

ATM S 103

Hurricanes and Thunderstorms

Their Science and Impacts



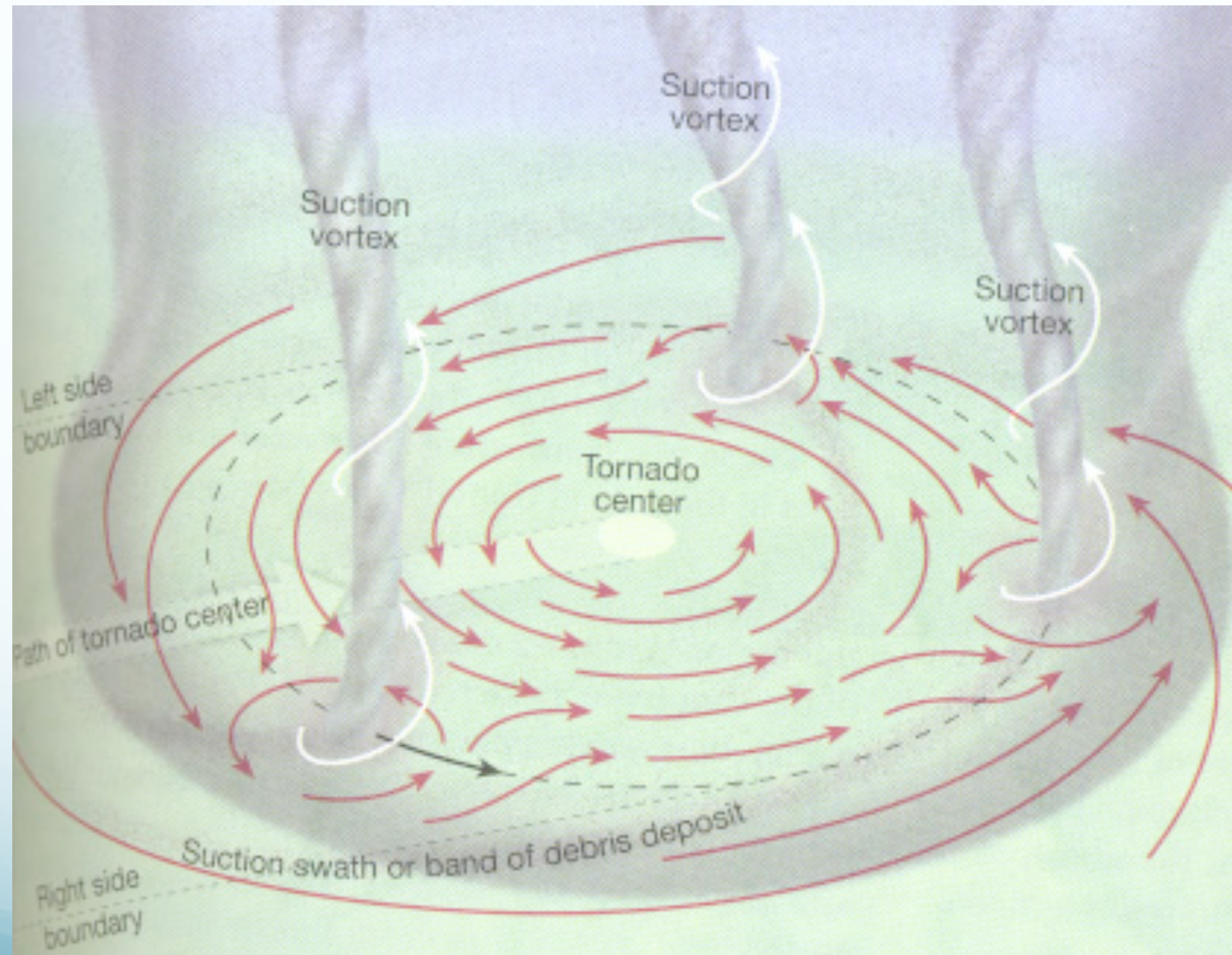
Announcement

- Homework 5 due today 6pm
- Mid-term 2 on May 22

Suction vortices

Multiple suction vortices (May 9, 2016, OK)

Multiple Suction Vortices



makes tornado damage capricious

Tornado Footage

[June 17, 2010 Southern Minnesota](#)

[Version with captions](#)

Simulation of EF-5 tornado

- <https://www.youtube.com/watch?v=bsO6xUHn5ME>

Tornado Demonstration

W

What part of the tornado demonstrator intensifies the vortex analogous to a skater pulling arms in?

