

ALLEY CATS: HOW EL NIÑO INFLUENCES TORNADO ALLEY AND THE THREAT OF CATASTROPHES

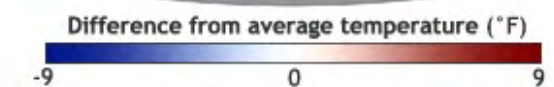
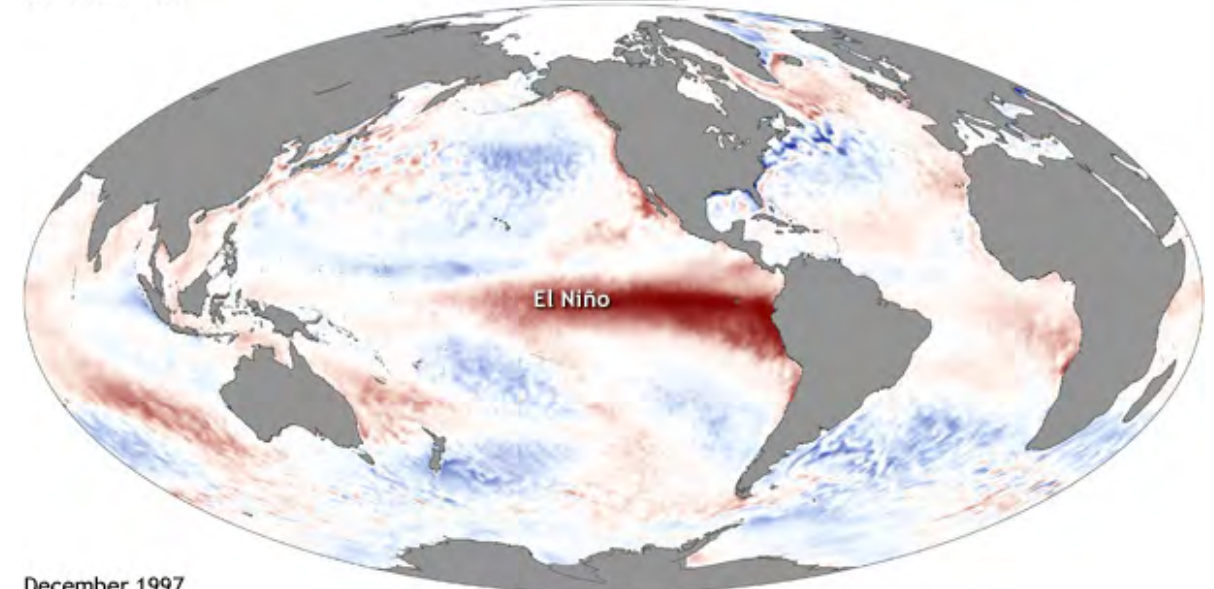
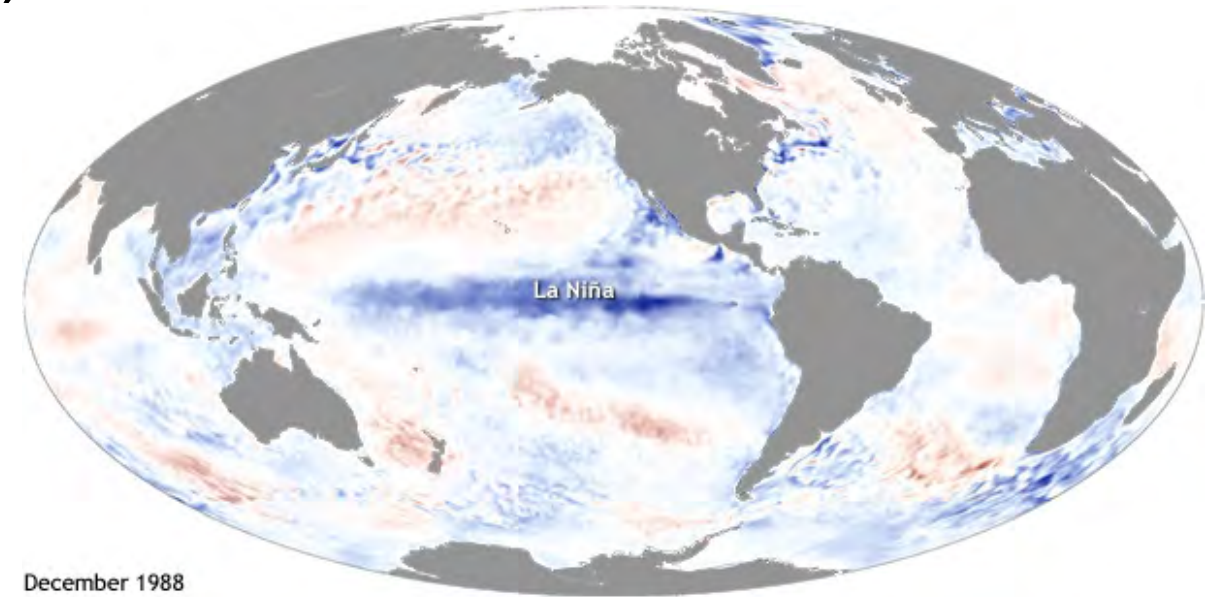
Kevin Van Leer - Sr. Product Manager, Model Product Management

National Tornado Summit - Tuesday, March 1st, 2016

EL NIÑO/SOUTHERN OSCILLATION (ENSO)

What is El Niño?

- A warming of the ocean surface, or above-average sea surface temperatures (SST), in the central and eastern tropical Pacific Ocean
- The low-level surface winds, which normally blow from east to west along the equator (“easterly winds”), instead weaken or, in some cases, start blowing the other direction (from west to east or “westerly winds”).

