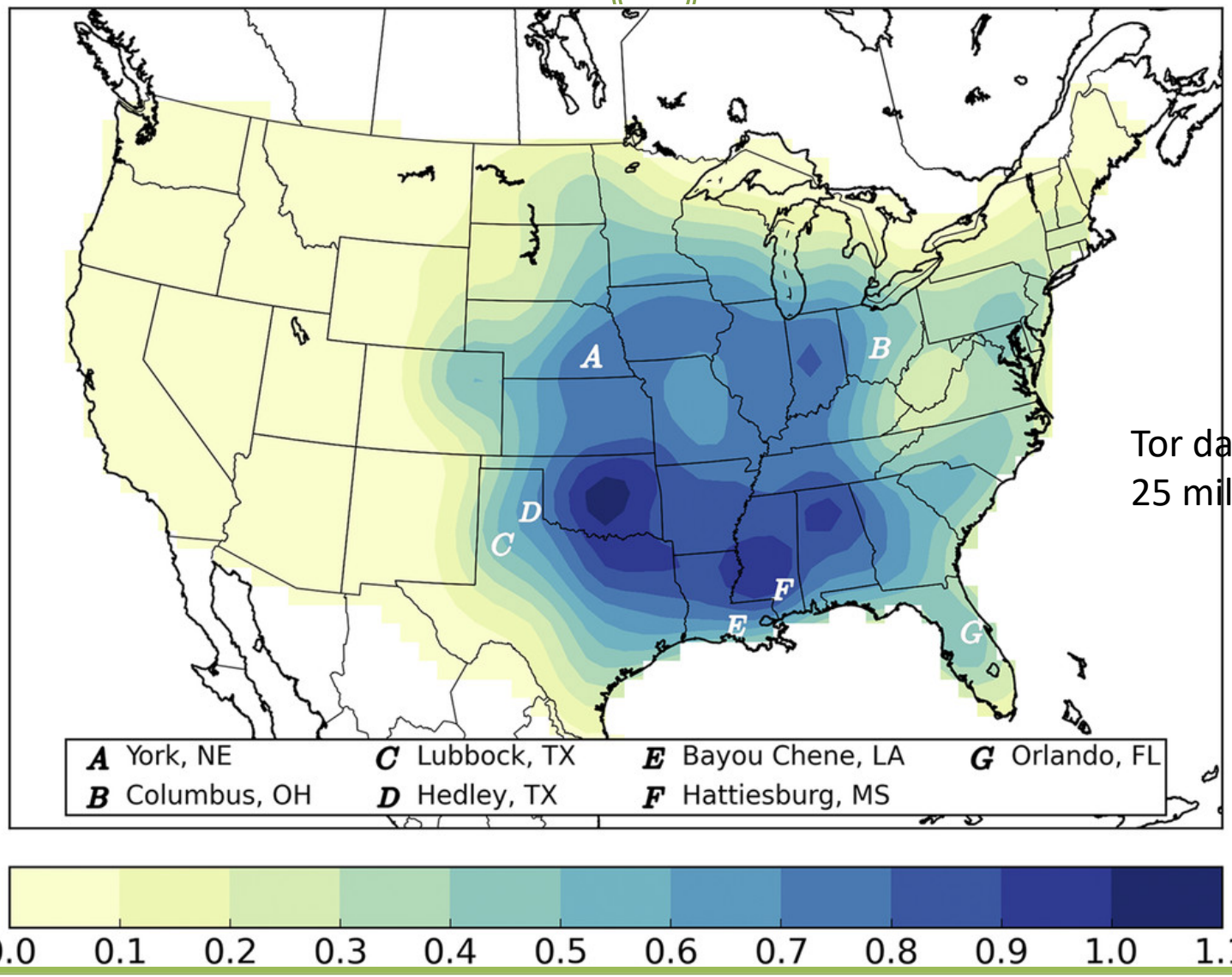
HAROLD.BROOKS@NOAA.GOV
@HEBROOKS87

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

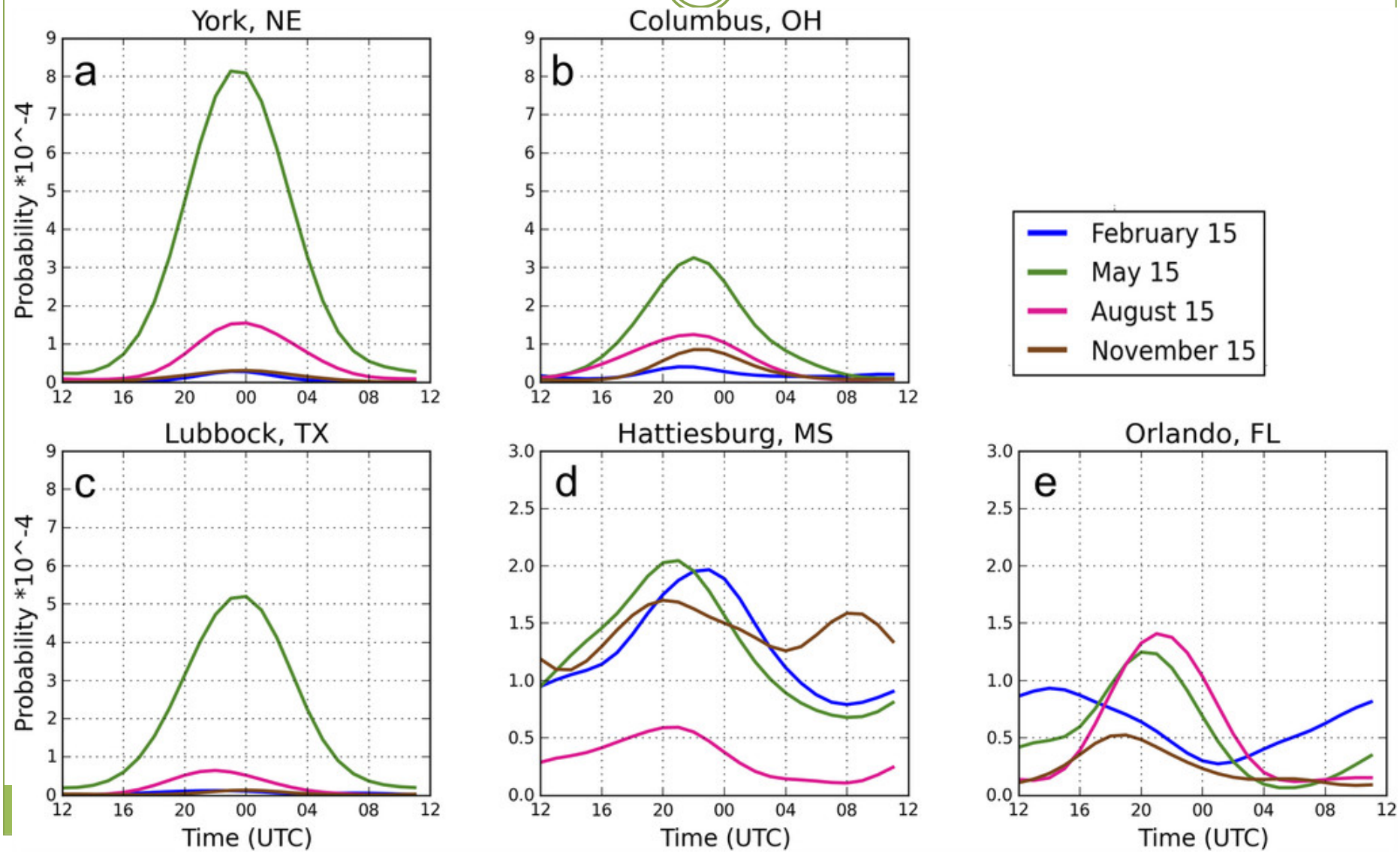

50
45
40
35
30
25
20
15
10
5
Significant (F2 or greater) Tornado Days Per Century (1921–1995)

Tornado Occurrence (Krocak and Brooks 2020)

