May 6, 2024

CAS Spring Conference

Assessment of Natural Catastrophe Impacts on the Insurance Industry

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Discussion Overview

Financial Impact of Recent Weather

- Review of 2023 Loss Activity
- Historical Loss Perspective
- Quantifying Industry Impacts

Loss Trend Drivers & Attribution Uncertainty

- Key contributors of weather loss trend
- Latest on climate change and severe storm activity
- Climate tele-connections and severe weather

Closing Thoughts

1

Financial Impact of Recent Weather

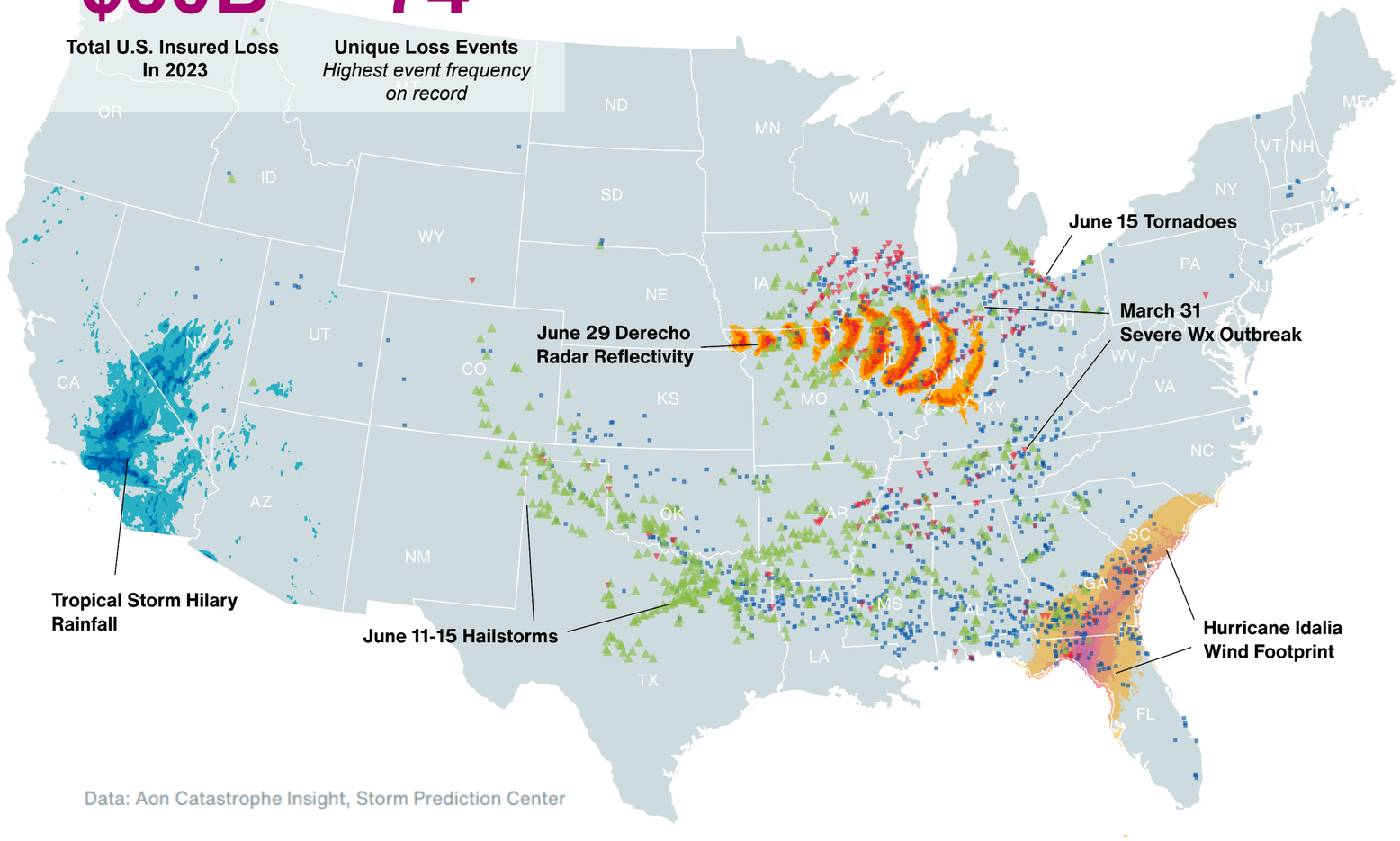
Significant U.S. Catastrophe Activity of 2023

$80B

Total U.S. Insured Loss In 2023

74

Unique Loss Events
Highest event frequency on record

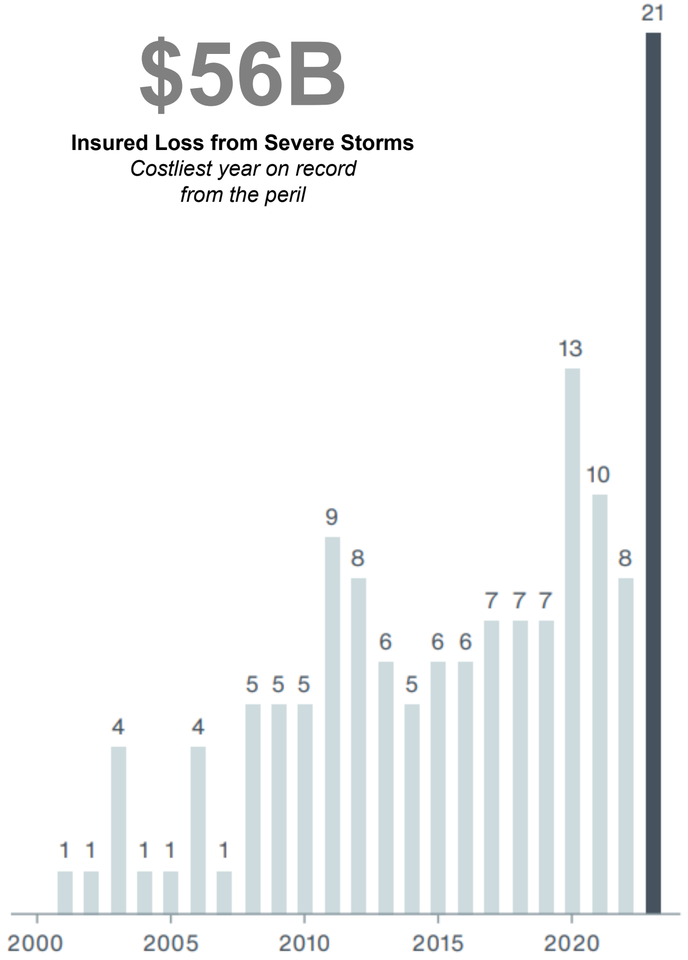


Data: Aon Catastrophe Insight, Storm Prediction Center

Number of SCS Events over $1B

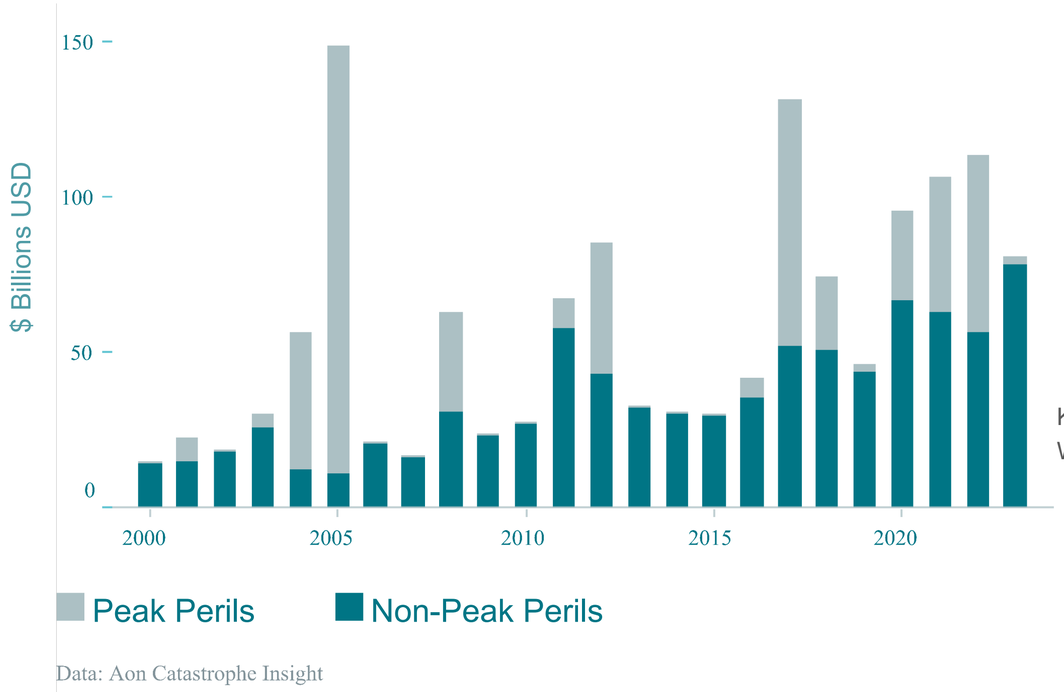
$56B

Insured Loss from Severe Storms
Costliest year on record from the peril



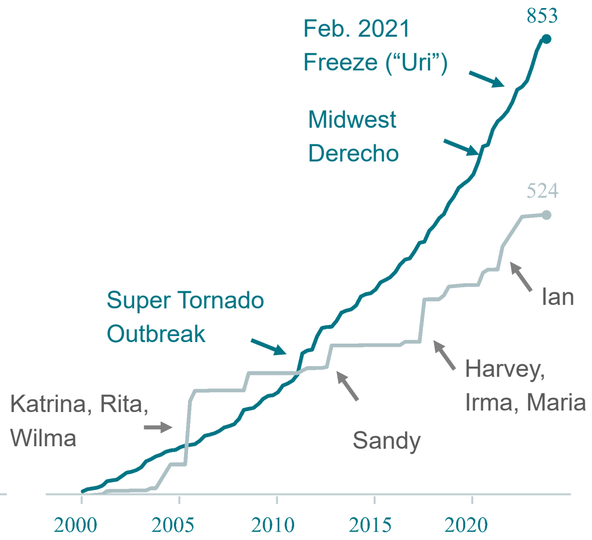
“Non-Peak” Perils Keeping Pace (or Outpacing) their Counterparts?

