



Tornado Climatology for Deep East Texas

Deep East Texas IWT Workshop

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Deep East Texas Counties Studied

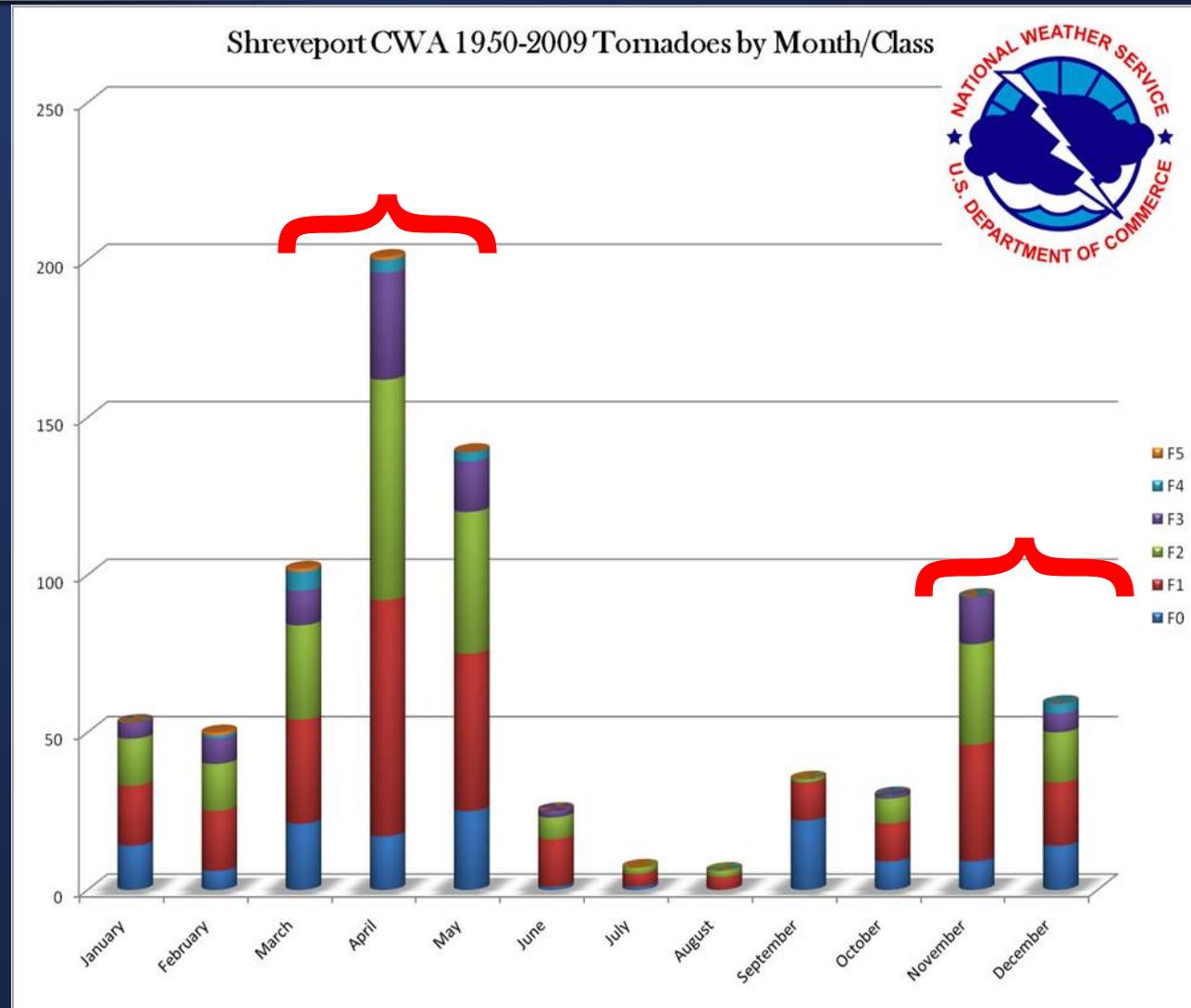
- Six (6) counties were included in this climate study.
- This study focuses on the 30 year period from 1990-2020, especially since the commissioning of the Shreveport Nexrad WSR-88D radar in the late summer of 1995.
- This will include monthly stats and including impacts from El Niño and La Niña.





Tornadoes Can Happen Anytime!

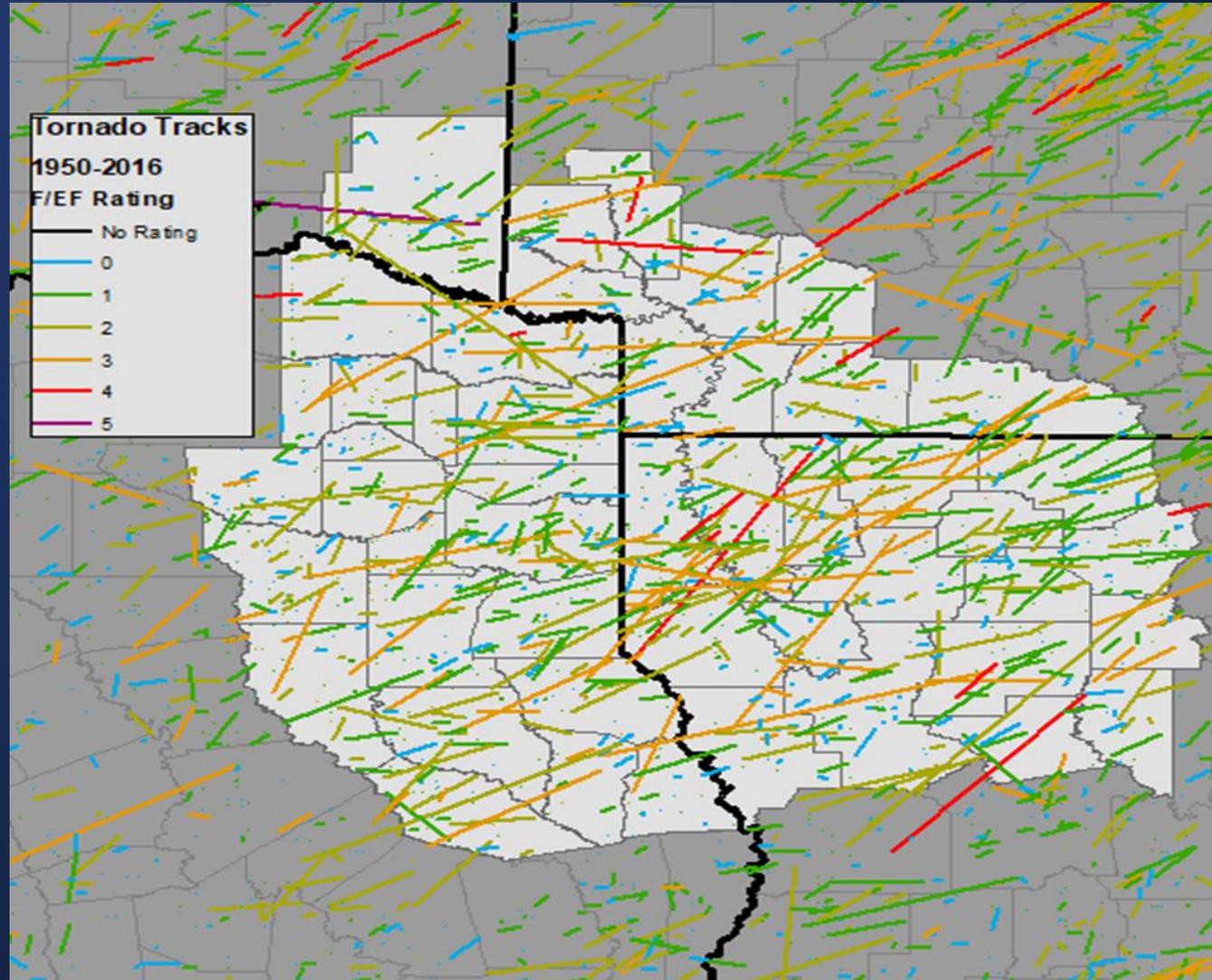
- The NWS Shreveport (County Warning Area) CWA has two severe weather seasons where tornado frequencies are highest.*





It Can Happen Anywhere!