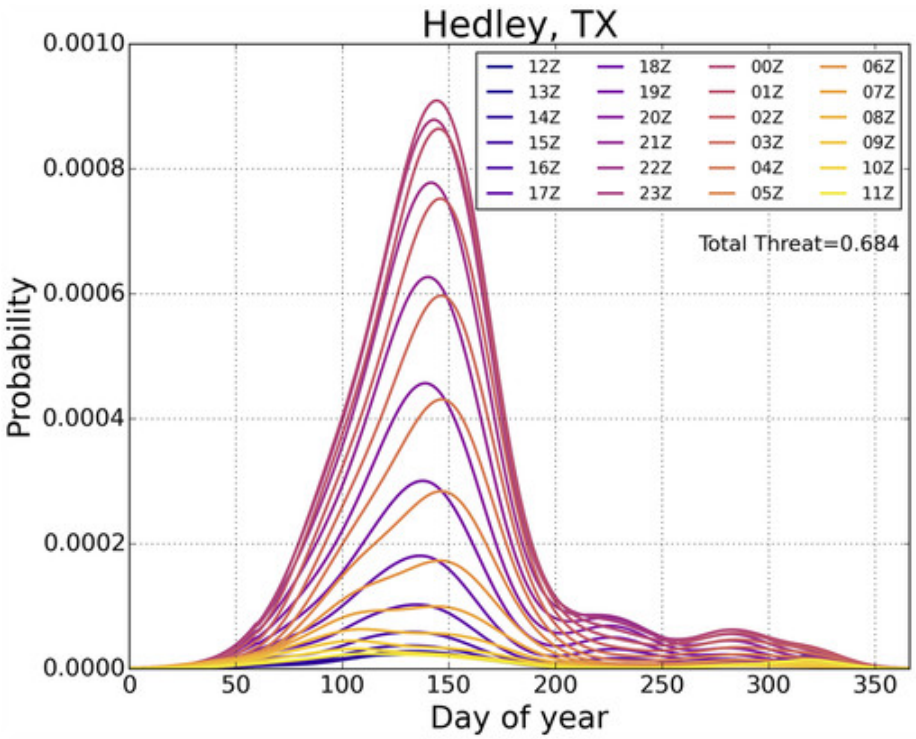


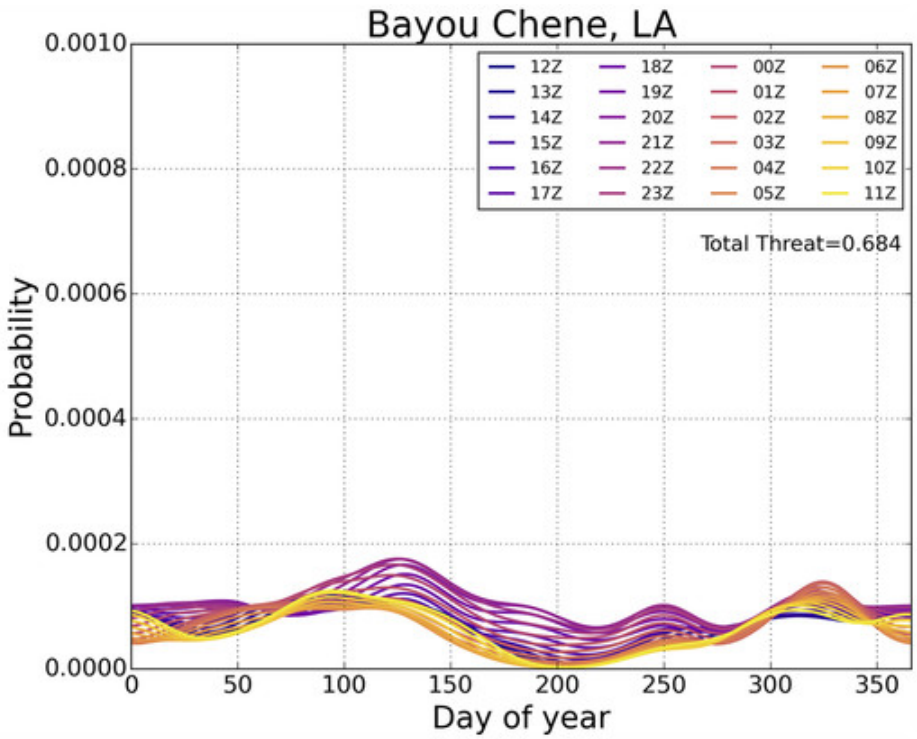
Tor days within 25 miles/year

Diurnal Cycle At Different Times of Year