Annual U.S. Insured Losses (2023 $)



Data: Aon Catastrophe Insight

Cumulative U.S. Insured Losses

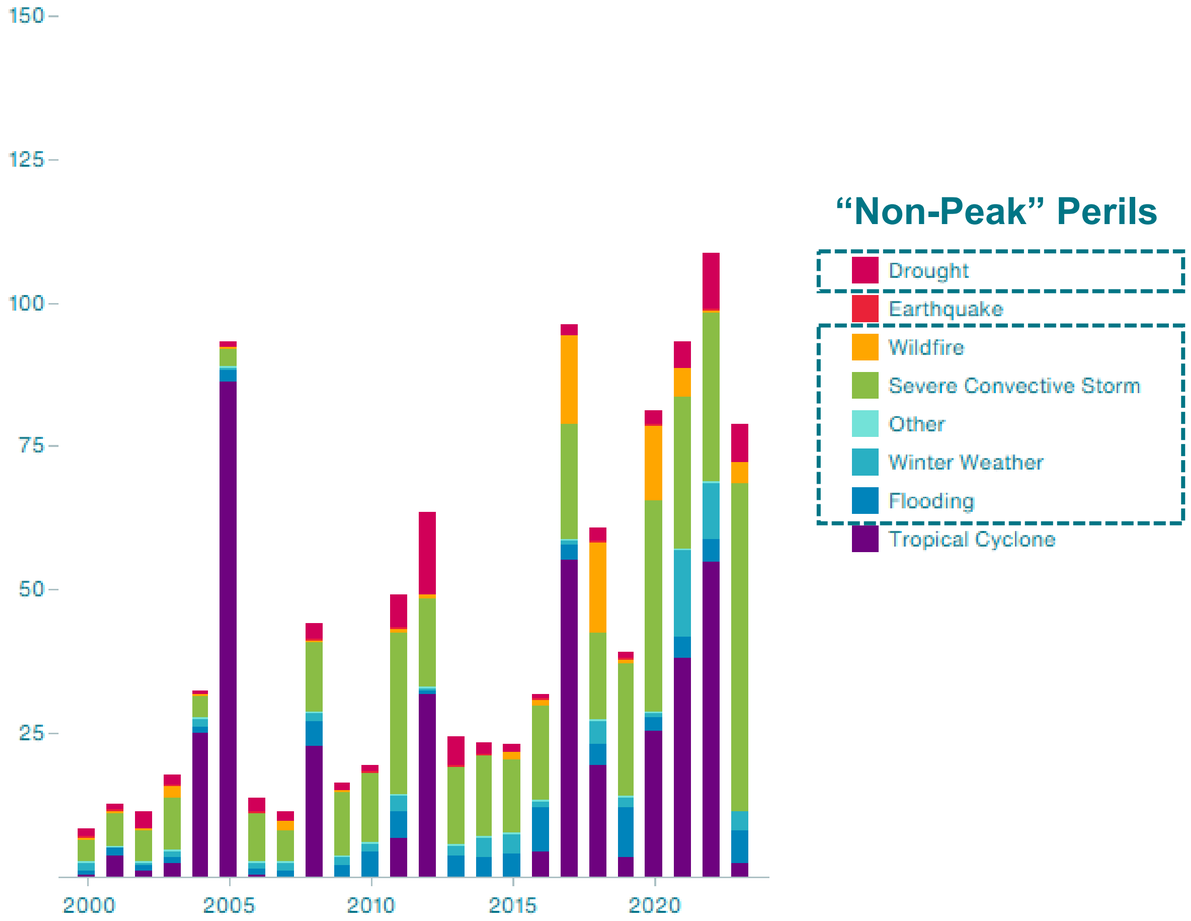


Cumulative losses from “non-peak” perils since 2000 exceeded $850 billion and outpaced peak perils

There were forty $1B+ insured industry loss events from perils other than hurricane in the US since 2020

Severe Storm Losses are Largest Driver of “Non-Peak” Loss Trend

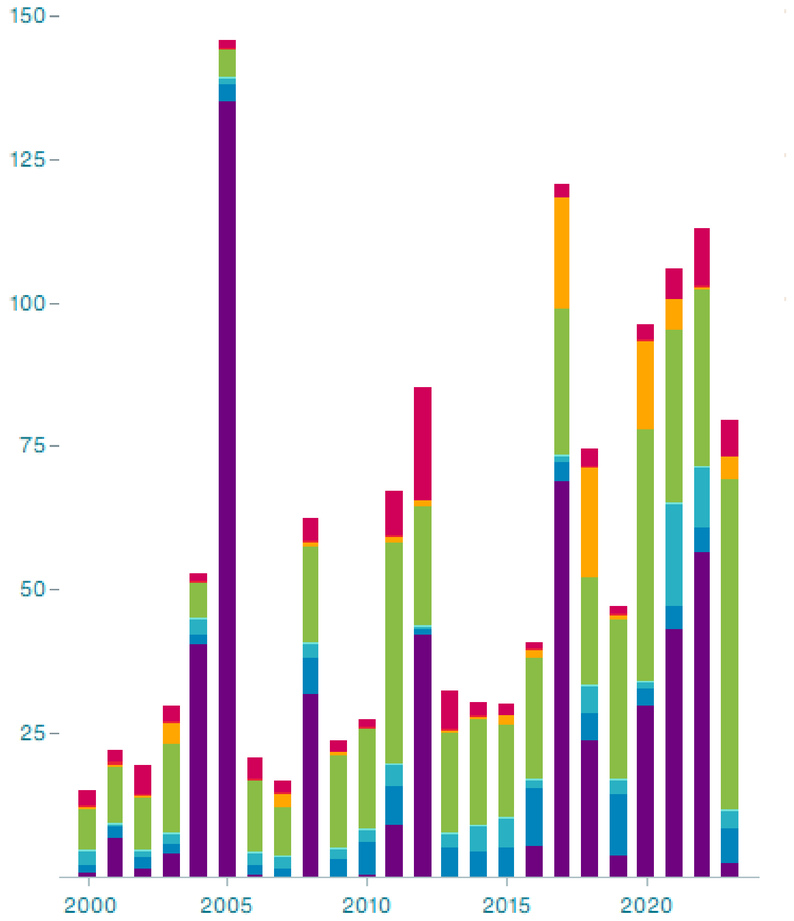
U.S. Nominal Insured Losses (2023 $ bn)



“Non-Peak” Perils

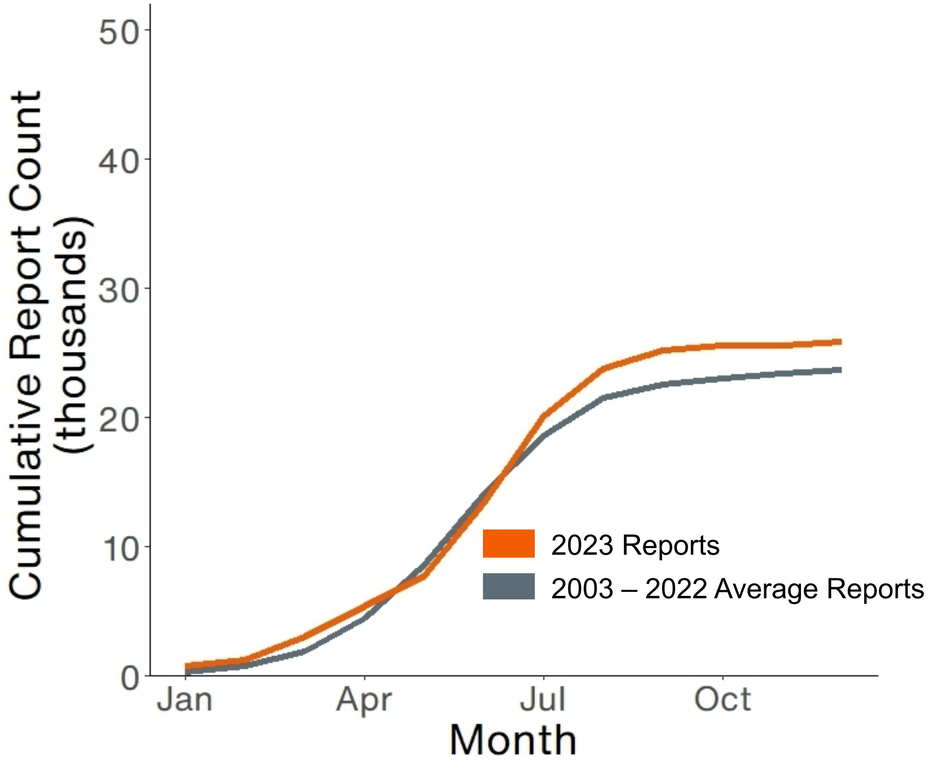
- Drought
- Earthquake
- Wildfire
- Severe Convective Storm
- Other
- Winter Weather
- Flooding
- Tropical Cyclone

