Florida Housing Coalition Hurricane Member Update Webinar

March 4, 2022
Sponsored by Fannie Mae

AGENDA

- Announcements
- U.S. Hurricane Damage Drivers and Atlantic Basin Seasonal Hurricane Prediction

FEMA

ebrief

HMA
Hazard Mitigation Assistance

You're Invited: 2022 Hazard Mitigation Grant Program Webinar Series

If you are interested in Hazard Mitigation Grant Program (HMGP) funding you may find FEMA's upcoming webinar series helpful. Next month FEMA is hosting an informative webinar series that will bring together subject-matter experts and practitioners to provide technical information, best practices, and tools and resources for submitting a successful HMGP application. The webinars are being designed for leaders in states, local communities, tribes and territories, as well as private sector entities, private non-profit organizations, and individuals.

HMGP 101 Program Overview
March 10, 2:30-4:00 p.m. Eastern Time

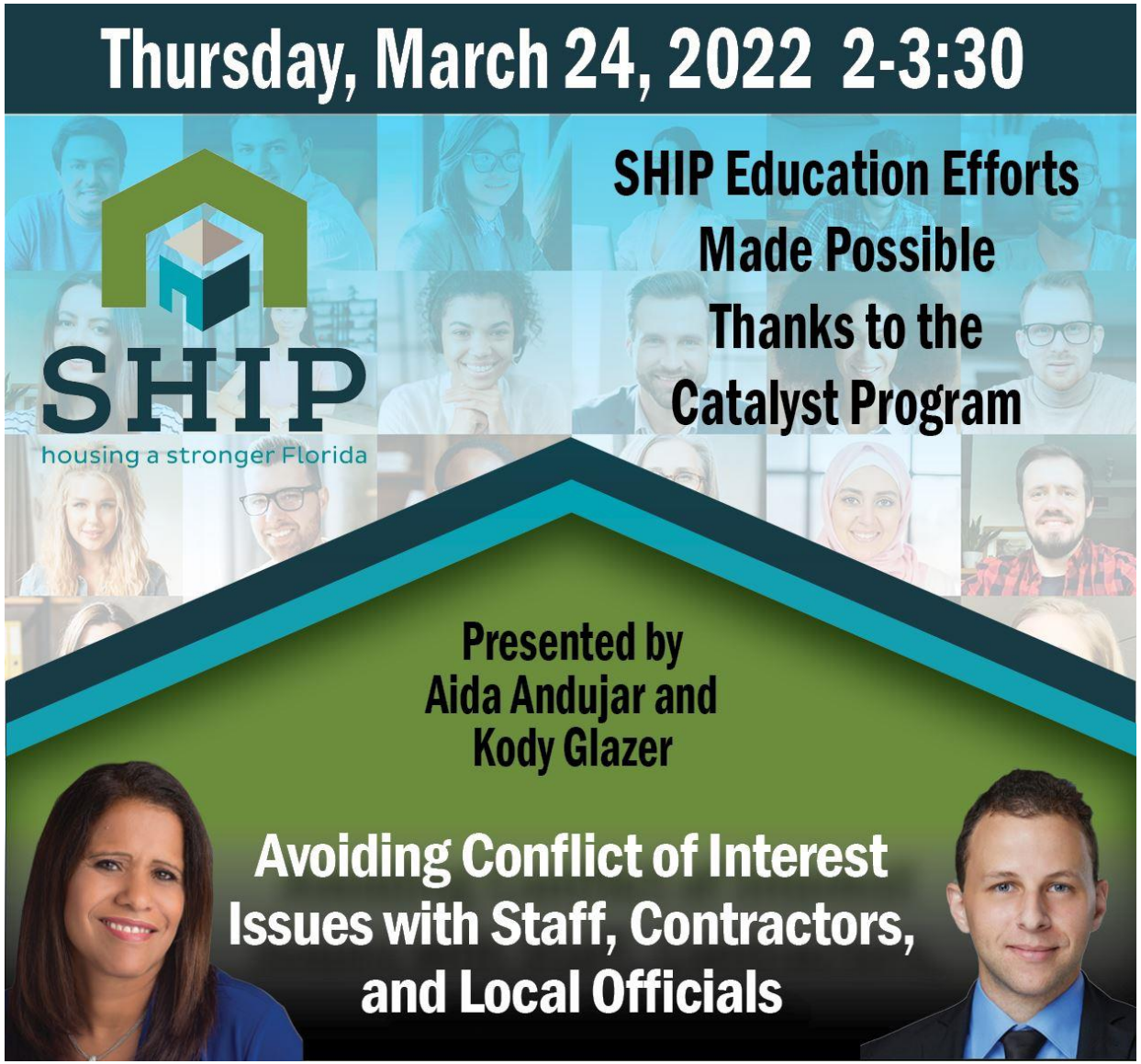
https://femacqpub1.connectsolutions.com/content/connect/c1/7/en/events/catalog.html?folder-id=221257069&from-origin=fema.connectsolutions.com

Training Announcement

Affordable Housing Funding Sources Part 1:

March 15, 2022 at 2:00pm

Register at
https://attendee.gotowebinar.com/register/9195494335965794831



Register at
https://attendee.gotowebinar.com/register/3874941076424523279

Register at
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi5pdjygZv2AhVKDkQIHfnaBwUQFnoECAgQAQ&url=https%3A%2F%2Fflghc.org%2Fregistration%2F&usg=AOvVaw0BWfM-8xSuS8Chm2kblNMQ

2022 ANNUAL STATEWIDE AFFORDABLE HOUSING CONFERENCE

HOME **MATTERS** IN FLORIDA

Hosted by the FLORIDA HOUSING COALITION

August 29th – August 31st

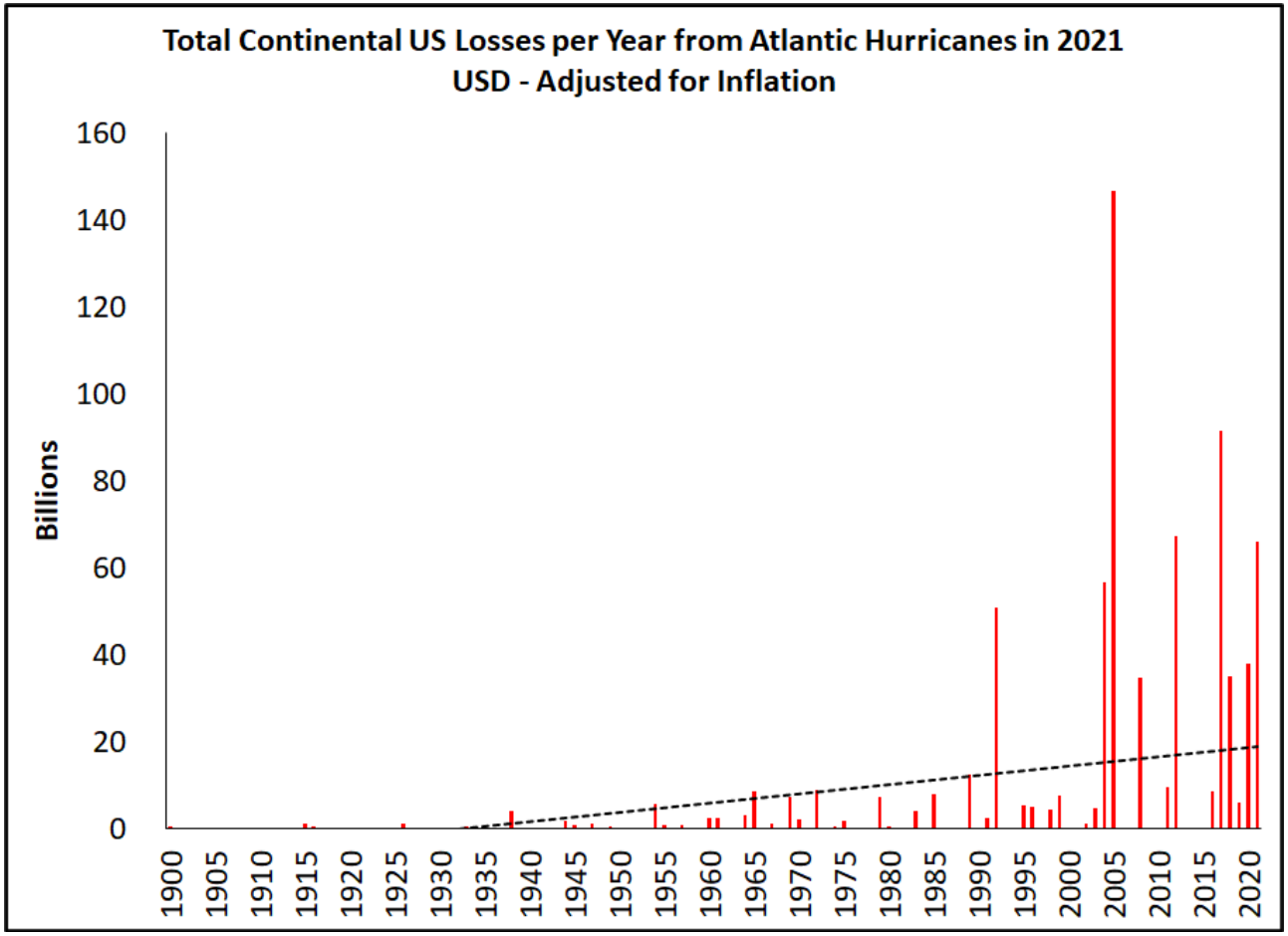
IN-PERSON AT THE ROSEN CENTRE, ORLANDO FL


U.S. Hurricane Damage Drivers and Atlantic Basin Seasonal Hurricane Prediction
Phil Klotzbach
March 4, 2022
Florida Housing Coalition Webinar
CIRA
RAMMB

Outline

- Past and potential future trends in US hurricane damage
- New hurricane categorization scale
- 2021 Atlantic hurricane season recap
- 2022 Atlantic hurricane season – preliminary thoughts

Continental US Hurricane Damage (1900-2021) – Adjusted for Inflation



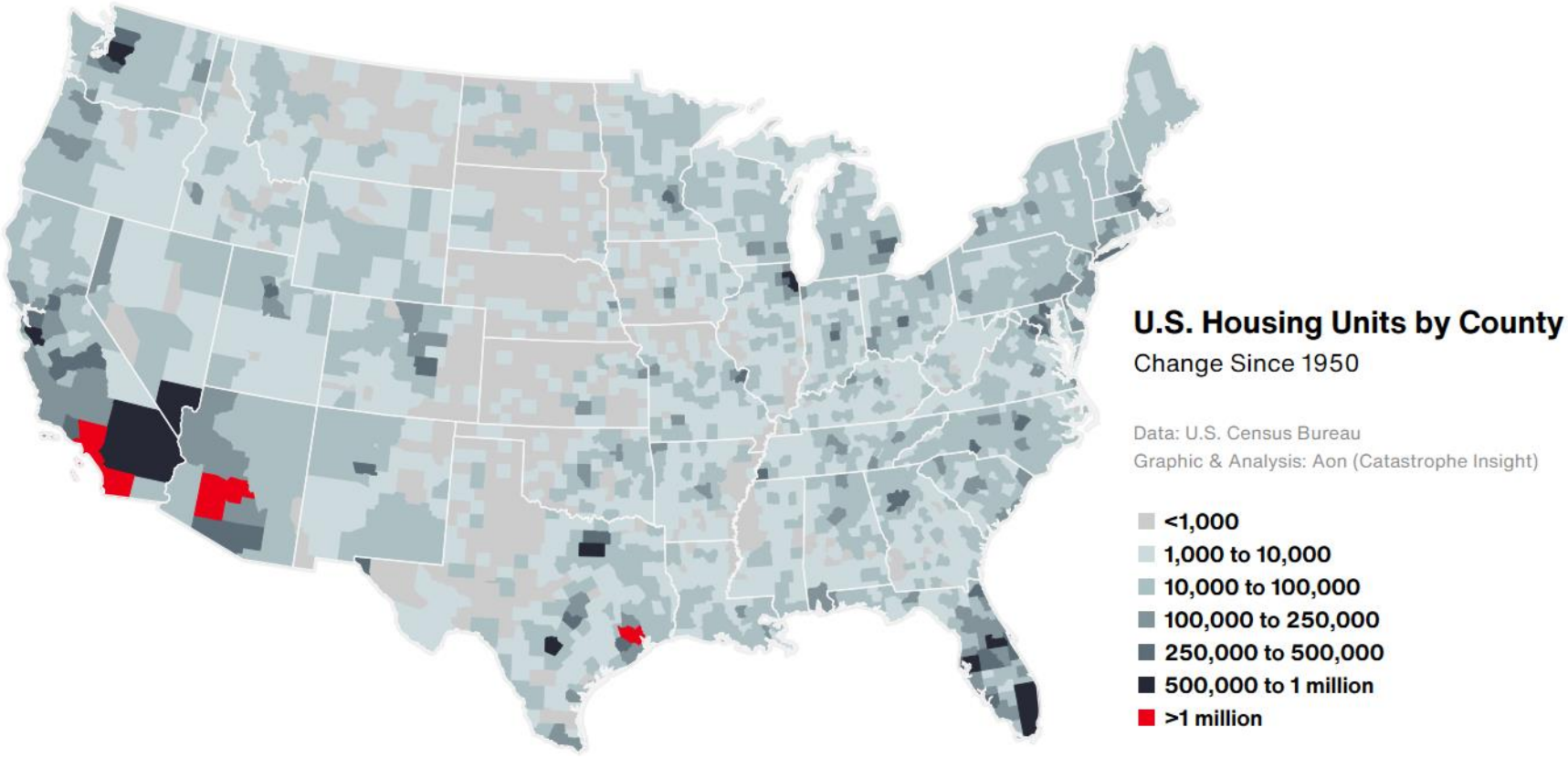
US Coastal Population Change Since 1900

U.S. Coastal Population
Net Change Since 1900

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

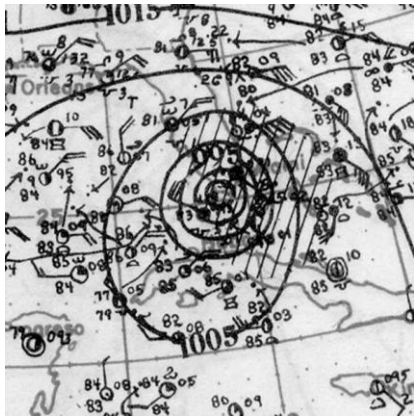
Steve Bowen (Aon)

US Housing Units by County (Change Since 1950)



Steve Bowen (Aon)