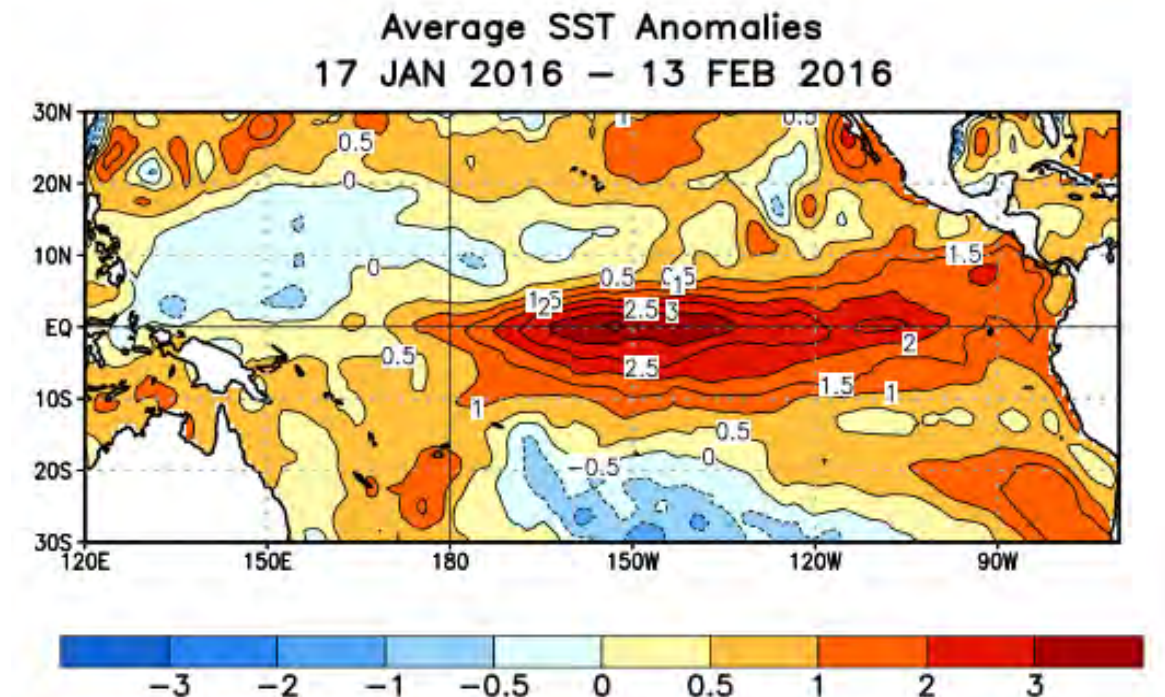
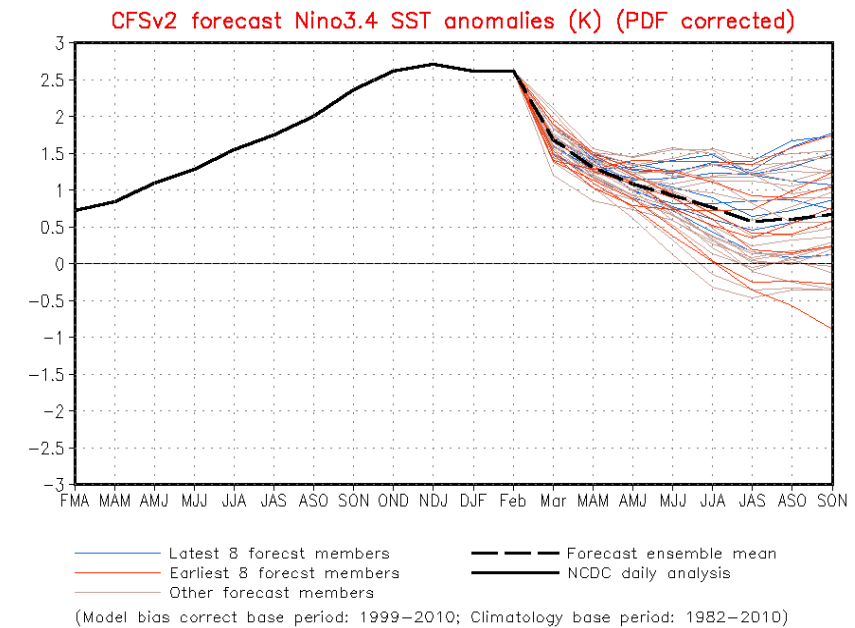


Maps by NOAA Climate.gov, based on data provided by NOAA

EL NIÑO SOUTHERN OSCILLATION (ENSO)