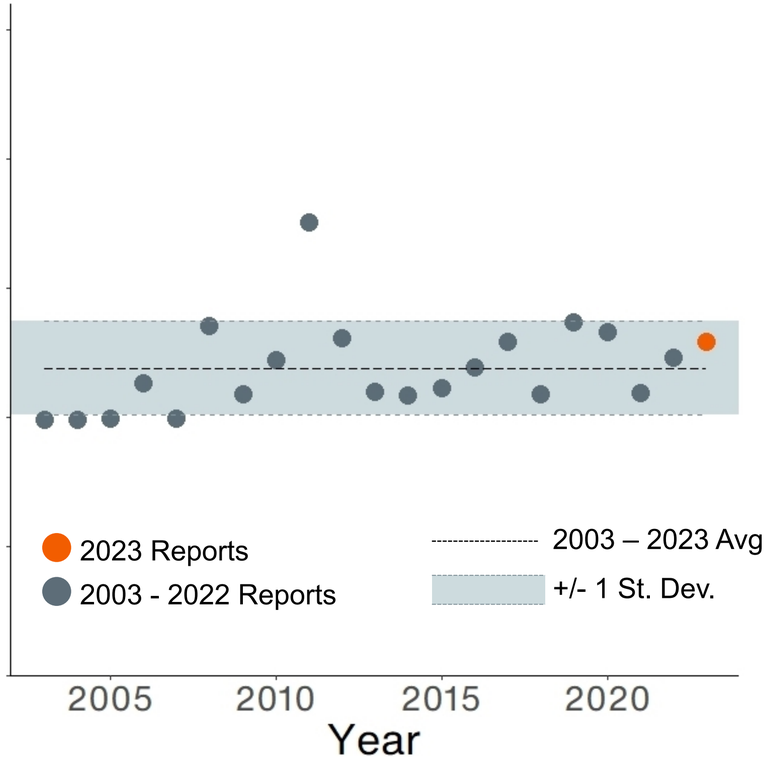
U.S. Inflation-Adj. Insured Losses (2023 $ bn)



Data: Aon Catastrophe Insight

2023 Storm Reports – Were Weather Reports Anomalous?





Source: NOAA Storm Prediction Center
Analysis by Aon

Annual cumulative severe weather reports for 2023 were

8% Above

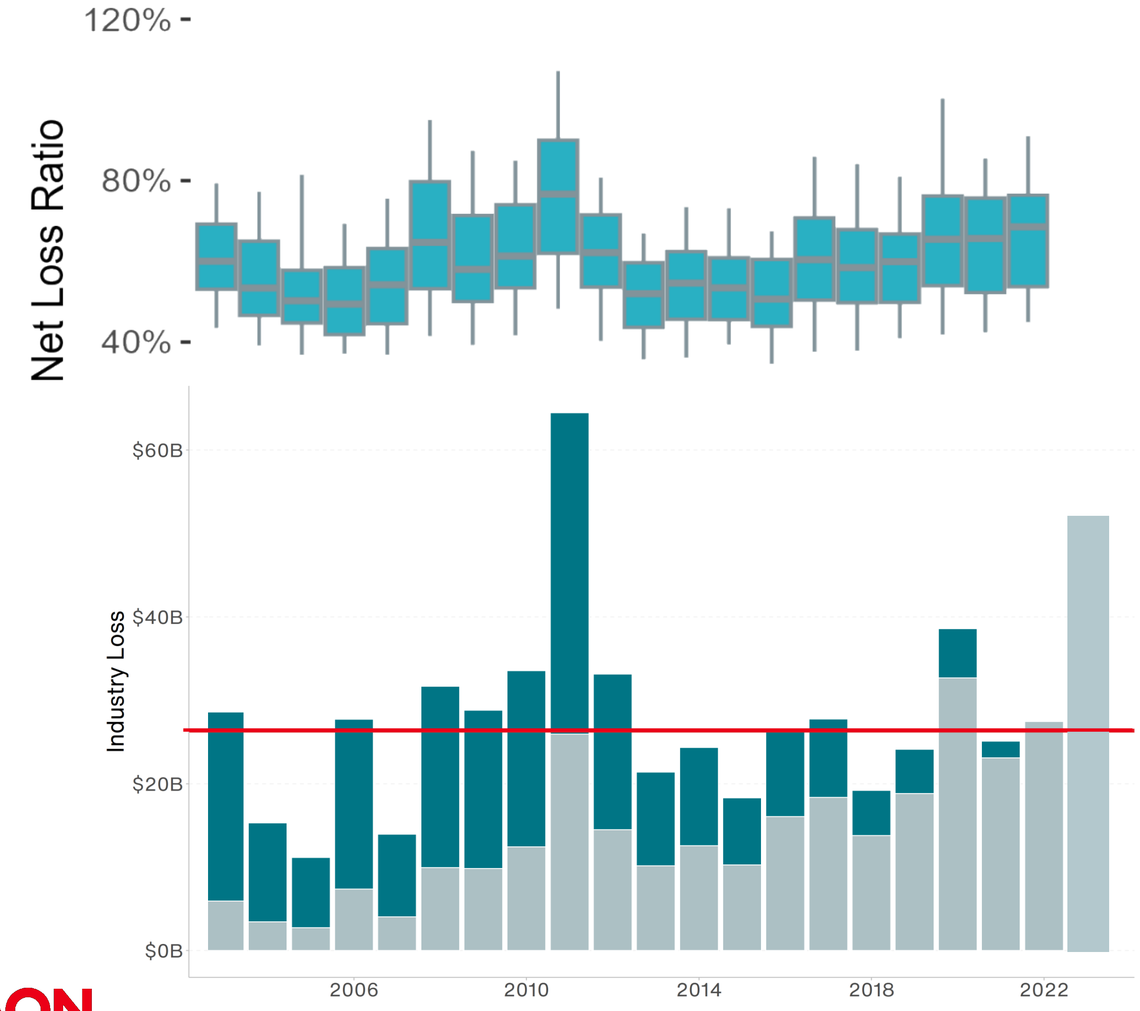
The 20-year average number of reports for 2003 - 2022

Based on actual observed reports of hail, straight line wind, and tornado damage from NOAAs Storm Prediction Center, 2023 was **marginally above average** largely driven by elevated activity in June.

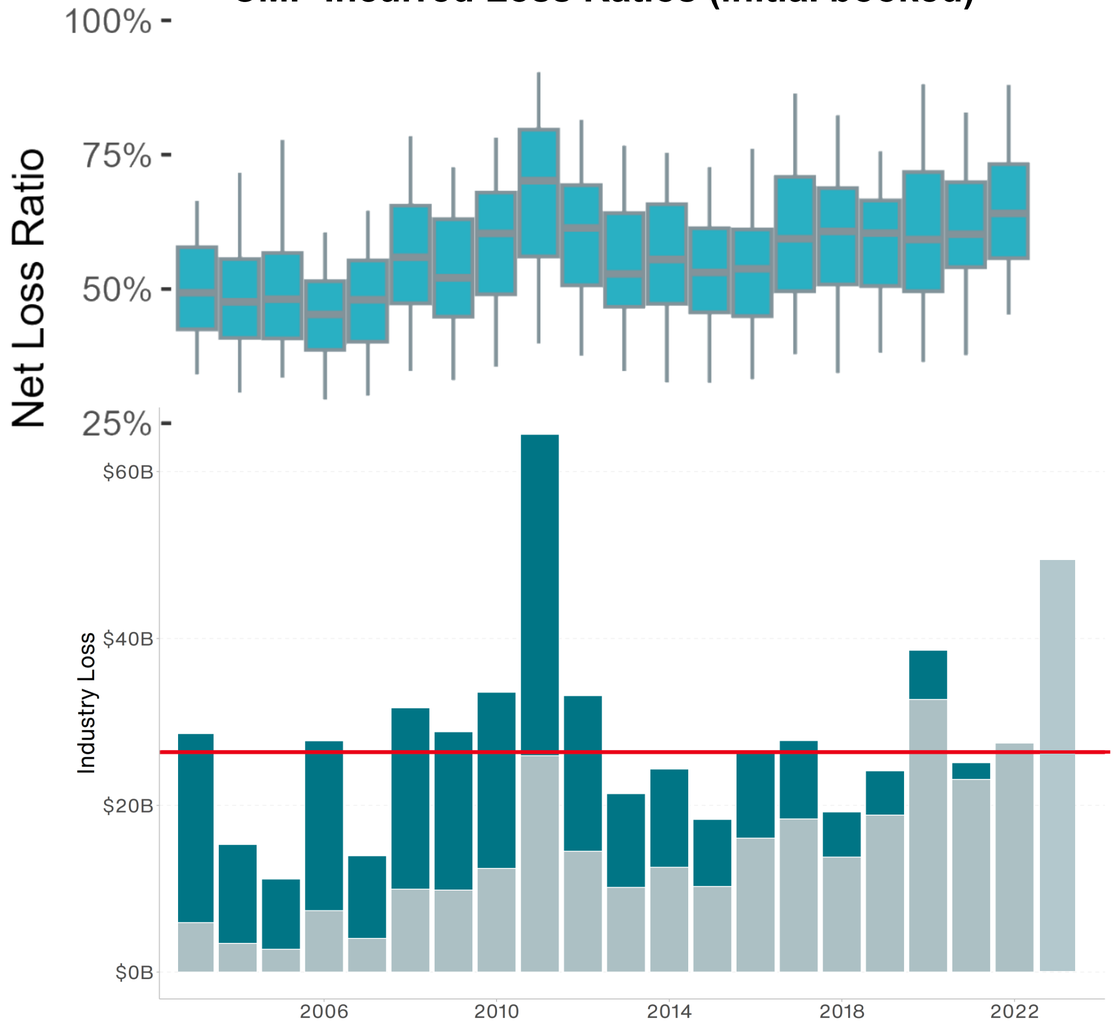
Total Loss Results: Do “Non-Peak” Perils Matter?