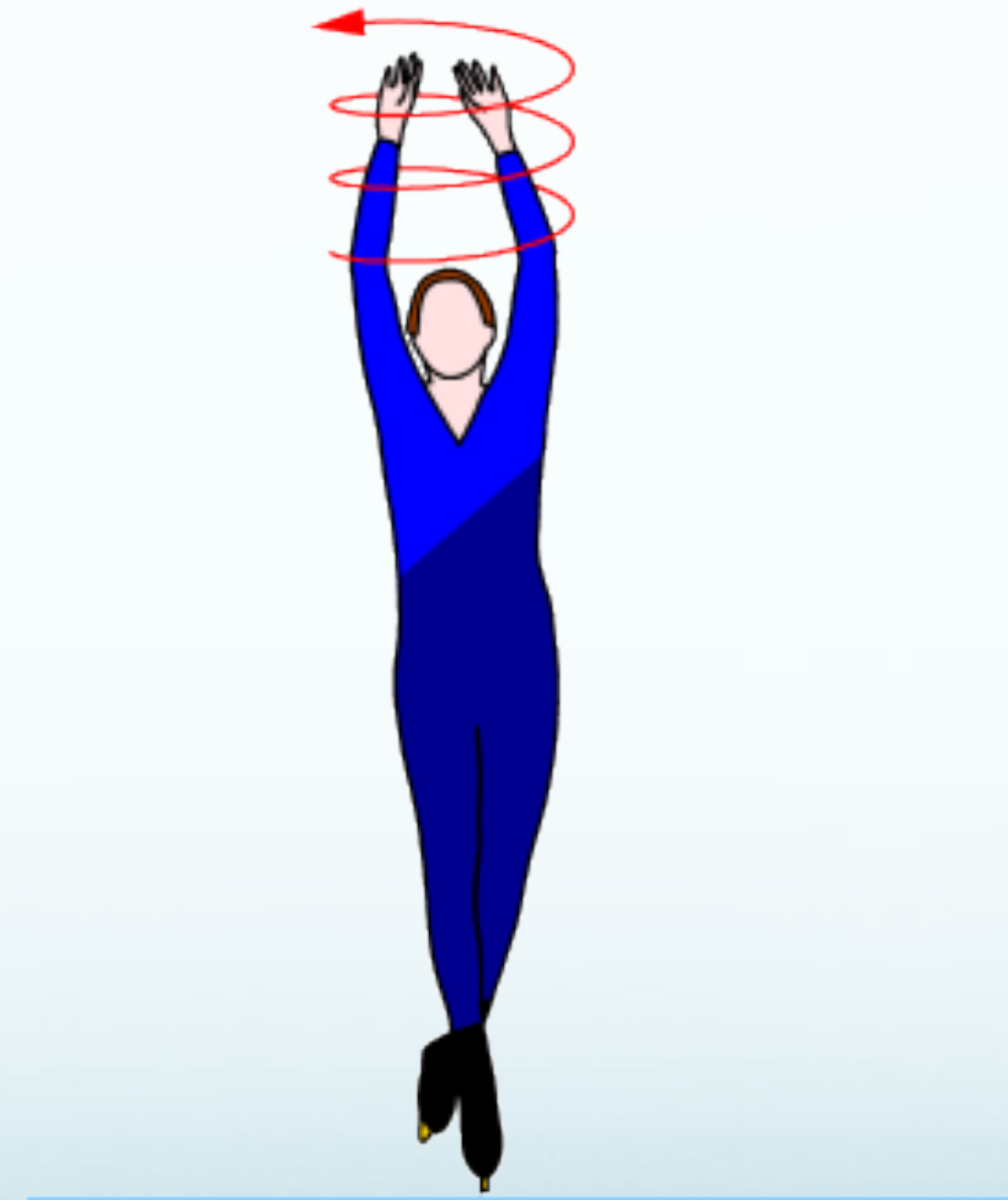
The fans on the bottom that push the air out of the vertical tubes

The dry ice in the water

The box fan in the top

Answer

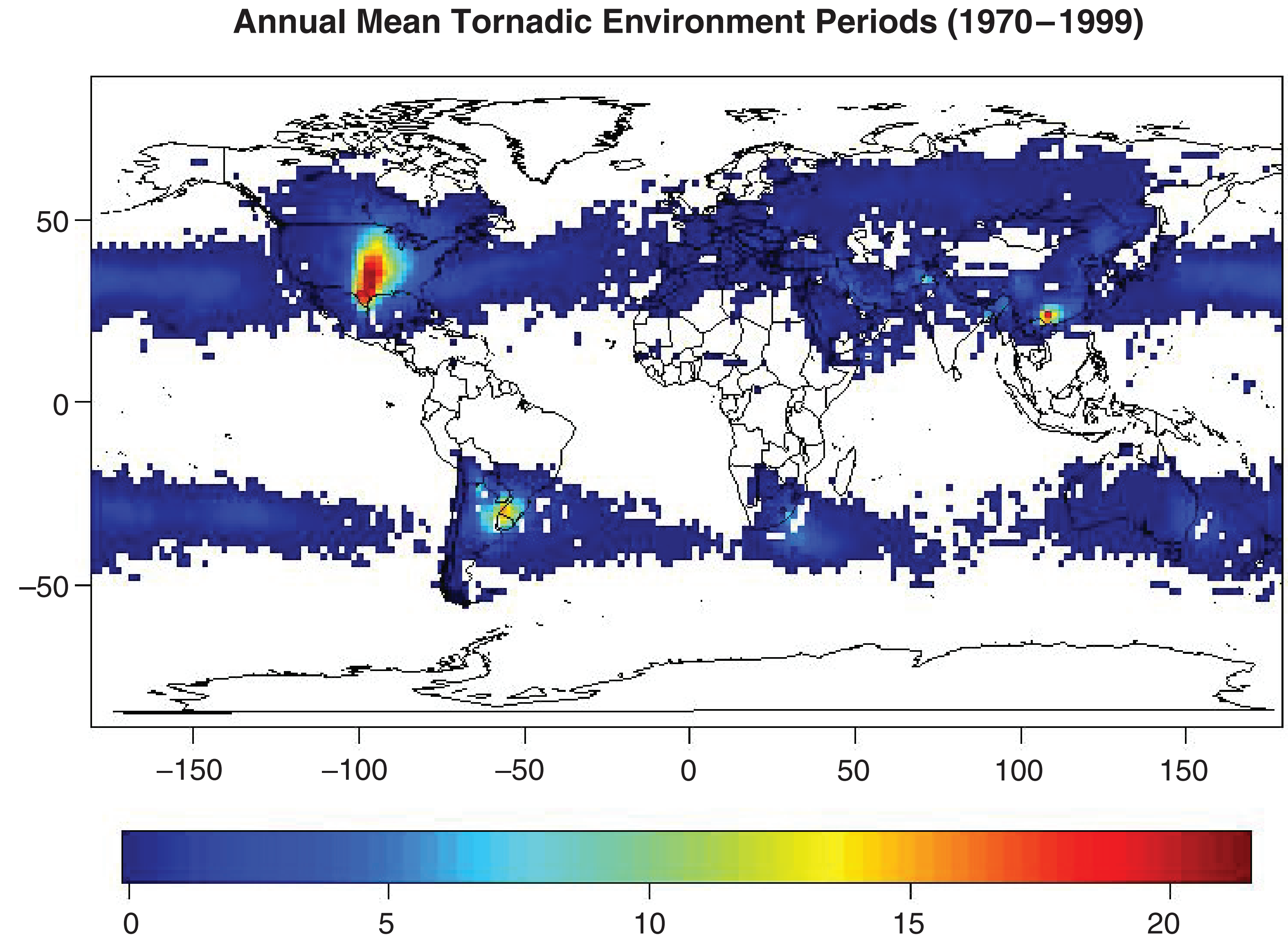
- The box fan on the top draws air toward the centerline as it sucks the air upward.



