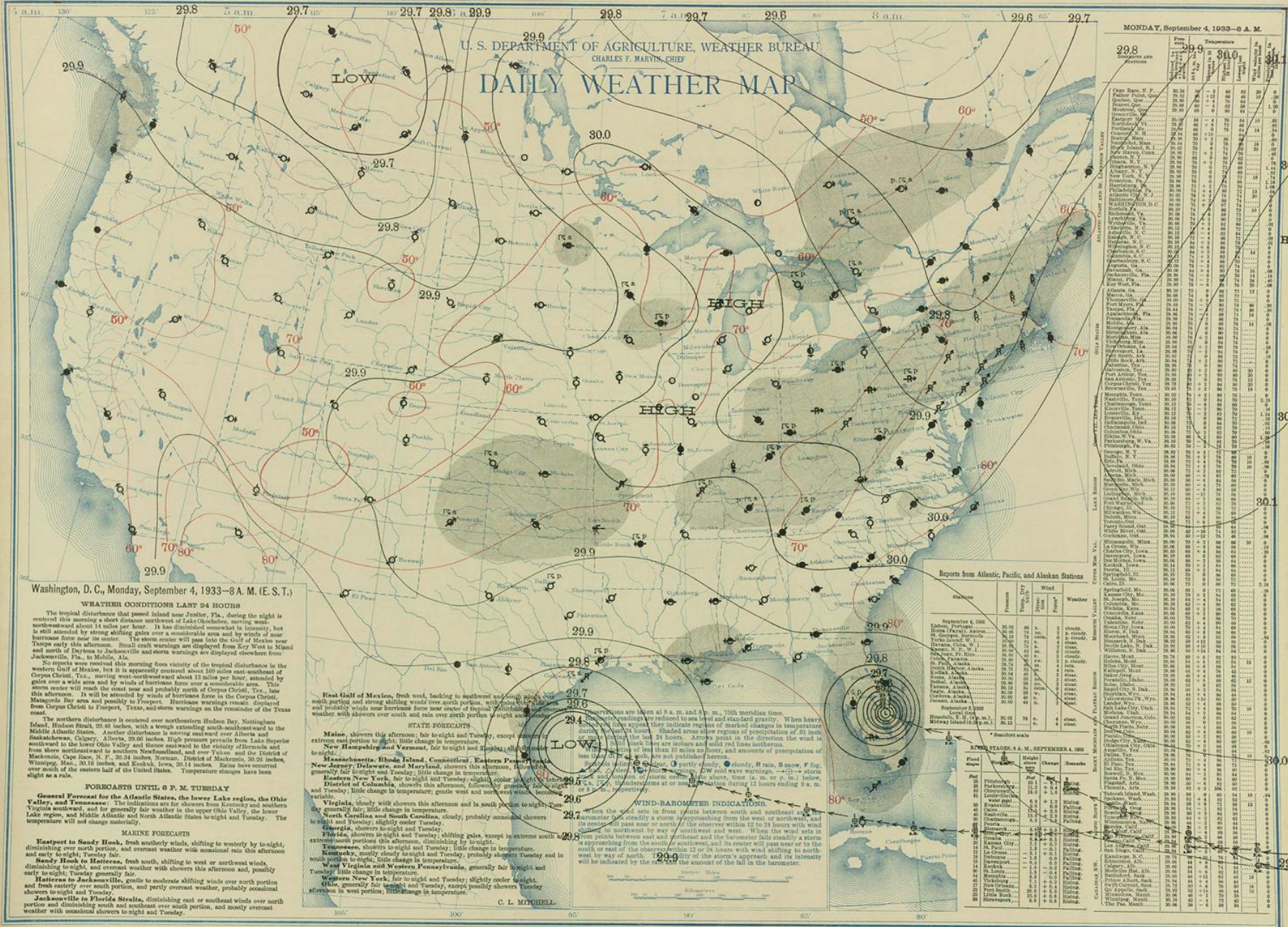# The Record-Breaking 1933 Atlantic Hurricane Season

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Colorado State University

Climate Diagnostics and Prediction Workshop

October 22, 2020

DAILY WEATHER MAP

U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU
CHARLES F. MARVIN, CHIEF

MONDAY, September 4, 1933—8 A. M.

Washington, D. C., Monday, September 4, 1933—8 A. M. (E.S.T.)

WEATHER CONDITIONS LAST 24 HOURS

The tropical disturbance that passed inland near Jupiter, Fla., during the night is centered this morning a short distance northwest of Lake Okeechobee, moving west-northwestward about 14 miles per hour. It has diminished somewhat in intensity, but is still attended by strong shifting gales over a considerable area and by winds of near hurricane force near its center. The storm center will pass into the Gulf of Mexico near Tampa early this afternoon. Small craft warnings are displayed from Key West to Miami and north of Daytona to Jacksonville and storm warnings are displayed elsewhere from Jacksonville, Fla., to Mobile, Ala.

No reports were received this morning from vicinity of the tropical disturbance in the western Gulf of Mexico, but it is apparently centered about 160 miles east-southeast of Corpus Christi, Tex., moving west-northwestward about 13 miles per hour, attended by gales over a wide area and by winds of hurricane force over a considerable area. This storm center will reach the coast near and probably north of Corpus Christi, Tex., late this afternoon. It will be attended by winds of hurricane force in the Corpus Christi, Matagorda Bay area and possibly to Freeport. Hurricane warnings remain displayed from Corpus Christi to Freeport, Texas, and storm warnings on the remainder of the Texas coast.

The northern disturbance is centered over northeastern Hudson Bay, Nottingham Island, Hudson Strait, 29.46 inches, with a trough extending south-southeastward to the Middle Atlantic States. Another disturbance is moving eastward over Alberta and Saskatchewan, Calgary, Alberta, 29.66 inches. High pressure prevails from Lake Superior southward to the lower Ohio Valley and thence eastward to the vicinity of Bermuda and from there northeastward to southern Newfoundland, and over Yukon and the District of Mackenzie, Cape Race, N. F., 30.34 inches, Norman, District of Mackenzie, 30.05 inches, Winnipeg, Man., 30.16 inches, and Keokuk, Iowa, 30.14 inches. Rains have occurred over much of the eastern half of the United States. Temperature changes have been slight as a rule.

FORECASTS UNTIL 8 P. M. TUESDAY

General Forecast for the Atlantic States, the lower Lake region, the Ohio Valley, and Tennessee: The indications are for showers from Kentucky and southern Virginia southward, and for generally fair weather in the upper Ohio Valley, the lower Lake region, and Middle Atlantic and North Atlantic States to-night and Tuesday. The temperature will not change materially.

MARINE FORECASTS

Eastport to Sandy Hook, fresh southerly winds, shifting to westerly by to-night, diminishing over north portion, and overcast weather with occasional rain this afternoon and early to-night; Tuesday fair.

Sandy Hook to Hatteras, fresh south, shifting to west or northwest winds, diminishing to-night, and overcast weather with showers this afternoon and, possibly early to-night; Tuesday generally fair.