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

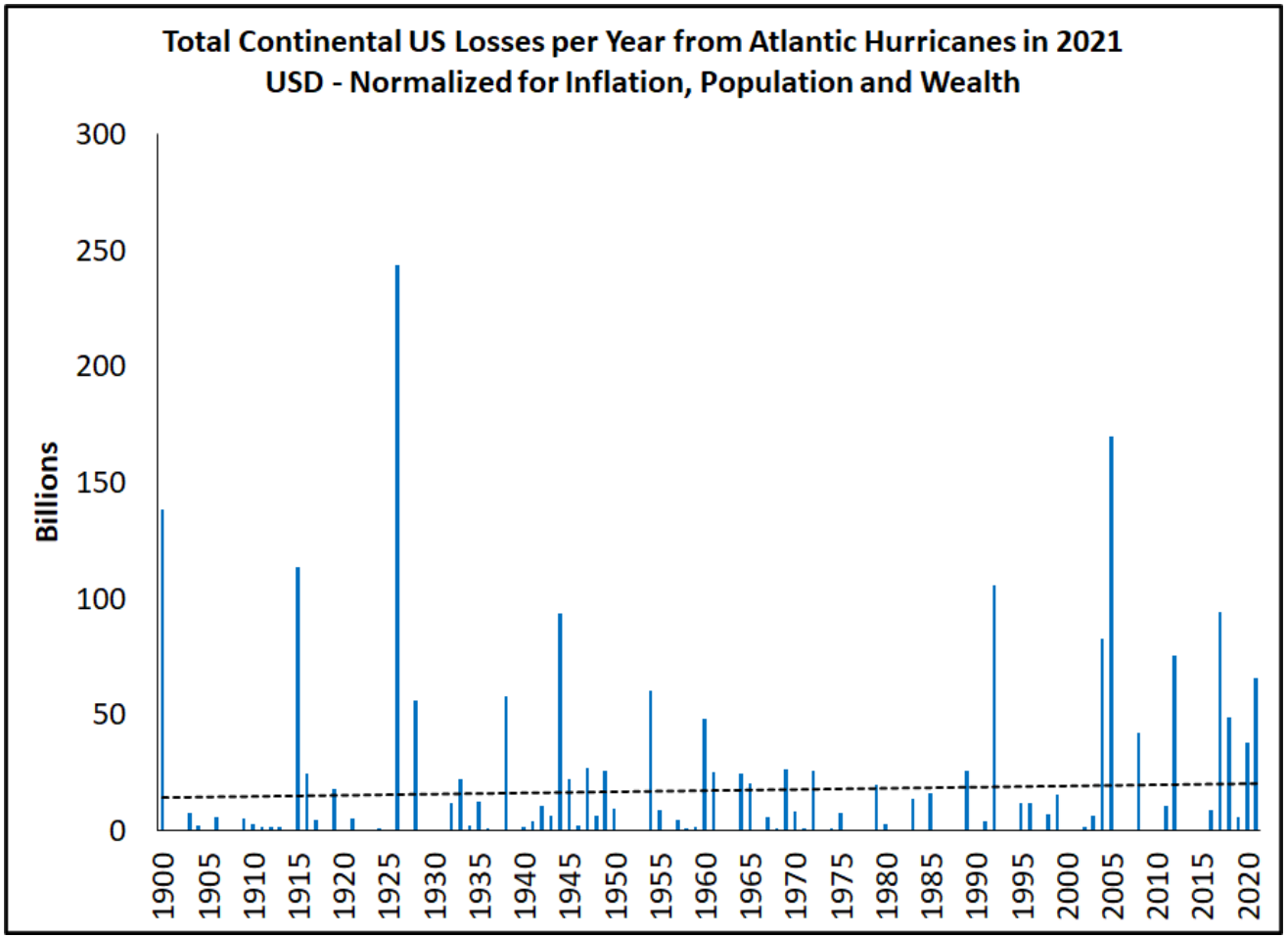
2020

1926 Great Miami Hurricane - >$222 Billion Economic Damage in 2020

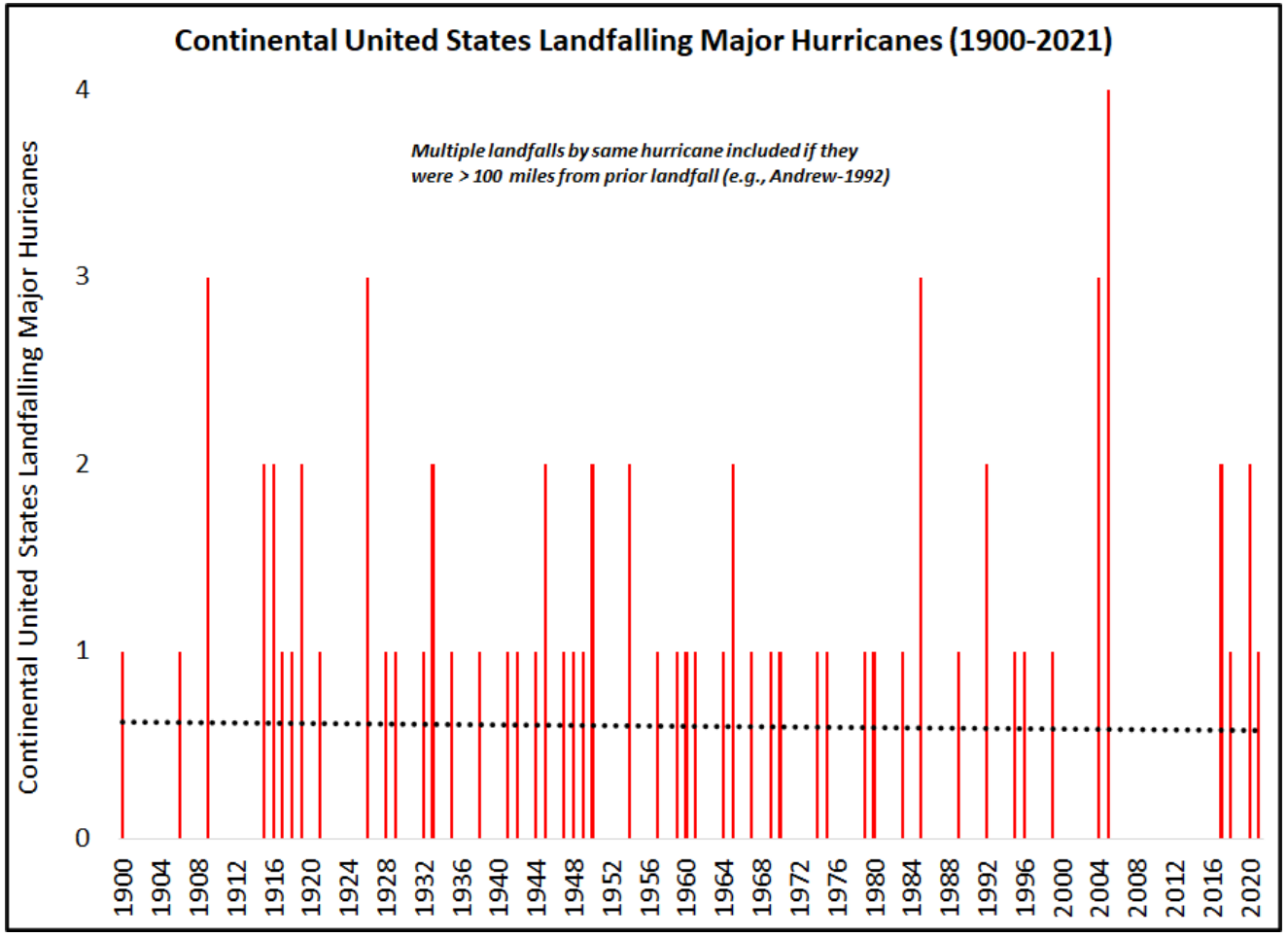
Weinkle, J. et al. (2018). Normalized hurricane damage in the continental United States 1900–2017. *Nature Sustainability* 1(12):808-813.

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.

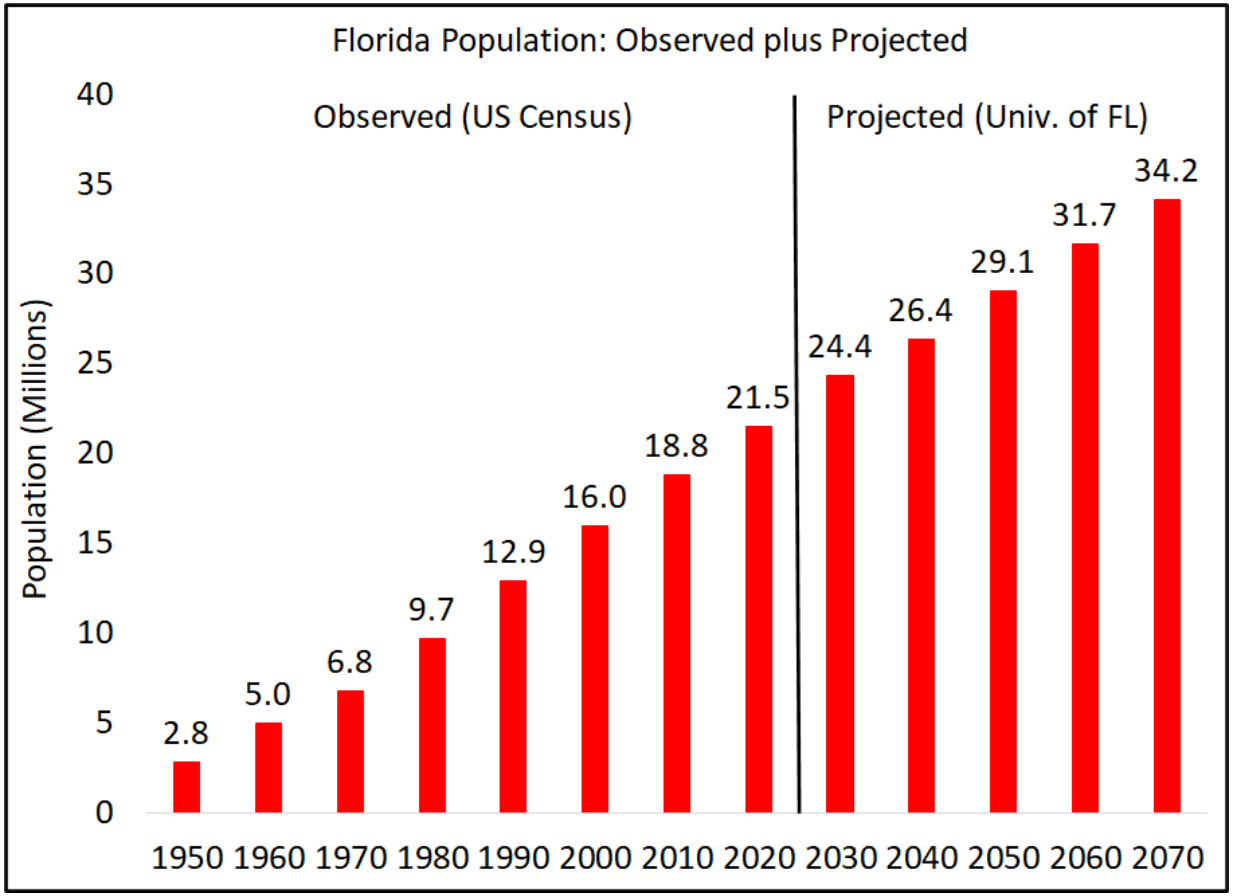
Normalized Continental US Losses (1900-2021)



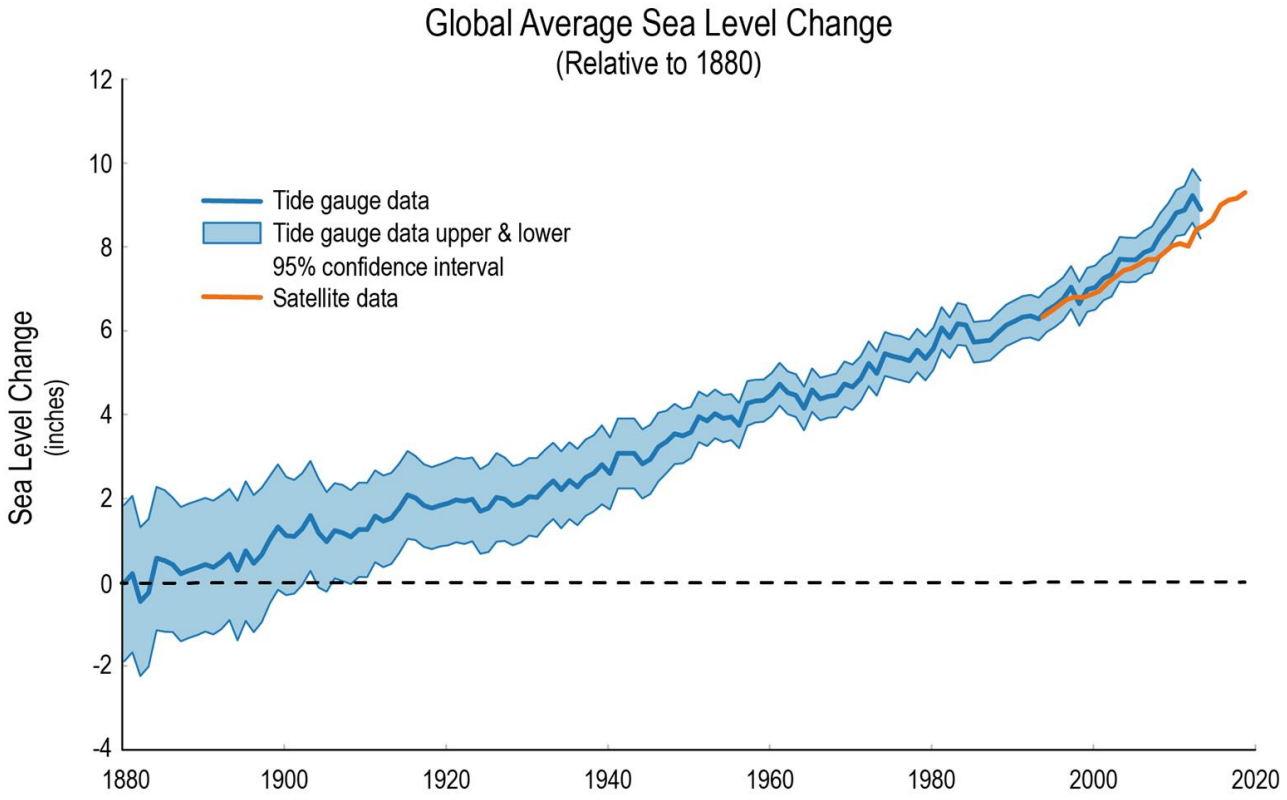
Observed Continental US Landfalling Hurricane Activity (1900-2021)



Observed and Projected Florida Population (1950-2070)

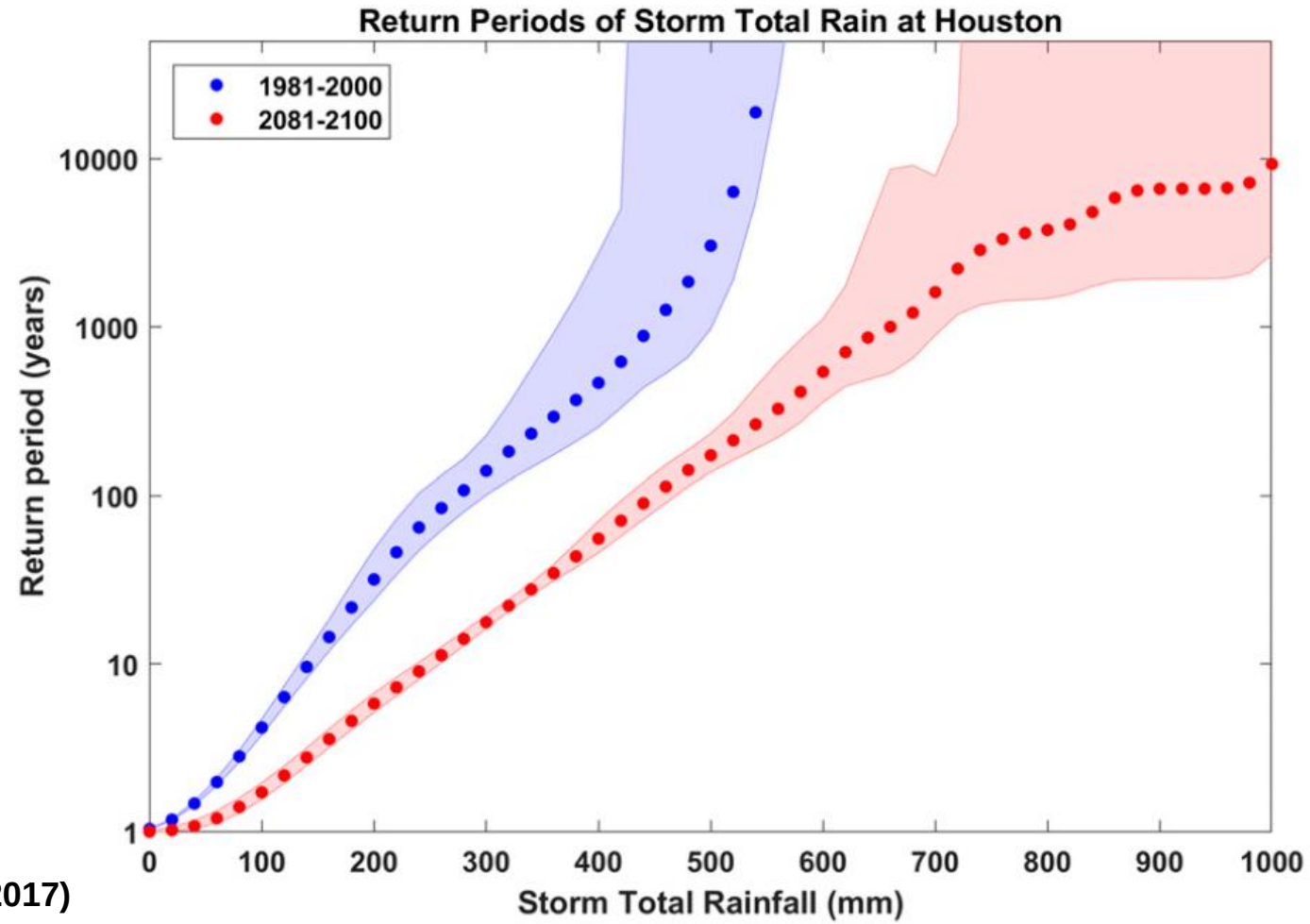


Observed Sea Level Change (1880-2020)