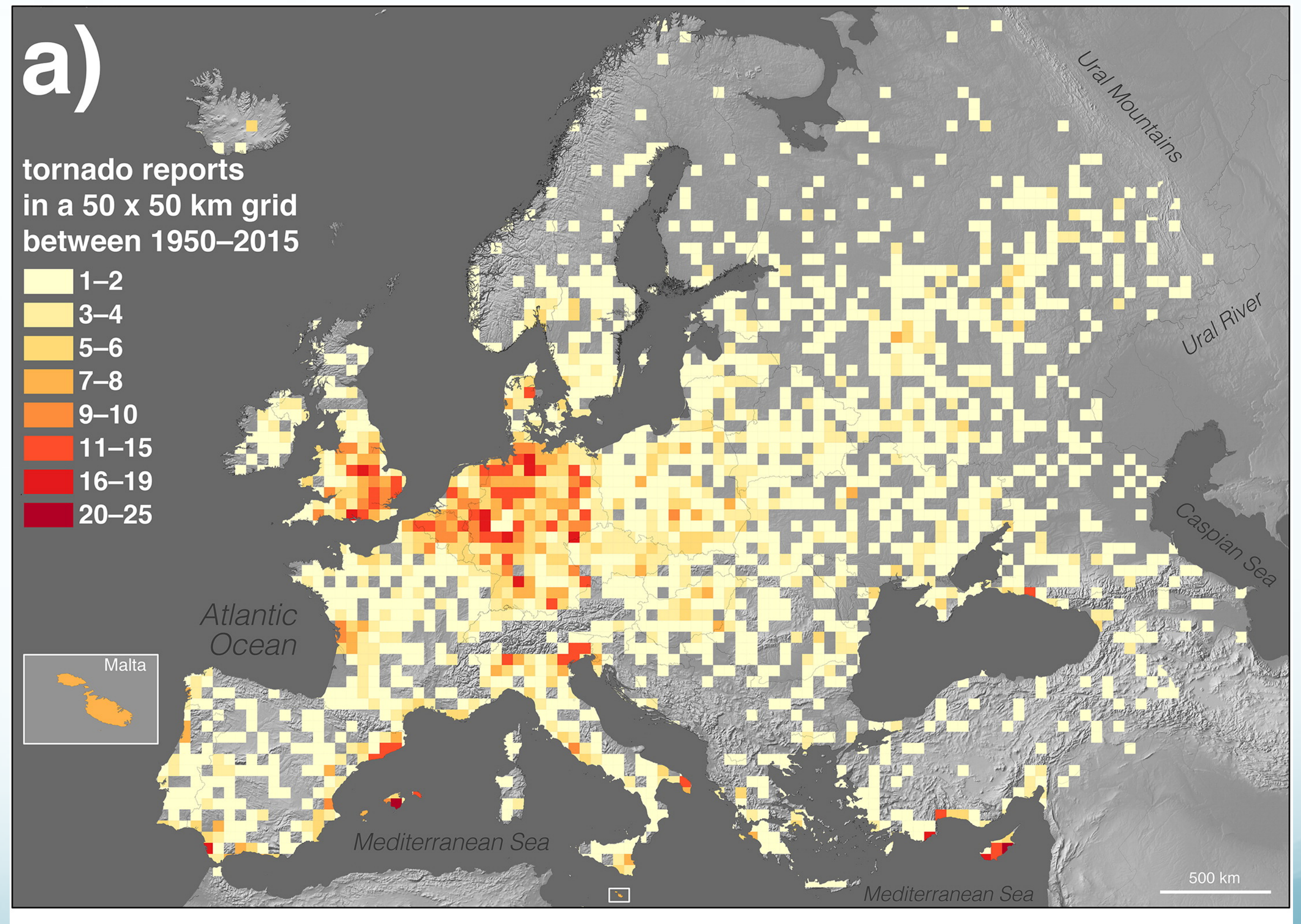
Tornado Climatology

Frequency of Tornadic Environments

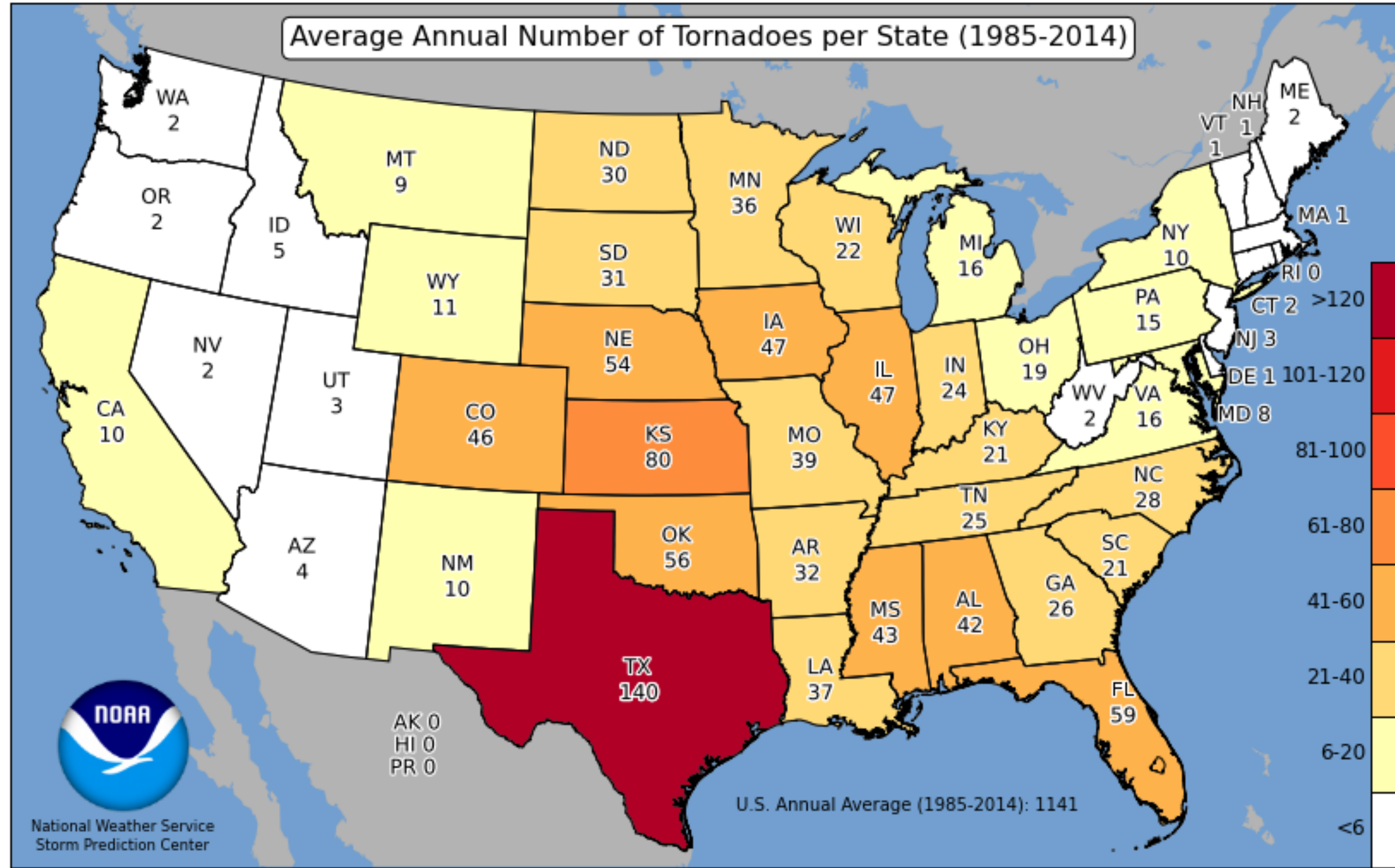
Average number
of days per year