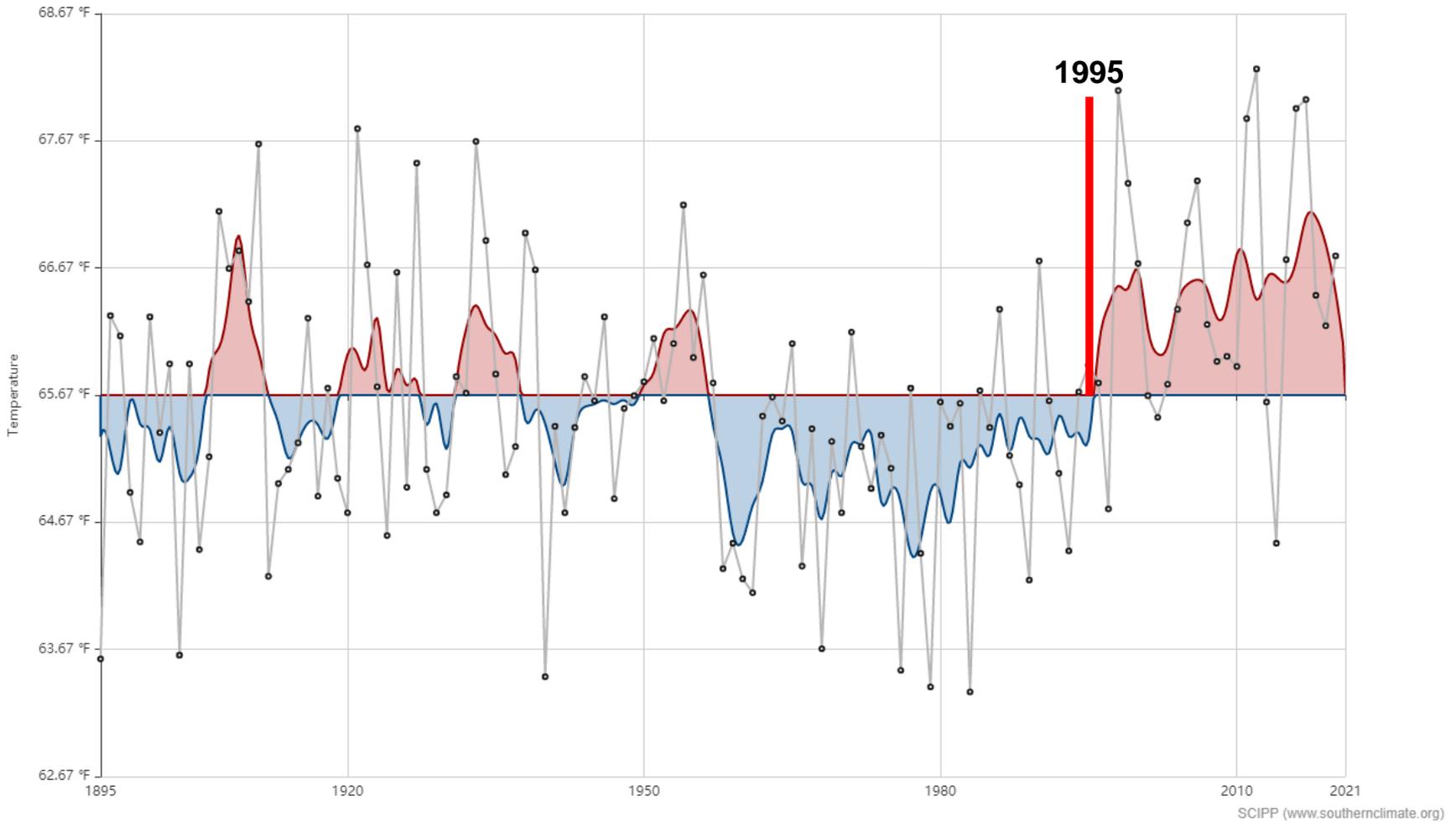
- Why do the tornado tracks drop off across portions of Deep East TX (Shelby, San Augustine, and Sabine Counties)?*





East Texas Annual Temperatures (1895-Present)

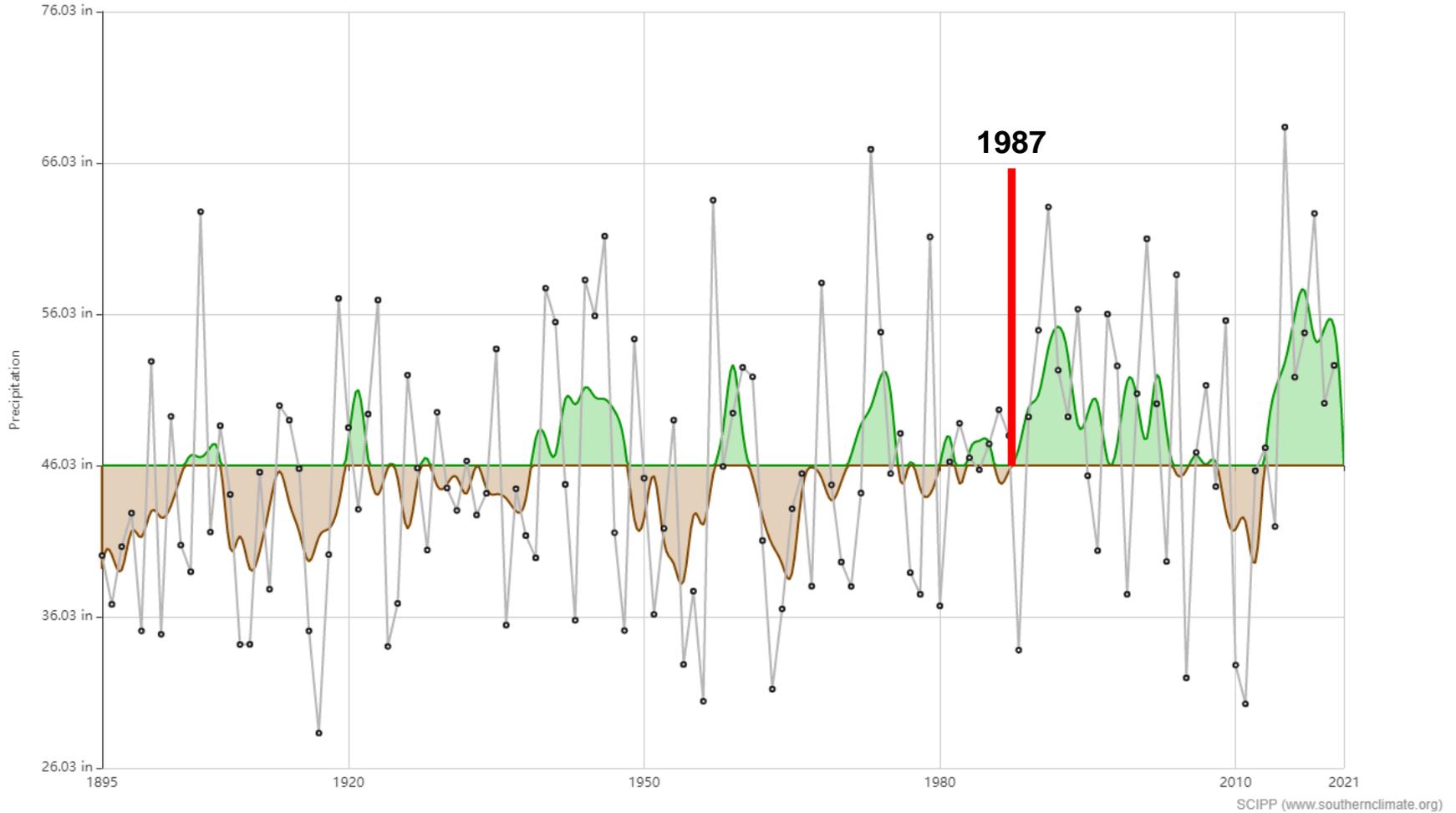
Climate Trends - State: TX, Season: Annual