2015-2016 El Niño

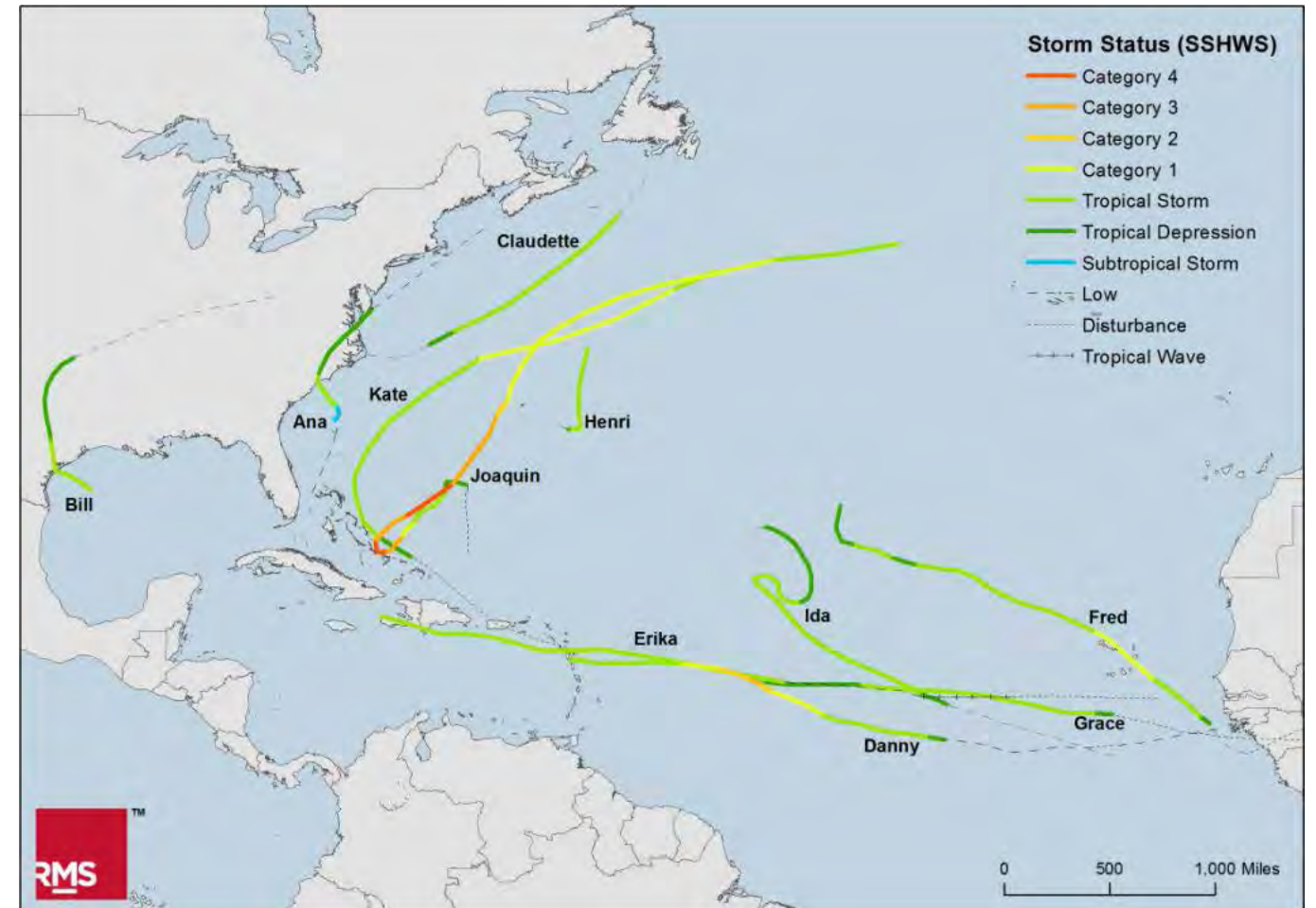
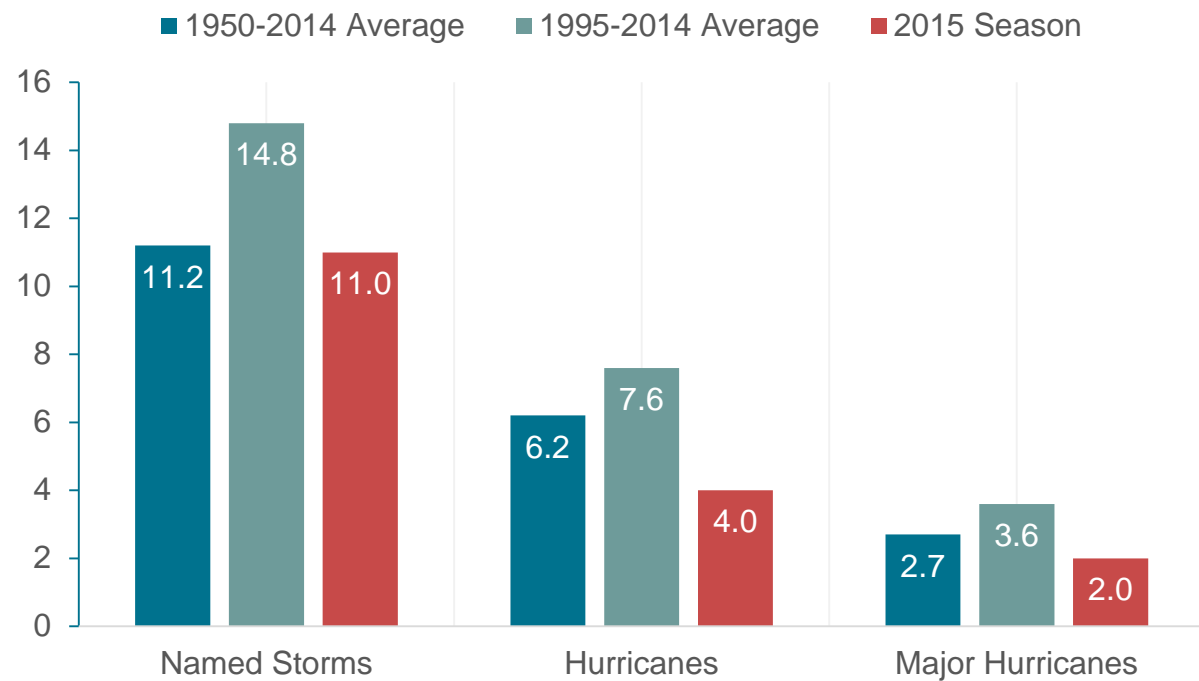
- NOAA operationally defines El Niño, the warm phase of ENSO, as occurring when the Oceanic Niño Index (ONI) is greater than or equal to $+0.5^{\circ}\text{C}$, typically for at least 5 consecutive overlapping 3-month periods
 - ONI is based on the 3-month running mean SST anomaly in the Niño 3.4 region of the Pacific
- The most recent ONI value (Nov 2015– Jan 2016) is 2.3°C , which is considered a “super” El Niño
- **The current El Niño is considered one of the strongest on record**



