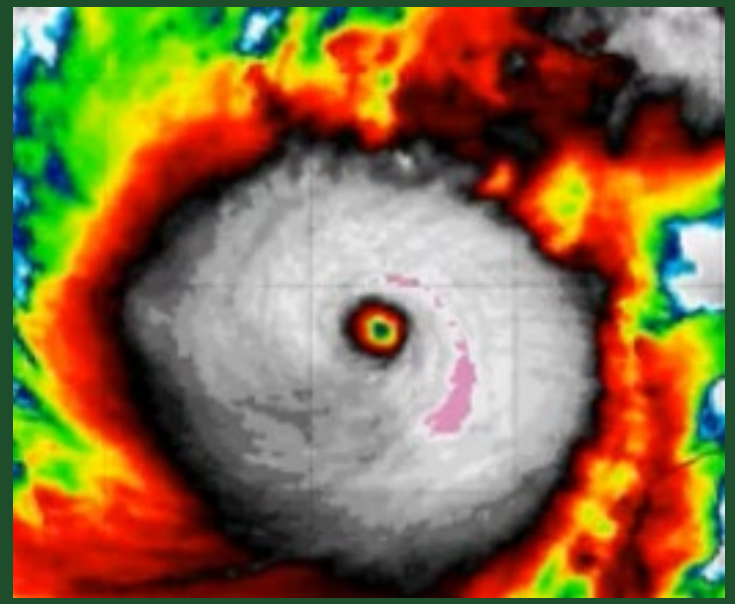
Atlantic Basin Seasonal Hurricane Outlook for 2026 and Long-Term Trends



Phil Klotzbach, Department of Atmospheric Science, Colorado State University

2026 FORECAST AS OF 9 APRIL 2026

Forecast Parameter	CSU Forecast	1991–2020 Average
Named Storms (NS)	13	14.4
Named Storm Days (NSD)	55	69.4
Hurricanes (H)	6	7.2
Hurricane Days (HD)	20	27.0
Major Hurricanes (MH)	2	3.2
Major Hurricane Days (MHD)	5	7.4
Accumulated Cyclone Energy (ACE)	90	123
ACE West of 60°W	50	73
Net Tropical Cyclone Activity (NTC)	100	135

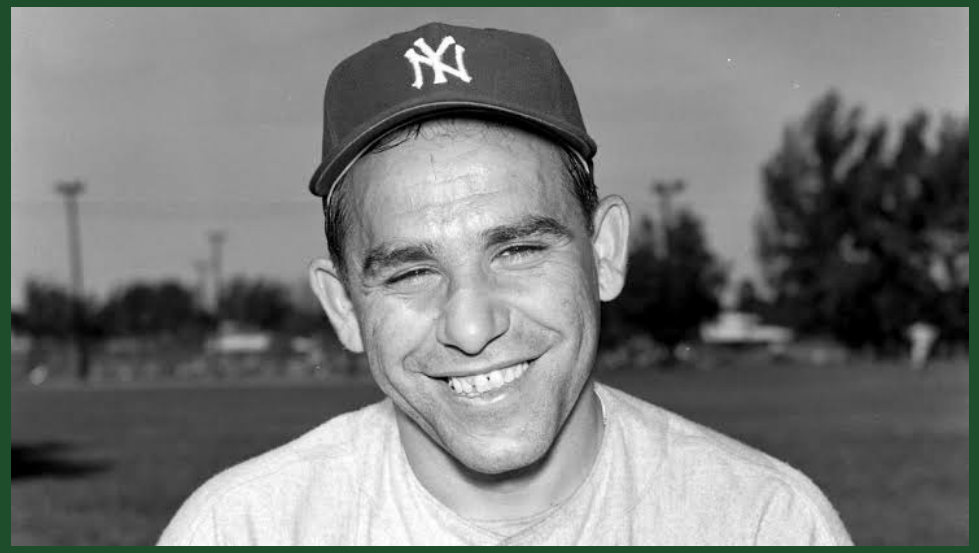
Seasonal Forecasting is more than this!

The Essence of Seasonal Forecasting

“It’s tough to make predictions, especially about the future.”

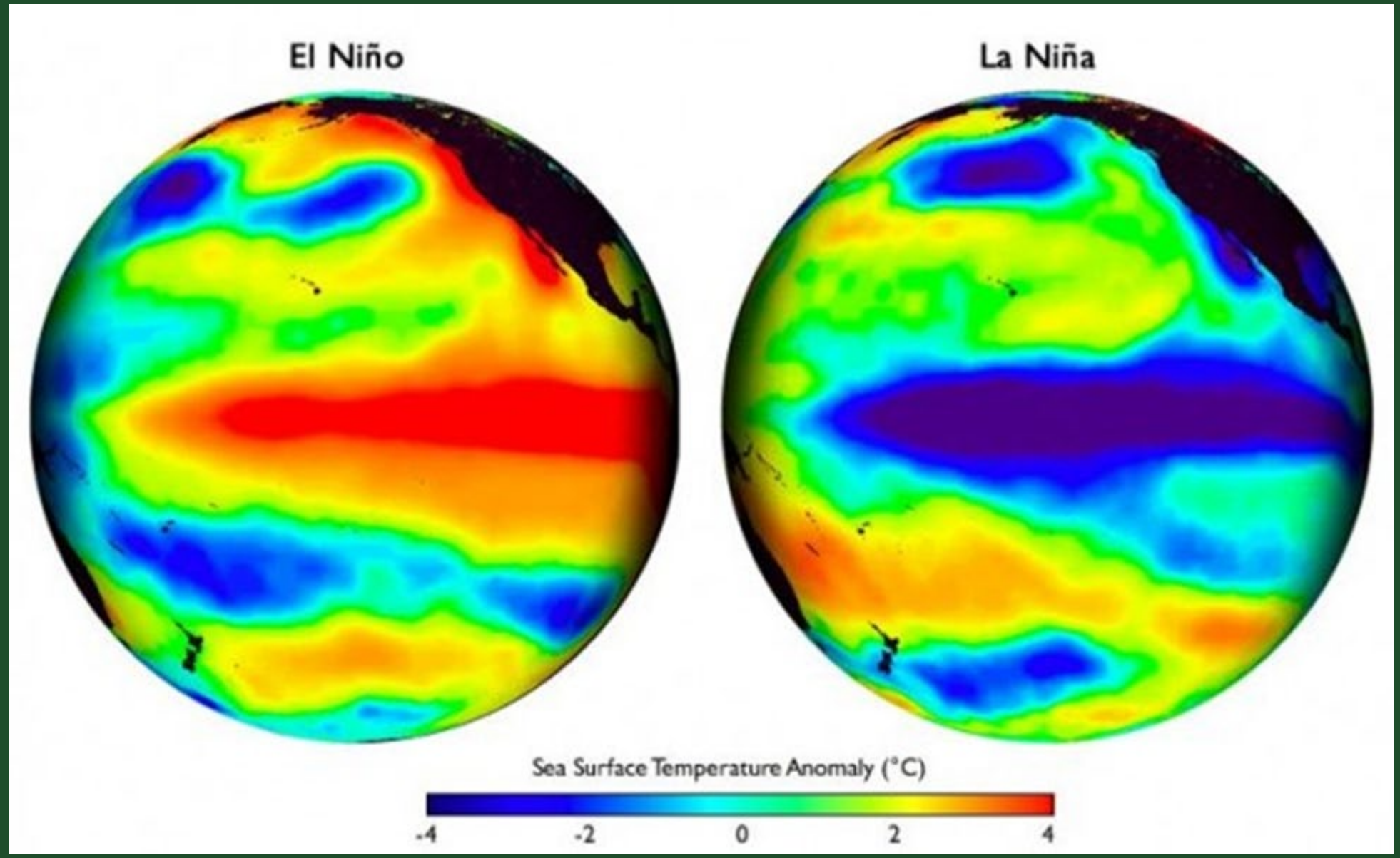
HOWEVER

“You can see a lot by looking”



Yogi Berra

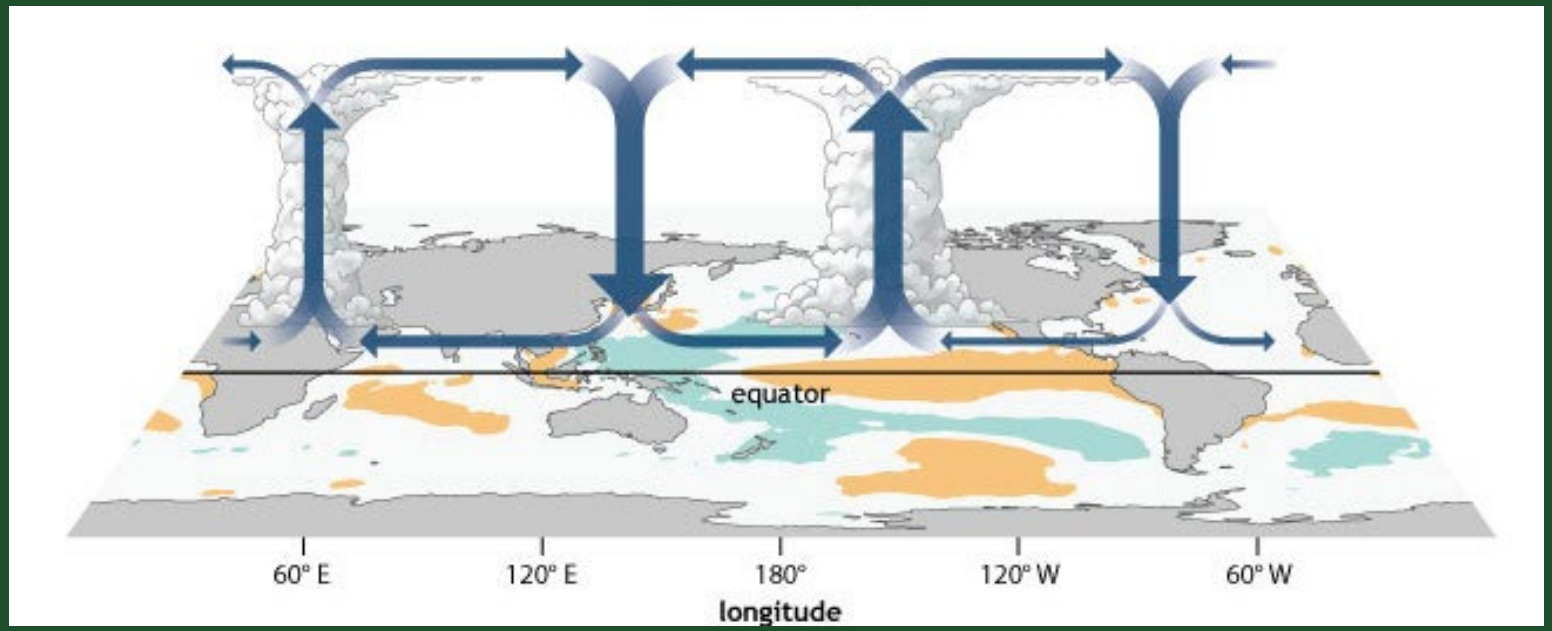
What is El Niño/La Niña?



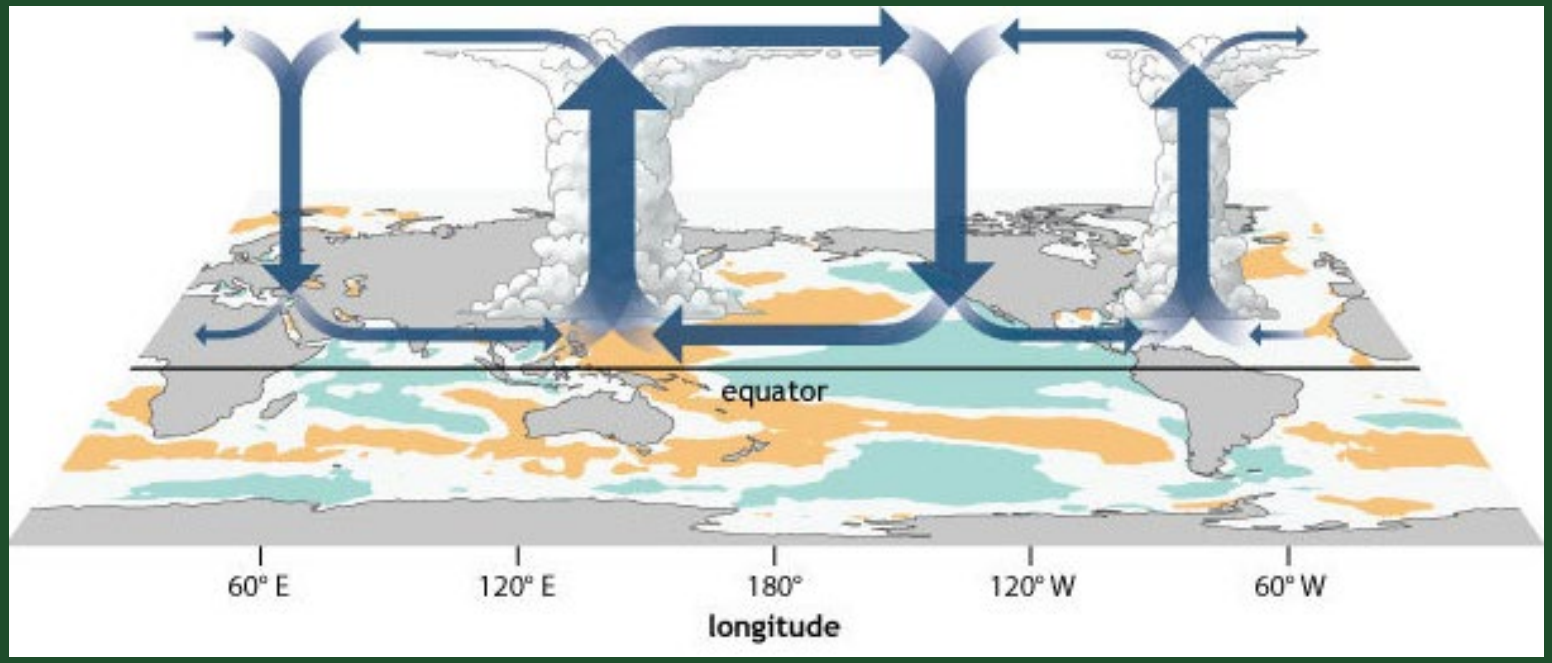
Columbia Univ

ENSO's Impact on Tropical Circulation

El Niño

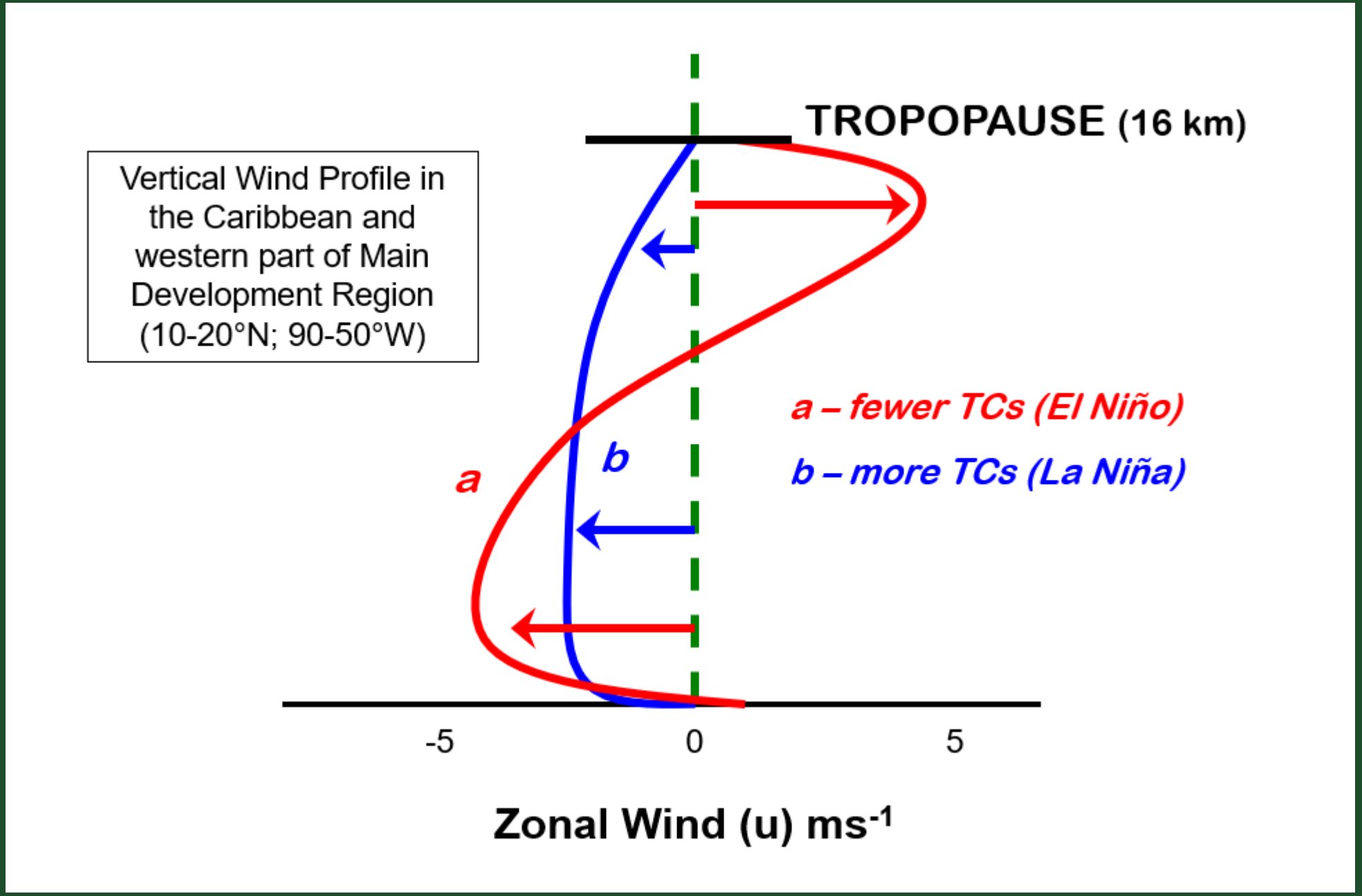


La Niña

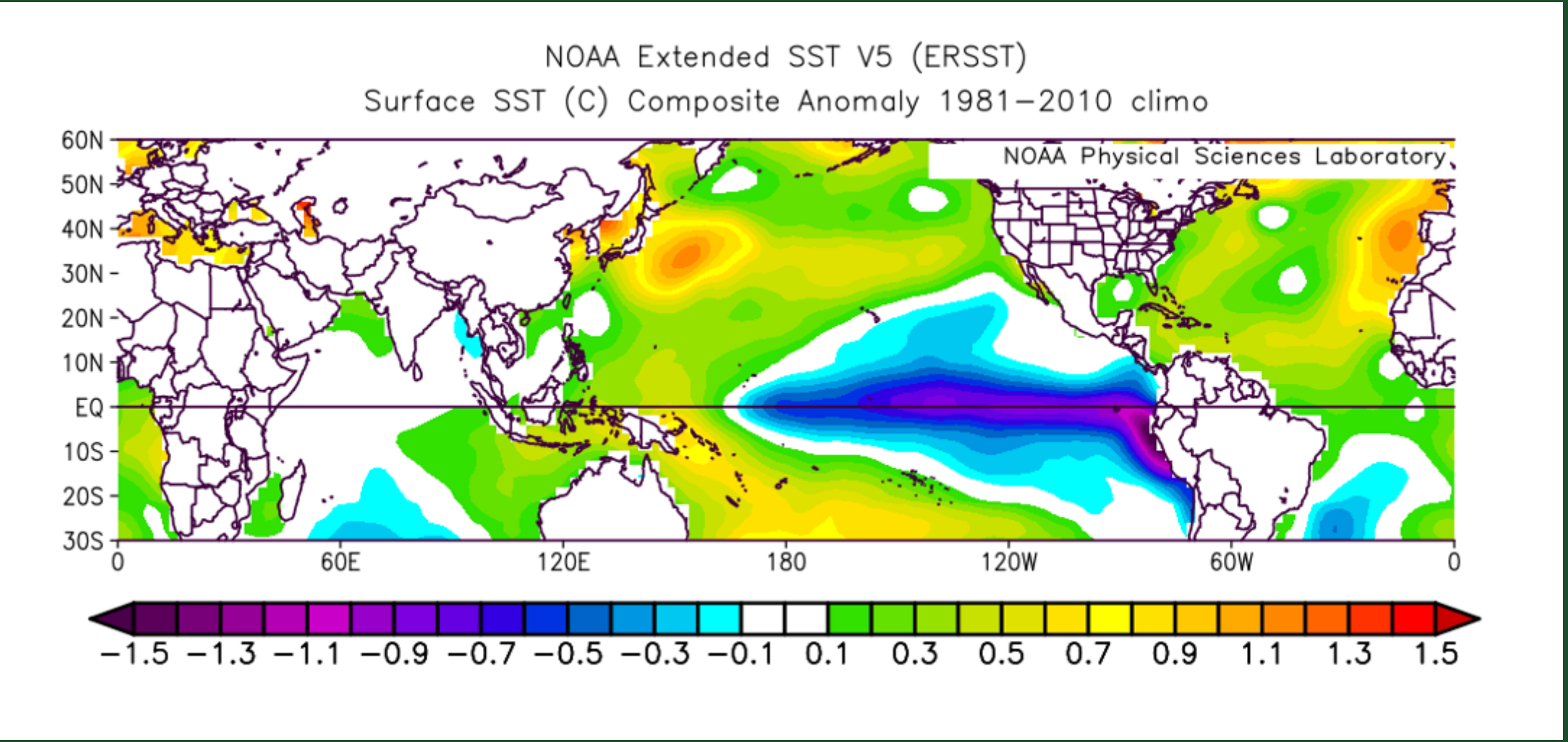


climate.gov

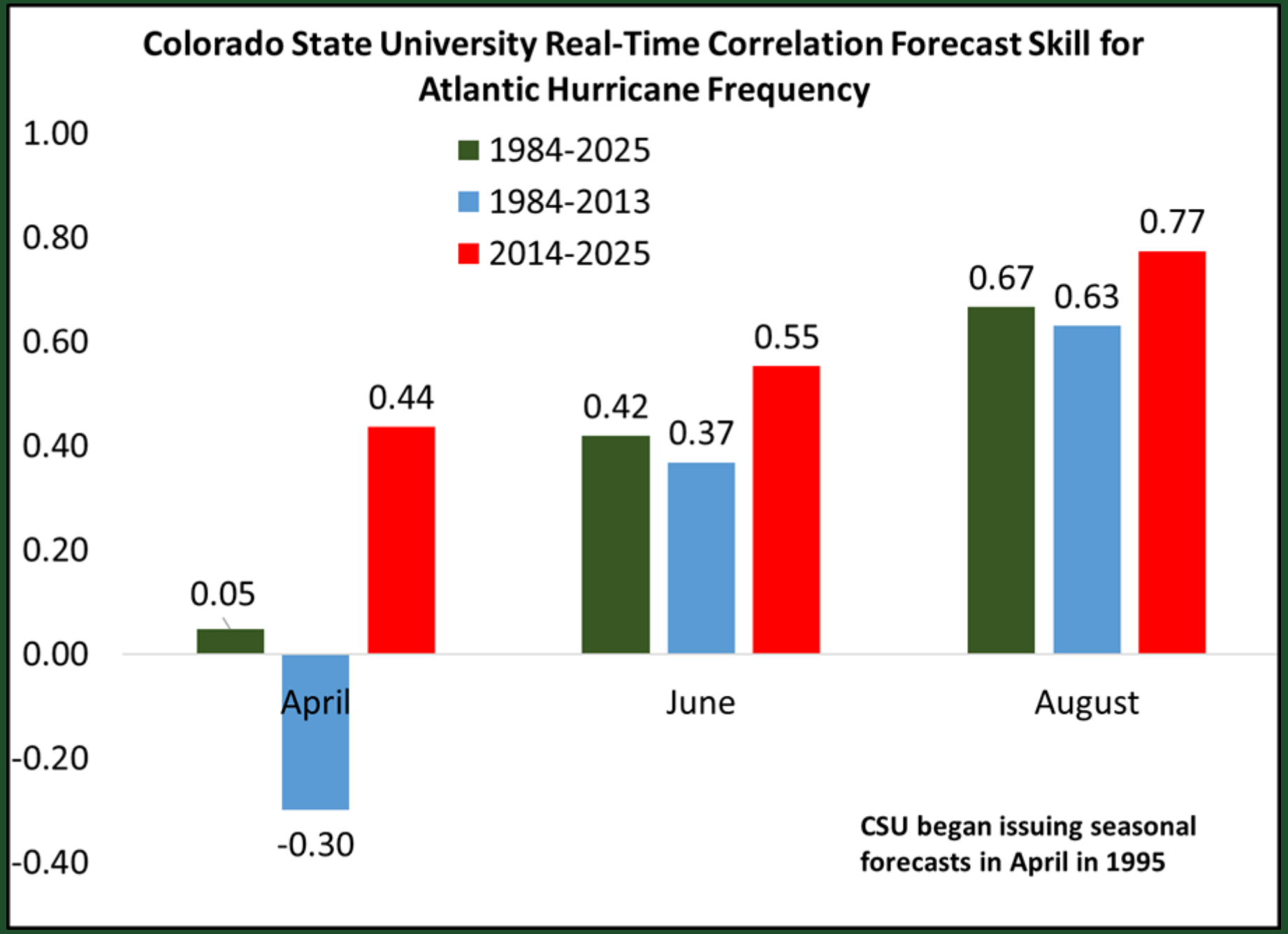
El Niño/La Niña Relationship with Vertical Wind Shear



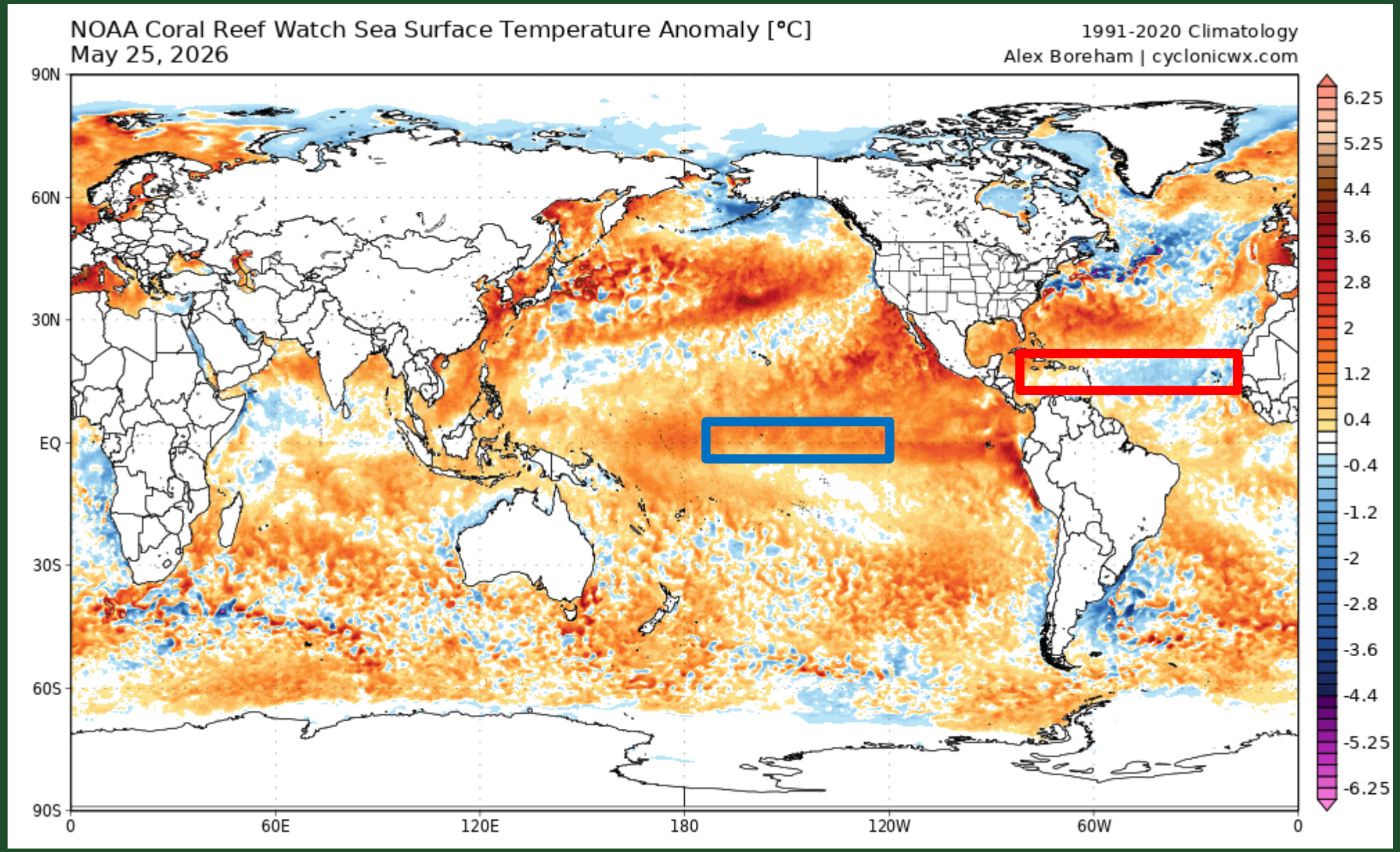
June-July Sea Surface Temperatures: Busy Hurricane Seasons minus Quiet Hurricane Seasons