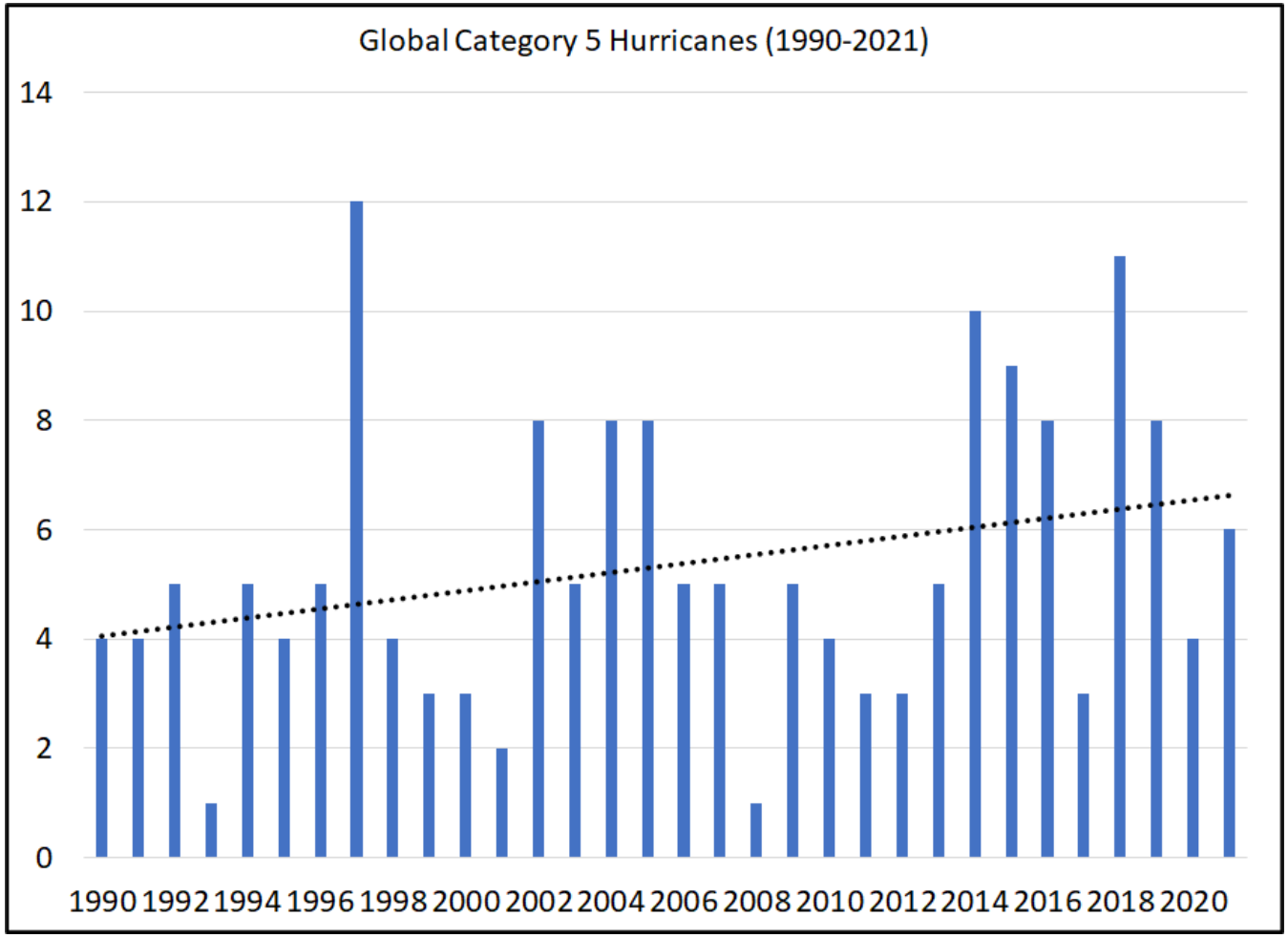
globalchange.gov

Projected Increase in Heavy Rainfall Events



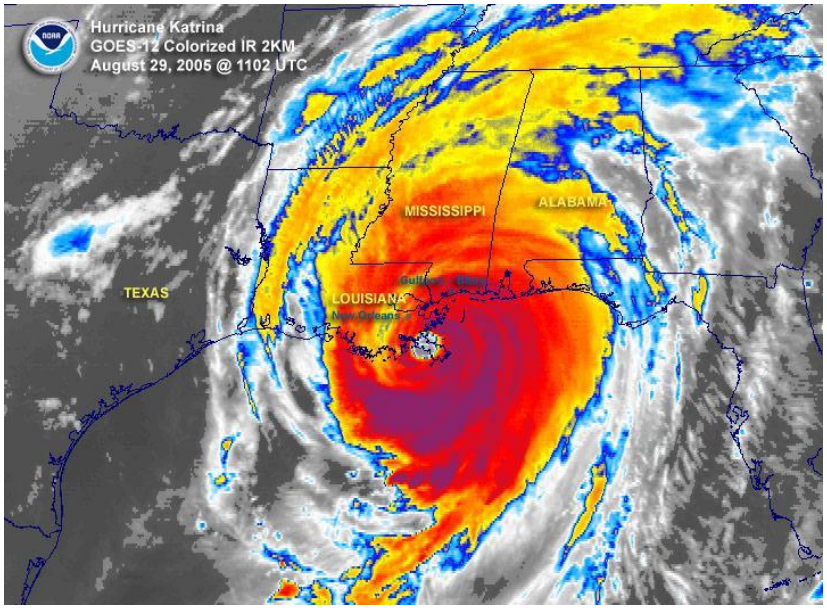
Emanuel et al. (2017)

Increasing Trend in Category 5 Hurricanes (>156 mph winds)



Which Hurricane Had Higher Damage Potential?

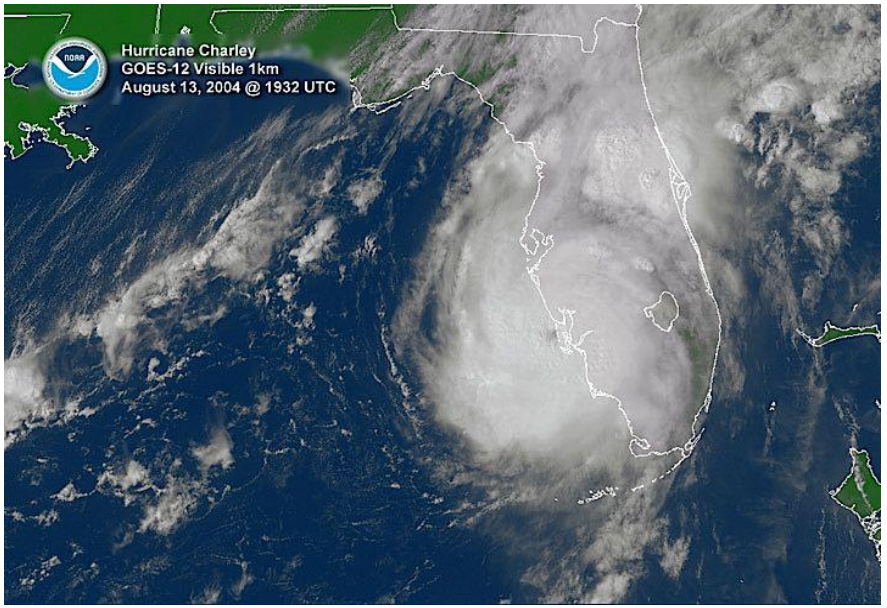
Hurricane Katrina (2005) – Cat. 3
125 mph, 920 hPa



Average 50 kt wind radii: ~105 nm

Maximum Storm Surge: ~28 ft

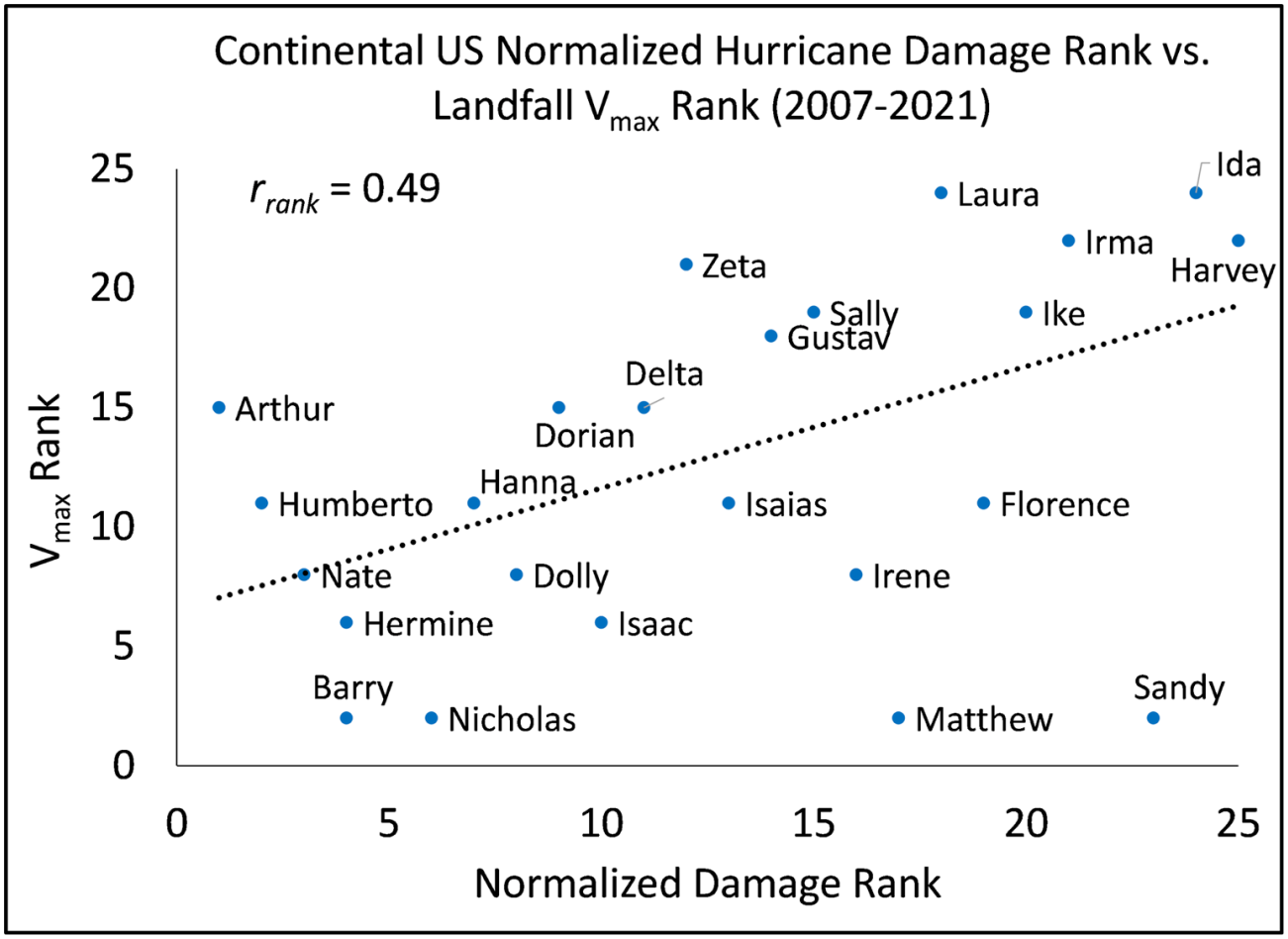
Hurricane Charley (2004) – Cat. 4
150 mph, 941 hPa



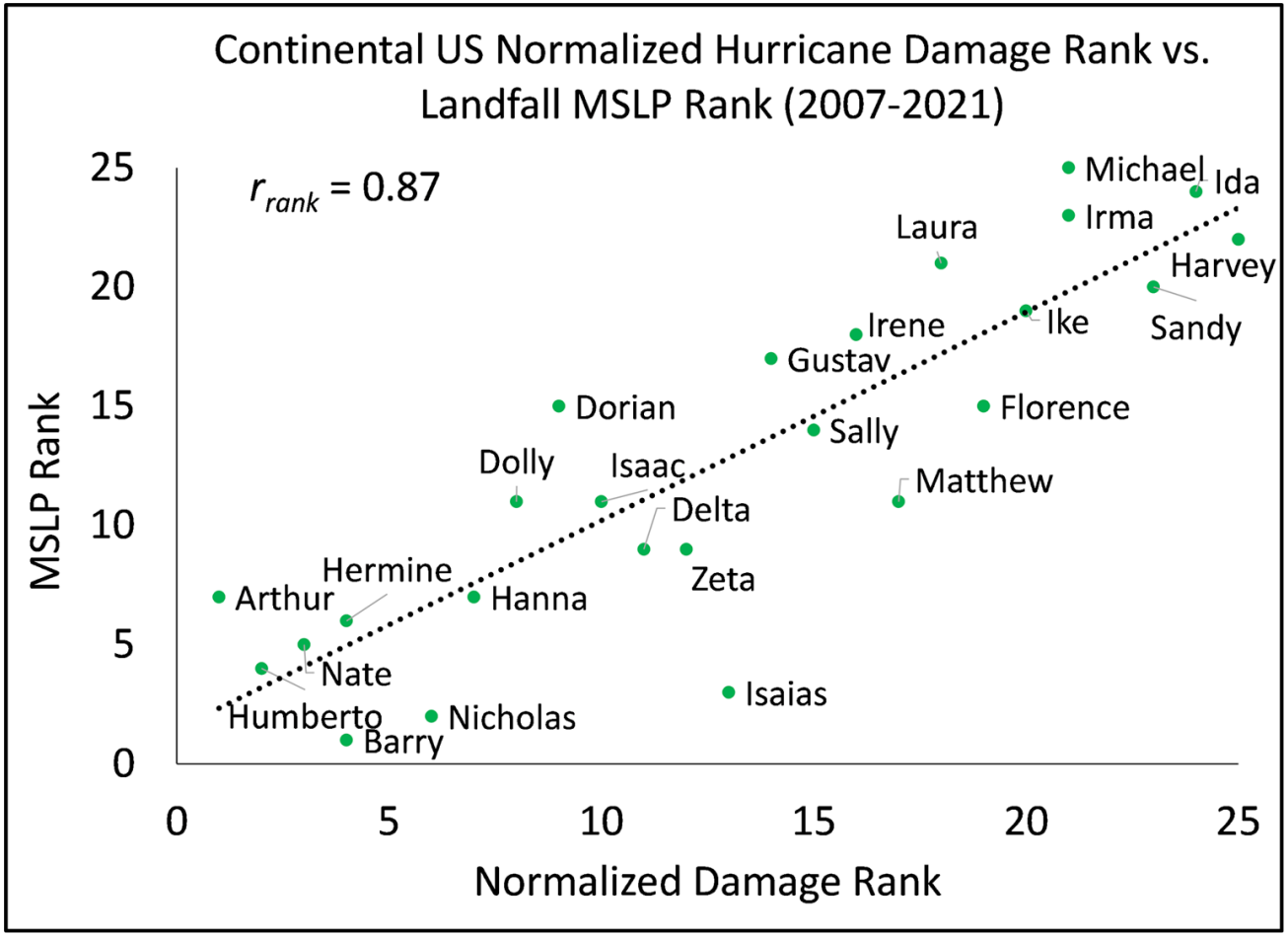
Average 50 kt wind radii: ~35 nm

Maximum Storm Surge: ~7 ft

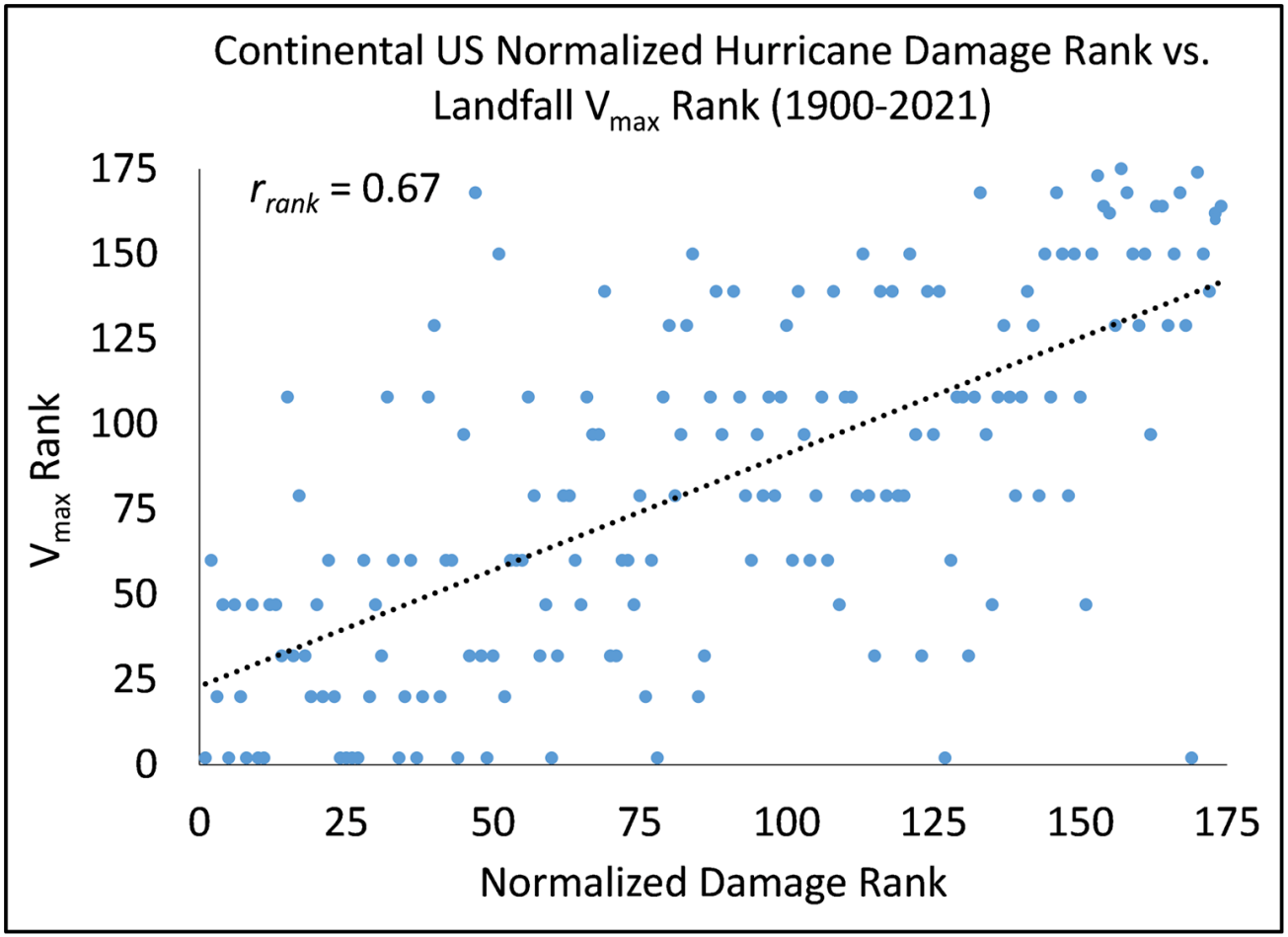
Continental US Relationship between Wind and Damage (2007-2021)