Annual Cycle by Every Hour of the Day





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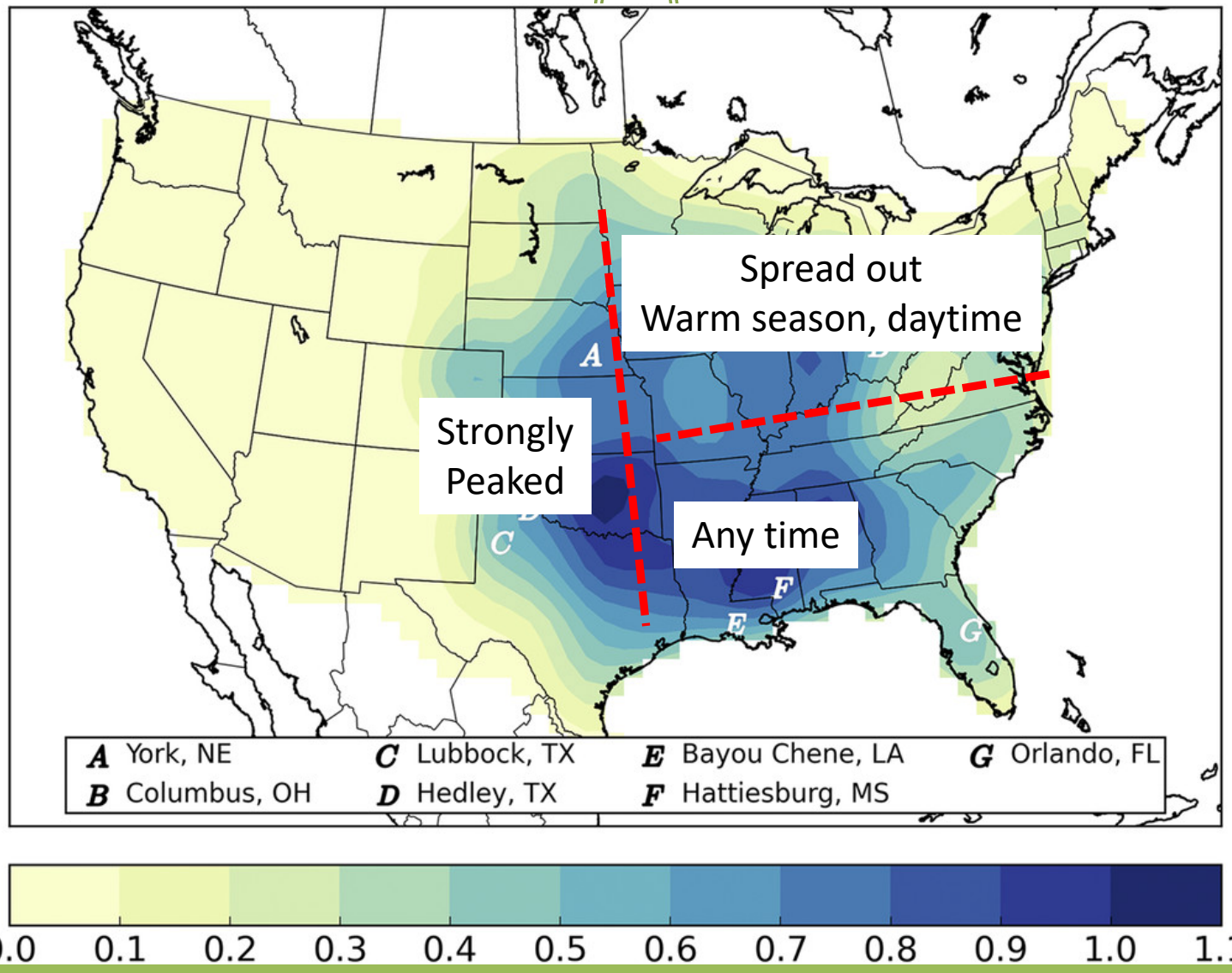
