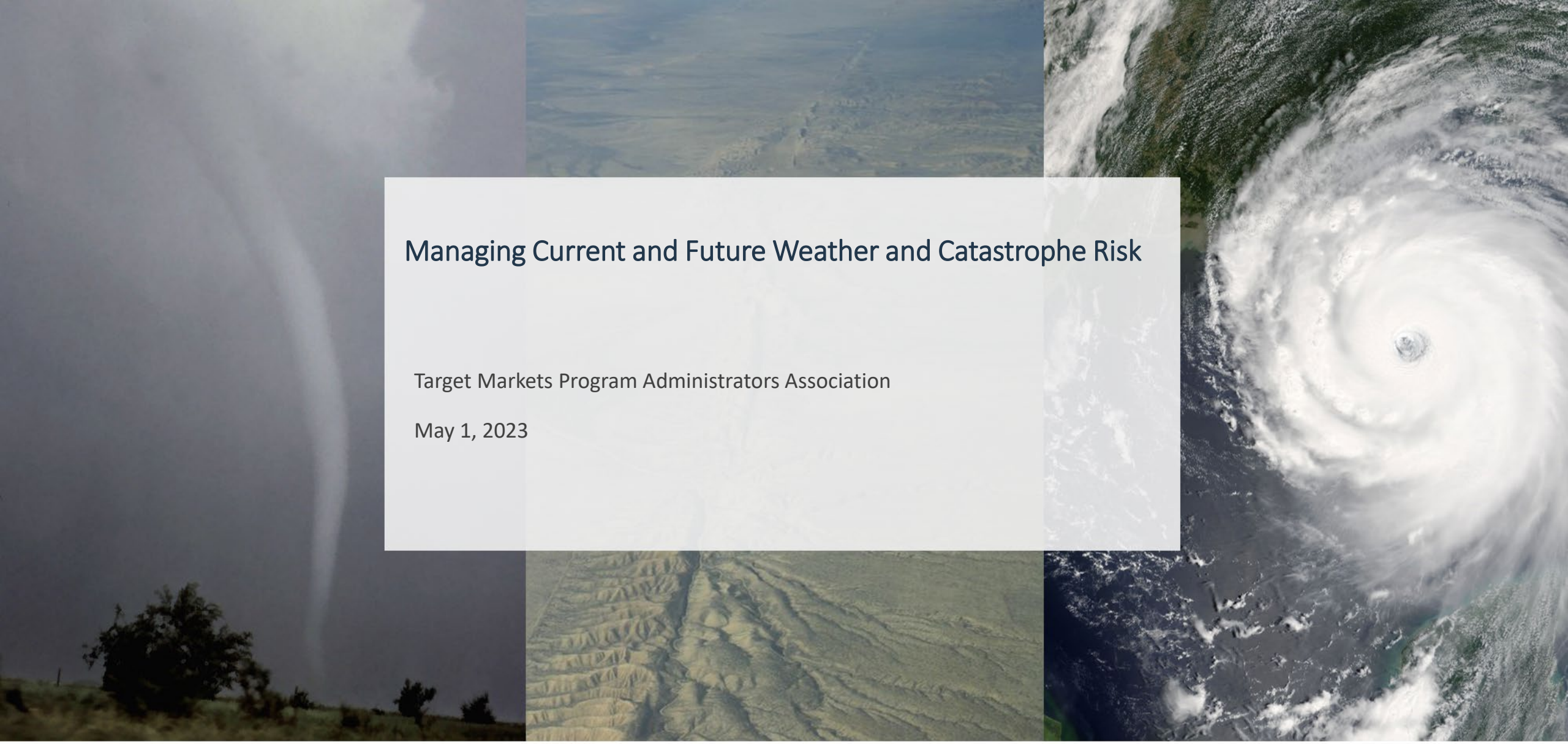


Managing Current and Future Weather and Catastrophe Risk

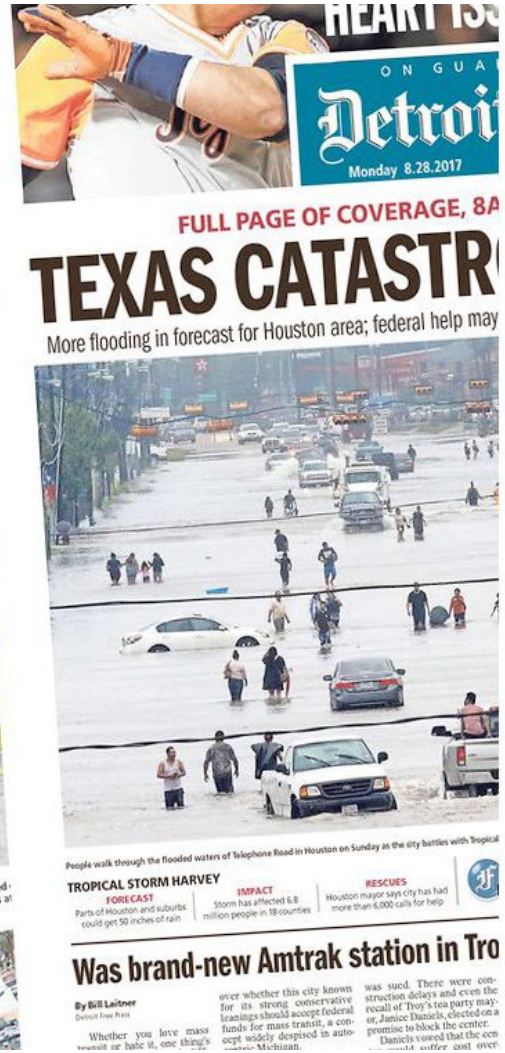
Target Markets Program Administrators Association

May 1, 2023

KC &CO

The Innovation and Technology Leader in Catastrophe Risk Modeling

Natural Catastrophes Are Increasingly Front-Page News



Biggest climate toll in year of 'devastating' disasters revealed

Most expensive storm cost $100bn while deadliest floods killed 1,700 and displaced 7 million, report finds

Tornadoes by the numbers: Damage reported across 14 states

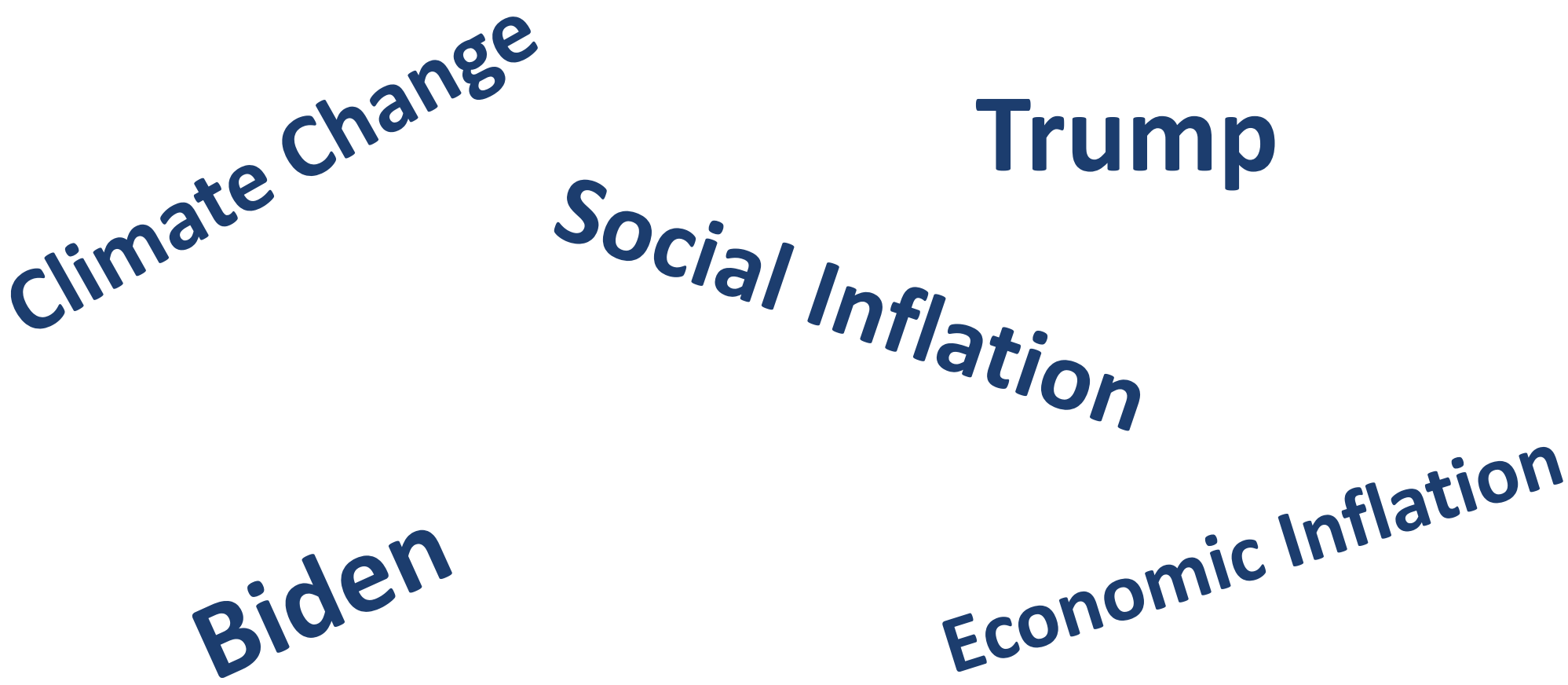
At least 32 people have died as a result of the storms on March 31 and April 1.

By Meredith Deliso, Kenton Gewecke, and Morgan Winsor
April 4, 2023, 6:00 AM

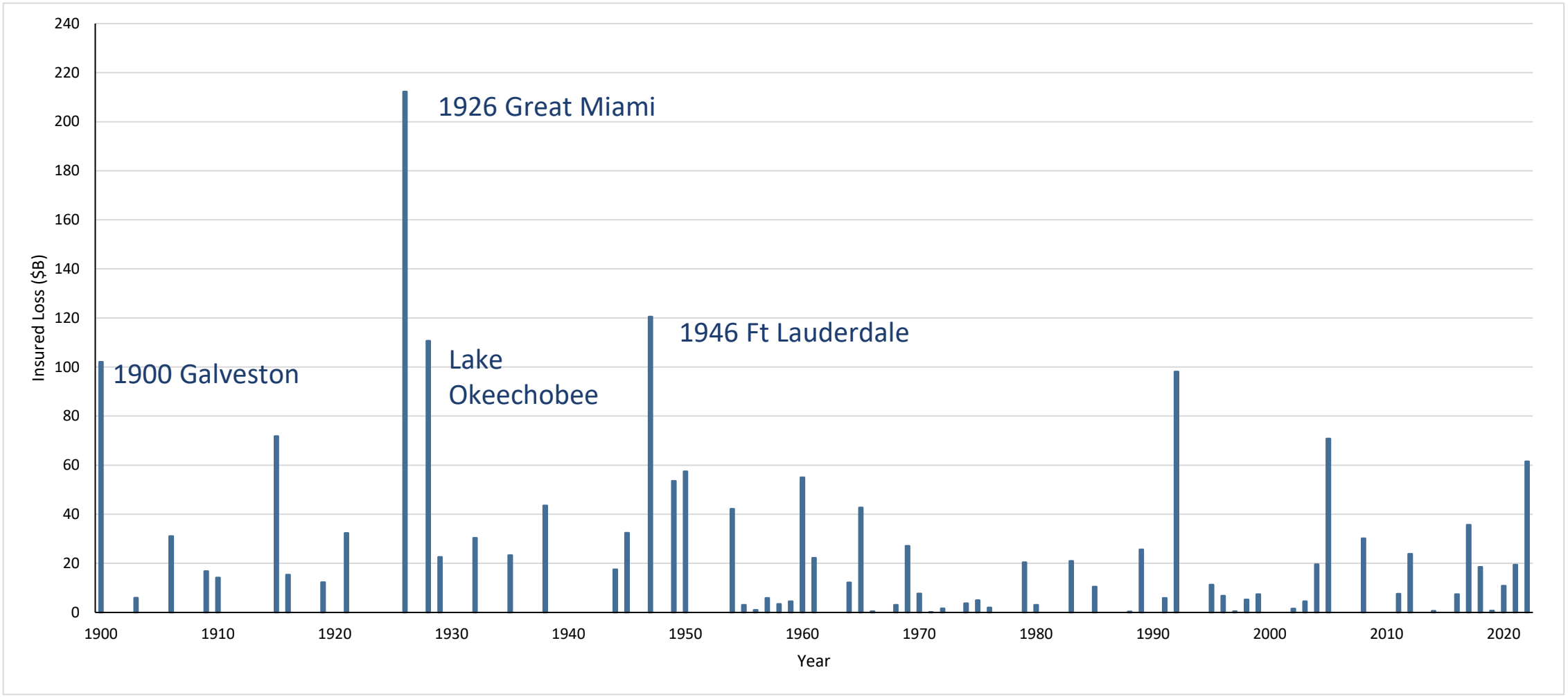
Winter Storm Elliott Intensified Into Bomb Cyclone With High Winds, Blizzard Conditions, Flooding

By weather.com meteorologists · December 24, 2022

What's Driving the Seemingly Ever-Increasing Losses?



Historical Hurricane Insured Losses Based on Today's Exposure



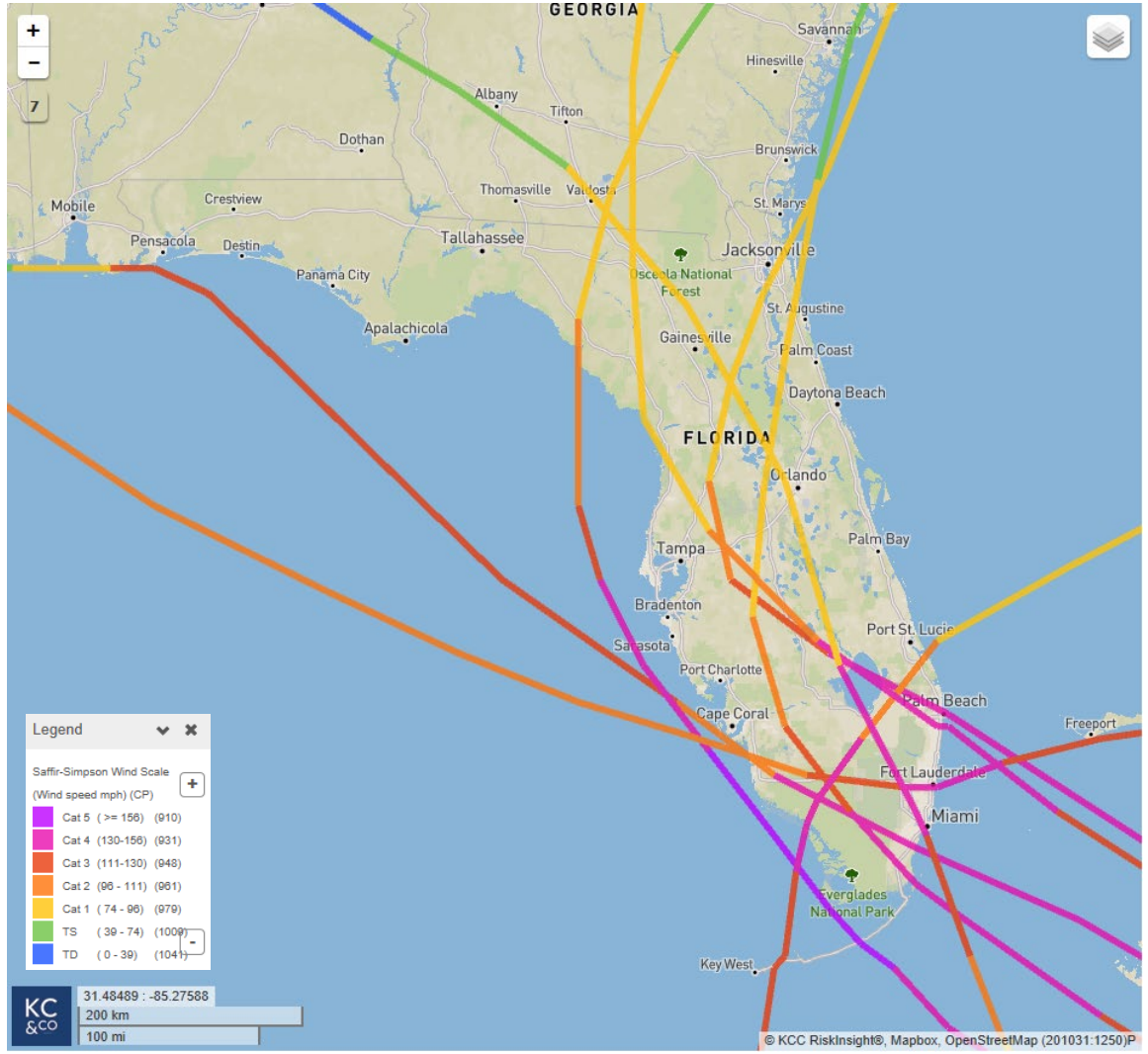
Miami in 1926 Versus Today

Source: Florida State Archives

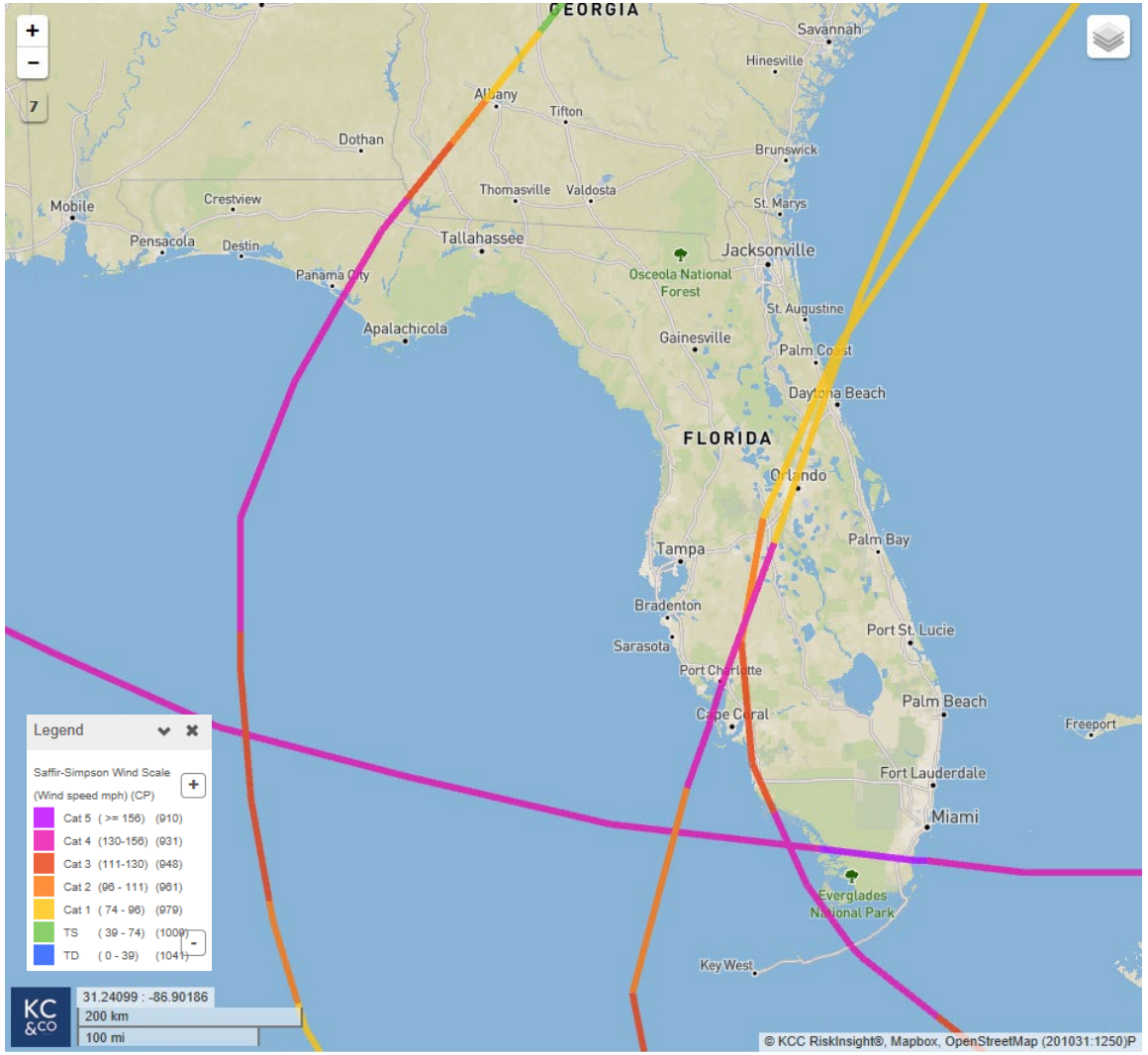
Source: Google Earth

We've Been Lucky Over the Past Few Decades (Category 4s and 5s Impacting Florida)