Industry Schedule P Results by Accident Year vs. PCS SCS Losses (Trended)

Homeowners Incurred Loss Ratios (initial booked)

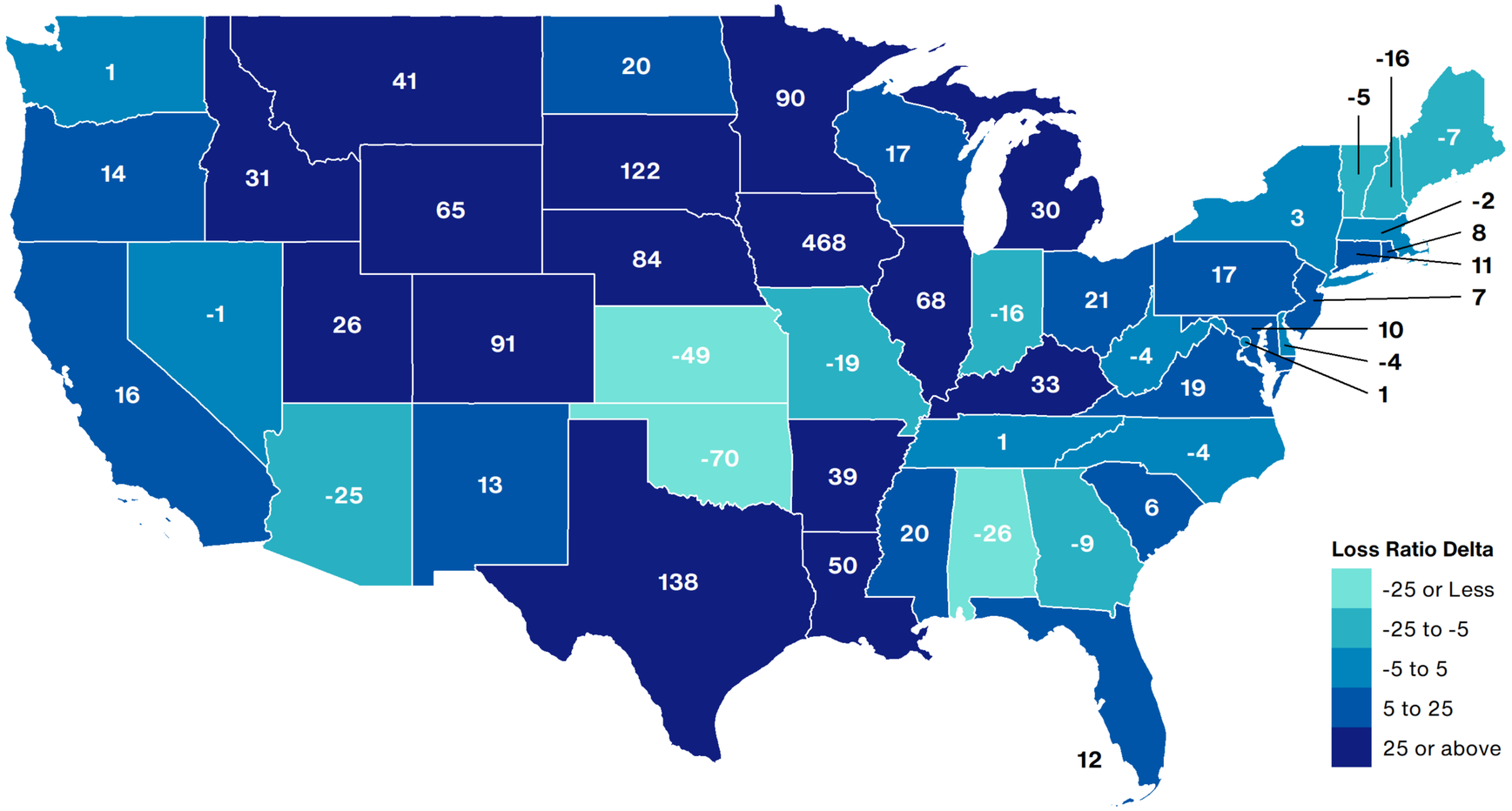


CMP Incurred Loss Ratios (initial booked)



Diagnosing Industry Impacts of Severe Storm Activity

Recent 5-yr (2018-2022) vs Prior 15-year (2003-2017) PCS Loss Ratio Performance



Multi-billion-dollar tornado, hail and derecho events since-2011 have driven industry loss ratios

25+ Points

above the prior decade average for 22% of the U.S. (11 states)

Industry loss ratios over the past 5-yrs were

100+ Points

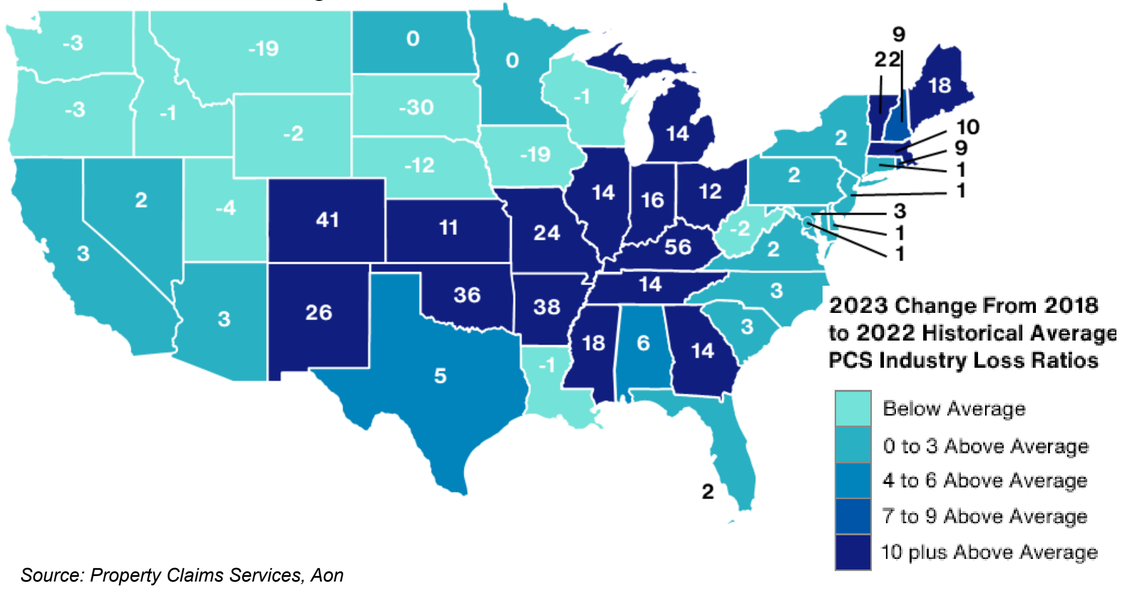
Above the historical average in Iowa, Texas and South Dakota as a result of numerous large hail events and record-breaking derechos

2023 FY Benchmarking of SCS & Winter Storm Loss Activity

Geography Plays Key Role in “Winners and Loser” of 2023 Losses

2023 vs. 2022 - 2018

5-Yr Severe Convective Storm (SCS) and Winter storm (WT)
Avg Loss Ratio Difference



Source: Property Claims Services, Aon

Pers/Comm Industry

7 Points Above

Average PCS Loss Ratio

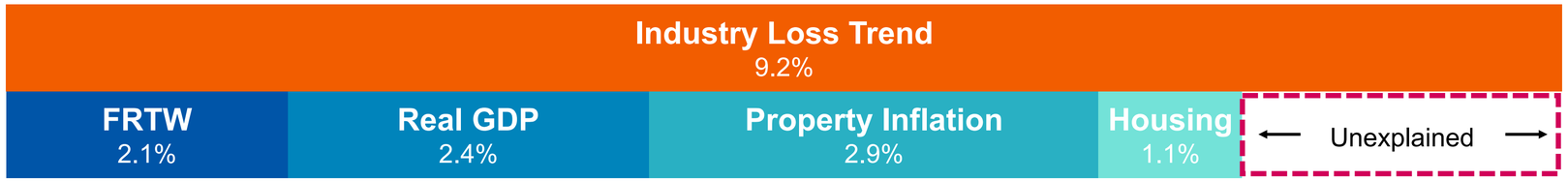
Personal and commercial loss ratios for 2023 ended the year **10-40+ points above the 5-year average across the central U.S. and mid-Mississippi Valley**, largely driven by elevated frequency in the first half of the year.

Higher weather frequency in 2023 **drove adverse under-performance** for the industry **relative to the most recent 5-yr average**.