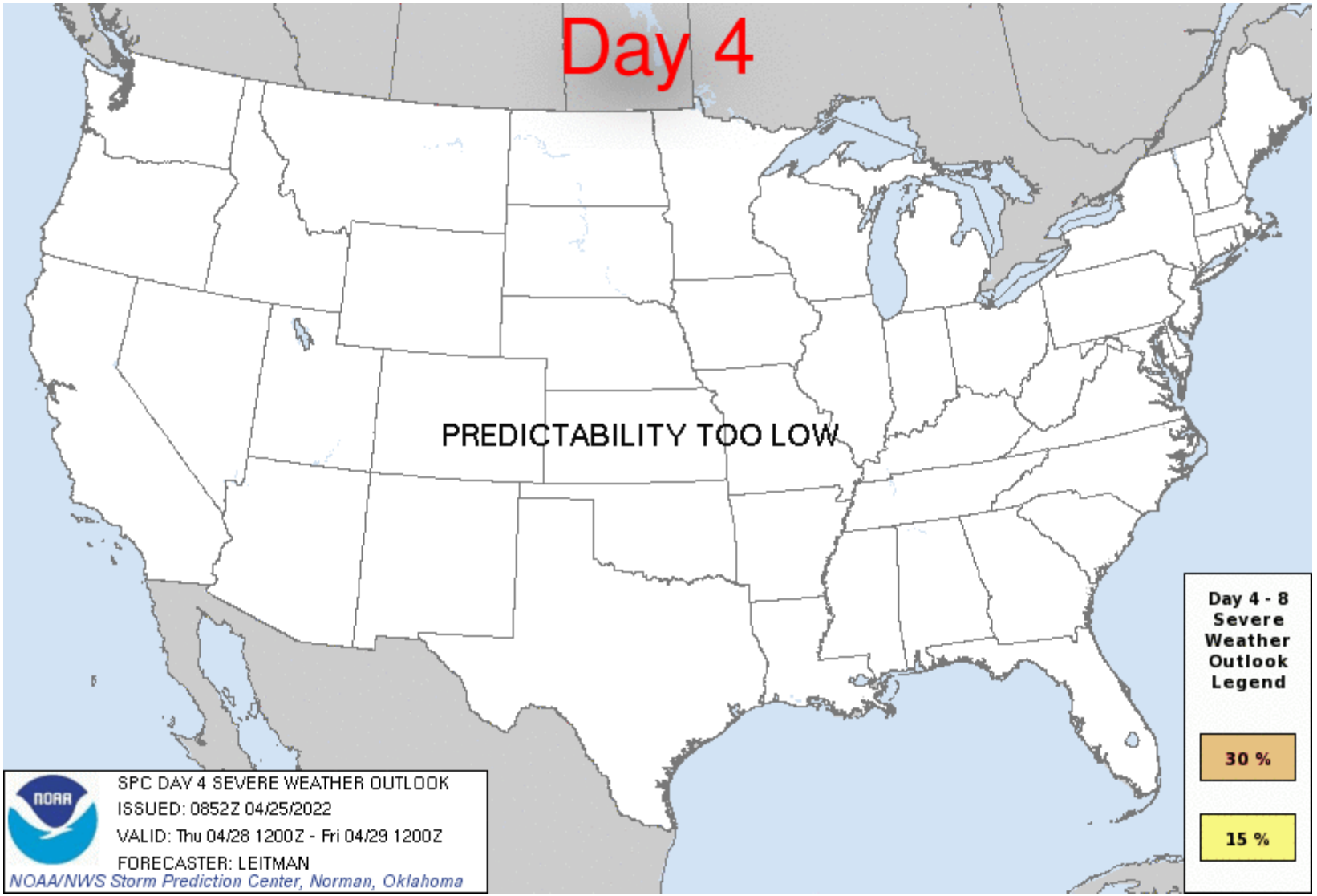
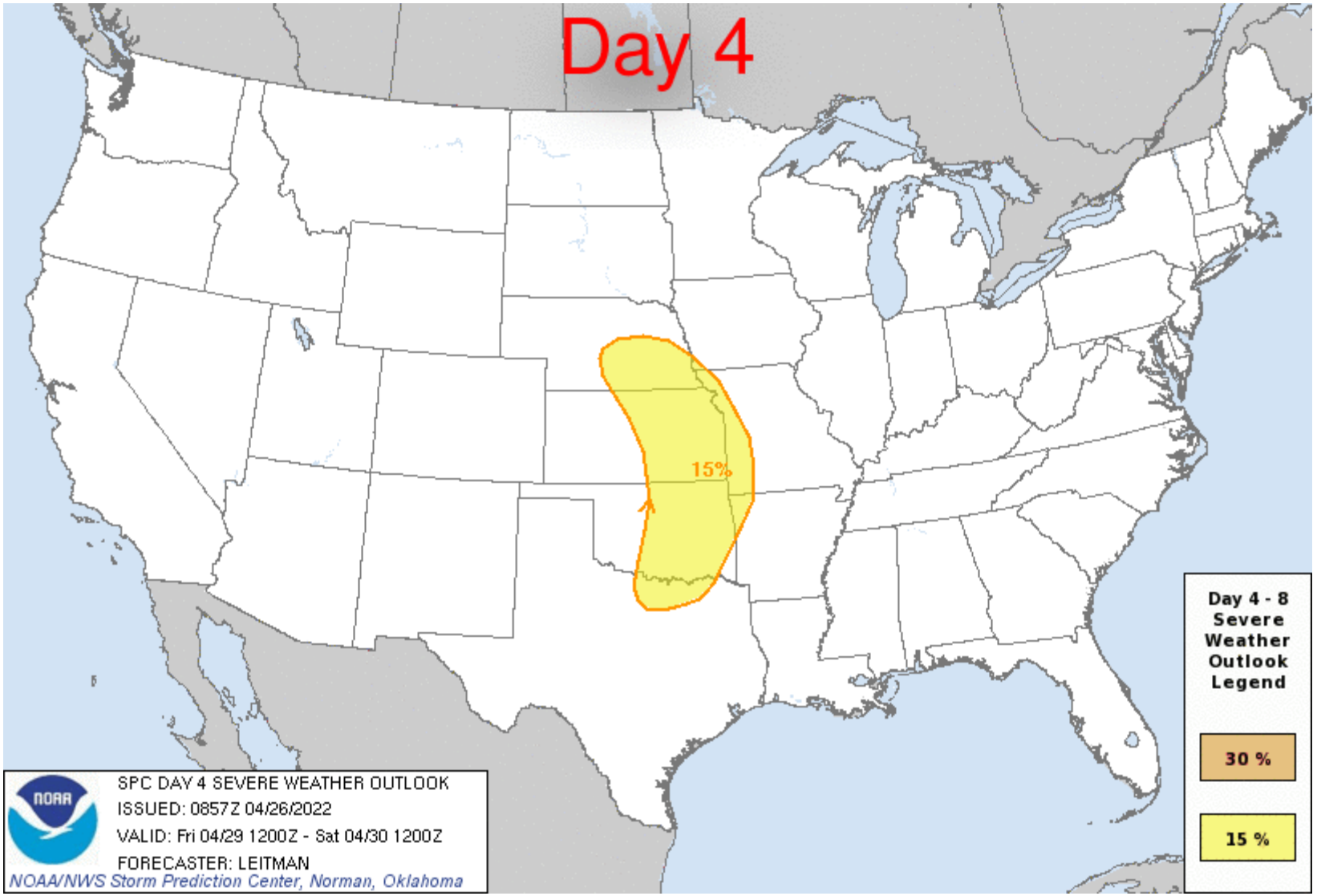
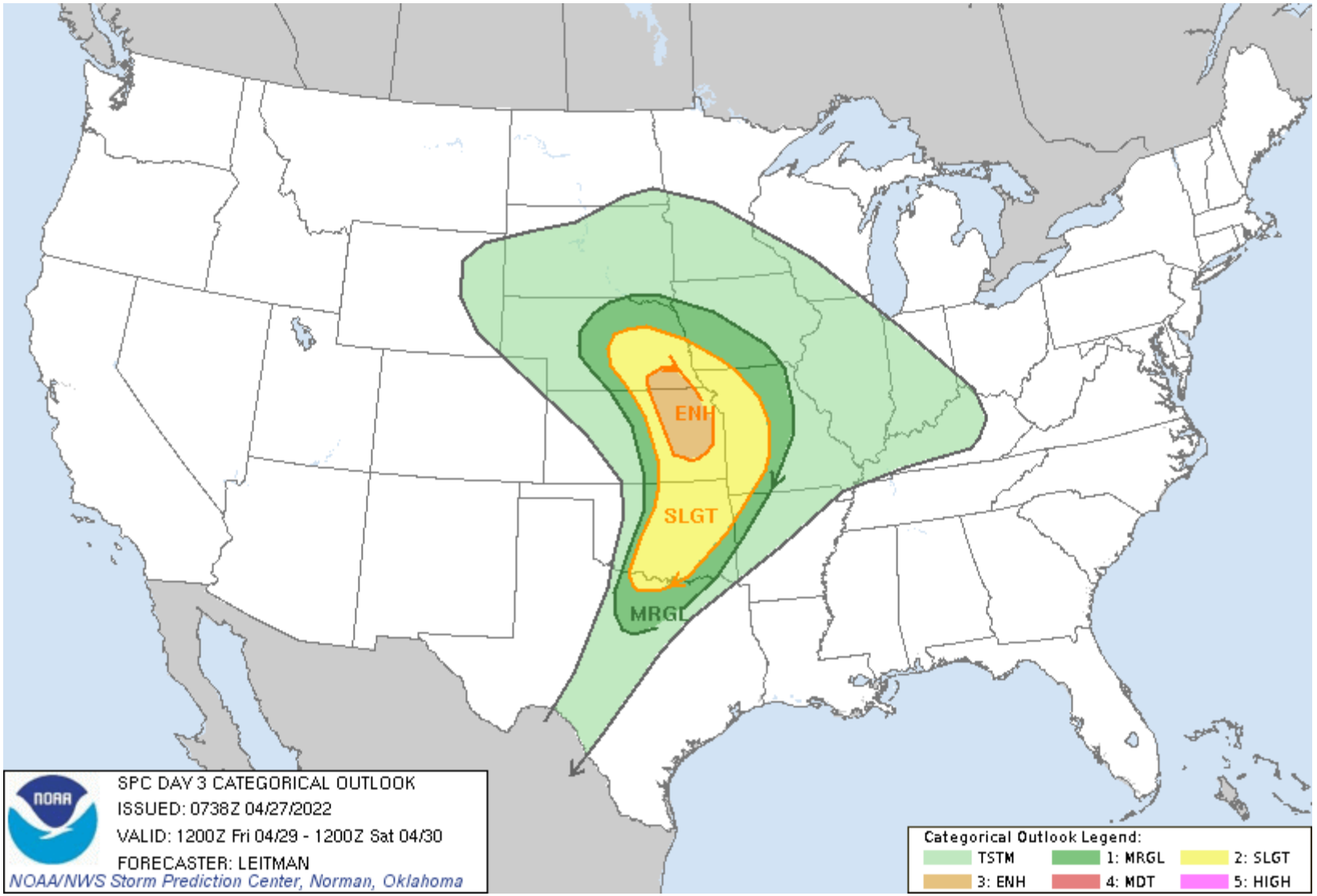