East Texas Annual Precipitation (1895-Present)

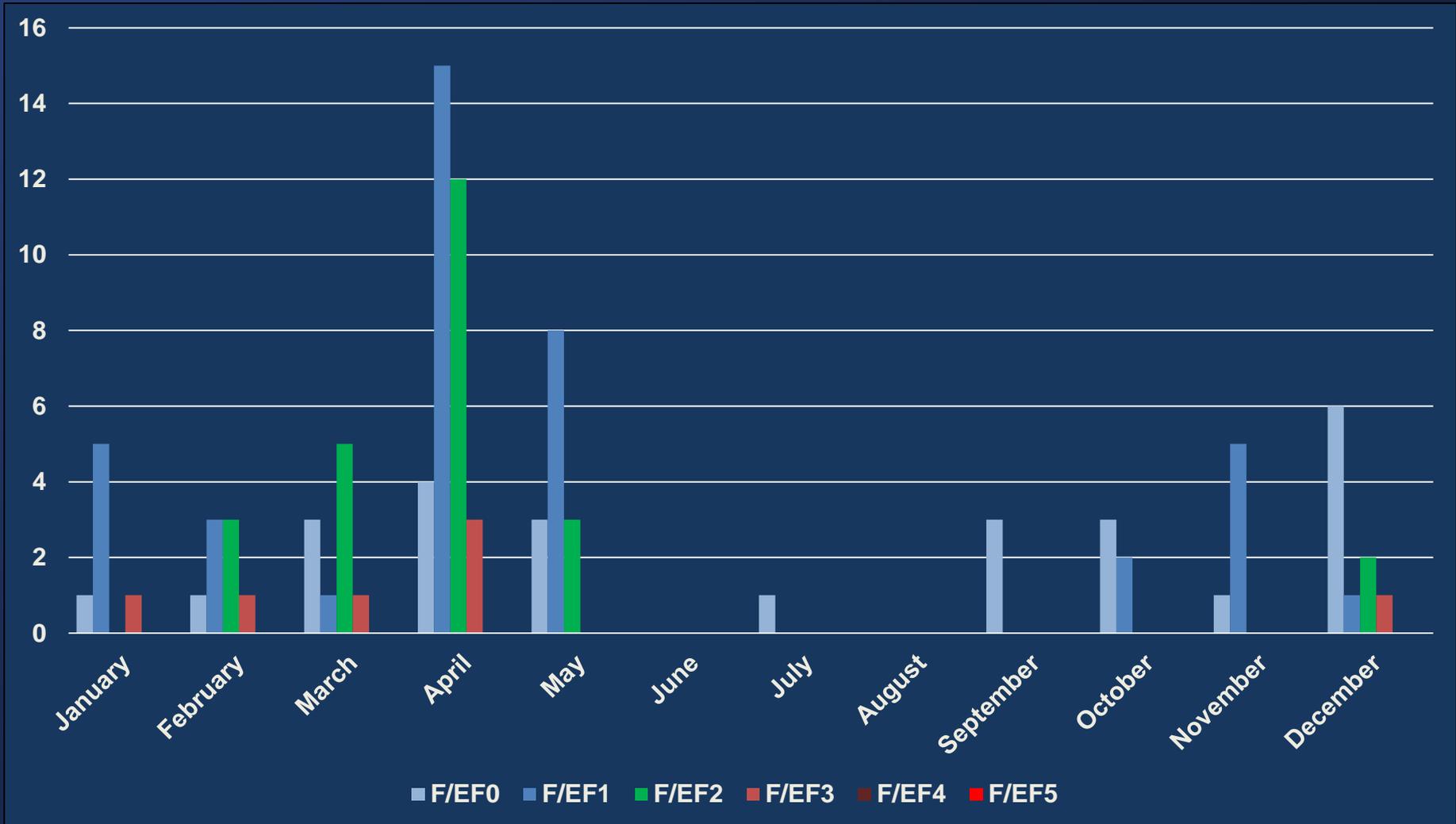
Climate Trends - State: TX, Season: Annual



SCIPP (www.southernclimate.org)



Deep East Texas Tornado Count (1990-2020)



Total Count: 98 tornadoes



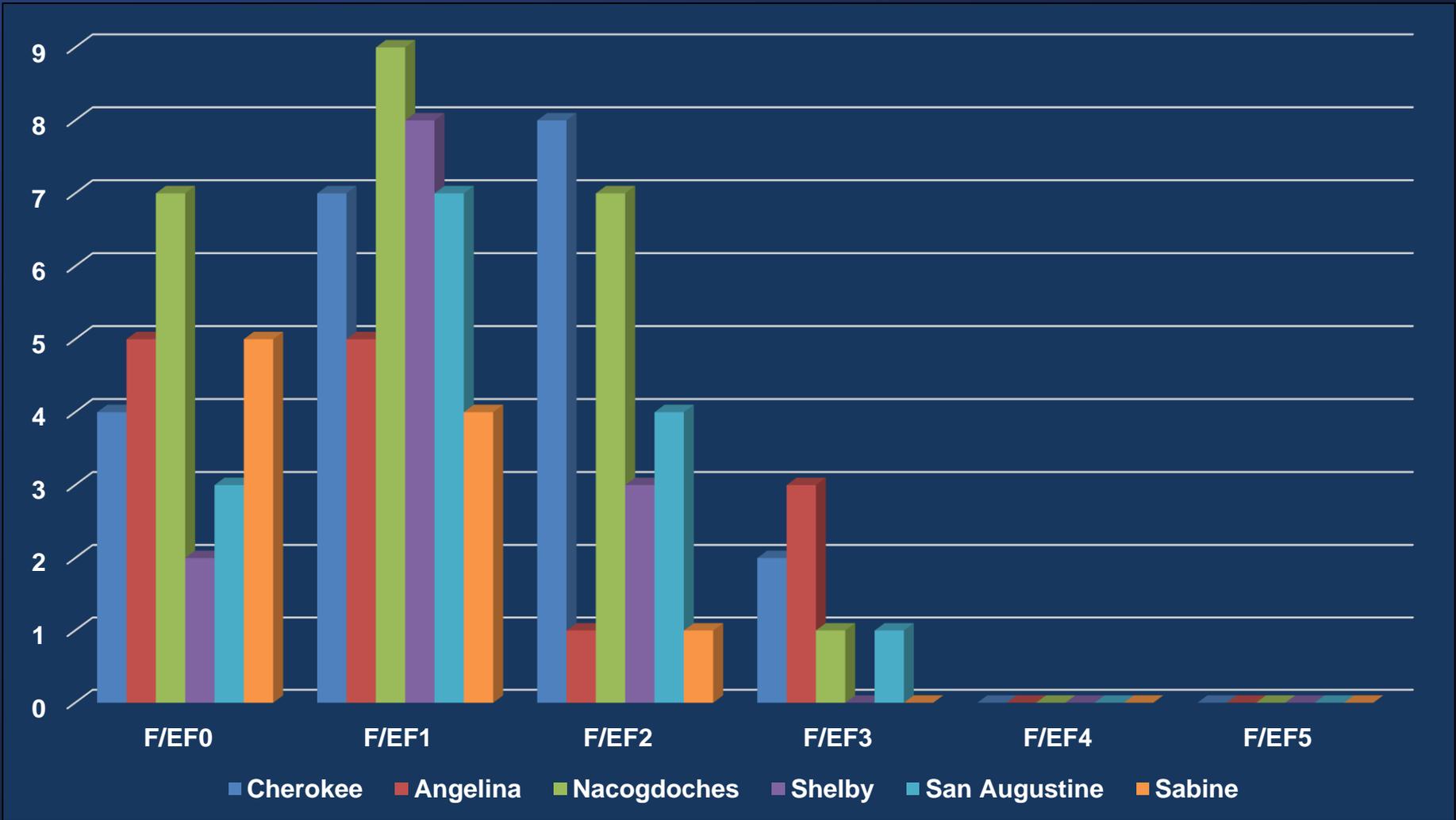
Individual County Tornado Count (1990-2020)