Images from the 15 Feb 2016 CPC ENSO Discussion

EL NIÑO'S IMPACT ON ATLANTIC HURRICANES

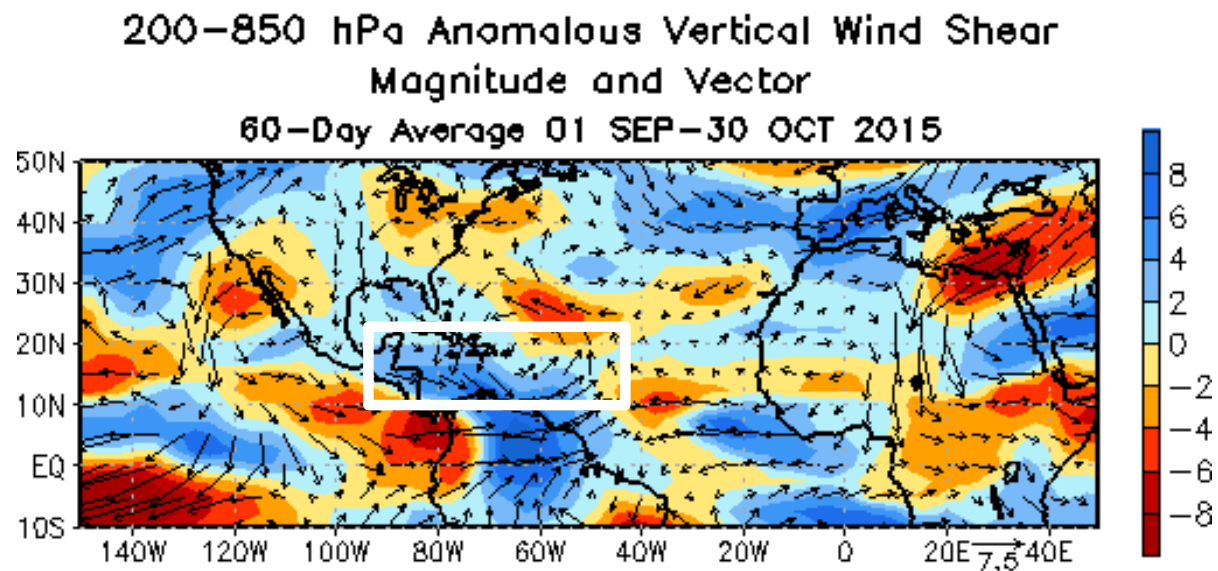
- From RMS's 2015 Atlantic Hurricane Season Review
 - “Although predicted SST and sea-level pressure conditions did not materialize, 2015 was indeed a quiet season, as a result of the anticipated El Niño event, which is currently tied with 1997 as the strongest event on record.”



COMPARING EL NIÑO RESEARCH

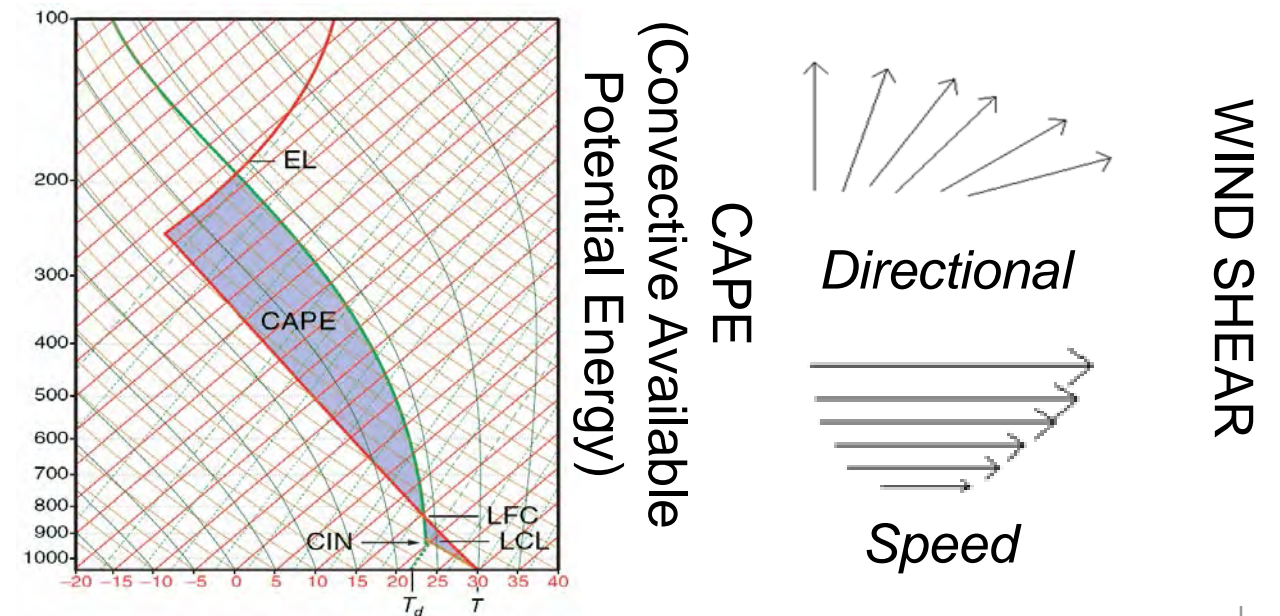
HURRICANES

- Longer history of research tying El Niño to reduced Atlantic hurricanes
- Hurricanes are a larger scale phenomenon than tornadoes
- Increased wind shear across the Caribbean creates an unfavorable environment for hurricane development



TORNADOES

- Recent research has identified a potential physical mechanism for El Niño's influence
- El Niño's influence is on a different scale than individual tornado development
- Focus is on El Niño's impact on **ingredients** for severe convective storm development