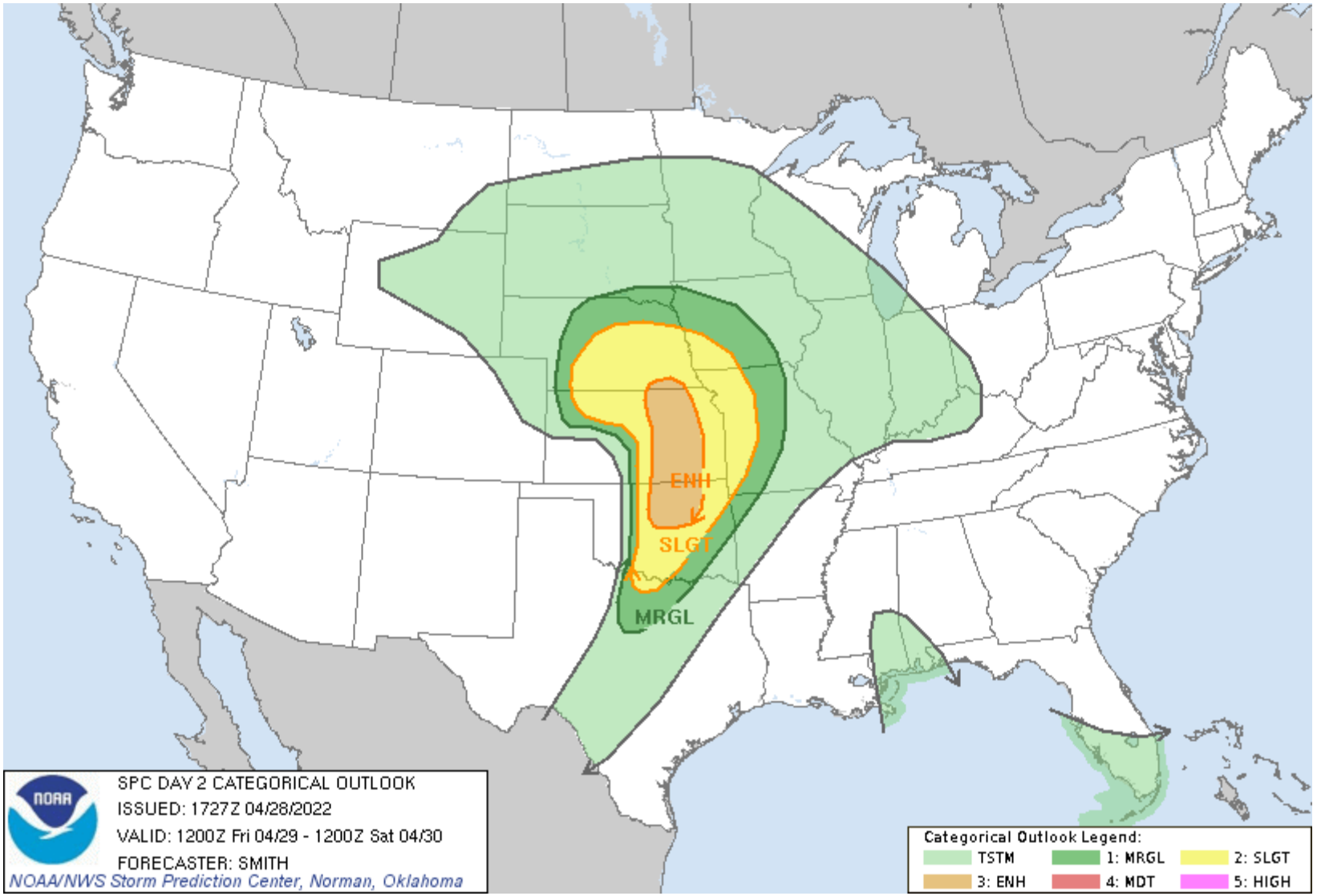
Forecasting Across Time and Space

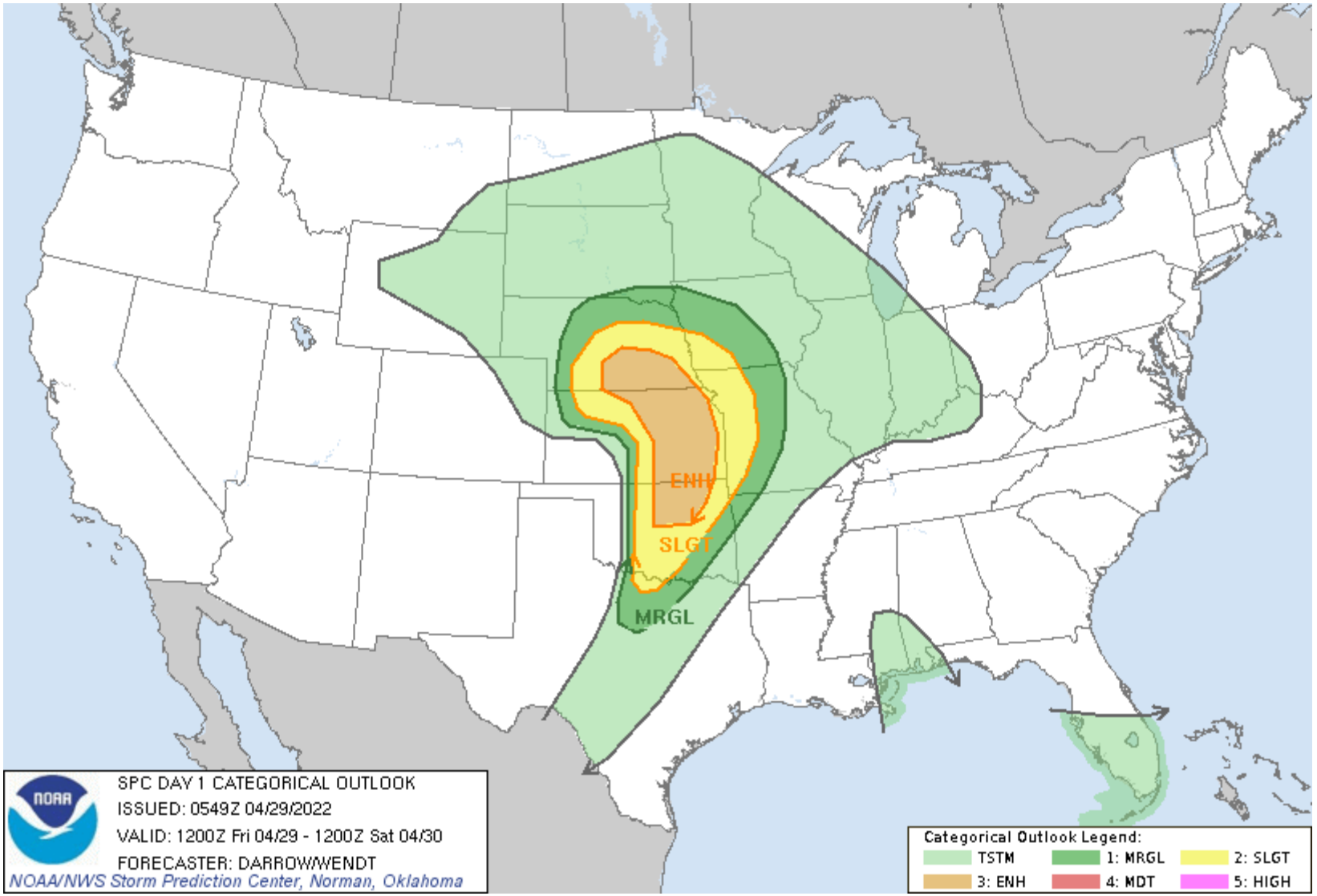
- Currently, forecasts begin “Day 8” (SPC)
  - >=1 day are for coverage within 25 miles of a point on the day
- Watches (SPC)
  - Conditions are favorable for storms within area
  - ~State-size, 6 hours
- Warnings (Local Forecast Office)
  - This storm is severe or will be
  - 300 sq mi., 45 minutes