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----------|-----|------|------|-----|------|-----|-----|----------|-----------|
| Cherokee | 1 | 0 | 1 | 12 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 22 |
| Angelina | 2 | 0 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 14 |
| Nacogdoches | 1 | 2 | 3 | 6 | 4 | 0 | 0 | 0 | 3 | 2 | 2 | 1 | 24 |
| Shelby | 1 | 1 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 13 |
| San Augustine | 1 | 3 | 3 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 15 |
| Sabine | 1 | 2 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 10 |

Total Count: 98 tornadoes



Individual County F/EF Count (1990-2020)



Total Count: 98 tornadoes



El Niño/La Niña

*El Niño: **Warming** of Sea Surface Temperatures (SST's) along the Equatorial Pacific between 170°W - 120°W and 5°N and 5°S.*

3 Month Running Mean SST's Departures $\geq +0.5^\circ$

*La Niña: **Cooling** of SST's in the same region as El Niño.*

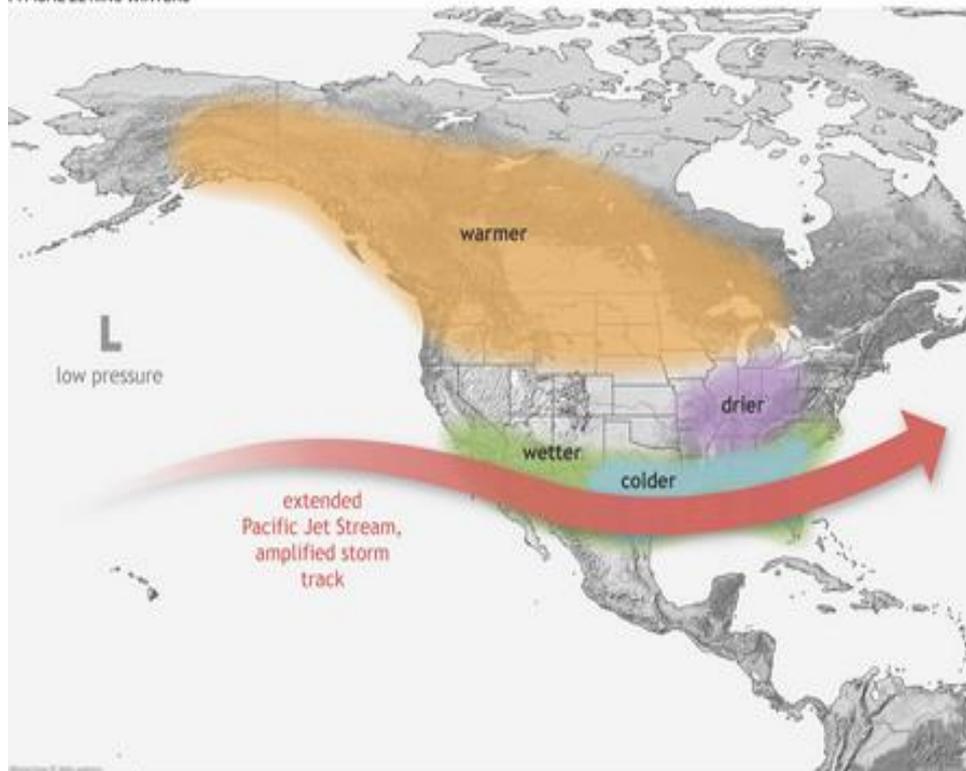
3 Month Running Mean SST's Departures $\leq -0.5^\circ$

- *To be classified as a distinct El Niño or La Niña episode, these SST conditions must be met for a period of at least 5 consecutive months.*



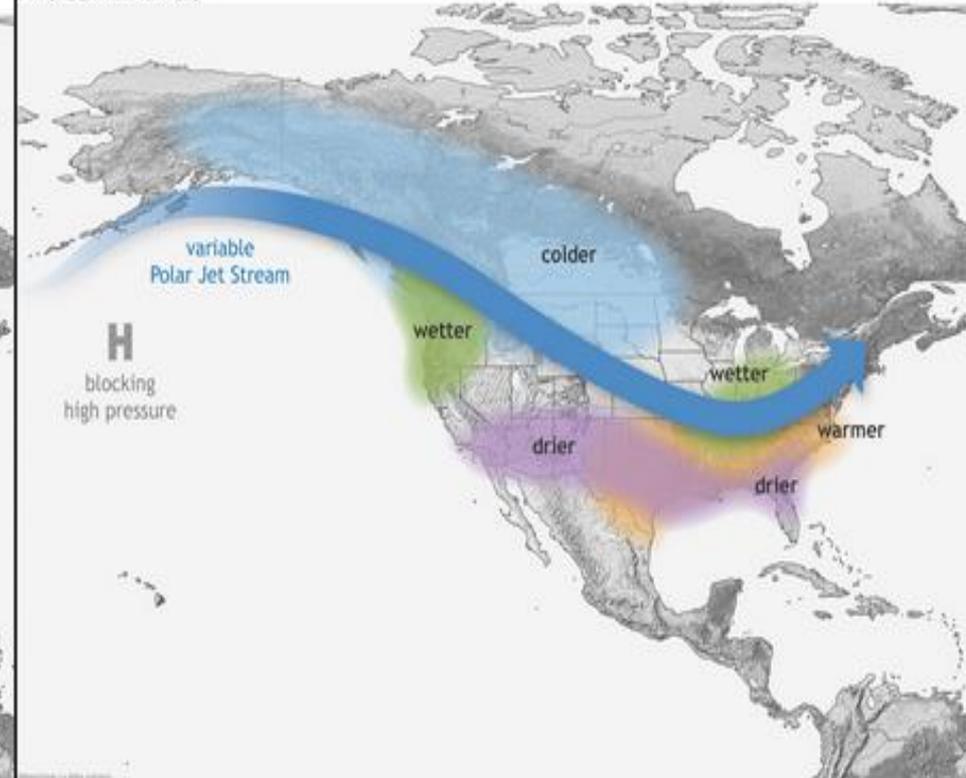
Jet Stream Patterns with El Niño and La Niña

TYPICAL EL NIÑO WINTERS



El Niño

TYPICAL LA NIÑA WINTERS



La Niña



ENSO Events (1990-Present)