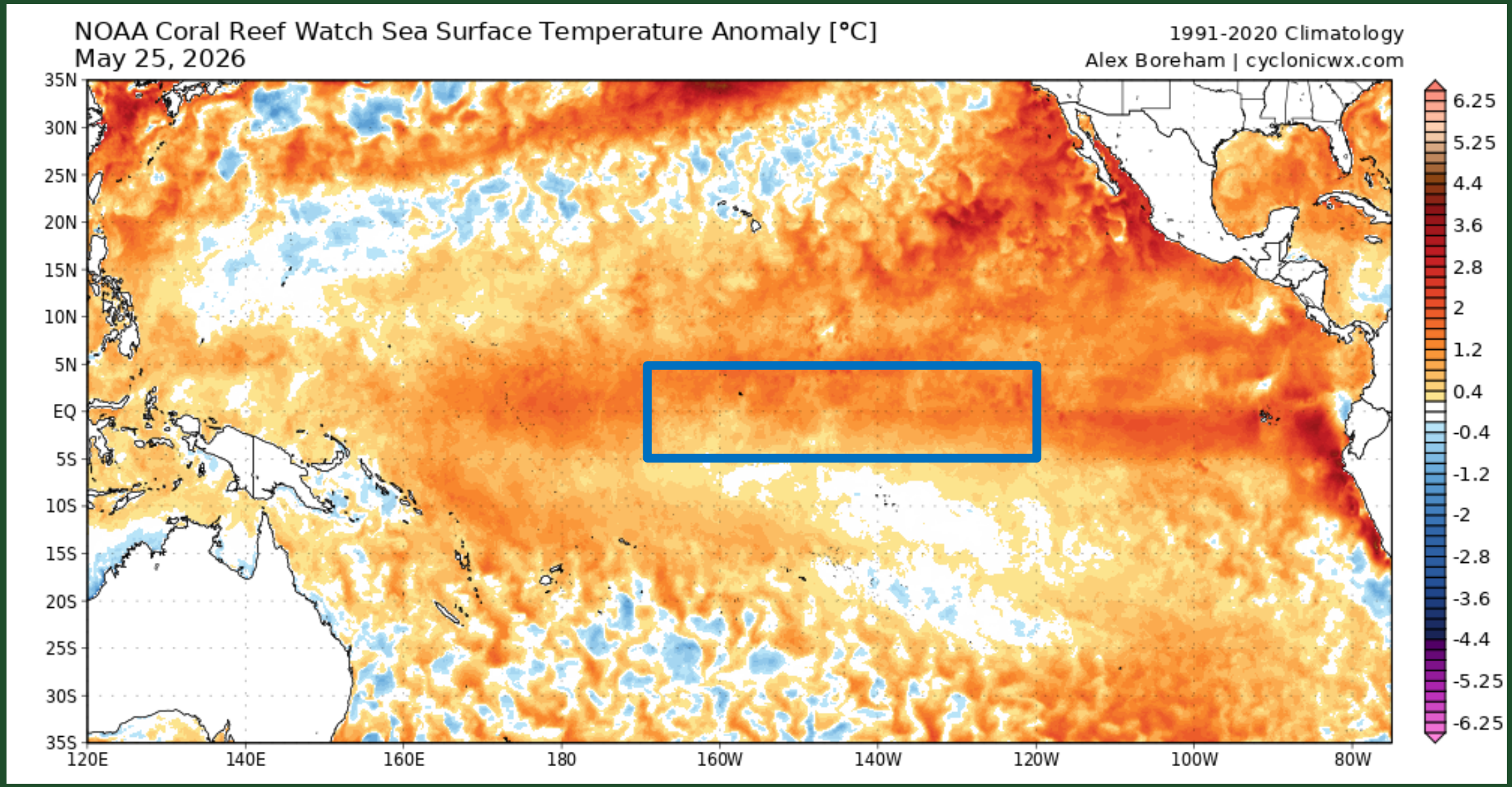
CSU Long-Term Seasonal Hurricane Forecast Track Record



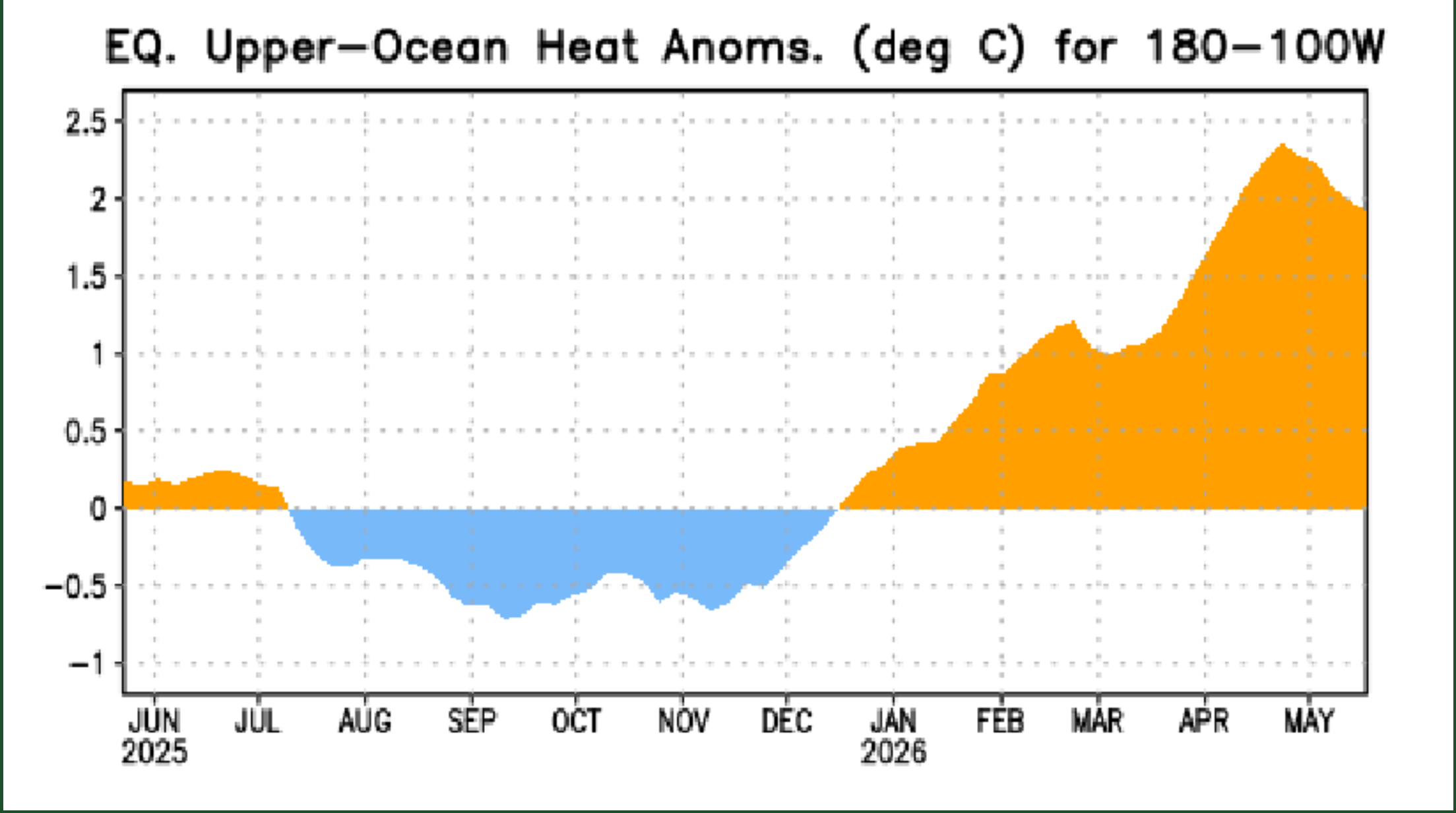
Current Sea Surface Temperature Anomalies



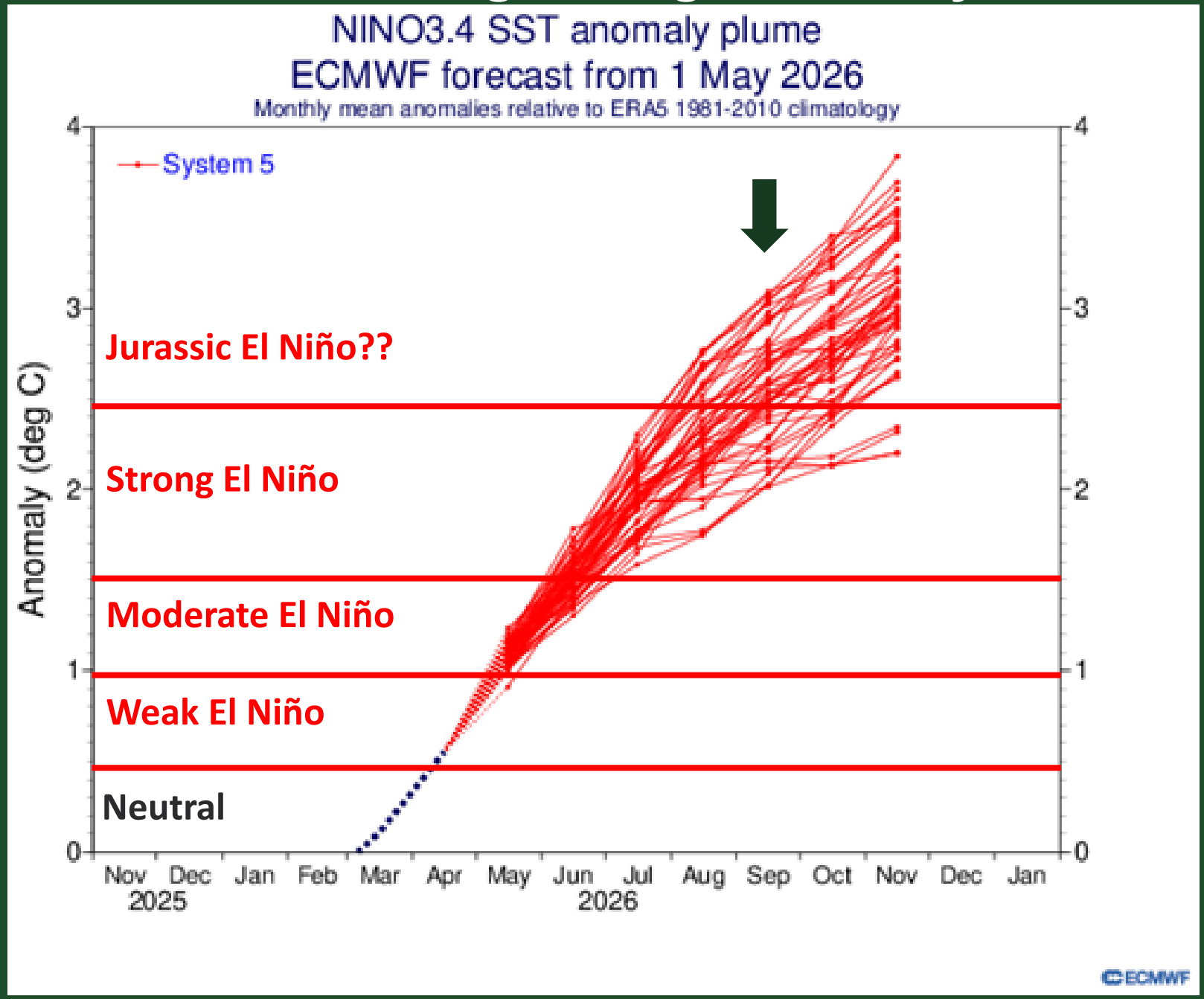
Warm ENSO Neutral Conditions



Eastern and Central Tropical Pacific Subsurface Anomalously Warming

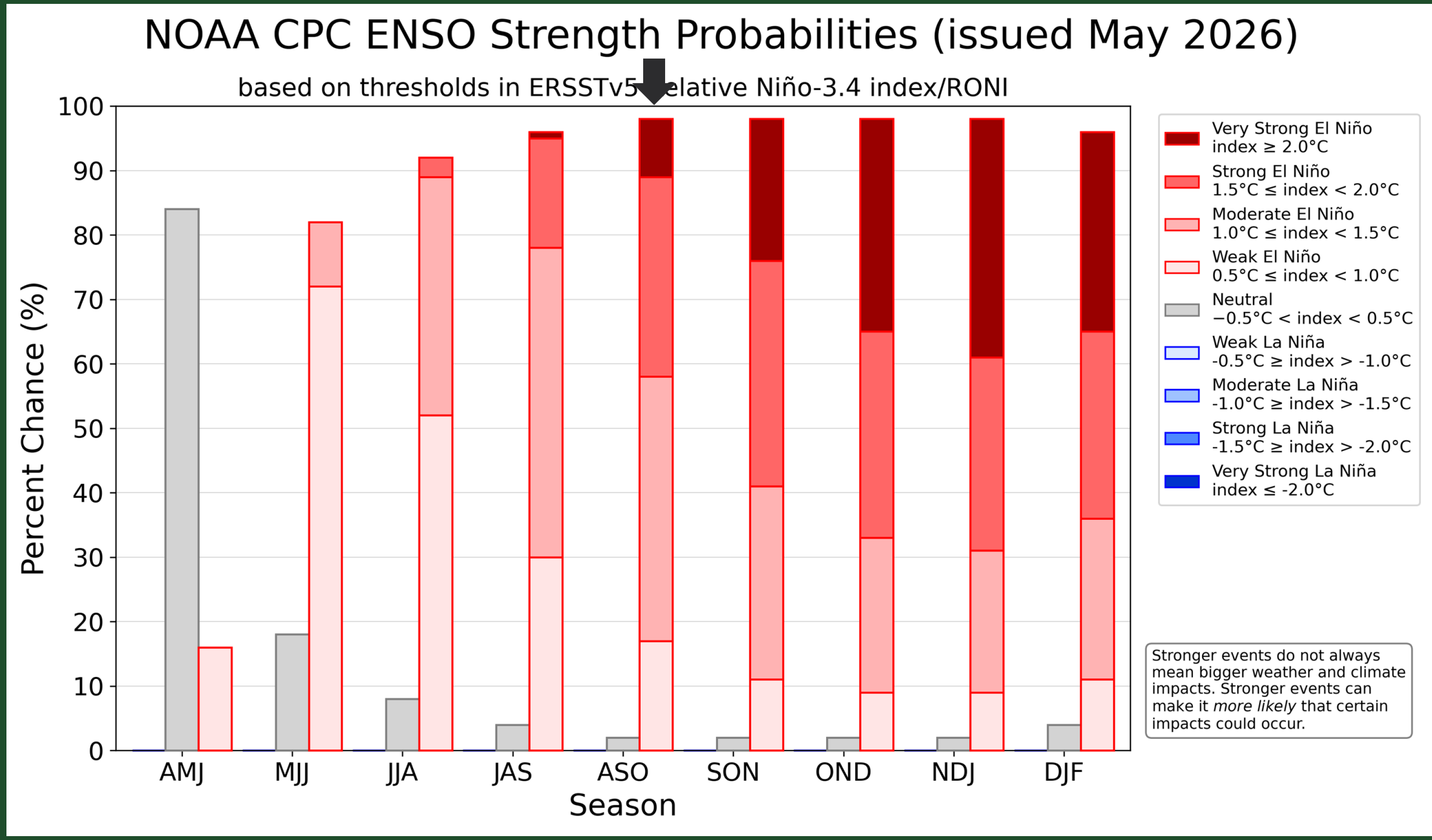


ECMWF Forecasting Strong El Niño by this Fall

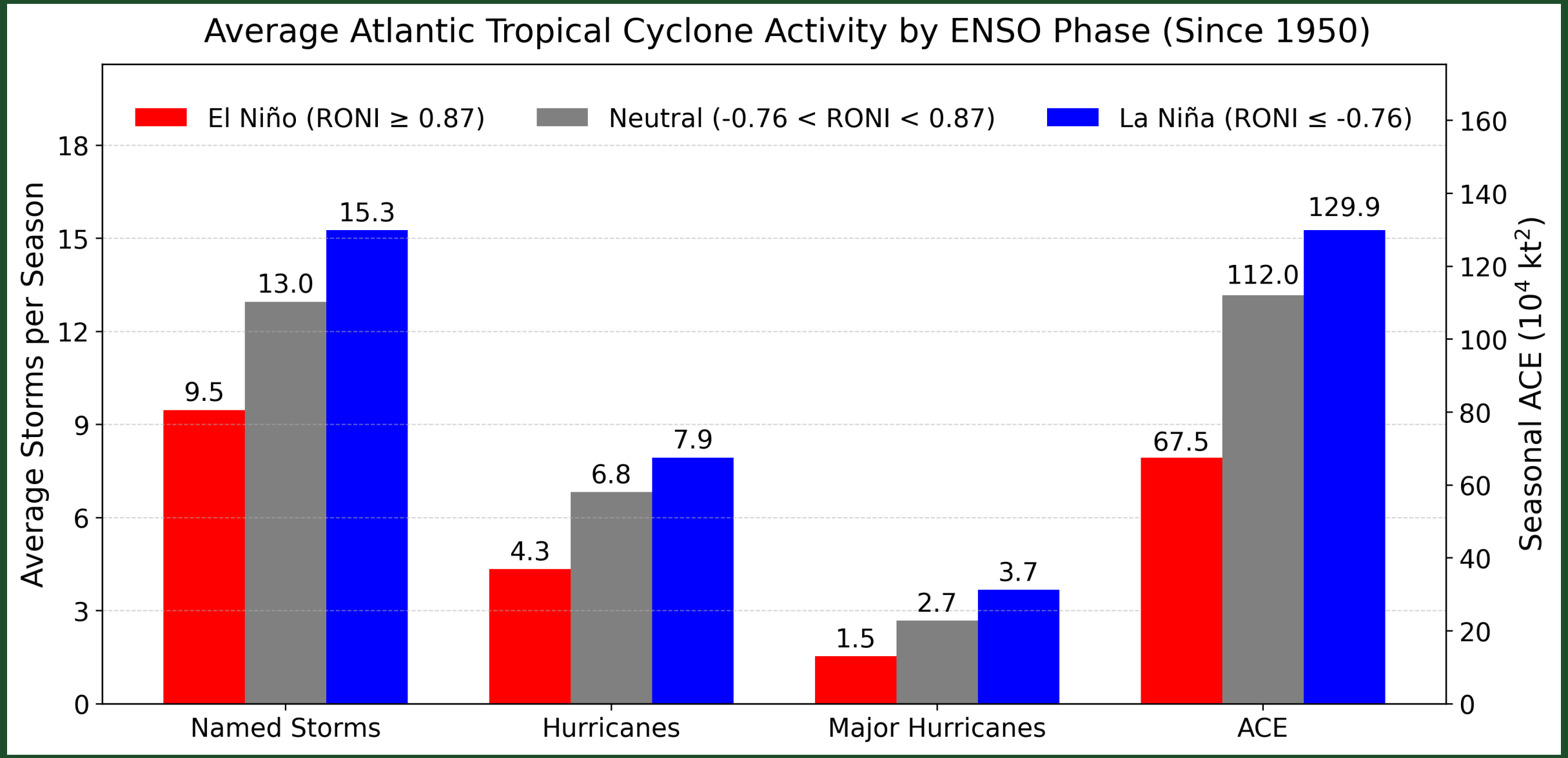


ChatGPT’s Take on What a Jurassic El Niño Looks Like

Official NOAA Forecast Strongly Favors El Niño for Aug–Oct



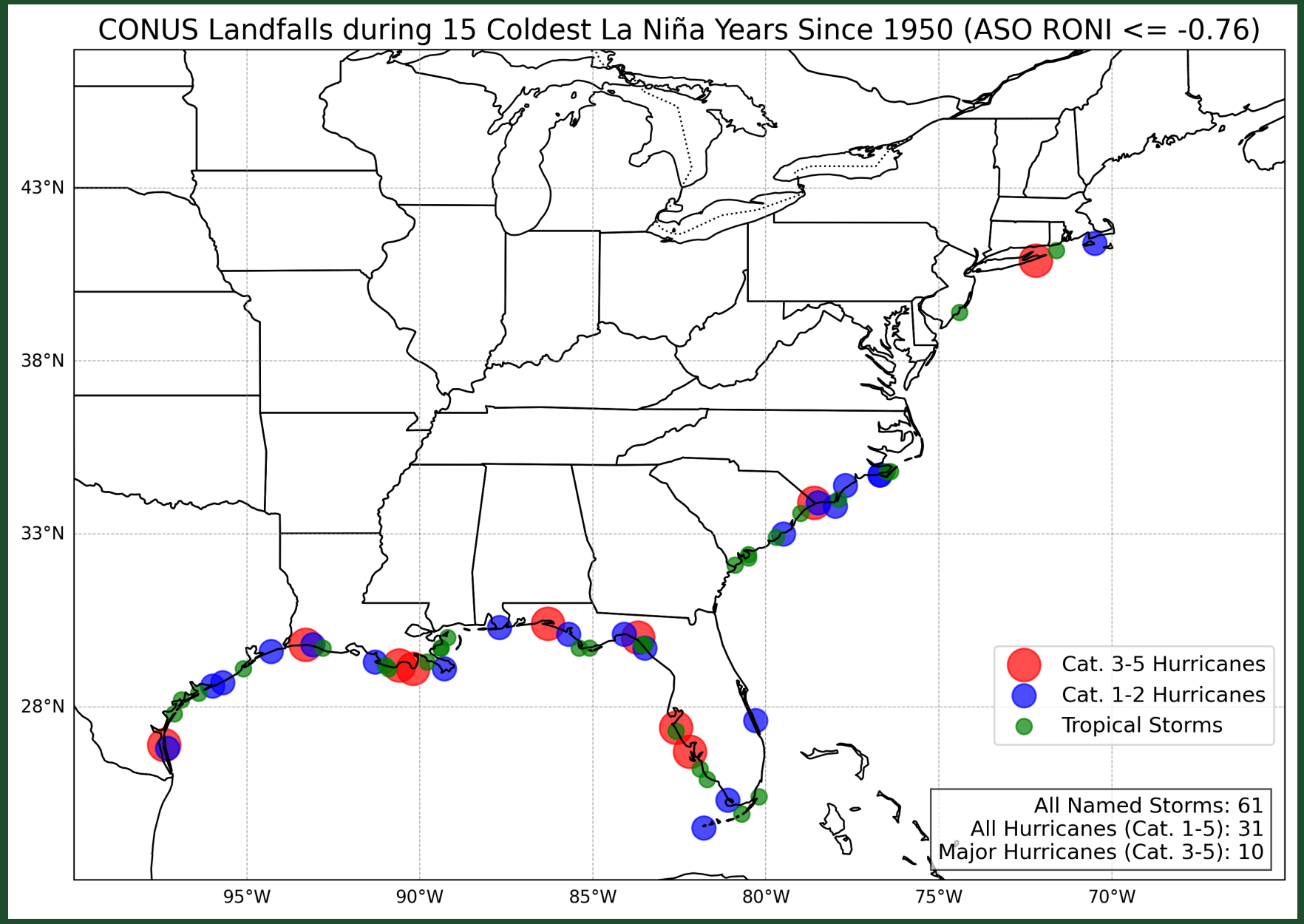
ENSO's Impacts on Atlantic Basin Hurricane Activity



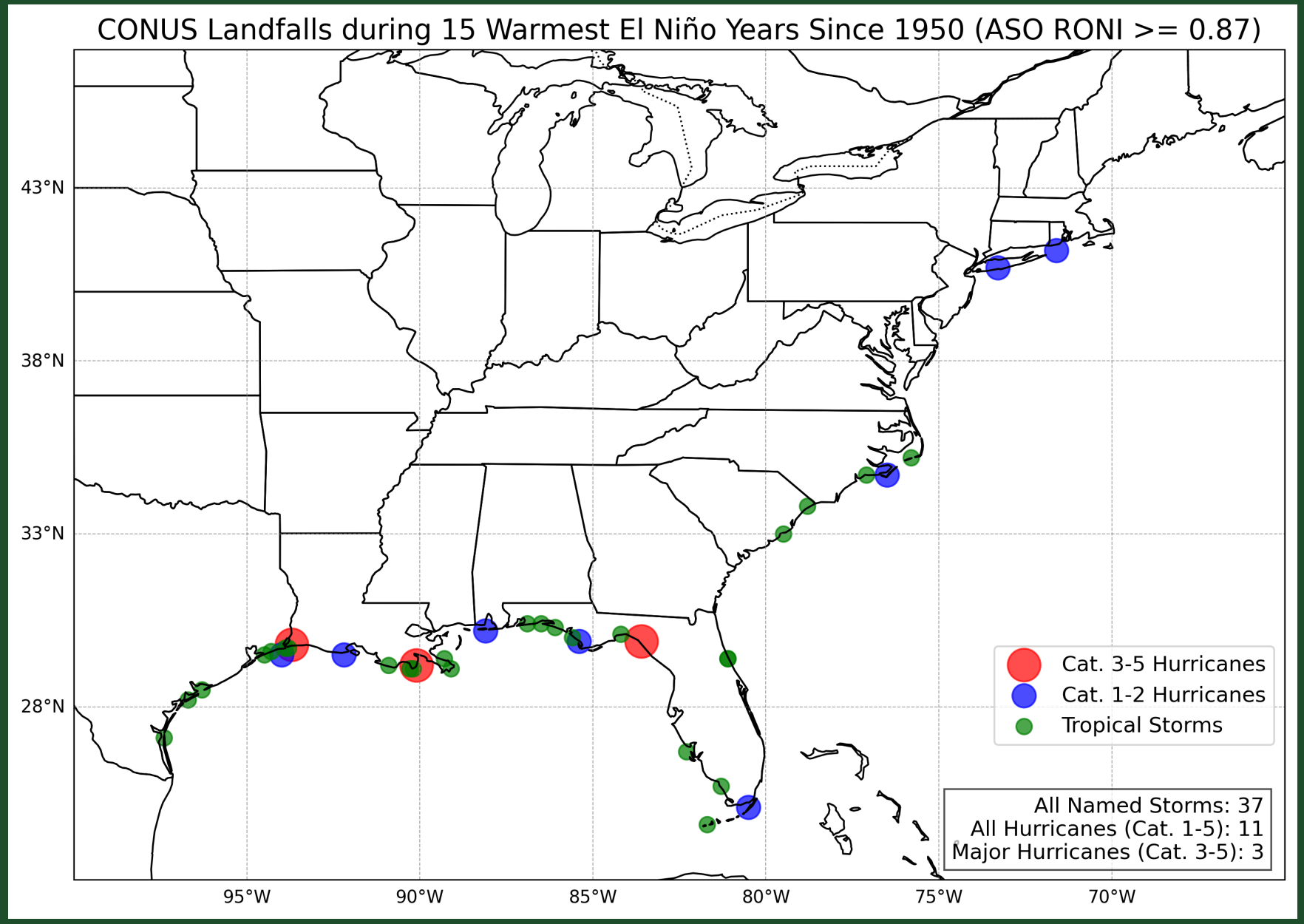
ENSO's Impacts on Continental US Hurricane Landfalls: La Niña

15 Years:

61 Named Storms
31 Hurricanes
10 Major Hurricanes



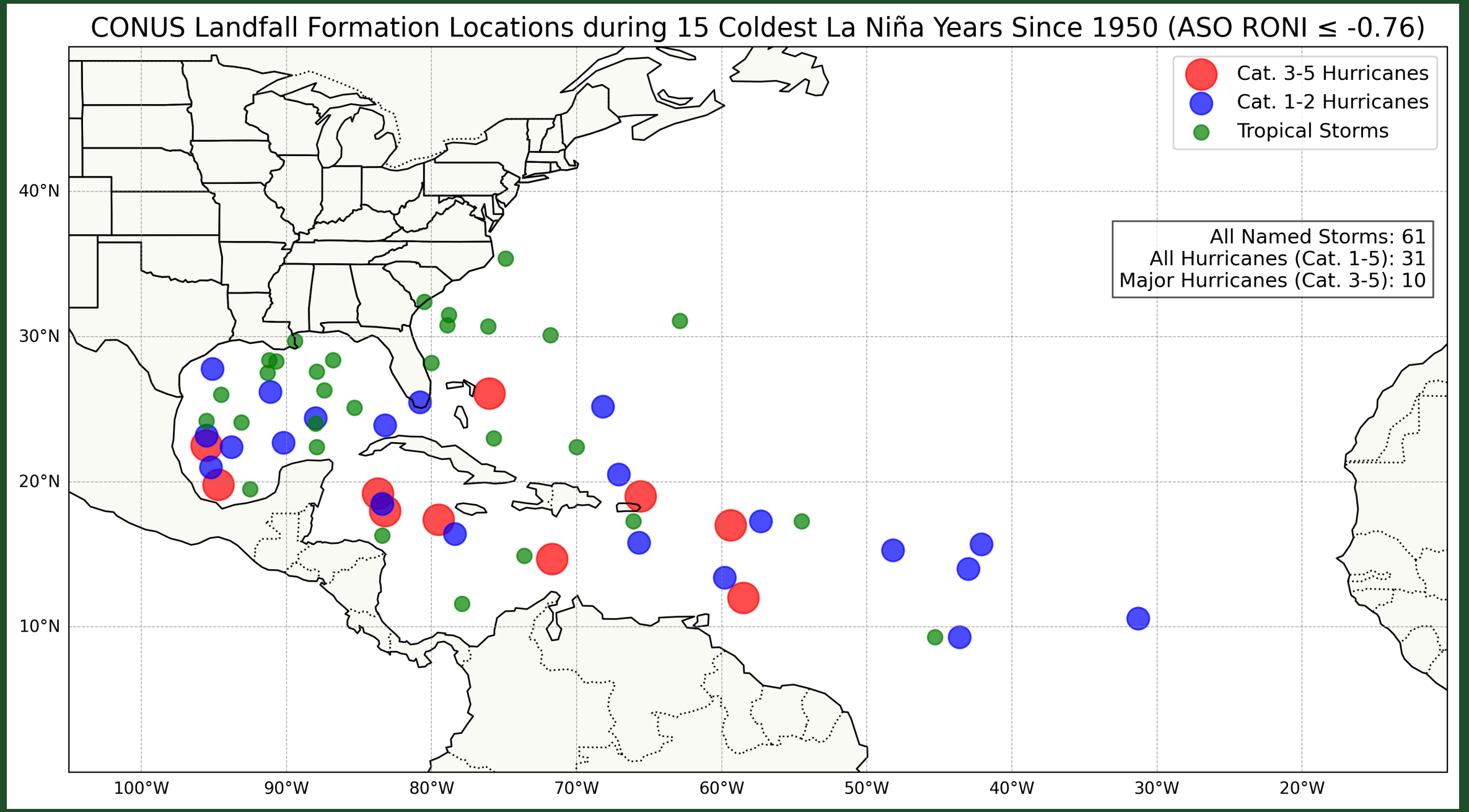
ENSO's Impacts on Continental US Hurricane Landfalls: El Niño