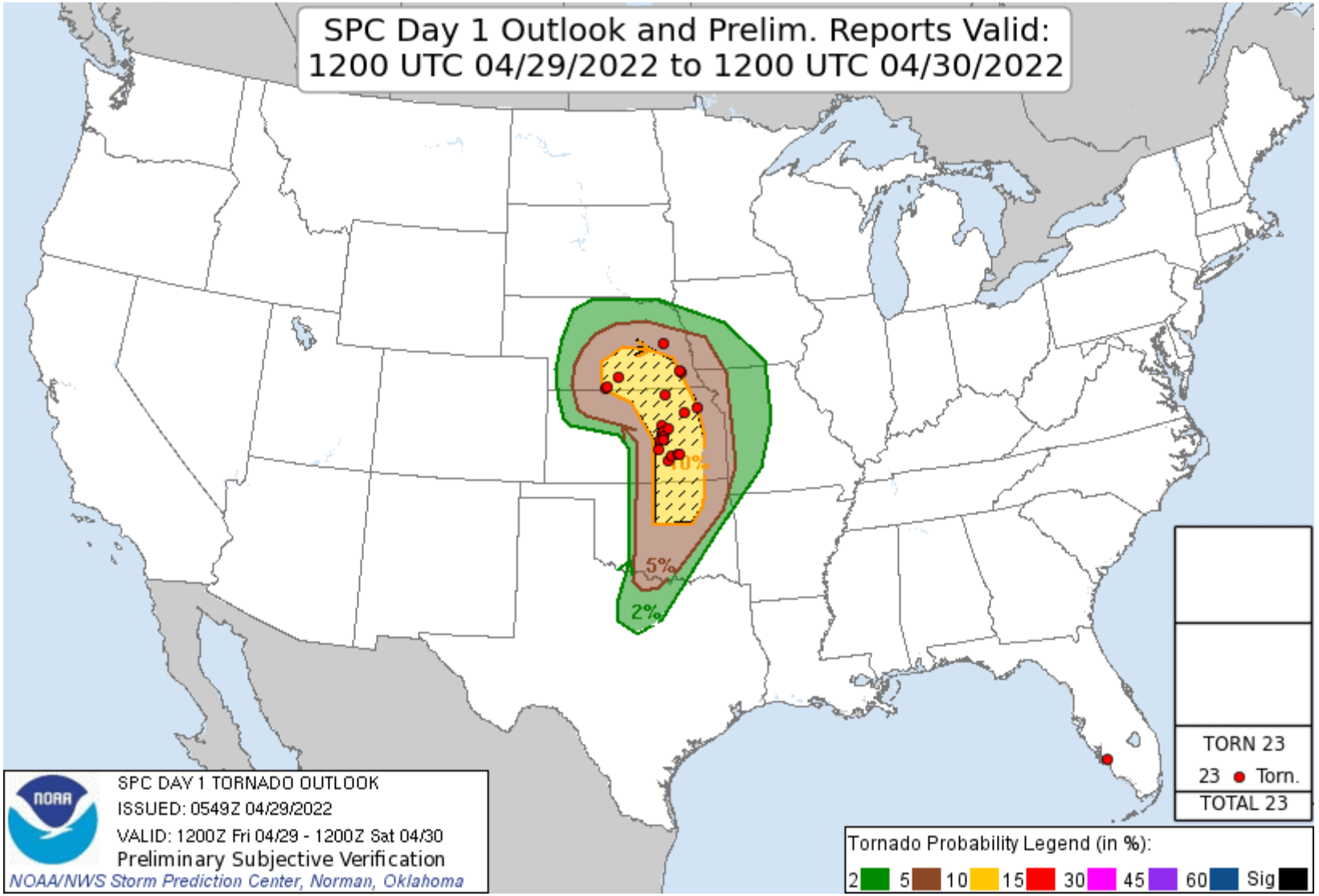

Day 4
PREDICTABILITY TOO LOW
Day 4 - 8 Severe Weather Outlook Legend
30 %
15 %
SPC DAY 4 SEVERE WEATHER OUTLOOK
ISSUED: 0852Z 04/25/2022
VALID: Thu 04/28 1200Z - Fri 04/29 1200Z
FORECASTER: LEITMAN
NOAA/NWS Storm Prediction Center, Norman, Oklahoma