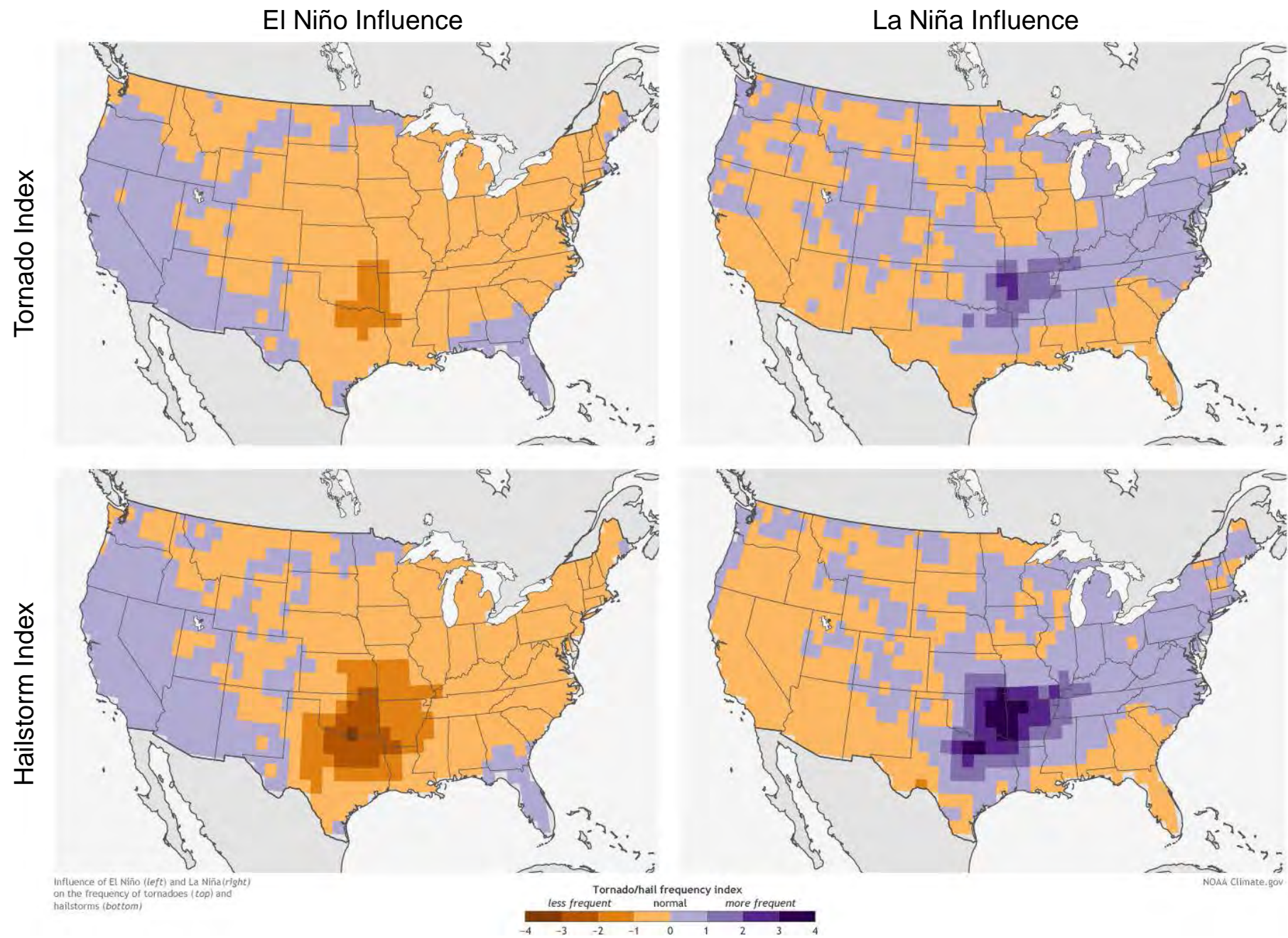
LATEST RESEARCH

ALLEN, TIPPETT, AND SOBEL (2015)

El Niño modifies the jet stream positioning over the continental U.S., which alters severe weather ingredients

Identified lower tornado and hail activity in central U.S. during El Niño episodes

Winter ENSO indices can be used to predict spring severe weather frequency



Images from Climate.gov; Adapted from referenced Nature publications

RESEARCH SUMMARY

Other References

- Cook and Shafer 2008
- Lee et al 2013
- Tippett et al 2014
- Sparrow and Mercer 2015

Increased Winter Activity in the Southeast and East

- Research has related El Niño to winter tornado outbreaks (As was seen in December 2015 and last week!)
- Large scale atmospheric conditions favorable for tornado outbreaks, such as southwesterly wind shear, in the Southeast

Reduced Spring Activity in the central Plains

- El Niño alters the jet stream position during the spring months, reducing favorable conditions for severe weather
- Fewer low pressure systems over the central Plains
- Less warm, moist air intrusion into central Plains from Gulf