Hatteras to Jacksonville, gentle to moderate shifting winds over north portion and fresh easterly over south portion, and partly overcast weather, probably occasional showers to-night and Tuesday.

Jacksonville to Florida Straits, diminishing east or southeast winds over north portion and diminishing south and southeast over south portion, and mostly overcast weather with occasional showers to-night and Tuesday.

STATE FORECASTS

Maine, showers this afternoon; fair to-night and Tuesday, except showers in extreme east portion to-night; little change in temperature.

New Hampshire and Vermont, fair to-night and Tuesday; slightly cooler to-night.

Massachusetts, Rhode Island, Connecticut, Eastern Pennsylvania, New Jersey, Delaware, and Maryland, showers this afternoon, followed by generally fair to-night and Tuesday; little change in temperature.

Eastern New York, fair to-night and Tuesday; slightly cooler to-night in interior.

District of Columbia, showers this afternoon, followed by generally fair to-night and Tuesday; little change in temperature; gentle west and northwest winds becoming variable.

Virginia, cloudy with showers this afternoon and in south portion to-night; Tuesday generally fair; little change in temperature.

North Carolina and South Carolina, cloudy, probably occasional showers to-night and Tuesday; slightly cooler Tuesday.

Georgia, showers to-night and Tuesday.

Florida, showers to-night and Tuesday; shifting gales, except in extreme south over extreme north portions this afternoon, diminishing by to-night.

Tennessee, showers to-night and Tuesday; little change in temperature.

Kentucky, mostly cloudy to-night and Tuesday, probably showers Tuesday and in south portion to-night; little change in temperature.

West Virginia and Western Pennsylvania, generally fair to-night and Tuesday; little change in temperature.

Western New York, fair to-night and Tuesday; slightly cooler Tuesday.

Ohio, generally fair to-night and Tuesday, except possibly showers Tuesday afternoon in west portion; little change in temperature.

C. L. MITCHELL.

WIND-BAROMETER INDICATIONS.

When the wind sets in from points between south and southeast and the barometer falls steadily, a storm is approaching from the west or northwest, and its center will pass near or north of the observer within 12 to 24 hours with wind shifting to northwest by way of southwest and west. When the wind sets in from points between east and northeast and the barometer falls steadily a storm is approaching from the south or southwest, and its center will pass near or to the south or east of the observer within 12 or 24 hours with wind shifting to northwest by way of north. The rapidity of the storm's approach and its intensity will be indicated by the rate and the amount of the fall in the barometer.

Reports from Atlantic, Pacific, and Alaskan Stations

Observations are taken at 8 a. m. and 8 p. m., 75th meridian time. Barometer readings are reduced to sea level and standard gravity. When heavy continuous lines appear they indicate regions of marked changes in temperature during the past 24 hours. Shaded areas show regions of precipitation of .01 inch or more during the last 24 hours. Arrows point in the direction the wind is blowing. Solid black lines are isobars and solid red lines are isotherms.

Symbols indicate ○ clear, ◑ partly cloudy, ● cloudy, R rain, S snow, F fog.

RIVER STAGES, 8 A. M., SEPTEMBER 4, 1933

East Gulf of Mexico, fresh west, backing to southwest and south winds over south portion and strong shifting winds over north portion, with gales over entire area and probably winds near hurricane force near center of tropical disturbance, and overcast weather with showers over south and rain over north portion to-night and Tuesday.

Price: Daily, except Sundays and holidays, $3.60 a year, 25 cents a month; daily, including Sundays and holidays, $3.60 a year, 30 cents a month. Send subscriptions to Superintendent of Documents, Washington, D. C.

U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART

1933

NUMBER	WIND (kt)	TYPE	NAME	DATE
1	45	T	----	MAY 14-19
2	95	H	----	JUN 24-JUL 7
3	45	T	----	JUL 14-24
4	50	T	----	JUL 24-27
5	80	H	----	JUL 24-AUG 5
6	120	MH	----	AUG 13-25
7	40	T	----	AUG 14-21
8	140	MH	----	AUG 22-SEP 5
9	55	T	----	AUG 23-30
10	35	T	----	AUG 26-30
11	120	MH	----	AUG 31-SEP 7
12	120	MH	----	SEP 8-18
13	95	H	----	SEP 10-16
14	140	MH	----	SEP 16-25
15	65	H	----	SEP 24-27
16	40	T	----	OCT 1-7
17	110	MH	----	OCT 1-9
18	80	H	----	OCT 25-NOV 7
19	60	T	----	OCT 26-28
20	50	T	----	NOV 15-17
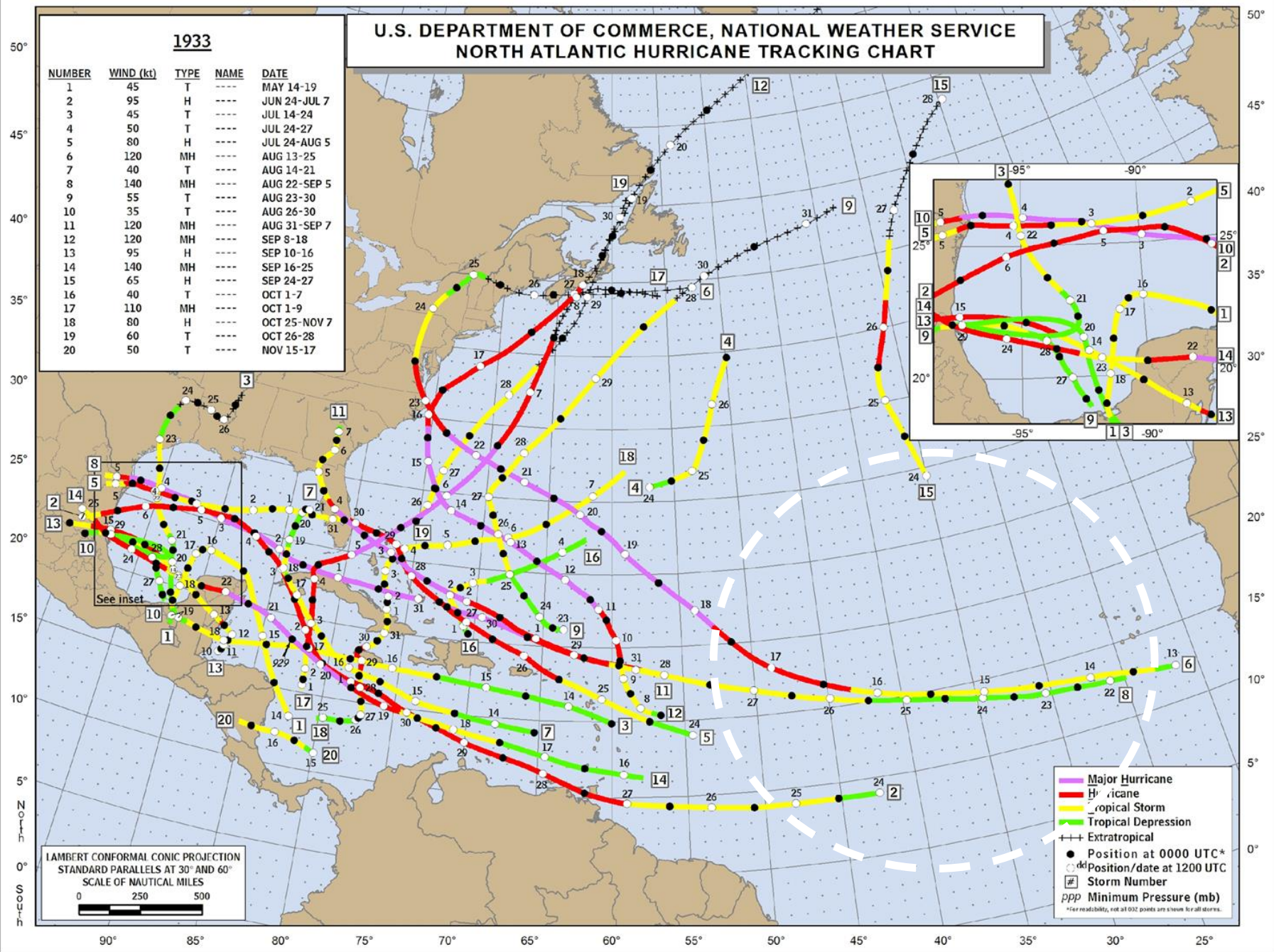
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0   250   500