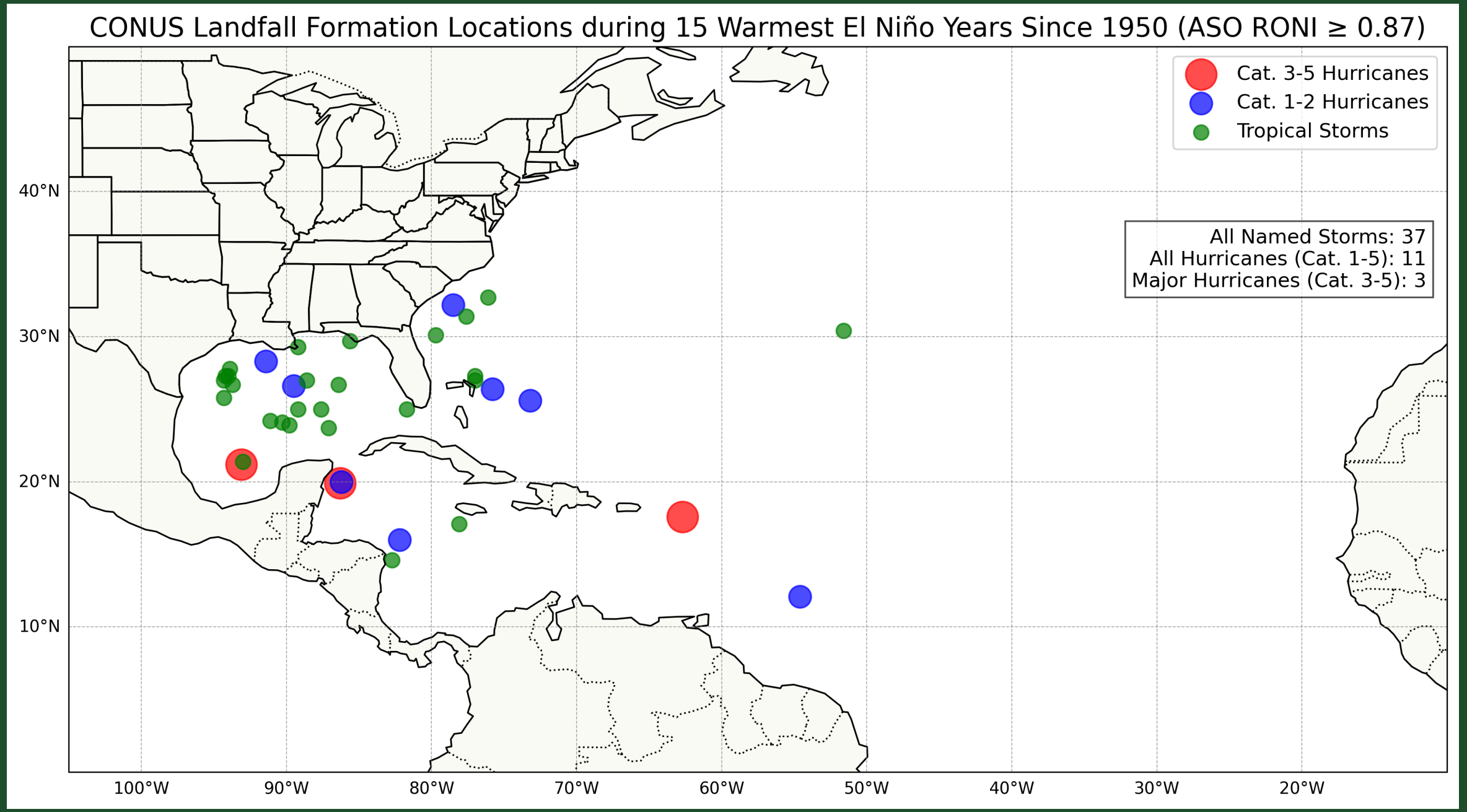
15 Years:

37 Named Storms
11 Hurricanes
3 Major Hurricanes

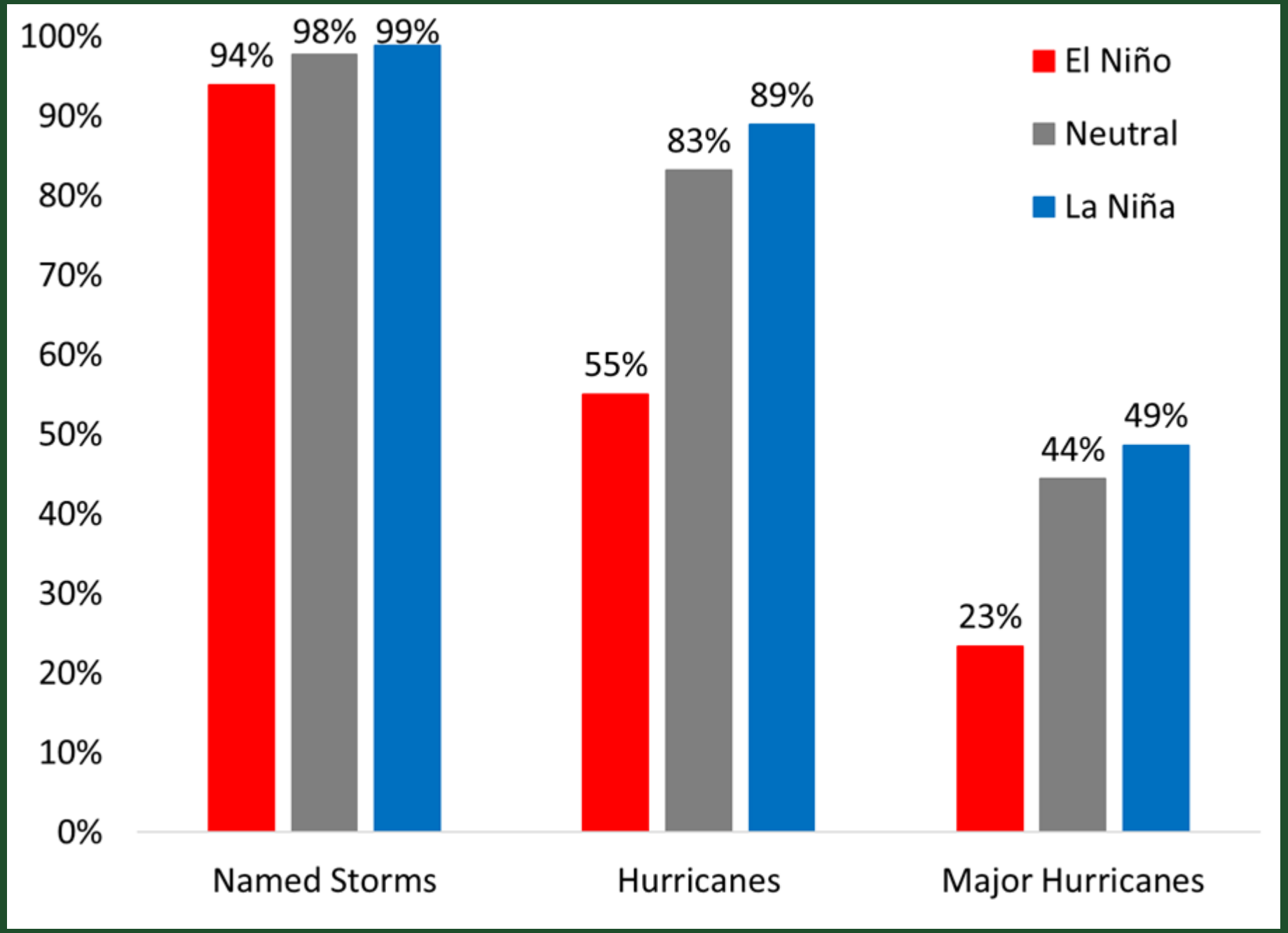
ENSO's Impacts on Continental US Hurricane Landfalls: La Niña NS Formations



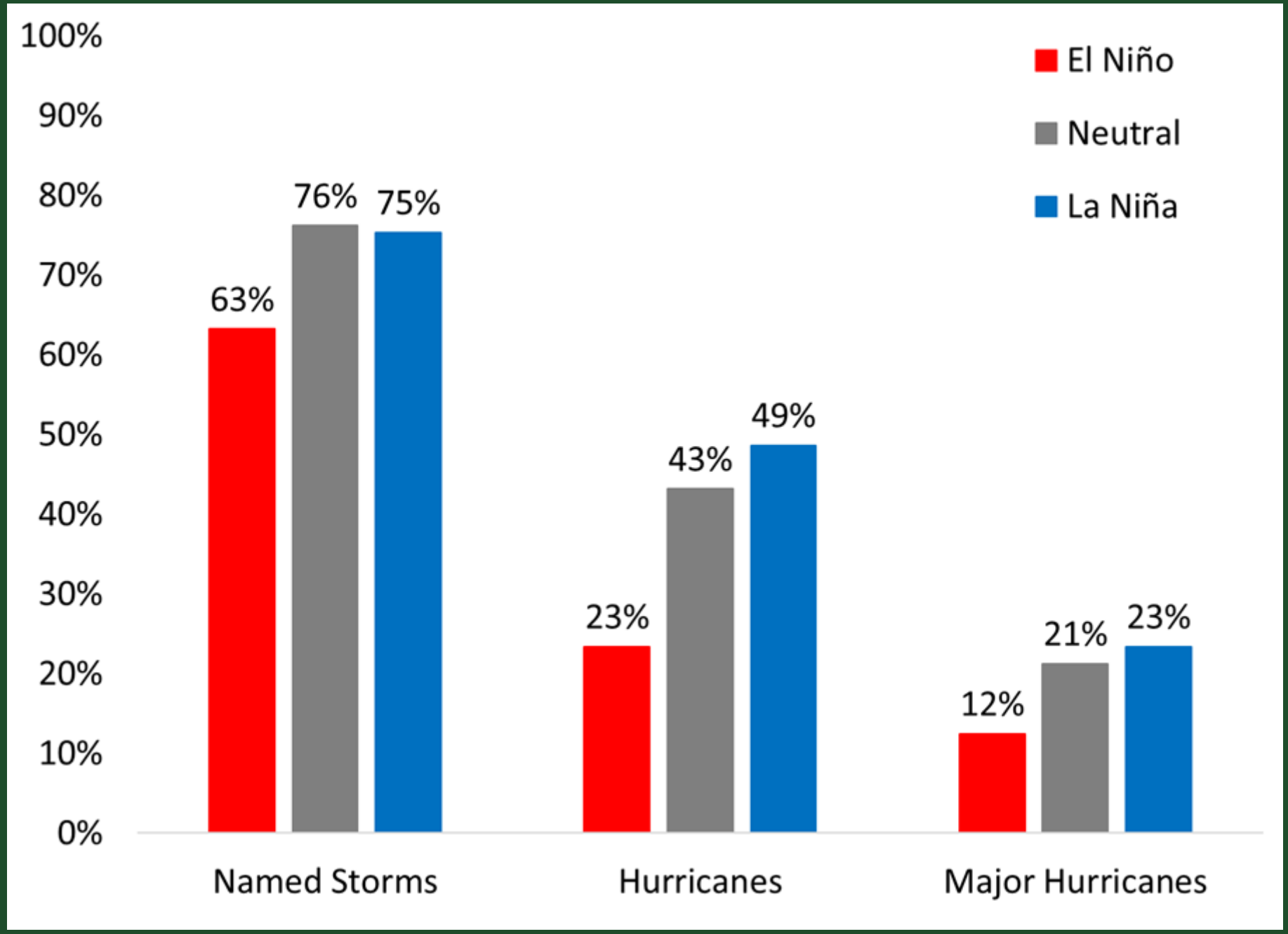
ENSO's Impacts on Continental US Hurricane Landfalls: El Niño NS Formations



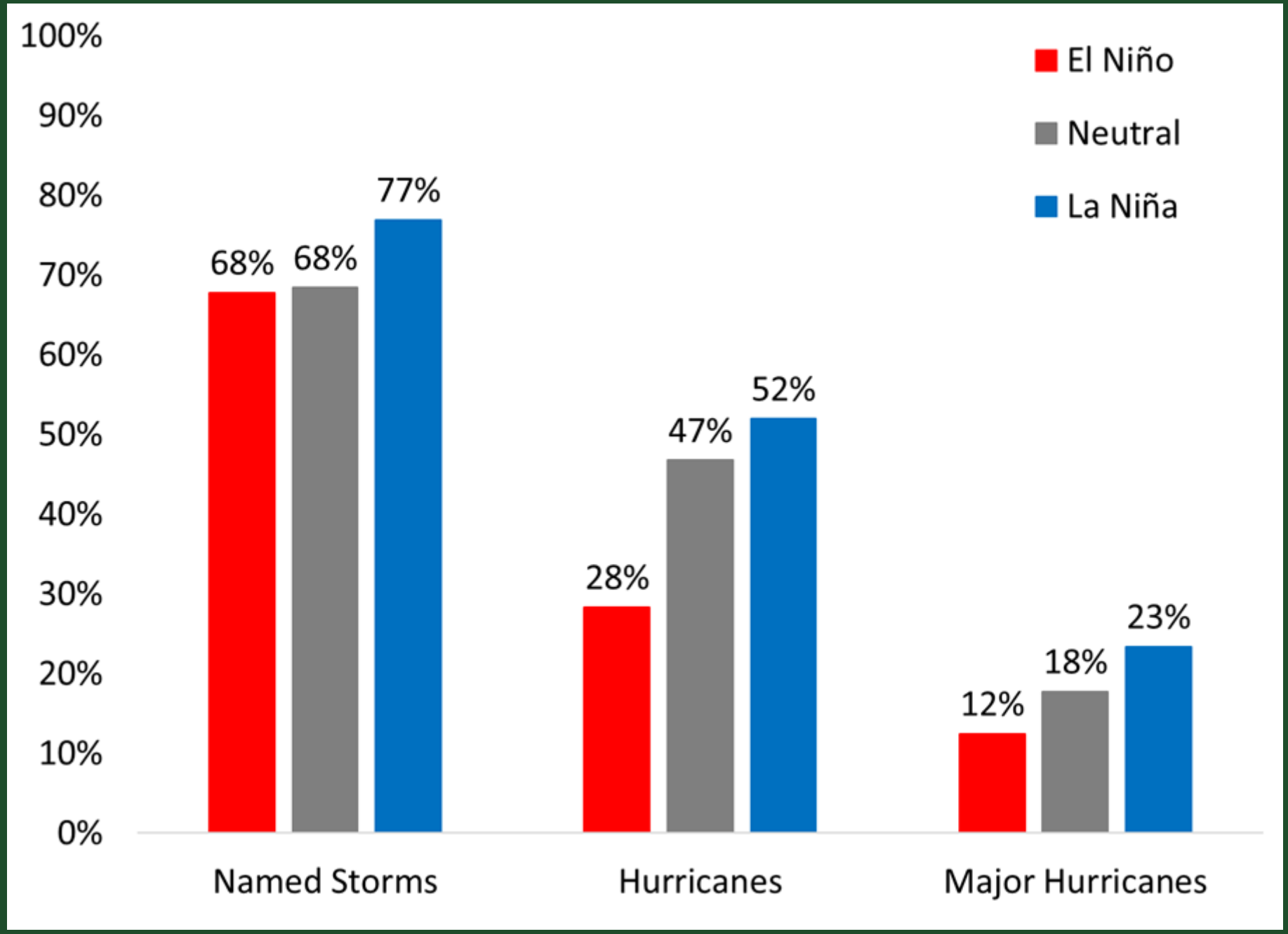
Odds of >=1 Continental US Landfall based on ENSO Phase



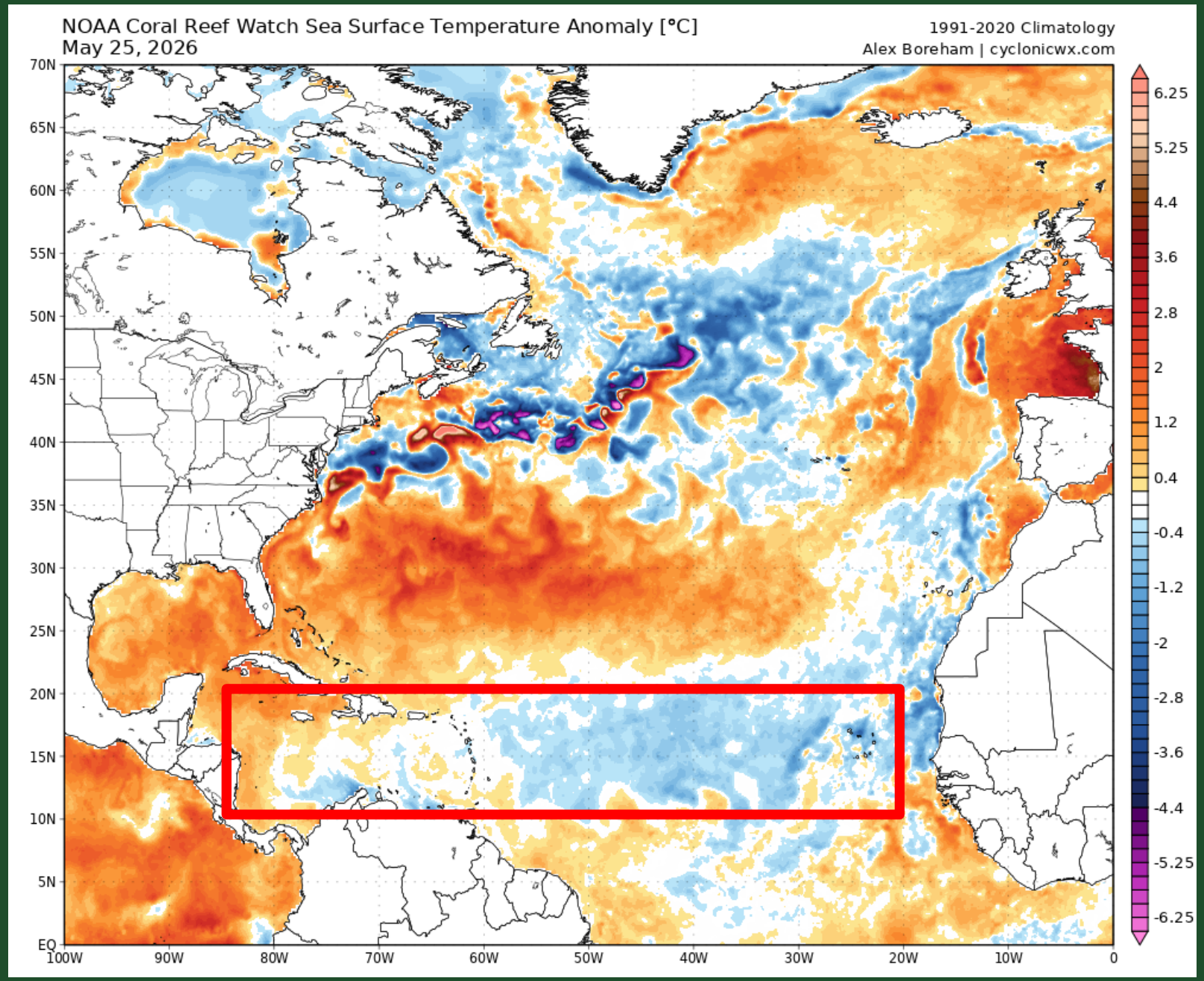
Odds of >=1 Florida Landfall based on ENSO Phase



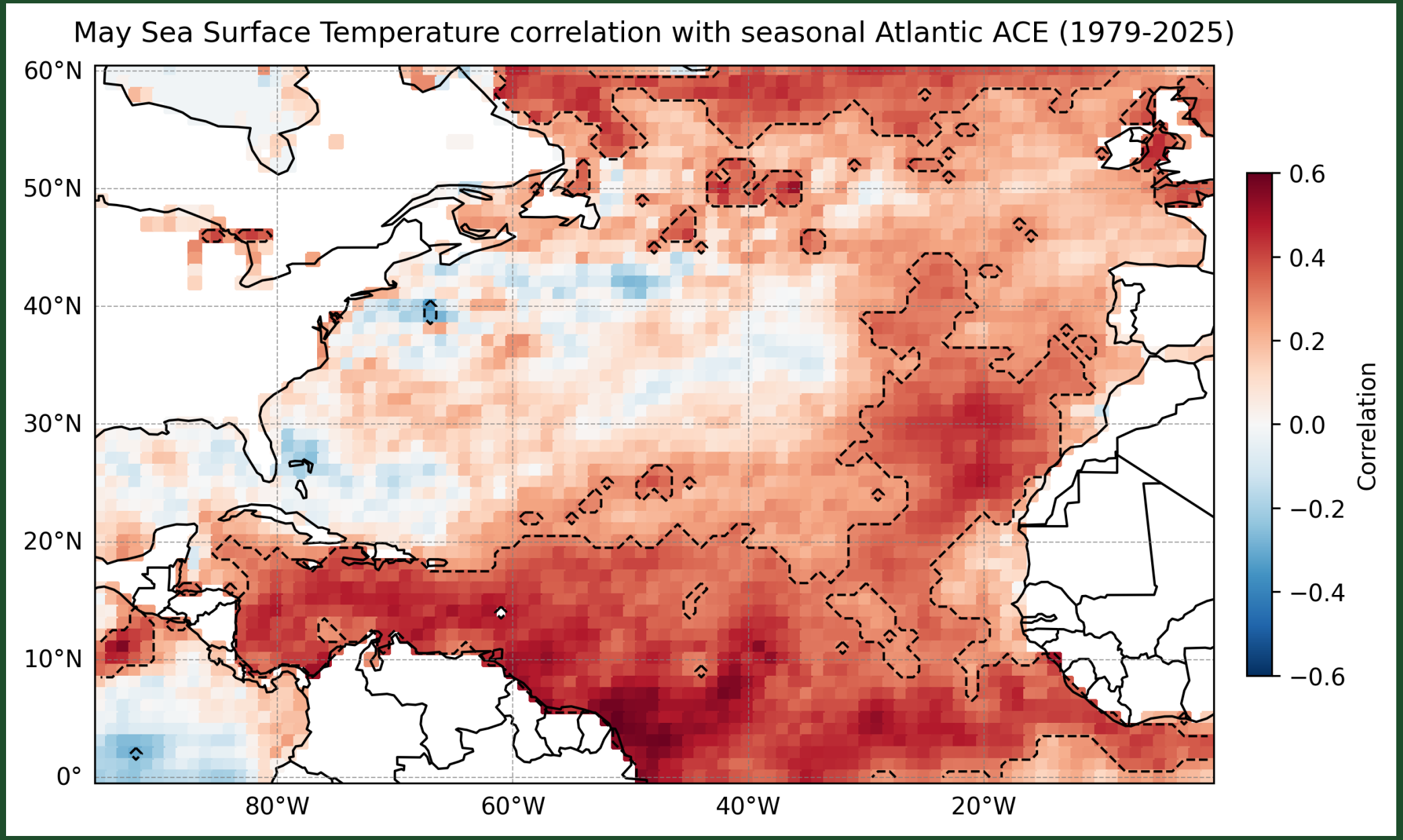
Odds of >=1 Texas or Louisiana Landfall based on ENSO Phase



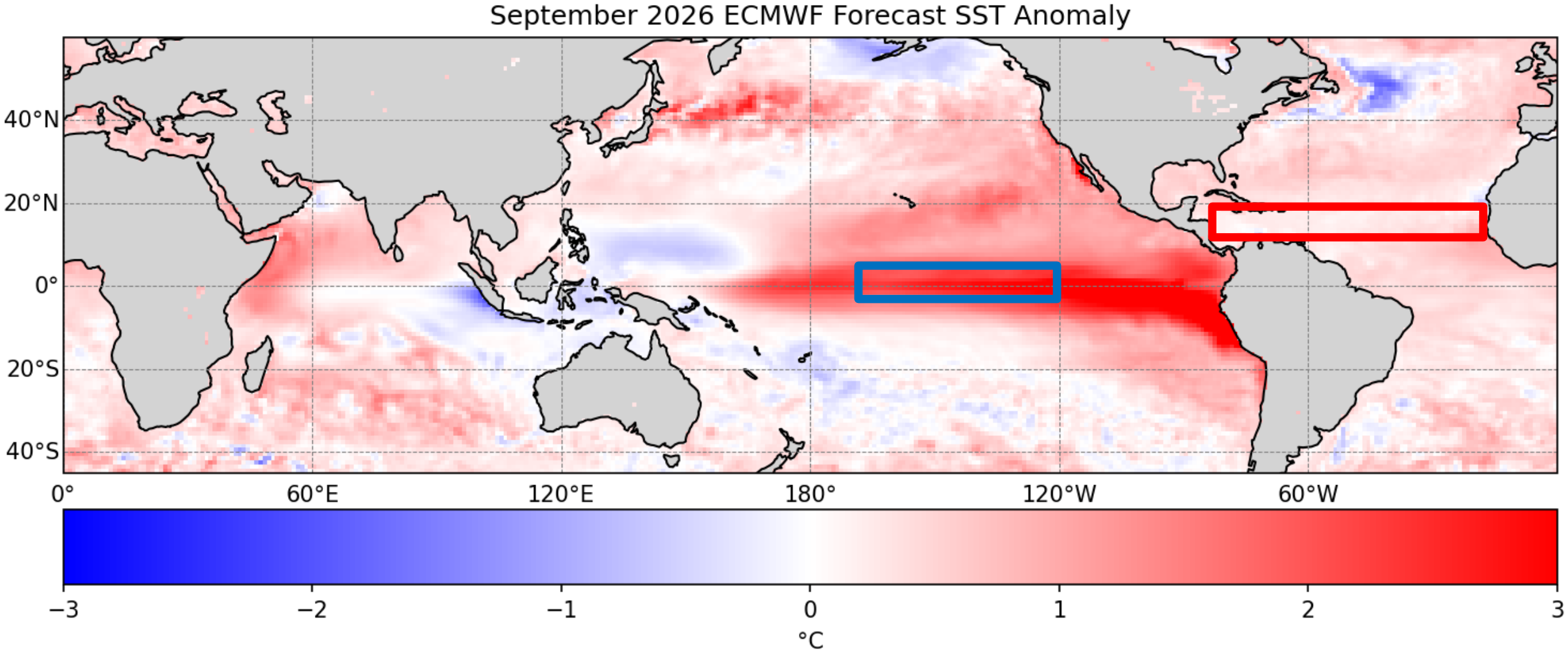
Current North Atlantic Sea Surface Temperature Anomalies



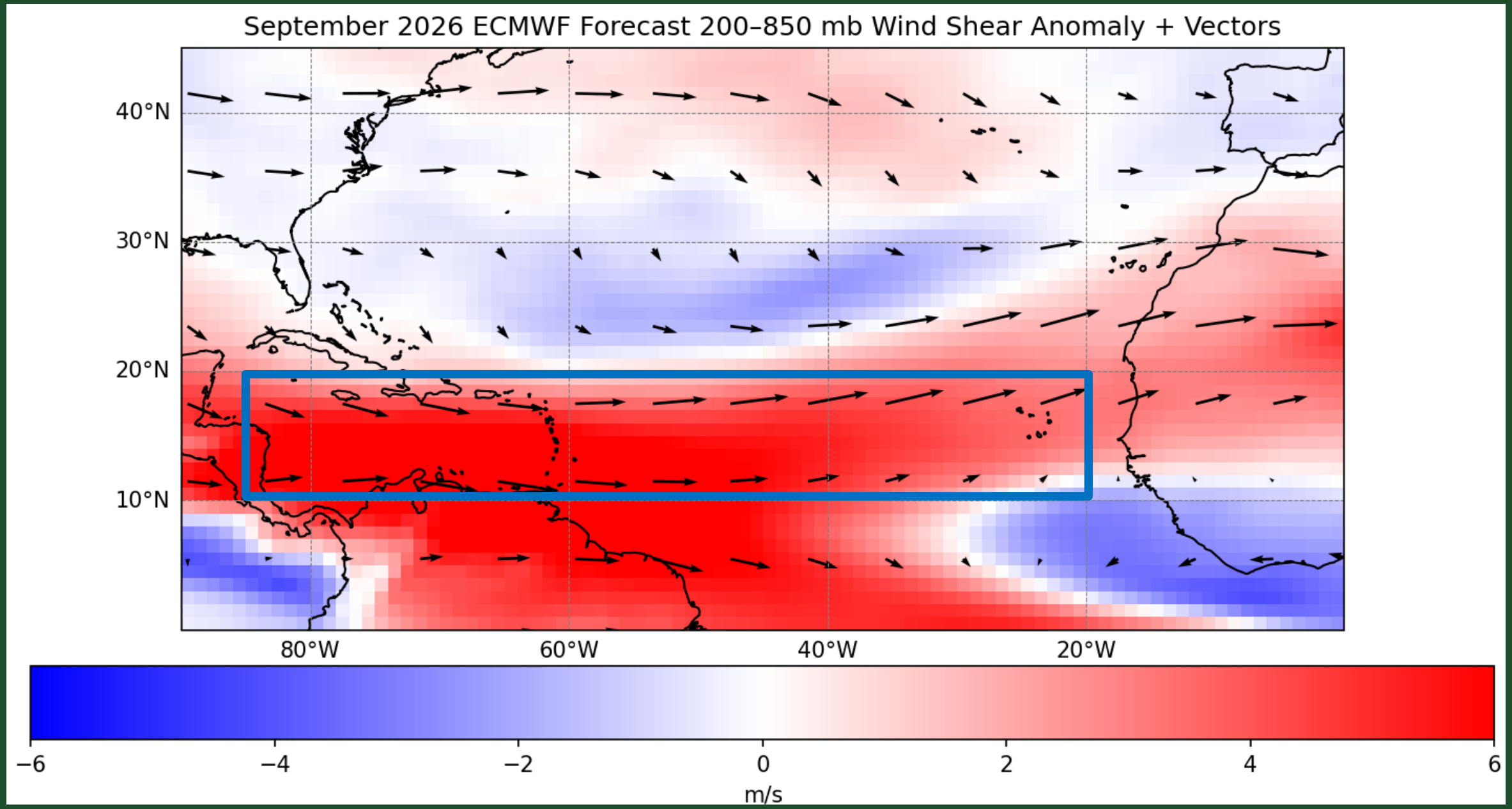
May Atlantic SST Correlation with Atlantic ACE