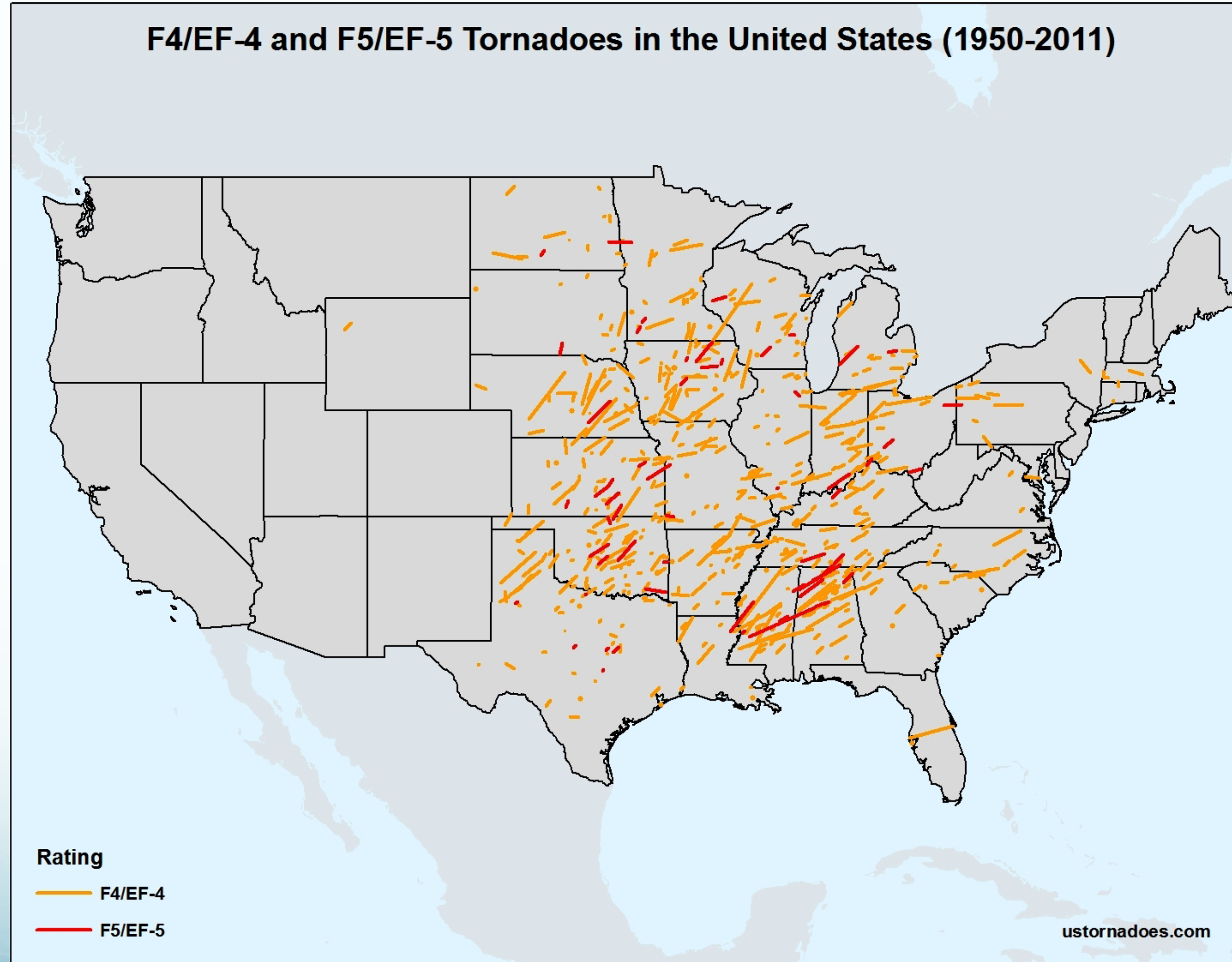
European tornado reports



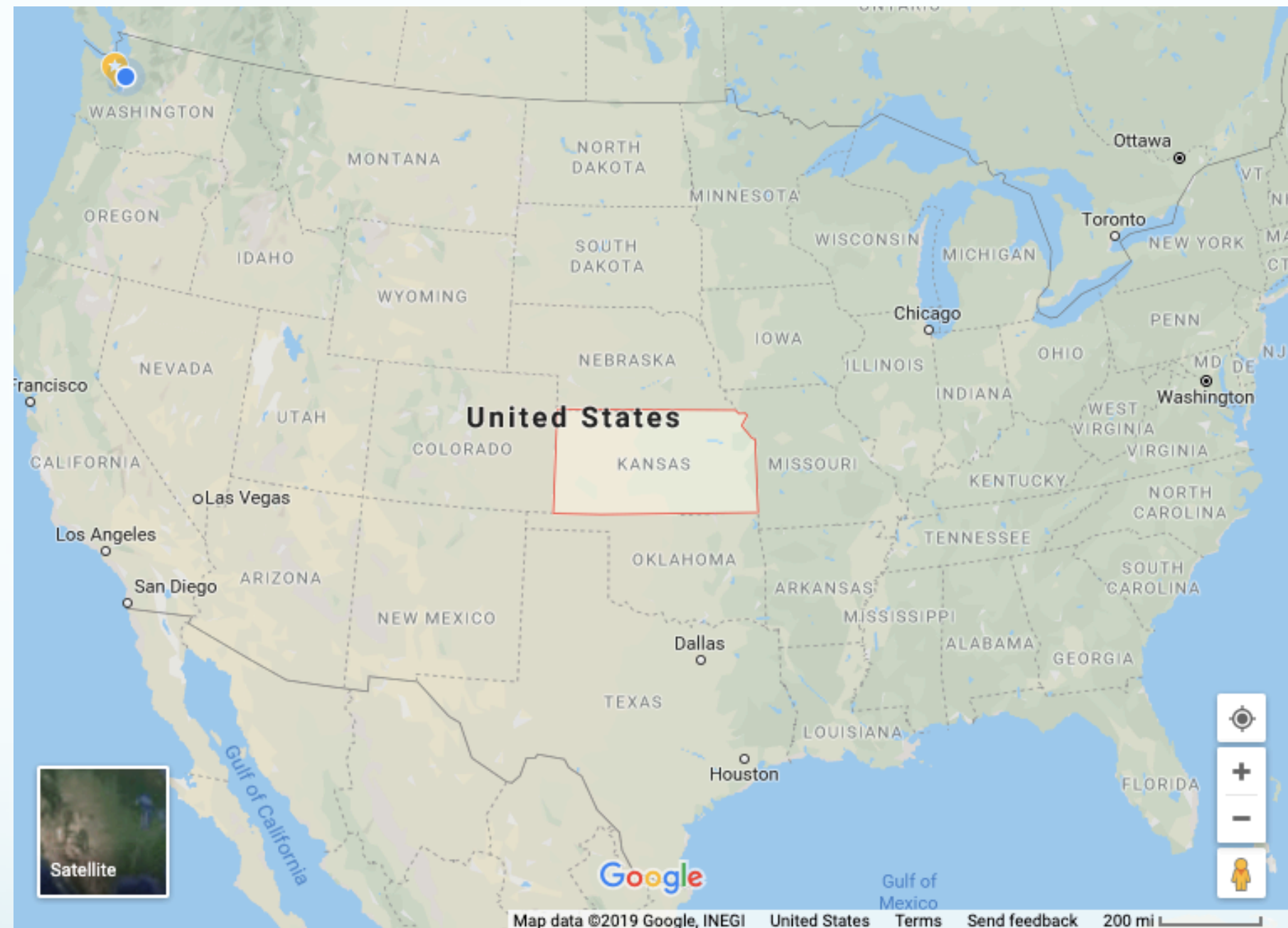
Distribution per State



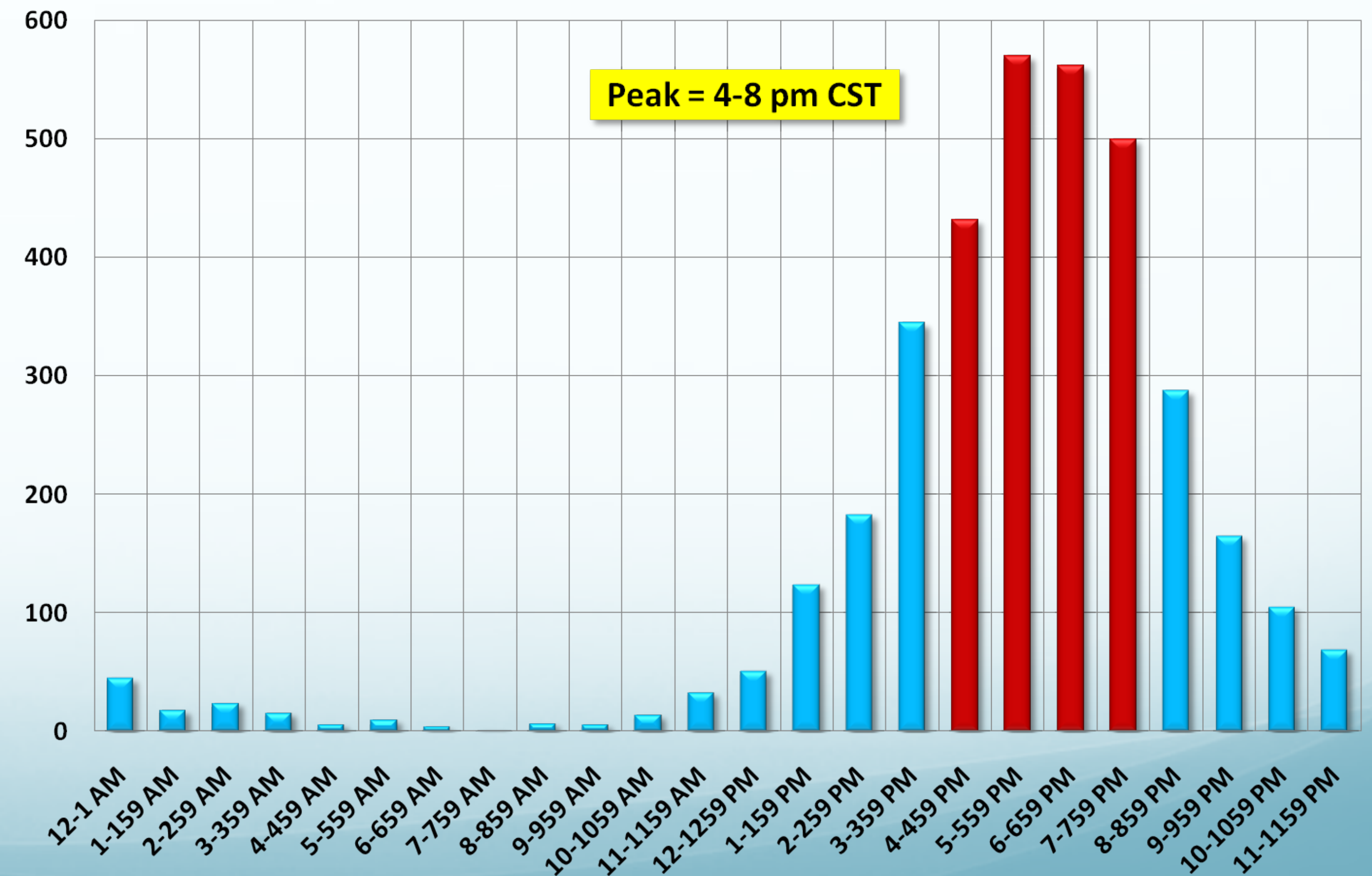