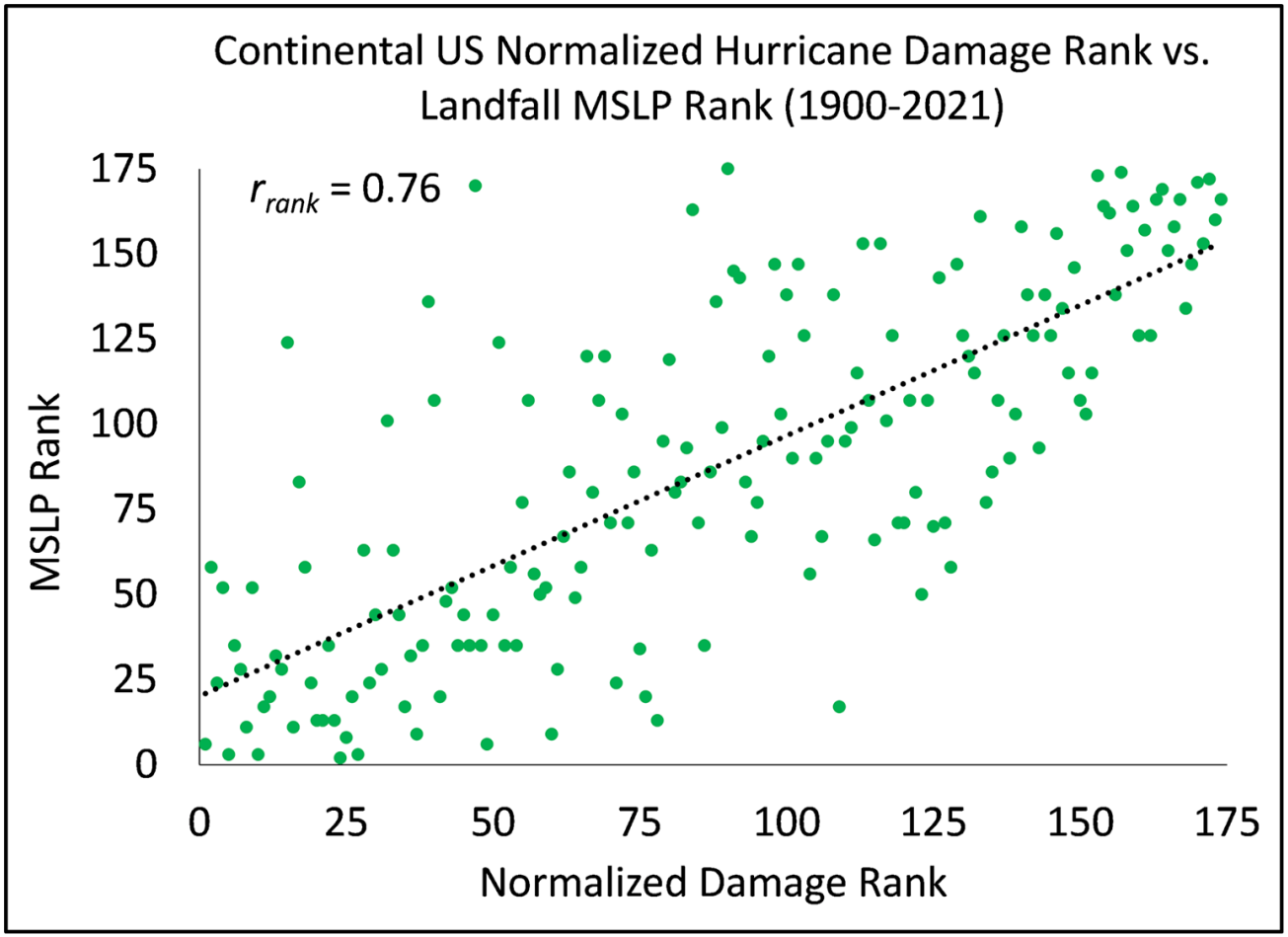
Continental US Relationship between Pressure and Damage (2007-2021)



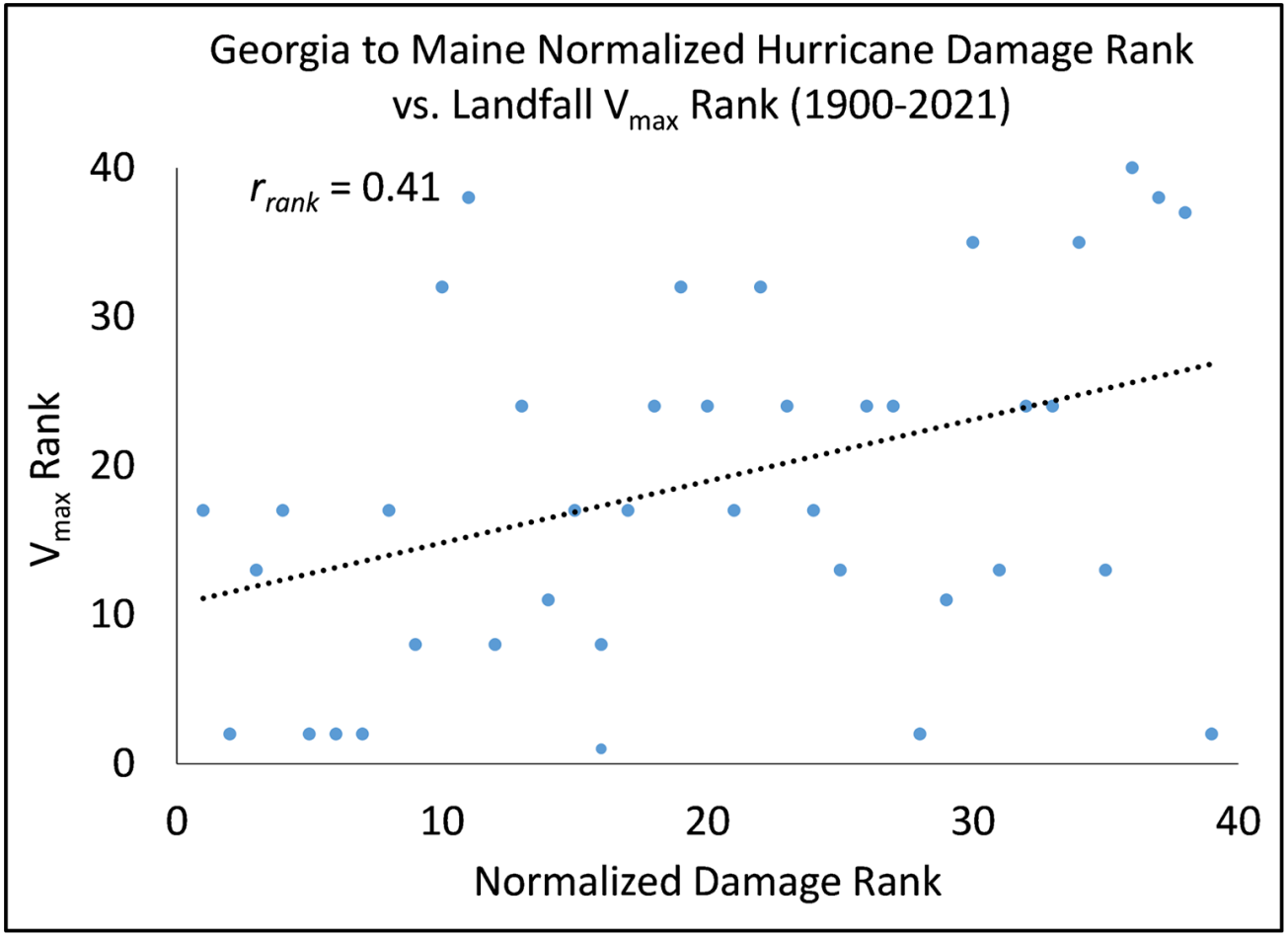
Continental US Relationship between Wind and Damage (1900-2021)



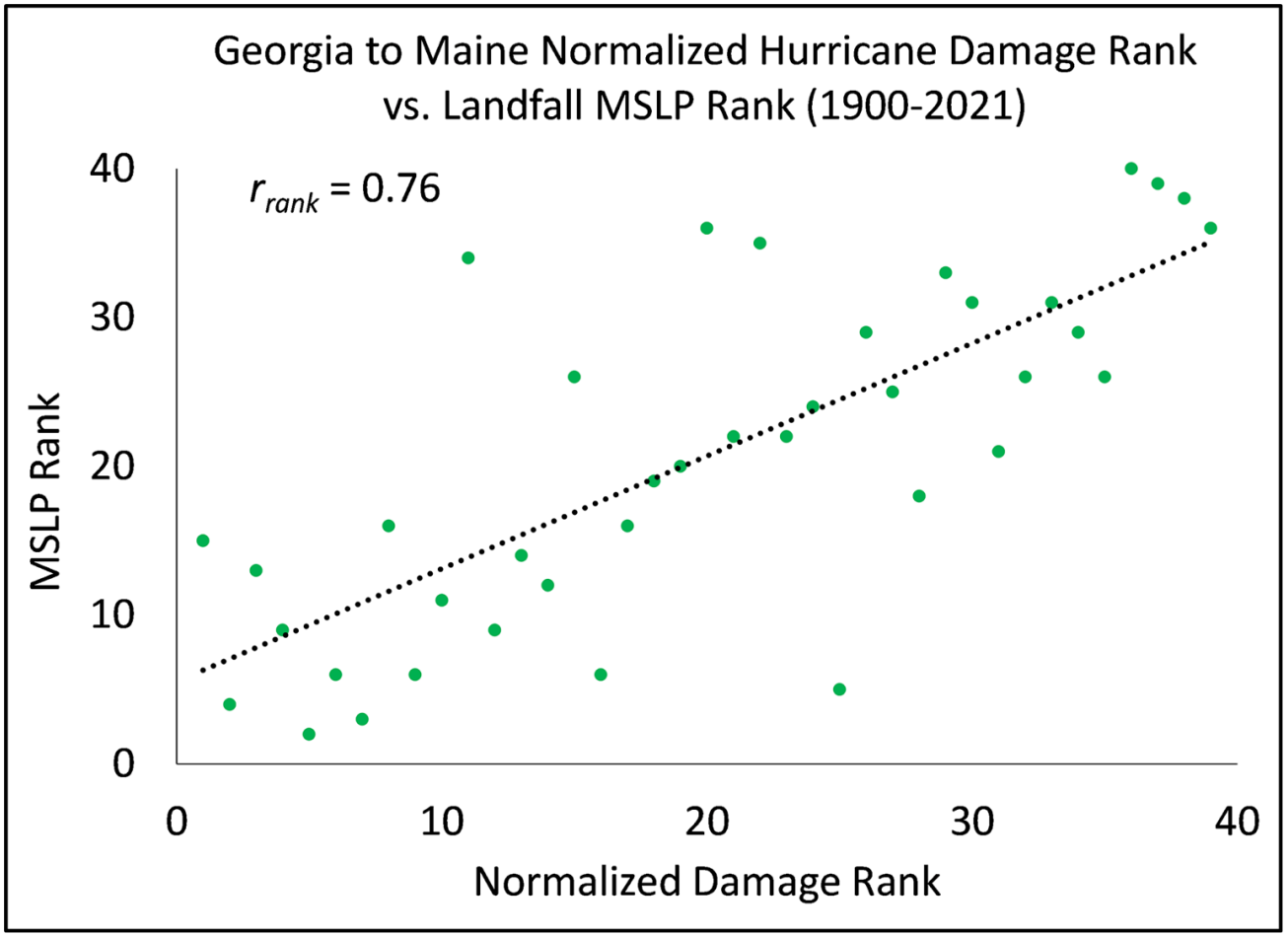
Continental US Relationship between Pressure and Damage (1900-2021)



Georgia to Maine Relationship between Wind and Damage (1900-2021)



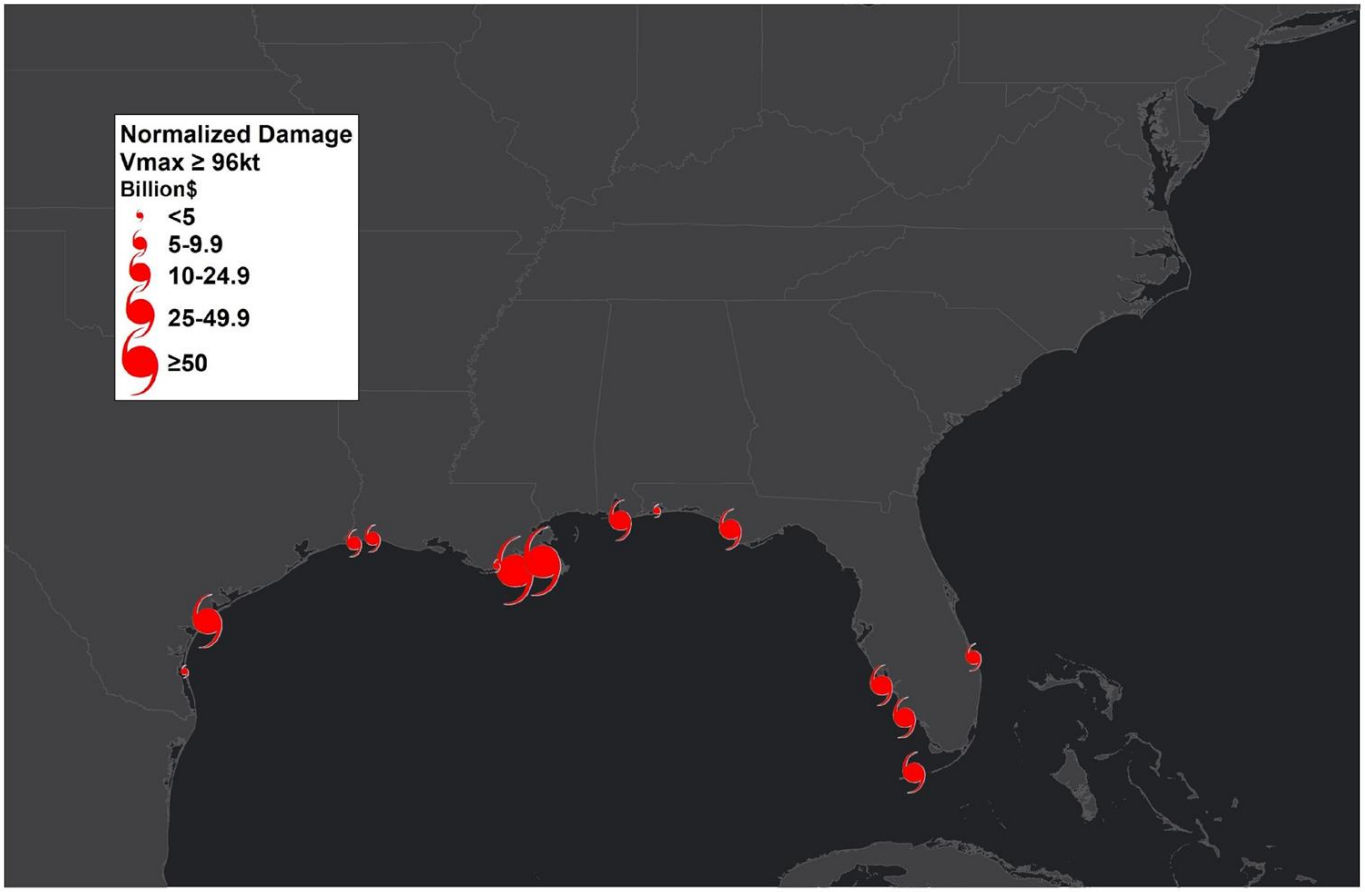
Georgia to Maine Relationship between Pressure and Damage (1900-2021)