Legend:
— Major Hurricane
— Hurricane
— Tropical Storm
— Tropical Depression
+++ Extratropical
● Position at 0000 UTC*
○ Position/date at 1200 UTC
Storm Number
ppp Minimum Pressure (mb)

*For readability, not all 00Z points are shown for all storms.
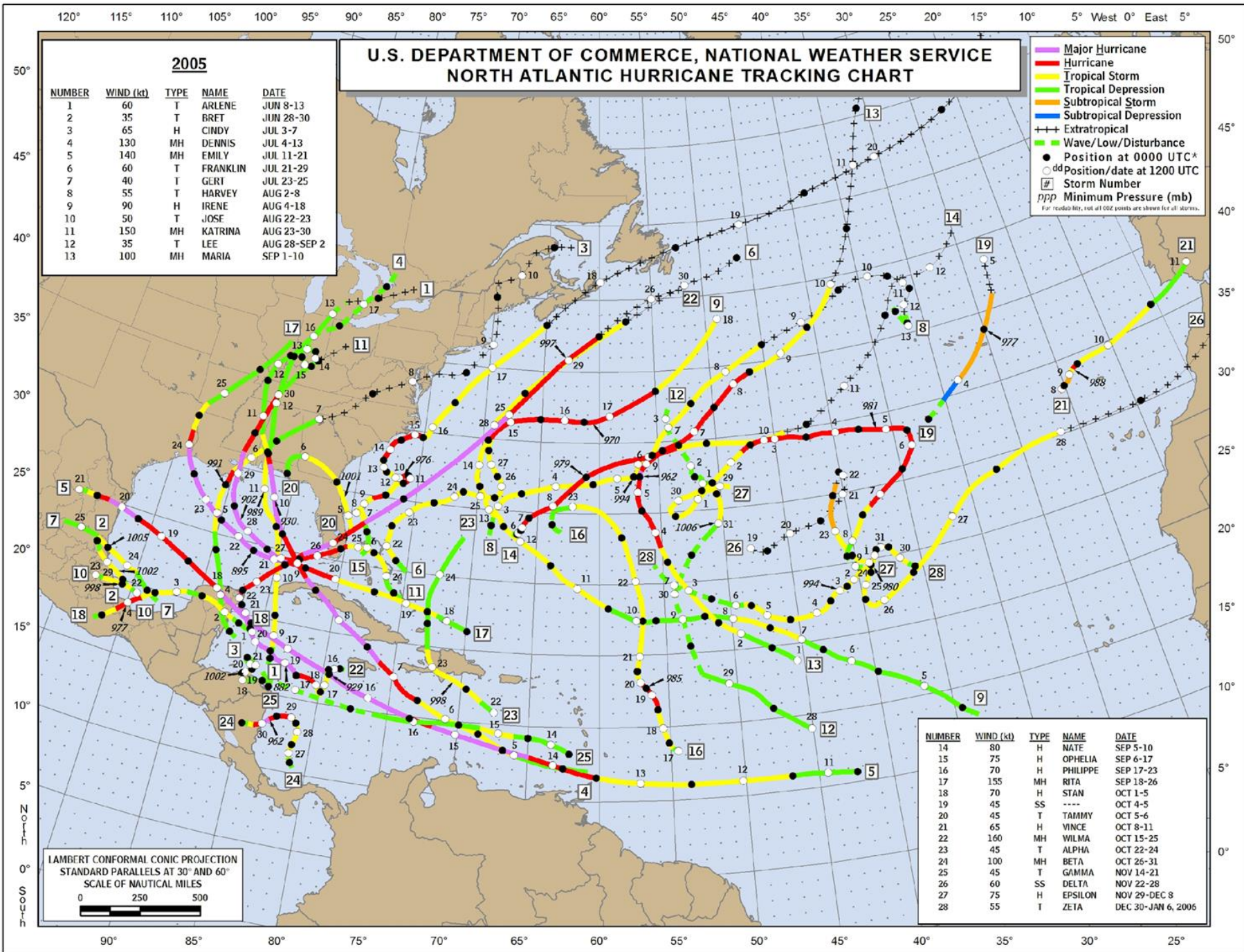
U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART

2005

NUMBER	WIND (kt)	TYPE	NAME	DATE
1	60	T	ARLENE	JUN 8-13
2	35	T	BRET	JUN 28-30
3	65	H	CINDY	JUL 3-7
4	130	MH	DENNIS	JUL 4-13
5	140	MH	EMILY	JUL 11-21
6	60	T	FRANKLIN	JUL 21-29
7	40	T	GERT	JUL 23-25
8	55	T	HARVEY	AUG 2-8
9	90	H	IRENE	AUG 4-18
10	50	T	JOSE	AUG 22-23
11	150	MH	KATRINA	AUG 23-30
12	35	T	LEE	AUG 28-SEP 2
13	100	MH	MARIA	SEP 1-10

Legend
- Major Hurricane
- Hurricane
- Tropical Storm
- Tropical Depression
- Subtropical Storm
- Subtropical Depression
- +++ Extratropical
- Wave/Low/Disturbance
- ● Position at 0000 UTC*
- ○ dd Position/date at 1200 UTC
- # Storm Number
- ppp Minimum Pressure (mb)

For readability, not all 00Z points are shown for all storms.