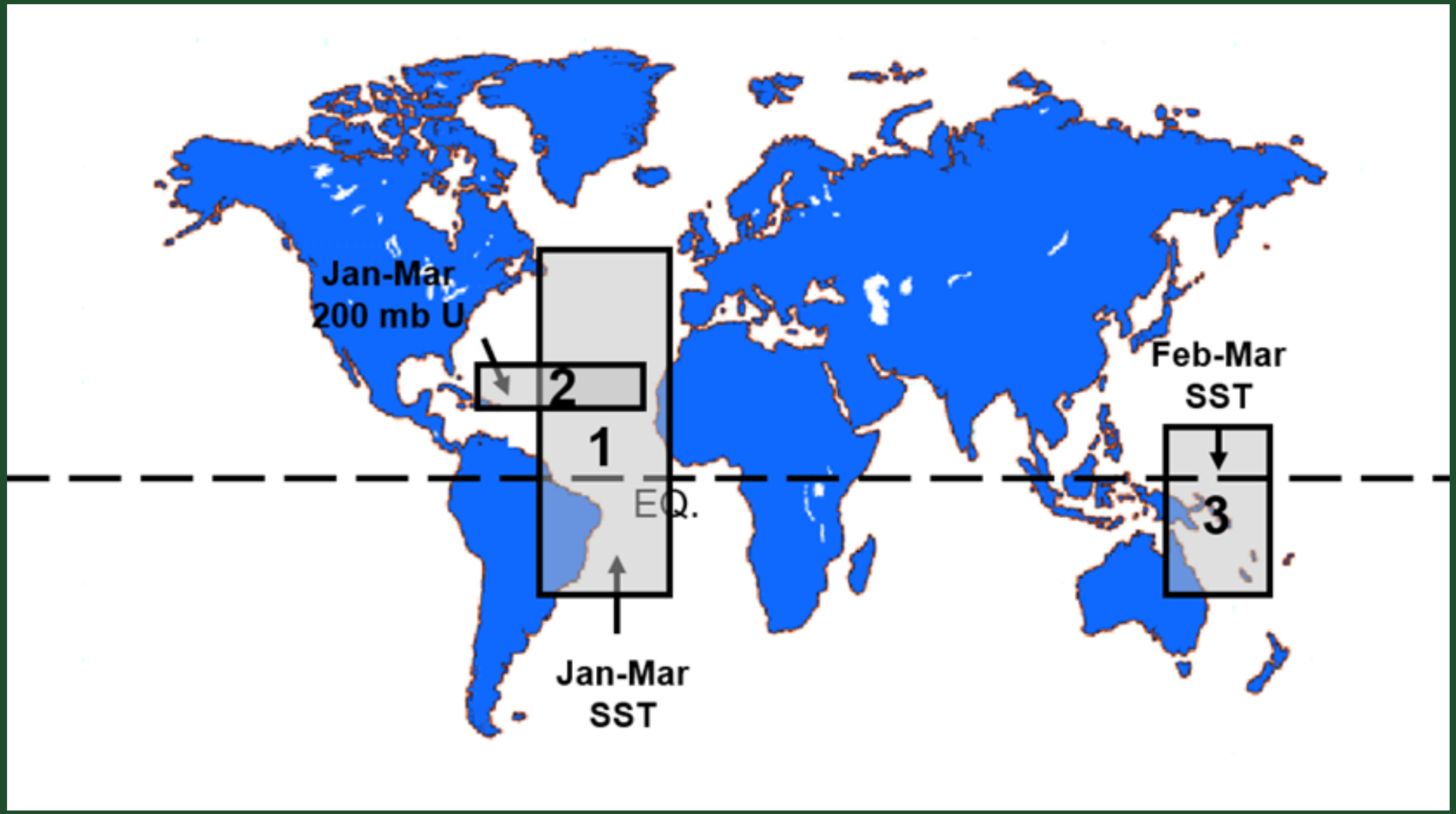
ECMWF September Forecast: Robust El Niño and Relatively Warm Atlantic



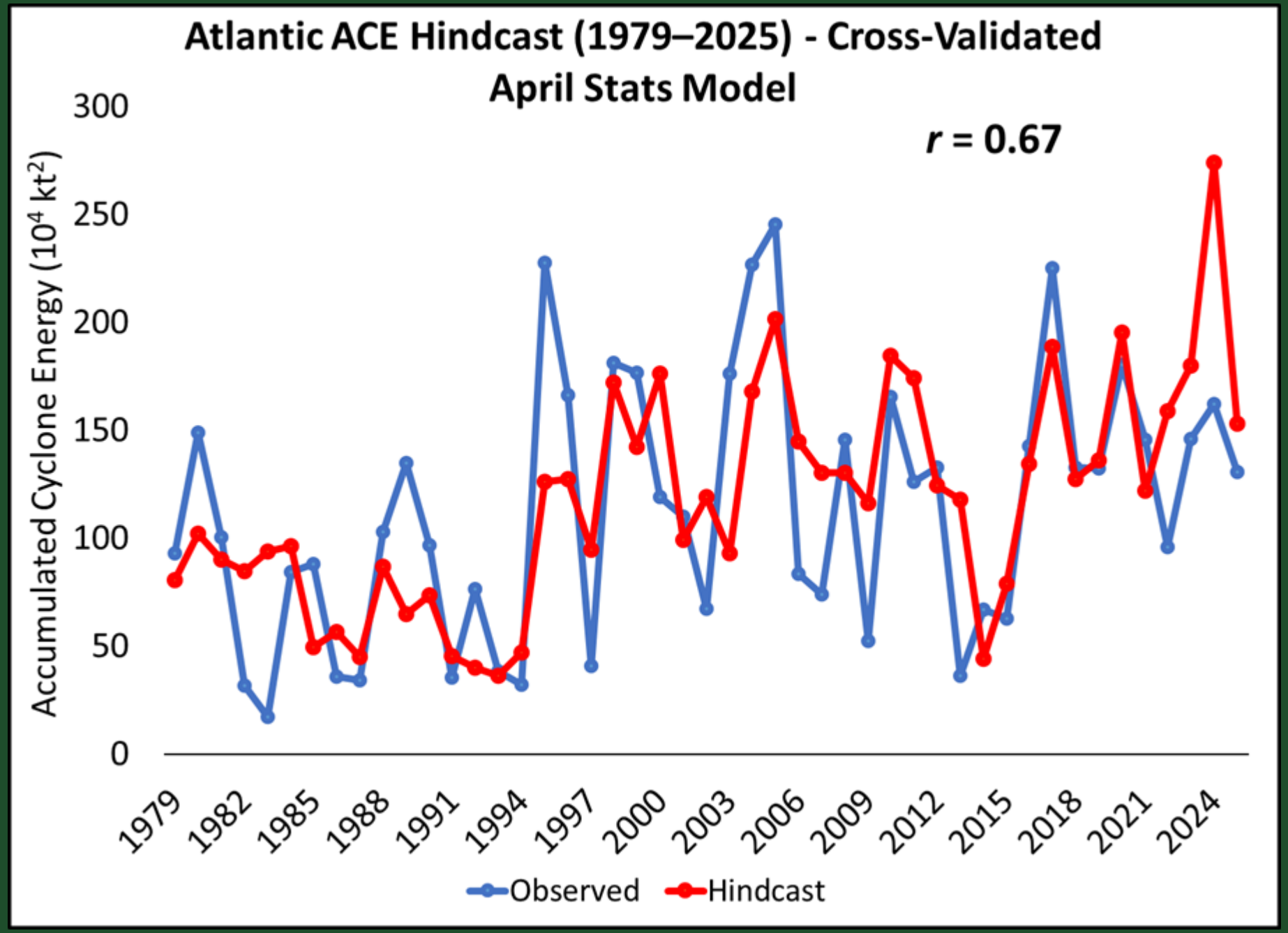
ECMWF September Forecast: Strong Vertical Wind Shear across the MDR



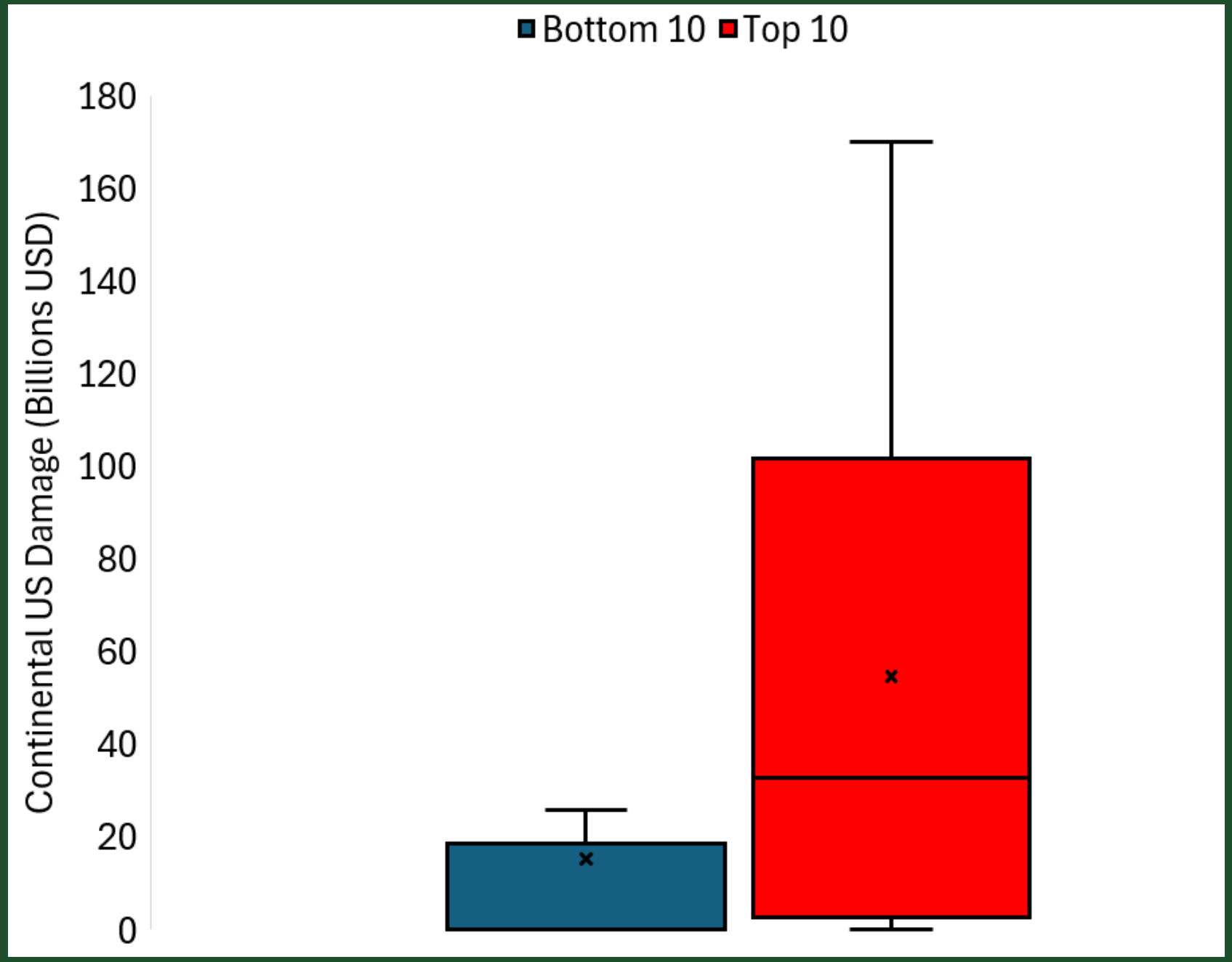
April Statistical Model Forecast



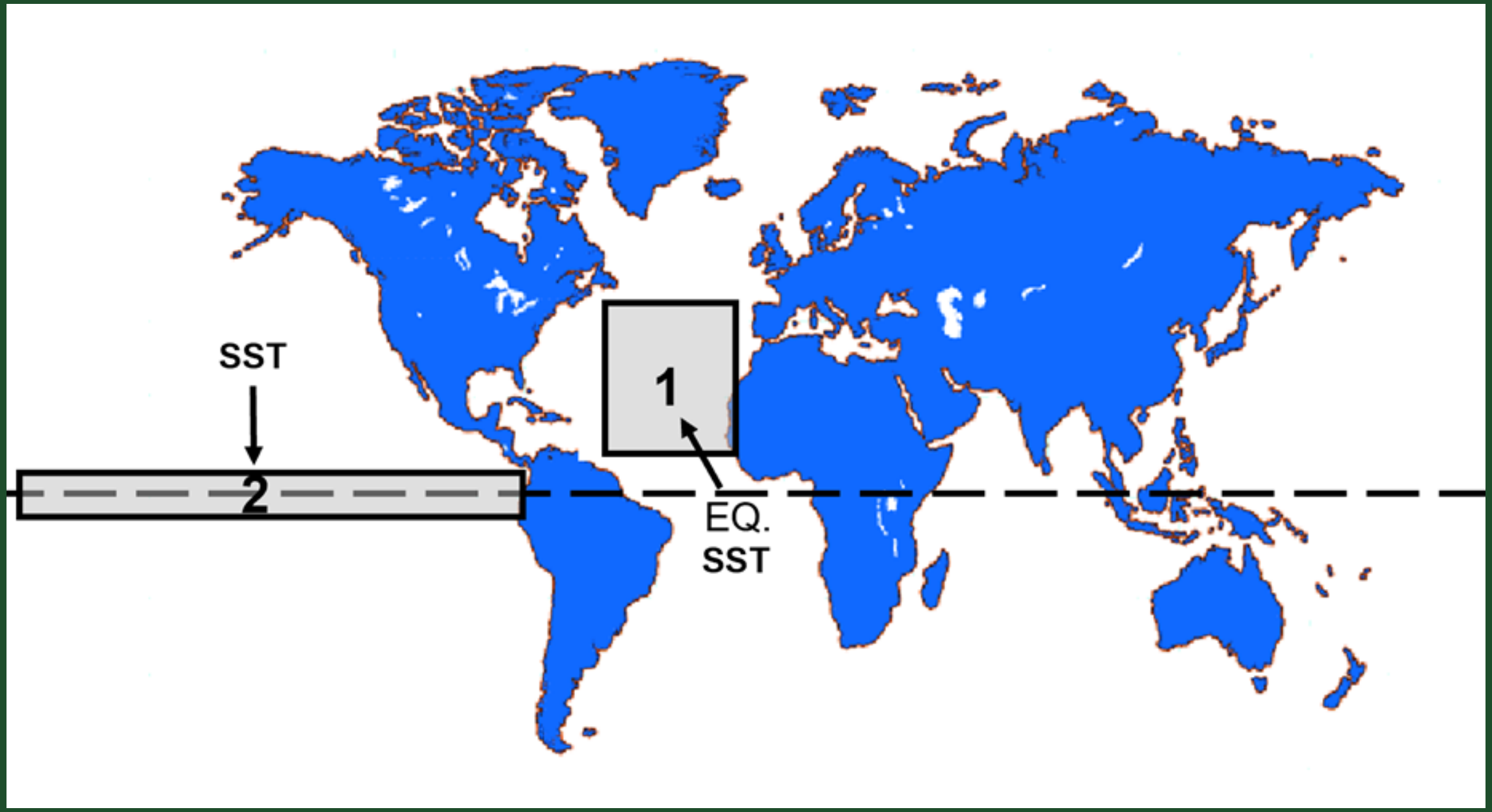
Statistical Model Hindcast Skill



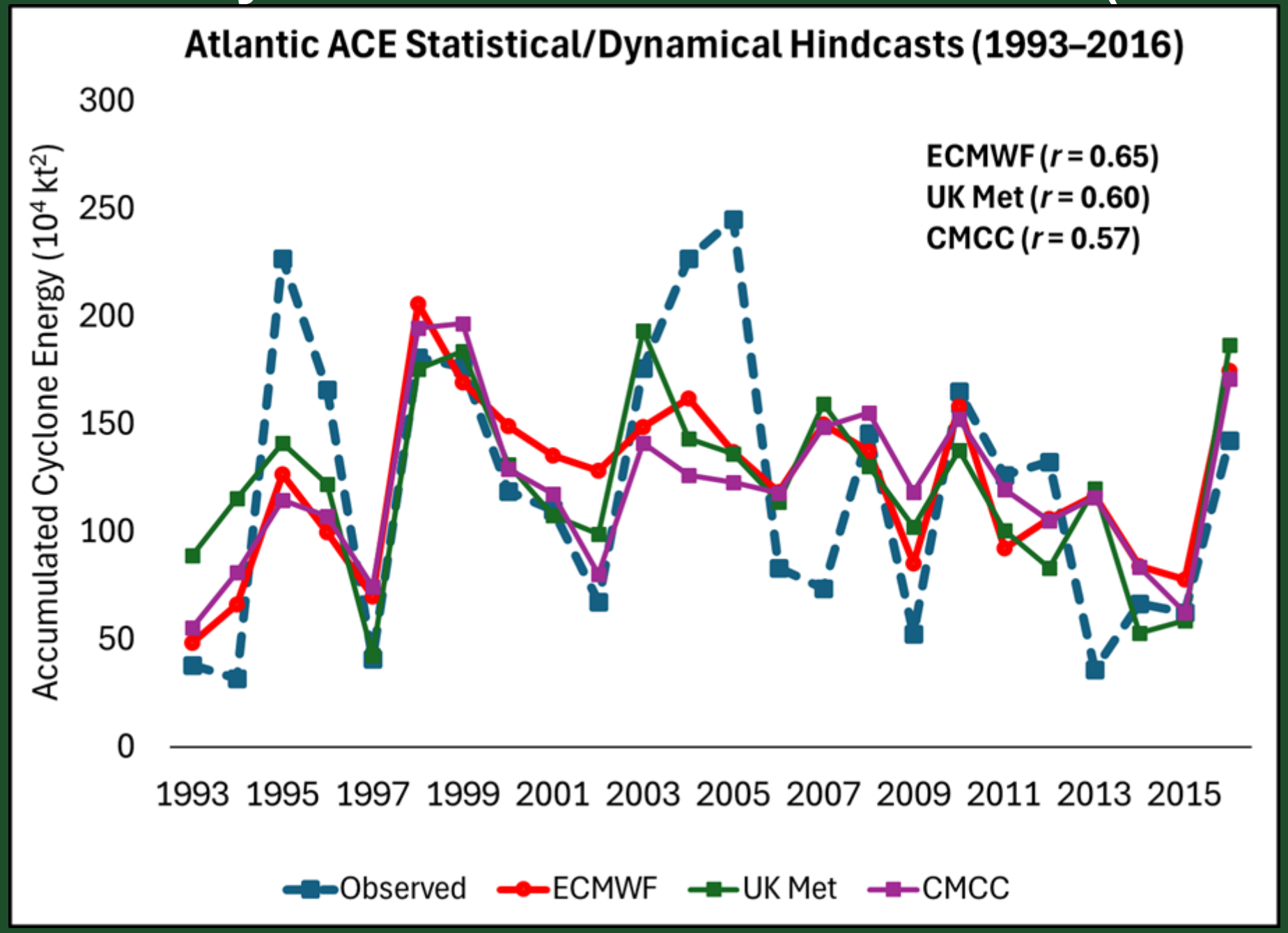
CSU April Stats Model Hindcasts vs. Continental US Hurricane Normalized Damage



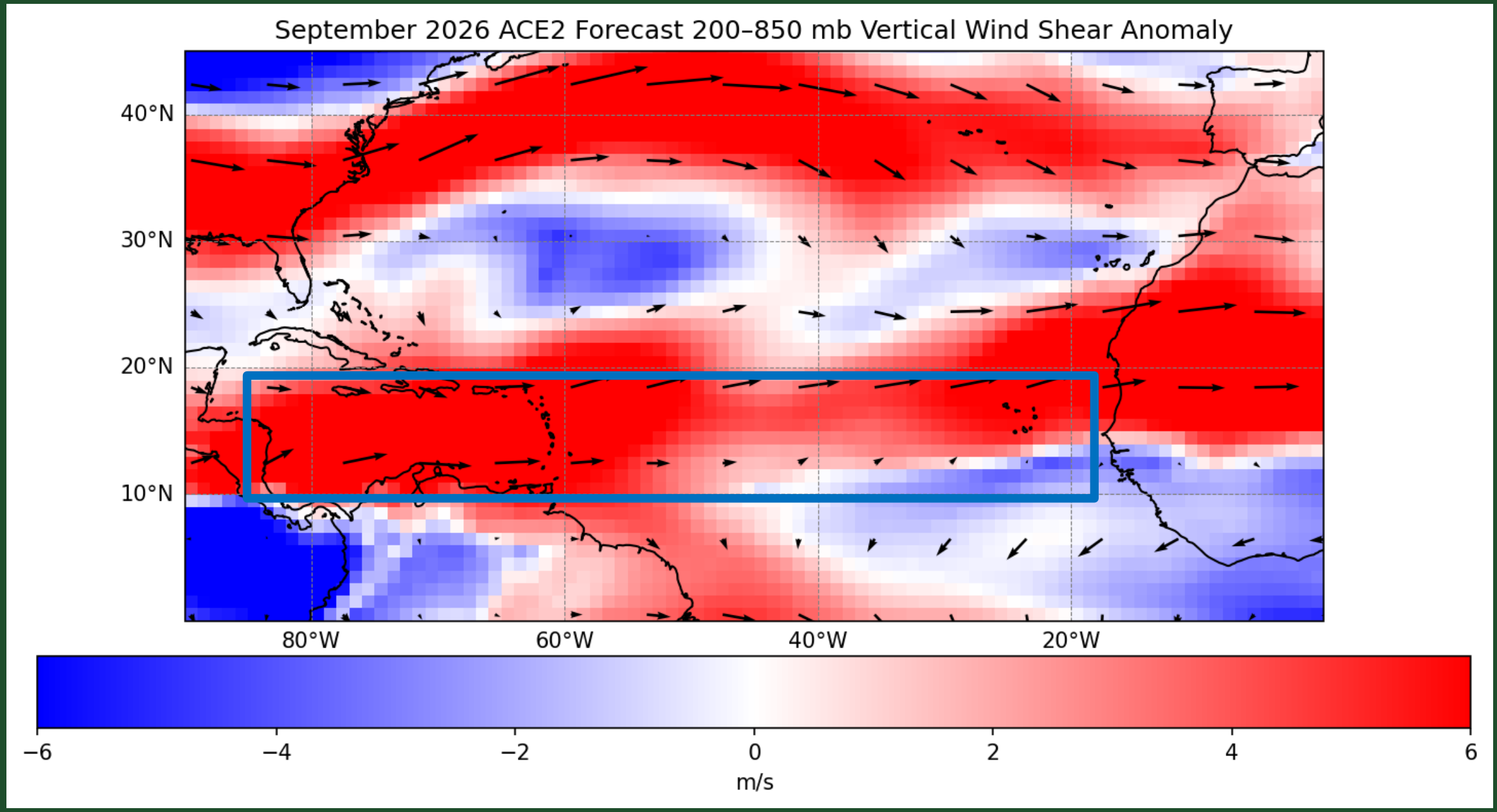
Statistical/Dynamical Model Forecast – Forecasting August Values



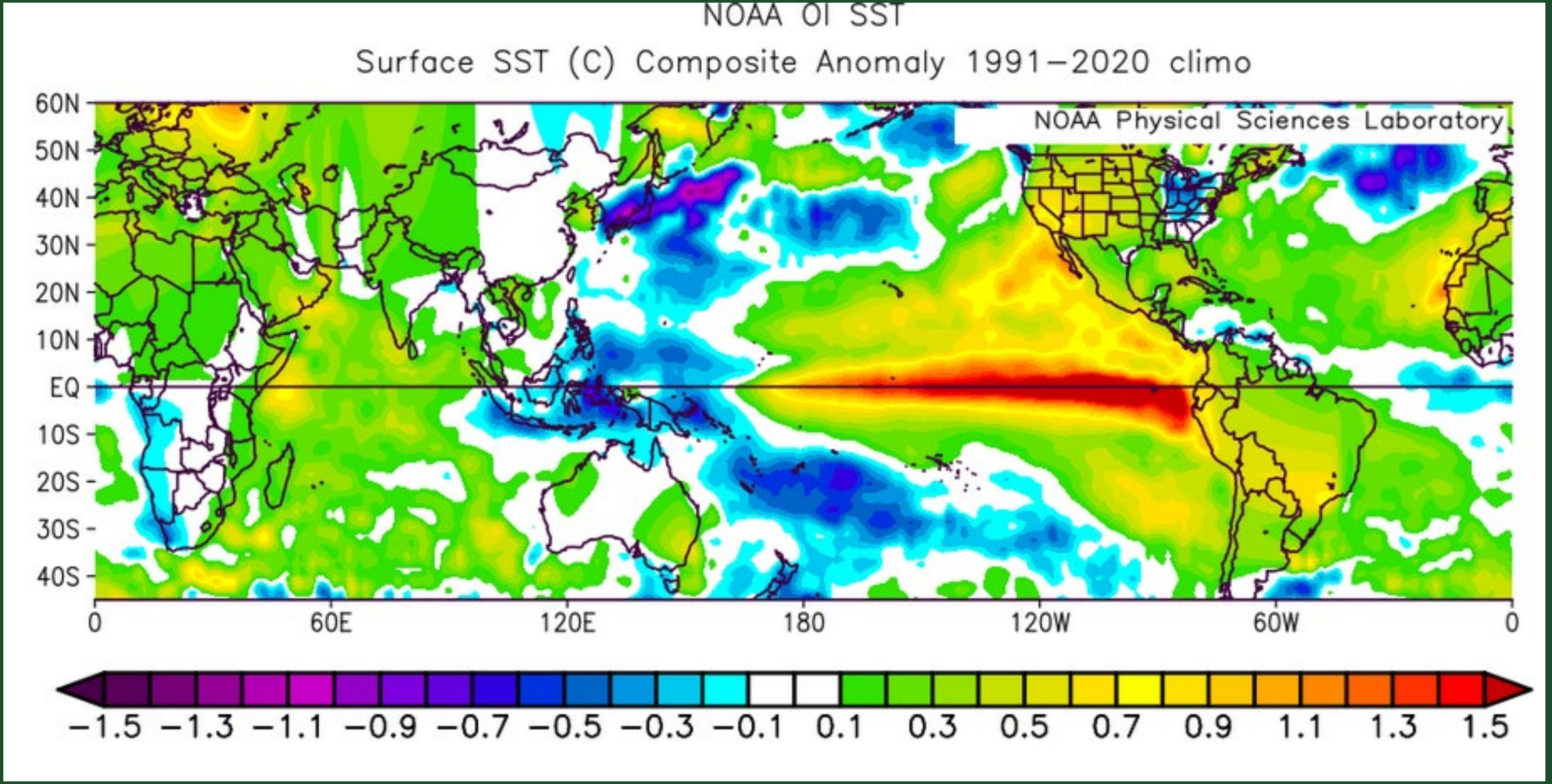
Statistical/Dynamical Model Hindcast Skill (3 Models)



ACE2 September Forecast: Strong Vertical Wind Shear across the MDR



August–October Sea Surface Temperature Anomalies in Analog Years



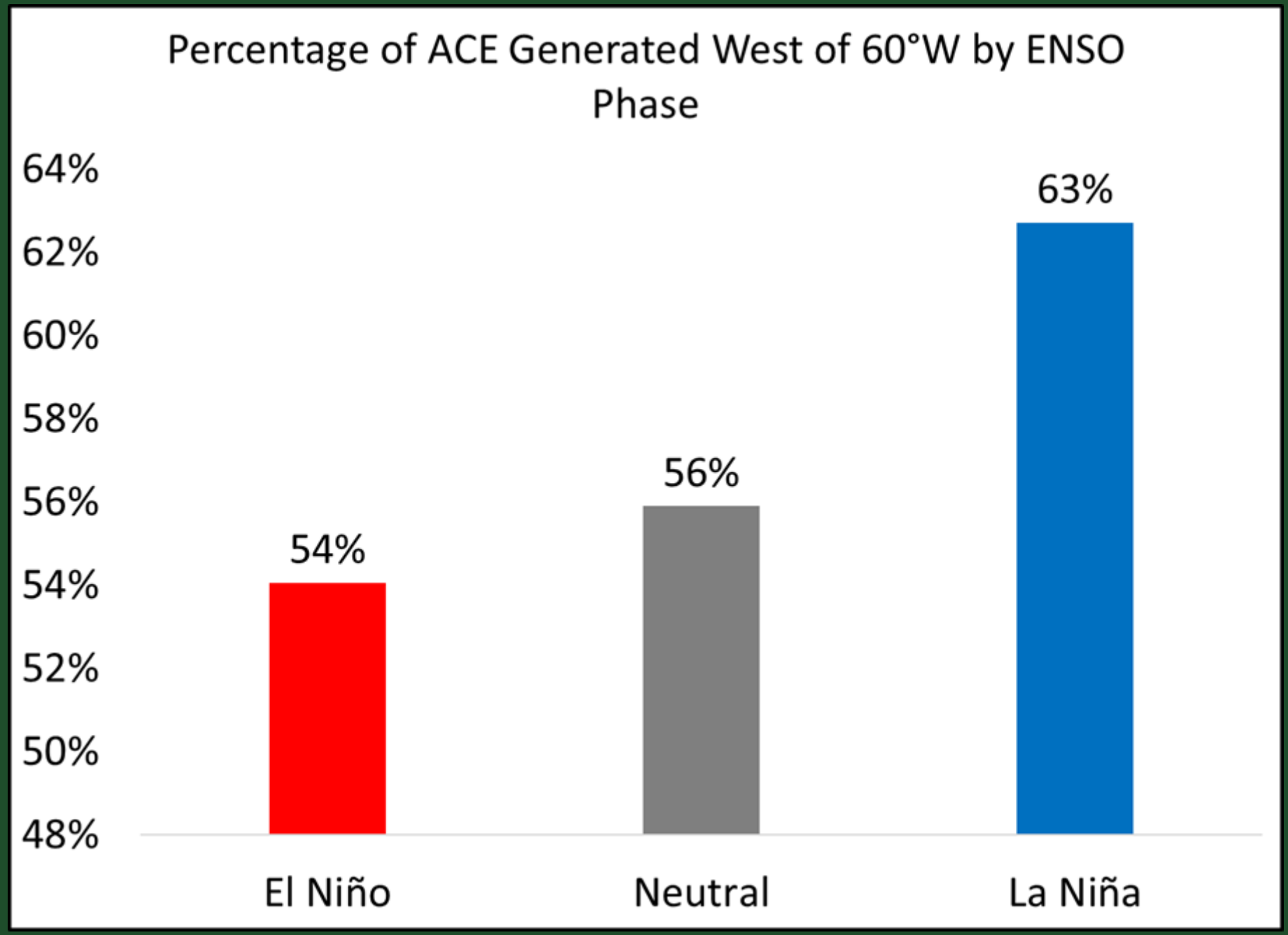
BEST ANALOG YEARS FOR 2026 (APRIL FORECAST)