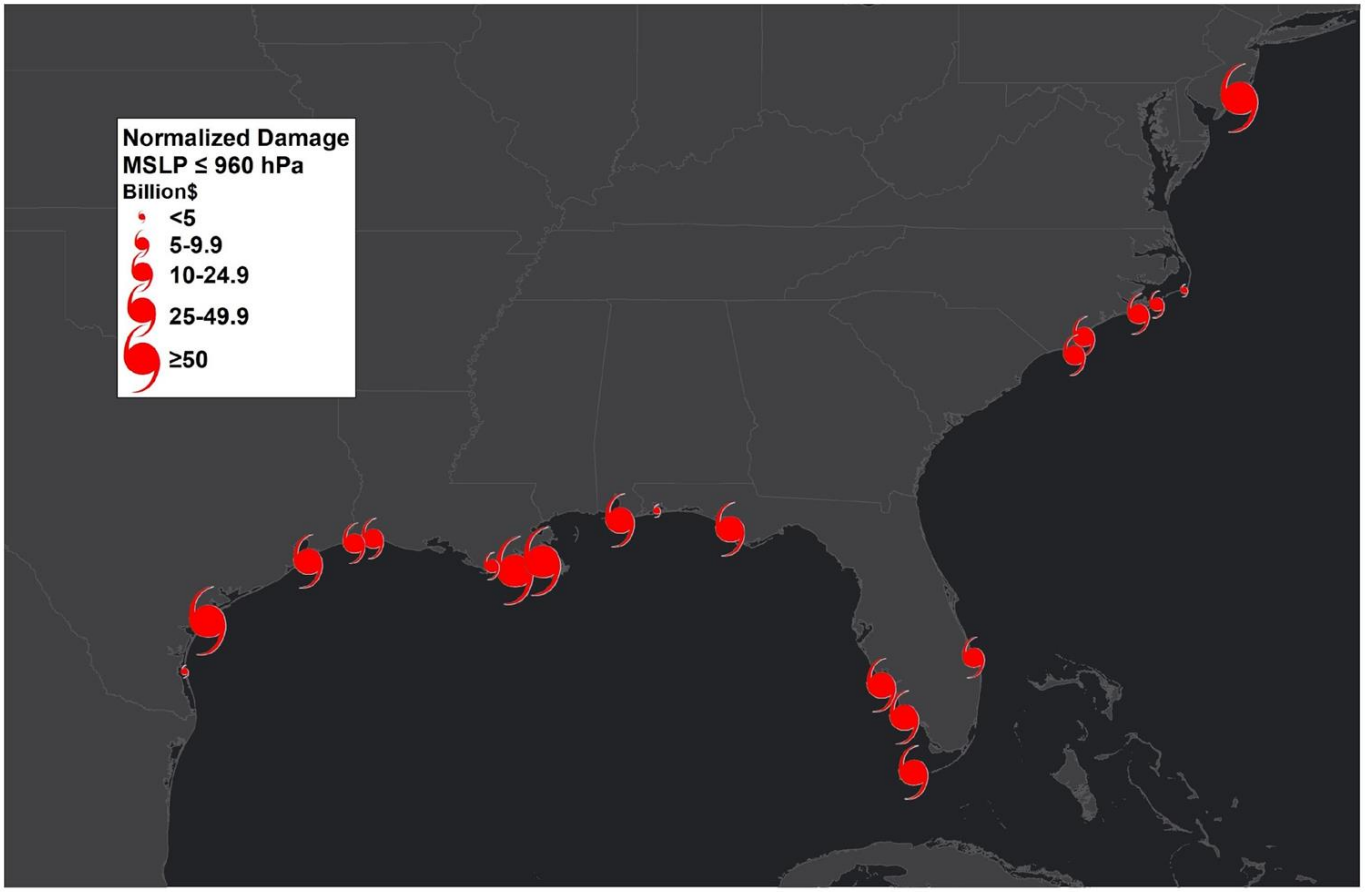
Saffir-Simpson Scale (Includes Proposed MSLP Addition)

Category	V_{max} (kt)	Revised MSLP (hPa)	Original MSLP (hPa)
1	64-82 (52%)	976-990 (55%)	>980 (n/a)
2	83-95 (31%)	961-975 (32%)	965-979 (38%)
3	96-112 (21%)	946-960 (20%)	945-964 (24%)
4	113-136 (13%)	926-945 (12%)	920-944 (12%)
5	>=137 (4%)	<=925 (4%)	<=919 (3%)

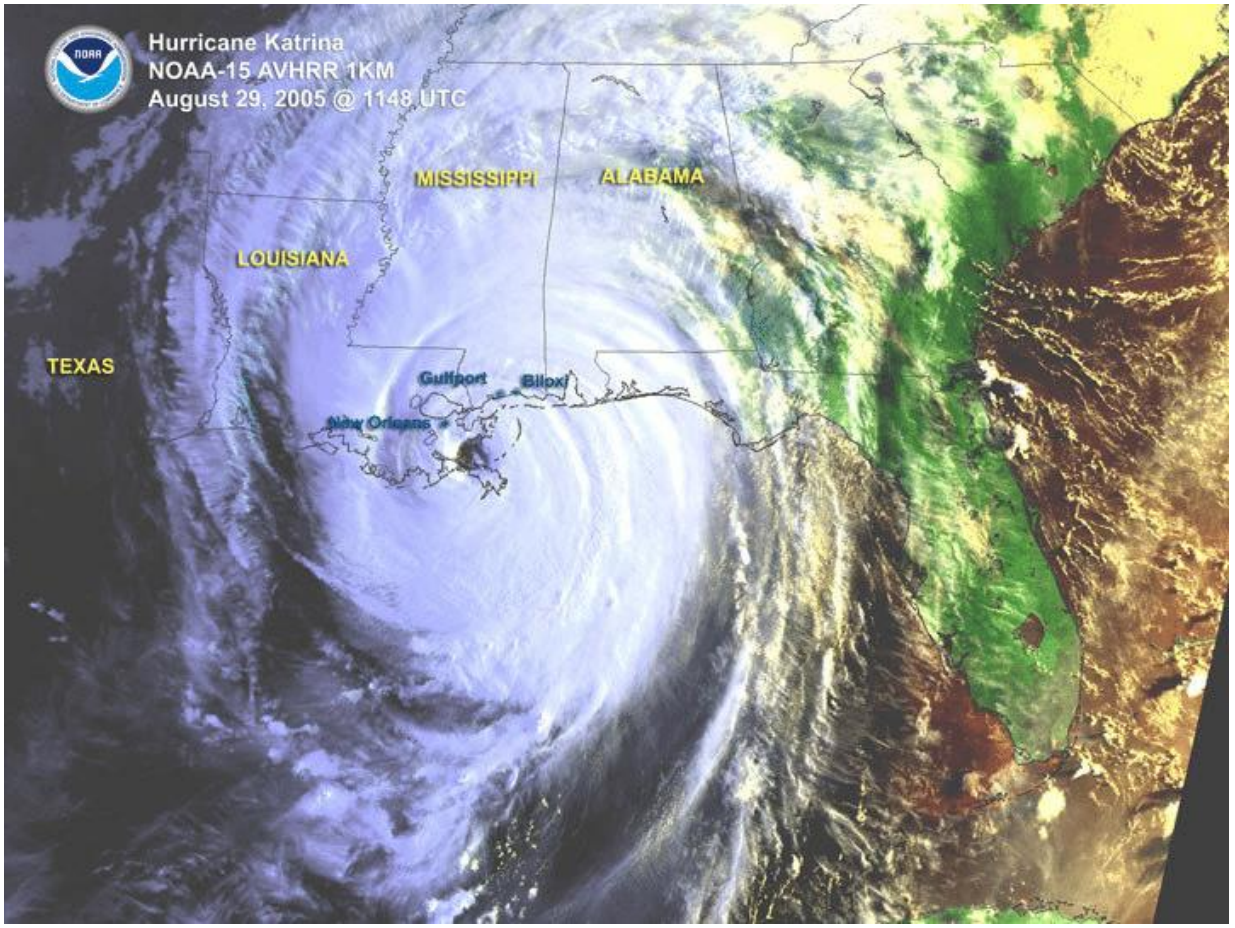
Continental US Major Hurricanes Using V_{max} Definition (1999-2021)



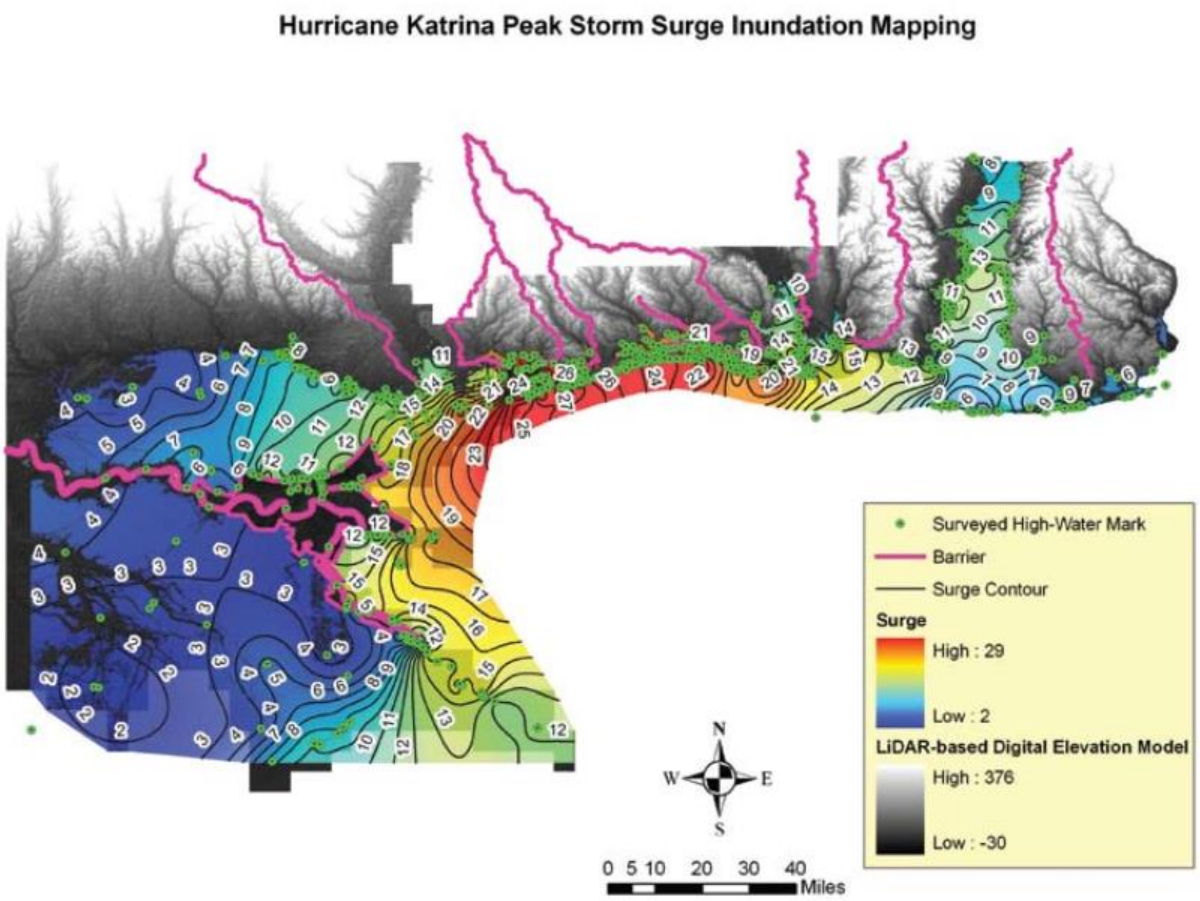
Continental US Major Hurricanes Using MSLP Definition (1999-2021)



Hurricane Katrina: Category 3 by V_{max}, Category 5 by MSLP

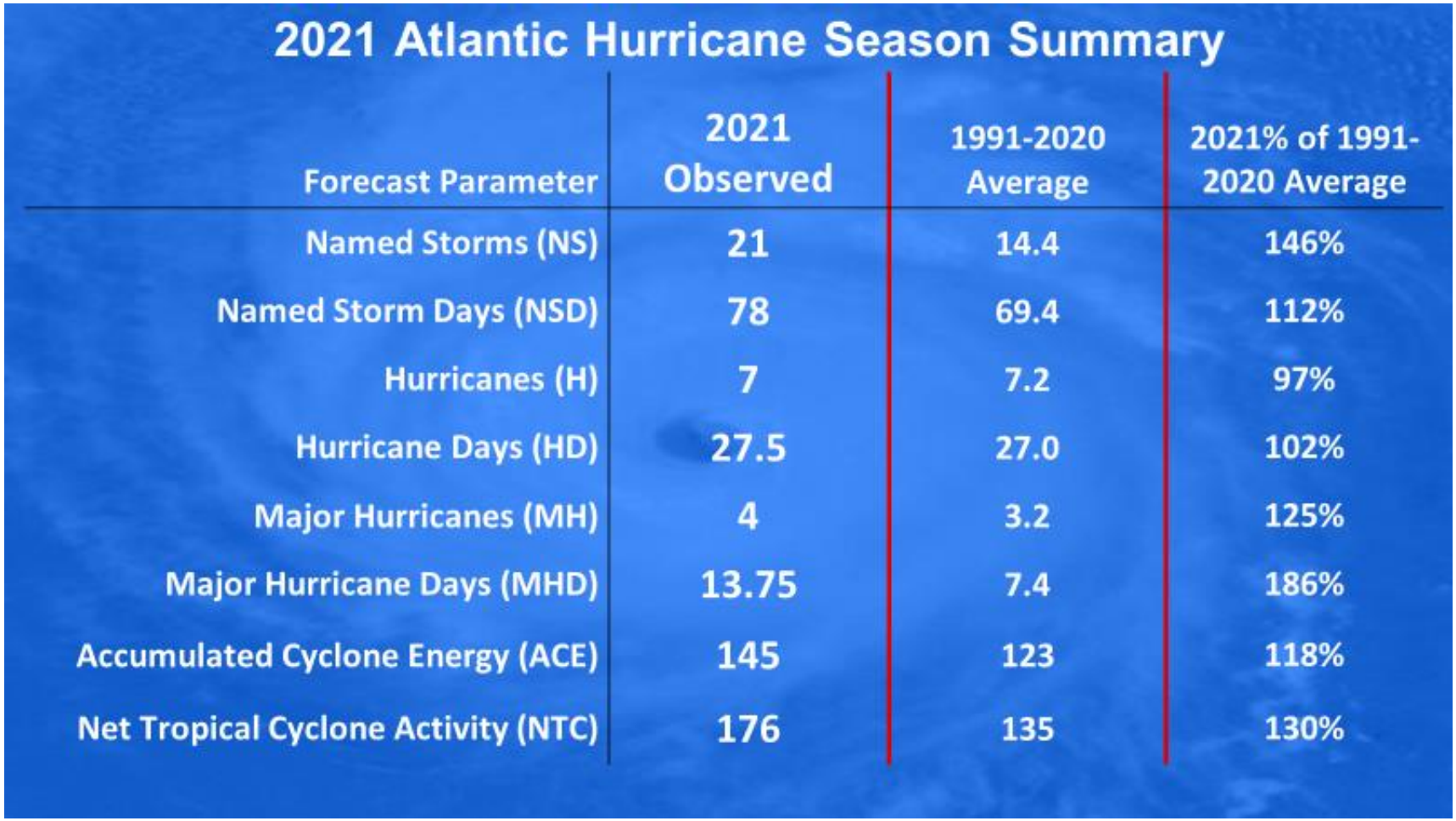


Storm Surge Inundation from Hurricane Katrina (2005)

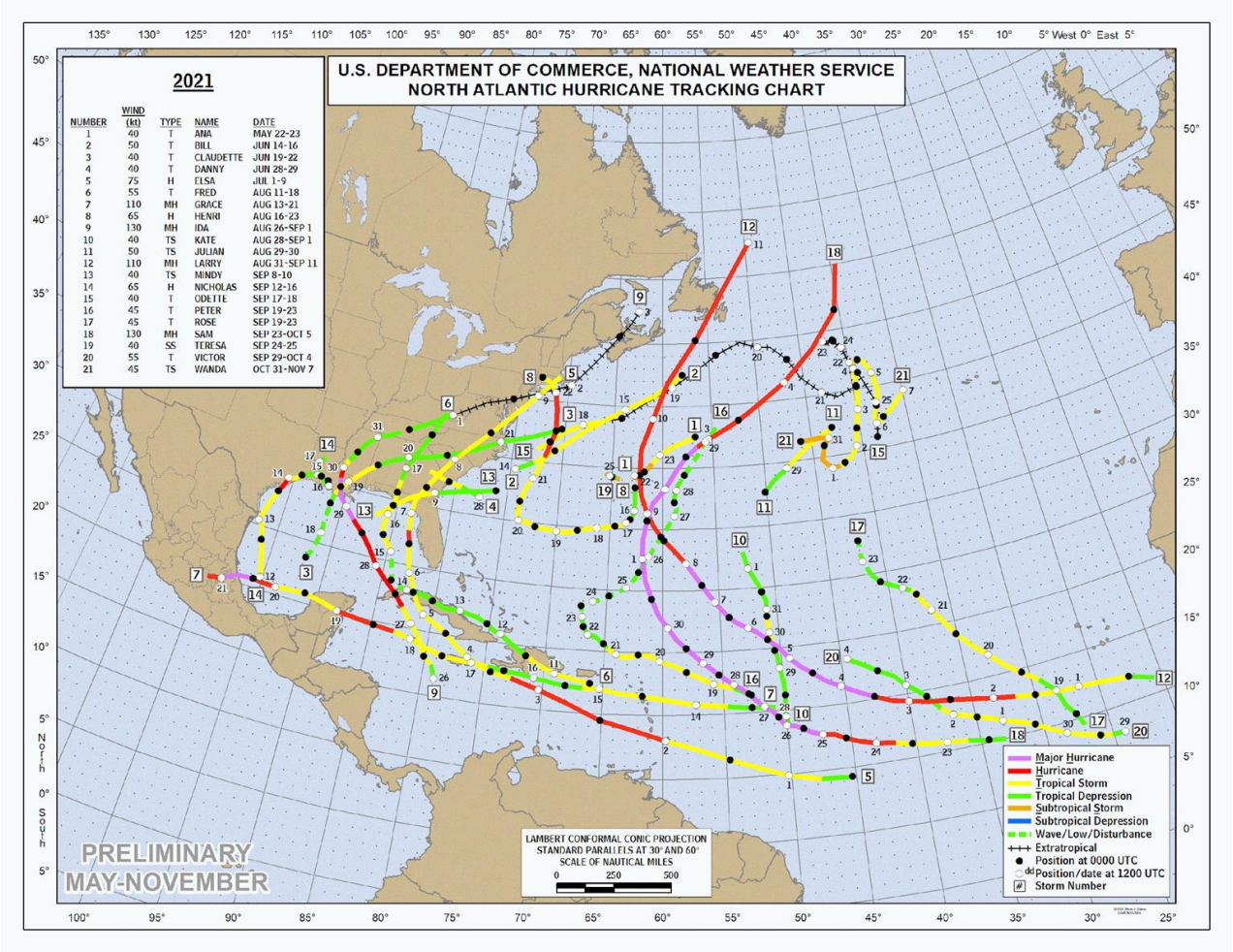


Turnipseed et al. (2007)