NUMBER	WIND (kt)	TYPE	NAME	DATE
14	80	H	NATE	SEP 5-10
15	75	H	OPHELIA	SEP 6-17
16	70	H	PHILIPPE	SEP 17-23
17	155	MH	RITA	SEP 18-26
18	70	H	STAN	OCT 1-5
19	45	SS	----	OCT 4-5
20	45	T	TAMMY	OCT 5-6
21	65	H	VINCE	OCT 8-11
22	160	MH	WILMA	OCT 15-25
23	45	T	ALPHA	OCT 22-24
24	100	MH	BETA	OCT 26-31
25	45	T	GAMMA	NOV 14-21
26	60	SS	DELTA	NOV 22-28
27	75	H	EPSILON	NOV 29-DEC 8
28	55	T	ZETA	DEC 30-JAN 6, 2006

LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 250 500
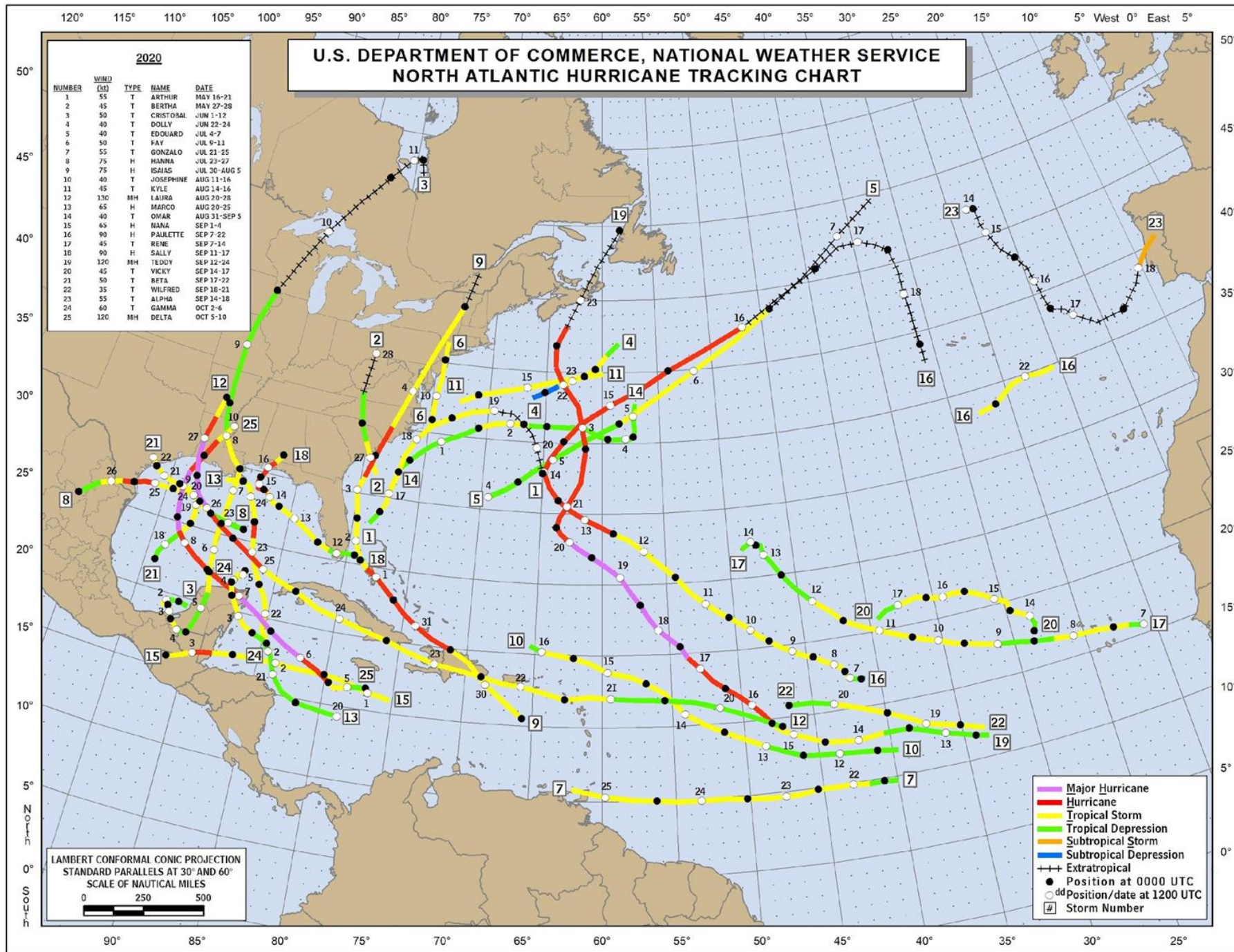
Figure Courtesy of Ethan Gibney, NOAA/NHC

1933 Atlantic Hurricane Season Comparison with 2005 and 1981-2010 Average (Ranks in Parentheses)

Forecast Parameter	1933	2005	1981-2010 Avg
Named Storms (NS)	20 (3)	28 (1)	12.1
Named Storm Days (NSD)	125.25 (2)	126.25 (1)	59.4
Hurricanes (H)	11 (T-4)	15 (1)	6.4
Hurricane Days (HD)	57.00 (4)	49.75 (8)	24.2
Major Hurricanes (MH)	6 (T-3)	7 (T-1)	2.7
Major Hurricane Days (MHD)	21.75 (5)	17.50 (7)	6.2
Accumulated Cyclone Energy (ACE)	259 (1)	245 (2)	106

T: Tie with other years

Data Sources

- Atlantic Hurricane Database (HURDAT2) (1851-2019) (Landsea and Franklin 2013)

- International Best Track Archive for Climate Stewardship (IBTrACSv4) (1851-2019) (Knapp et al. 2010)

- 20th Century Reanalysis Version 3 (1836-2015) (Slivinski et al. 2019)

- MJO Reconstruction: Surface Pressure-Based Reconstruction of the Wheeler-Hendon MJO Index (1905-2015) (Oliver and Thompson 2012)

- Normalized Hurricane Damage (Weinkle et al. 2018)

1933 Landfalling Hurricanes

Legend:
- - - - - Extratropical
——— TD, TS
——— Hurricane, Cat. 1-2
——— Hurricane, Cat. 3-5

Chesapeake-Potomac Hurricane (80 kt, 963 hPa)

47 Fatalities

Original Base Economic Damage: $17 million – likely large under-estimate, should be at least $40 million

Original Normalized Damage Estimate: $13-16 billion, likely should be >$30 billion