	NS	NSD	H	HD	MH	MHD	ACE	NTC
2006	10	58.00	5	21.25	2	2.00	83	87
2009	9	30.00	3	12.00	2	3.50	53	69
2015	11	43.50	4	12.00	2	4.00	63	81
2023	20	100.50	7	31.5	3	7.25	148	156
MEAN	*12.5*	*58.0*	*4.8*	*19.2*	*2.3*	*4.2*	*87*	*98*
2026 Forecast	13	55	6	20	2	5	90	100

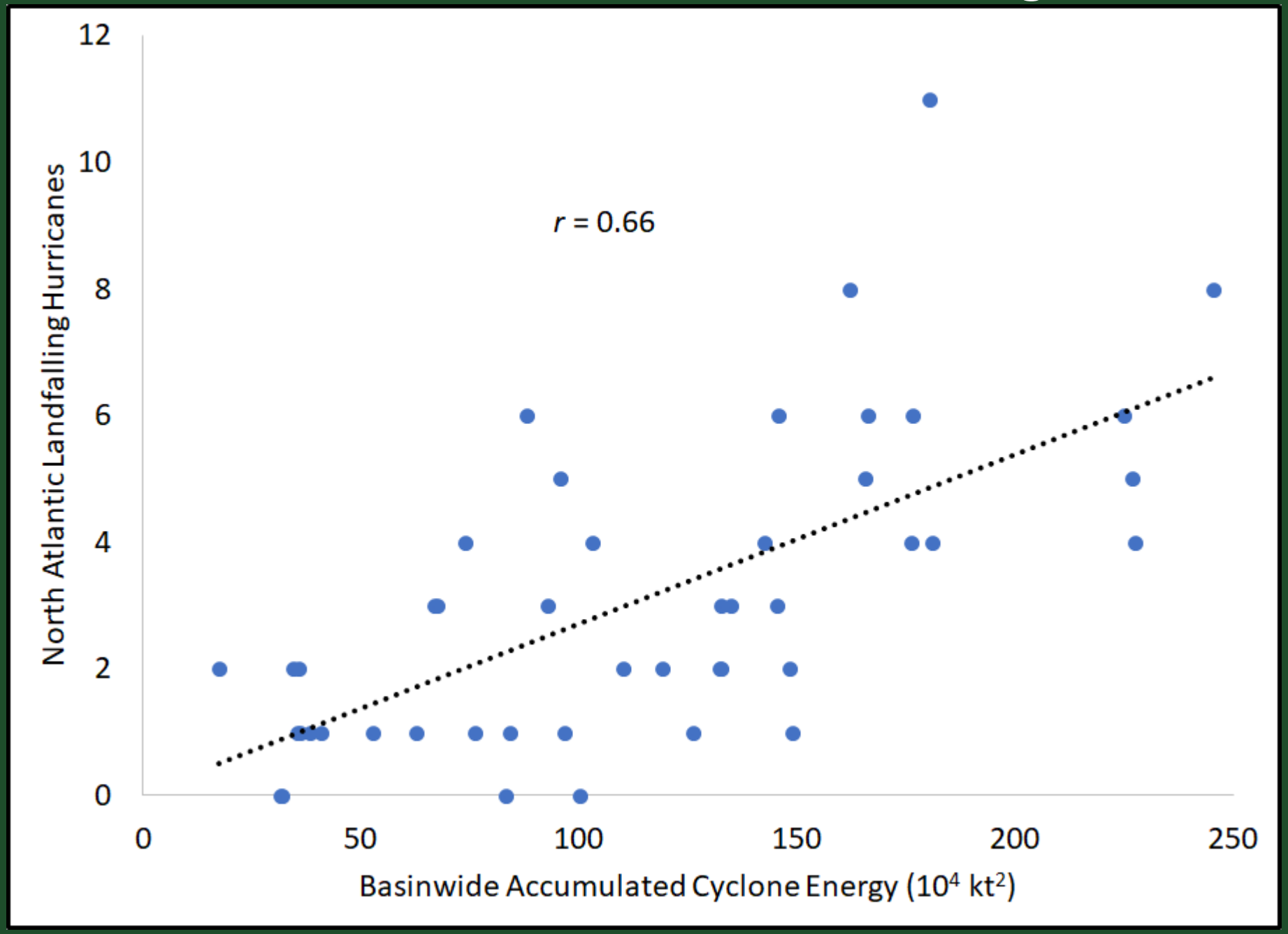
2026 Seasonal Hurricane Forecast Model Uncertainty

Forecast Parameter	2026 Forecast	Uncertainty Range (~70% of Forecasts Fall within Range)
Named Storms (NS)	13	10–16
Named Storm Days (NSD)	55	35–78
Hurricanes (H)	6	4–8
Hurricane Days (HD)	20	10–33
Major Hurricanes (MH)	2	1–4
Major Hurricane Days (MHD)	5	1–8
Accumulated Cyclone Energy (ACE)	90	49–141
ACE West of 60°W	50	25–85
Net Tropical Cyclone Activity (NTC)	100	58–151

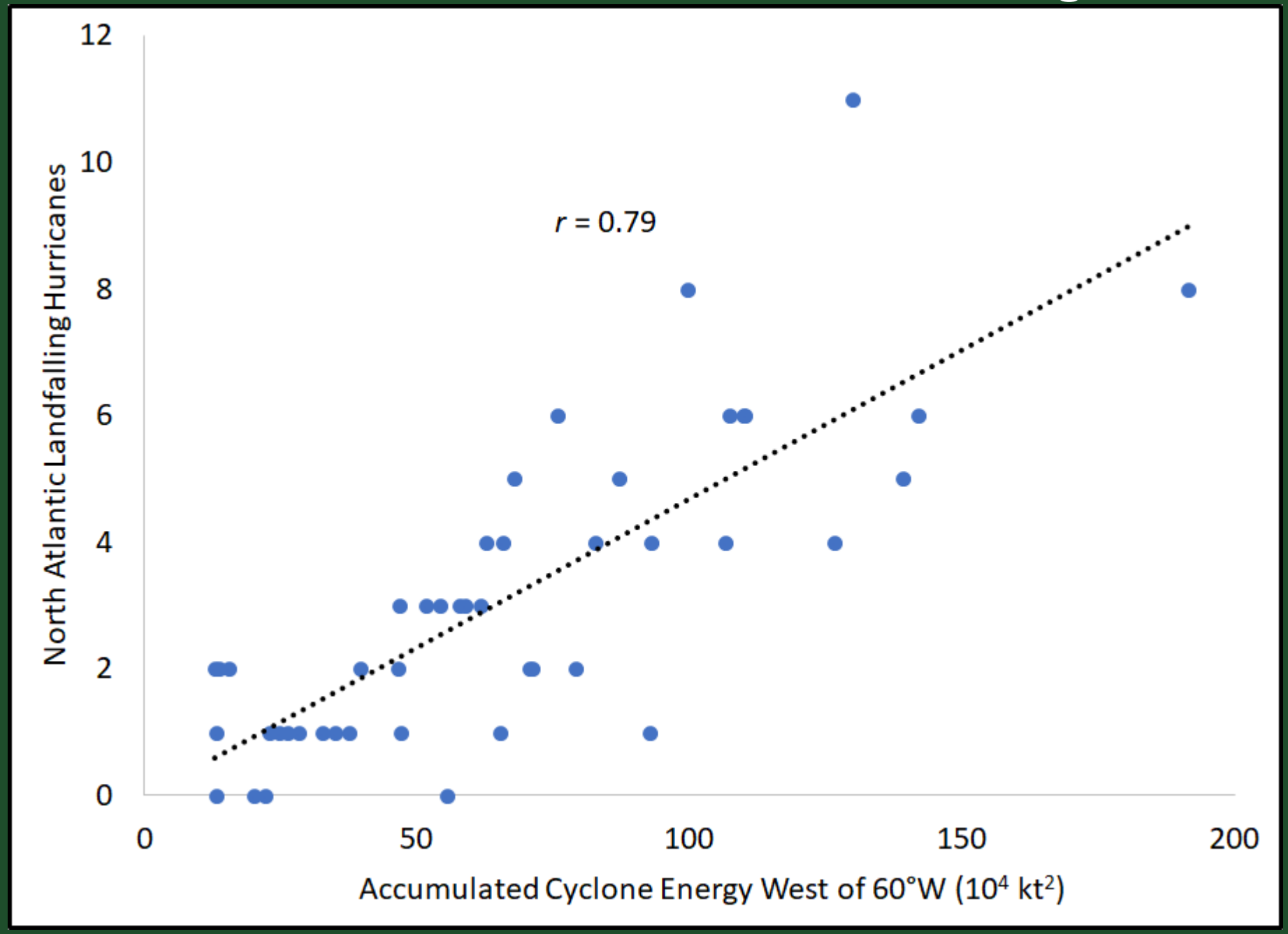
Percentage of Basinwide ACE West of 60°W vs. ENSO Phase



Basinwide ACE vs. North Atlantic Landfalling Hurricanes



ACE West of 60°W vs. North Atlantic Landfalling Hurricanes



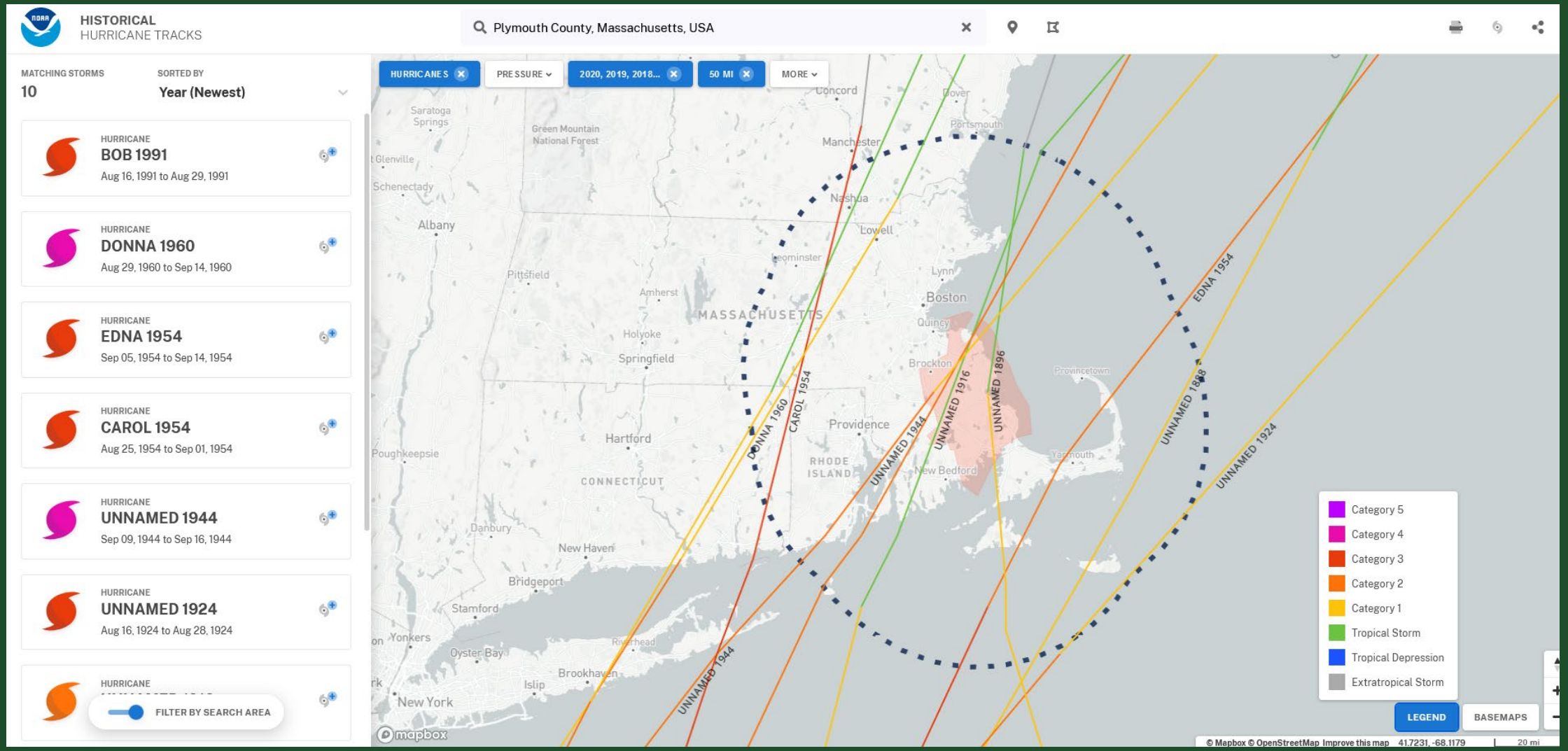
2026 PROBABILITIES FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE LANDFALL IN EACH OF THE FOLLOWING AREAS

(1880–2020 PROBABILITIES IN PARENTHESES)

1) Entire U.S. coastline – 32% (43%)
2) U.S. East Coast including Peninsula Florida – 15% (21%)
3) Gulf Coast from the Florida Panhandle westward to Brownsville – 20% (27%)
4) Caribbean (10-20°N, 88-60°W) – 35% (47%)

Count all named storms, hurricanes and major hurricanes within 50 miles of each county/parish (1880–2020)

Example: All Hurricanes within 50 miles of Plymouth County, MA



https://coast.noaa.gov/hurricanes/

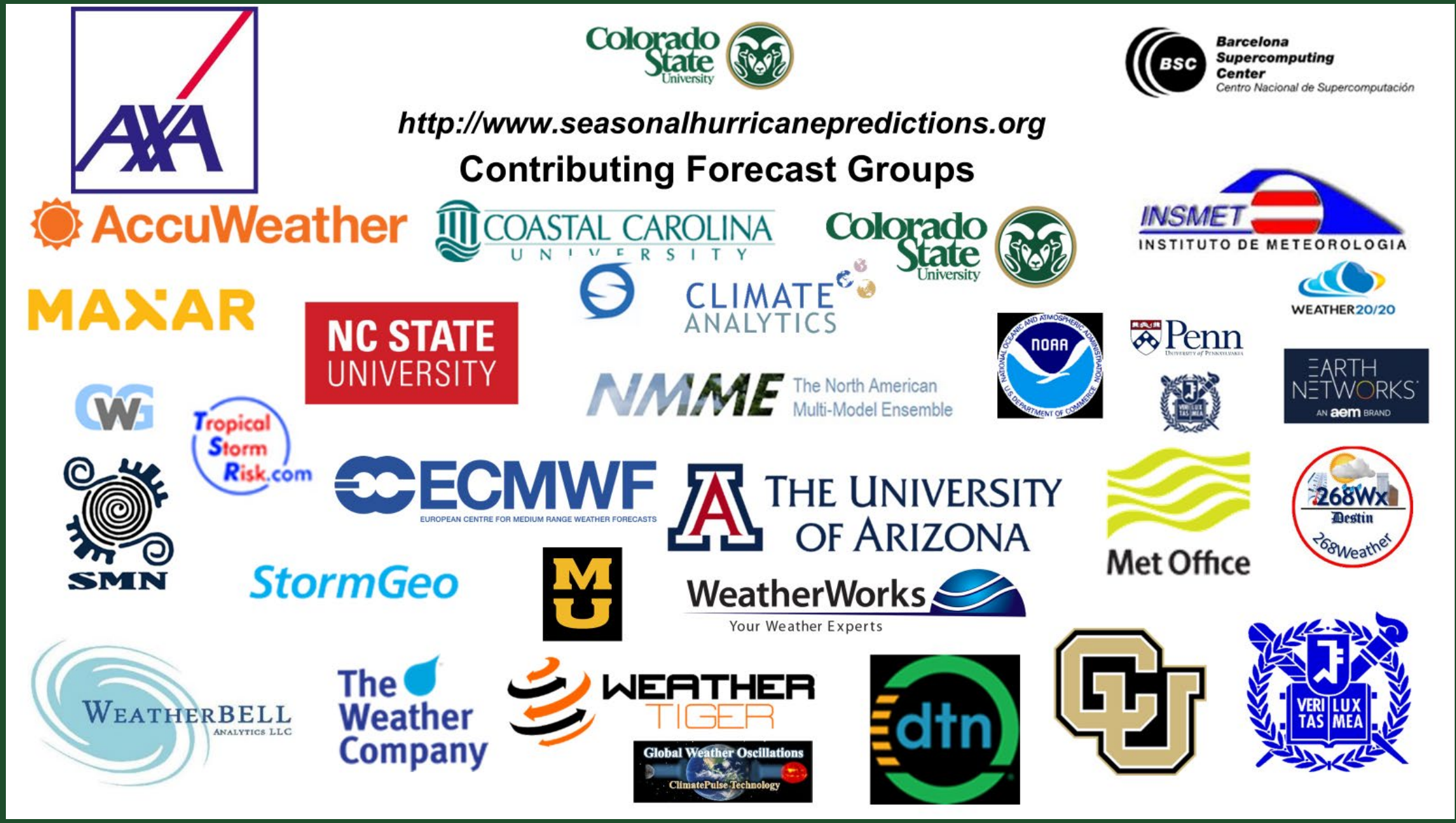
2026 Probabilities (1880–2020 Probabilities in Parentheses)

State	>=1 Hurricane Within 50 Miles	>=1 Major Hurricane Within 50 Miles
Florida	43% (56%)	21% (29%)
Louisiana	28% (38%)	10% (14%)
Massachusetts	10% (14%)	2% (3%)
Mississippi	20% (28%)	5% (8%)
New York	7% (9%)	1% (2%)
North Carolina	28% (38%)	5% (8%)
Texas	27% (36%)	11% (16%)

2026 Atlantic Seasonal Hurricane Forecast Schedule

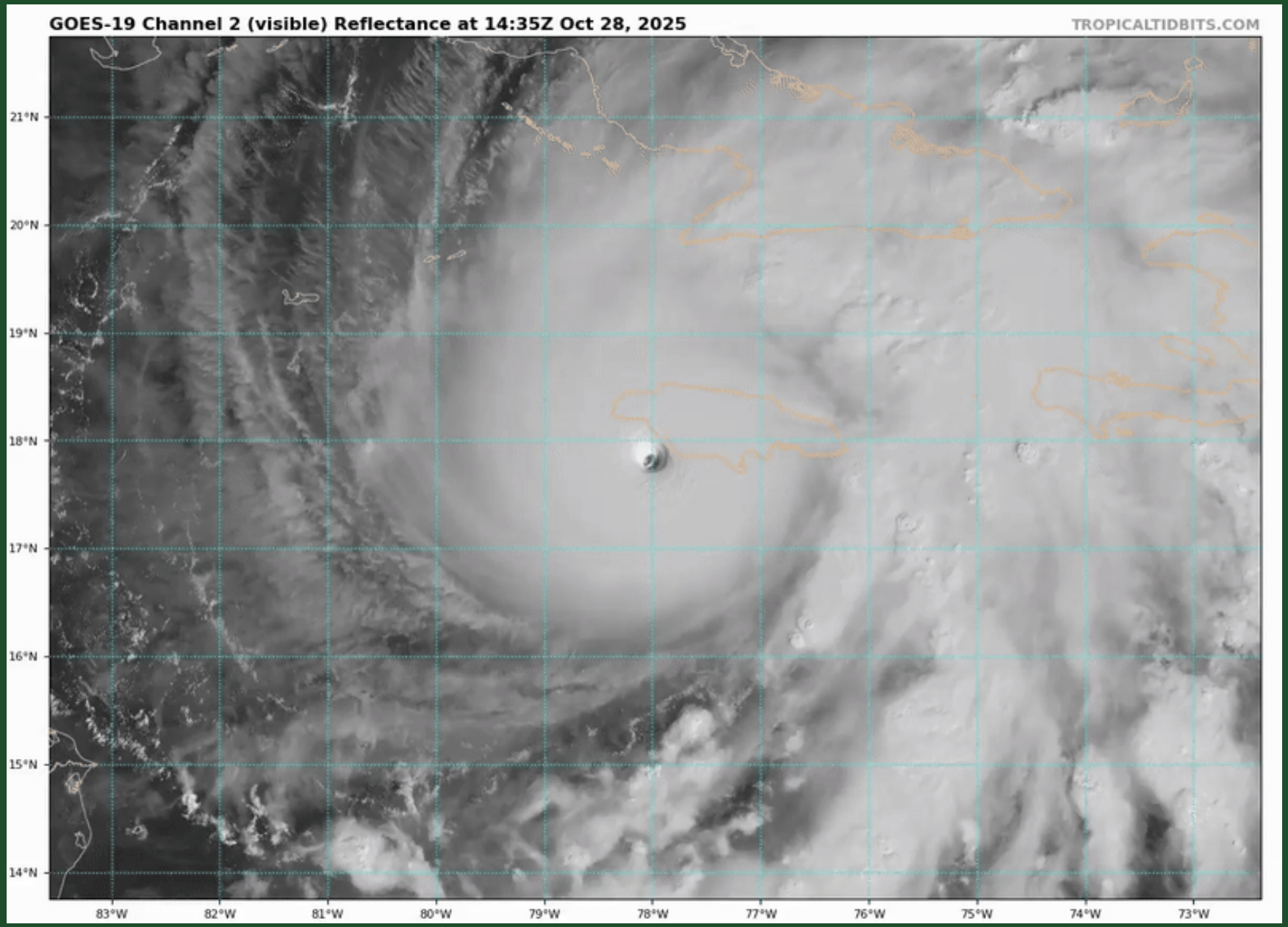
Date	9 April	10 June	8 July	5 Aug
Seasonal Forecast	X	X	X	X

Seasonal Hurricane Predictions Platform



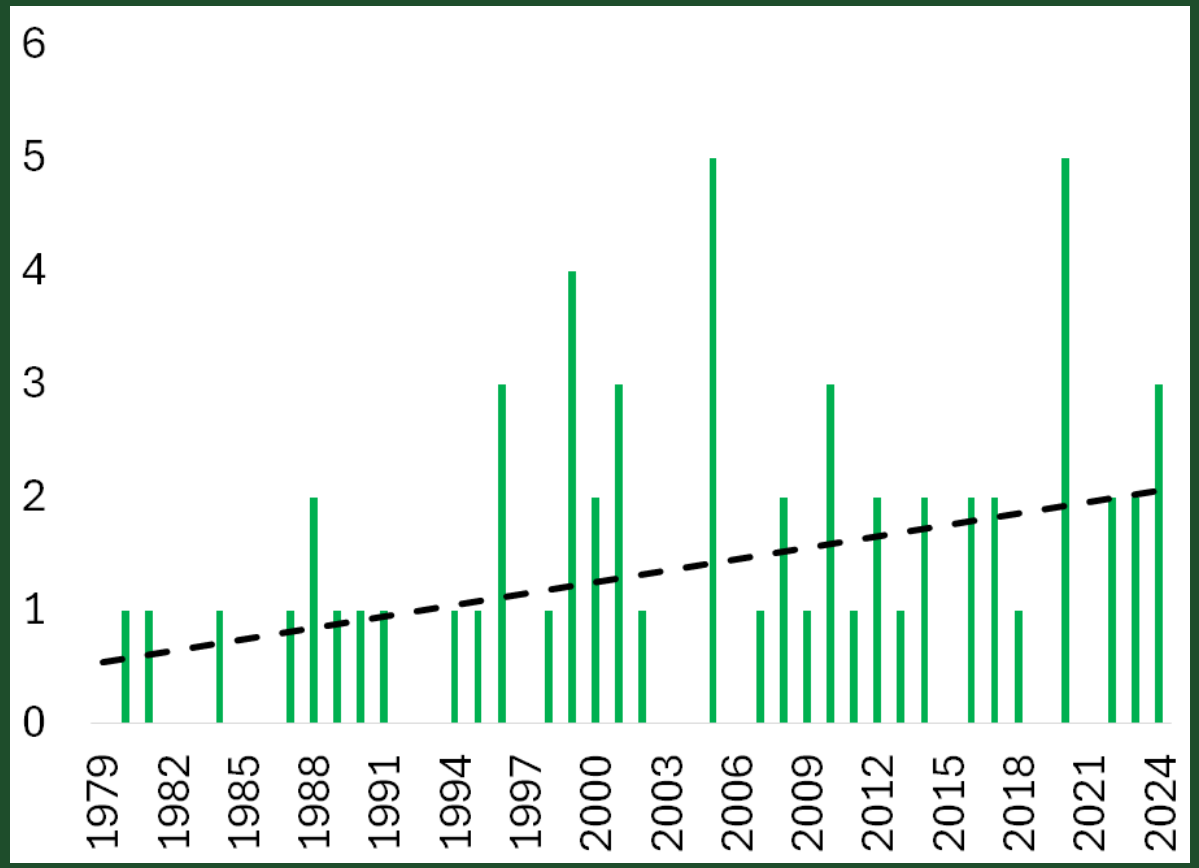
Seasonalhurricanepredictions.org Visualization – 2026 Hurricane Season

Hurricane Melissa Landfall (185 mph, 897 mb)