El Niño: *Warming* of SST's with a 3 Month Running Mean $\geq +0.5^\circ$

La Niña: *Cooling* of SST's with a 3 Month Running Mean $\leq -0.5^\circ$

Neutral: 3 Month Running Mean SST's $+0.5^\circ \geq x \geq -0.5^\circ$

In the last 30 years, we have recorded:

9 El Niño events

10 La Niña events

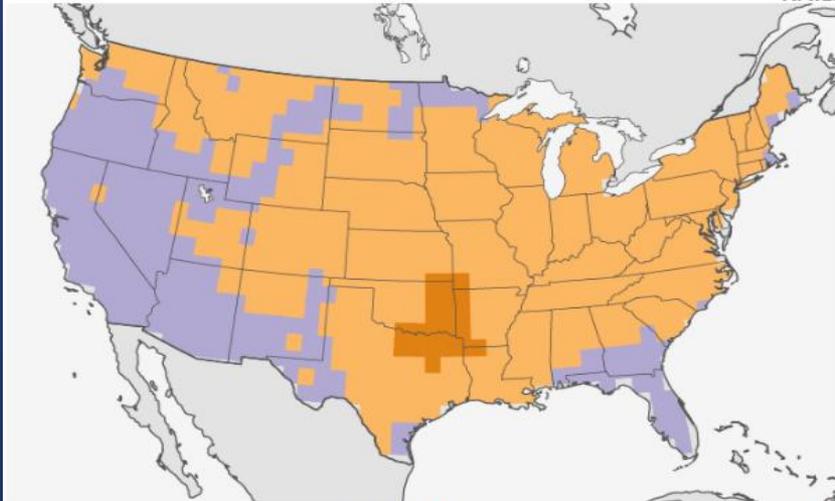
****Effects from El Niño/La Niña are most pronounced during the winter/early spring months. ****

| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1990 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 |
| 1991 | 0.4 | 0.3 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.6 | 0.6 | 0.8 | 1.2 | 1.5 |
| 1992 | 1.7 | 1.6 | 1.5 | 1.3 | 1.1 | 0.7 | 0.4 | 0.1 | -0.1 | -0.2 | -0.3 | -0.1 |
| 1993 | 0.1 | 0.3 | 0.5 | 0.7 | 0.7 | 0.6 | 0.3 | 0.3 | 0.2 | 0.1 | 0.0 | 0.1 |
| 1994 | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.6 | 0.7 | 1.0 | 1.1 |
| 1995 | 1.0 | 0.7 | 0.5 | 0.3 | 0.1 | 0.0 | -0.2 | -0.5 | -0.8 | -1.0 | -1.0 | -1.0 |
| 1996 | -0.9 | -0.8 | -0.6 | -0.4 | -0.3 | -0.3 | -0.3 | -0.3 | -0.4 | -0.4 | -0.4 | -0.5 |
| 1997 | -0.5 | -0.4 | -0.1 | 0.3 | 0.8 | 1.2 | 1.6 | 1.9 | 2.1 | 2.3 | 2.4 | 2.4 |
| 1998 | 2.2 | 1.9 | 1.4 | 1.0 | 0.5 | -0.1 | -0.8 | -1.1 | -1.3 | -1.4 | -1.5 | -1.6 |
| 1999 | -1.5 | -1.3 | -1.1 | -1.0 | -1.0 | -1.0 | -1.1 | -1.1 | -1.2 | -1.3 | -1.5 | -1.7 |
| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
| 2000 | -1.7 | -1.4 | -1.1 | -0.8 | -0.7 | -0.6 | -0.6 | -0.5 | -0.5 | -0.6 | -0.7 | -0.7 |
| 2001 | -0.7 | -0.5 | -0.4 | -0.3 | -0.3 | -0.1 | -0.1 | -0.1 | -0.2 | -0.3 | -0.3 | -0.3 |
| 2002 | -0.1 | 0.0 | 0.1 | 0.2 | 0.4 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.3 | 1.1 |
| 2003 | 0.9 | 0.6 | 0.4 | 0.0 | -0.3 | -0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| 2004 | 0.4 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| 2005 | 0.6 | 0.6 | 0.4 | 0.4 | 0.3 | 0.1 | -0.1 | -0.1 | -0.1 | -0.3 | -0.6 | -0.8 |
| 2006 | -0.9 | -0.8 | -0.6 | -0.4 | -0.1 | 0.0 | 0.1 | 0.3 | 0.5 | 0.8 | 0.9 | 0.9 |
| 2007 | 0.7 | 0.2 | -0.1 | -0.3 | -0.4 | -0.5 | -0.6 | -0.8 | -1.1 | -1.3 | -1.5 | -1.6 |
| 2008 | -1.6 | -1.5 | -1.3 | -1.0 | -0.8 | -0.6 | -0.4 | -0.2 | -0.2 | -0.4 | -0.6 | -0.7 |
| 2009 | -0.8 | -0.8 | -0.6 | -0.3 | 0.0 | 0.3 | 0.5 | 0.6 | 0.7 | 1.0 | 1.4 | 1.6 |
| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
| 2010 | 1.5 | 1.2 | 0.8 | 0.4 | -0.2 | -0.7 | -1.0 | -1.3 | -1.6 | -1.6 | -1.6 | -1.6 |
| 2011 | -1.4 | -1.2 | -0.9 | -0.7 | -0.6 | -0.4 | -0.5 | -0.6 | -0.8 | -1.0 | -1.1 | -1.0 |
| 2012 | -0.9 | -0.7 | -0.6 | -0.5 | -0.3 | 0.0 | 0.2 | 0.4 | 0.4 | 0.3 | 0.1 | -0.2 |
| 2013 | -0.4 | -0.4 | -0.3 | -0.3 | -0.4 | -0.4 | -0.4 | -0.3 | -0.3 | -0.2 | -0.2 | -0.3 |
| 2014 | -0.4 | -0.5 | -0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.1 | 0.2 | 0.5 | 0.6 | 0.7 |
| 2015 | 0.5 | 0.5 | 0.5 | 0.7 | 0.9 | 1.2 | 1.5 | 1.9 | 2.2 | 2.4 | 2.6 | 2.6 |
| 2016 | 2.5 | 2.1 | 1.6 | 0.9 | 0.4 | -0.1 | -0.4 | -0.5 | -0.6 | -0.7 | -0.7 | -0.6 |
| 2017 | -0.3 | -0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.1 | -0.1 | -0.4 | -0.7 | -0.8 | -1.0 |
| 2018 | -0.9 | -0.9 | -0.7 | -0.5 | -0.2 | 0.0 | 0.1 | 0.2 | 0.5 | 0.8 | 0.9 | 0.8 |
| 2019 | 0.7 | 0.7 | 0.7 | 0.7 | 0.5 | 0.5 | 0.3 | 0.1 | 0.2 | 0.3 | 0.5 | 0.5 |
| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
| 2020 | 0.5 | 0.5 | 0.4 | 0.2 | -0.1 | -0.3 | -0.4 | -0.6 | -0.9 | -1.2 | -1.3 | -1.2 |