2021 Atlantic Hurricane Season Summary Statistics



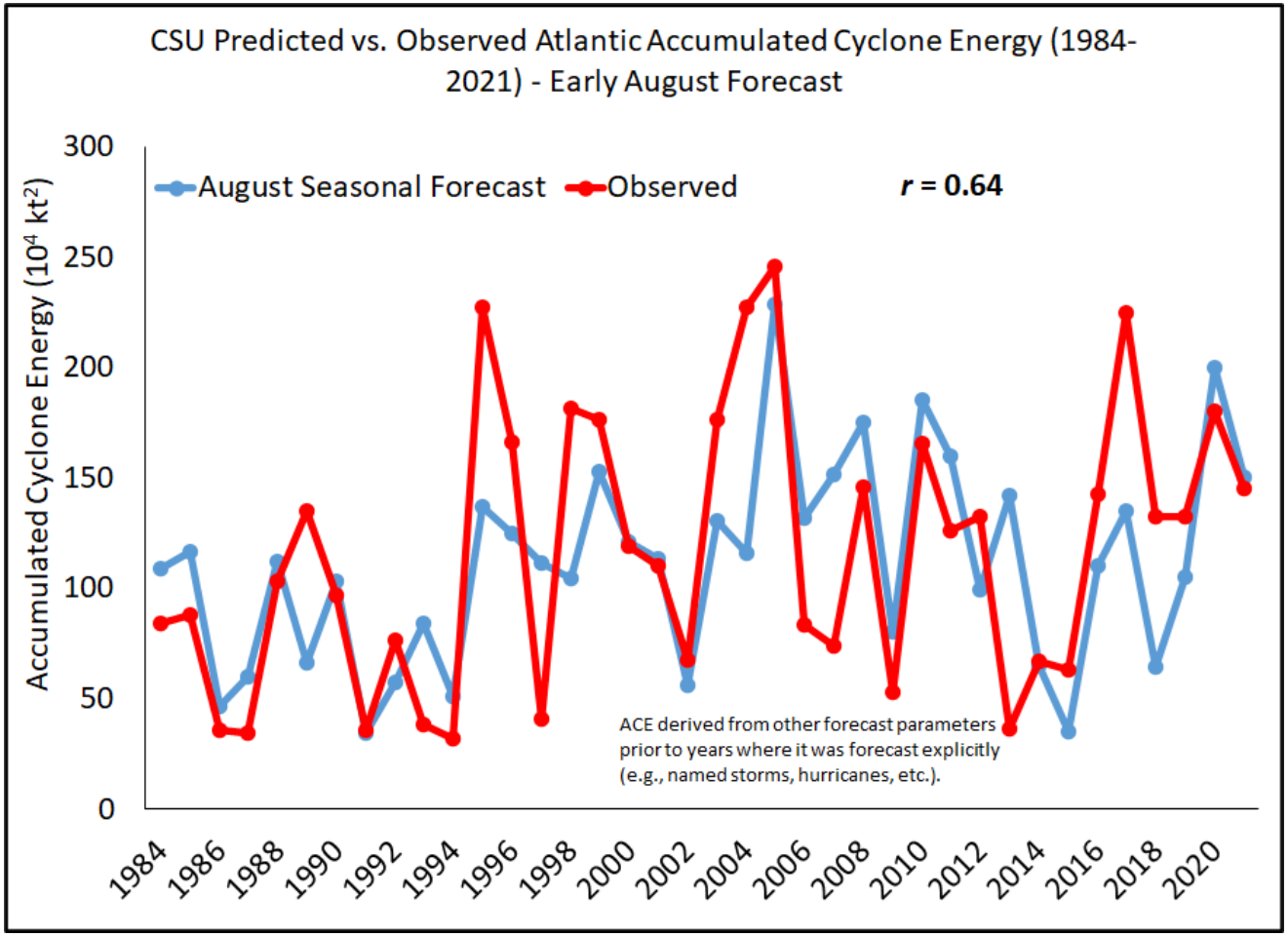
2021 Atlantic Hurricane Season Track Map



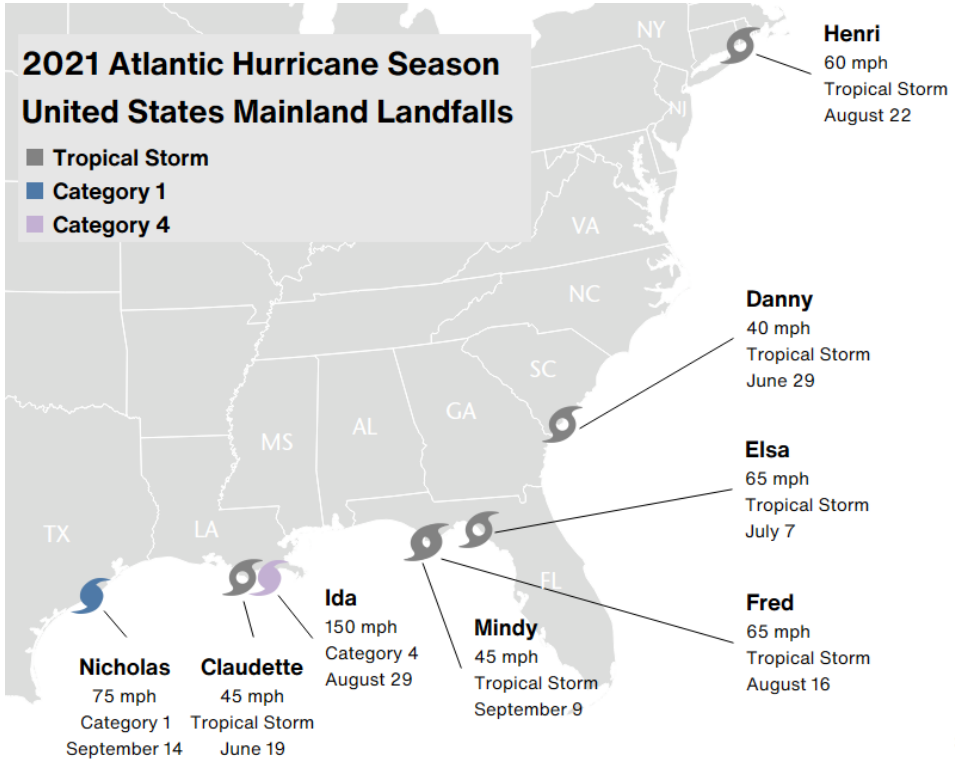
2021 CSU Seasonal Hurricane Forecast Verification

Forecast Parameter and 1991-2020 Average (in parentheses)	8 April 2021	3 June 2021	8 July 2021	5 August 2021	Observed	% of 1991-2020 Average
Named Storms (NS) (14.4)	17	18	20	18	21	146%
Named Storm Days (NSD) (69.4)	80	80	90	80	78	112%
Hurricanes (H) (7.2)	8	8	9	8	7	97%
Hurricane Days (HD) (27.0)	35	35	40	35	27.5	102%
Major Hurricanes (MH) (3.2)	4	4	4	4	4	125%
Major Hurricane Days (MHD) (7.4)	9	9	9	9	13.75	186%
Accumulated Cyclone Energy (ACE) (123)	150	150	160	150	145	118%
Net Tropical Cyclone Activity (NTC) (135%)	160	160	170	160	176	130%

CSU Long-Term August Seasonal Hurricane Forecast Track Record



Another busy year for Continental US Landfalls



2021 Atlantic Hurricane Seasonal Stat Highlights

145

Accumulated Cyclone Energy (ACE)
Satellite Era Rank: 14th

21

Named Storms
3rd Most on Record
4th Season w/ 20+ NS

13.75

Number of Major Hurricane Days
Satellite Era Rank: 6th

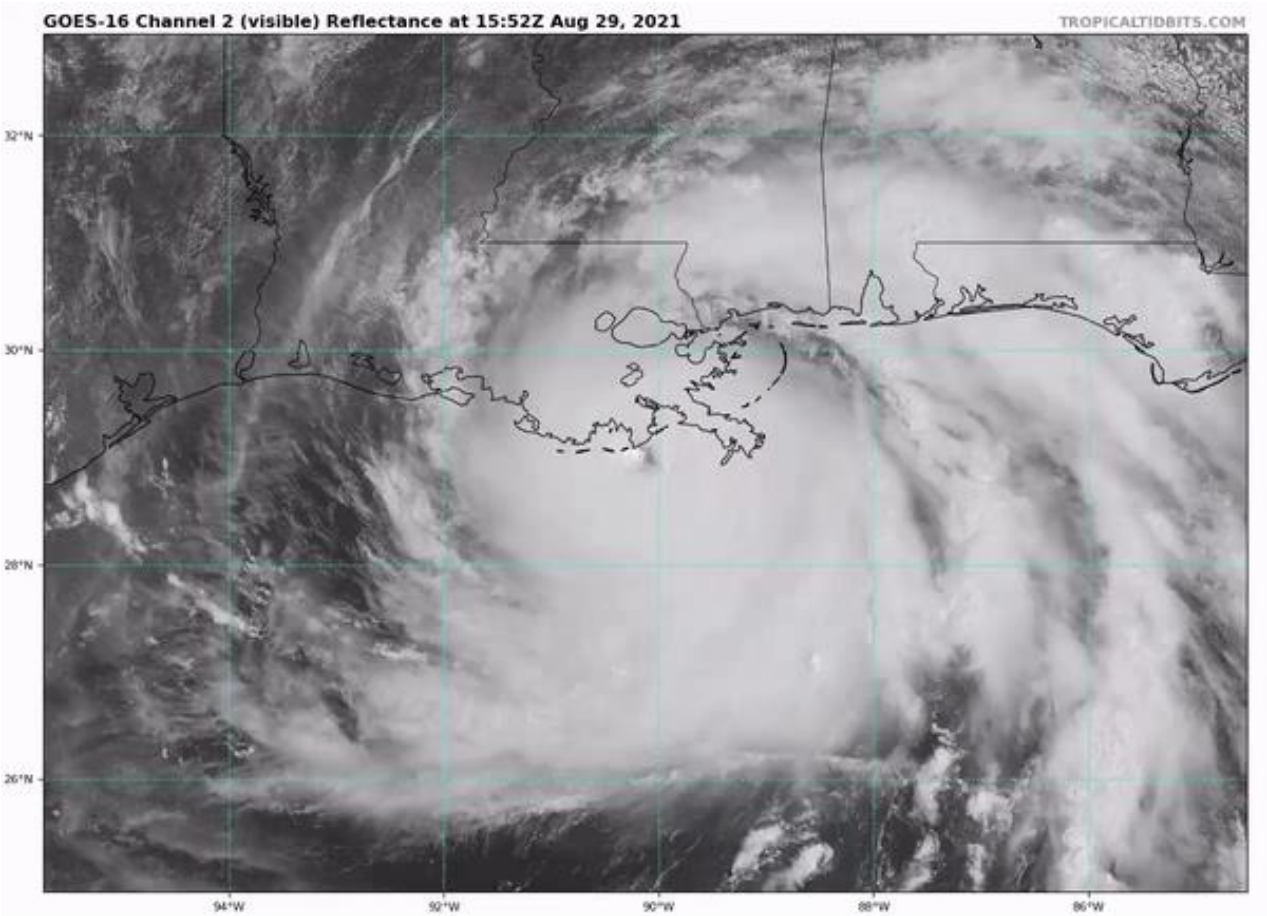
$80B

United States Economic Loss
Preliminary Estimate

Satellite Era: 1965-Present (Highest Quality Data)

Data: NOAA & Aon
Graphic: Aon (Catastrophe Insight)

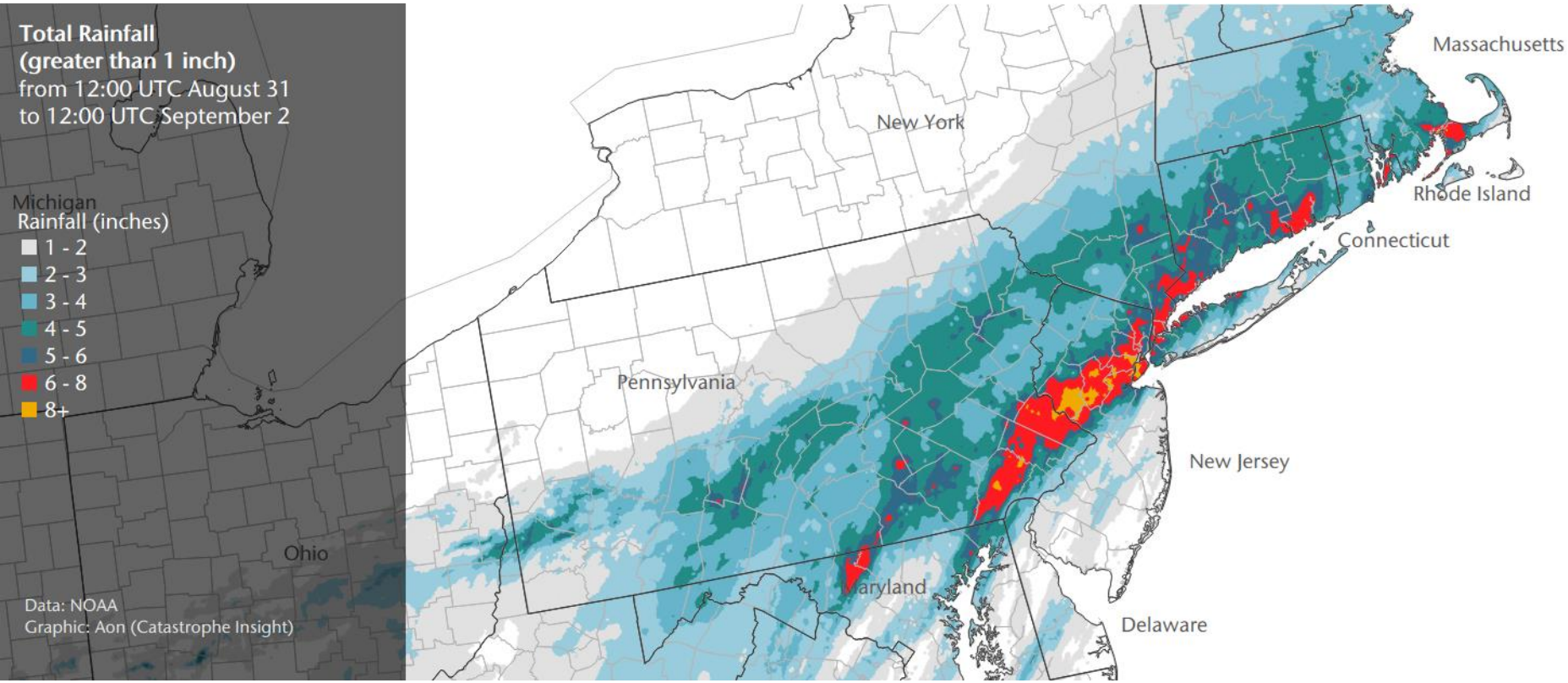
Hurricane Ida



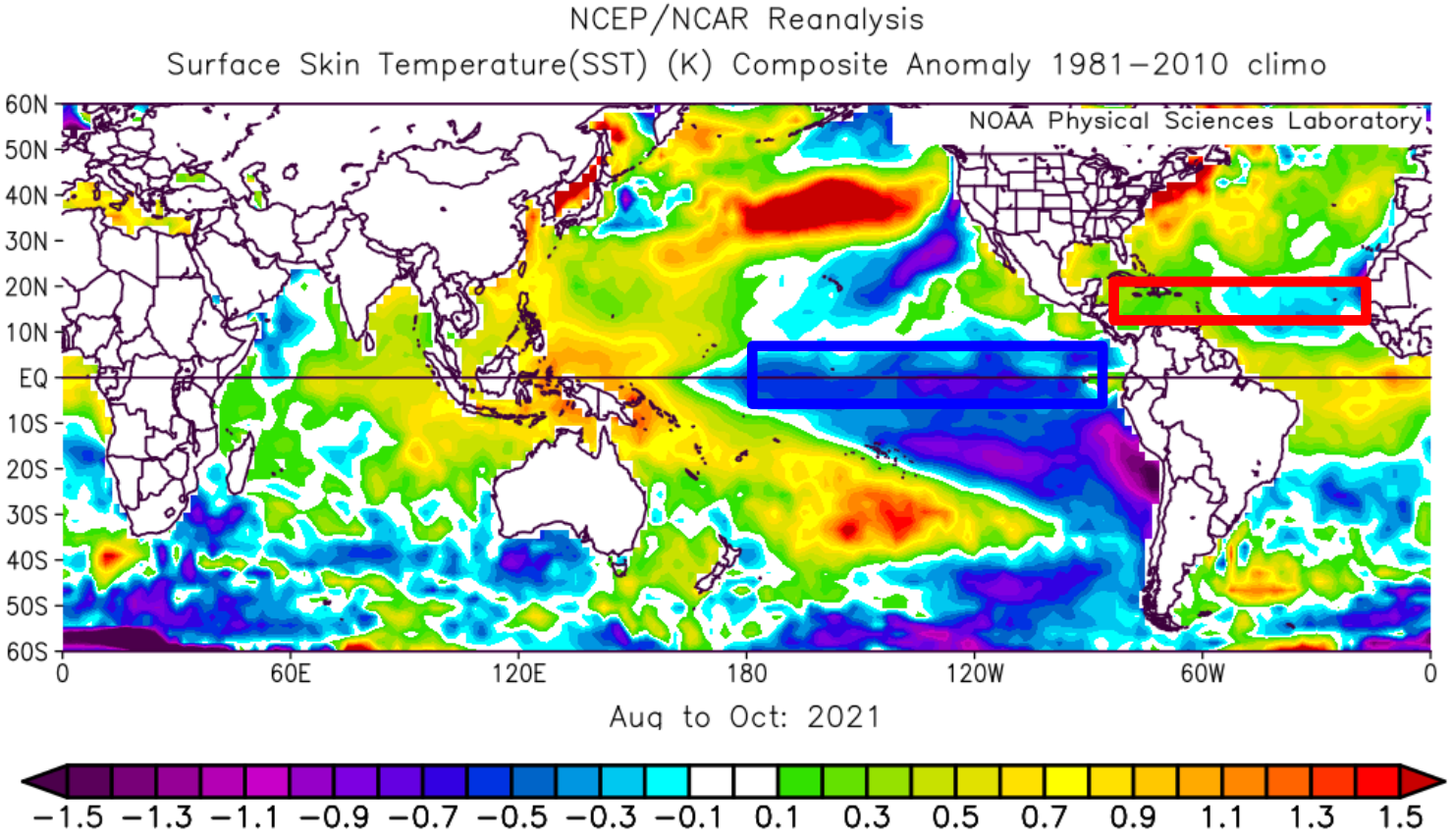
Hurricane Ida Notable Statistics

- Landfall Intensity: 150 mph. Tied with Last Island (1856) and Laura (2020) for strongest max winds at time of landfall in Louisiana
- Landfall Intensity: 930 hPa. 2nd strongest hurricane to make landfall in Louisiana by pressure, trailing only Katrina (2005, 920 hPa).
- ~$75 Billion USD in economic damage
- 95 fatalities in the United States – 53 combined in NJ, NY and PA