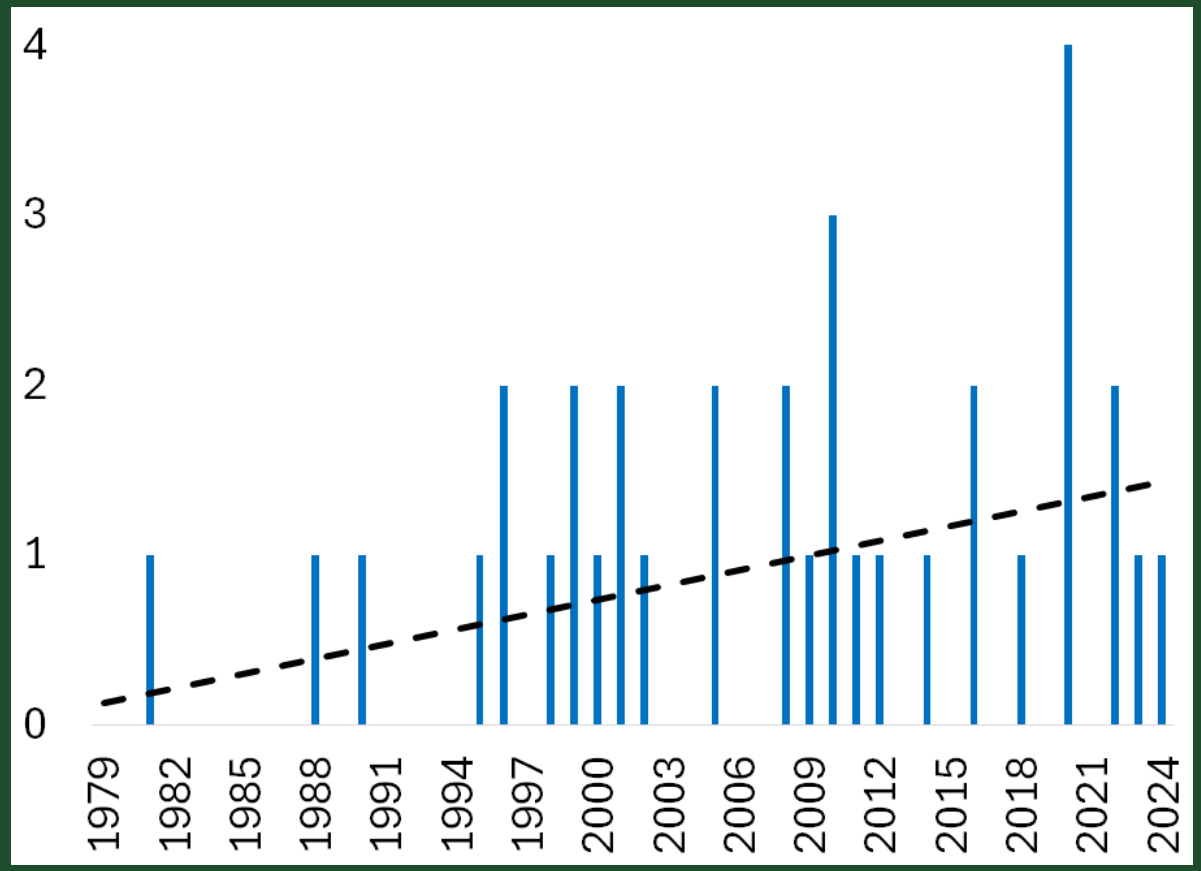


Caribbean October – November Tropical Cyclone Trends

Named Storm



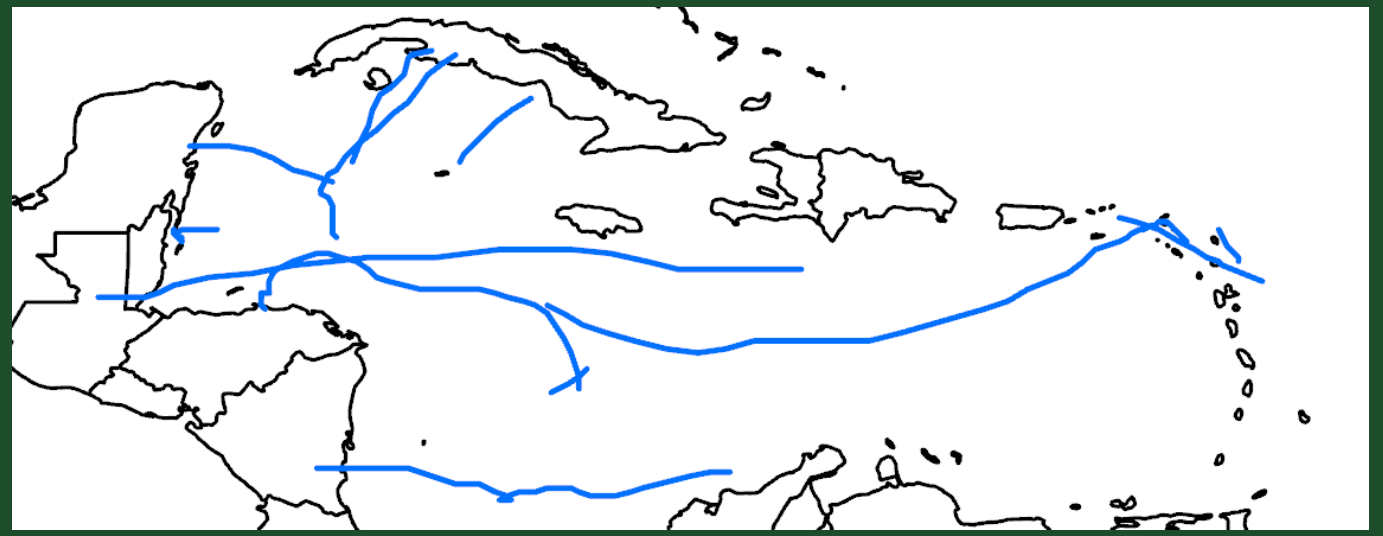
Hurricane



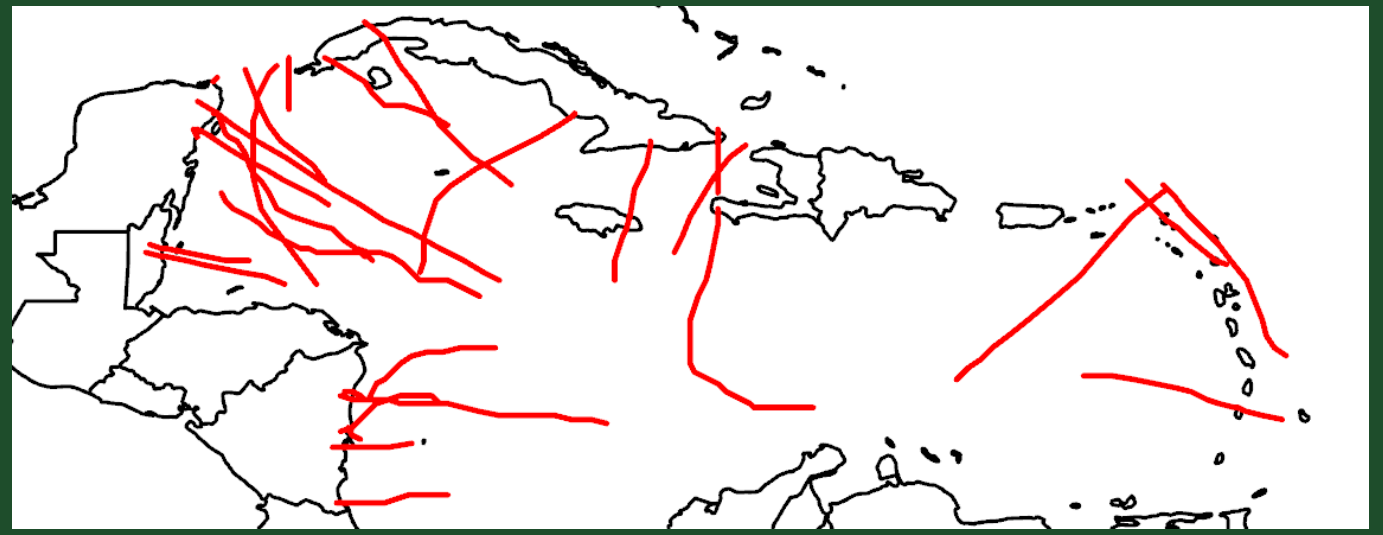
Klotzbach, P. J., and Coauthors, 2026: Recent increasing trend in October-November Caribbean tropical cyclone activity. *Geophysical Research Letters,* 53, e2025GL120183

Caribbean October–November Hurricane Tracks

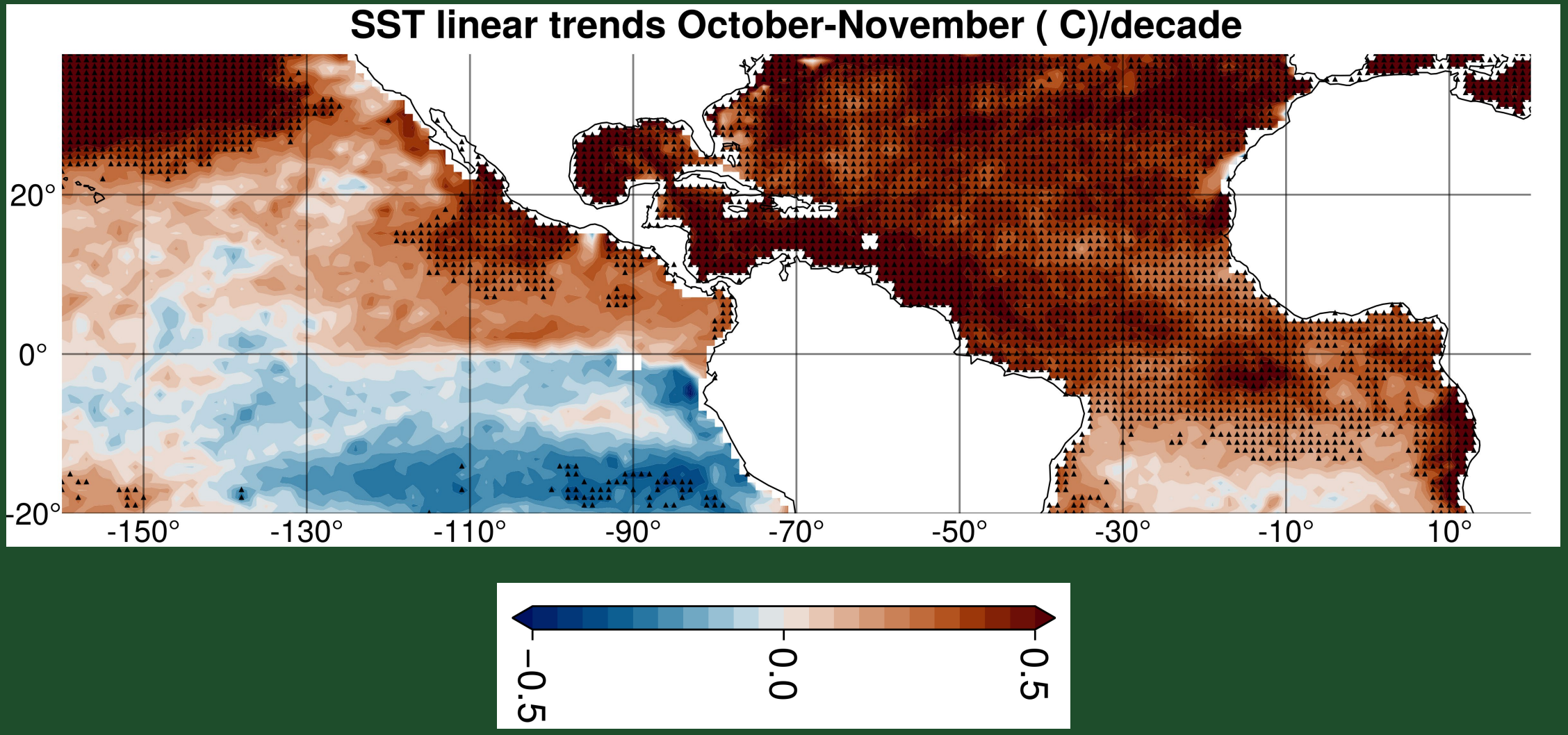
1979–2001 (12 Hurricanes)



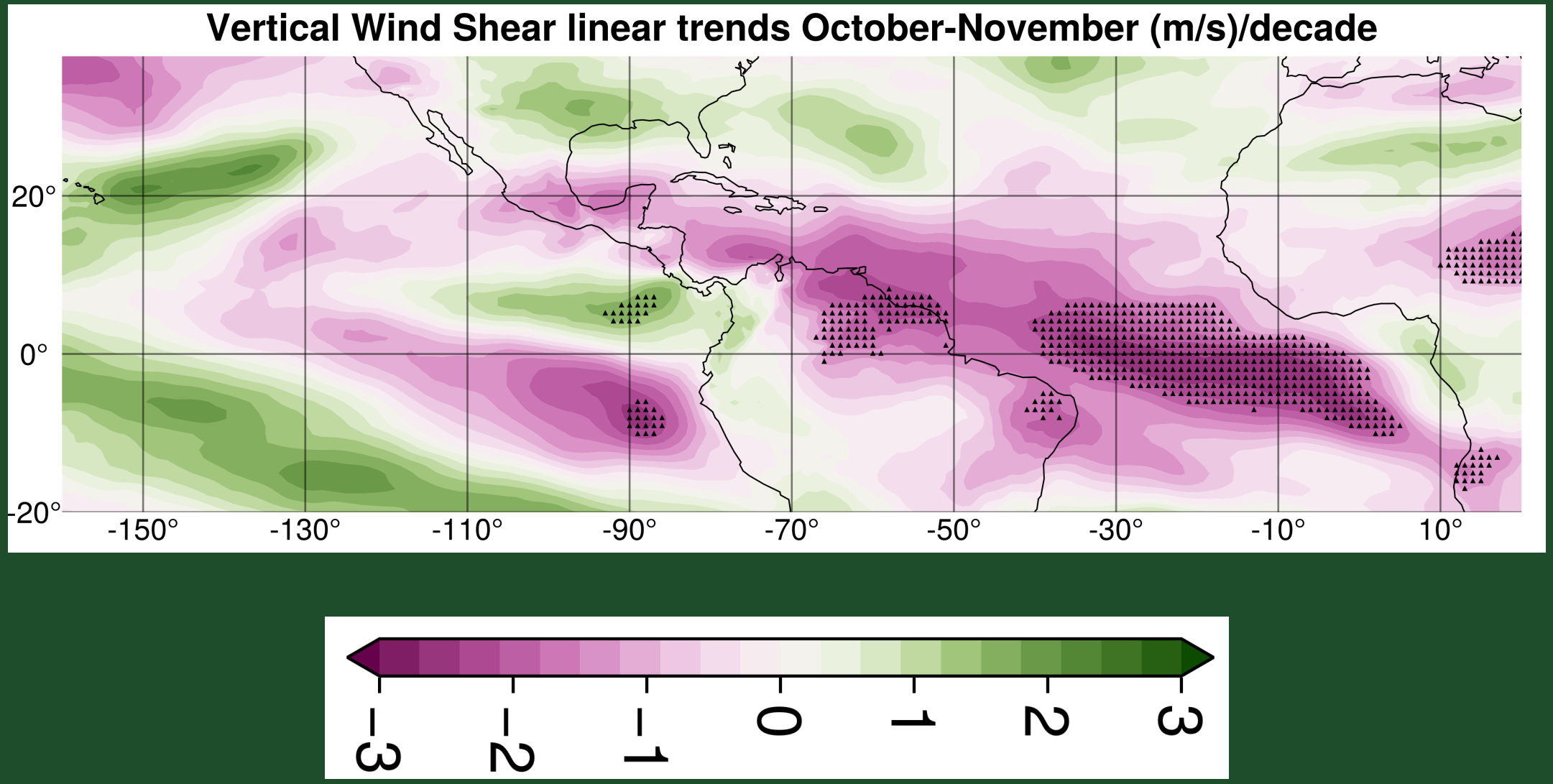
2002–2024 (24 Hurricanes)



Linear SST Trends in Oct–Nov (1979–2024)



Linear VWS Trends in Oct–Nov (1979–2024)

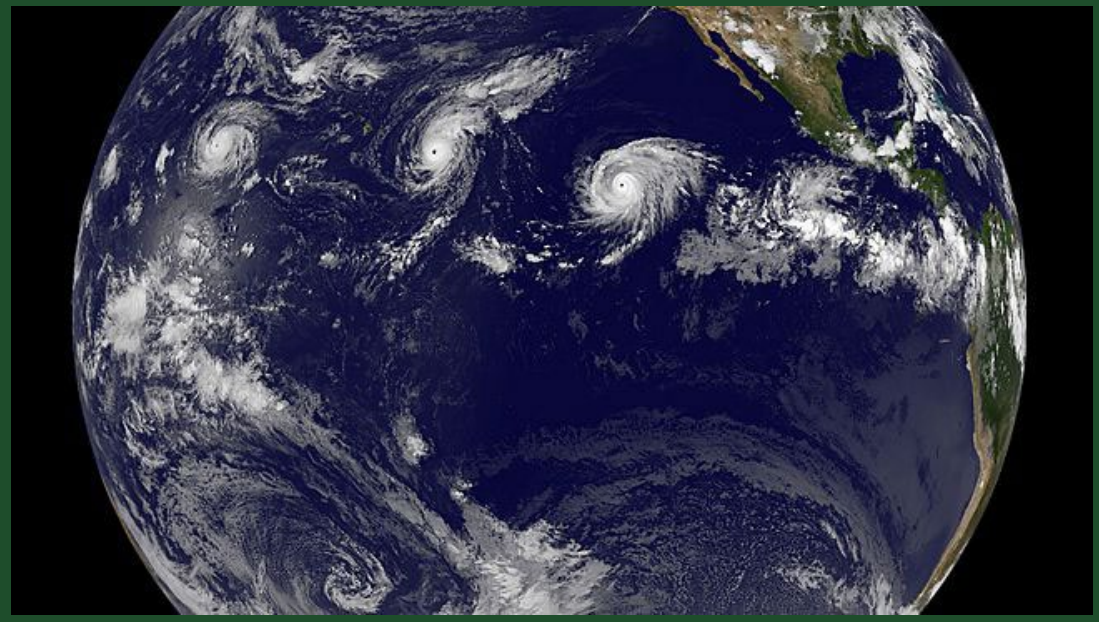


Trends in Global Tropical Cyclone Activity: 1990–2021

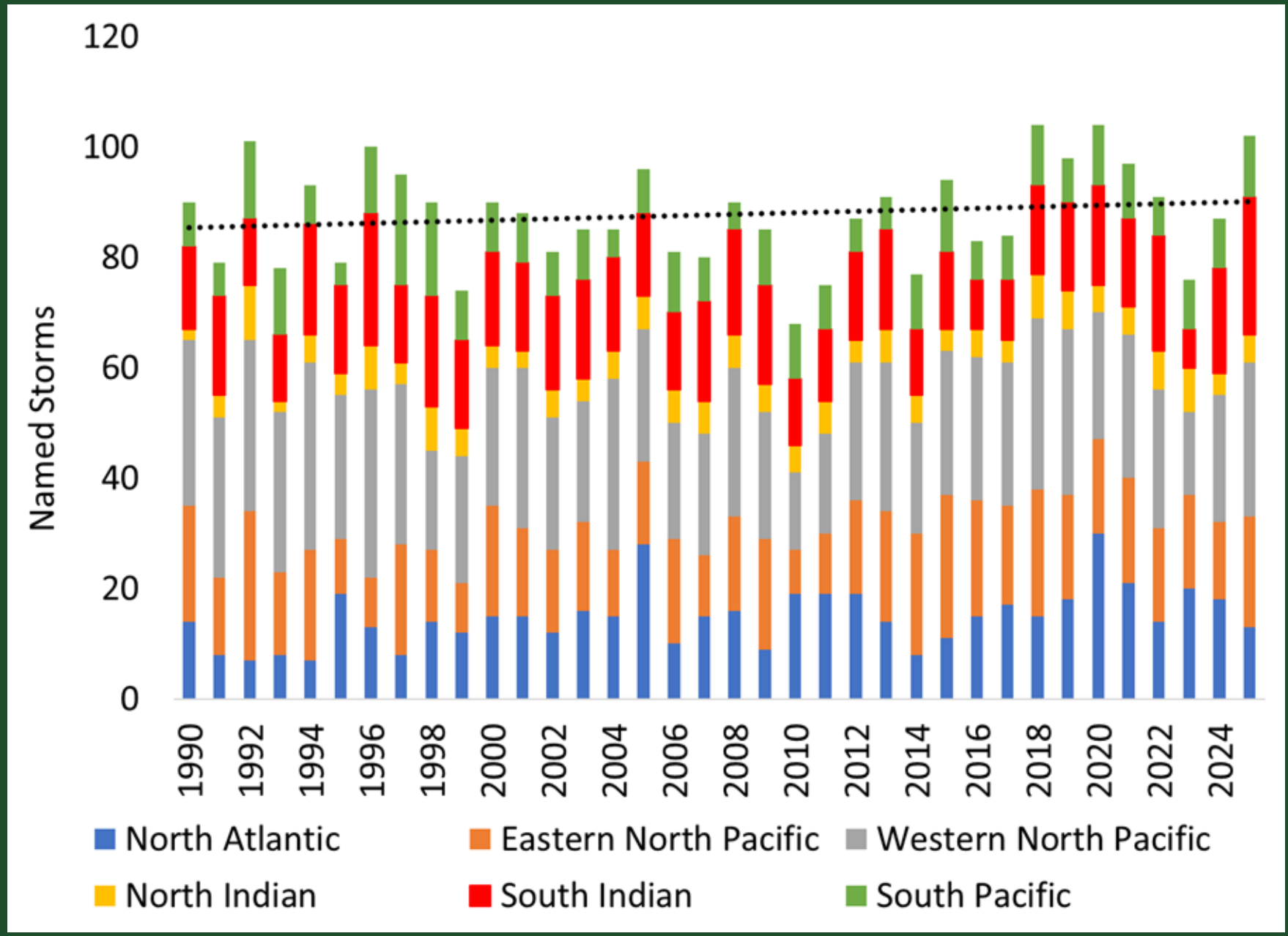
Published in 2022 in *Geophysical Research Letters*

Updated with Data Through 2025

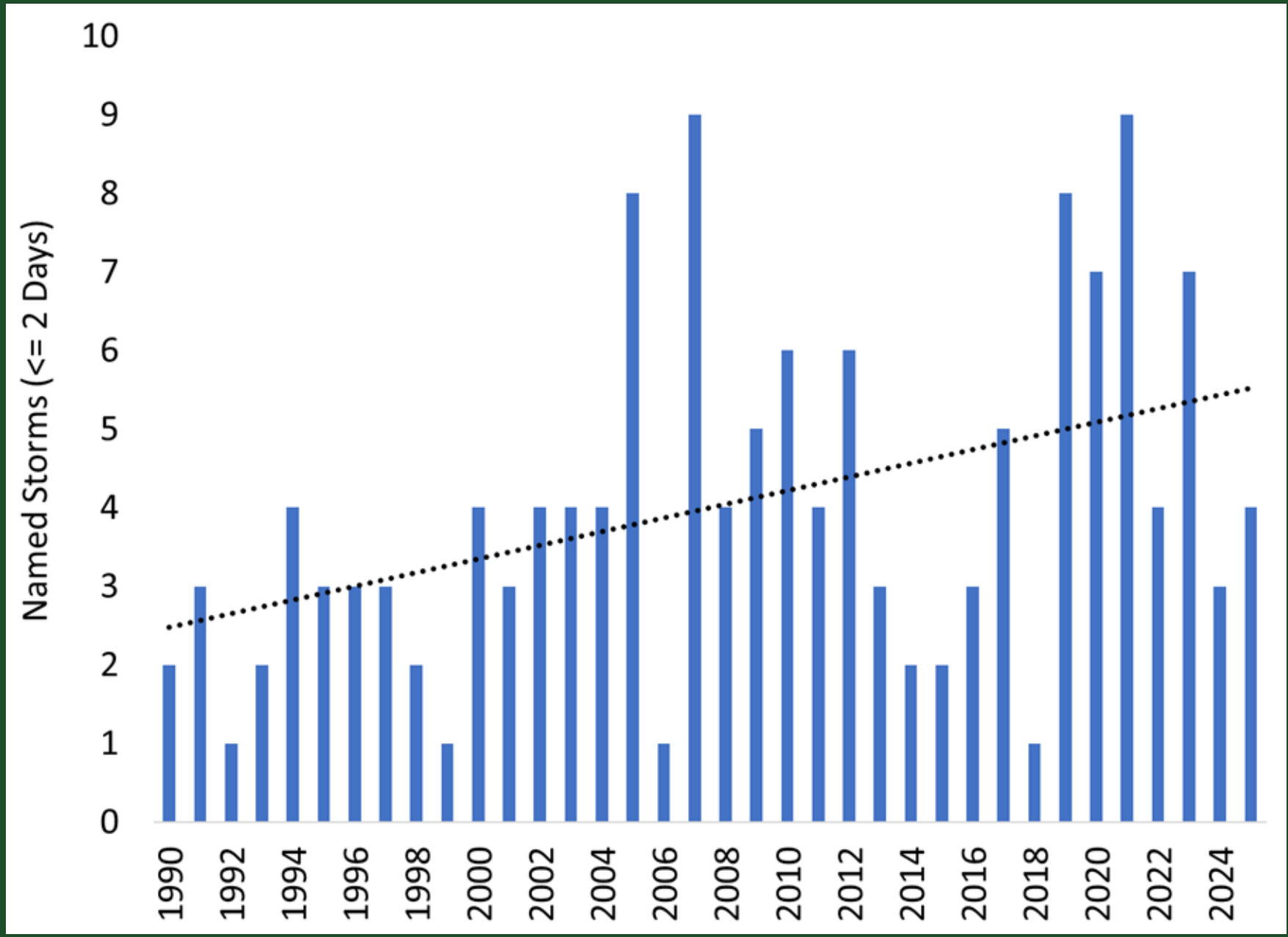
Co-authors: Kim Wood*, Carl Schreck, Steve Bowen, Christina Patricola, Michael Bell



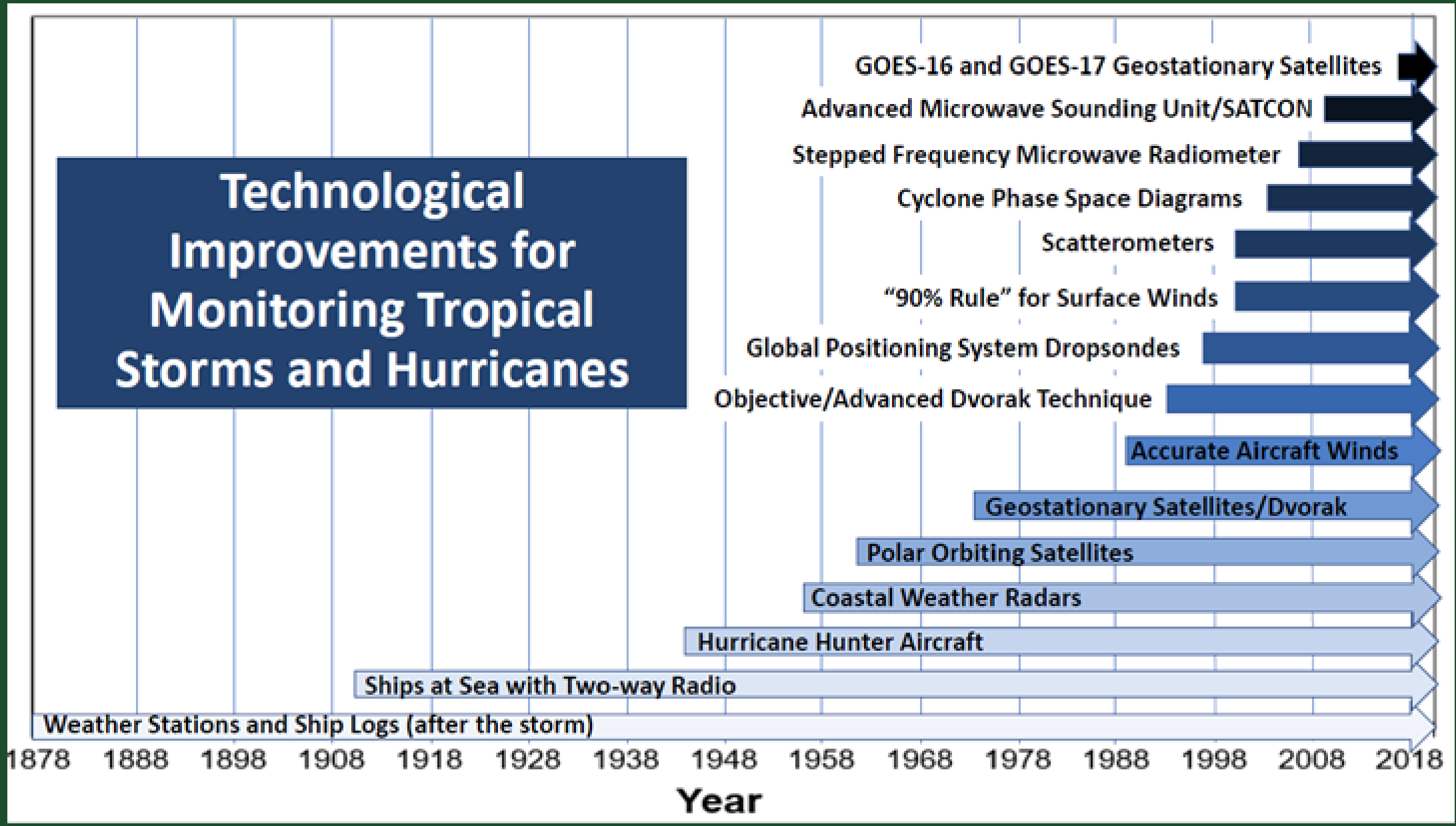
Global Named Storms (>=39 mph) (1990–2025)



Atlantic Named Storms (<=2 Days) (1990–2025)

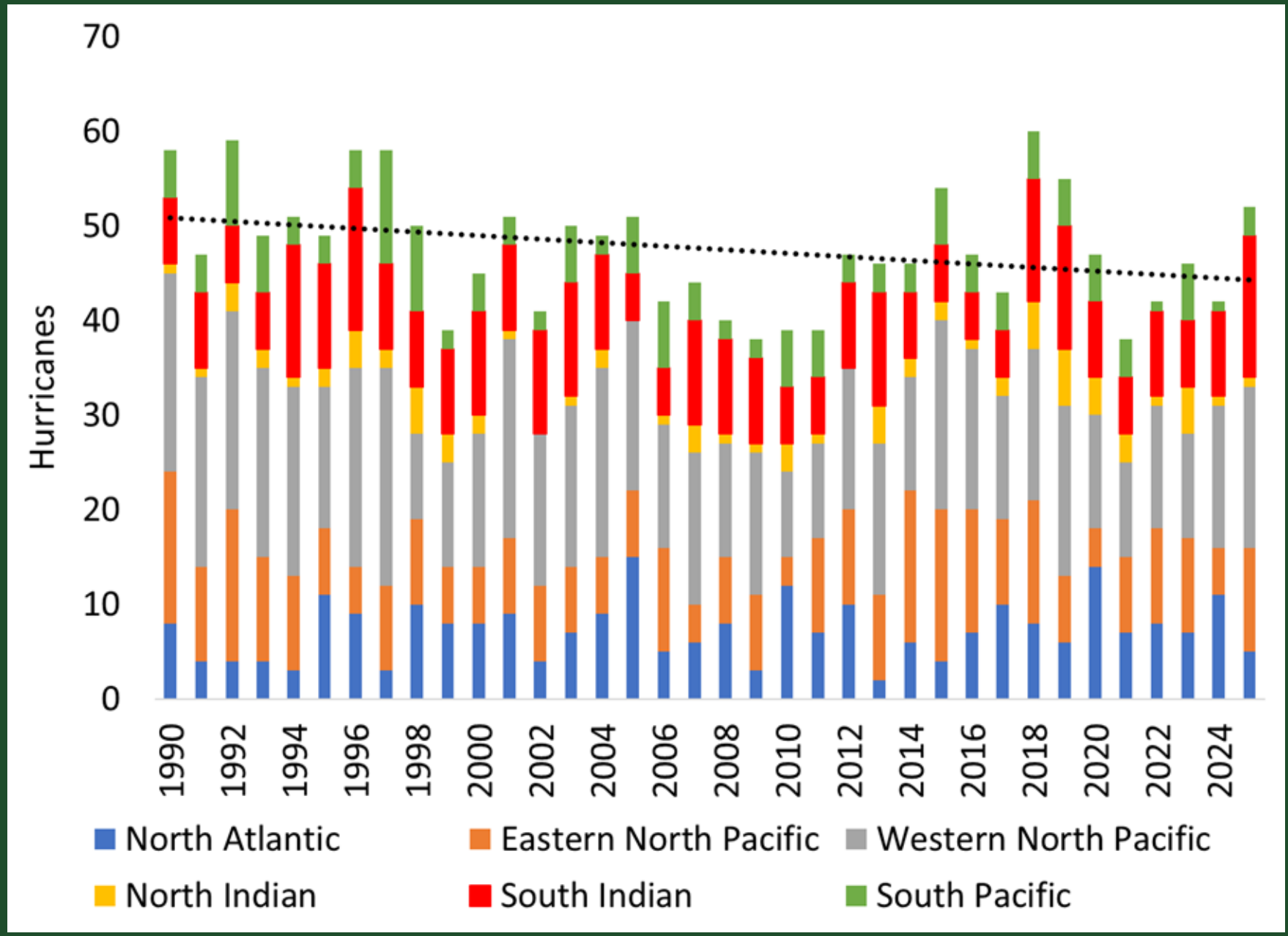


Atlantic Hurricane Observational Network Improvements

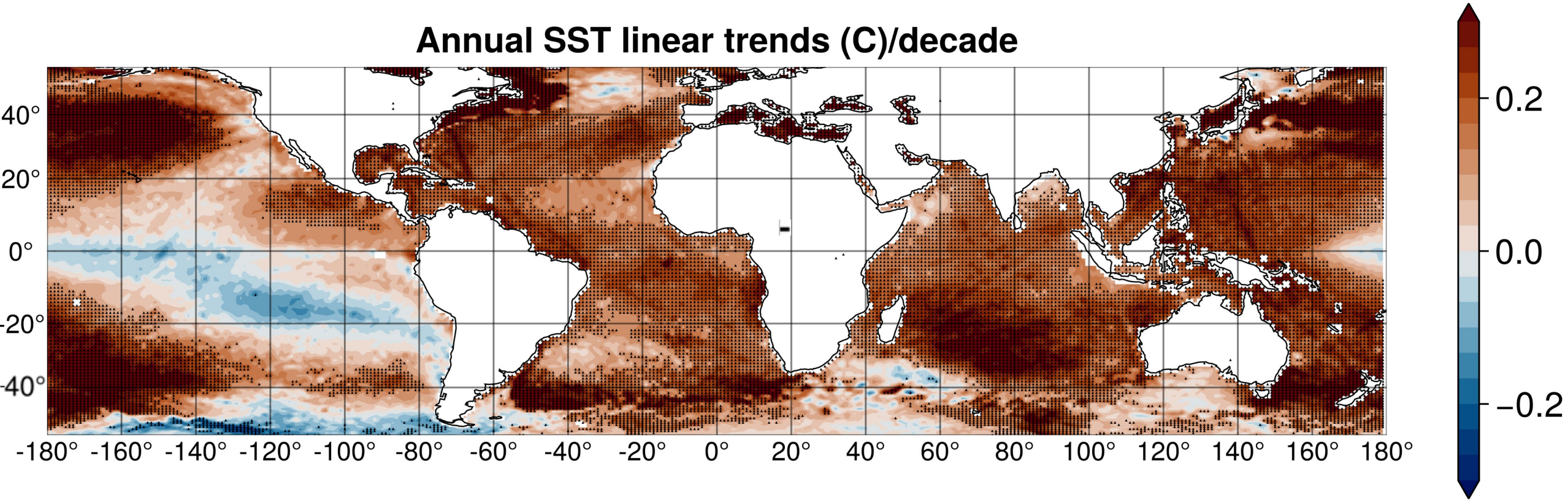


Chris Landsea (NHC)