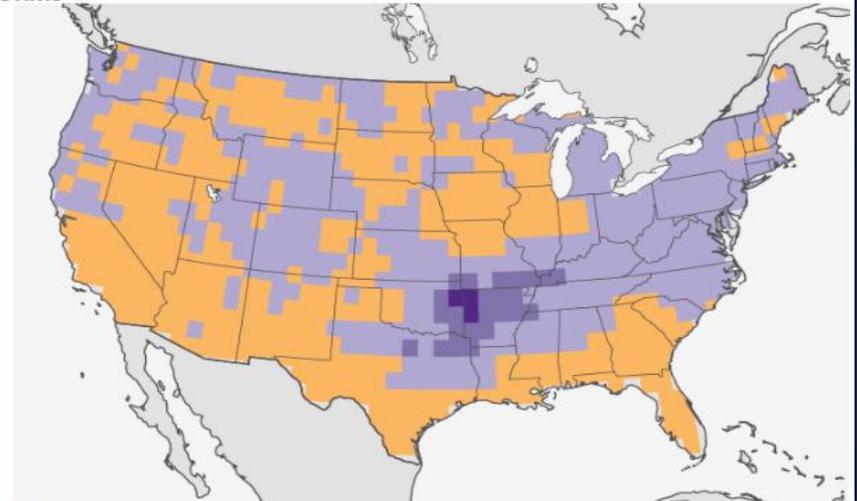


Tornadoes/Hail during El Niño/La Niña Events (1979-2015)

HAILSTORMS

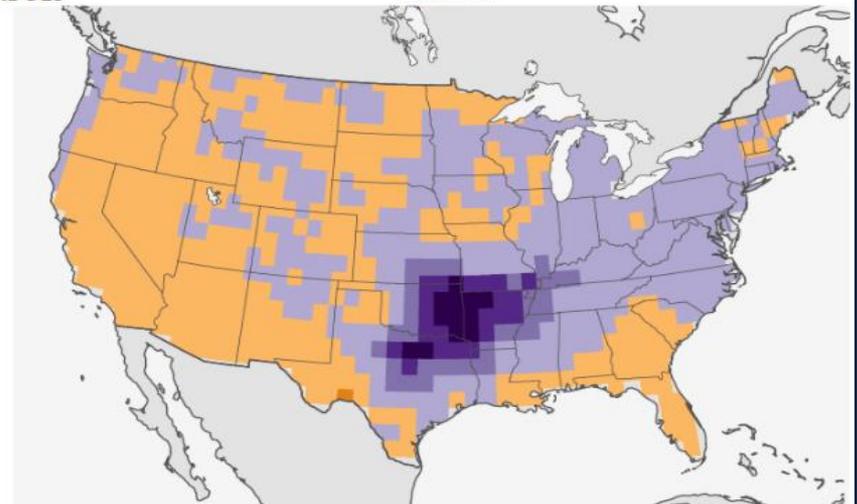
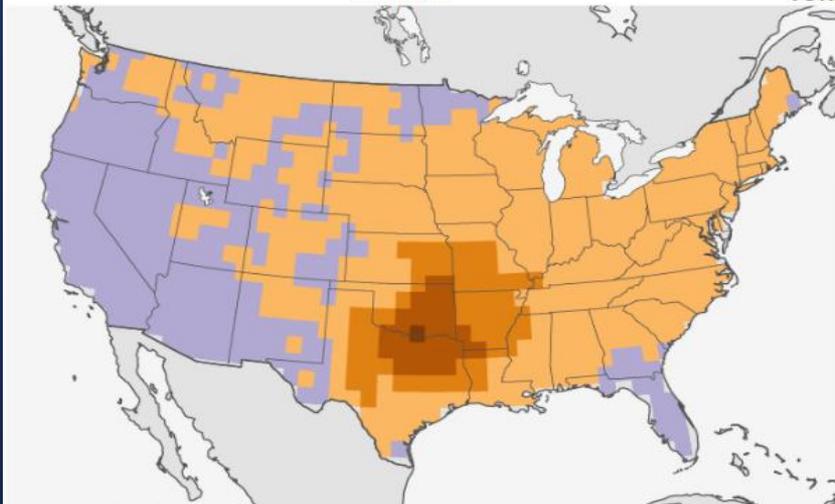


EL NIÑO

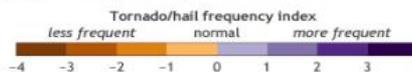


LA NIÑA

TORNADOES



Influence of El Niño (left) and La Niña (right) on the frequency of tornadoes (top) and hailstorms (bottom)



NOAA Climate.gov



Tornadoes during El Niño Events (1990-Present)

9 El Niño Events

Event Duration:

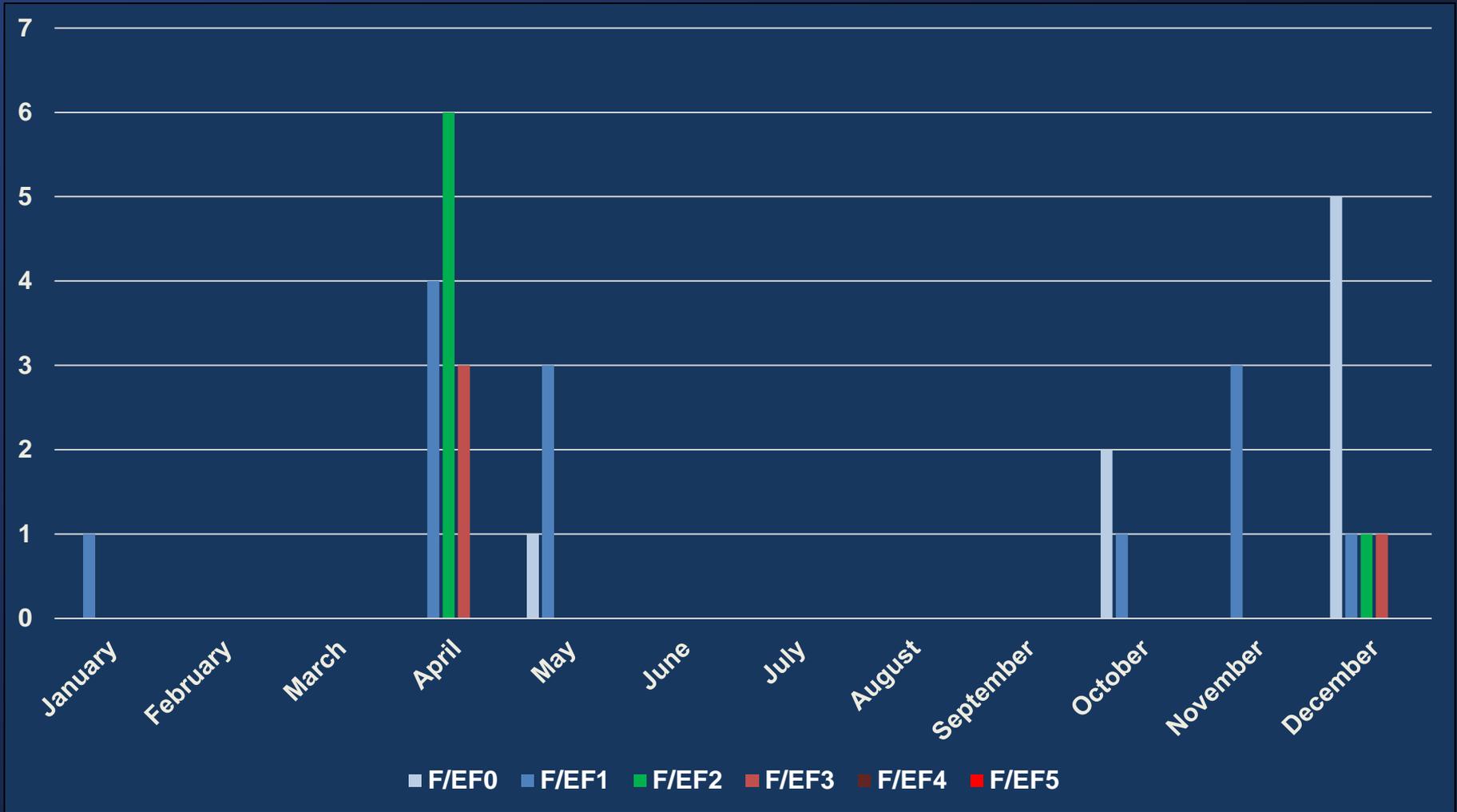
Tornado Count:

| | |
|---------------------------|----------|
| <i>Apr '91 – July '92</i> | <i>5</i> |
| <i>Aug '94 – Apr '95</i> | <i>0</i> |
| <i>Apr '97 – June '98</i> | <i>4</i> |
| <i>May '02 – Mar '03</i> | <i>0</i> |
| <i>June '04 – Mar '05</i> | <i>0</i> |
| <i>Aug '06 – Feb '07</i> | <i>1</i> |
| <i>June '09 – Apr '10</i> | <i>8</i> |
| <i>Sept '14 – May '16</i> | <i>5</i> |
| <i>Aug '18 – July '19</i> | <i>9</i> |