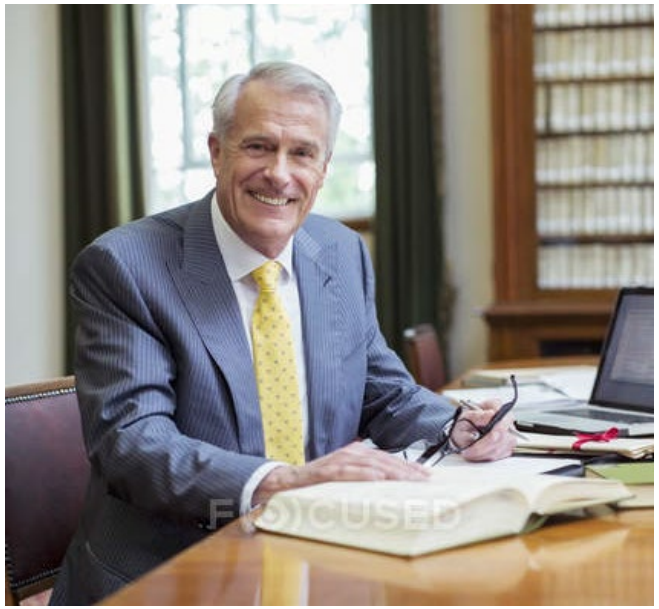
1900 to 1959



1960 to 2020

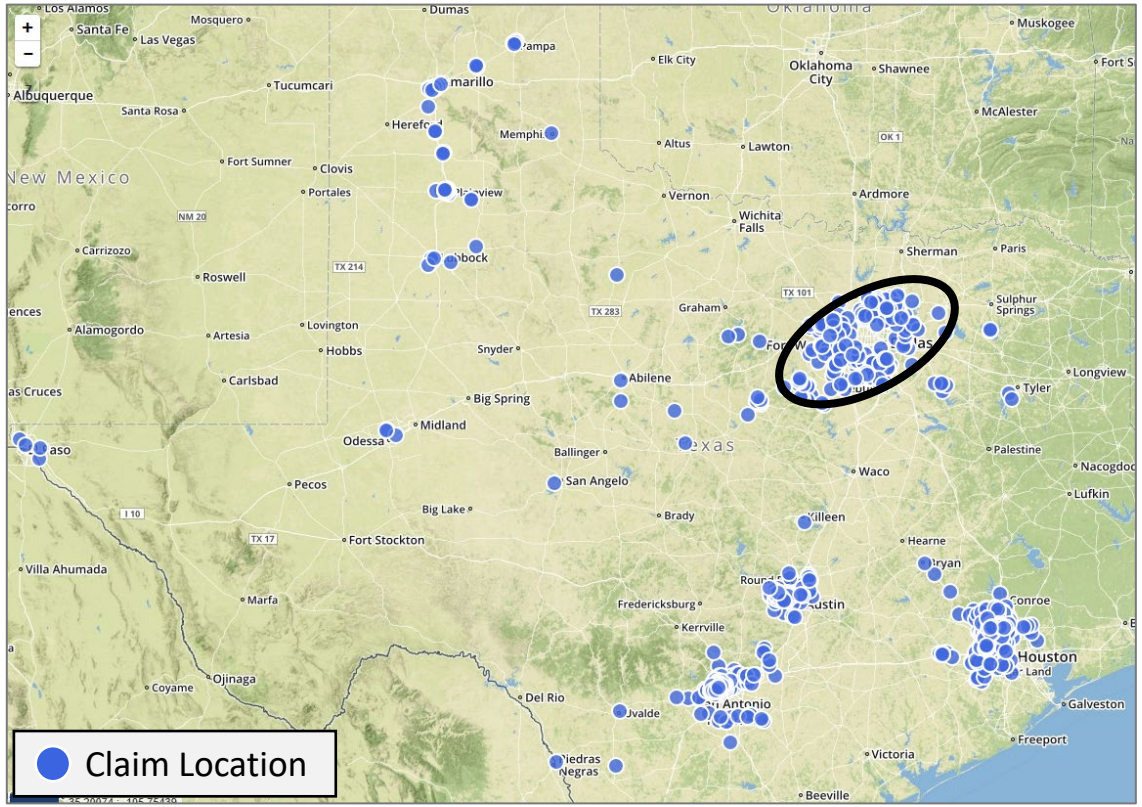


What is Social Inflation and Where Does it Come From?

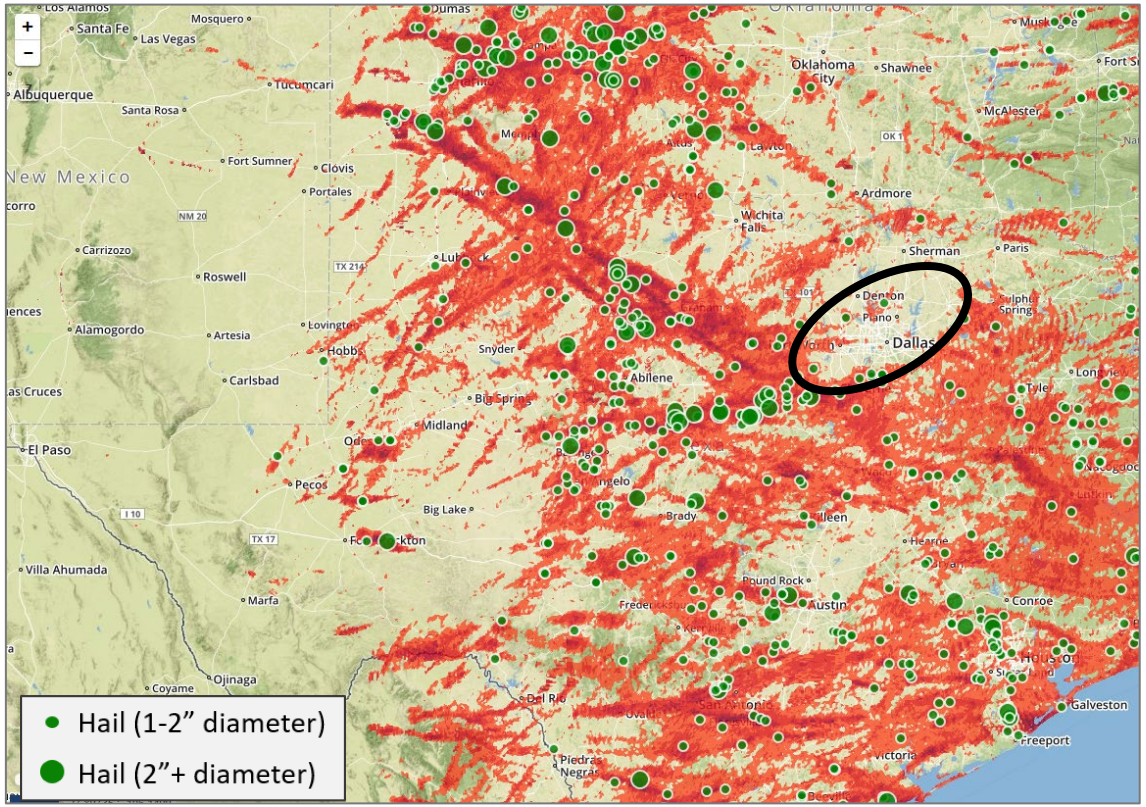


How Can There Be Hail Damage without Hail?