Violent Tornadoes (EF4 and EF5, 1950-2011)



Time of Day: Kansas



KS Hourly (CST) Tornado Frequency 1950-2009



W Why is there a late afternoon maximum in the frequency of Kansas tornadoes?

Lifting of low-level air by fronts is maximized then.

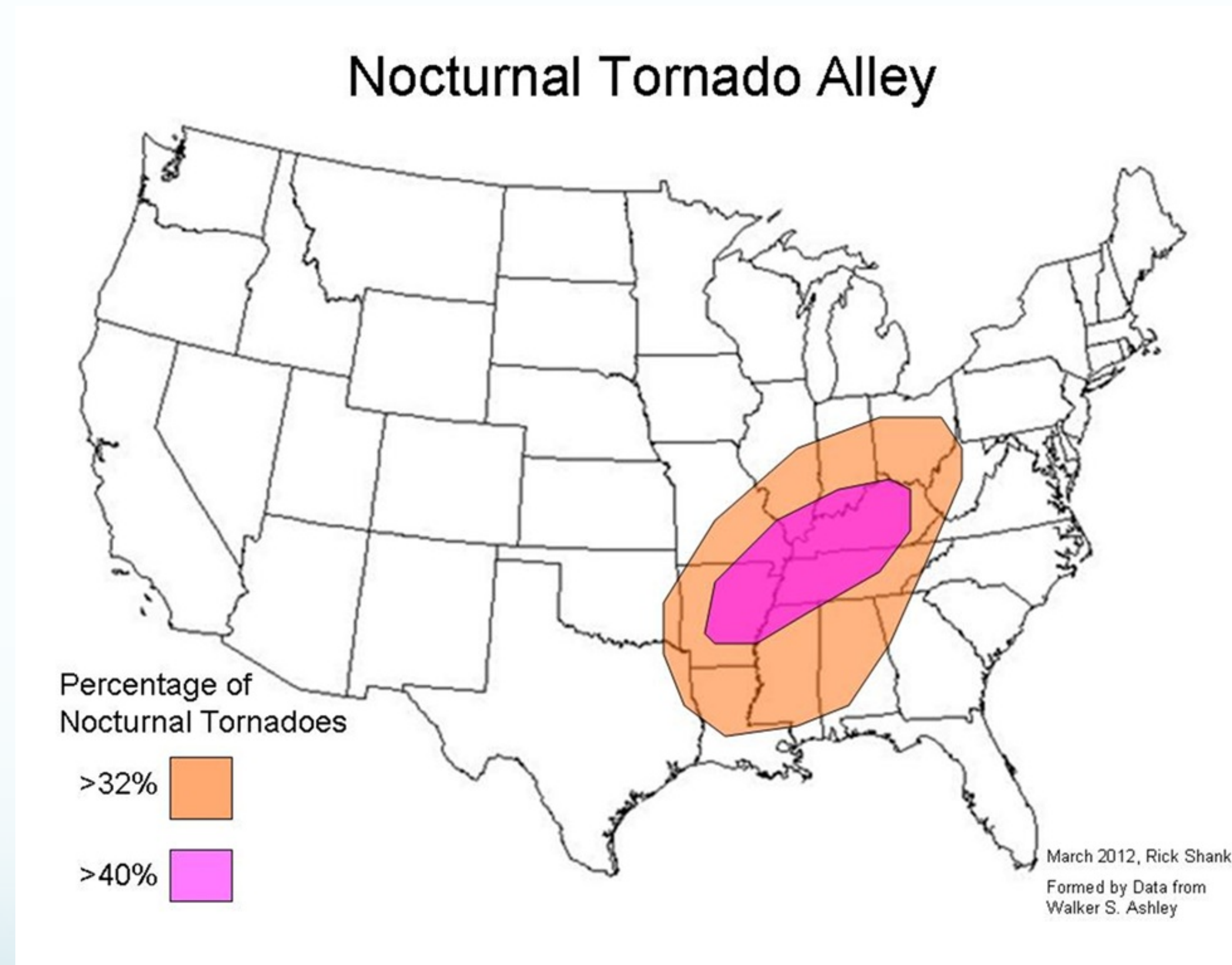
Daily heating by the sun, and resulting warming of the low-level air, is maximized then.