Storm Tide from Chesapeake-Potomac Hurricane from SLOSH Model Hindcast
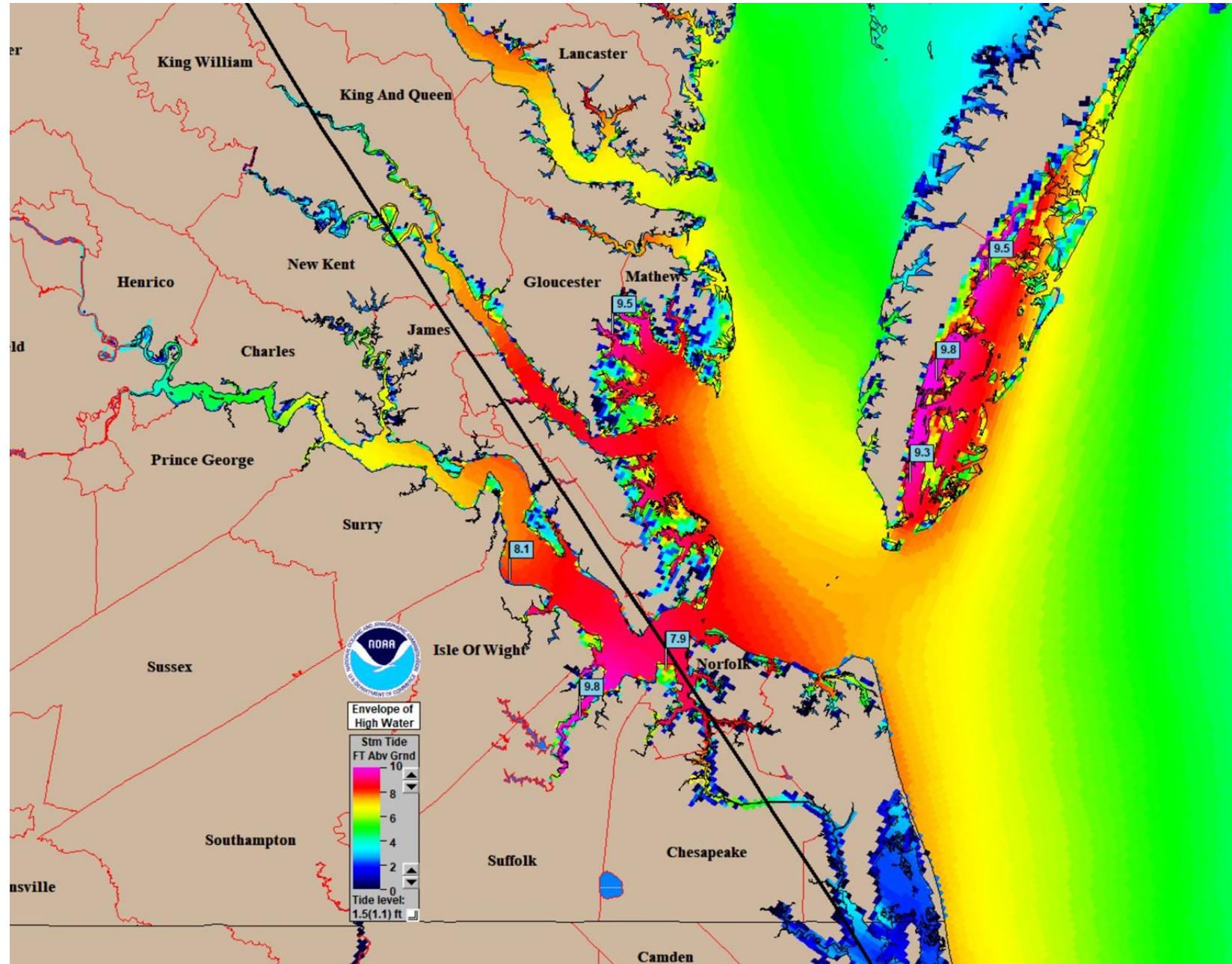
1933 Landfalling Hurricanes
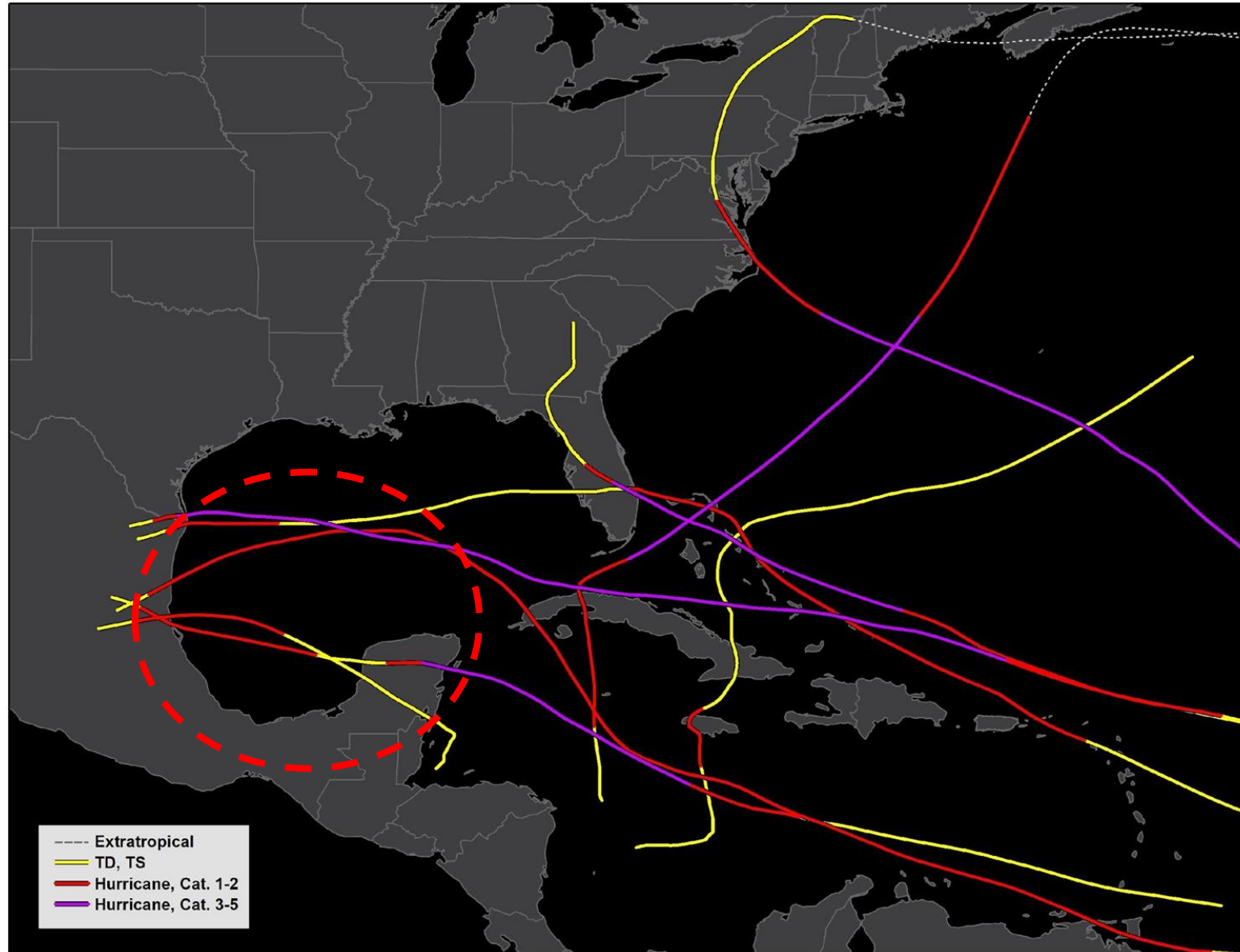
Atlantic Hurricanes Making Landfall in Mexico (1878-2019)
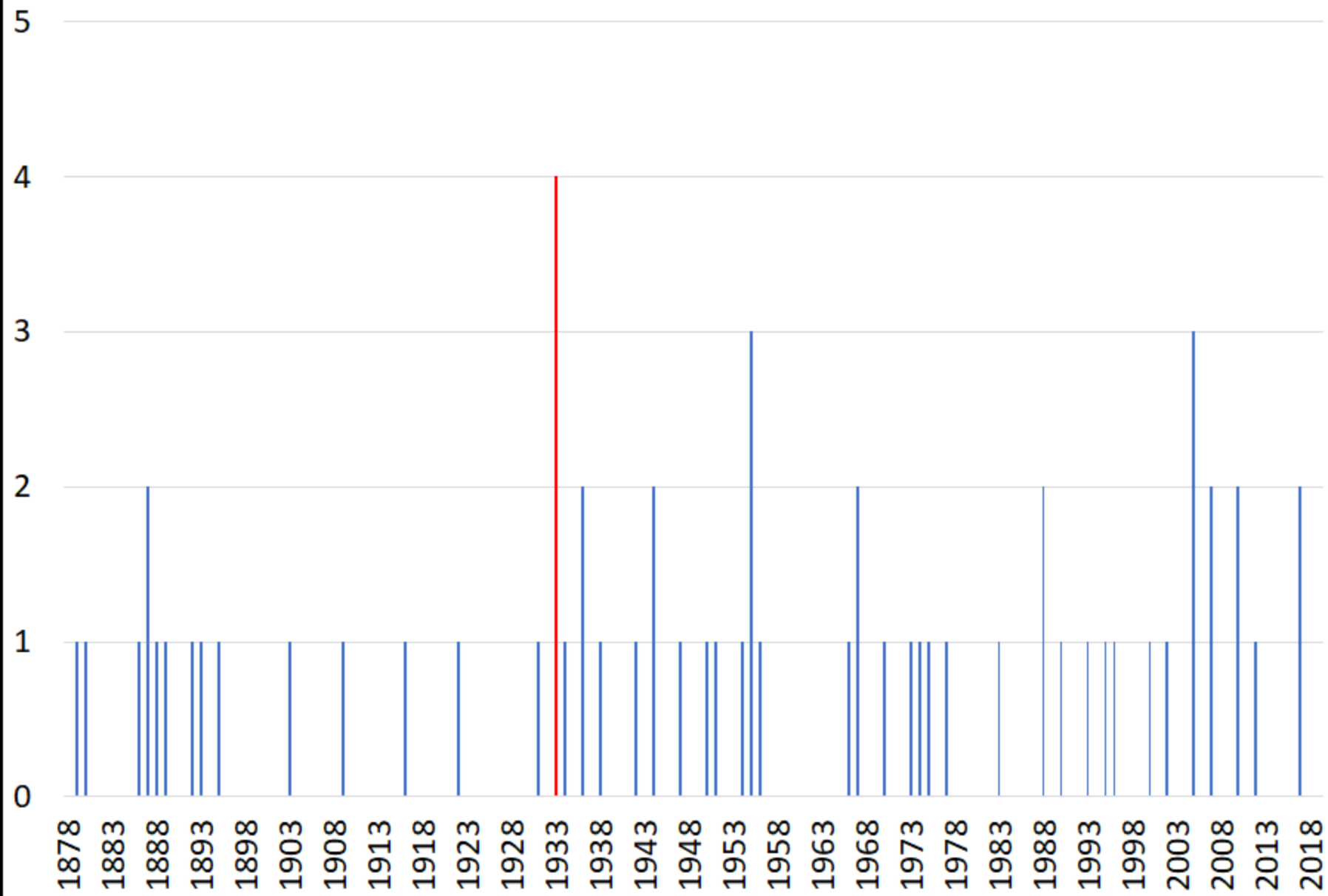
Tampico Hurricane (95 kt, 960 hPa)