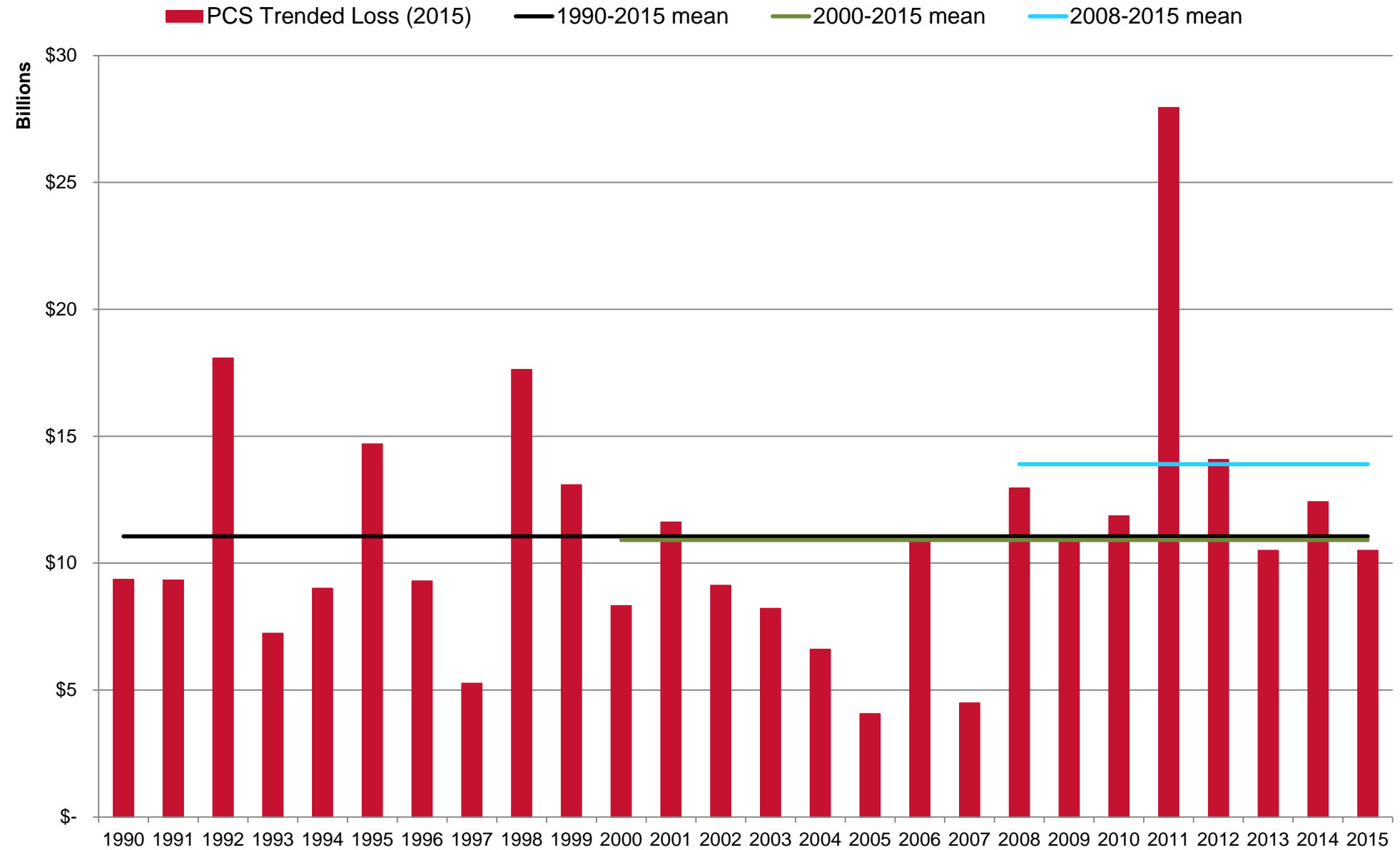
2015 SEVERE WEATHER SEASON

2015 INSURED LOSSES

From an insured loss perspective, 2015 was a “normal year”

Only 2 events with insured losses greater than \$1B

Many events dominated by flash flood losses, instead of hail, wind, and tornado



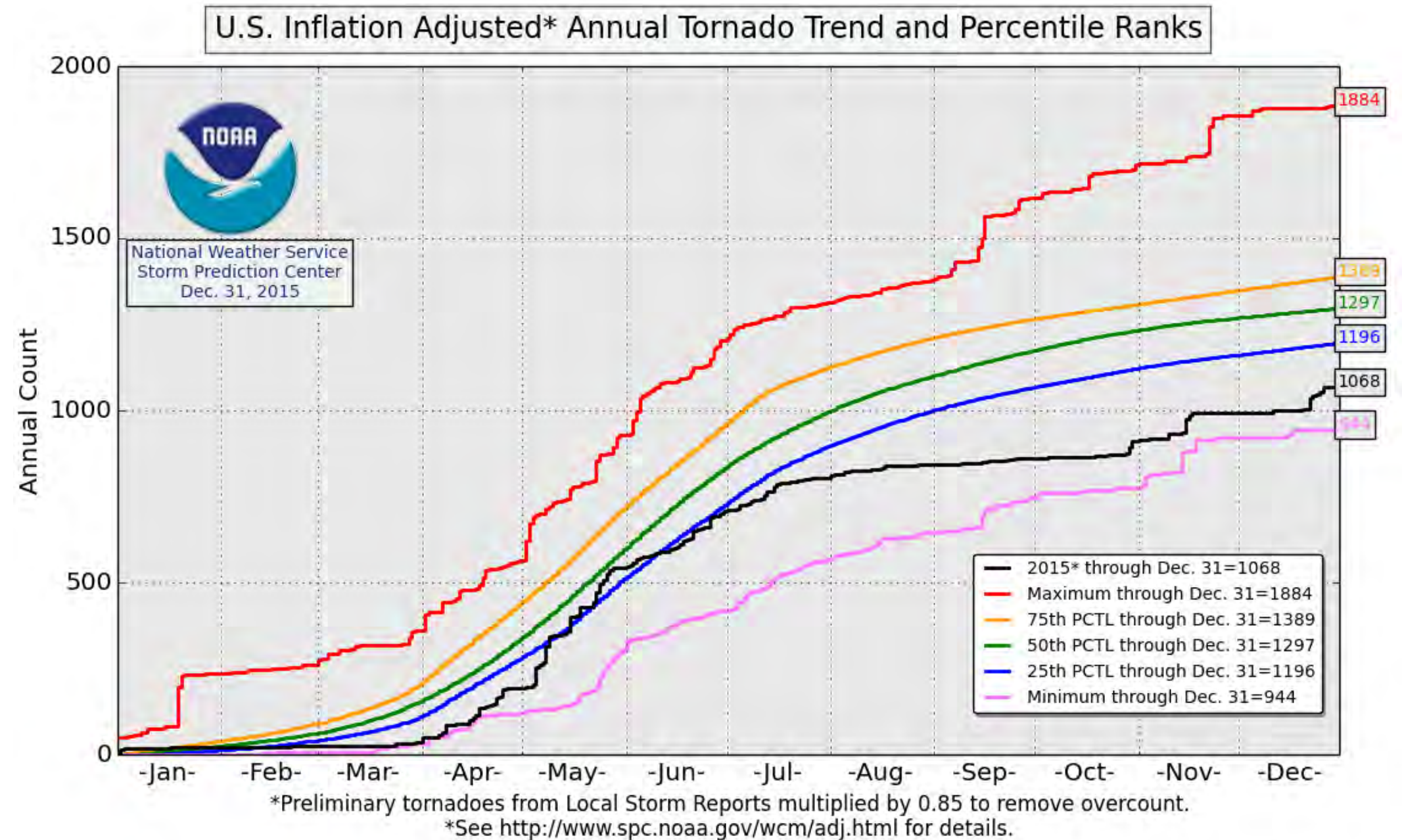
Data retrieved from Property Claims Service (PCS) and Trended to 2015

2015 TORNADO COUNTS

Tornado counts below the 25th percentile

Slow start season (March and April)