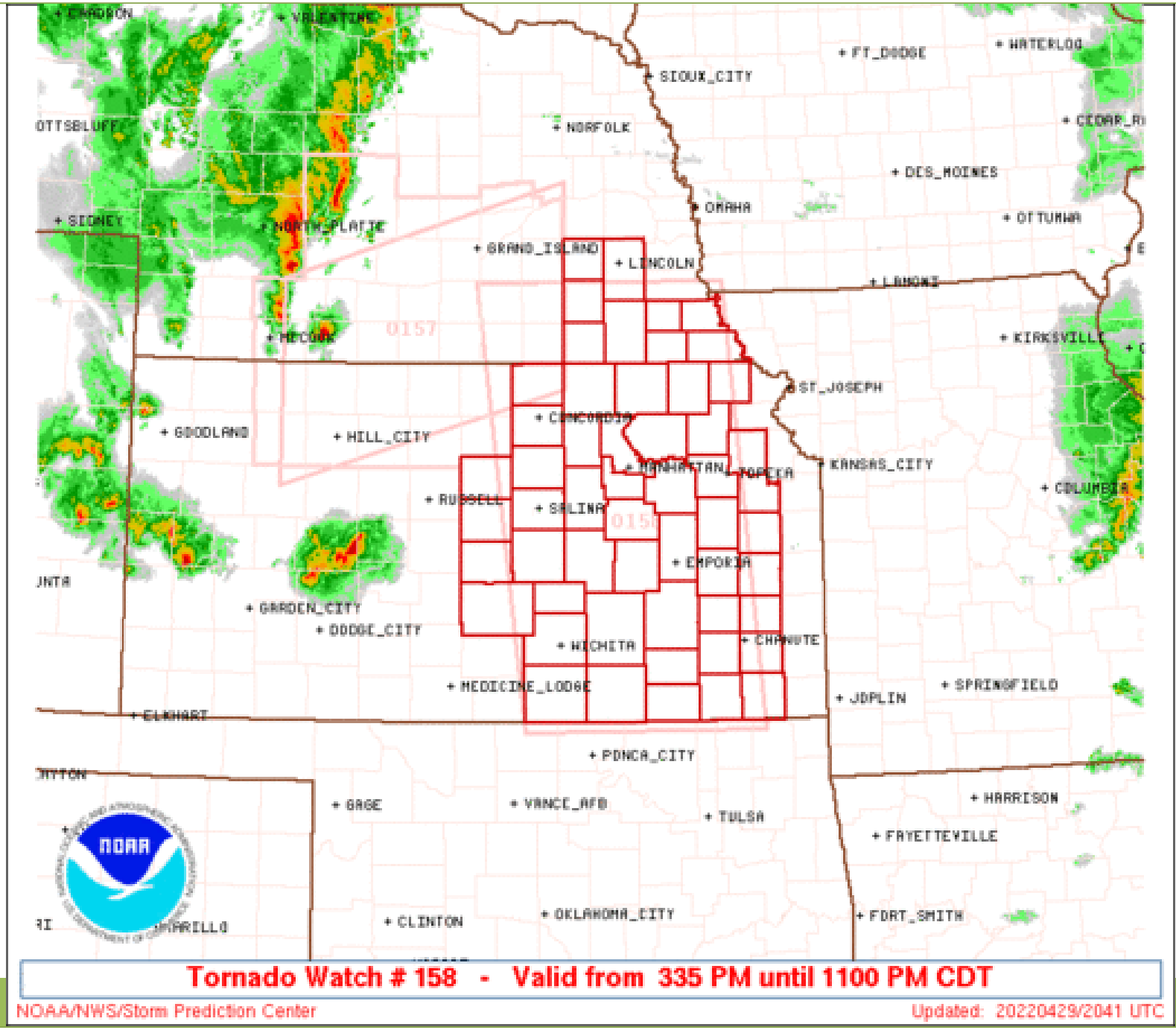

Day 4
15%
Day 4 - 8 Severe Weather Outlook Legend
30 %
15 %
SPC DAY 4 SEVERE WEATHER OUTLOOK
ISSUED: 0857Z 04/26/2022
VALID: Fri 04/29 1200Z - Sat 04/30 1200Z
FORECASTER: LEITMAN
NOAA/NWS Storm Prediction Center, Norman, Oklahoma