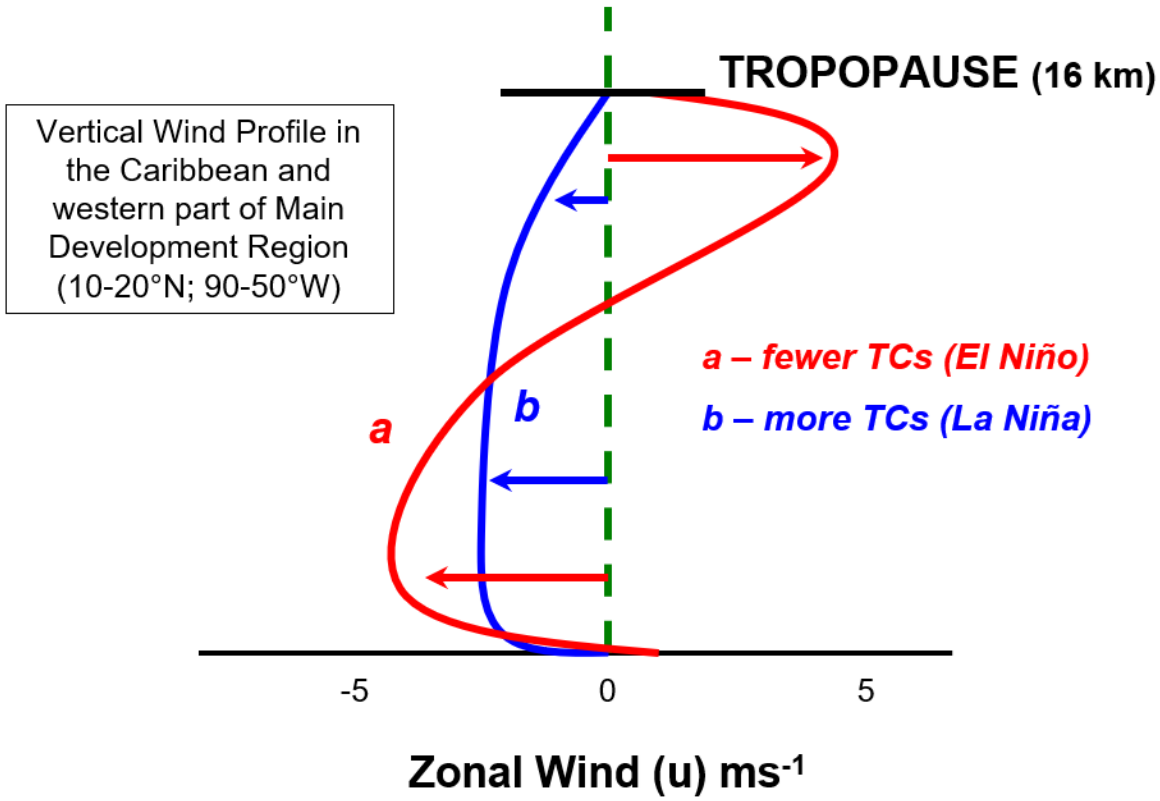
Post-Tropical Cyclone Ida Mid-Atlantic Flooding



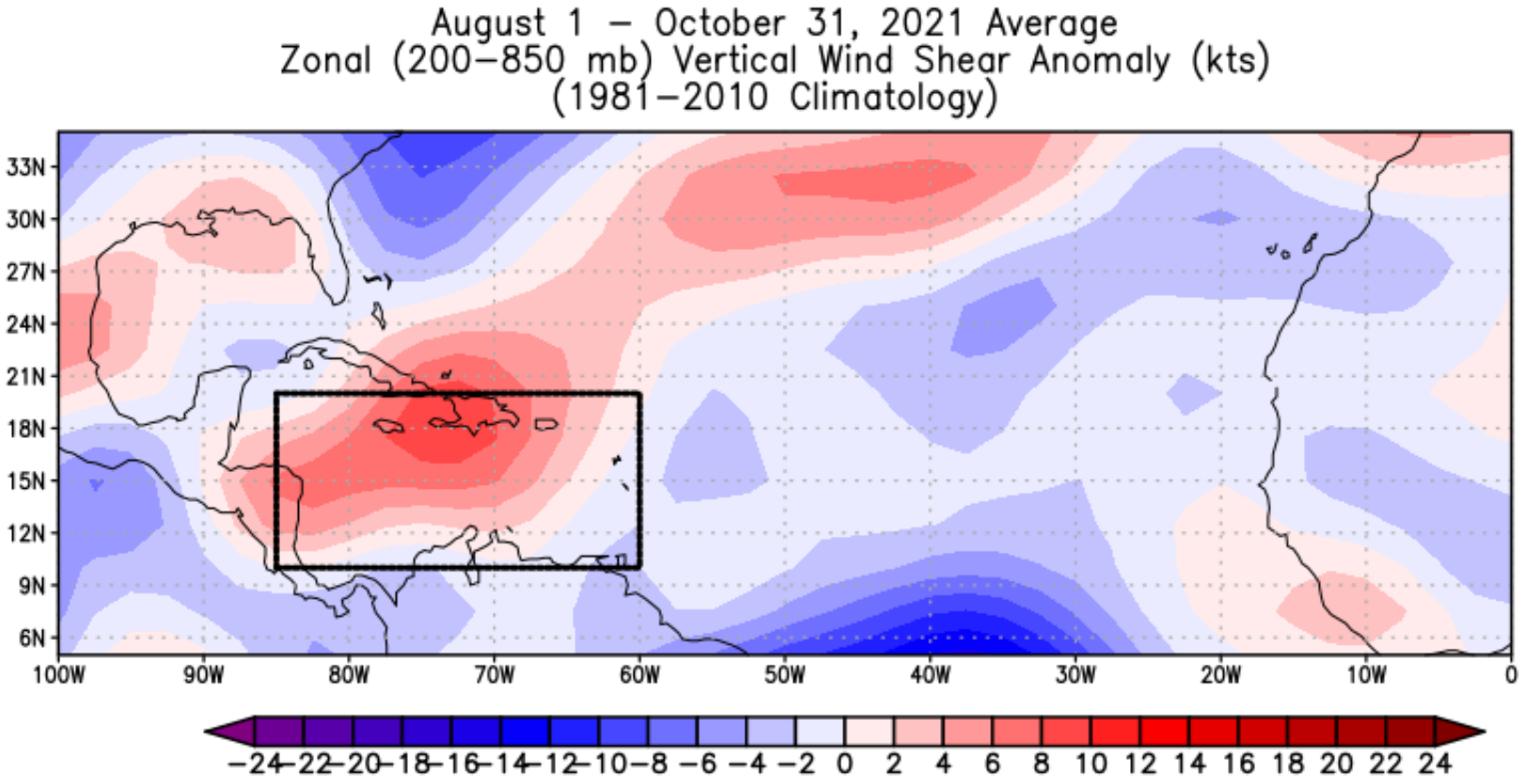
August-October 2021 Global Sea Surface Temperature Anomalies



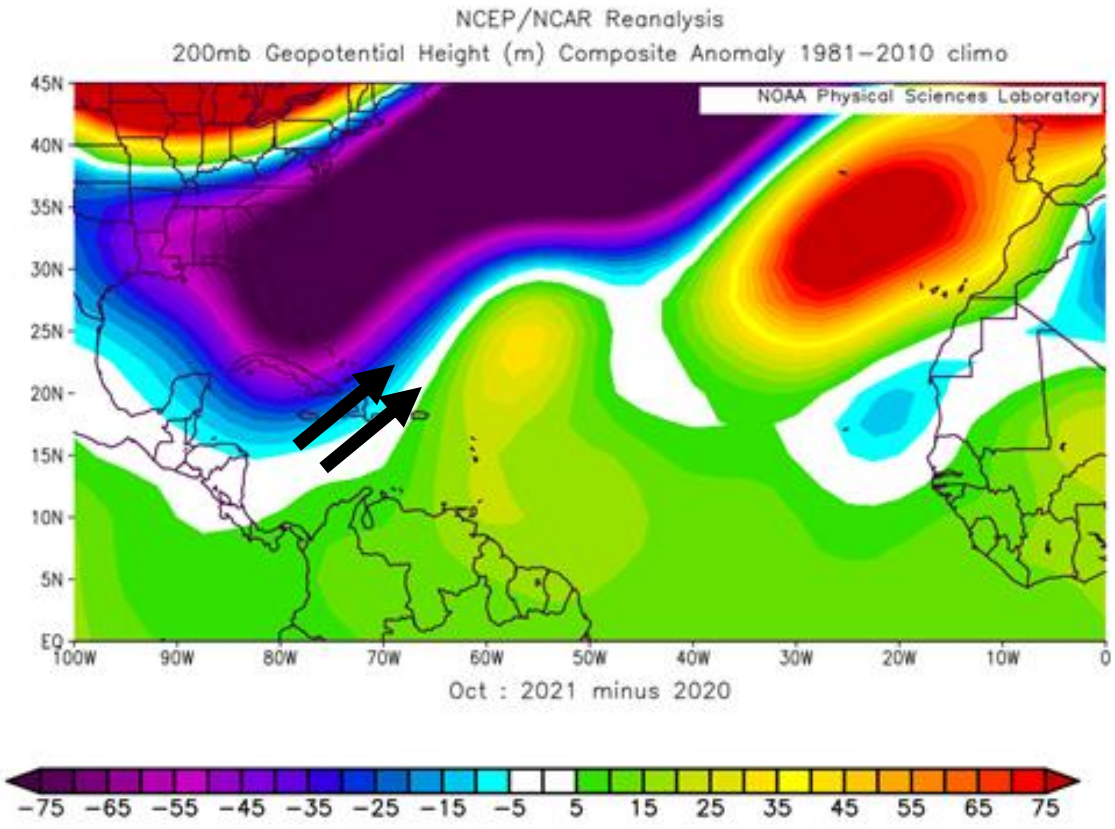
El Niño/La Niña Typical Relationship with Caribbean Vertical Wind Shear



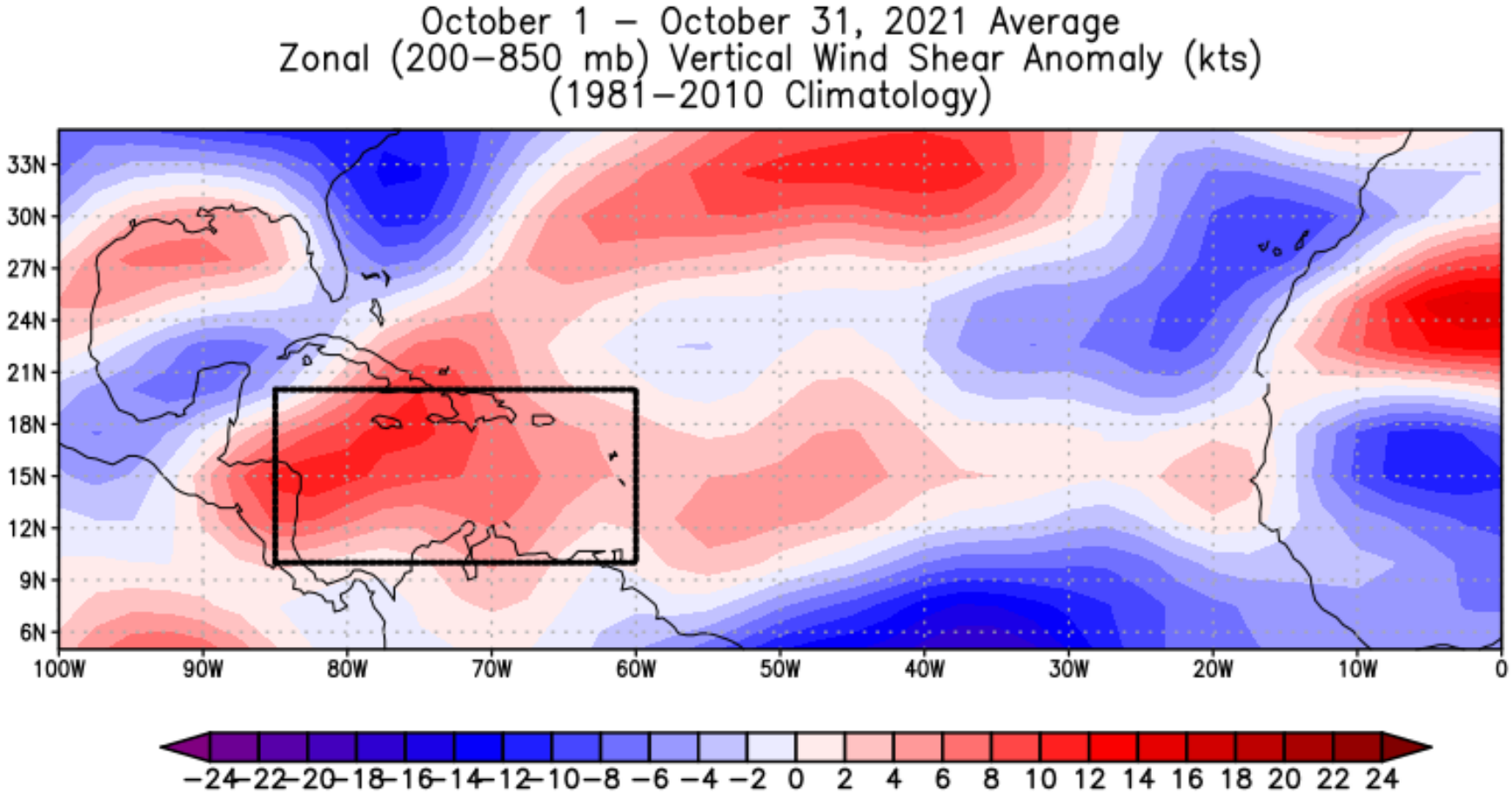
August-October-Averaged 2021 Atlantic Vertical Wind Shear



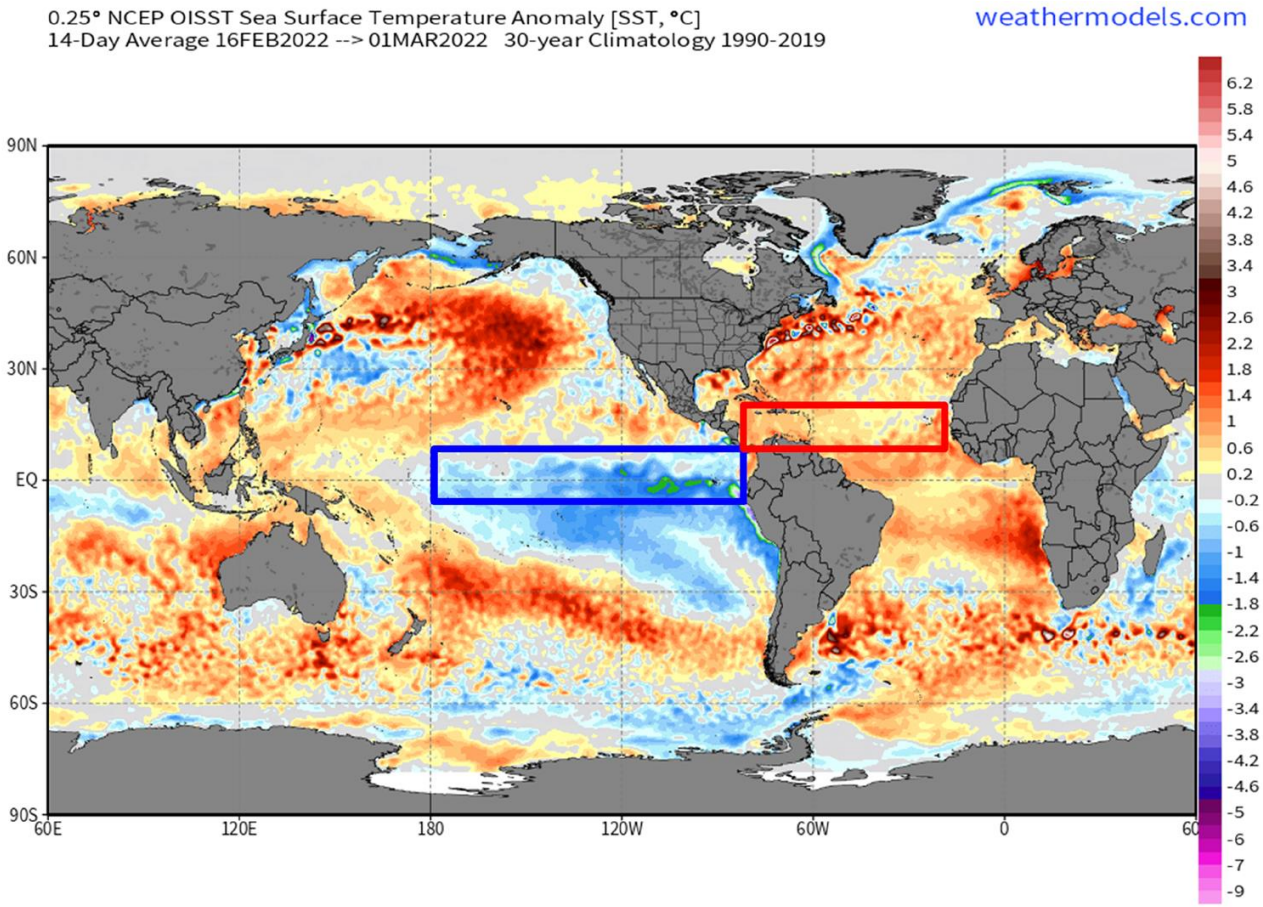
Upper-Level (~38000 Feet) Pressure Pattern in October 2021 Differenced From October 2020