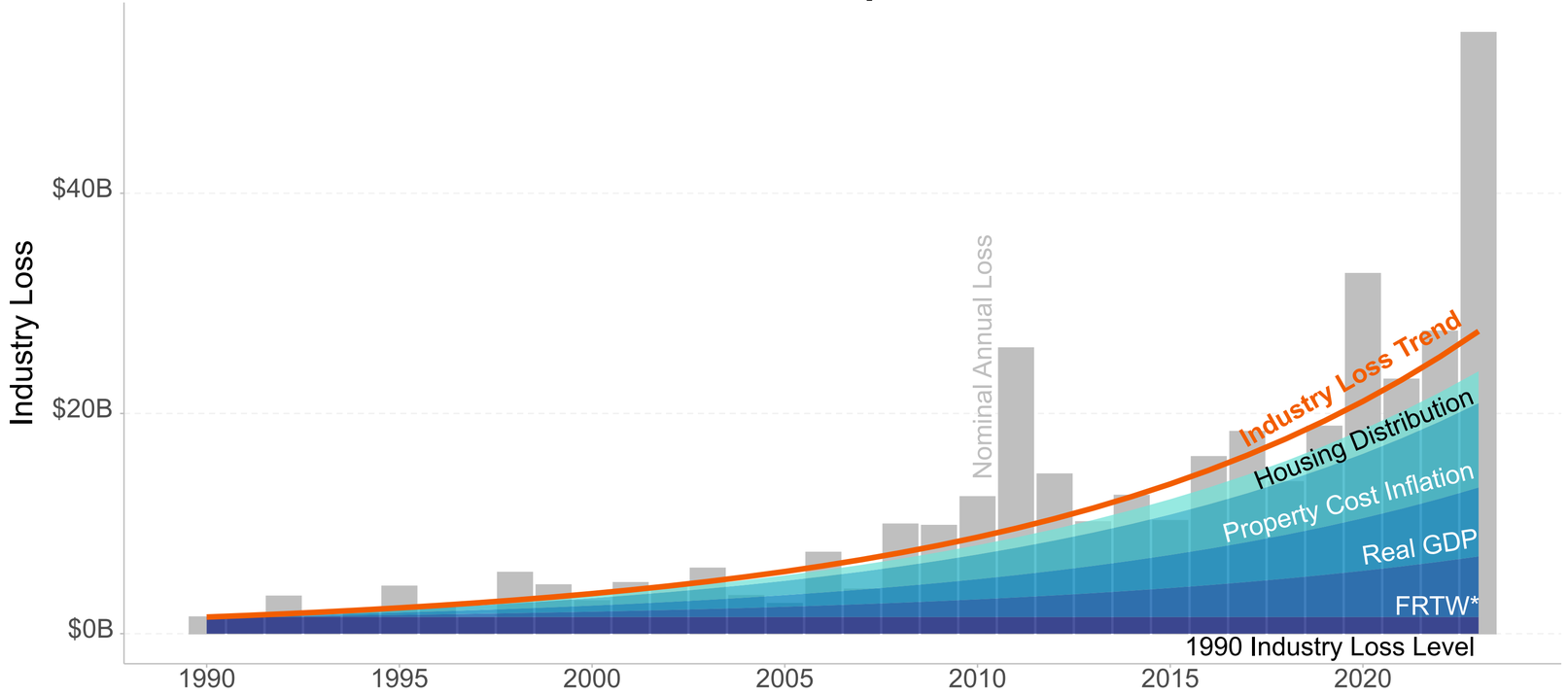
2

Loss Trend Drivers and Attribution Uncertainty

80+% of SCS loss trend is explained by exposure changes



Nominal Annual SCS Losses and Loss and Exposure Trends



Losses are PCS Wind and Thunderstorm Events
A $100M in 2006 dollars (trended using CPI) threshold was applied to PCS events before aggregating the untrended (i.e. nominal) losses by year for the exhibit above
* FRTW is Fixed Reproducible Tangible Wealth

Growth in SCS losses must be viewed in context with exposure changes

SCS losses are increasing by about 9.2% a year, on average

80+% of this growth is due to changes in underlying exposures and valuations while the remaining ~20% is unexplained by these exposure changes

Exposure changes come in different forms

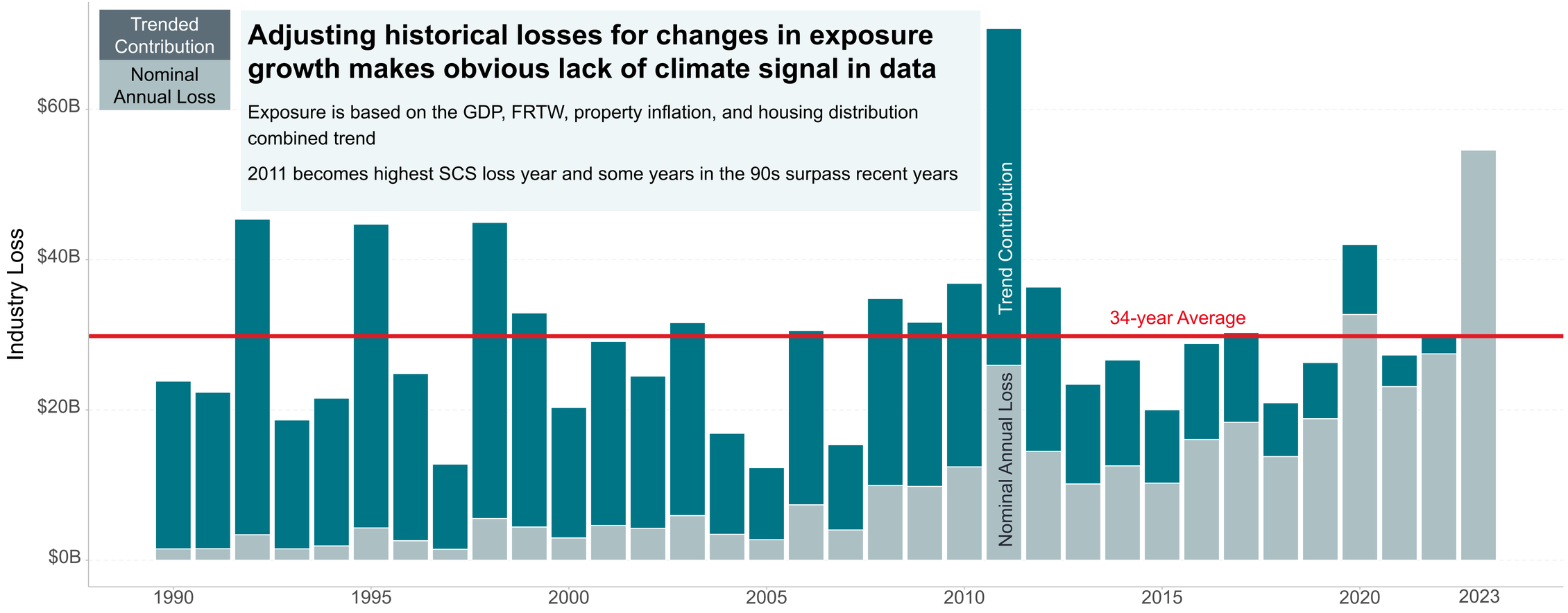
Real GDP and fixed reproducible tangible wealth growth account for change in how much “stuff” there is and how much it is worth

Inflation for property building costs has generally outpaced broader inflation, especially in recent years

Finally, the population distribution has changed over time resulting in more homes in high hazard areas like Texas

Visible trend disappears when nominal losses are exposure trended

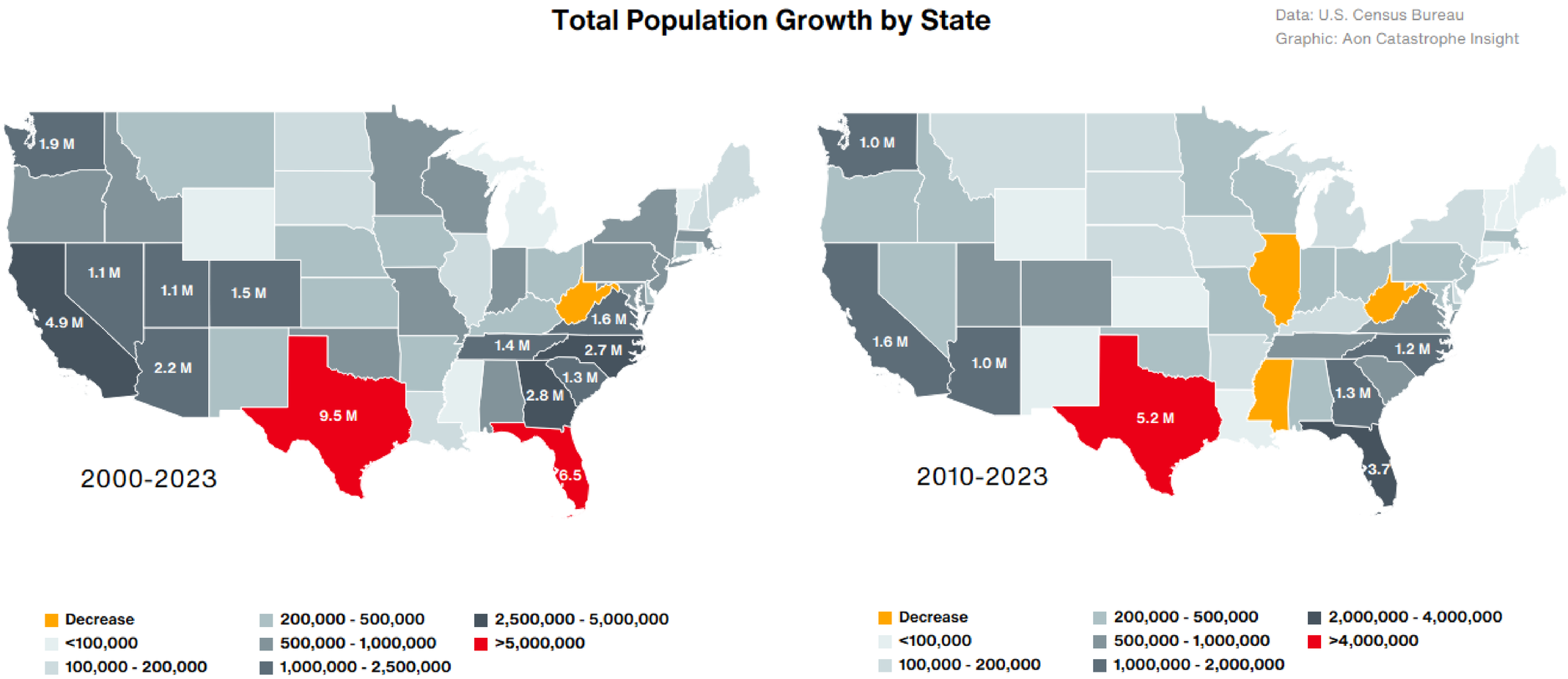
Trended Annual SCS Losses



“When it comes to tackling climate change and extreme weather, we ignore population at our peril.”

Emma Woods, UK Royal Society, Head of Policy & Wellbeing

Population (Exposure!) Expansion in Higher Risk Areas



Along with Increased Building Density in Higher Risk Areas

"Expanding Bullseye" Hail Swath Example
Dallas / Fort Worth (Texas) Metroplex

1950

Population: **1.25M**
Housing Units: **403K**

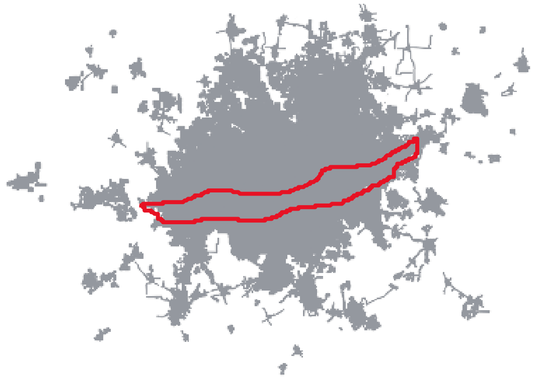
1970

Population: **2.43M**
Housing Units: **826K**

2000

Population: **5.19M**
Housing Units: **2.01M**

Today



Population: **~8.0M**
Housing Units: **~3.0M**

As population grows and the urban footprint expands, the risk of potential damage increases.