ENH
SLGT
MRGL
SPC DAY 3 CATEGORICAL OUTLOOK
ISSUED: 0738Z 04/27/2022
VALID: 1200Z Fri 04/29 - 1200Z Sat 04/30
FORECASTER: LEITMAN
NOAA/NWS Storm Prediction Center, Norman, Oklahoma
Categorical Outlook Legend:
TSTM
1: MRGL
2: SLGT
3: ENH
4: MDT
5: HIGH


ENH
SLGT
MRGL
SPC DAY 2 CATEGORICAL OUTLOOK
ISSUED: 1727Z 04/28/2022
VALID: 1200Z Fri 04/29 - 1200Z Sat 04/30
FORECASTER: SMITH
NOAA/NWS Storm Prediction Center, Norman, Oklahoma
Categorical Outlook Legend:
TSTM
1: MRGL
2: SLGT
3: ENH
4: MDT
5: HIGH


ENH
SLGT
MRGL
SPC DAY 1 CATEGORICAL OUTLOOK
ISSUED: 0549Z 04/29/2022
VALID: 1200Z Fri 04/29 - 1200Z Sat 04/30
FORECASTER: DARROW/WENDT
NOAA/NWS Storm Prediction Center, Norman, Oklahoma
Categorical Outlook Legend:
TSTM
1: MRGL
2: SLGT
3: ENH
4: MDT
5: HIGH

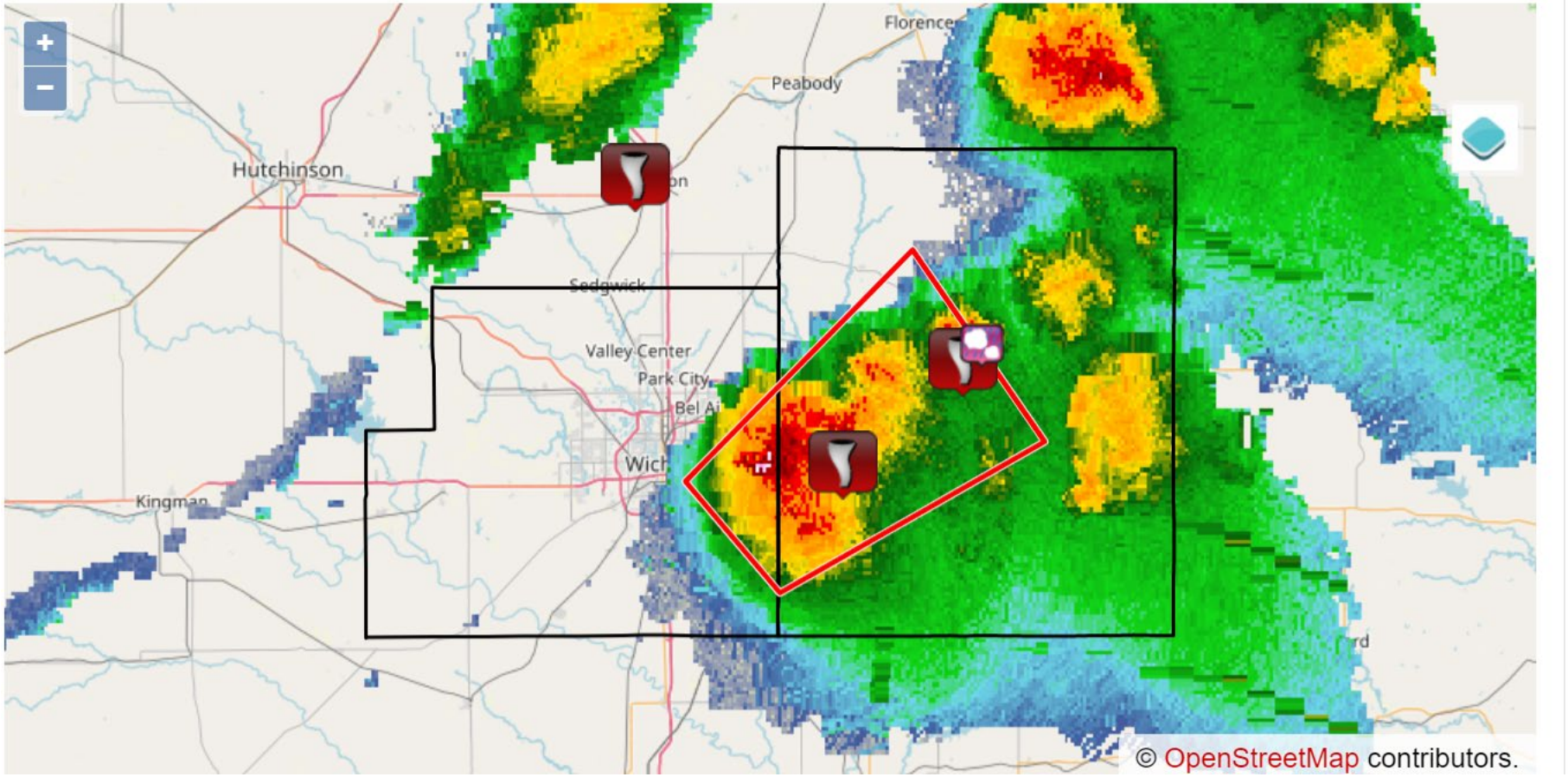

SPC Day 1 Outlook and Prelim. Reports Valid:
1200 UTC 04/29/2022 to 1200 UTC 04/30/2022
10%
5%
2%
TORN 23
23 Torn.
TOTAL 23
SPC DAY 1 TORNADO OUTLOOK
ISSUED: 0549Z 04/29/2022
VALID: 1200Z Fri 04/29 - 1200Z Sat 04/30
Preliminary Subjective Verification
NOAA/NWS Storm Prediction Center, Norman, Oklahoma
Tornado Probability Legend (in %):
2 5 10 15 30 45 60 Sig



Tornado Watch # 158 - Valid from 335 PM until 1100 PM CDT

NOAA/NWS/Storm Prediction Center

Updated: 20220429/2041 UTC


Florence
Peabody
Hutchinson
Sedgwick
Valley Center
Park City
Kingman
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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