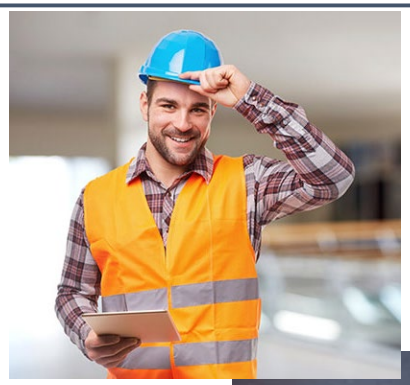
Hail Claims

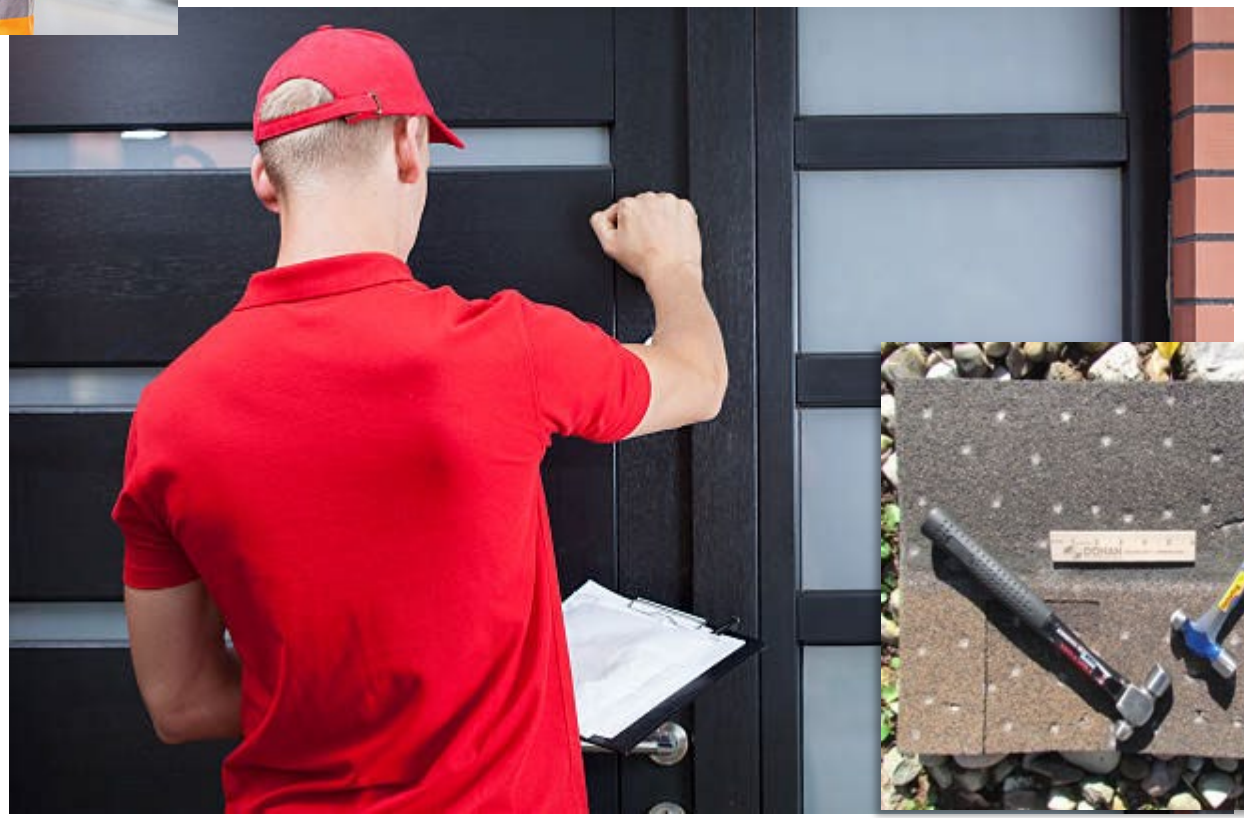


Hail Footprint and Reports

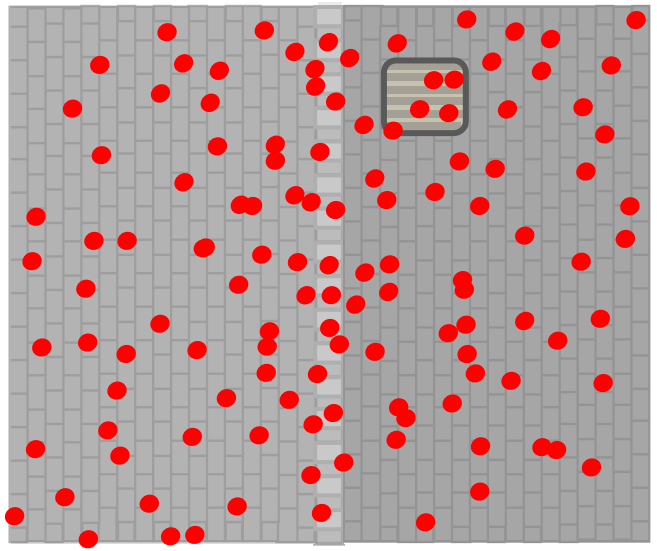


How You Can Get Claims Here

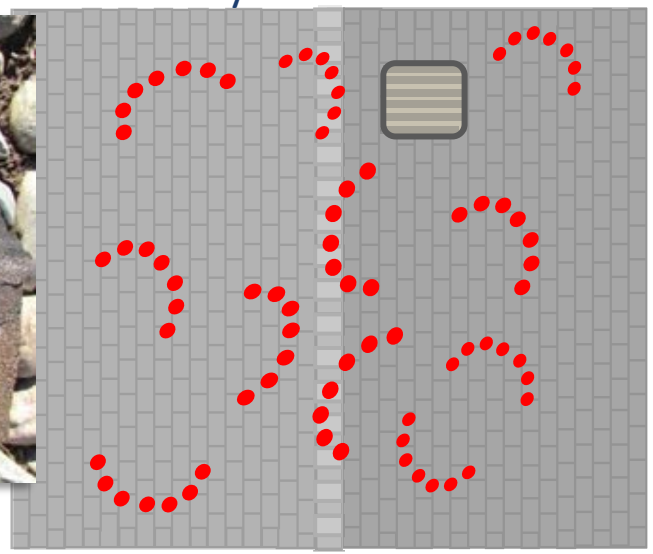




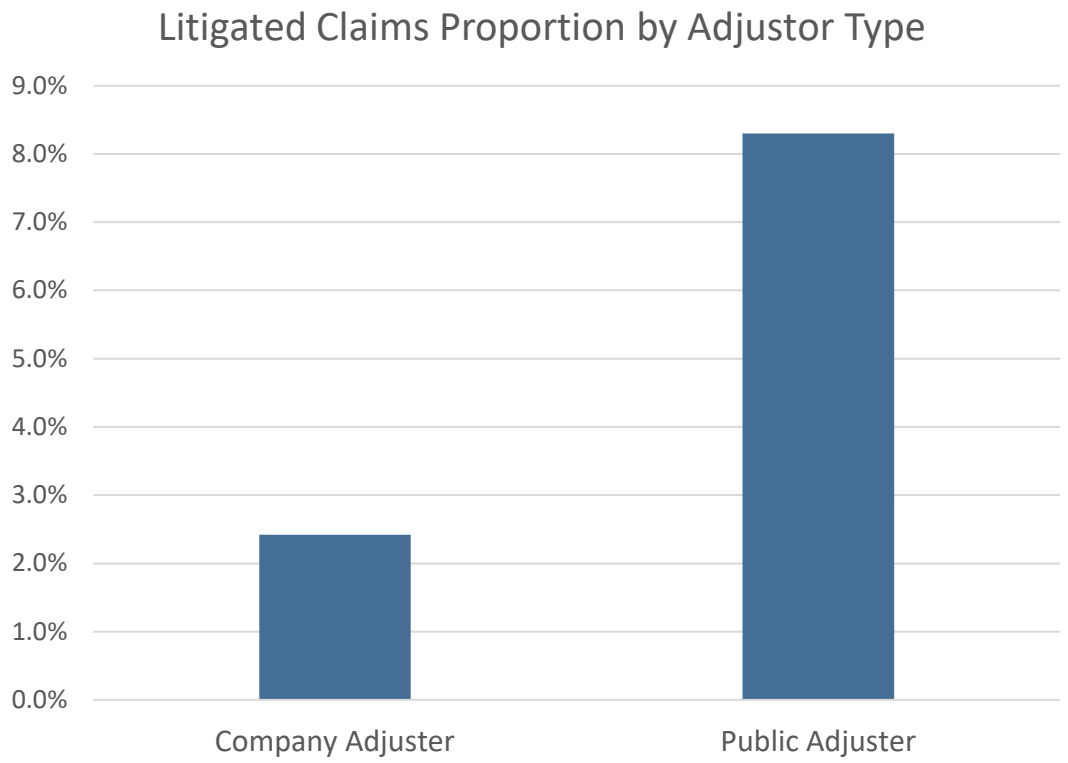
Meteorological Hail



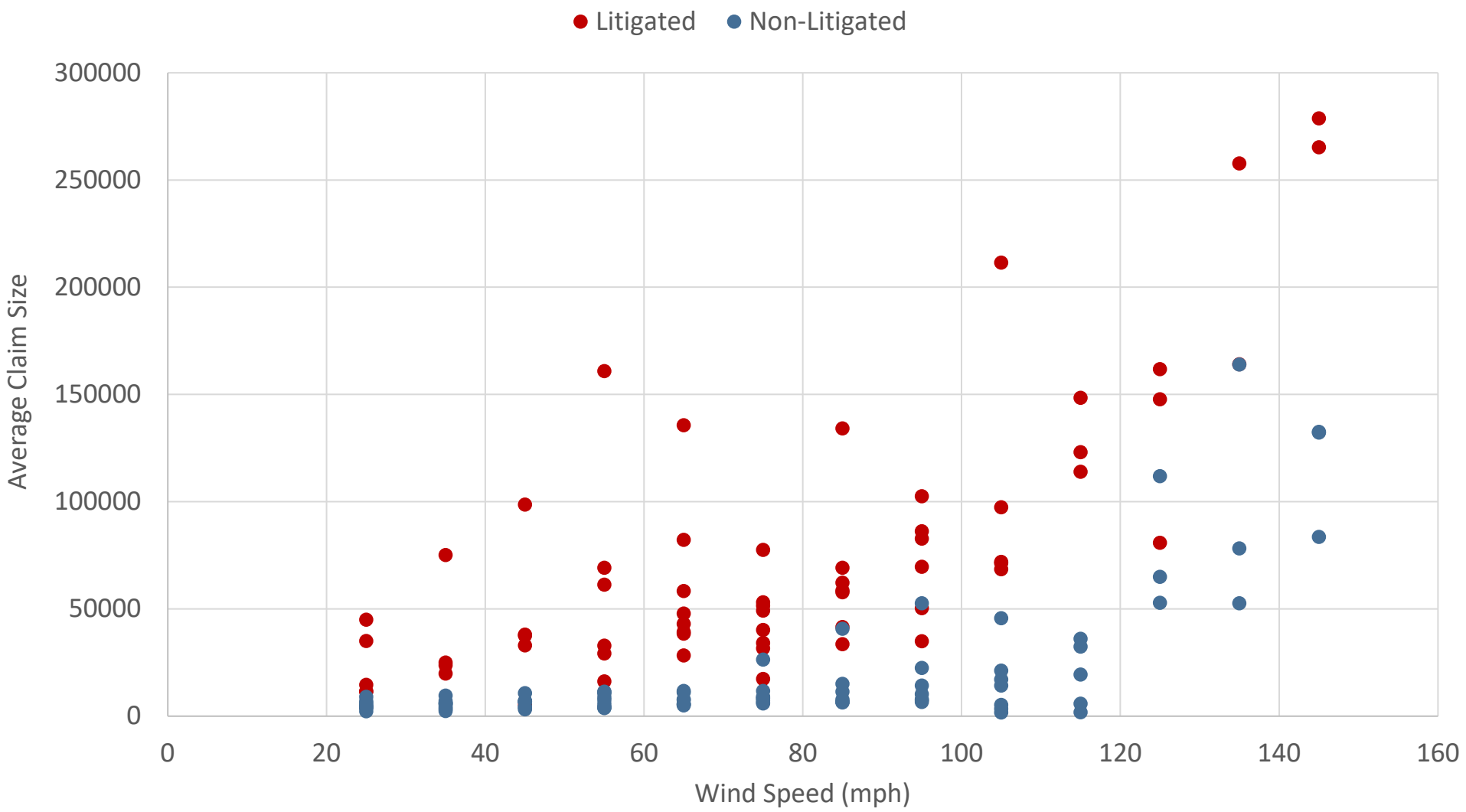
Synthetic Hail



Public Adjustors Drive Up Costs of Claims and Increase Litigated Claims Proportion



Why it Matters: Litigated Claim Severity is 3 to 5 Times Larger



Forthepeople.com

We Never Settle for Less, and Neither Should You

Settlement

Employment & Workplace Discrimination Lawyers

WHAT WE WON
$1,250,000,000

PRE-TRIAL OFFER
$0

Jacob T. Rodgers v. City of Gainesville D/B/A Gainesvill...

Car Accident

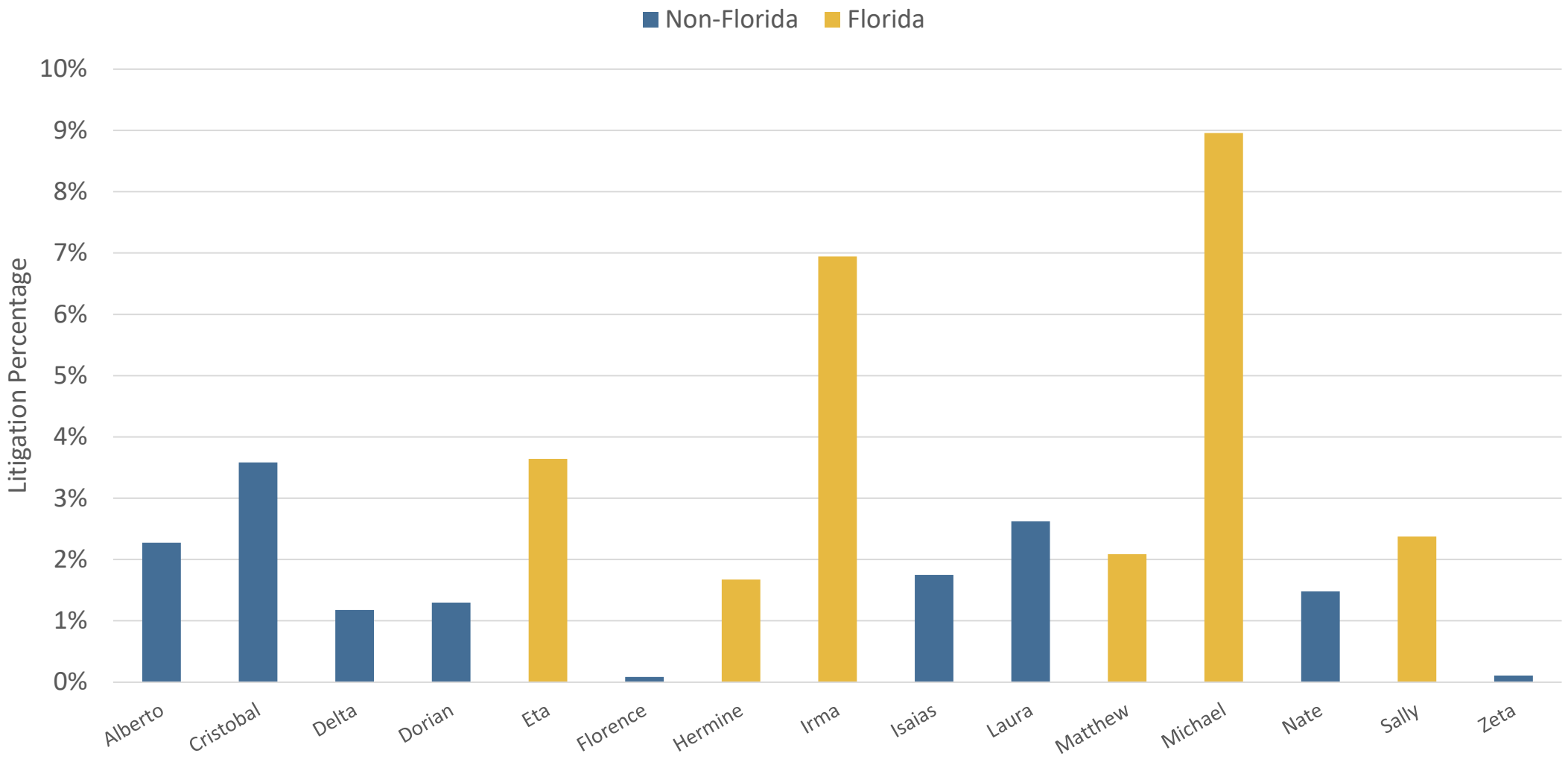
WHAT WE WON
$120,000,000

PRE-TRIAL OFFER
$20,000

Consumers Must be Educated!

Claims + $Billions to Attorneys = Premiums

Florida Has Been Leading in Percentage of Litigated Claims: Recent Reforms Will Help

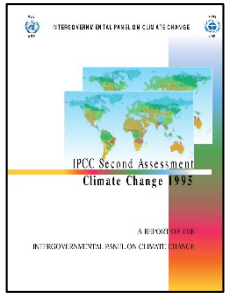


The Intergovernmental Panel on Climate Change (IPCC) Assessment Reports (AR)

First Assessment Report (FAR)

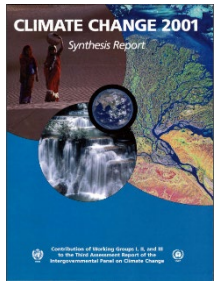
1990

1995



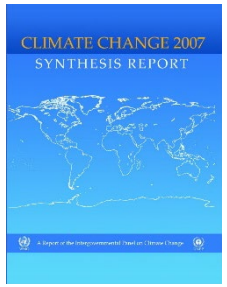
Second Assessment Report (SAR)

Third Assessment Report (TAR)

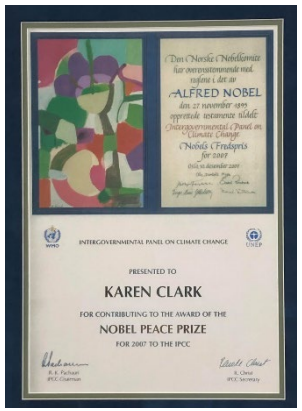


2001

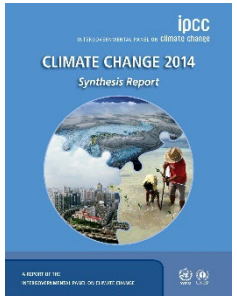
2007



Fourth Assessment Report (AR4)

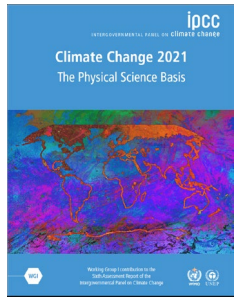


Fifth Assessment Report (AR5)



2014

2021



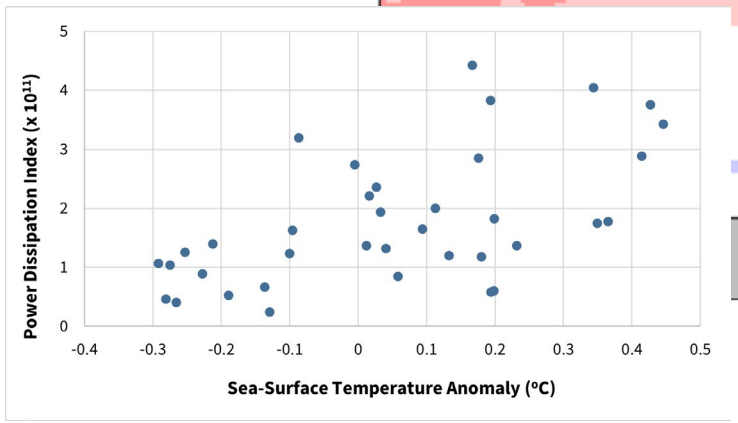
Sixth Assessment Report (AR6)

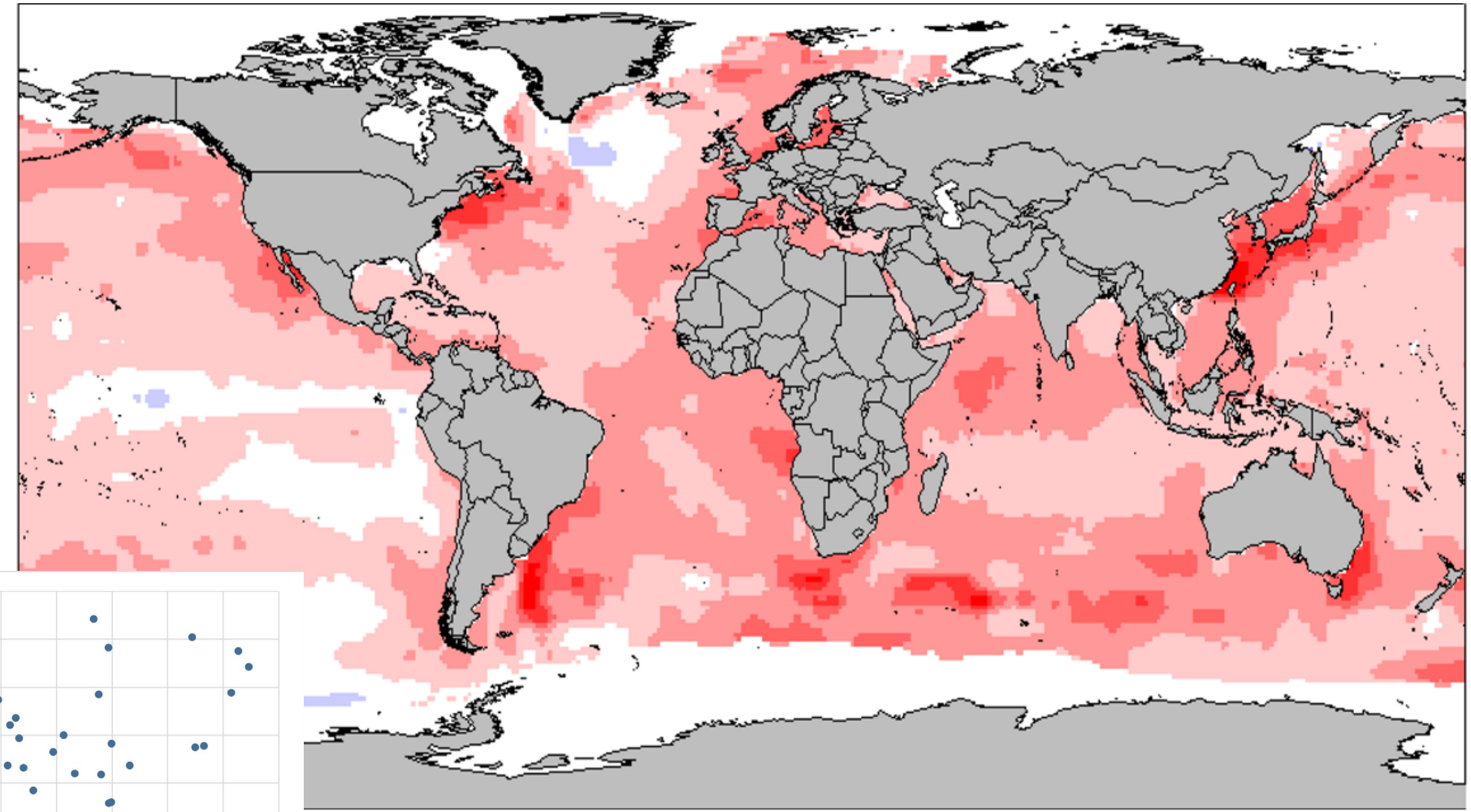
Current Scientific Consensus: Conclusions of IPCC AR6

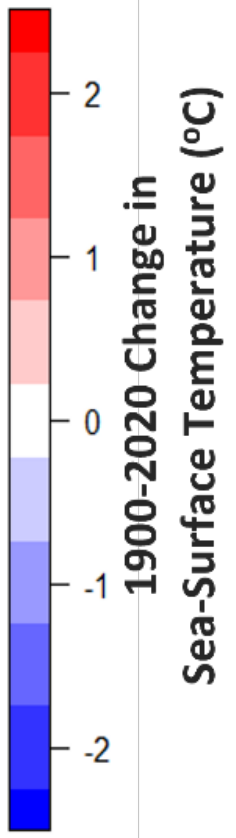
	Frequency	Severity	Confidence
Hurricanes	No change	Increase	High
Coastal Flooding	Increase	Increase	High
Inland Flooding*	Increase	Increase	Medium
Severe Convective Storms	Uncertain	Uncertain	Low
Wildfires*	Increase	Increase	High
Winter Storms	Uncertain	Increase	Low

*Impacts of climate change region-dependent

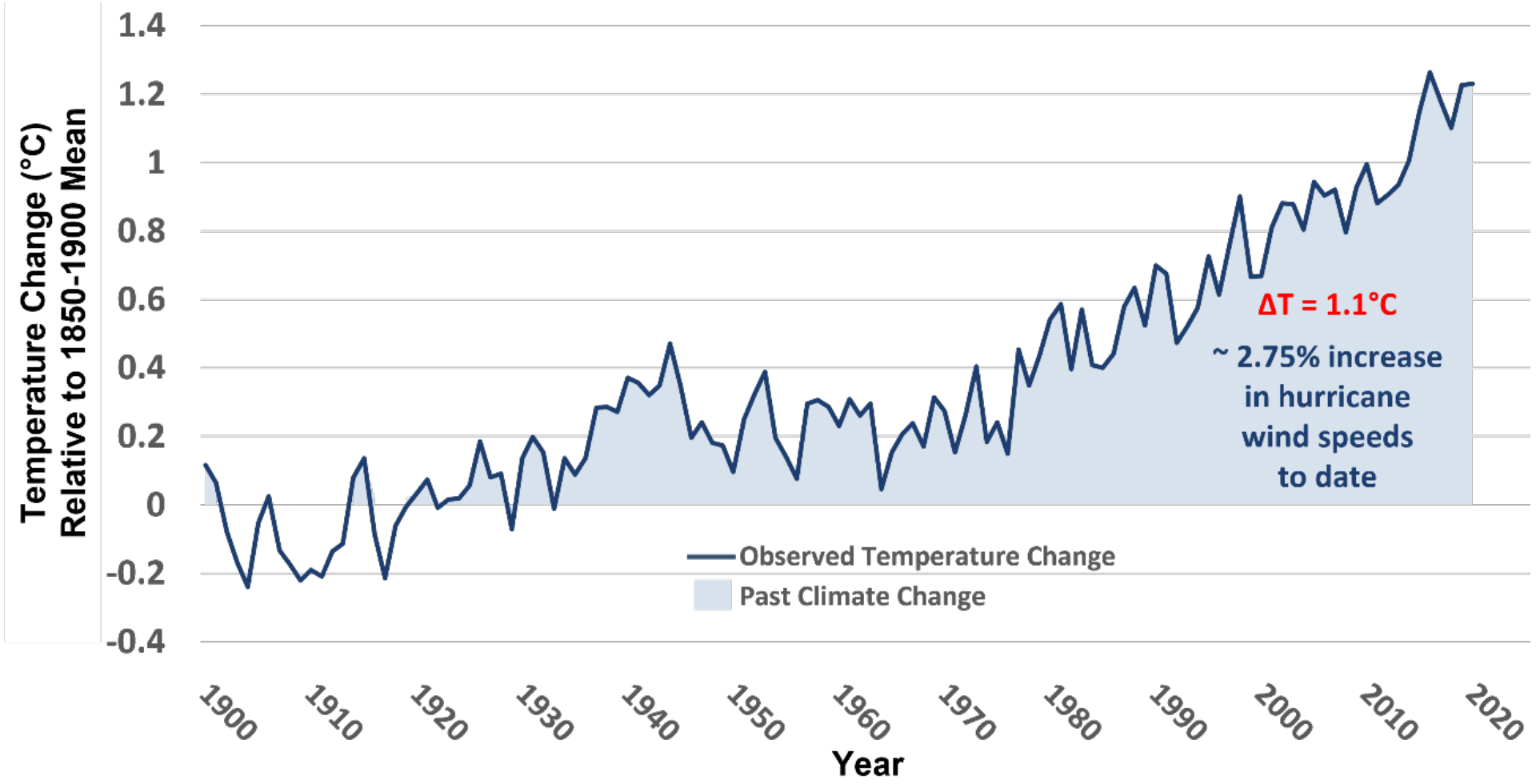
Warming Sea Surface Temperatures (SSTs) Lead to Increased Hurricane Intensity







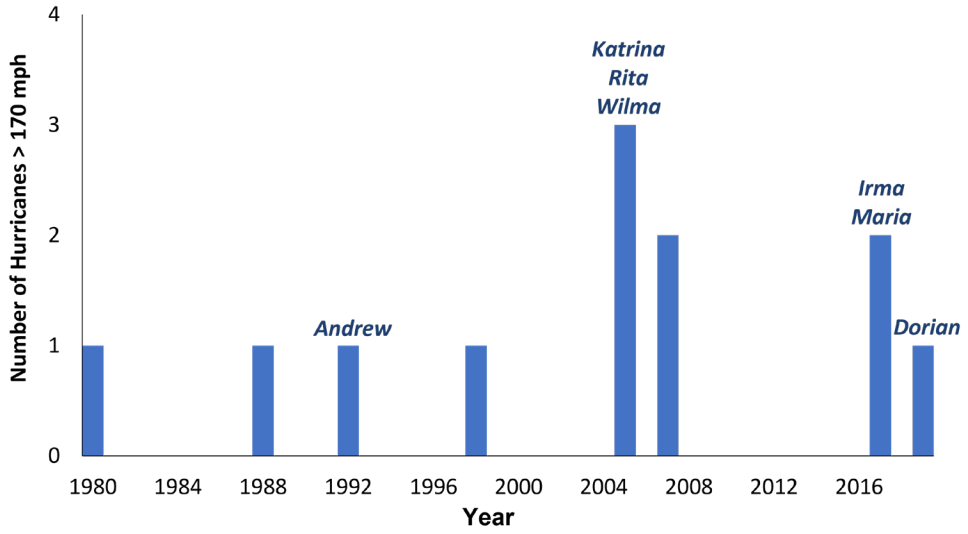
Assessment of the Current Climate – How Much Have Global Temperatures Increased to Date?