Upper-level temperatures are lowest then.

Answer

- The late-afternoon maximum is tied to the maximum in low-level heating.
- The heating makes it easier for air parcels near the surface to rise to a level where they are warmer than their environment and trigger a thunderstorm.

Nocturnal Tornadoes



Gust fronts and cold pools triggered by earlier storms to the west can trigger new storms at later times to the east.

Seasonal Distribution of Severe Tornadoes

[NOAA animation \(EF 2 or greater\)](#)

Washington State Tornadoes

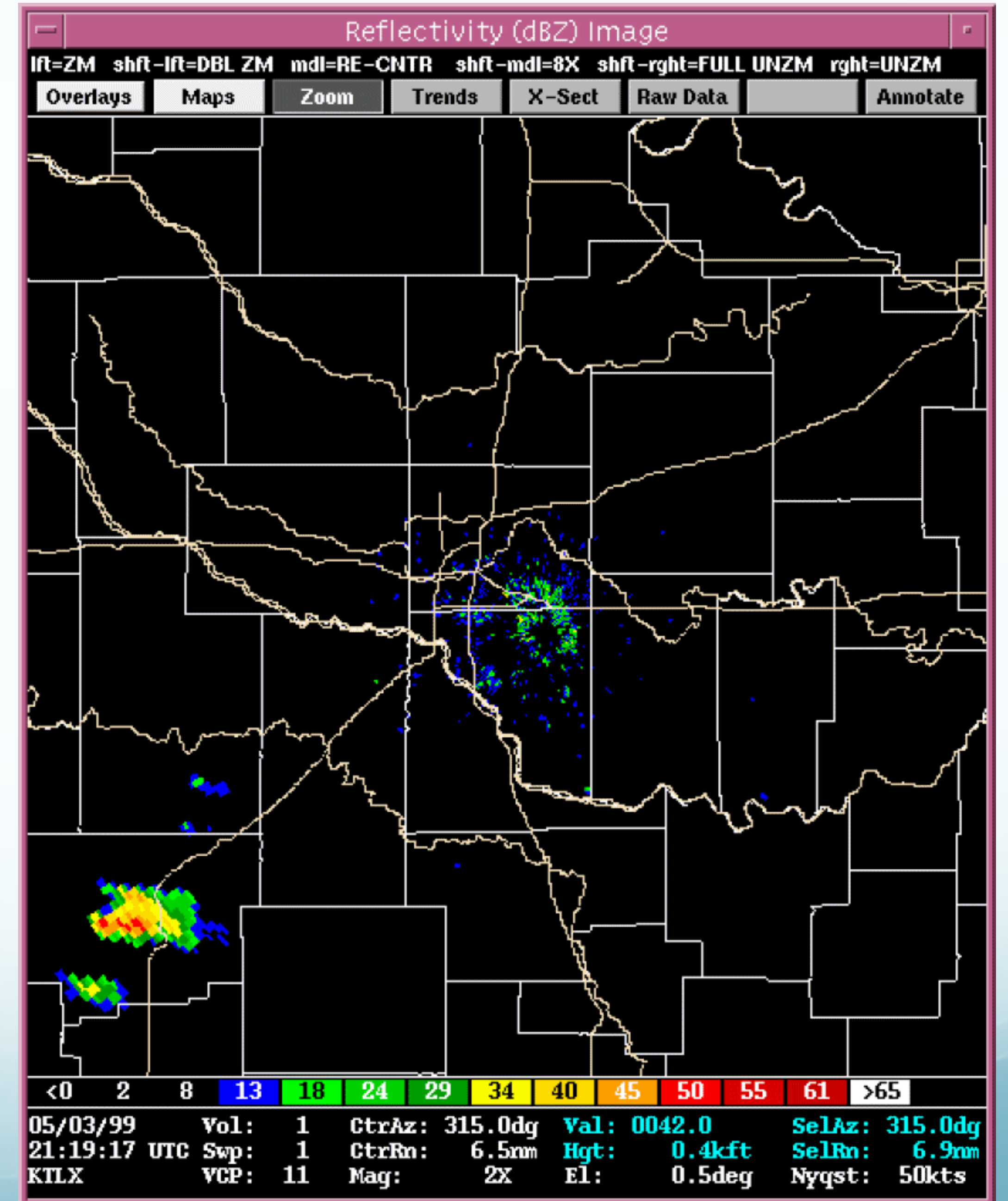
- 120 tornadoes in Washington state between 1954 and 2017 (tornadohistoryproject.com)
- APR 5, 1972 12:30 pm 6 dead 304 injured: From Oregon, the tornado swept into Vancouver, hit a school, and killed people at a shopping center.