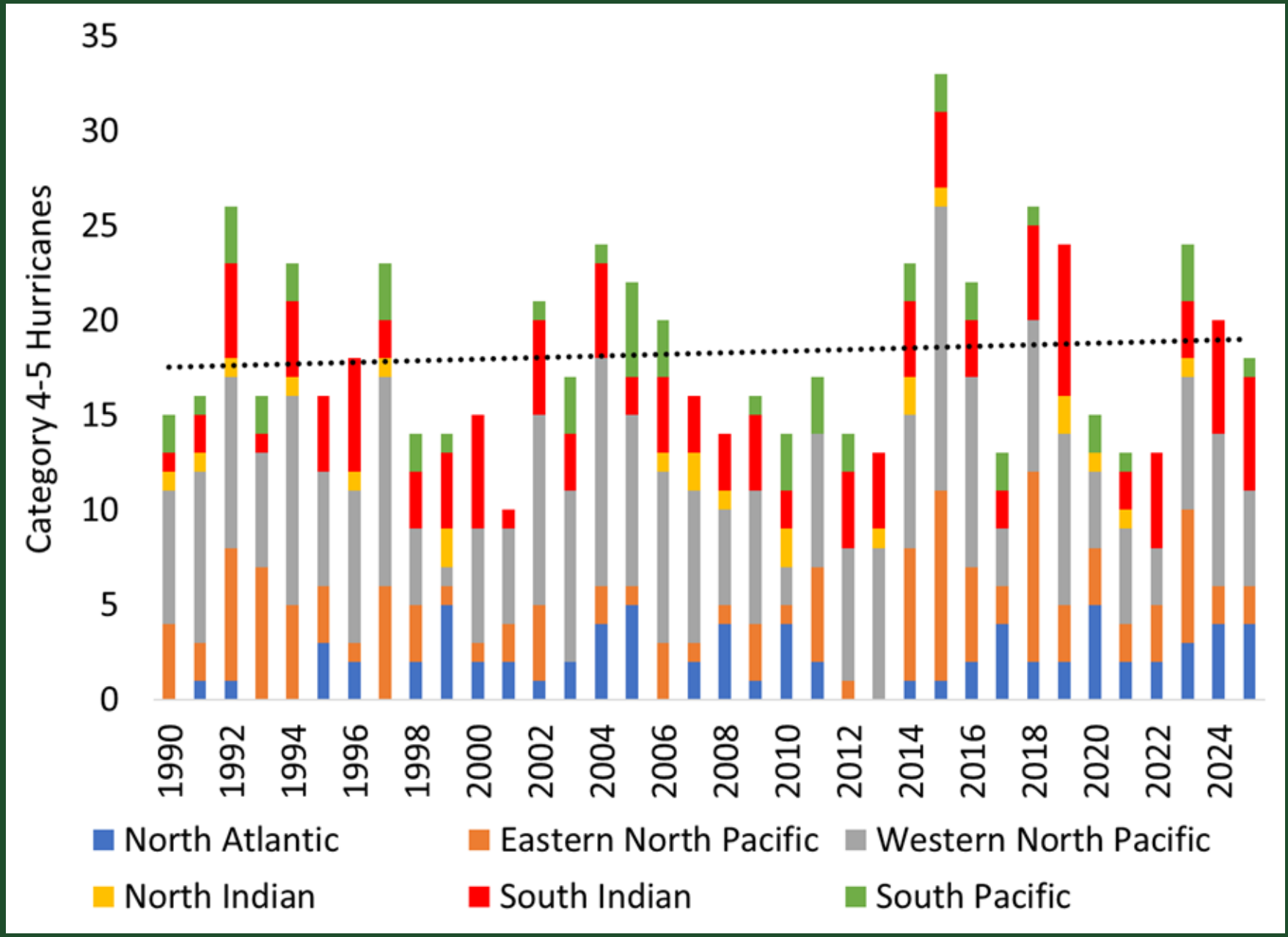
Global Hurricanes/Typhoons (1990–2025)



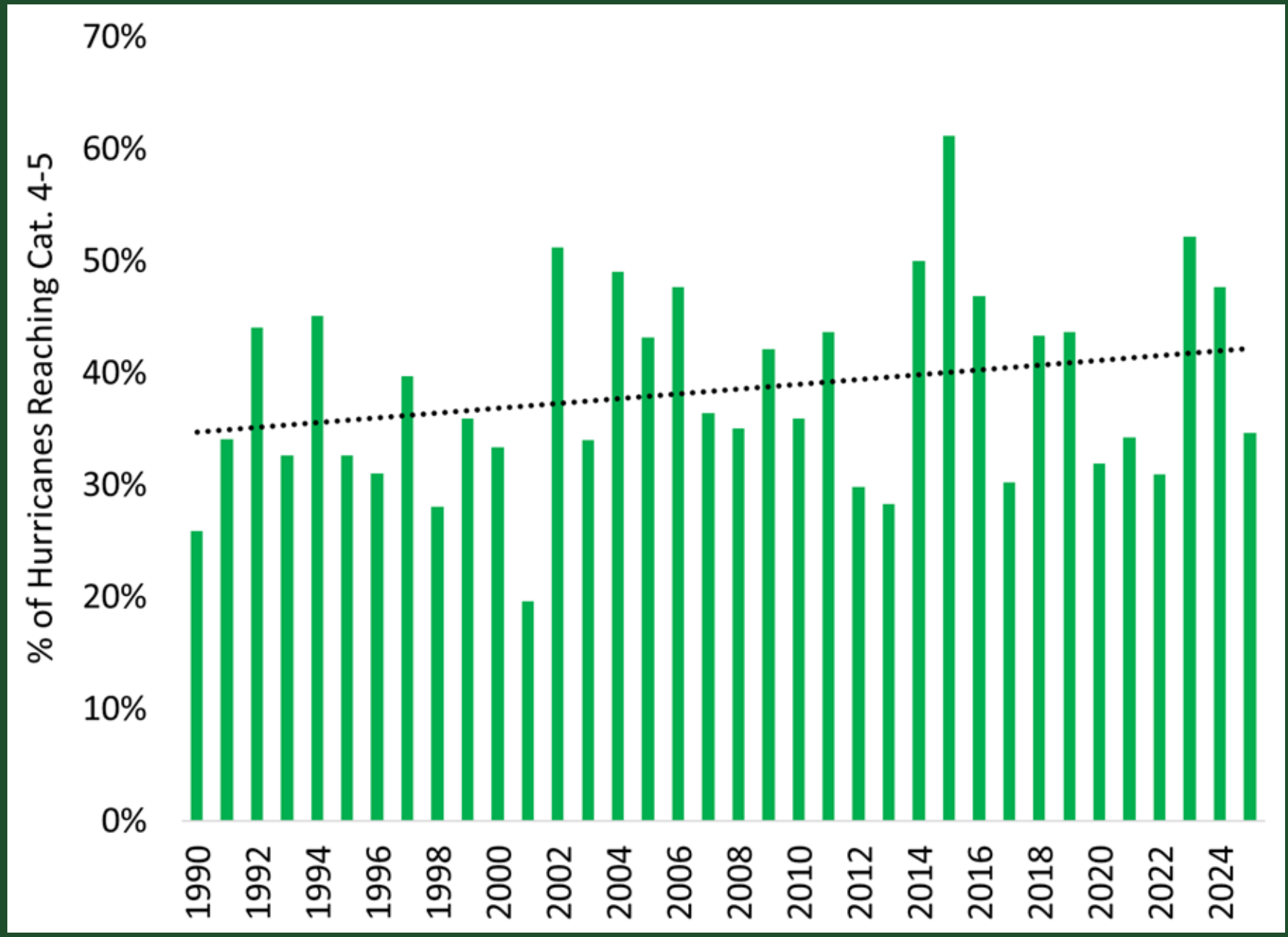
Trend Towards More La Niña-Like Environment since 1990



Category 4–5 (>=130 mph) Hurricanes (1990–2025)

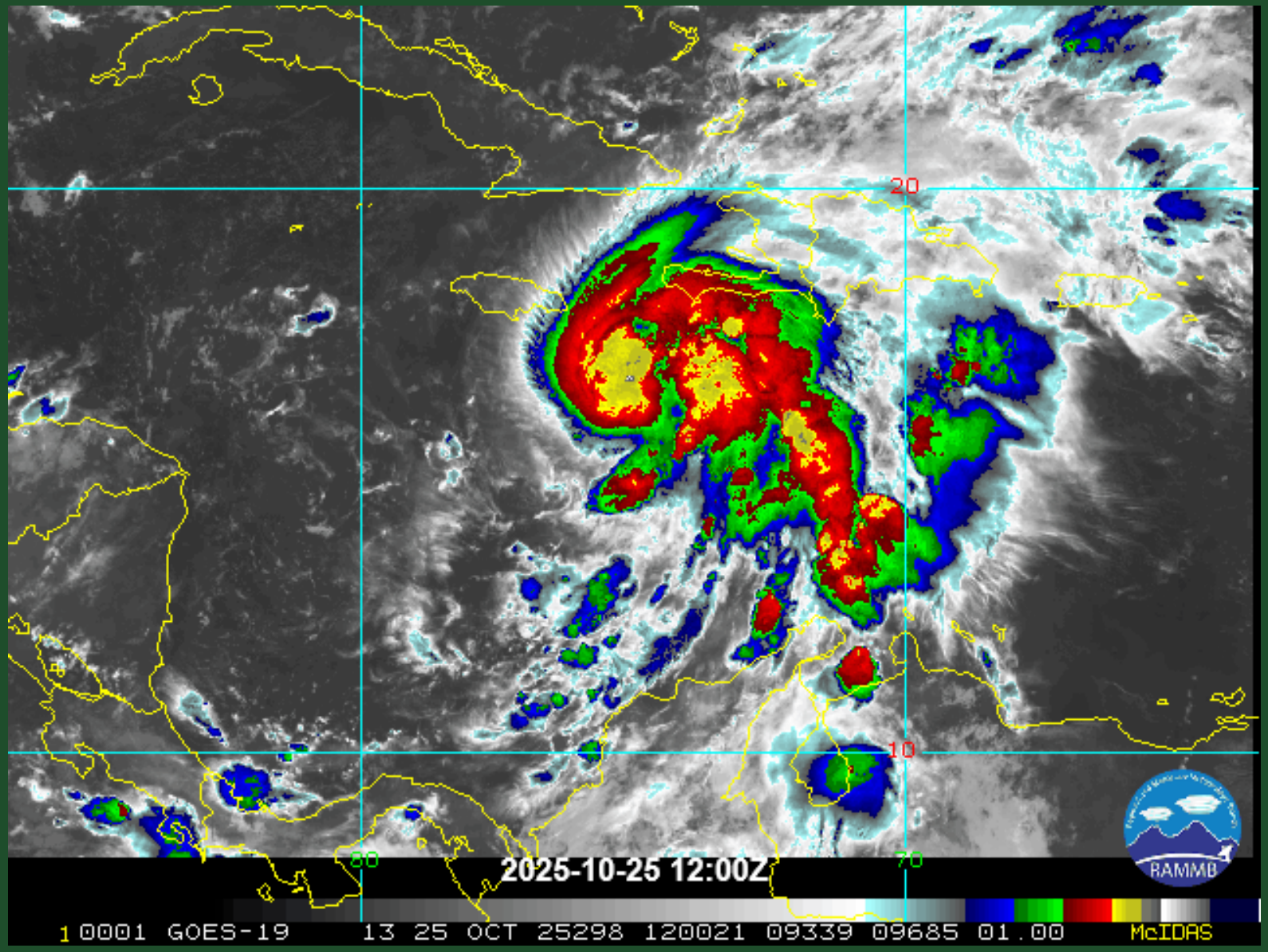


Global Cat. 4–5 Hurricane Percentage (>=130 mph winds) (1990–2025)

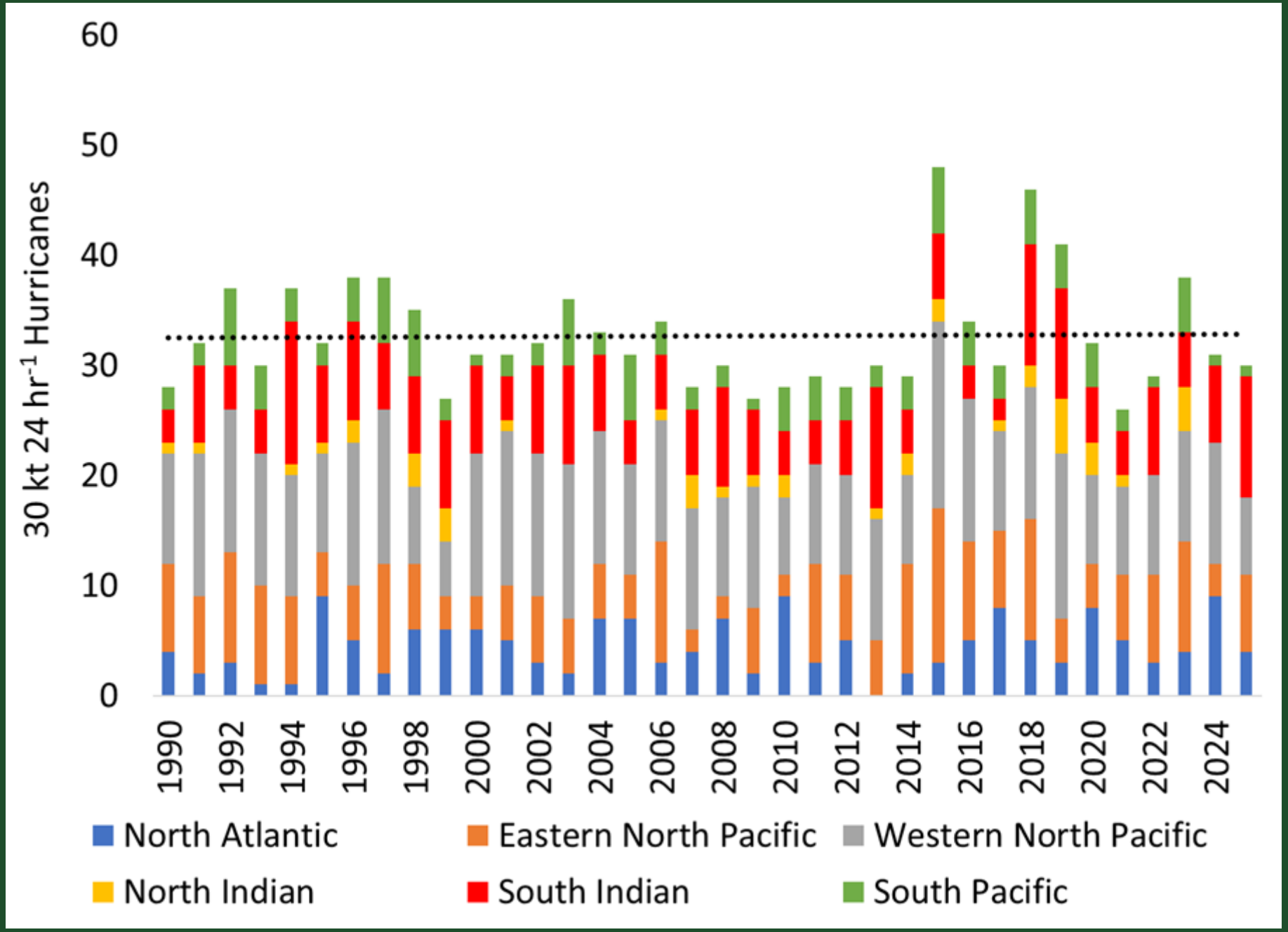


What About Rapid Intensification?

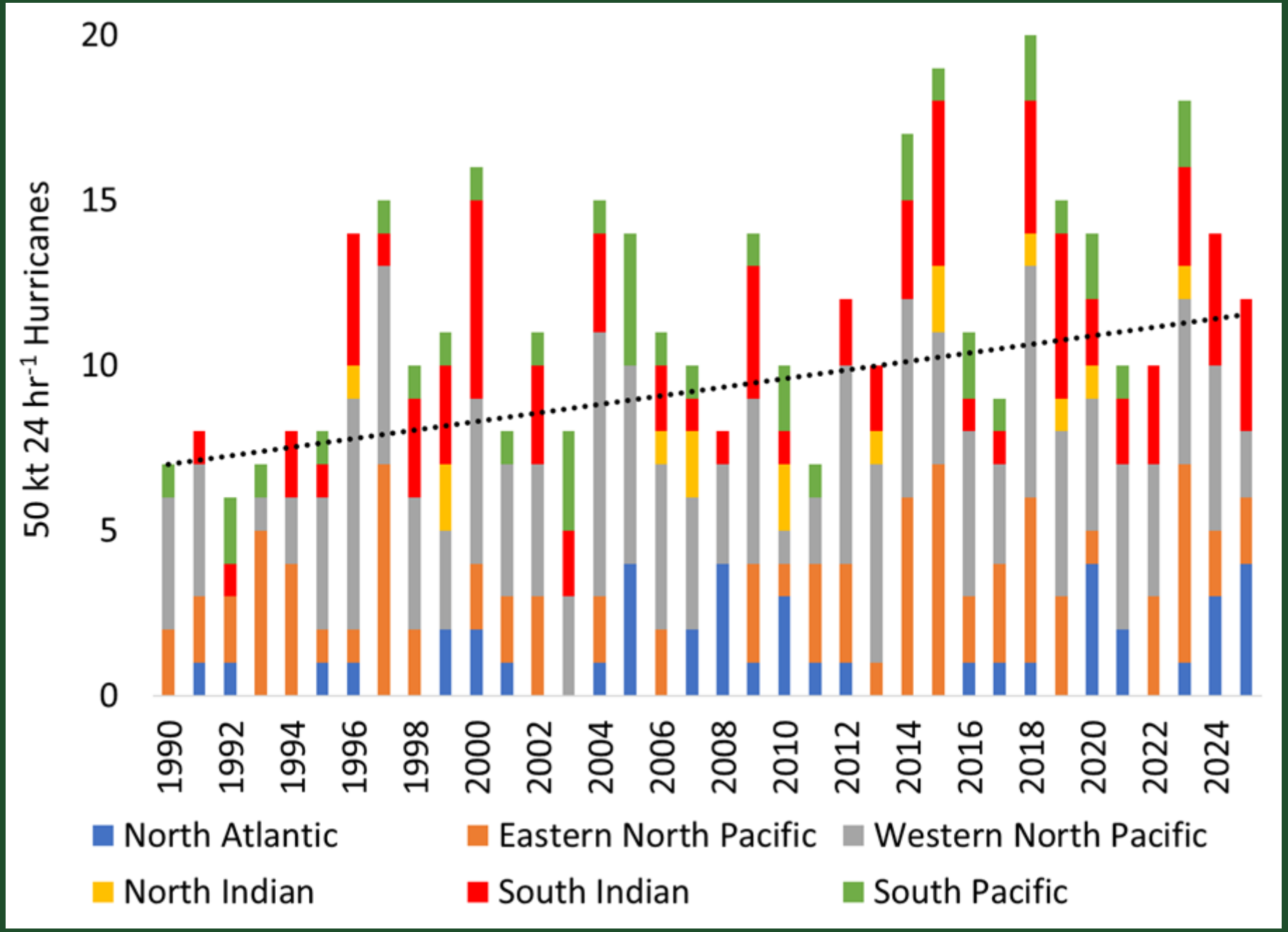
Hurricane Melissa (2025): Tropical Storm to Category 4 Hurricane in 24 Hours



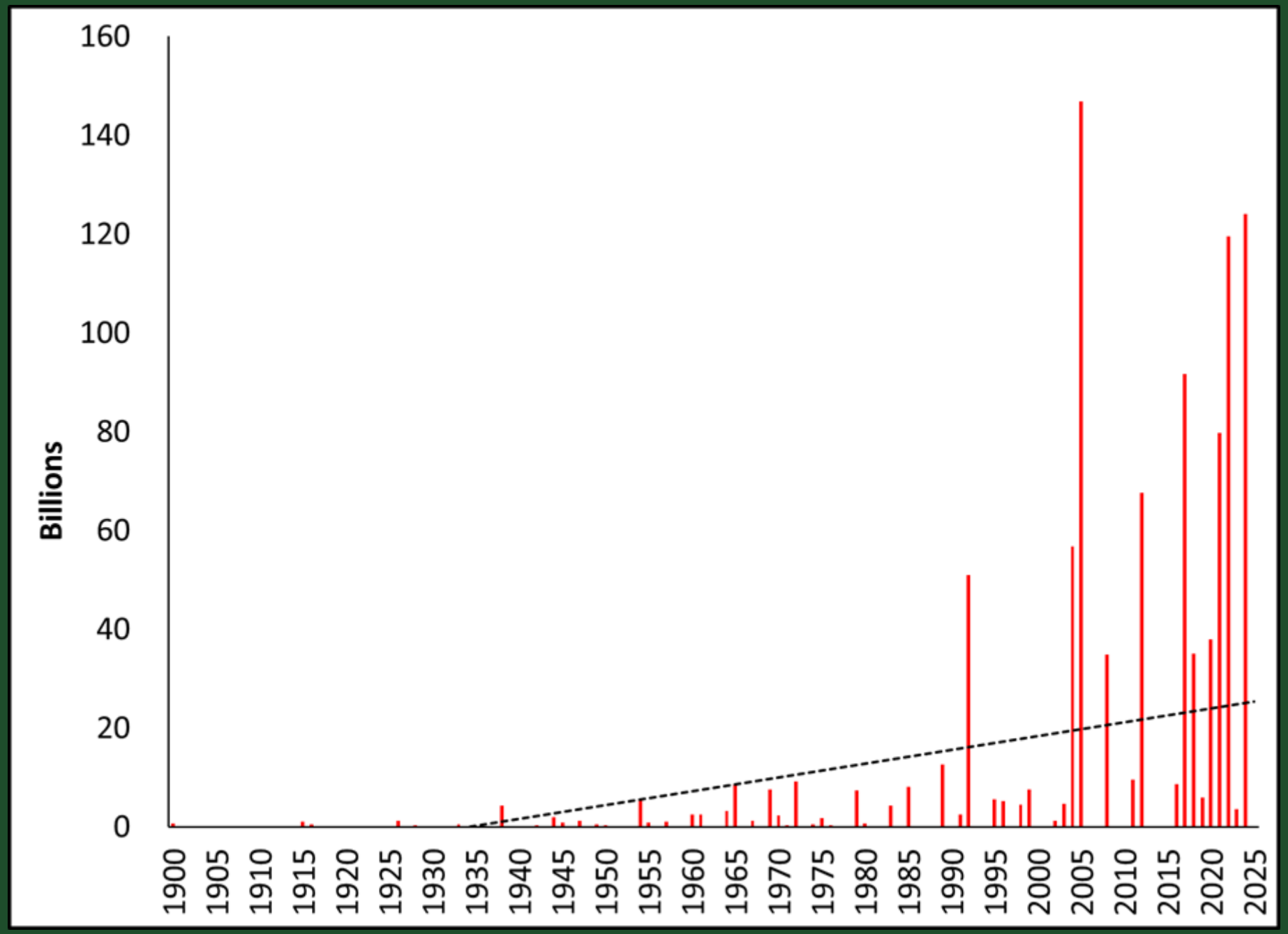
Rapidly Intensifying Hurricanes (>=35 mph 24 hr^{-1}) (1990–2025)



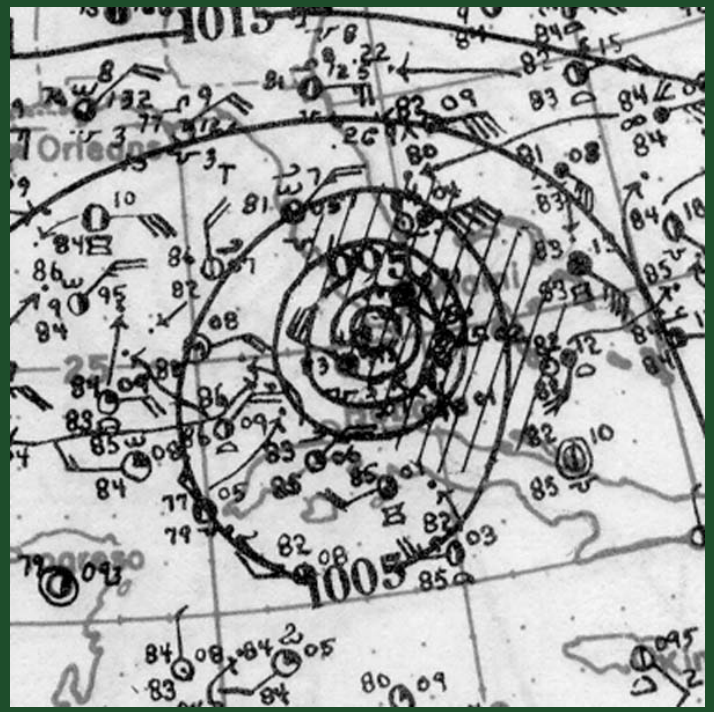
Super Rapidly Intensifying Hurricanes (>=60 mph 24 hr^{-1}) (1990–2025)



Continental US Hurricane Losses (2024 USD) – Adjusted for Inflation



1926 Great Miami Hurricane (145 mph winds, 930 hPa) – Category 4



Miami-Dade County Population Explosion since 1926

Miami-Dade County Population: ~100,000

1926

Miami-Dade County Population: ~2.7 Million

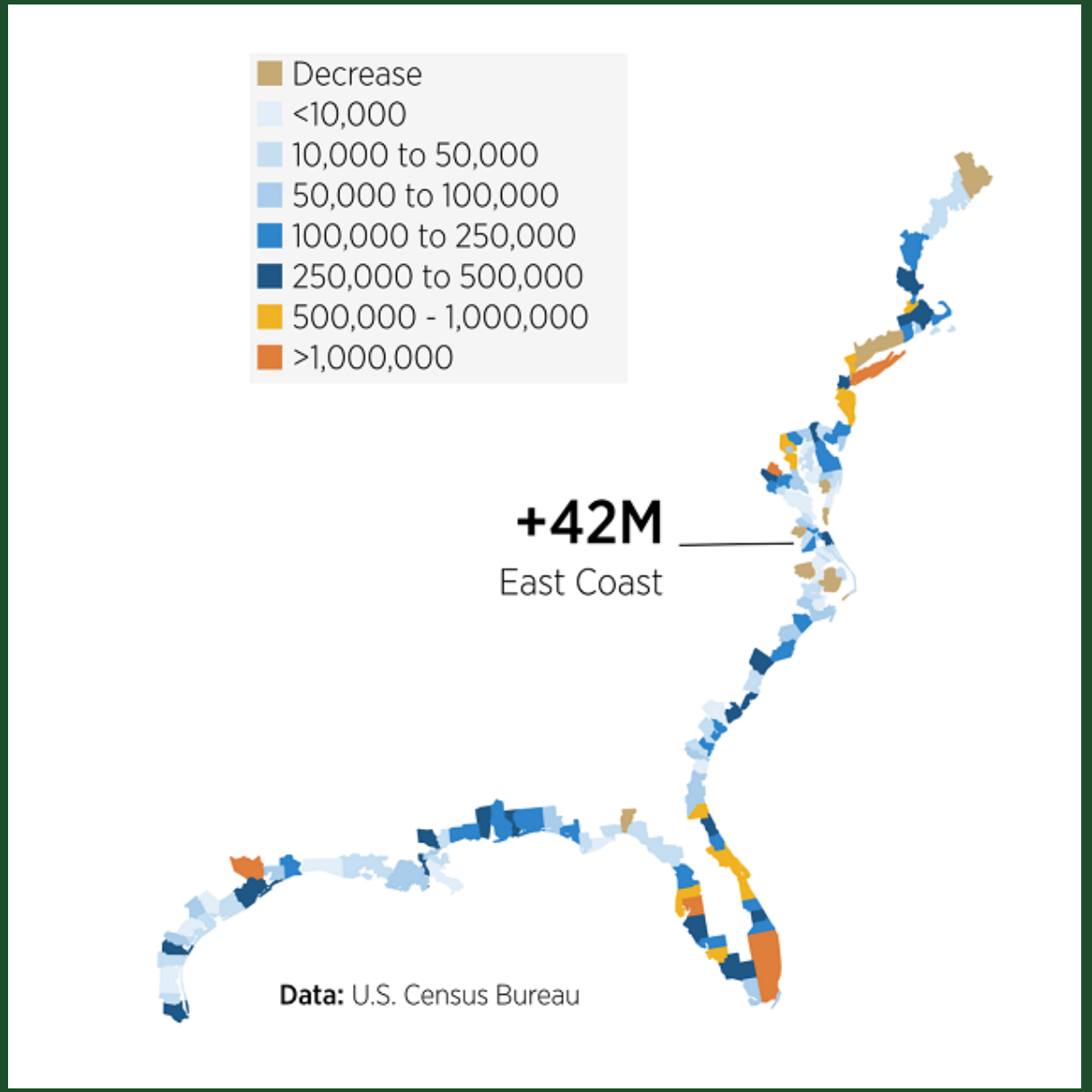
2026

1926 Great Miami Hurricane - >$200 Billion Economic Damage in 2024

Weinkle, J. et al. (2018). Normalized hurricane damage in the continental United States 1900–2017. *Nature Sustainability* 1(12):808-813.