*Totals include Collin, Dallas, Denton, Ellis, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise counties

Adapted from Ashley, et al (2014)

Data: U.S. Census Bureau
Graphic & Analysis: Aon (Catastrophe Insight)

Contributors to Higher Natural Hazard / Climate-Related Losses

Weather Risk and Attribution

Weather has always and will always occur

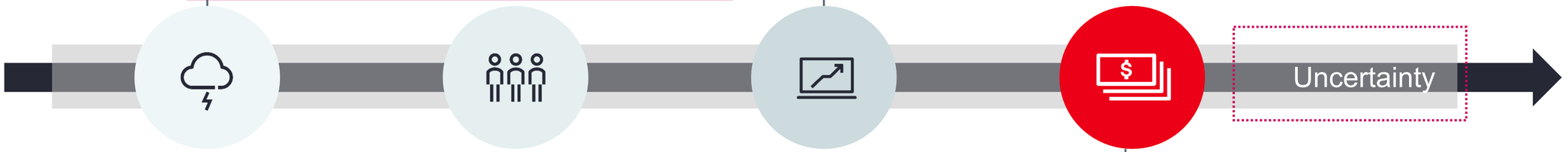
Quantifying the “fingerprints” of climate change remain a challenge despite knowing its existence

Acceleration of more unusual weather behavior with more impactful incidents on a per event basis

Replacement Costs / Misc.

Higher cost of labor and goods adds to recovery / rebuild costs

Can result in compounded implications to global supply chain



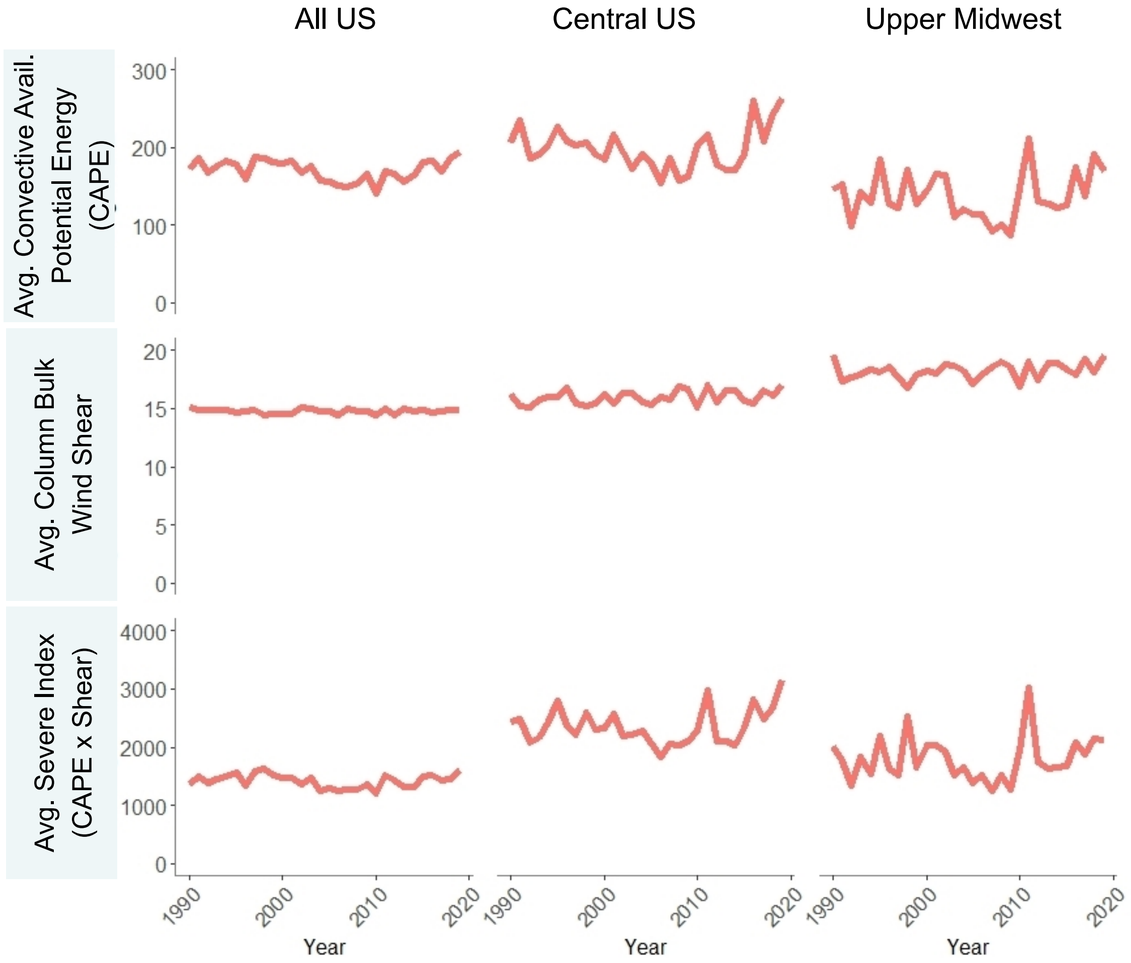
More People in Harms Way

Continued population migration pattern into known high-risk natural peril regions

Result

Increasingly expensive weather & climate related natural catastrophe losses

Weather “Ingredients” Through Time



Key metrics used to measure “ingredients” that support severe convective storm formation include:

- **CAPE** – measure of atmospheric instability
- **Shear –** Change in wind speed/direction with height
- **Severe Index** – Product of CAPE x Shear, commonly used to diagnose severe convective storm potential.

While interannual variability in available potential energy at a regional level is apparent, **there don’t appear to be any discernible trends in large scale atmospheric ingredients to support elevated severe thunderstorm activity.**

Central US

Upper Midwest

Analysis based on NOAA’s ERA5 reanalysis data from 1990 – 2019. 6-hourly observations were averaged through all days in each year to calculate annual average for each atmospheric metric.

“Climate is what we expect, weather is what we get.”

Mark Twain

Climate Change Impacts on U.S. Physical Hazards

Assessed by IPCC in Assessment Report 6

Extreme Heat events will continue to occur more often, particularly near cities

Extreme Rainfall and flash (pluvial) flood risk will continue to increase, especially in central and eastern U.S. urban areas

Coastal Flooding will continue to increase due the combined effects of sea level rise and storm surge

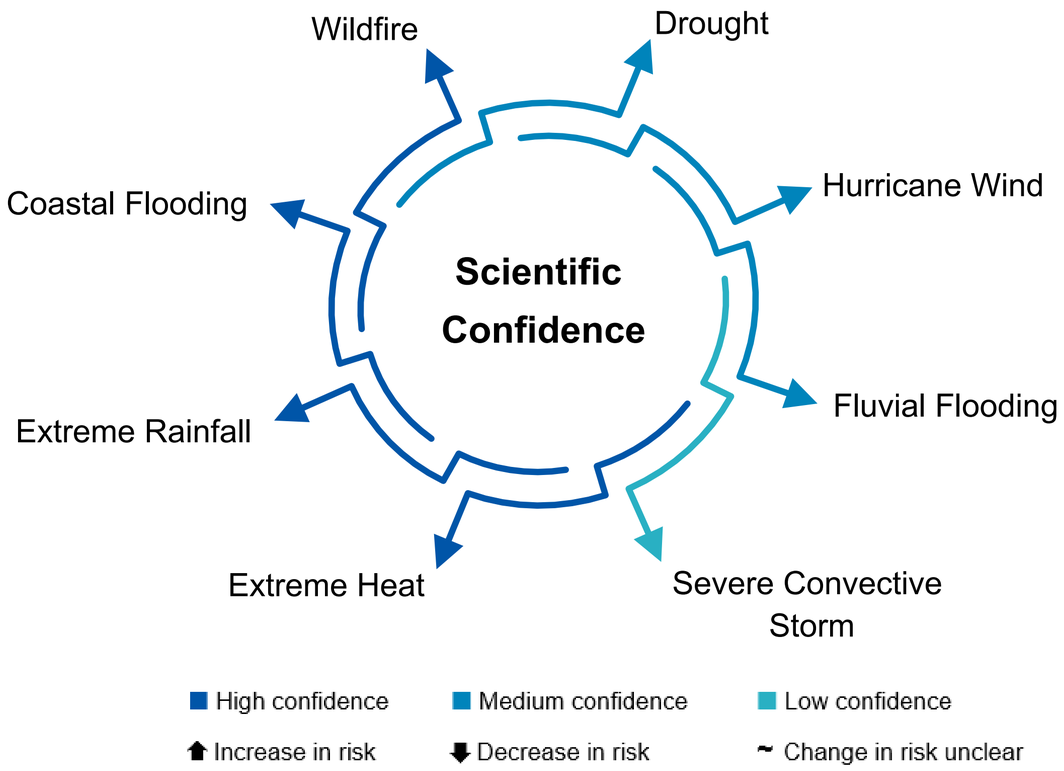
Wildfire favorable conditions have increased in recent past, and will continue to increase

Drought and heatwaves will become more frequent with increased water stress over land due to increased evaporation and decreased soil moisture

Hurricane Wind intensities will increase due to warmer sea surface temperatures

Fluvial Flooding will increase and impact more land areas with more frequent extreme rainfall

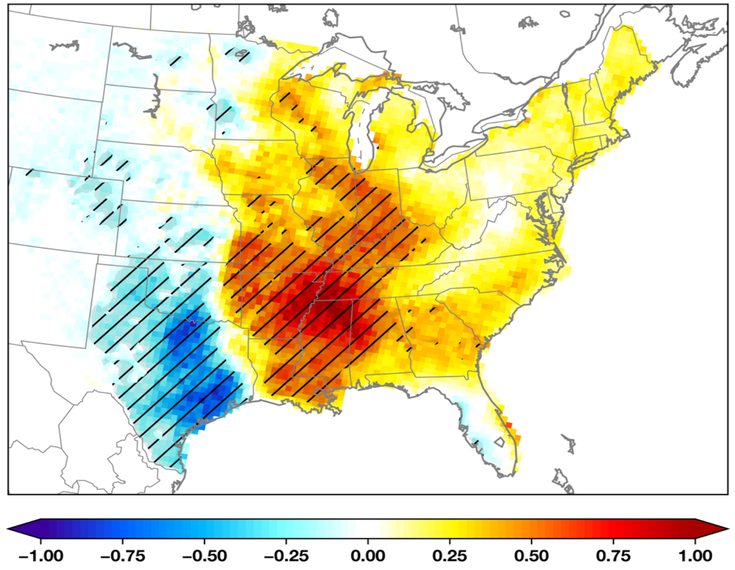
Severe Convective Storm frequency or intensity may or may not be significantly impacted by climate change



Climate change influence (and confidence) varies by individual peril and region.