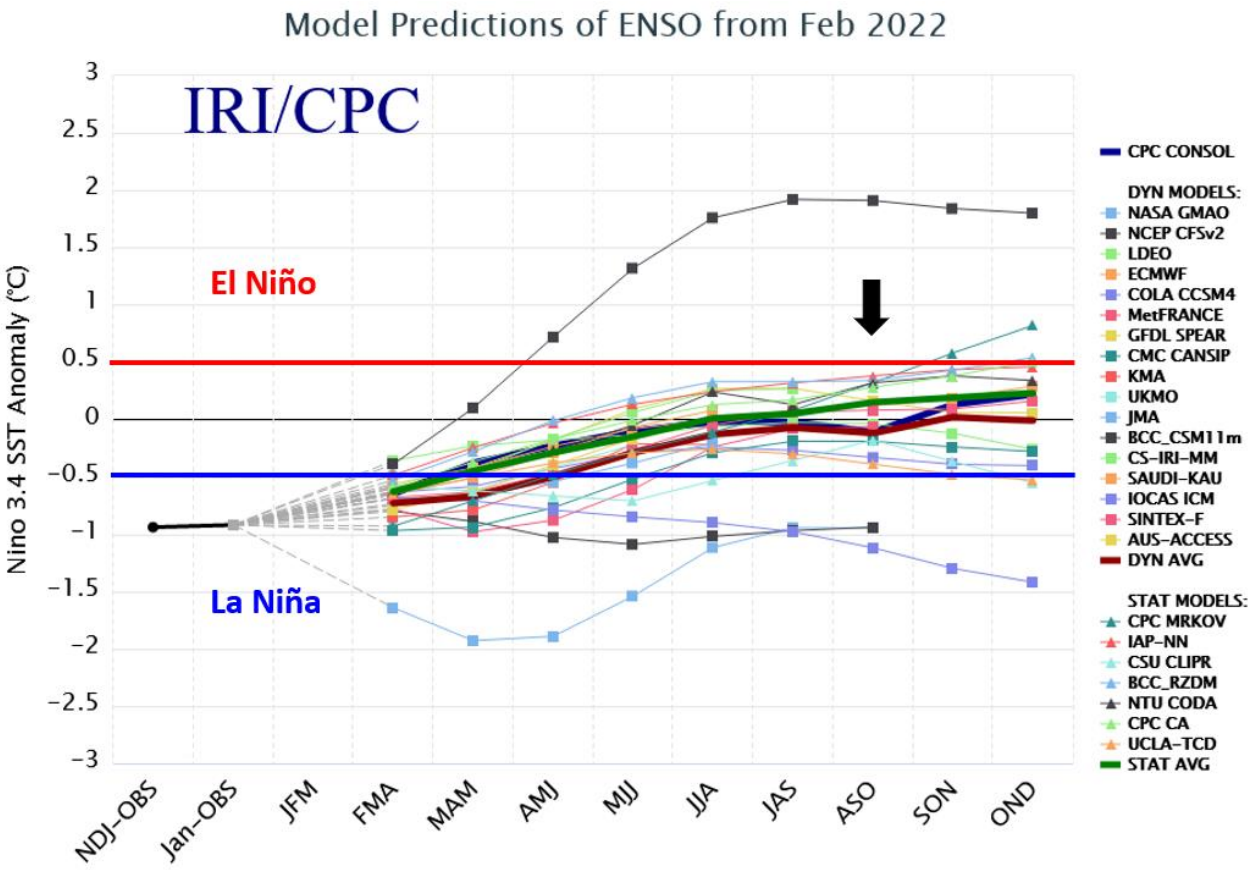
October 2021 Atlantic Vertical Wind Shear



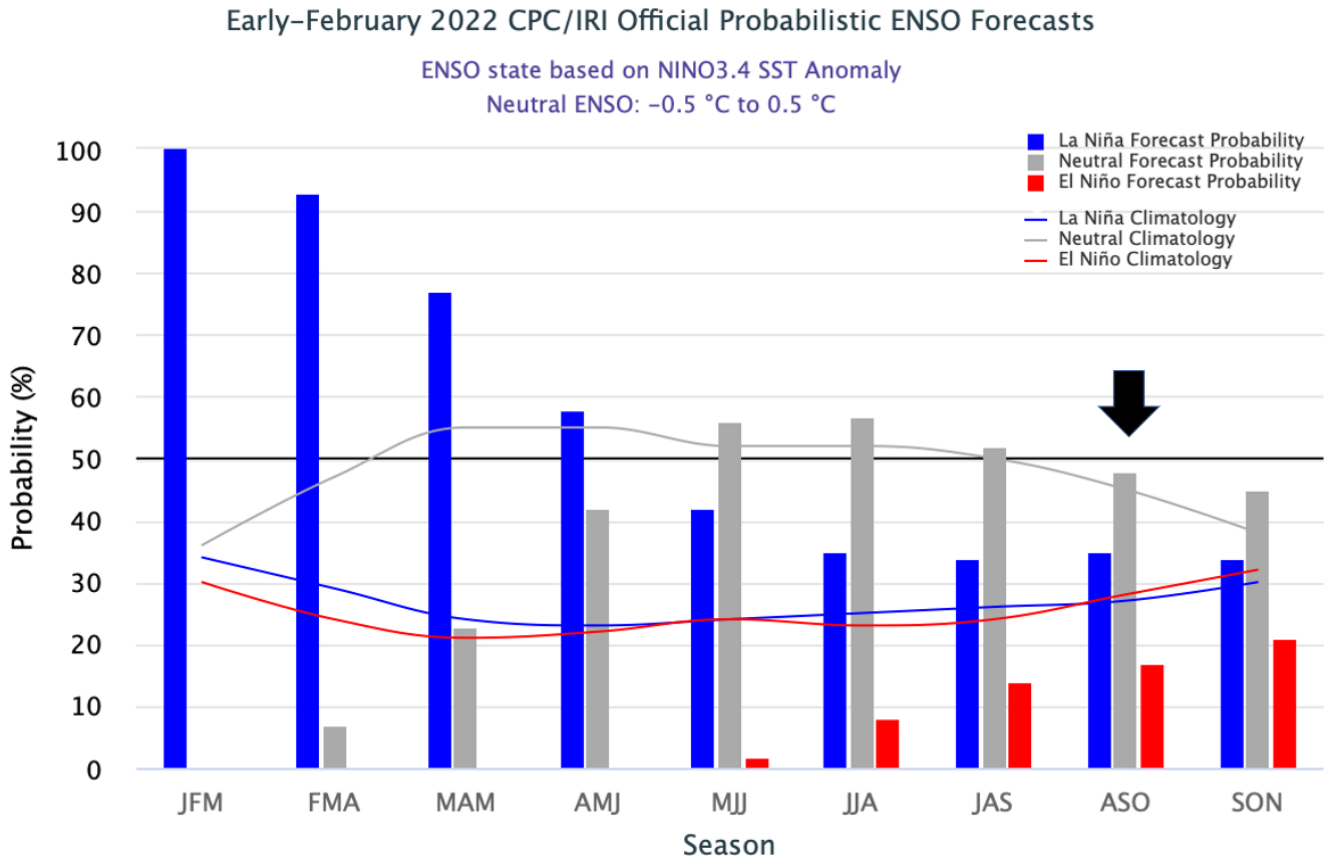
Current Sea Surface Temperature Anomaly Pattern



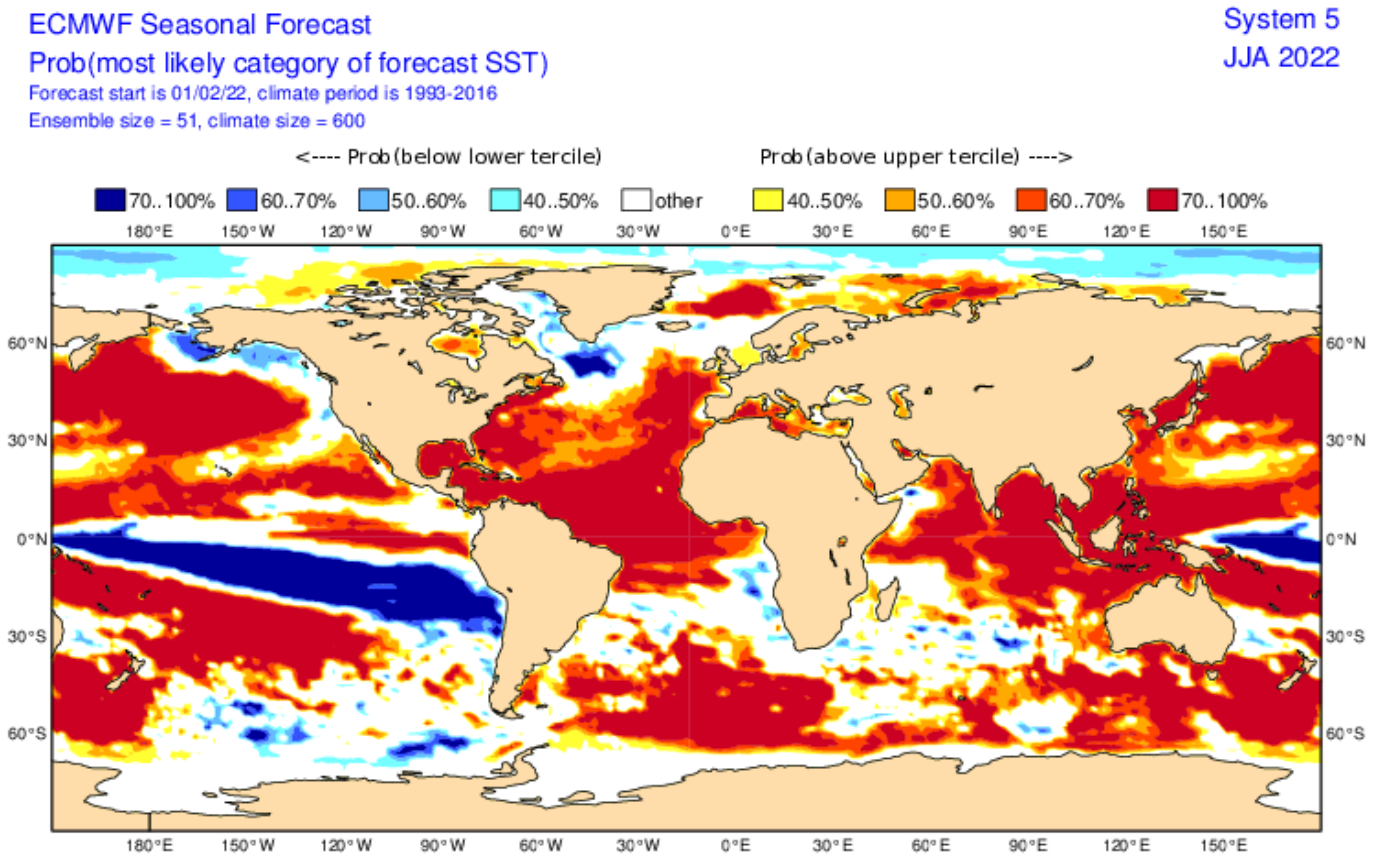
Current ENSO Forecasts from Global Models



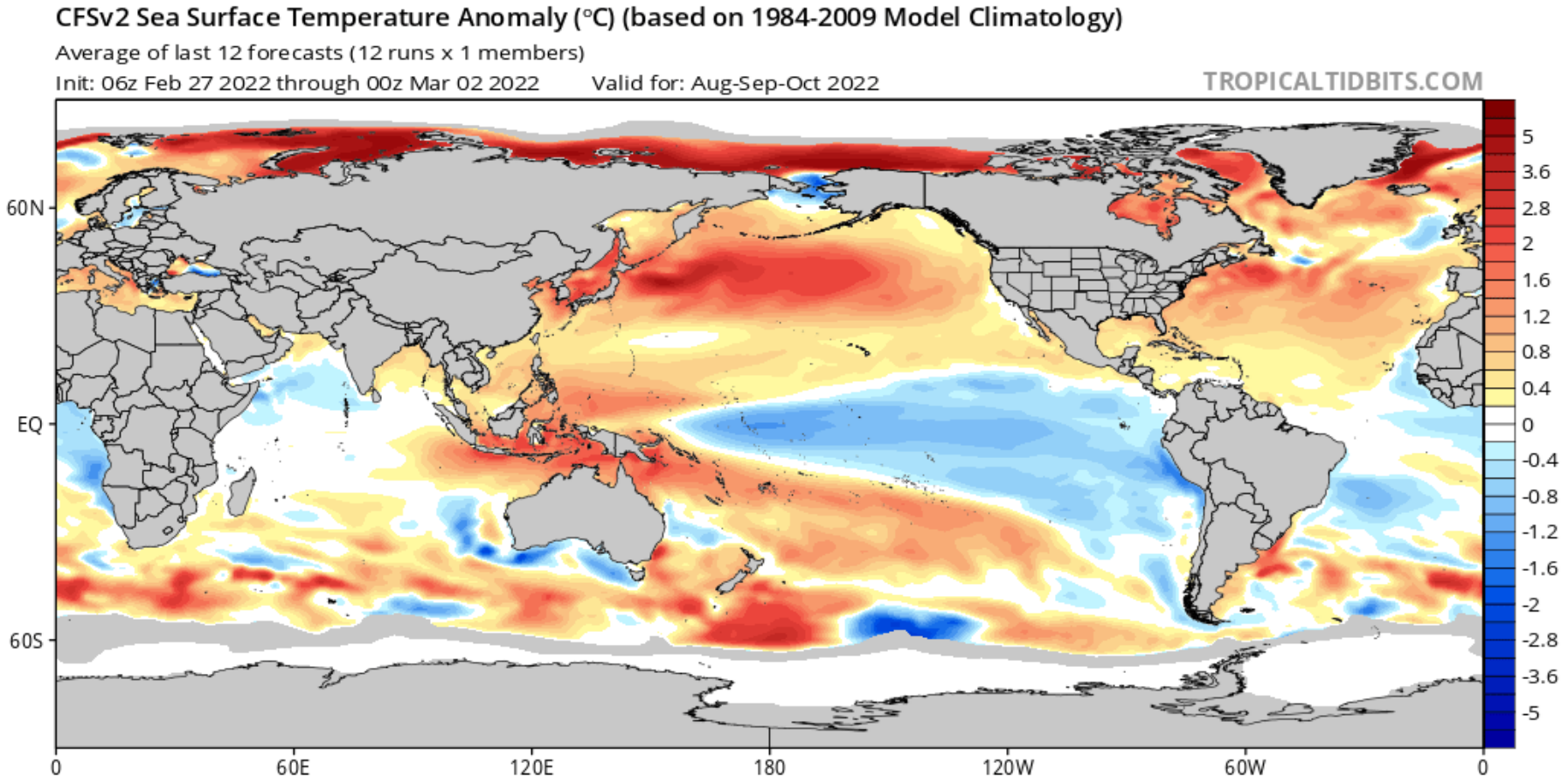
Official Probabilistic ENSO Forecast from NOAA



ECMWF Forecasts of Sea Surface Temperature Anomalies: June-August 2022



CFS Forecasts of Sea Surface Temperature Anomalies: August-October 2022



2022
Forecast Schedule

Date	7 April	2 June	7 July	4 Aug
Seasonal Forecast	X	X	X	X

Contact Info:

Phil Klotzbach

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Web: http://tropical.colostate.edu

Twitter: @philklotzbach

Next Week's Training

Using SHIP for Manufactured Housing

March 4 at 1:30 pm

Register at

https://us02web.zoom.us/webinar/register/WN_ABfS89bUT9q1fupoQnizUg

Technical Assistance is Available

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Webinars

Thank You!

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Michael Chaney
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