~200 Fatalities

75% of houses in Tampico destroyed

Original Base Economic Damage: $5 million

Tampico Metropolitan Area: Population in 1933 – 100,000 --- Population in 2020 – 1,000,000

1933 vs. 2005 and 1981-2010 Atlantic Monthly Average ACE
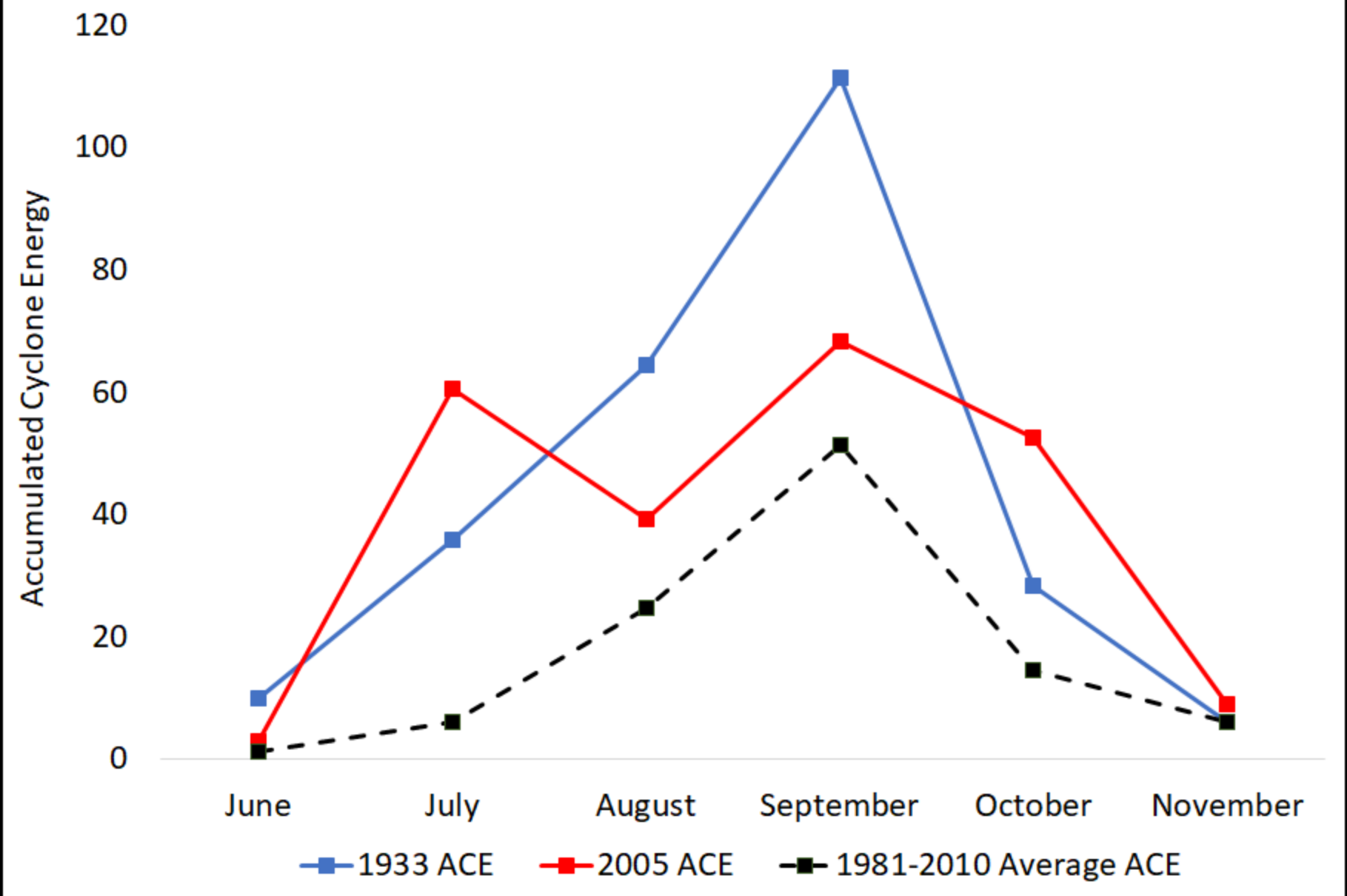
August-October 1933 Large-Scale Conditions