IPCC studies:

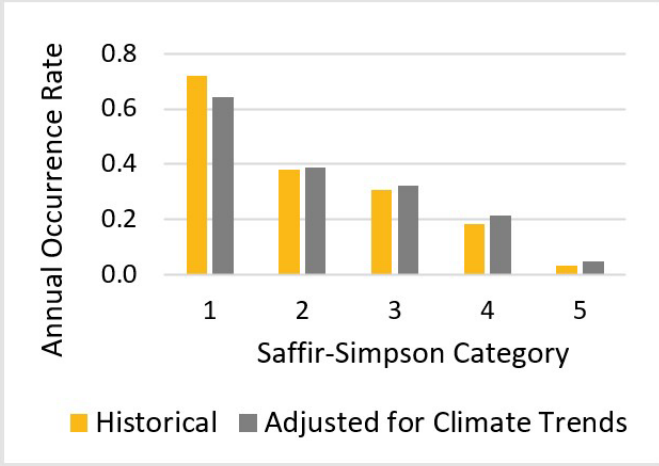
2.5% increase in hurricane wind speed for each 1°C warming

Increase in Wind Speed Leads to Stronger Hurricanes and Higher Proportion of Major (Cat 3-5) Storms



Historical Landfall Rates versus Adjusted for Global Climate Trends To Date

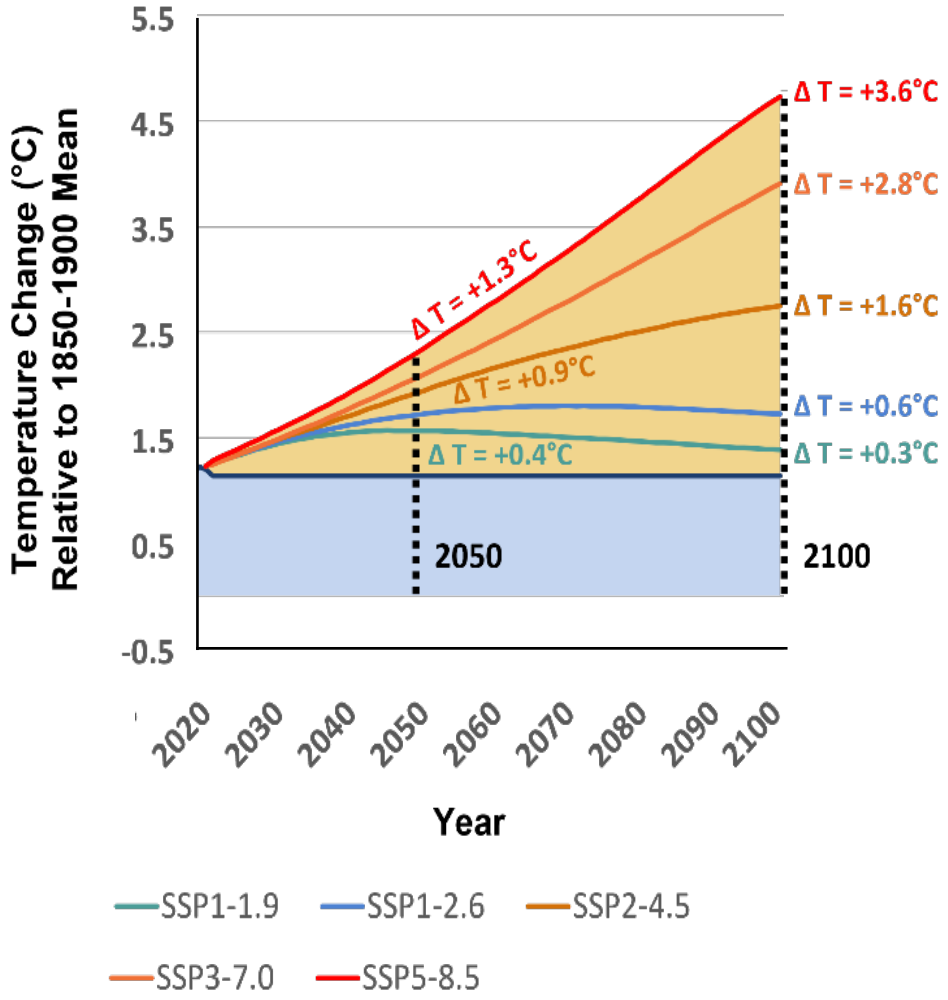
Proportion of Landfalling Hurricanes		
	Non-Major	**Major**
Historical	68%	32%
Adjusted for Global Climate Trends To Date	64%	36%



Increase in intensity since 1900 leads to **11% increase** in insured loss relative to a no climate change catalog

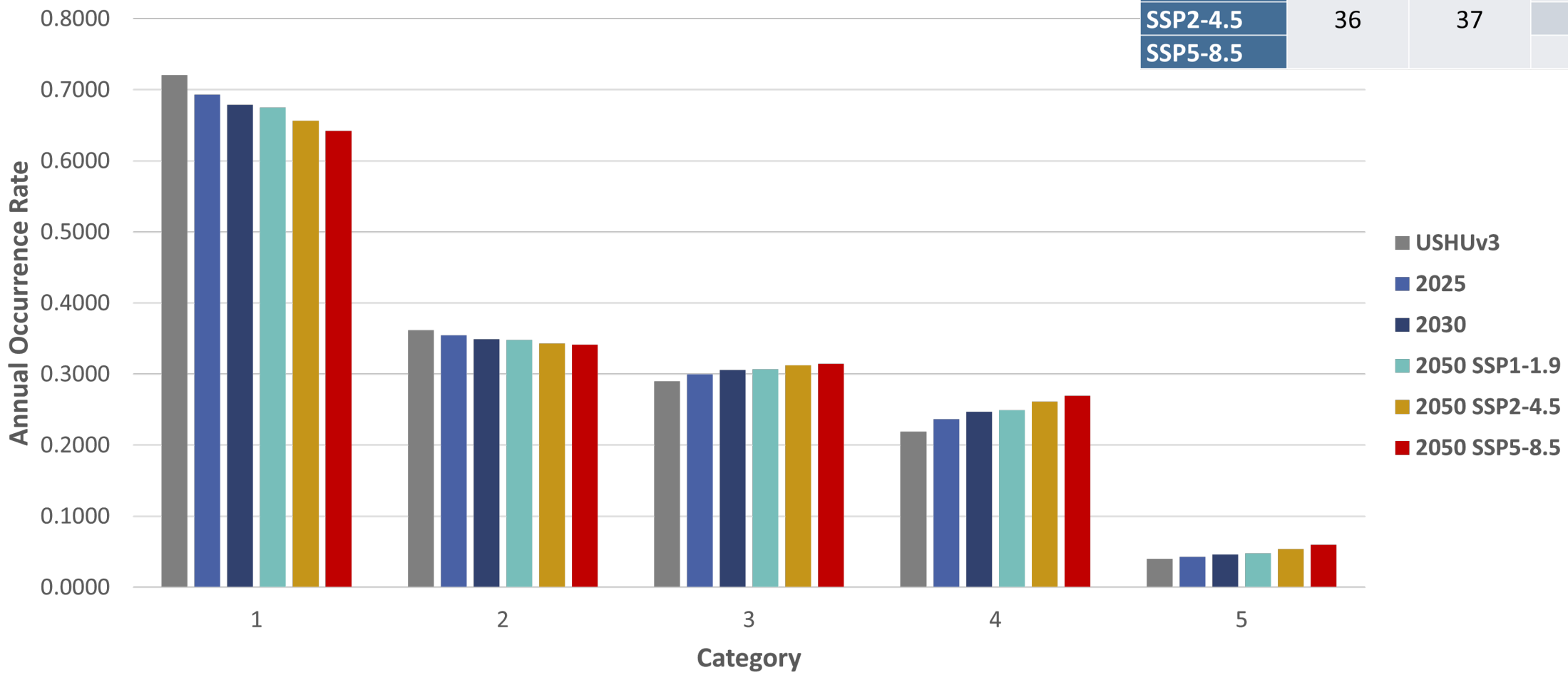
What Will Happen in Future – IPCC Shared Socioeconomic Pathways (SSPs)

Scenario	Radiative Forcing (W/m^2)	SSP Assumptions
SSP1-1.9	1.9	Global shift toward environmentally sustainable economic growth. Significantly and rapidly reduced per capita energy consumption, reaching net zero emissions by 2050.
SSP1-2.6	2.6	Global shift to sustainability and emissions cut significantly to net zero by 2050, but at a slower rate than SSP1-1.9 leading to a larger radiative forcing.
SSP2-4.5	4.5	Largely business-as-usual with regard to technological advancements and economic growth, with slow progress toward sustainability goals.
SSP3-7.0	7.0	Increased global competition and a shift towards national security and resource stockpiling, leading to significant increase in emissions from modern level.
SSP5-8.5	8.5	Rapid global economic growth supported by heavy investment in fossil fuel energy.

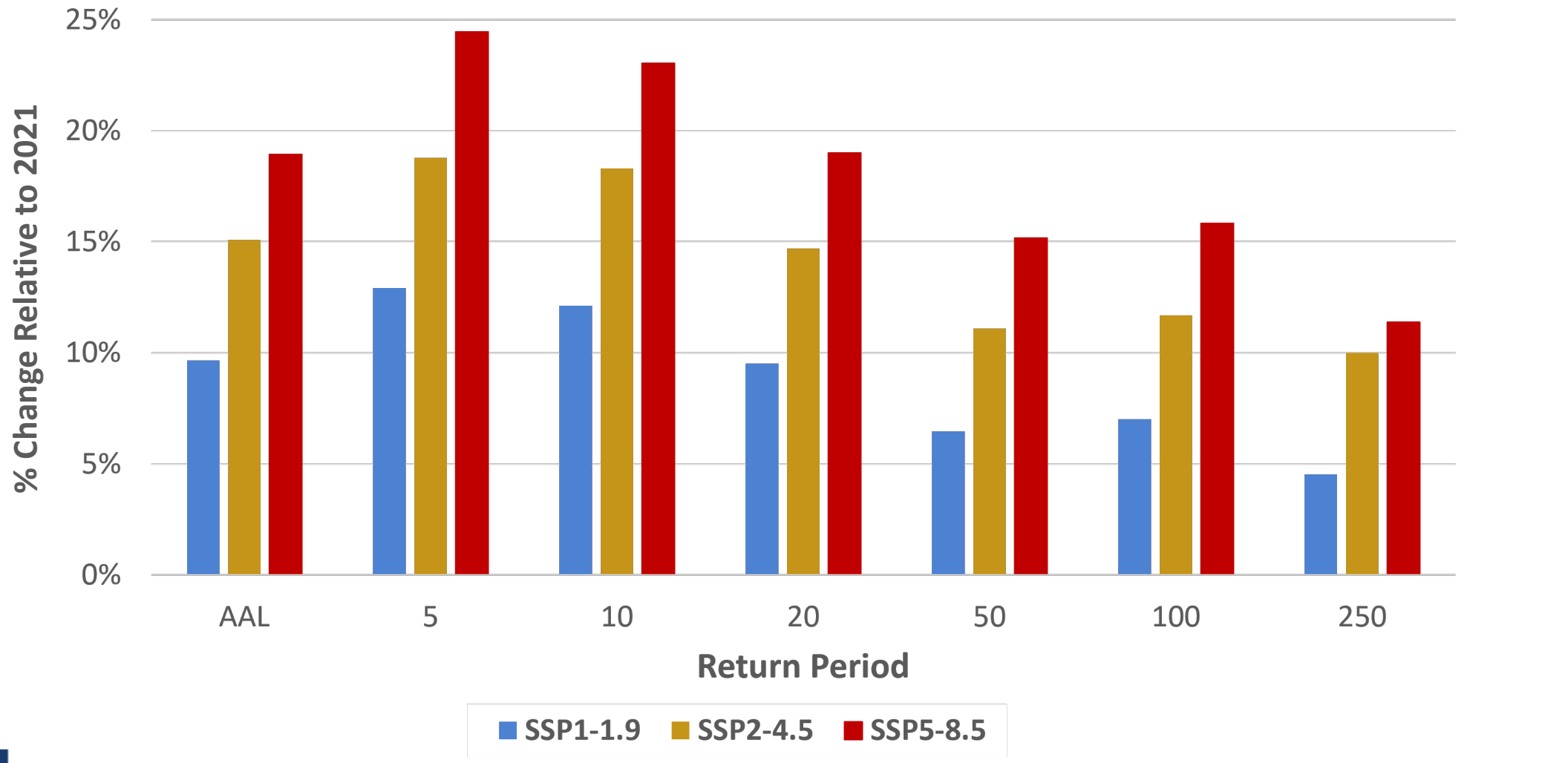


Projected Increases in Atlantic Hurricane Intensity for Future Scenarios

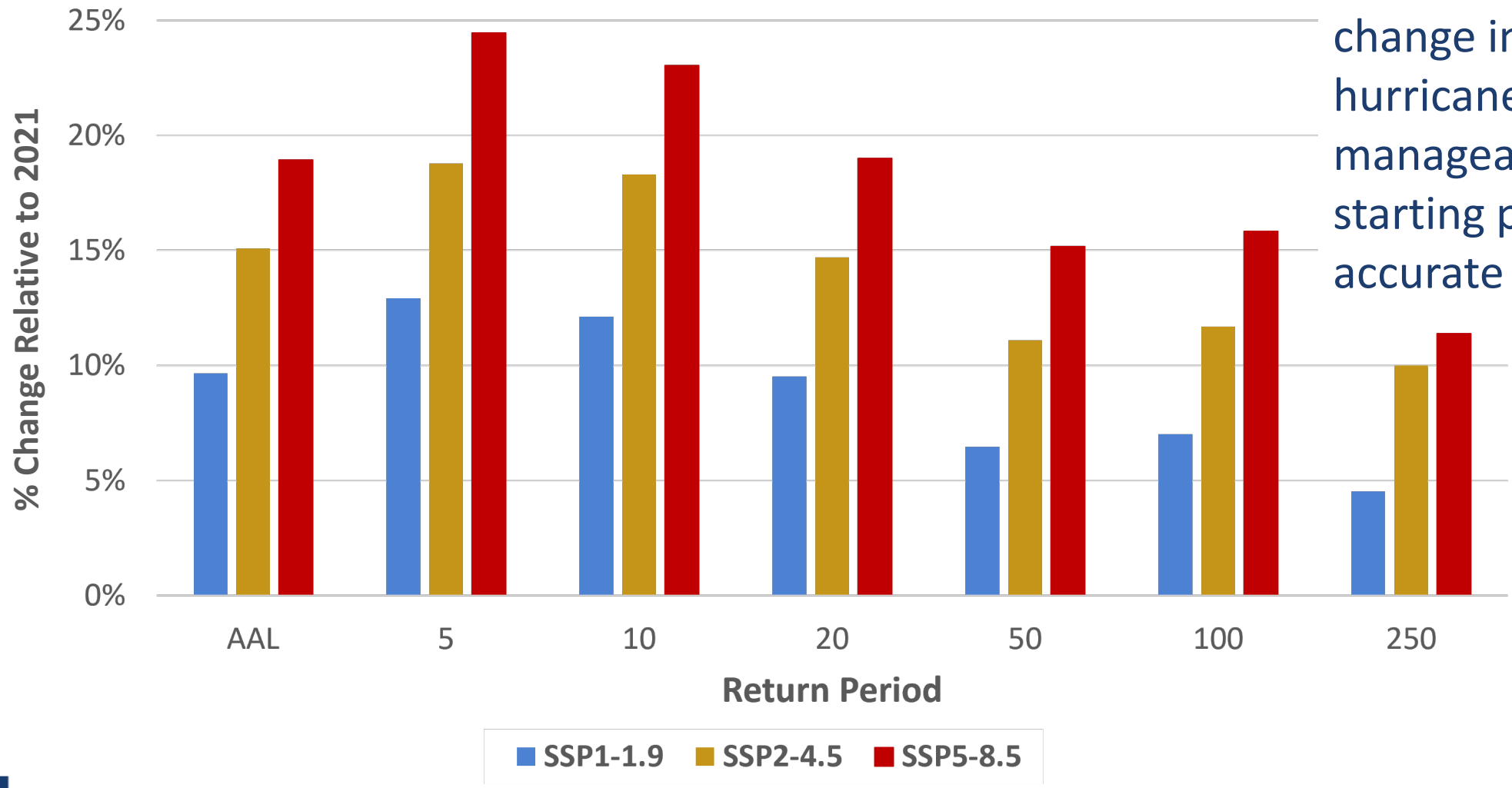
	Proportion of Major Hurricanes (%)		
	2025	2030	2050
SSP1-1.9	36	37	37
SSP2-4.5			39
SSP5-8.5			40