Climate Change “Fingerprint” on Severe Thunderstorm Risk

Trends in Significant Tornado Environments

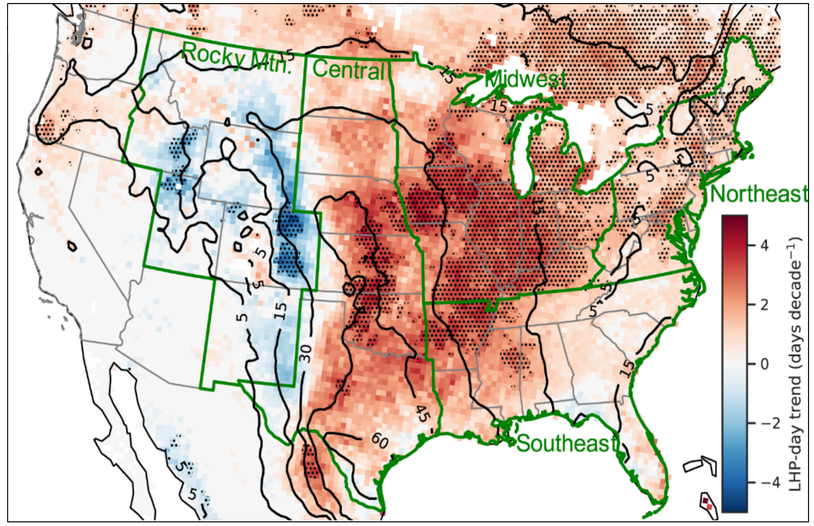


https://www.nature.com/articles/s41612-018-0048-2

Gensini, V.A., Brooks, H.E. Spatial trends in United States tornado frequency. *npj Clim Atmos Sci* **1**, 38 (2018). https://doi.org/10.1038/s41612-018-0048-2

Increased frequency of favorable tornado environments across Gulf Coast and Mississippi Valley 1979-2017

Trends in Large Hail Potential

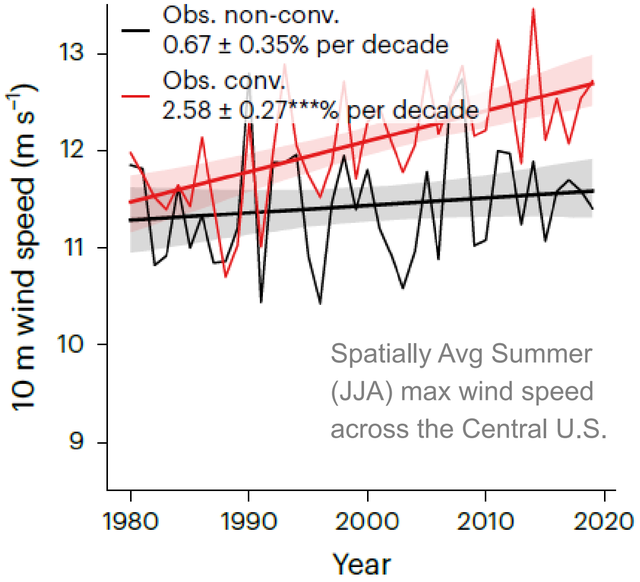


https://www.nature.com/articles/s41612-019-0103-7

Tang, B.H., Gensini, V.A. & Homeyer, C.R. Trends in United States large hail environments and observations. npj Clim Atmos Sci 2, 45 (2019). https://doi.org/10.1038/s41612-019-0103-7

Increased frequency of favorable large hail environments across eastern U.S. with largest increases in Upper Midwest 1979-2017

Trends in Significant Convective Wind



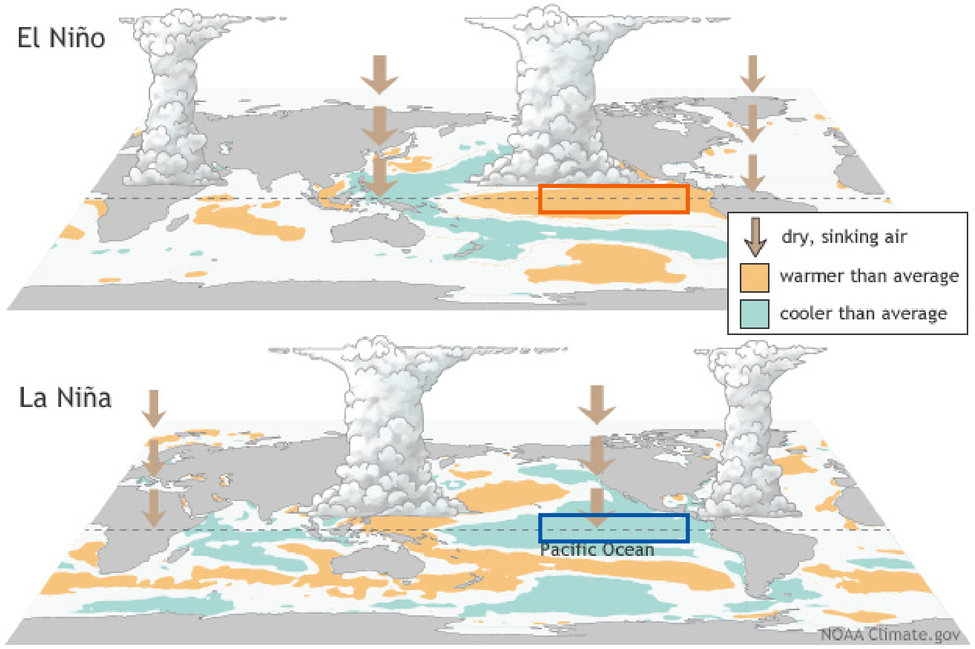
Prein, A.F. Thunderstorm straight line winds intensify with climate change. *Nat. Clim. Chang.* **13**, 1353–1359 (2023). https://doi.org/10.1038/s41558-023-01852-9

Maximum wind speed observations associated with thunderstorms are more intense across the central U.S.

While scientists continue to explore potential impacts of climate change on environmental conditions favorable for Severe Convective Storms, recent **research has shown a notable shift in recent decades in where significant events are occurring in the U.S.**

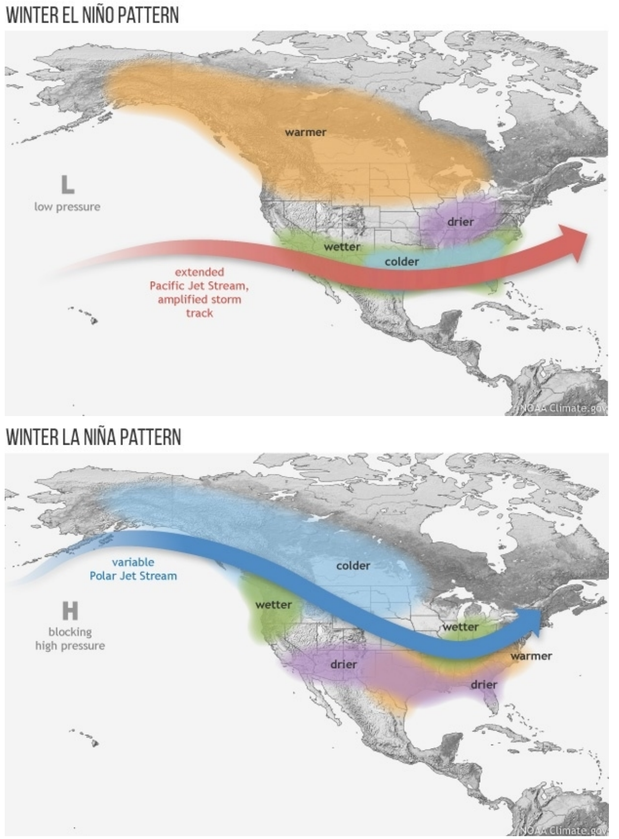
What is the El Niño Southern Oscillation (ENSO)?

How do eastern Pacific sea-surface temperatures influence U.S. thunderstorm activity?



ENSO is a coupled atmosphere-ocean climate feedback loop that fluctuates between warm and cool phases on a 2-7yr time scale.

- El Niño (warm phase) conditions have warmer than average waters off the coast of South America
- La Niña (cool phase) conditions have cooler than average waters off the coast of South America



Source: NOAA climate.gov

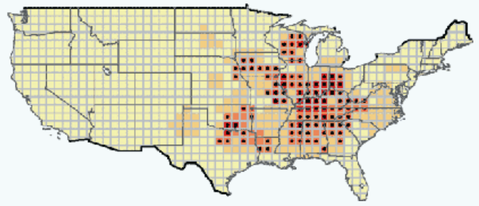
El Niño conditions typically lead to a more stable jet stream pattern which is less conducive for severe weather in the Midwest

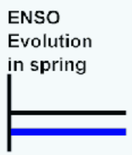
La Niña conditions typically lead to increased "waviness" in the polar jet stream thus increasing the likelihood of thunderstorm activity from the Midwest to the Eastern U.S.