Significant events in May, November, and December

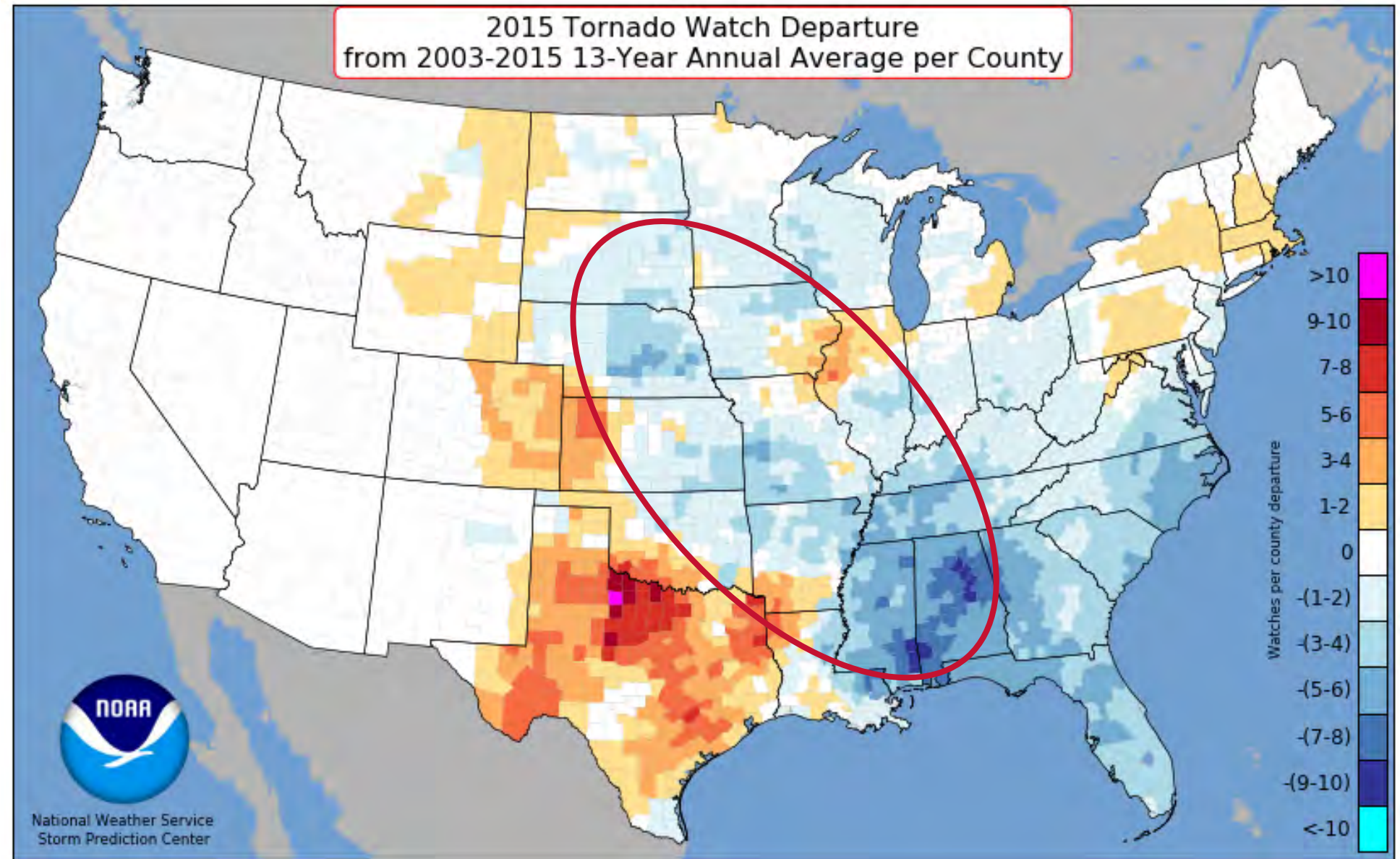


2015 TORNADO WATCH COUNTS

Marked decrease in Tornado Watches in “Tornado Alley” and Southeast U.S.

Reflects decreased tornado activity in these areas

Pattern matches well with those identified in research



2015-2016 WINTER SEVERE WEATHER

Evergreen, VA – 24 Feb 2016



Photo: Jason Smith

Rowlett, TX – 26 Dec 2015



Photo: NWS Forth Worth

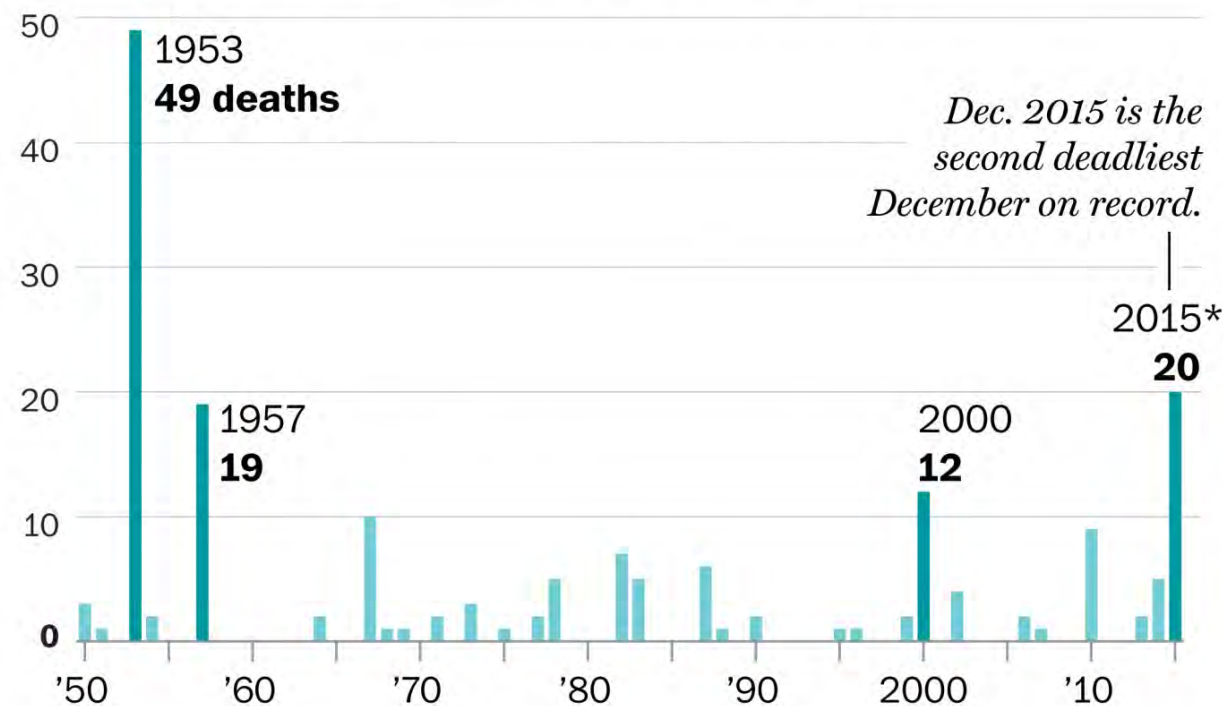
Clarksdale, MS – 23 Dec 2015



Photo: AFP/Getty Images

Increased Winter activity in the Southeast and East aligns well with published research findings

Tornado deaths in December since 1950



Note: December 2015 data is preliminary.