Insured Loss Increases by 2050: Increases Generally Less Than 1 Percent Per Year



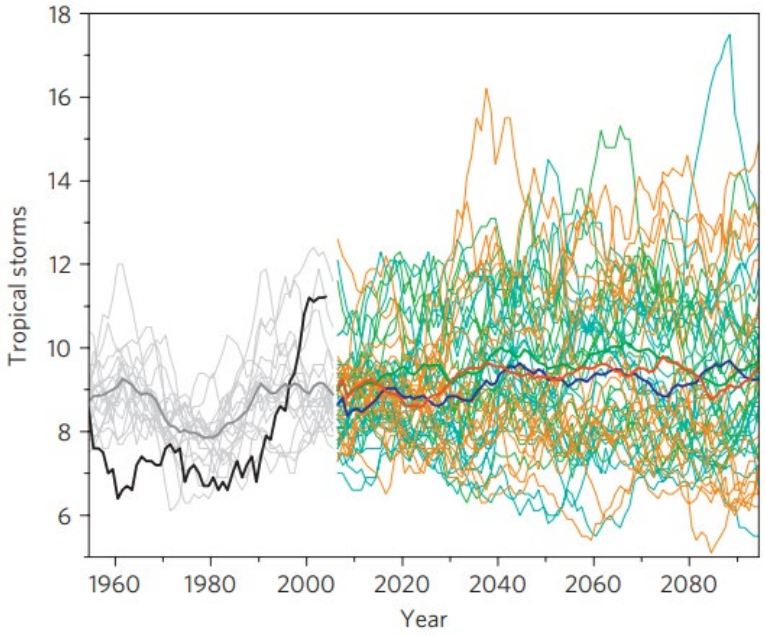
Insured Loss Increases by 2050: Increases Generally Less Than 1 Percent Per Year



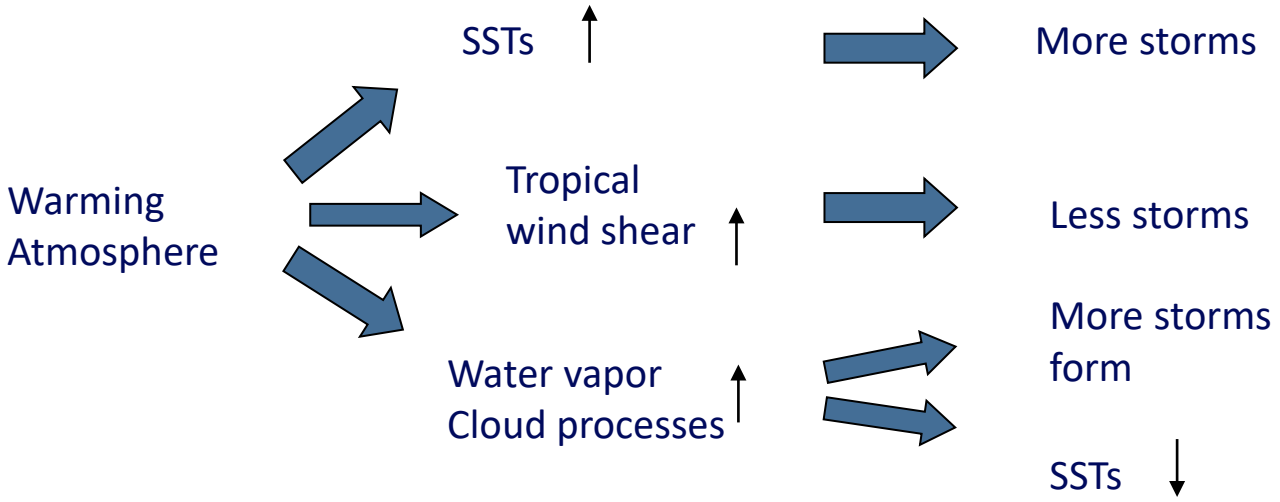
Conclusion: Climate change impacts on hurricane losses are manageable **IF** your starting point is an accurate model

Why Climate Change May Not Cause Increased Hurricane Frequency

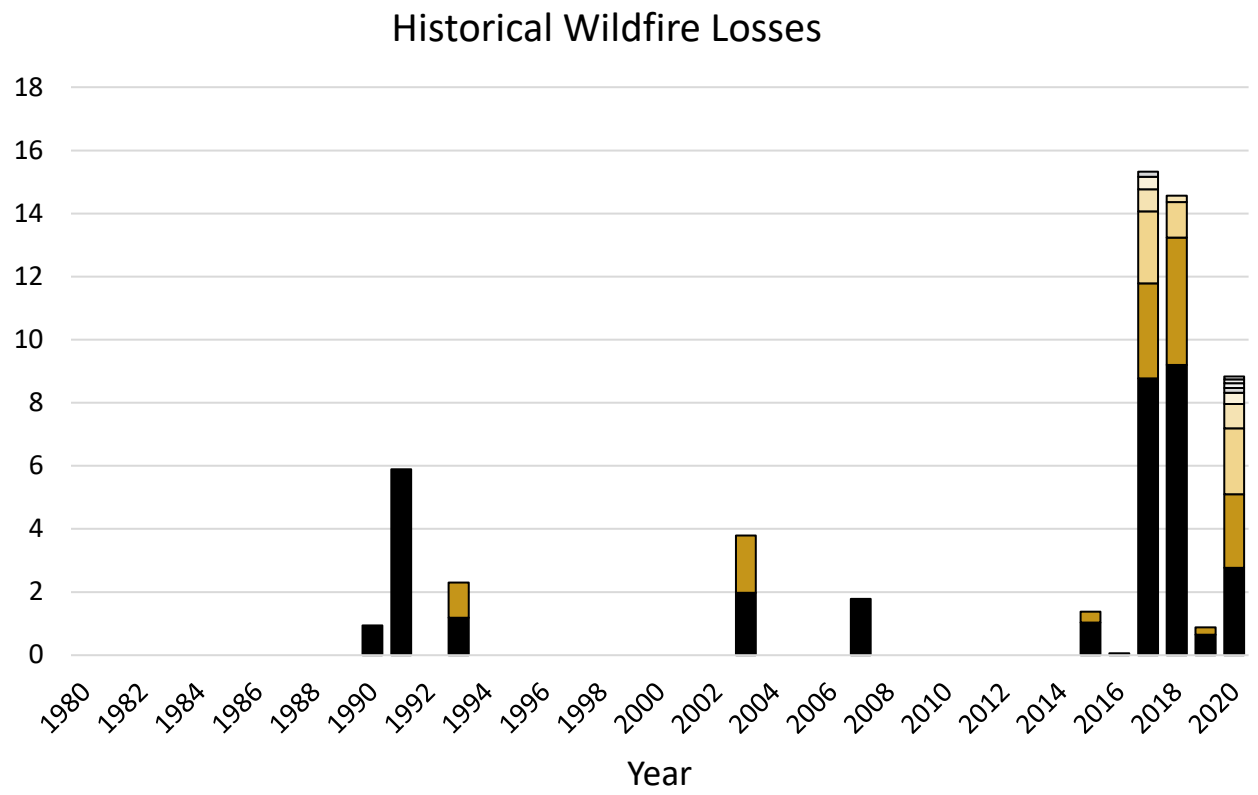
Global climate models disagree



Complex feedback mechanisms in atmosphere

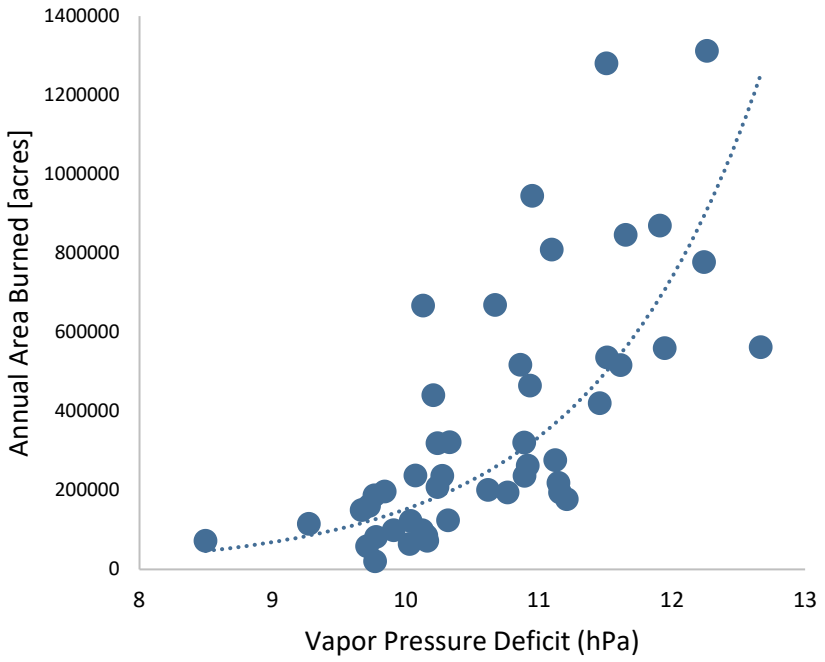


What's Happening with Wildfires—Trend or Short Term Aberration?

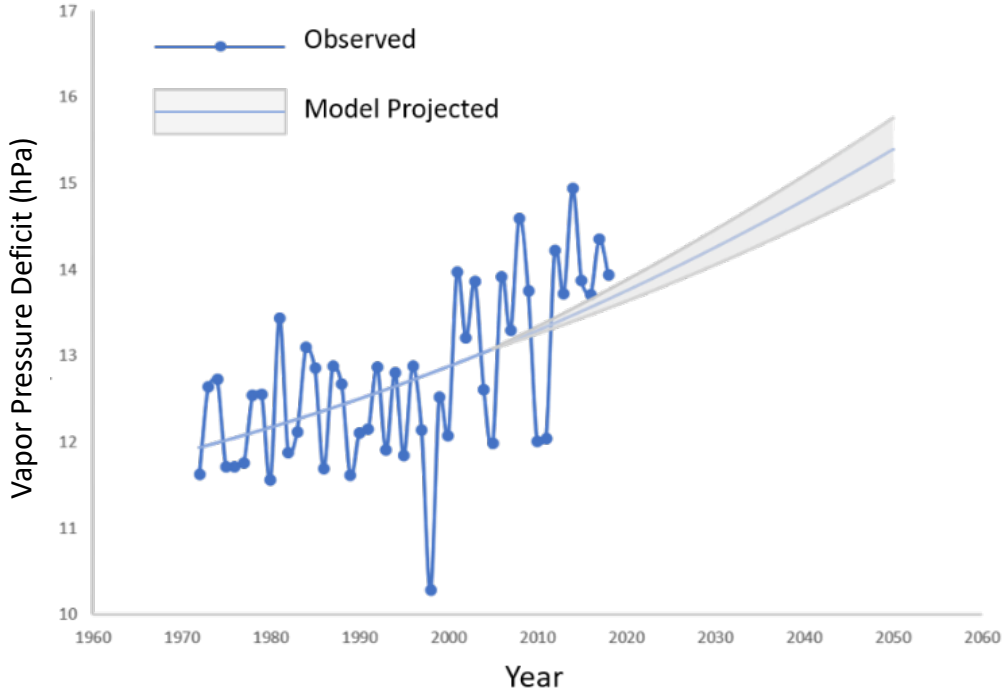


Wildfire Frequency and Size Highly Correlated to VPD Which is Directly Impacted by Climate Change

Response of Fires to VPD Changes (Western US)



Projected Increase in VPD (Western US)

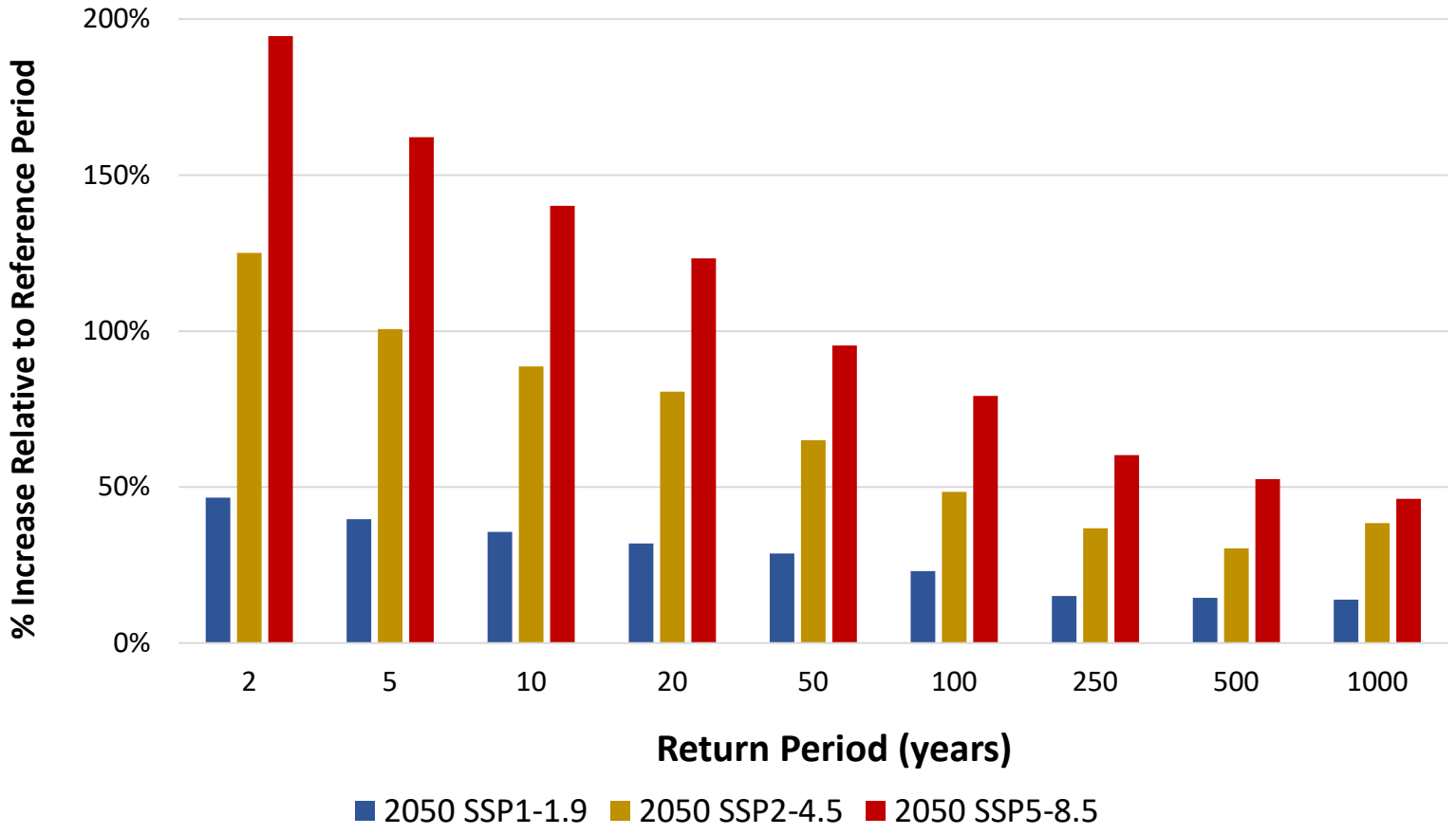


Vapor Pressure Deficit (VPD): Capacity of an airmass to hold moisture beyond what is available in the atmospheric environment

Increases directly with warming air temperature

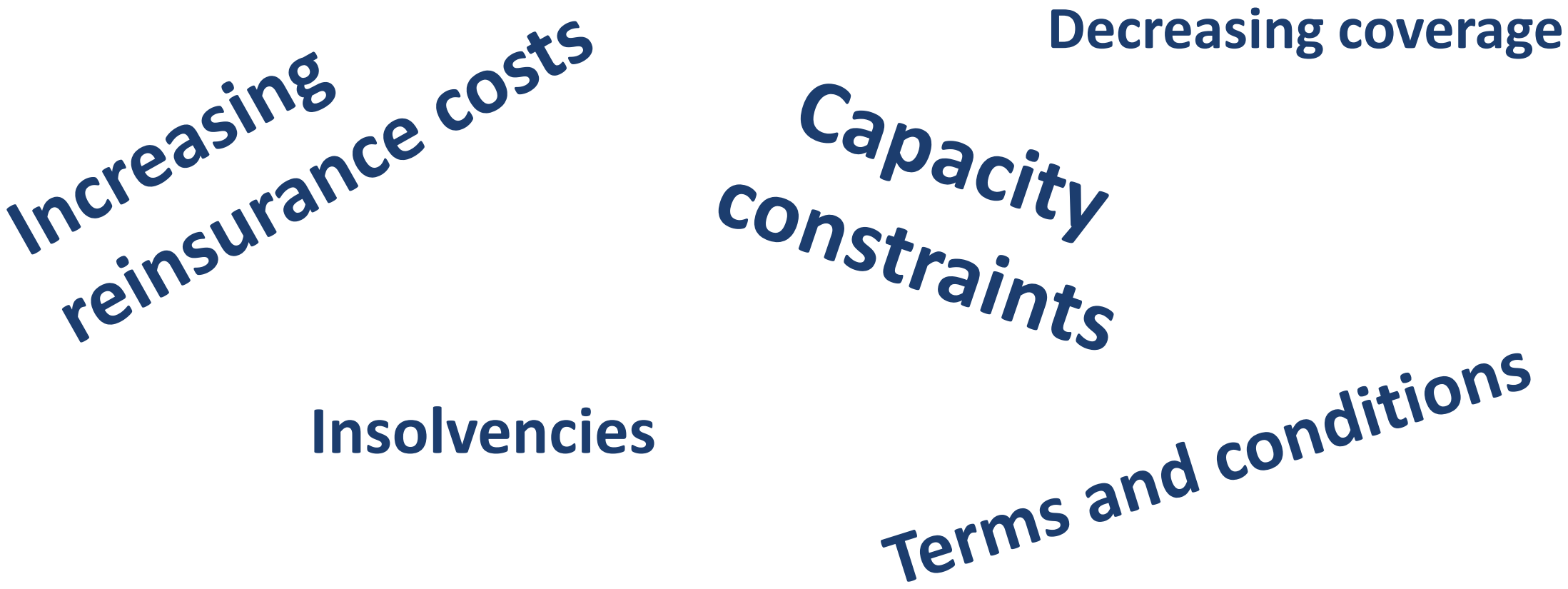
KCC Wildfire Model Converts IPCC Projections into Projected EP Curves

	VPD Change Relative to 2020 (%)		
	2025	2030	2050
SSP1-1.9	3.2	4.5	5.2
SSP2-4.5			11.8
SSP5-8.5			17.5