Total Tornado Count: 32



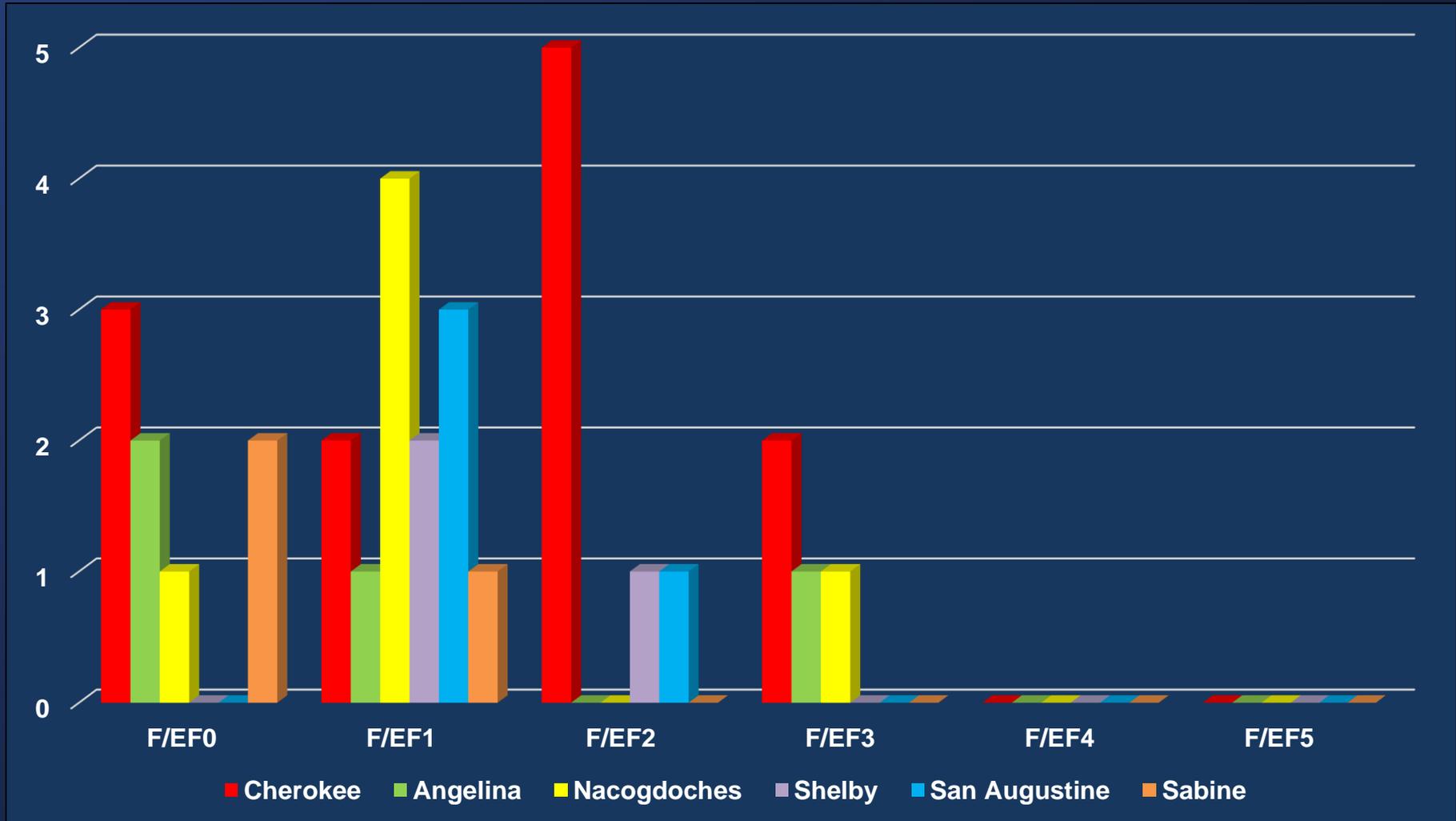
Tornadoes during El Niño Events (1990-Present)



Total Count: 32 tornadoes



Tornadoes during El Niño Events by County (1990-Present)



Total Count: 32 tornadoes



Tornadoes during La Niña Events (1990-Present)

10 La Niña Events

Event Duration:

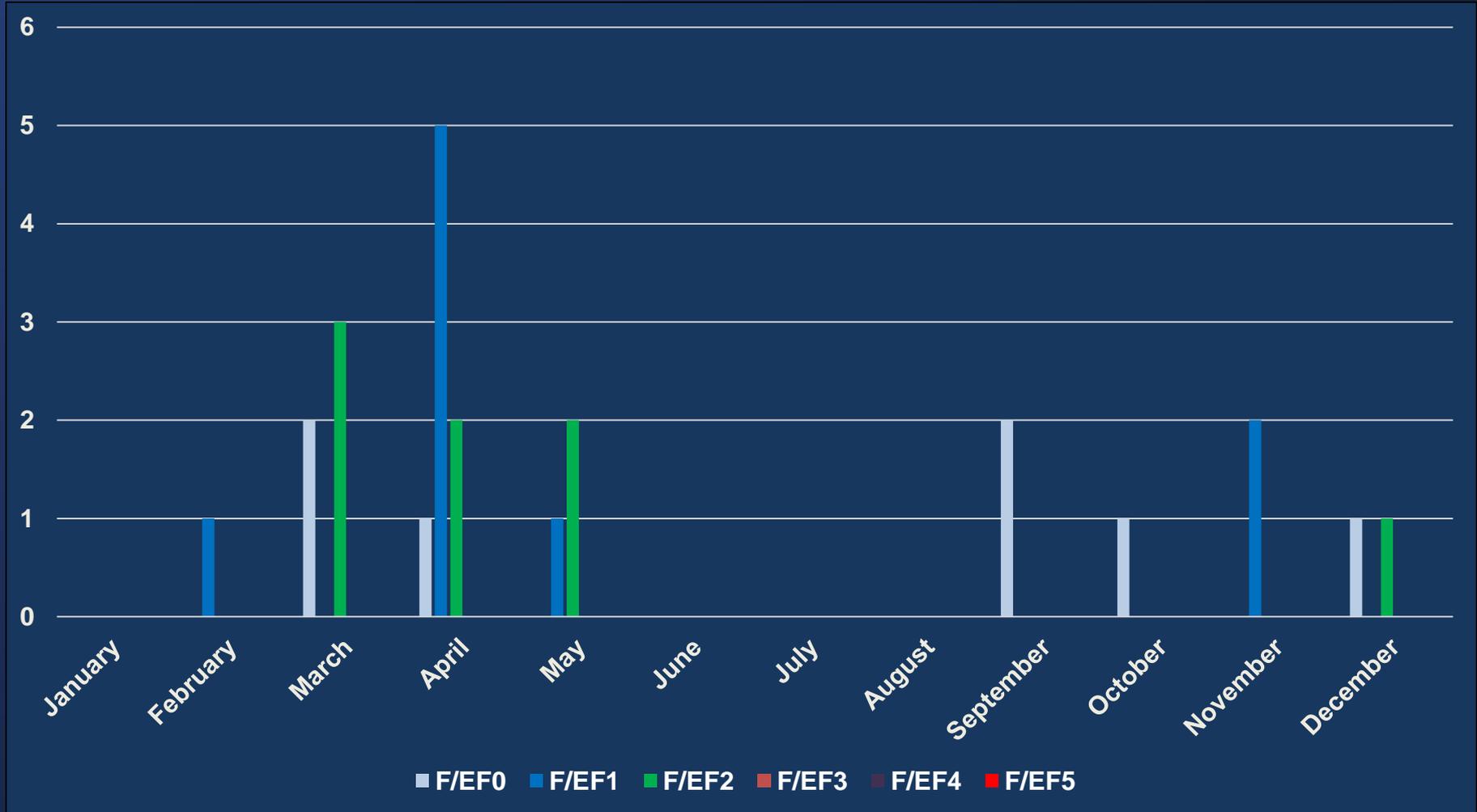
Tornado Count:

| | |
|--------------------|----|
| July '95 – Apr '96 | 4 |
| June '98 – Mar '01 | 10 |
| Oct '05 – Apr '06 | 0 |
| May '07 – July '08 | 2 |
| Oct '08 – Apr '09 | 1 |
| May '10 – June '11 | 4 |
| June '11 – May '12 | 2 |
| July '16 – Jan '17 | 0 |
| Sept '17 – May '18 | 1 |
| July '20 – Present | 0 |

Total Tornado Count: 24



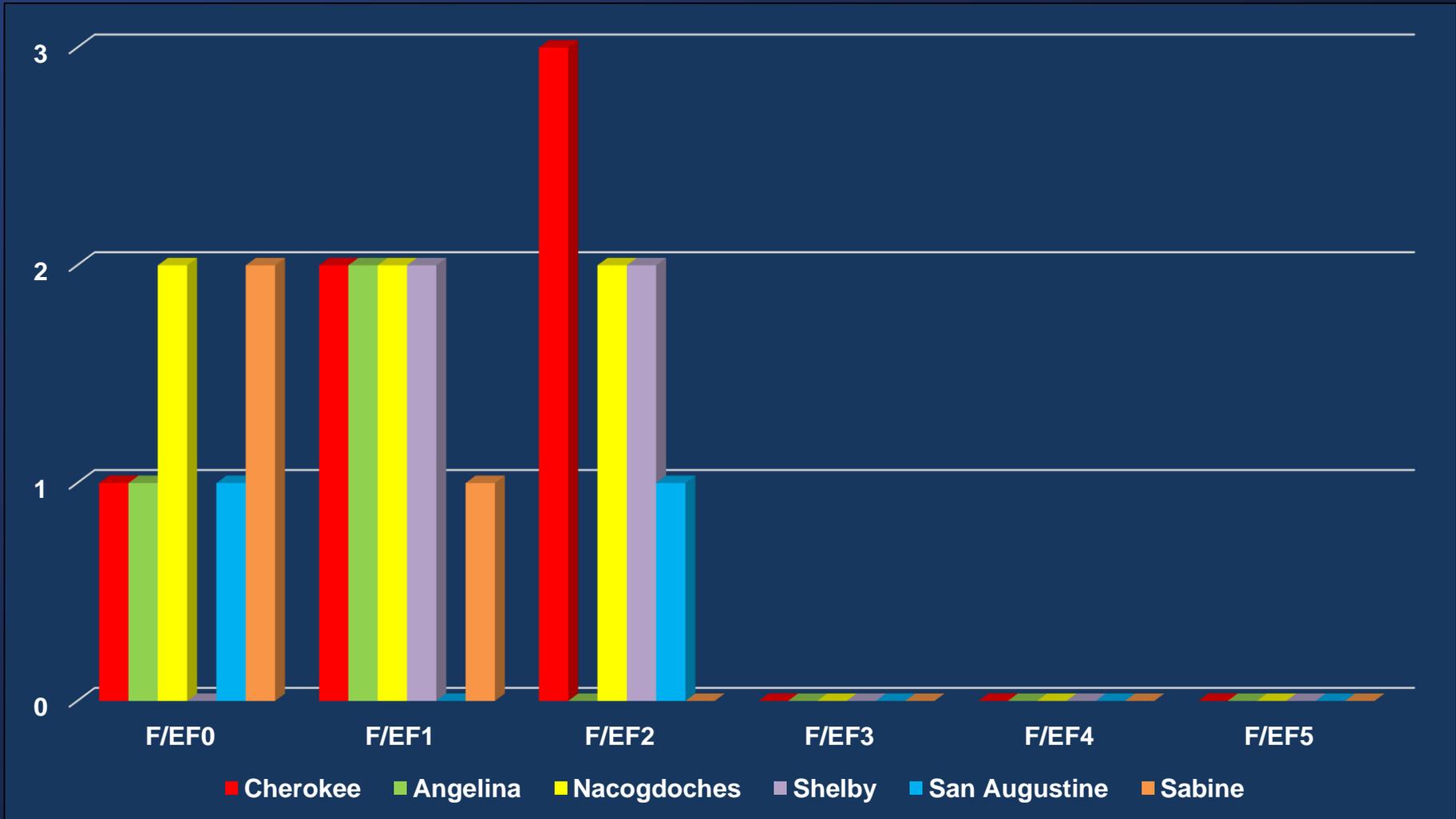
Tornadoes during La Niña Events (1990-Present)



Total Count: 24 tornadoes



Tornadoes during La Niña Events by County (1990-Present)



Total Count: 24 tornadoes



Killer Tornadoes (1991-2020)

- **Three** killer tornadoes have touched down in the last 30 years within the study area:
 - 1) Feb. 21, 2013:** Sabine County, **EF-1 (104 mph), 1 fatality** (A tree fell on a woman in a mobile home.)
 - 2) April 13, 2019:** Cherokee County (Alto Tornado), **EF-3 (160 mph), 1 fatality, 20 injuries**. (Occurred at Caddo Mounds State Park as visitors were outside and trying to take cover from the tornado. One other fatality occurred in Houston County from this 44 mile long track tornado where a woman was inside a double-wide mobile home when it was thrown and destroyed.)
 - 3) Jan. 10, 2020:** Nacogdoches County, **EF-1 (100 mph), 1 fatality, 1 injury**. (A tree fell onto a mobile home, killing a man inside and injuring another person inside.)



Summary

- East Texas (and all of our region) has seen a persistent trend of above normal temperatures and precipitation since the mid 90's, which has contributed to more extreme weather events.
- The majority of tornadoes in Deep East Texas consist of EF-0's, EF-1's, and EF-2's, which peak in April-May, with a secondary peak in November-December.
- While the longer term history since the late 70's suggest that there will be more frequent tornadoes in Deep East Texas during La Niña events, this study has shown that we are seeing more tornadoes during El Niño events since the early 90's. However, this study area is small and the results may not representative of what has occurred on a larger scale. Thus, additional larger scale studies are needed to determine if these tornado tendencies indeed fit over a larger area.
- Killer tornadoes have been rare in Deep East Texas, but education and awareness campaigns should continue/be expanded, especially for those living in mobile homes.



Deep East Texas Tornado Climatology

The End



Any Questions???

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