Source: National Weather Service

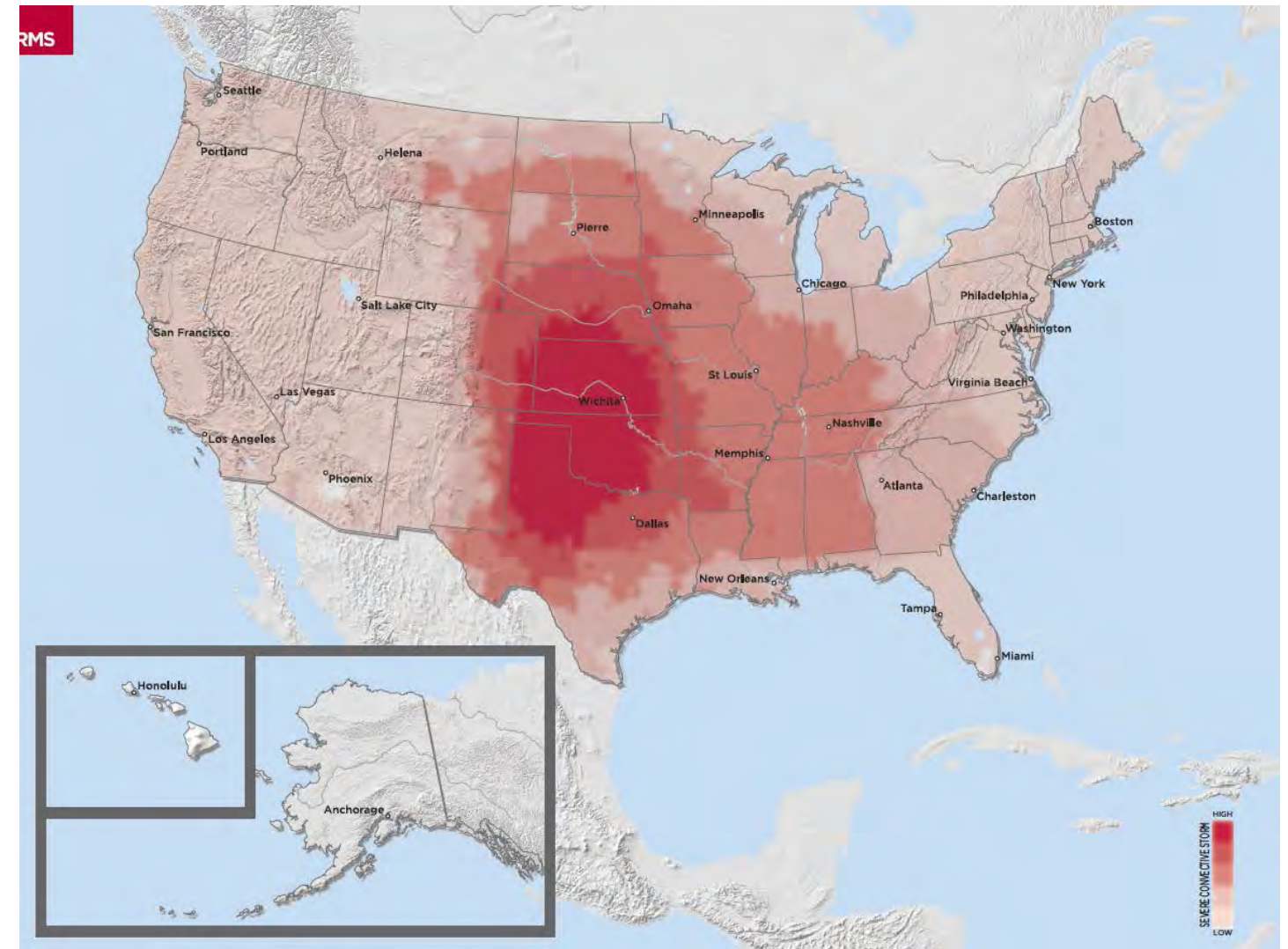
THE WASHINGTON POST

WHY SHOULD ENSO BE REPRESENTED IN CAT MODELS?

WHY SHOULD ENSO BE REPRESENTED IN CAT MODELS?

- A granular seasonal view on severe weather patterns could inform the insurance industry of increased or decreased risk geographically
- Observed patterns during **this** El Niño event compare well with the recent research
 - Reduced Spring activity in the central Plains
 - Increased Winter activity in the Southeast and East
- These patterns could be reflected in a special stochastic event set for use in El Niño or La Niña periods generated using an **ingredients-based** approach
 - This type of approach is already used in CAT models to generate severe convective storm event sets

Severe Convective Storm Risk



SUMMARY

- The current El Niño episode is one of the strongest on record
- The 2015 season saw decreased tornado activity over the central U.S., though insured losses were still near “average”
- The 2015/2016 winter has been marked by significant severe weather events
- Recent research has identified links between El Niño and decreases in severe weather activity over the central U.S., as well as an increase in activity during winter months
- The ingredients-based approach to severe storm event set generation in CAT models may present a future opportunity for incorporating seasonal views of severe storm frequency
- Many questions remain regarding the impacts of ENSO on severe convective storm activity, though recent research is showing great promise.



ABOUT RMS

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