a) SLP

b) Zonal shear

c) SST

d) 500-hPa Height
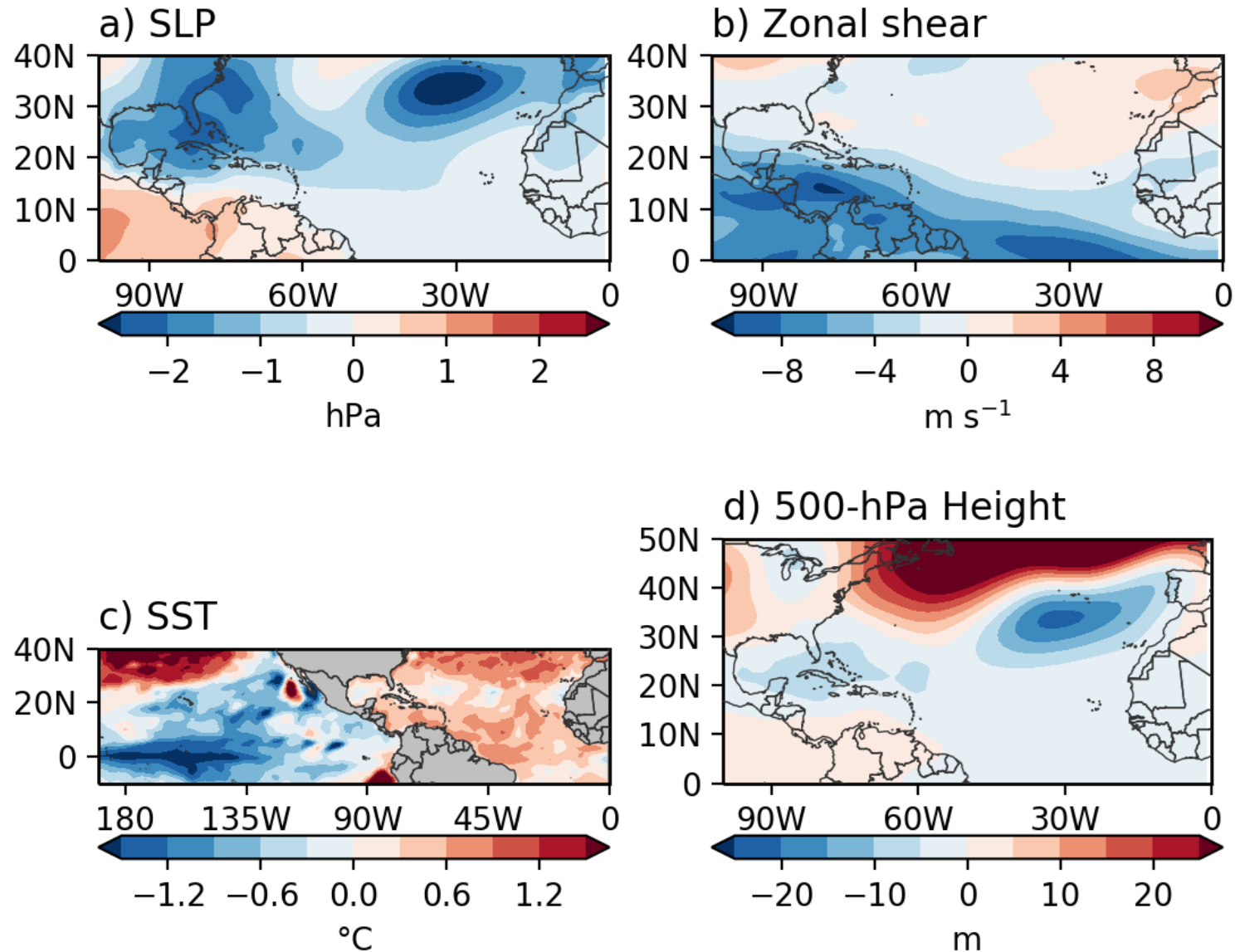
August-October Sea Surface Temperature Anomalies