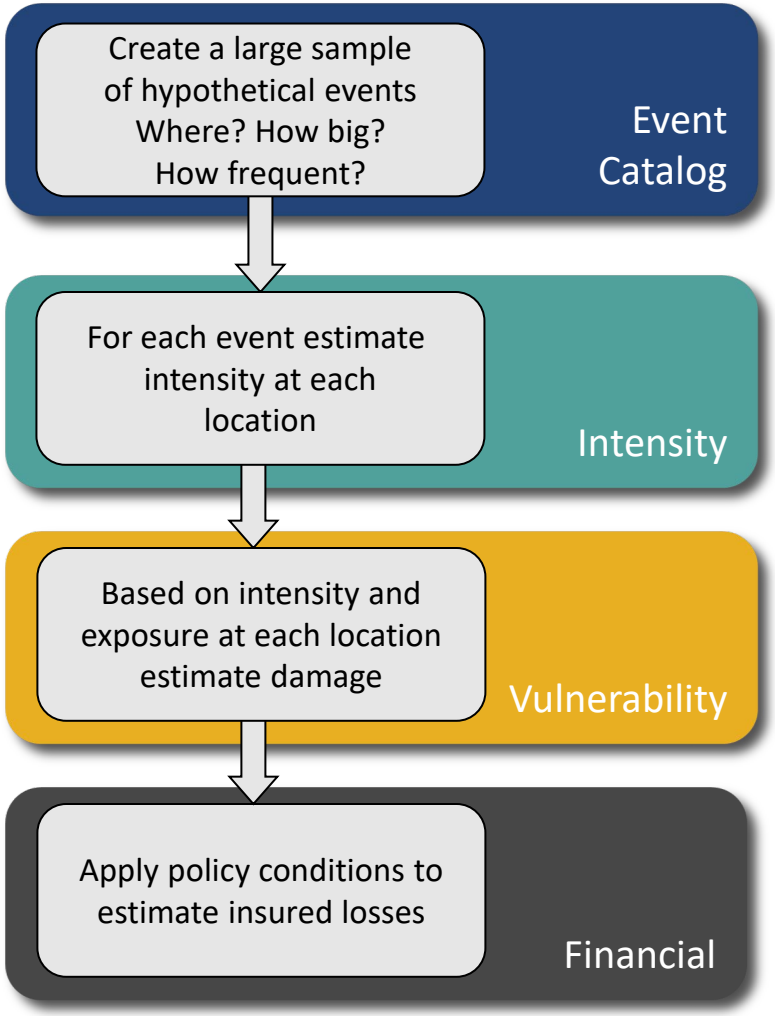


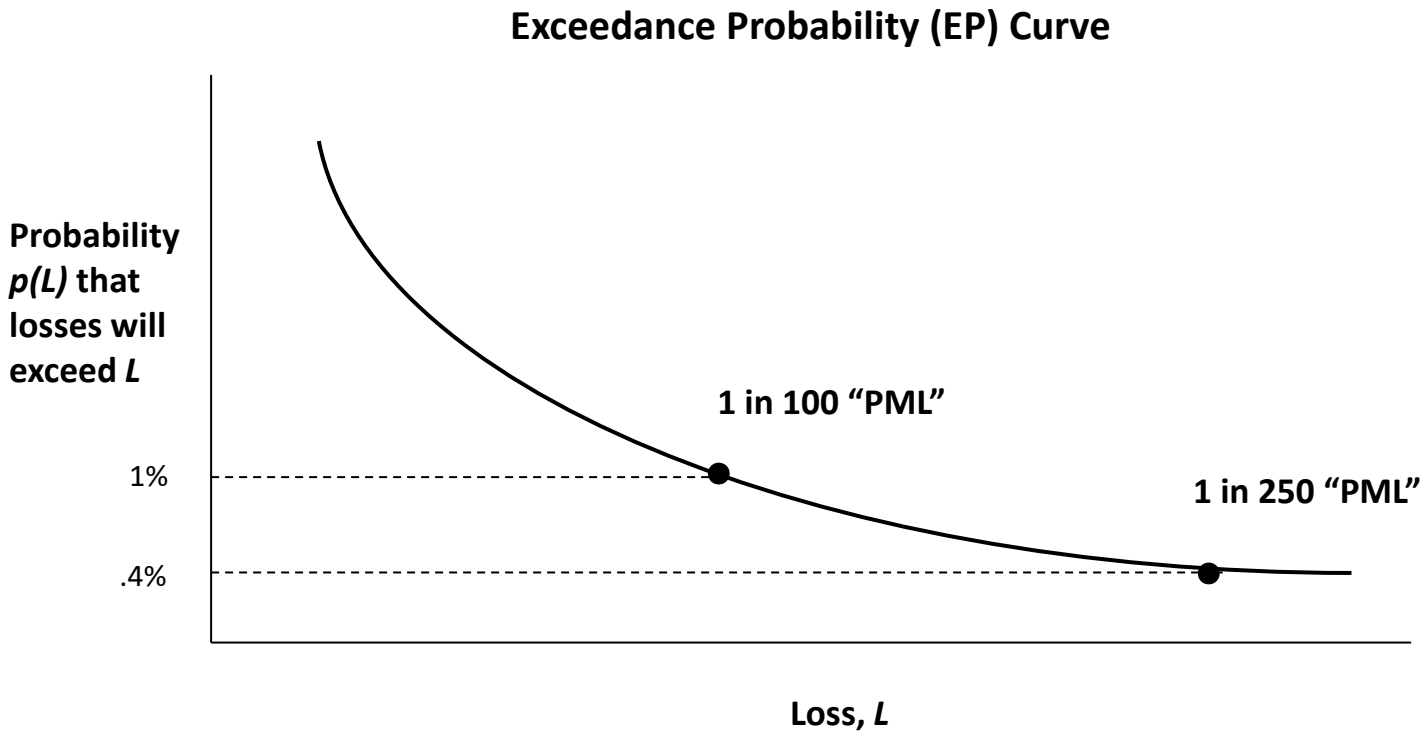
All of This Can Be Quantified and Captured by the Models

Reinsurance Market: 2022 Looks a Lot Like 1992



Anatomy of a Catastrophe Model





Today’s Challenges Go Well Beyond Hurricanes and Earthquakes

Derechoes

Severe Thunderstorms

Wildfires

Winter Storms

Arctic Air Outbreaks

Legacy Models Don't Handle the Frequency (aka Secondary) Perils Adequately

The Growing Impact of Secondary Perils

David Blades – Associate Director, AM Best

2022 Casualty Actuarial Society – Spring Meeting
May 17, 2022

When secondary perils aren't so secondary

Expert highlights an area which tends to be overlooked, leading to massive losses

The growing prominence of loss events arising from secondary perils could cause reinsurers to "misunderstand or underprice" their exposure because models for these risks are less developed compared to primary peril modelling, according to Jim Bichard, partner and global insurance leader at professional services firm PricewaterhouseCoopers (PWC).

Worries over secondary perils to drive reinsurance rates surge at 1/1

Small, localised and expensive: why we must urgently learn more about secondary perils

Industry Solution to Models That Don't Accurately Reflect the Risk

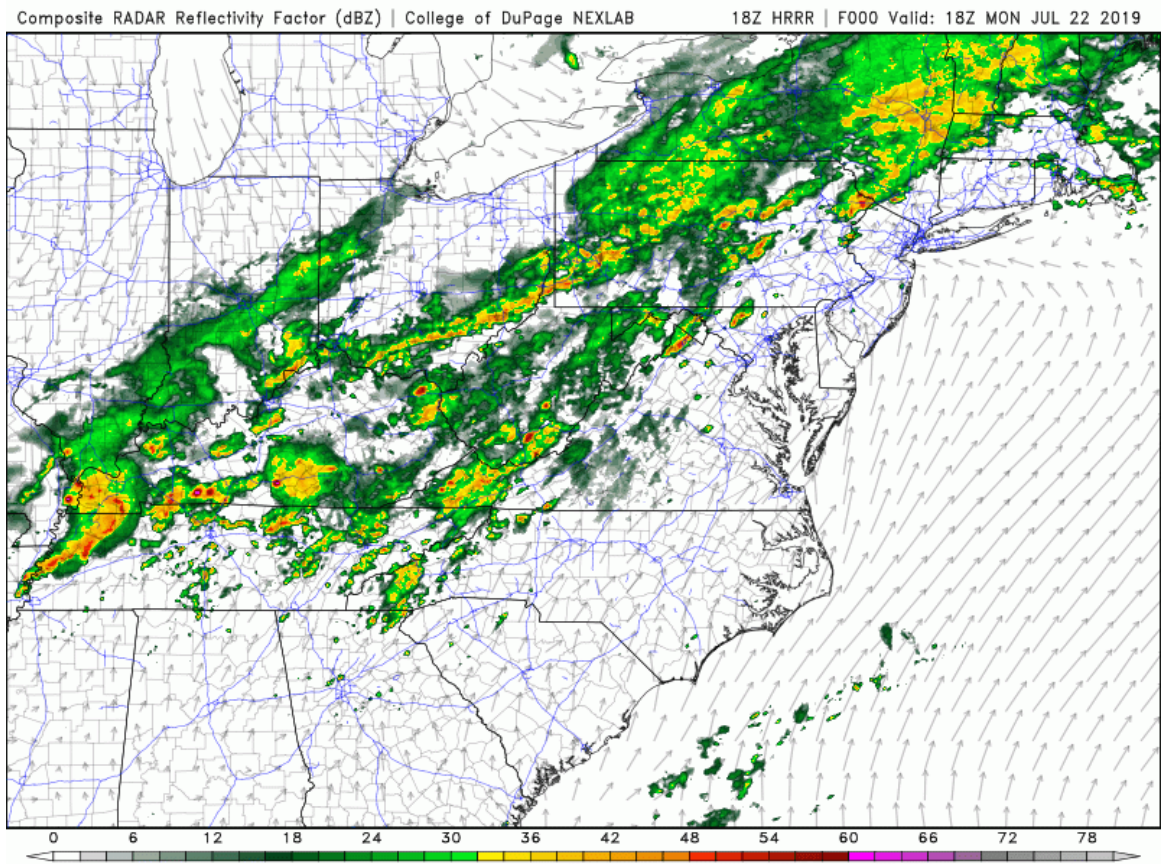
Why Did KCC Get Into the Modeling Business?

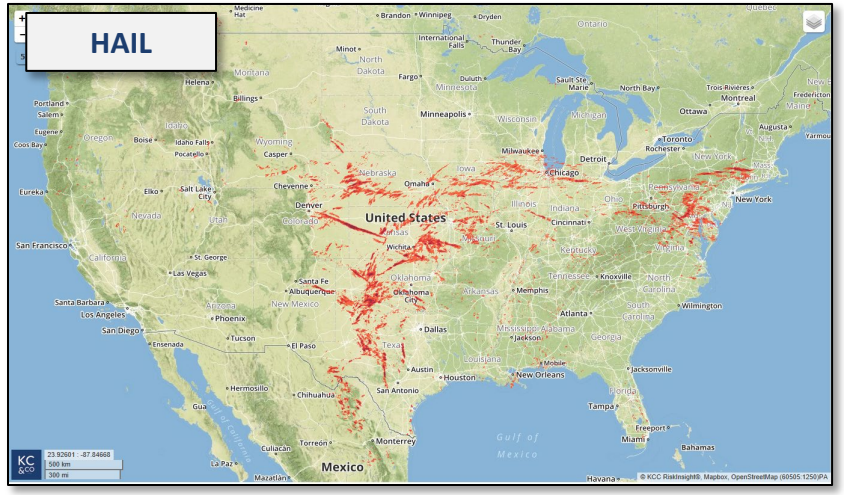
Because we believe there is a better way

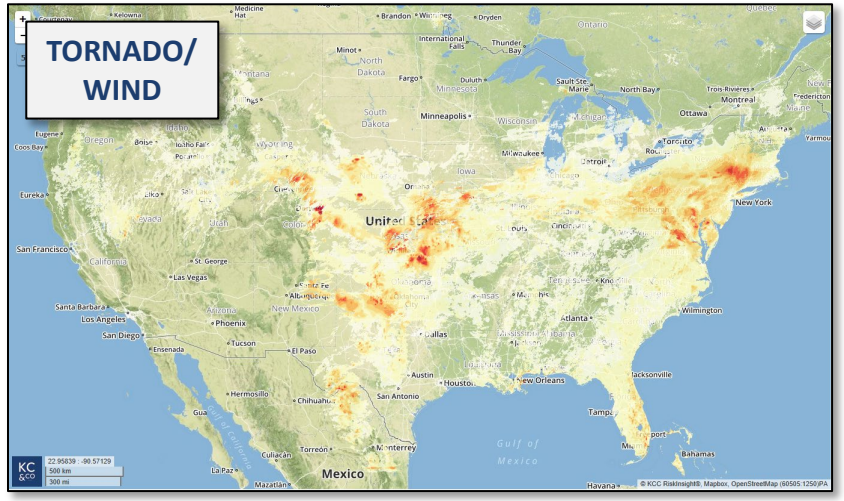
If the status quo isn't working—let's fix it!

Advanced and Innovative Techniques: KCC Models Combine NWP and Remote Sensing Data

- KCC uses a **physics-based** modeling methodology (NWP), where **hail** and **wind/tornado** sub-perils are modeled separately

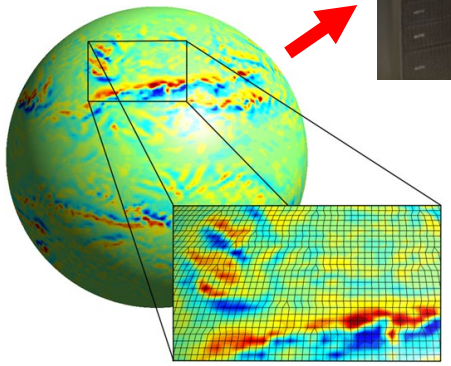


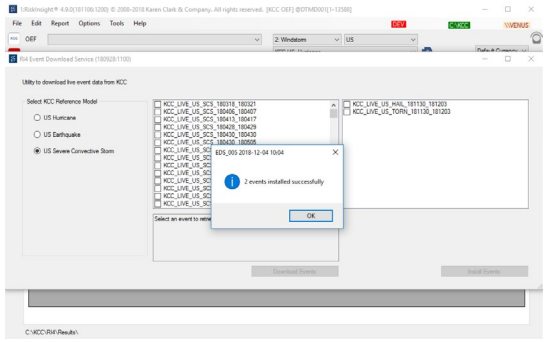




Combined with Continuous Model Validation: KCC Live Events

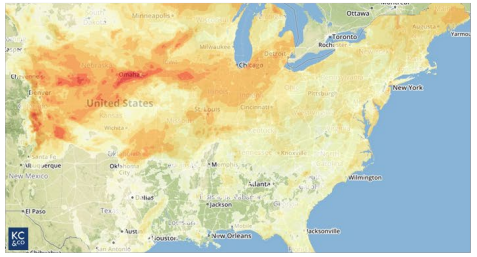
- KCC automatically downloads and archives **~30 GB** of data per day to support SCS Live Events





Hail Intensity Footprint

Tornado/Wind Intensity Footprint



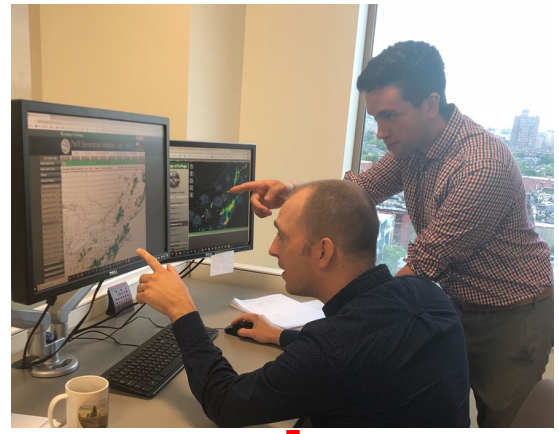
Hail and Tornado/Wind Claims and Losses by State and ZIP

State	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:CO	319,134,000	4.19	64.11	52,185	6,100
US:IN	21,548,000	8.77	4.33	3,057	7,000
US:NE	18,687,000	0.84	3.75	2,853	6,600
US:OK	11,504,000	4.94	2.31	2,544	4,500
US:OH	11,763,000	6.62	2.36	1,551	7,600

State	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:CO	29,190,000	2.56	8.41	5,376	5,400
US:IN	35,625,000	3.85	10.27	5,092	7,000
US:IL	52,951,000	8.62	15.26	4,912	10,800
US:MI	35,886,000	5.94	10.34	4,750	7,600
US:OK	12,301,000	1.54	3.55	2,394	5,100

ZIP	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:CO:80138	133,111,000	0.14	26.74	8,917	14,900
US:CO:80911	33,190,000	0.12	6.67	8,214	4,000
US:CO:80910	20,687,000	0.15	4.16	6,792	3,000
US:CO:80904	6,540,000	0.1	1.31	3,879	1,700
US:CO:80905	9,843,000	0.06	1.98	3,848	2,600

ZIP	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:IA:51501	1,192,000	0.02	0.34	458	2,600
US:IA:51503	924,000	0.02	0.27	447	2,100
US:IA:52501	1,022,000	0.01	0.29	411	2,500
US:WY:82007	897,000	0.01	0.26	381	2,400
US:NE:68046	764,000	0.01	0.22	357	2,100



Confidential KCC SCS Activity Report

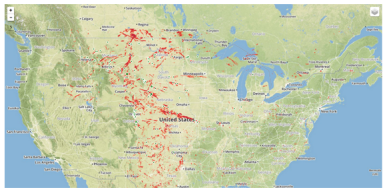
Event Start: 6 July 2019 Event End: 14 July 2019

Accumulated Industry Loss: $ 791,010,000

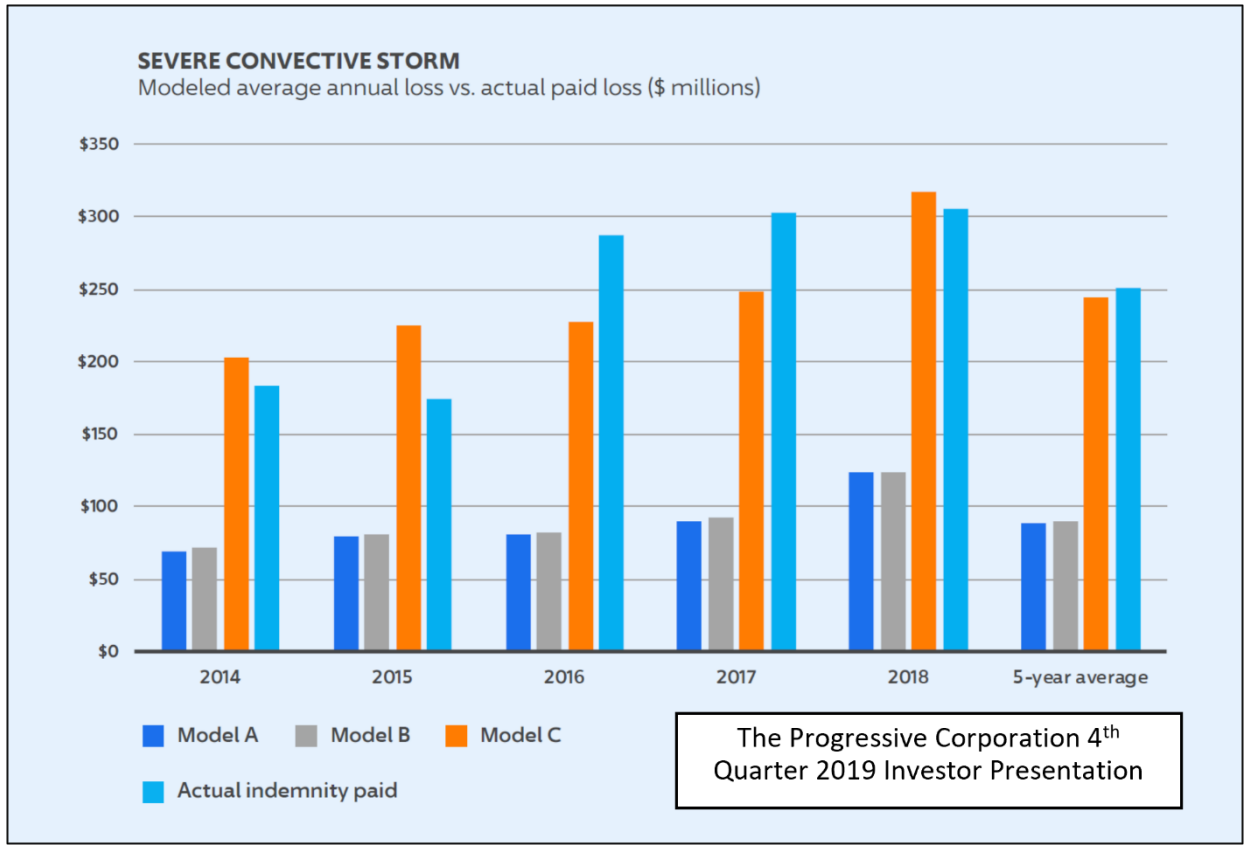
Daily Summary

Most of the weekend severe storm activity occurred in Montana and the Dakotas where golf-ball size hail fell and several wind gusts over 85mph were reported. Multiple damaging wind gusts also occurred just south of Minneapolis/St. Paul. In addition, a line of storms formed over central Illinois on Sunday evening where a wind gust over 75mph was reported. The threat of severe storms continues today for the Northern Plains states of Montana, Wyoming, North and South Dakota and Minnesota, with impacts also possible further south in the Mississippi River Valley as the remnants of tropical cyclone Barry move through the region.