ENSO Phase Correlated with U.S. Regional Tornado Activity

Phase of the El Niño Southern Oscillation (El Niño/La Niña) during winter and spring months has been shown to correlated with likelihood of regional tornado outbreaks (12+ tornadoes within 200km) in historical data

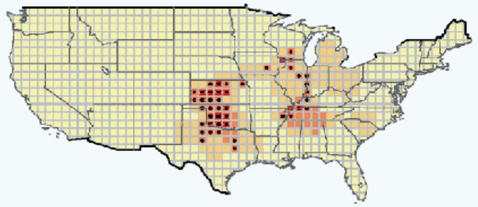
Resurgent La Niña (April)

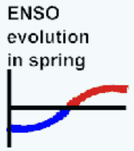




Increased probability of tornado outbreaks across the Ohio and Tennessee Valleys

Transitioning La Niña (April)

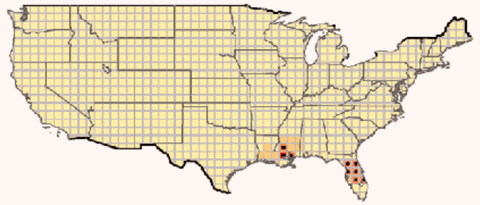




Slightly higher probability of tornadoes in the Midwest and substantial increase in outbreak probability across the Plains

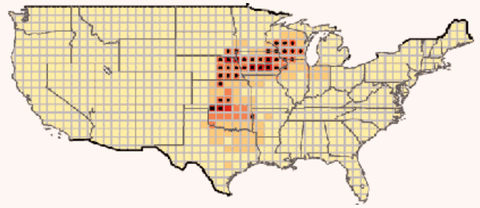
2020 – 2022

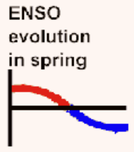
Persistent El Niño (Feb)



Increased probability of tornado outbreaks across the Gulf Coast and Florida

Early Terminating El Niño (May)





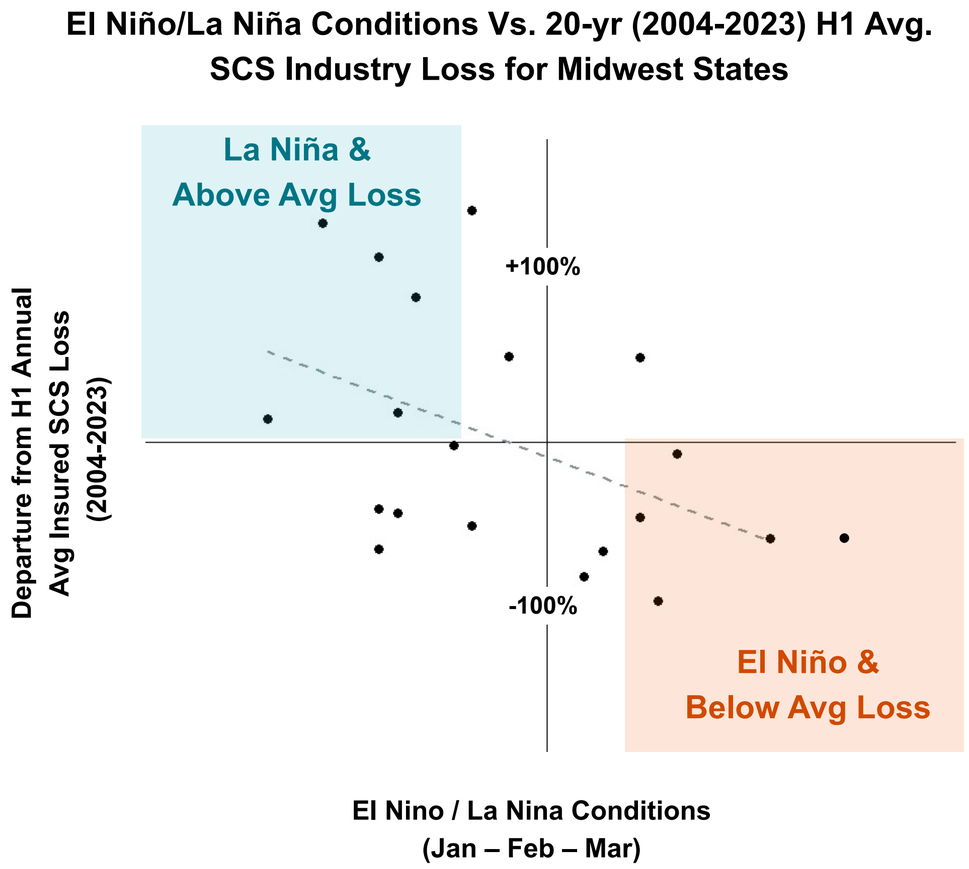
Increased tornado outbreak probability across the Upper Midwest (NE, IA, MN, WI)

2024 (?)

Source: U.S. regional tornado outbreaks and their links to spring ENSO phases and North Atlantic SST variability – Geophysical Fluid Dynamics Laboratory (noaa.gov)

How Does Winter/Spring ENSO Phase Impact SCS Losses?

El Niño/La Niña and Departure from 20-yr Average Industry Loss For Midwest States



ENSO Pattern \ Industry Loss	Above Average	Below Average
La Niña	**5**	4
Neutral	2	3
El Niño	1	**5**

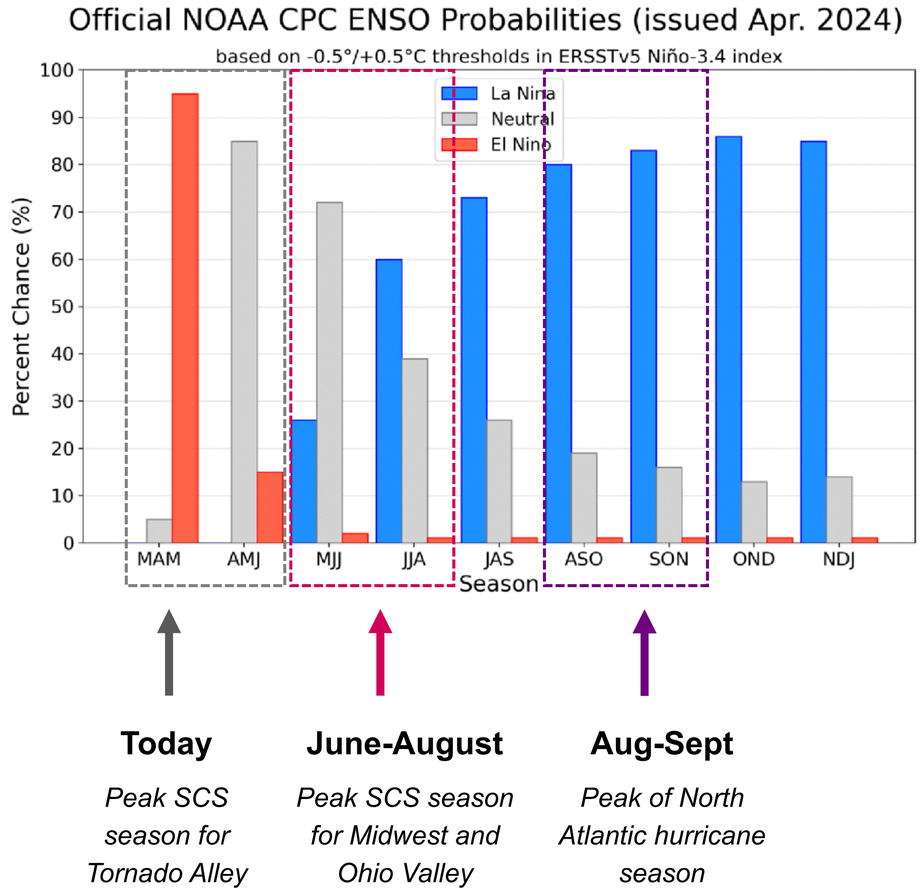
For Midwest states, in the last 20 years:

- 55% of years with La Niña conditions experienced above average industry losses
- 80% of years with El Niño conditions experienced below average industry losses

El Niño/La Niña conditions determined from Oceanic Niño 3.4 Index
Above X Axis shows years where industry losses were above average; below the x-axis are years where industry losses were below average

Source: Property Claims Services Industry Insured Loss Estimates 2004 – 2023; NOAAs Climate Prediction Center Historical ENSO Conditions
Analysis: Aon

How Could ENSO Conditions Impact 2024 Weather Patterns?



Today

Peak SCS season for Tornado Alley

June-August

Peak SCS season for Midwest and Ohio Valley

Aug-Sept

Peak of North Atlantic hurricane season

A gradual transition from El Niño to Neutral conditions is expected within the April – June window with an accelerated development of La Niña conditions favored over the summer

- **Neutral conditions** usually correspond to an **"average" severe weather season** with peak activity in Central and Southern Plains
- **Spring onset of La Niña (May-July)** *could* lead to elevated SCS activity in the Midwest
- **La Niña conditions** during the peak of the North Atlantic hurricane season (Aug – Nov) strongly correlate with heightened activity

Closing Thoughts

U.S insured losses have steadily risen over the past 20 years, driven by increased frequency and severity of “non-peak” perils.

- Losses in the last decade exceeded those of the prior decade by 65%.
- “Non-peak” perils, including Severe Thunderstorms and Winter storm, comprise 60% of all insured losses in the 21st century.

There are multiple drivers of recent loss increases.

- 80+% of severe thunderstorm loss trend over the past 3 decades is explained by socioeconomic drivers. The remaining 20%...
  - Is the uncertainty, of which known and unknown climate influences must fit into
  - Recent heightened frequency of La Niña phase of ENSO is key driver of Midwest and Ohio Valley weather volatility.
  - Recent research has concluded that La Niña conditions may become more frequent in the future with atmospheric warming due to climate change.

Effectively navigating periods of heightened weather frequency/volatility requires leveraging industry data and analytics to maintain underwriting and risk tolerance discipline.

AON

Thank You

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