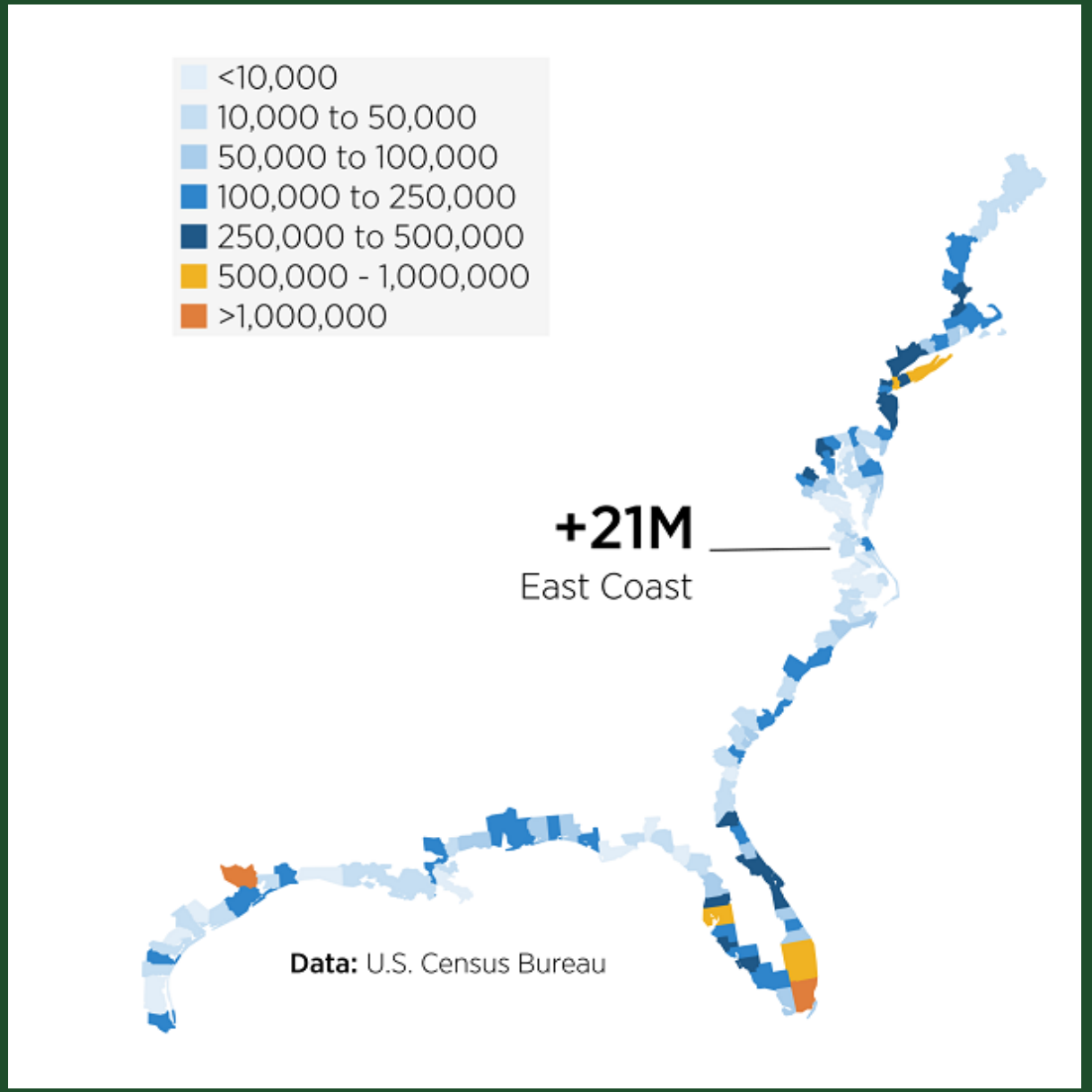
Klotzbach, P. J., Bowen, S. G., Pielke, R., Jr., & Bell, M. M. (2018). Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks, *Bulletin of the American Meteorological Society*, *99*(7), 1359-1376.

US Gulf/East Coast Population Change Since 1900



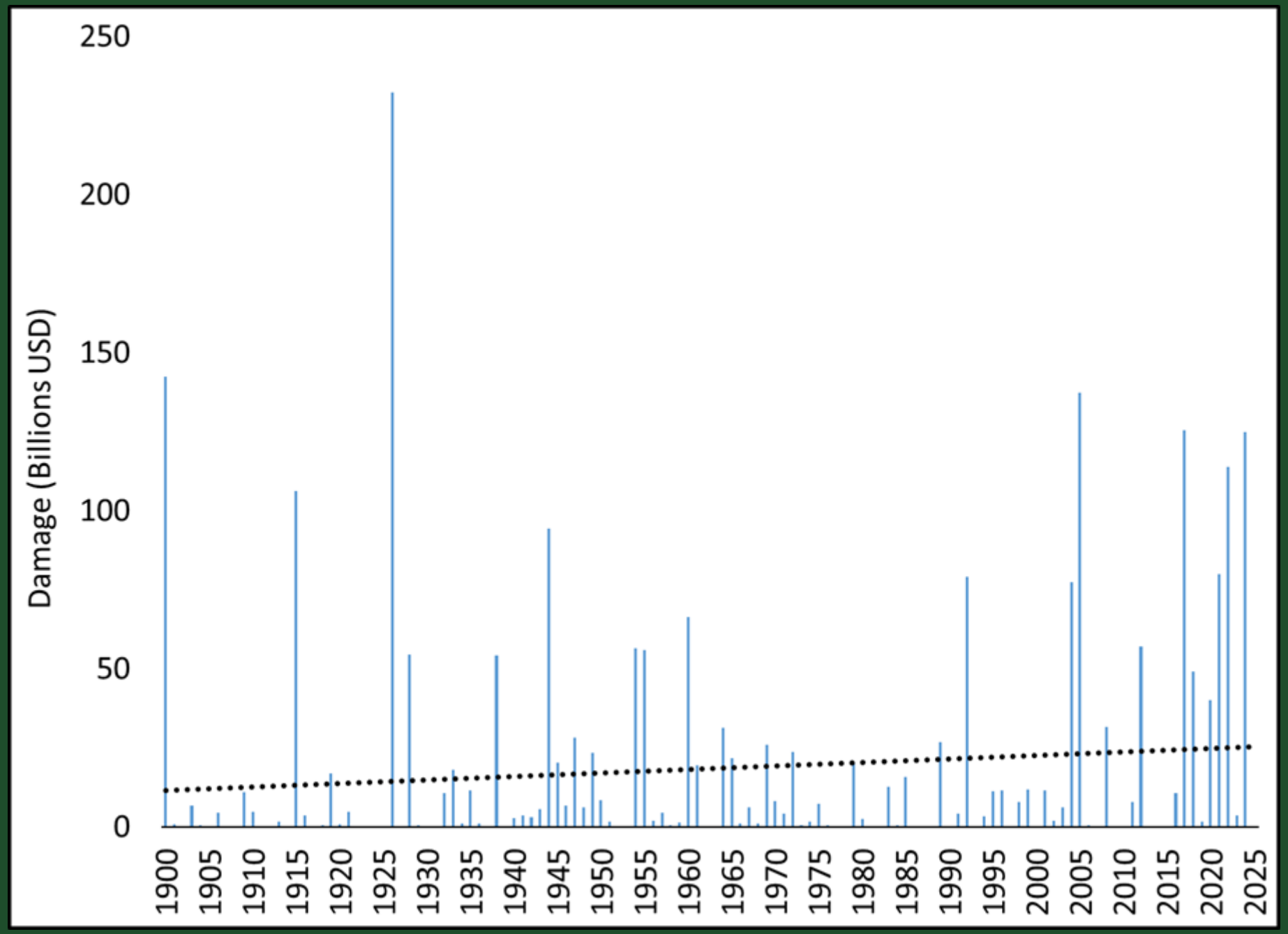
Steve Bowen (Gallagher Re)

US Gulf/East Coast Housing Unit Change Since 1900

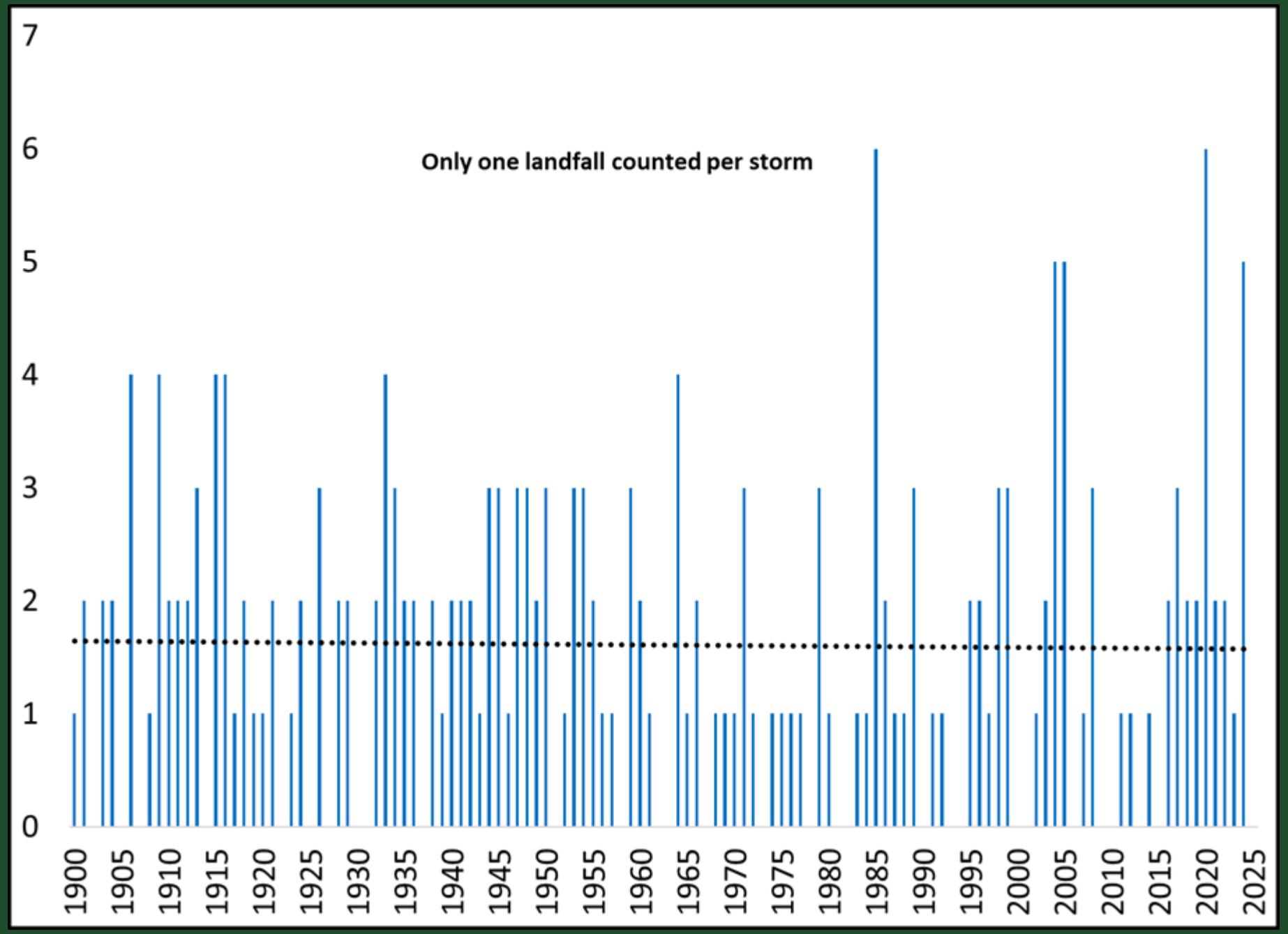


Steve Bowen (Gallagher Re)

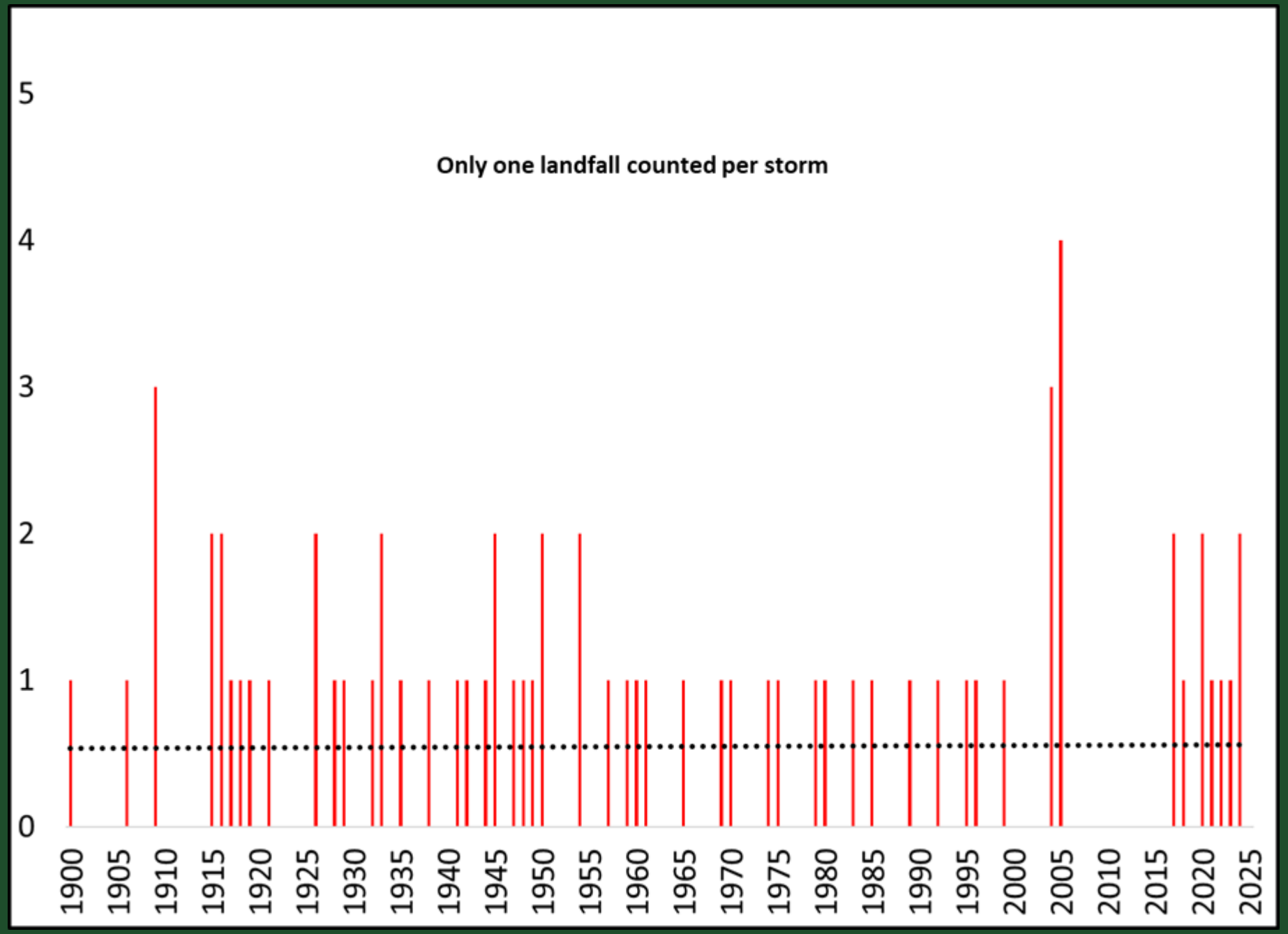
Normalized Continental US Hurricane Losses (1900–2025)



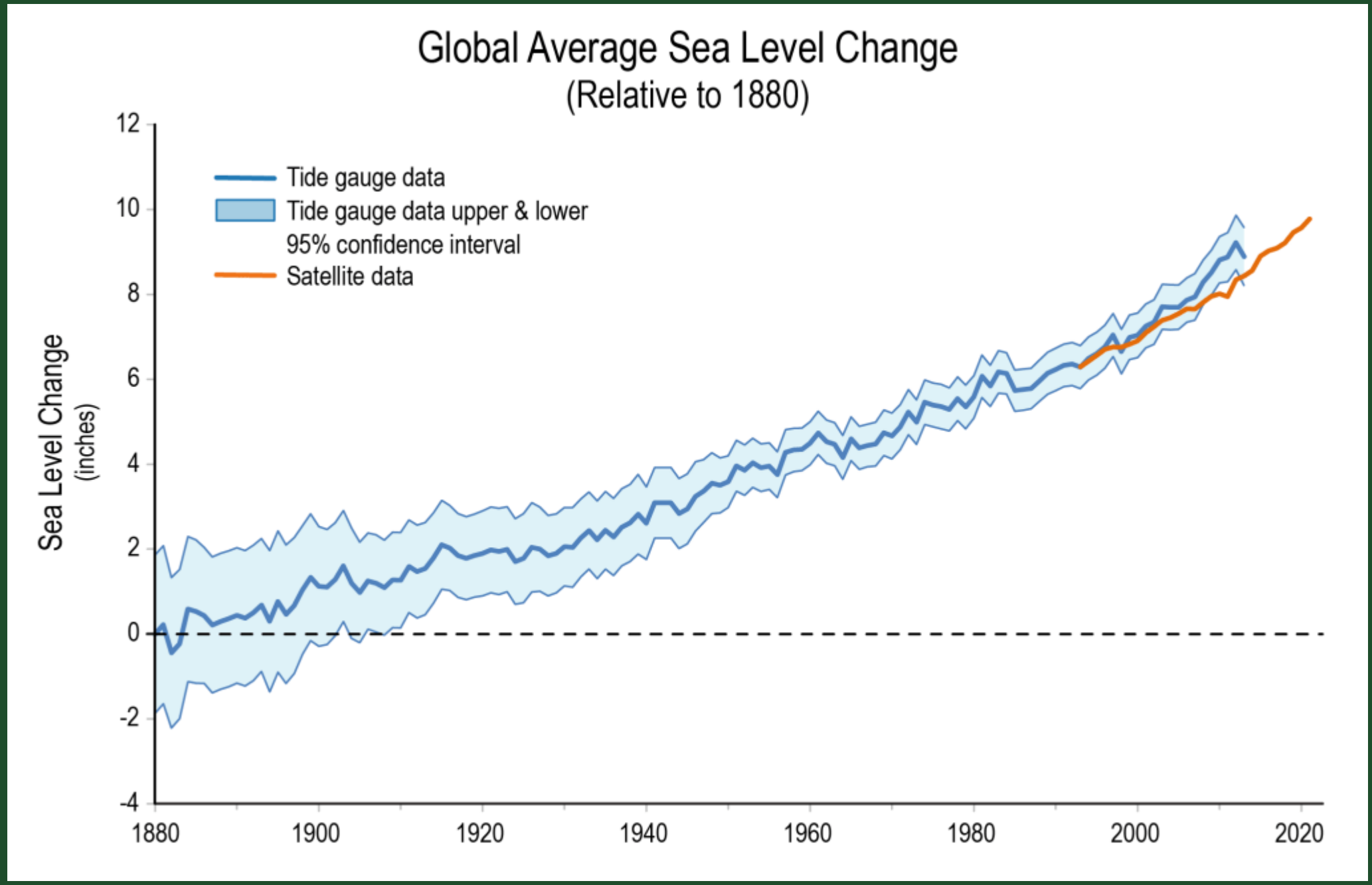
Observed Continental US Landfalling Hurricane Activity (1900–2025)



Observed Continental US Landfalling Major Hurricane Activity (1900–2025)

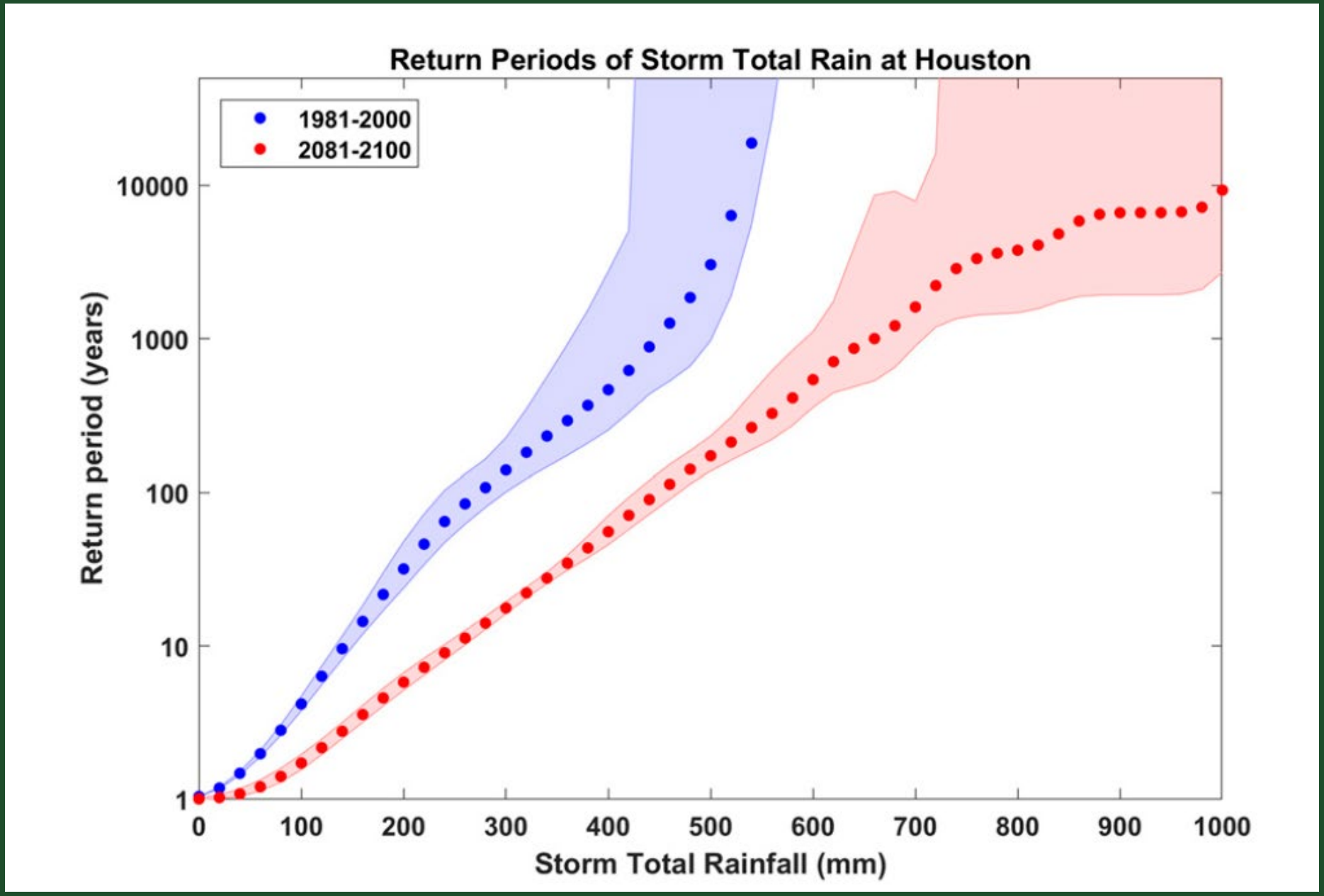


Observed Sea Level Change (1880–2025)



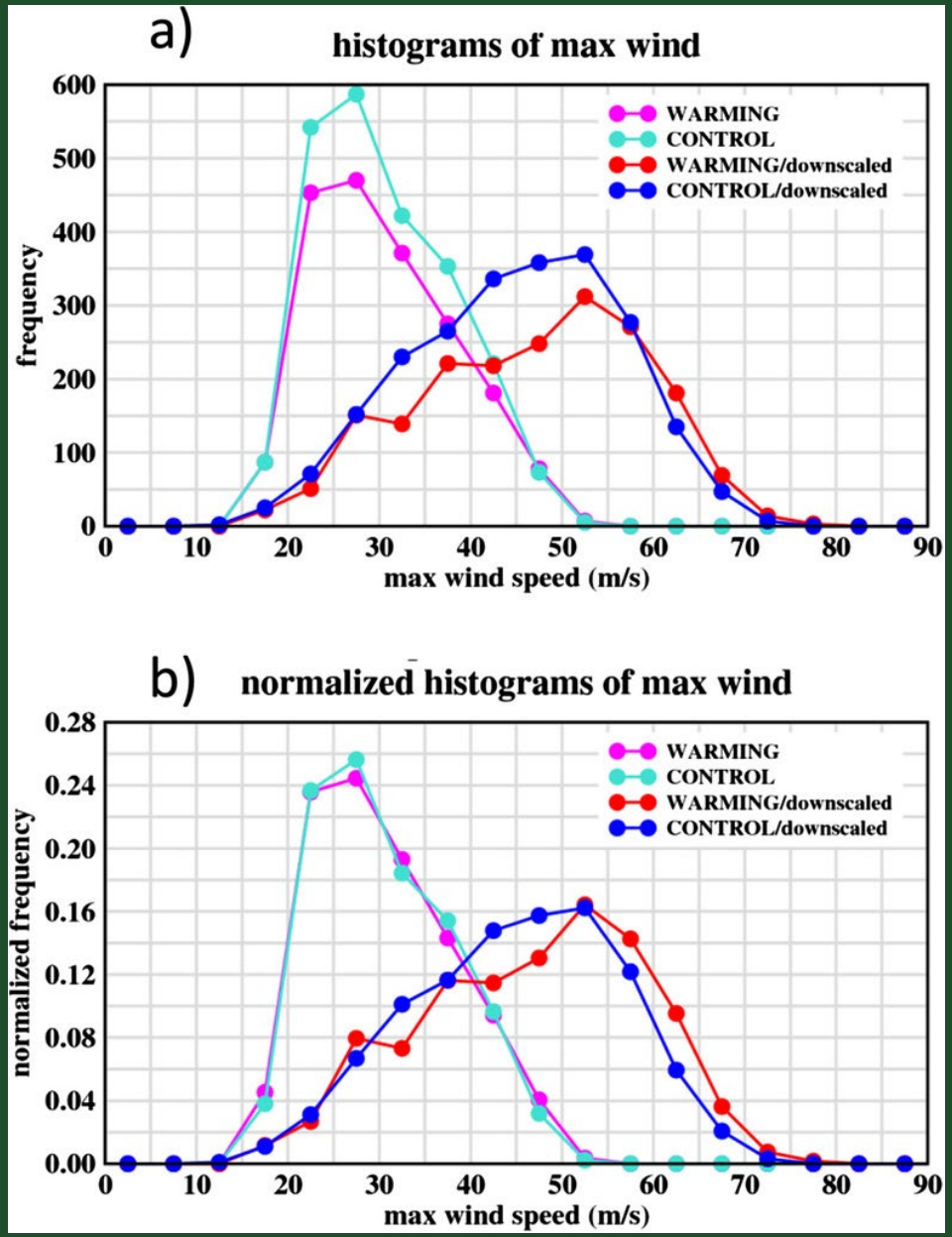
globalchange.gov

Projected Increase in Heavy Rainfall Events



Emanuel et al. (2017)

Late 21st Century Projections of Global Hurricane Intensity



Knutson et al. (2015)

Global Tropical Cyclone Trend Summary

- Global hurricane frequency has trended downward, likely due to long-term trend towards La Niña

- High-end rapid intensification has trended upward, likely due to increasing tropical sea surface temperatures

- No long-term trend in continental US landfalling hurricane frequency

- Inflation-adjusted damage for continental US landfalling hurricanes has skyrocketed, mostly driven by growth in population and wealth along the coastline

Arago's Admonition

"Never, no matter what may be the progress of science, will honest scientific men (or women) who have regard for their reputations venture to predict the weather!"

Contact Info

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