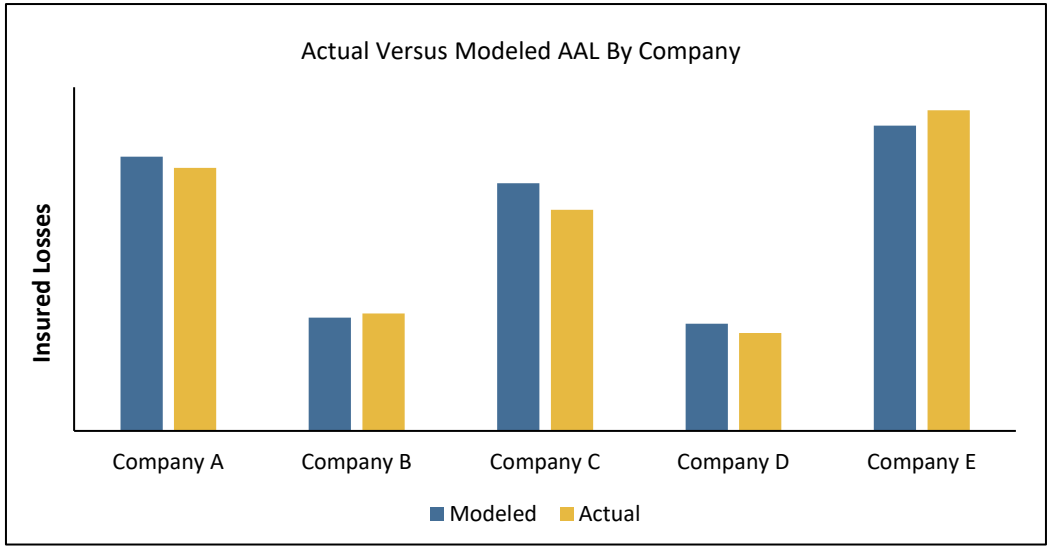
Modeled Hail Footprint with Reports

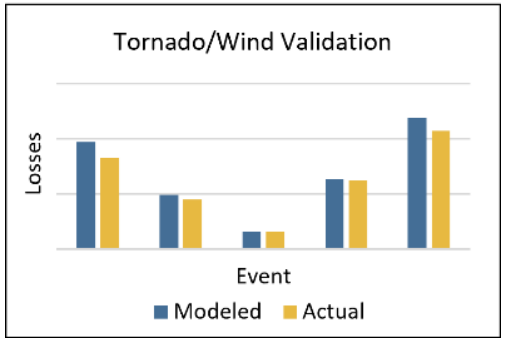


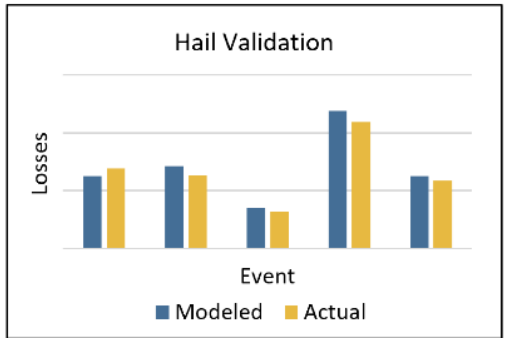
KCC Models Are Proven to Be Accurate: Insurer Validated Against $ Billions Claims Data



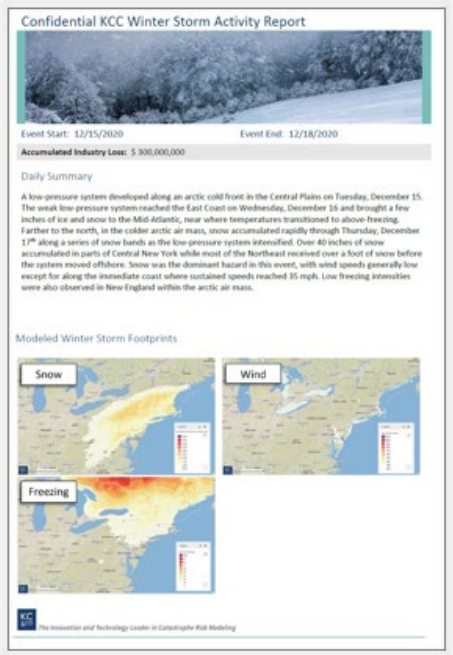
KCC = Model C







The February 2021 Arctic Air Outbreak Was Not a “Model Miss” for the KCC Winter Storm Model


Confidential KCC Winter Storm Activity Report

Event Start: 12/15/2020 Event End: 12/18/2020

Accumulated Industry Loss: $ 300,000,000

Daily Summary

A low-pressure system developed along an arctic cold front in the Central Plains on Tuesday, December 15. The weak low-pressure system reached the East Coast on Wednesday, December 16 and brought a few inches of ice and snow to the Mid-Atlantic, near where temperatures transitioned to above-freezing. Farther to the north, in the colder arctic air mass, snow accumulated rapidly through Thursday, December 17th along a series of snow bands as the low-pressure system intensified. Over 40 inches of snow accumulated in parts of Central New York while most of the Northeast received over a foot of snow before the system moved offshore. Snow was the dominant hazard in this event, with wind speeds generally low except for along the immediate coast where sustained speeds reached 35 mph. Low freezing intensities were also observed in New England within the arctic air mass.

Modeled Winter Storm Footprints

Snow

Wind

Freezing


KCC Confidential Report - Winter Storm Orlena (1/30/21-2/3/21)

Event Start: 1/30/2021 Event End: 2/3/2021

Accumulated Industry Loss: $ 540,000,000

Event Summary

An extratropical cyclone brought active weather along the west coast before progressing east. The storm brought heavy snow to Illinois and Ohio, accumulating to around 6-12 inches, on January 30. When the storm reached the East Coast on January 31, a secondary low-pressure circulation developed offshore.

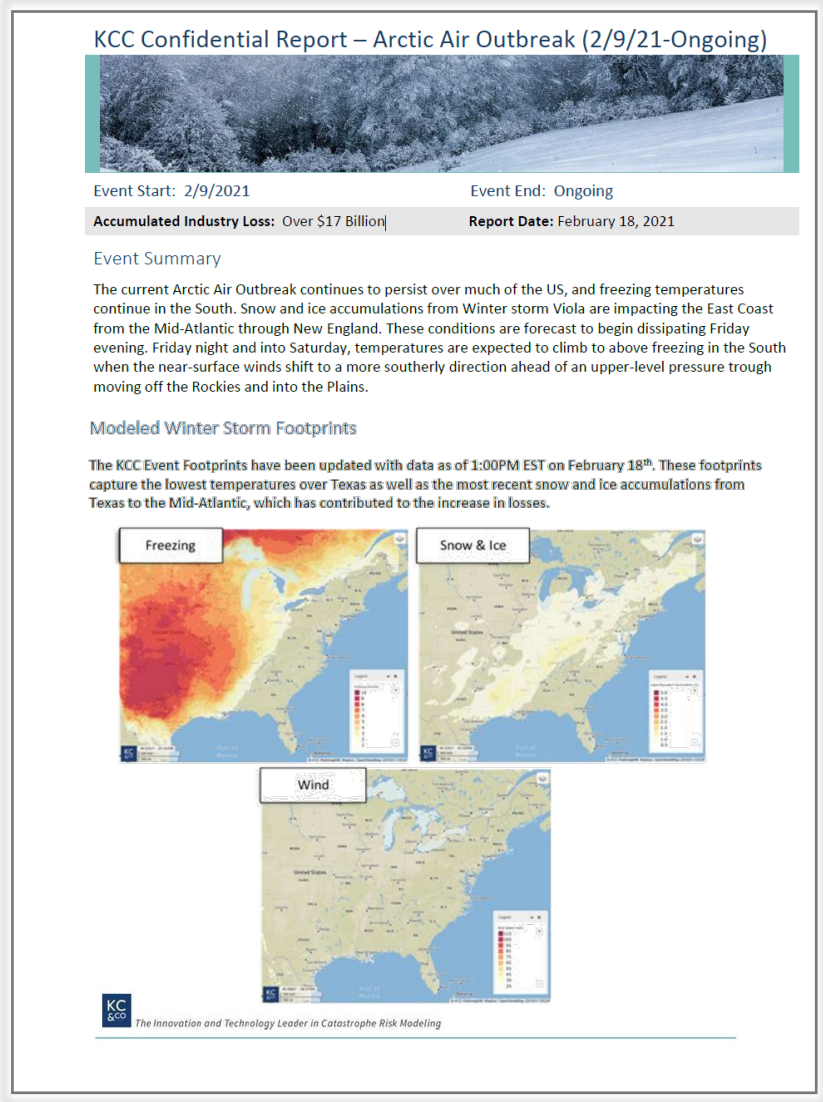
The secondary low-pressure system intensified on February 1, and snowbands that produced localized heavy snowfall rates developed to the north and west of the center. The storm stalled offshore, and the heavy snow continued over the Mid-Atlantic through Tuesday, February 2. Several locations in the affected area reported over 30 inches of snow, which translates to over 2.5 inches of liquid water—the intensity measure important for estimating damage from snow. The deepening low-pressure system also resulted in strong winds, particularly along the coast, where sustained wind speeds exceeded 35 mph.

Modeled Winter Storm Footprints

Snow

Wind

Freezing


KCC Confidential Report – Arctic Air Outbreak (2/9/21-Ongoing)

Event Start: 2/9/2021 Event End: Ongoing

Accumulated Industry Loss: Over $17 Billion **Report Date:** February 18, 2021

Event Summary

The current Arctic Air Outbreak continues to persist over much of the US, and freezing temperatures continue in the South. Snow and ice accumulations from Winter storm Viola are impacting the East Coast from the Mid-Atlantic through New England. These conditions are forecast to begin dissipating Friday evening. Friday night and into Saturday, temperatures are expected to climb to above freezing in the South when the near-surface winds shift to a more southerly direction ahead of an upper-level pressure trough moving off the Rockies and into the Plains.

Modeled Winter Storm Footprints

The KCC Event Footprints have been updated with data as of 1:00PM EST on February 18th. These footprints capture the lowest temperatures over Texas as well as the most recent snow and ice accumulations from Texas to the Mid-Atlantic, which has contributed to the increase in losses.

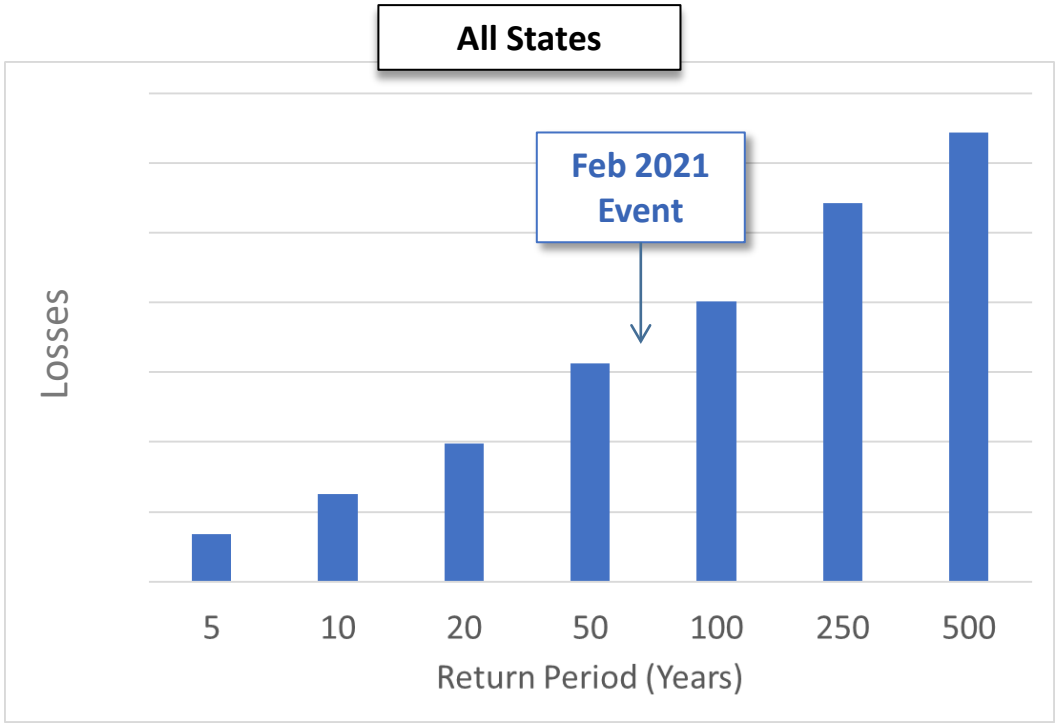
Freezing

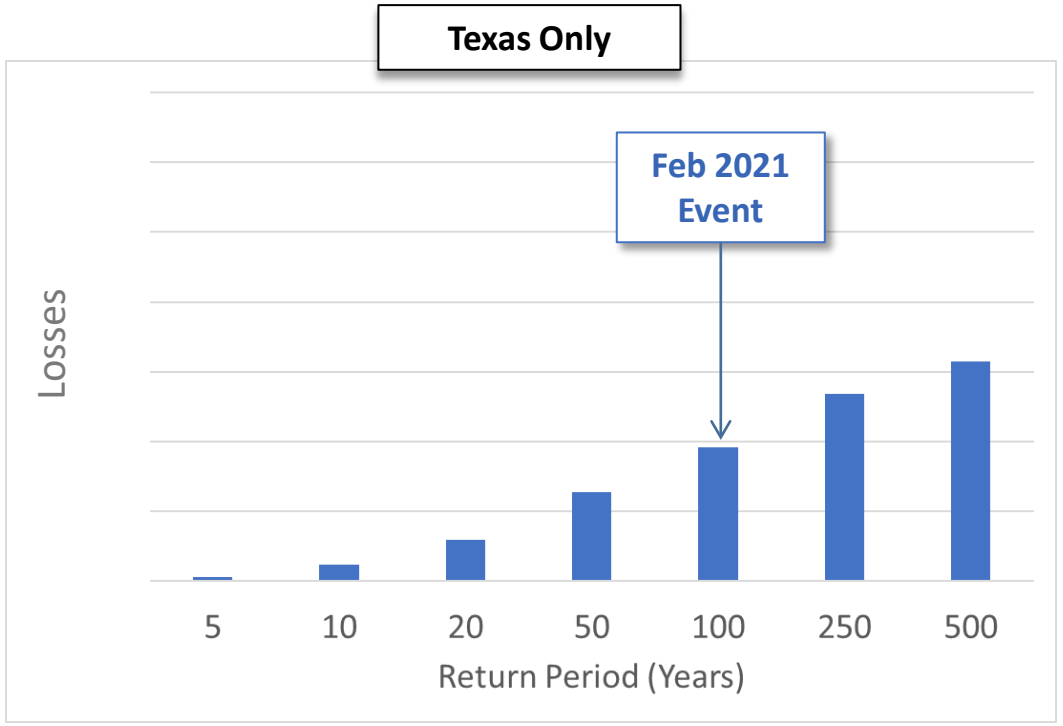
Snow & Ice

Wind

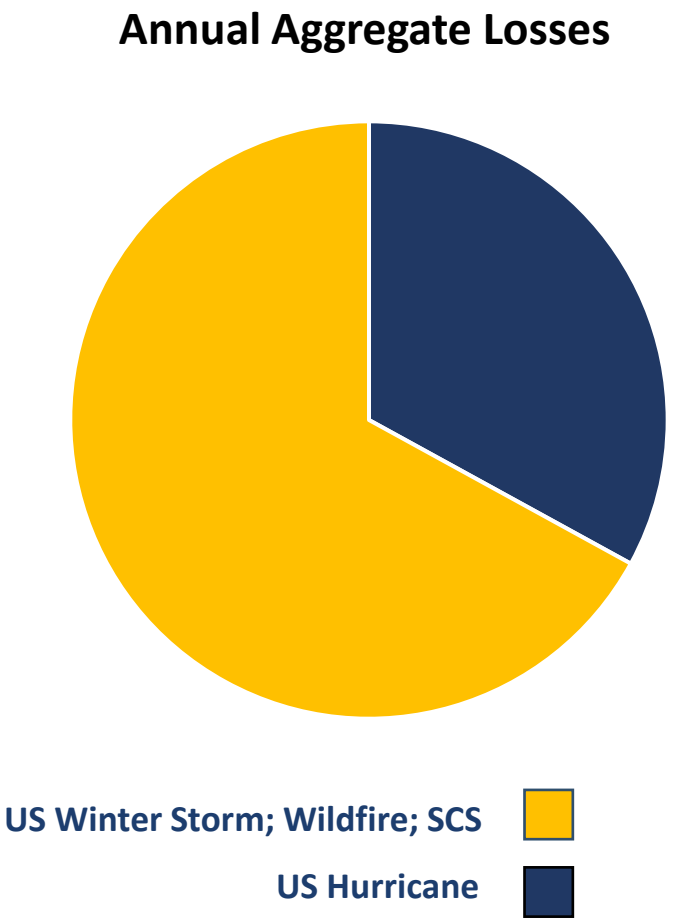
The Innovation and Technology Leader in Catastrophe Risk Modeling

KCC Winter Storm Model: Captured the Loss in Real Time and Well *Before* it Occurred in EP Curves



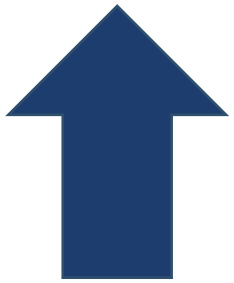


How Much Do US Insurers Pay Out Each Year on AVERAGE for Weather-related Perils?