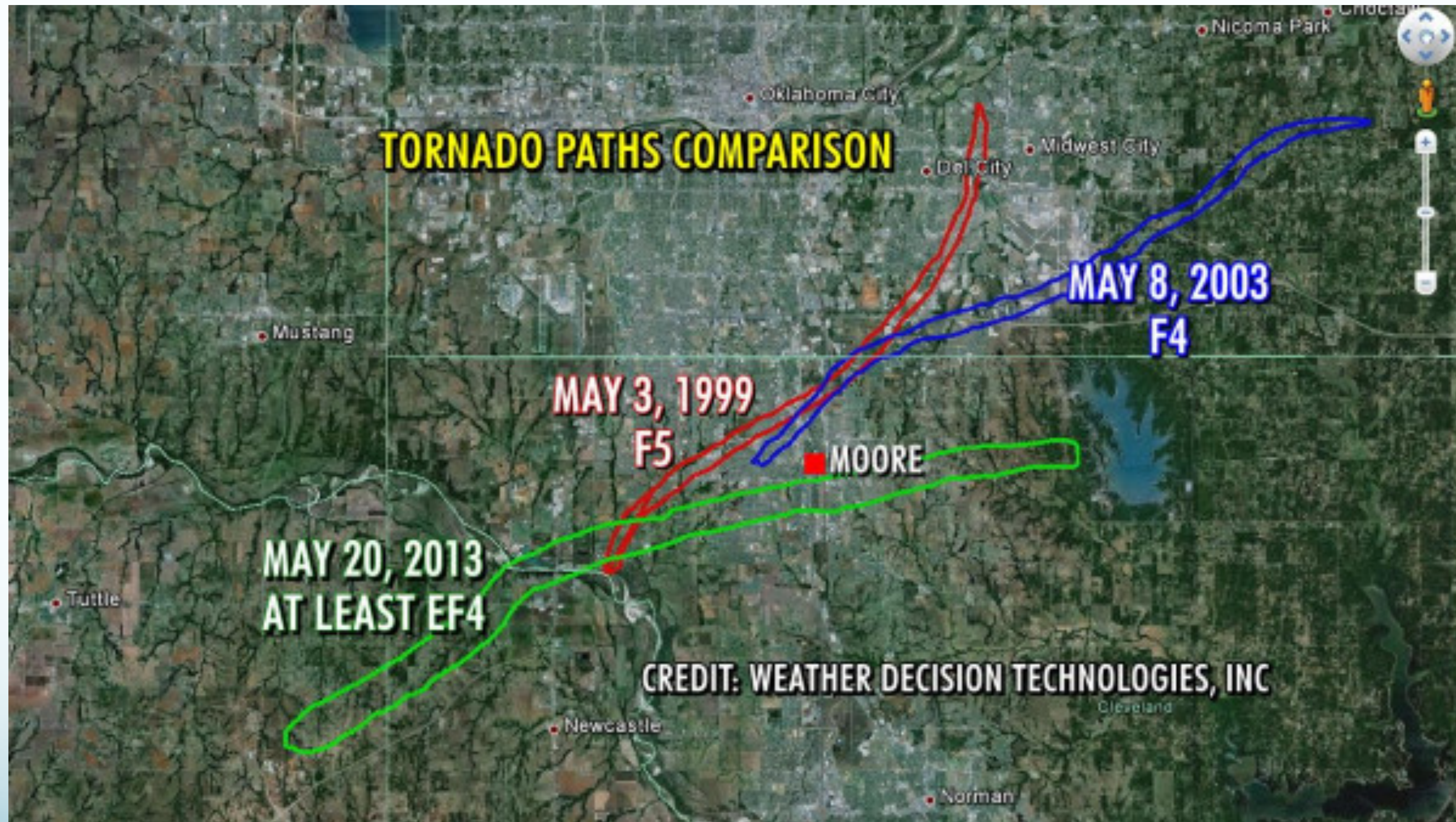
Washington State Tornadoes

- 120 tornadoes in Washington state between 1954 and 2017
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- DEC 18, 2018 2:30 pm: [Port Orchard](#)

Moore & OKC, OK 1999



Moore, Oklahoma Tornado Paths



Moore, OK 1999



Moore, OK 1999



Should you open the windows of your house to help equalize the pressure if a tornado is going to hit?

- No it makes it easier for damaging winds to enter your house.
- And in a severe case: Don't bother, the tornado will do it for you.

Tornadoes: Adaptation

- April 2014: Moore, OK becomes first municipality in US to upgrade building codes to withstand higher tornado winds (UPI)
 - Designed to withstand 135 mph winds (up from 90 mph)
 - Roof sheathing,
 - Wind-resistant garage doors,
 - Hurricane clips



Storm Cellar



Storm Cellar in Garage



Above Ground Safe Room



W

Which type of shelter is most likely to have its door blocked by debris?

Exterior in-ground
shelter

Above ground
safe room

Garage-floor
shelter

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Total Results

Answer

- The garage-floor shelter can most easily be block by debris from a semi-destroyed house.
- GPS coordinates of shelters are registered with local governments and used in search and rescue