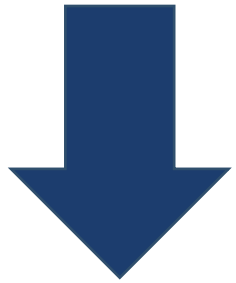
$65 Billion

Frequency Perils Provide Challenges and Opportunities for Risk Transfer



Need to protect earnings and surplus from higher frequency events

HOWEVER



Current capacity and coverage provided

KC: Models that are **less** wrong are **more** useful!

Claims management and fraud detection/prevention/addressing social inflation

Accurate rates—prices commensurate with the risk

Better underwriting and risk selection

Effective portfolio management—no surprises

Innovative reinsurance and ILS applications

Current Risk Transfer Products

- What reinsurers and ILS investors don't like about traditional indemnity-based covers
  - Take too long to settle—major event loss can take years to fully develop
  - Loss creep—social inflation, LAE, non-modeled loss, etc.

- What insurers don't like about parametric-based triggers
  - Too much basis risk

- ILWs based on PCS worst of all worlds
  - Significant basis risk
  - PCS estimates can take a year a more to develop

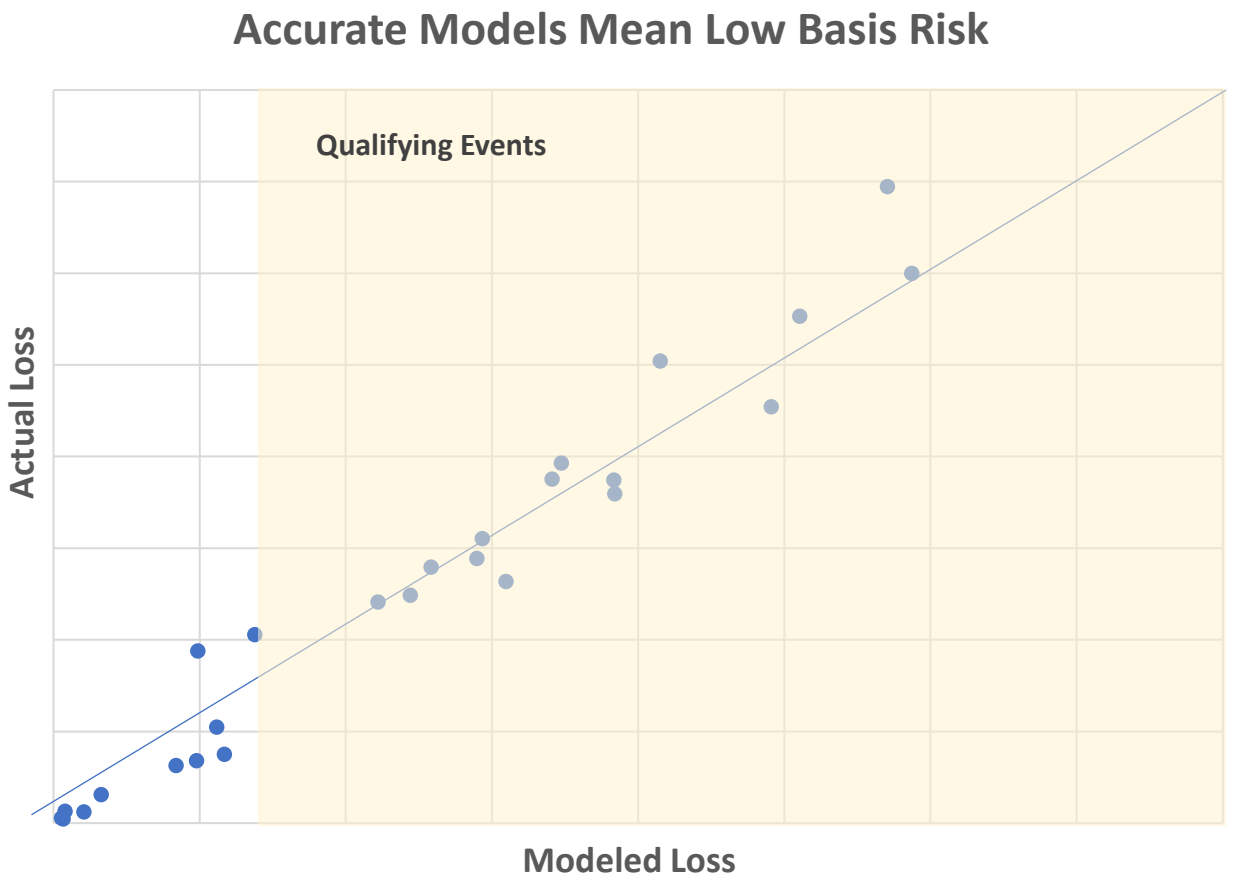
Accurate Models Provide Opportunities for Covering Growing Risk: “Modeled Loss” Trigger

Indemnity Based Trigger

Payout = Ceding Company Actual Loss

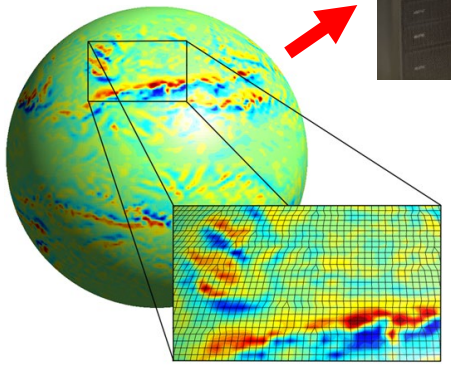
Modeled Loss Trigger

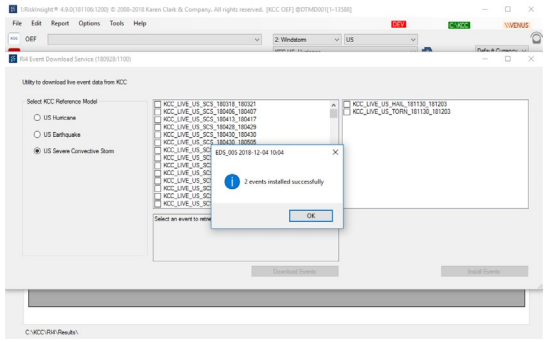
Payout = Modeled Loss on Ceding Company Exposure



KCC SCS Live Events Process Provides Daily Hail and Tornado/Wind "Footprints" for Loss Calculation

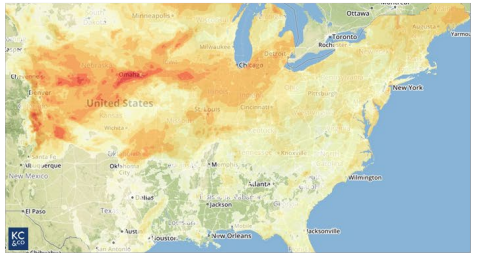
- KCC automatically downloads and archives **~30 GB** of data per day to support SCS Live Events

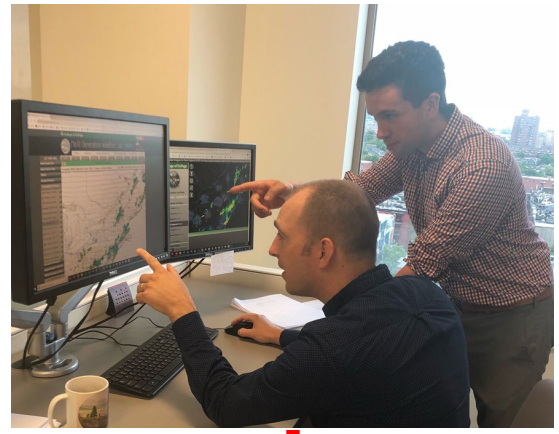




Hail Intensity Footprint

Tornado/Wind Intensity Footprint





Hail and Tornado/Wind Claims and Losses by State and ZIP

State	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:CO	319,134,000	4.19	64.11	52,185	6,100
US:IN	21,548,000	8.77	4.33	3,057	7,000
US:NE	18,687,000	0.84	3.75	2,853	6,600
US:OK	11,504,000	4.94	2.31	2,544	4,500
US:OH	11,763,000	6.62	2.36	1,551	7,600

State	LOSS Gross	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:CO	29,190,000	2.56	8.41	5,376	5,400
US:IN	35,625,000	3.85	10.27	5,092	7,000
US:IL	52,951,000	8.62	15.26	4,912	10,800
US:MI	35,886,000	5.94	10.34	4,750	7,600
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Confidential KCC SCS Activity Report

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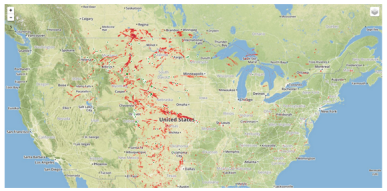
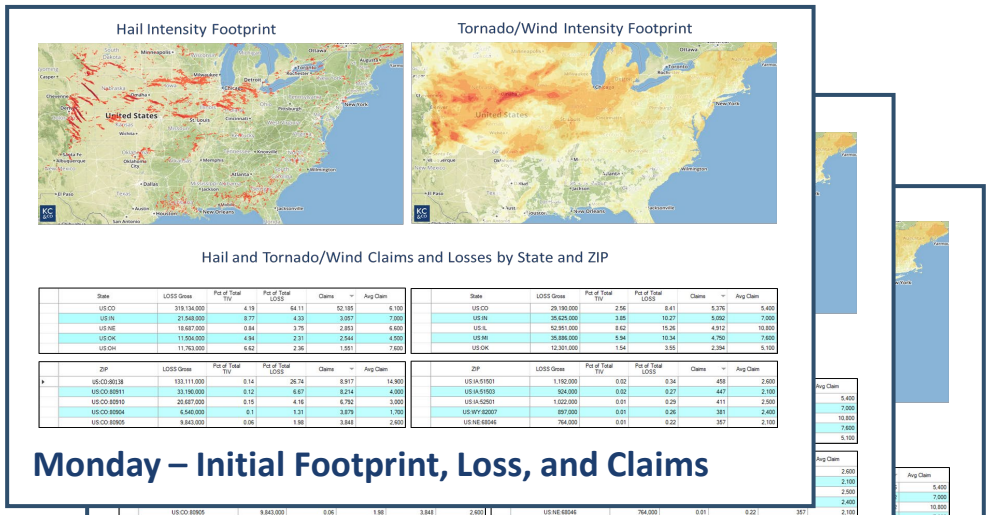
Modeled Hail Footprint with Reports



KCC Advanced Technology Delivers Objective and Scientific Event Definitions and Loss and Claims Estimates in Real Time

1 Dynamic footprints deliver cumulative hazard and loss data as storm progresses



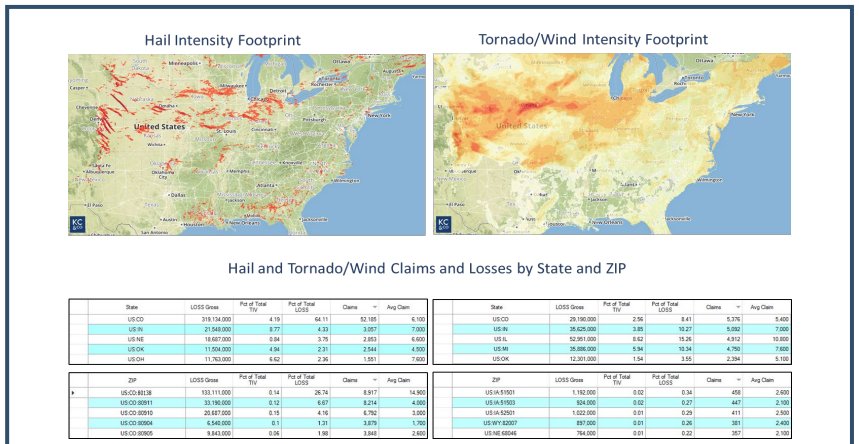
Monday – Initial Footprint, Loss, and Claims

Tuesday – Cumulative Footprint, Loss, and Claims

Wednesday – Cumulative Footprint, Loss, and Claims

…until event ends

2 Final hazard and loss data issued when storm system ends for all events in the season



Event 2022-023 – Final Footprint, Loss, and Claims

Confidential KCC SCS Activity Report

Event Start: 18 July 2022

Event End: On-going

Accumulated Industry Loss:
$ 653,103,000

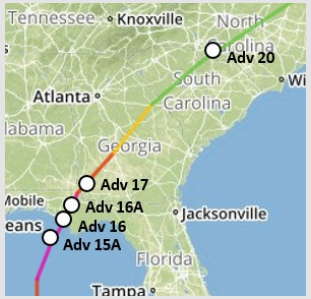
KCC Event ID:
2022-037

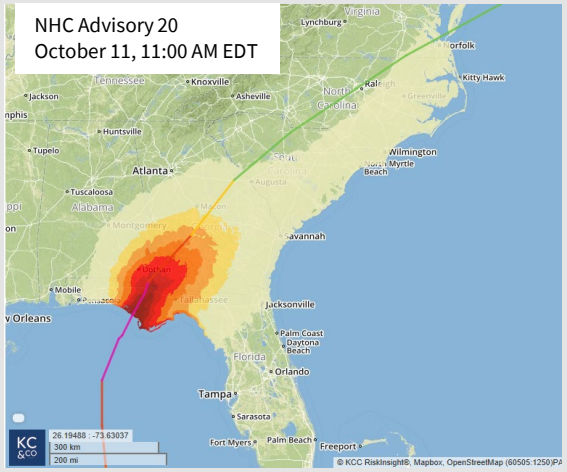
Reports now include KCC Event ID

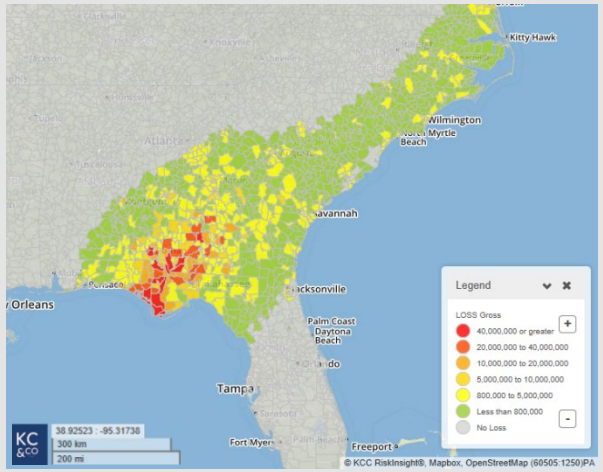
KCC Live Events Provide Hurricane Footprints and Real-Time Data on Industry and Company-Specific Losses

Real-Time Events Validate and Verify Underlying Model Assumptions

Date and Time (EDT)	NHC Advisory	Projected Wind Speed at Landfall (mph)	KCC Industry Loss Estimate ($ billion)
10/10, 8:00 AM	15A	145	7
10/10, 11:00 AM	16	150	8
10/10, 2:00 PM	16A	155	8
10/10, 5:00 PM	17	155	8
10/11, 11:00 AM	20	155	8

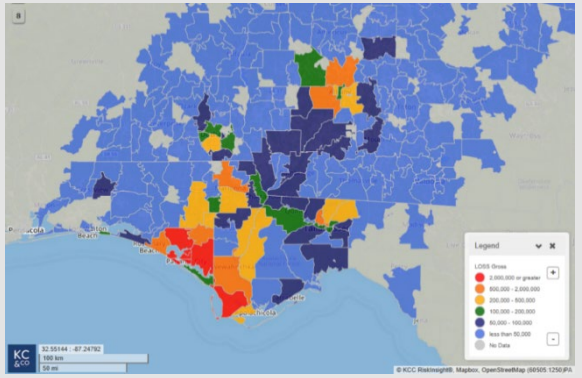






Information Made Available to Insurers as Storms Develop

Maps of Losses and Claims



Numbers of claims and average severity by intensity band

Intensity	TIV	LOSS Gross	Pct Damage	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
3: 60-70 mph	1,560,799,000	1,518,000	0.1	4.1	1.06	179	8,000
4: 70-80 mph	1,184,211,000	2,156,000	0.18	3.11	1.5	277	8,000
5: 80-90 mph	441,035,000	3,189,000	0.72	1.16	2.22	210	15,000
6: 90-100 mph	207,367,000	2,643,000	1.27	0.54	1.84	141	19,000
7: 100-110 mph	91,456,000	2,241,000	2.45	0.24	1.56	85	26,000
8: 110-120 mph	265,442,000	17,863,000	6.73	0.7	12.44	291	61,000
9: 120-130 mph	562,867,000	83,639,000	14.86	1.48	58.26	794	105,000

Losses and claims information by ZIP

ZIP	TIV	LOSS Gross	Pct Damage	Pct of Total TIV	Pct of Total LOSS	Claims	Avg Claim
US:FL:32305	54,105,000	27,000	0.05	0.14	0.02	5	5,500
US:FL:32308	135,122,000	188,000	0.14	0.36	0.13	24	7,800
US:FL:32309	173,491,000	223,000	0.13	0.46	0.16	27	8,300
US:FL:32310	41,467,000	75,000	0.18	0.11	0.05	10	7,500
US:FL:32311	169,968,000	76,000	0.04	0.45	0.05	10	7,600
US:FL:32312	306,909,000	386,000	0.13	0.81	0.27	39	9,900
US:FL:32317	79,258,000	51,000	0.06	0.21	0.04	6	8,500
US:FL:32320	31,519,000	359,000	1.14	0.08	0.25	24	15,000
US:FL:32321	4,017,000	215,000	5.34	0.01	0.15	5	42,900
US:FL:32322	27,403,000	65,000	0.24	0.07	0.05	8	8,100
US:FL:32324	1,874,000	63,000	3.37	0	0.04	2	31,600
US:FL:32327	219,468,000	99,000	0.05	0.58	0.07	13	7,600

Modeled Loss Triggers Deliver Several Benefits to Insurers and Reinsurers

- Modeled loss triggers offer
  - Transparency
  - Accuracy
  - Speed
  - Much less basis risk than parametric triggers
- Reinsurers can provide additional cover at a better price
- Modeled loss triggers can be created for any peril (including hurricane and SCS) and calculated in near real time with KCC models
- Avoid surprise losses with daily updates on qualifying events and always know your position with respect to aggregate retention and limit


Source: NOAA


Source: NOAA

What KCC Believes

- Innovative, accurate, and real-time models can be developed for all perils—severity and frequency (aka primary and secondary)
- The impacts of climate change on weather-related perils can be quantified and built into the models
- The impacts of social and economic inflation can be analyzed, quantified, and captured
- Insurance is a food chain—prices must be consistent across the chain—insurance, reinsurance, retro
- Growing risk means growing **opportunities**
- Insurers and reinsurers can capture these opportunities while providing a stable market for homeowners and commercial property owners