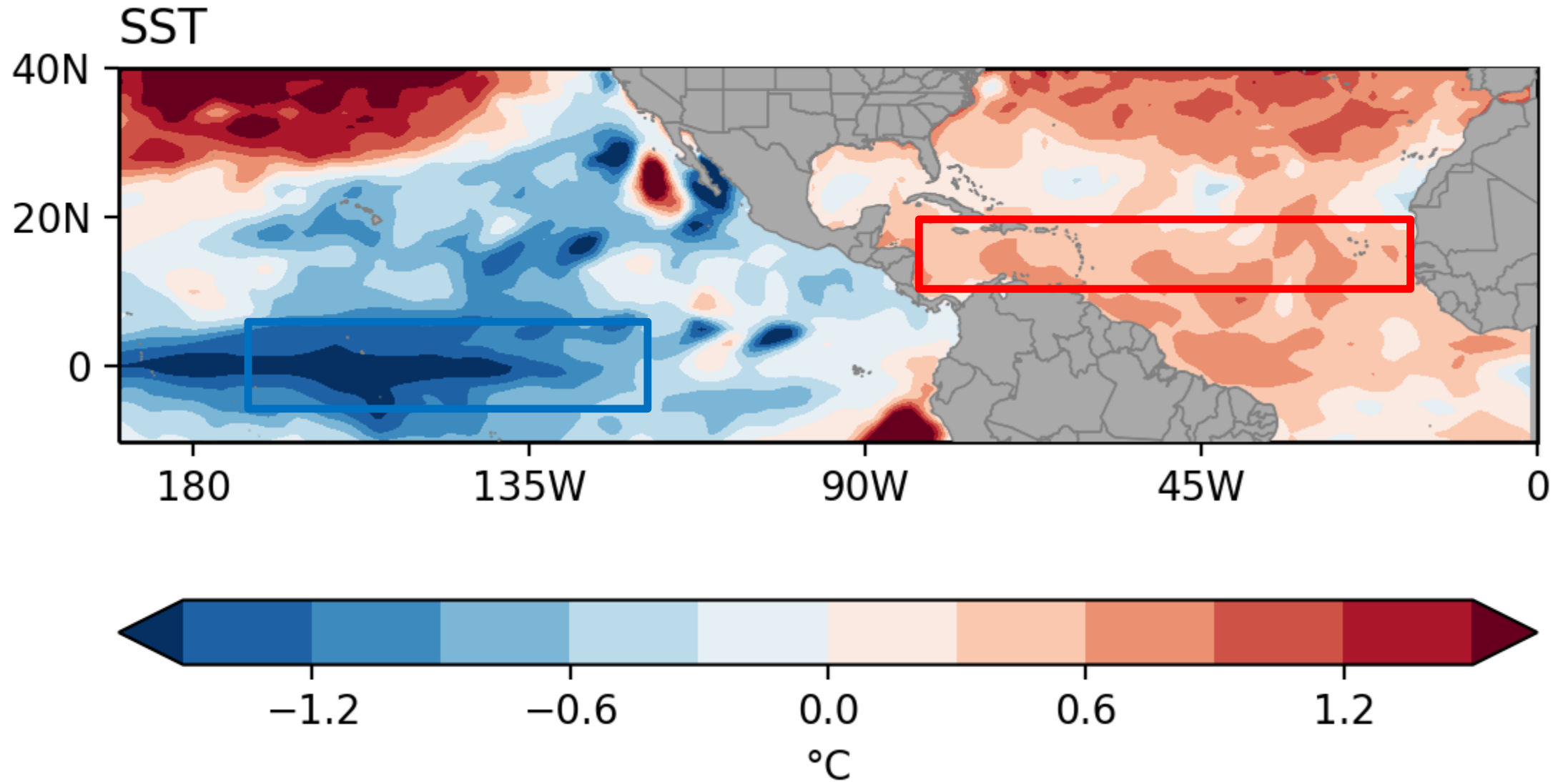
Madden-Julian Oscillation (MJO)
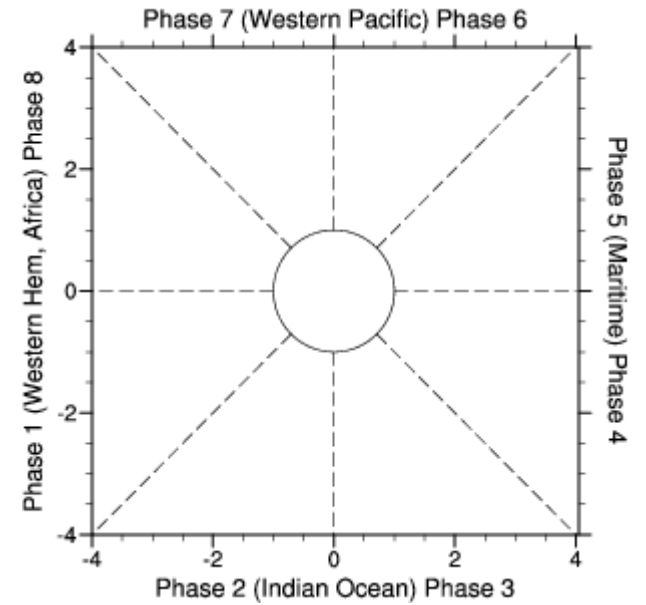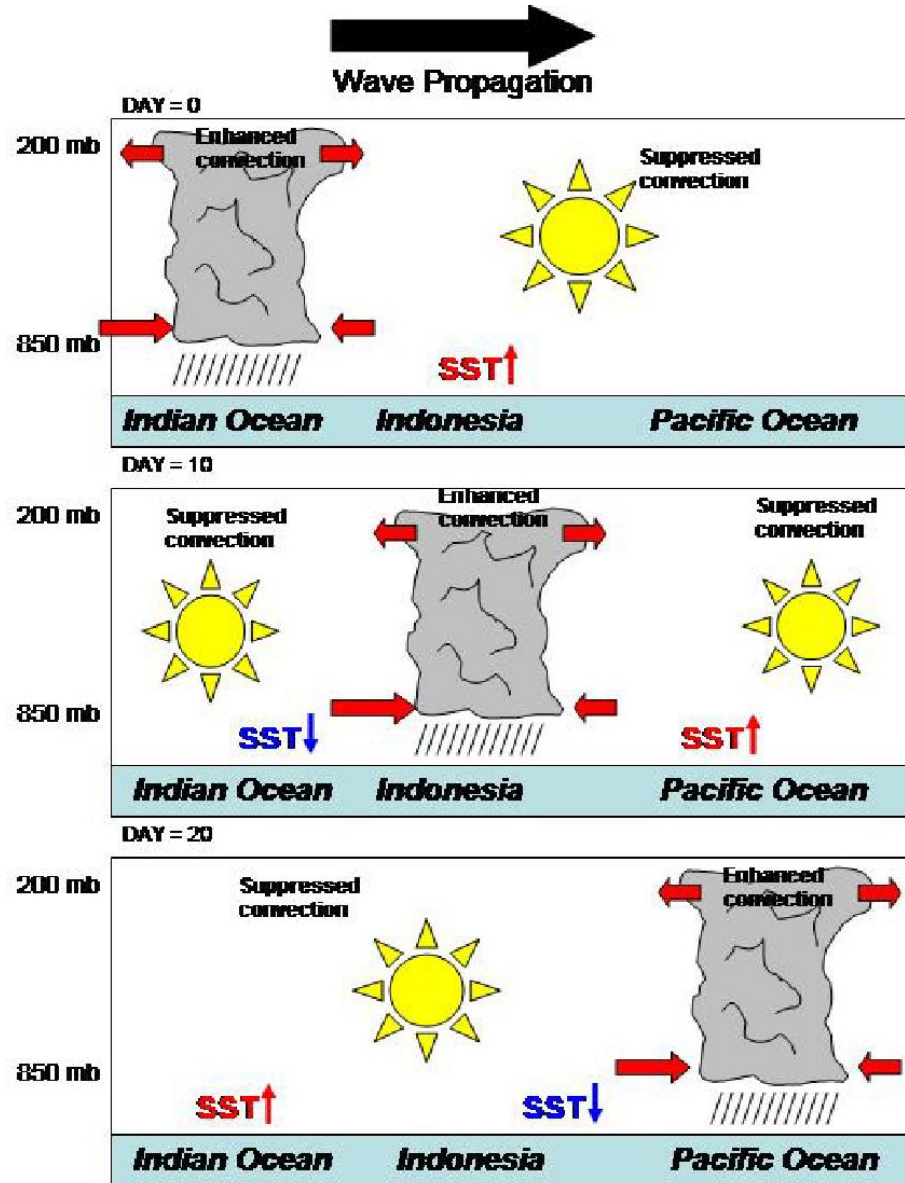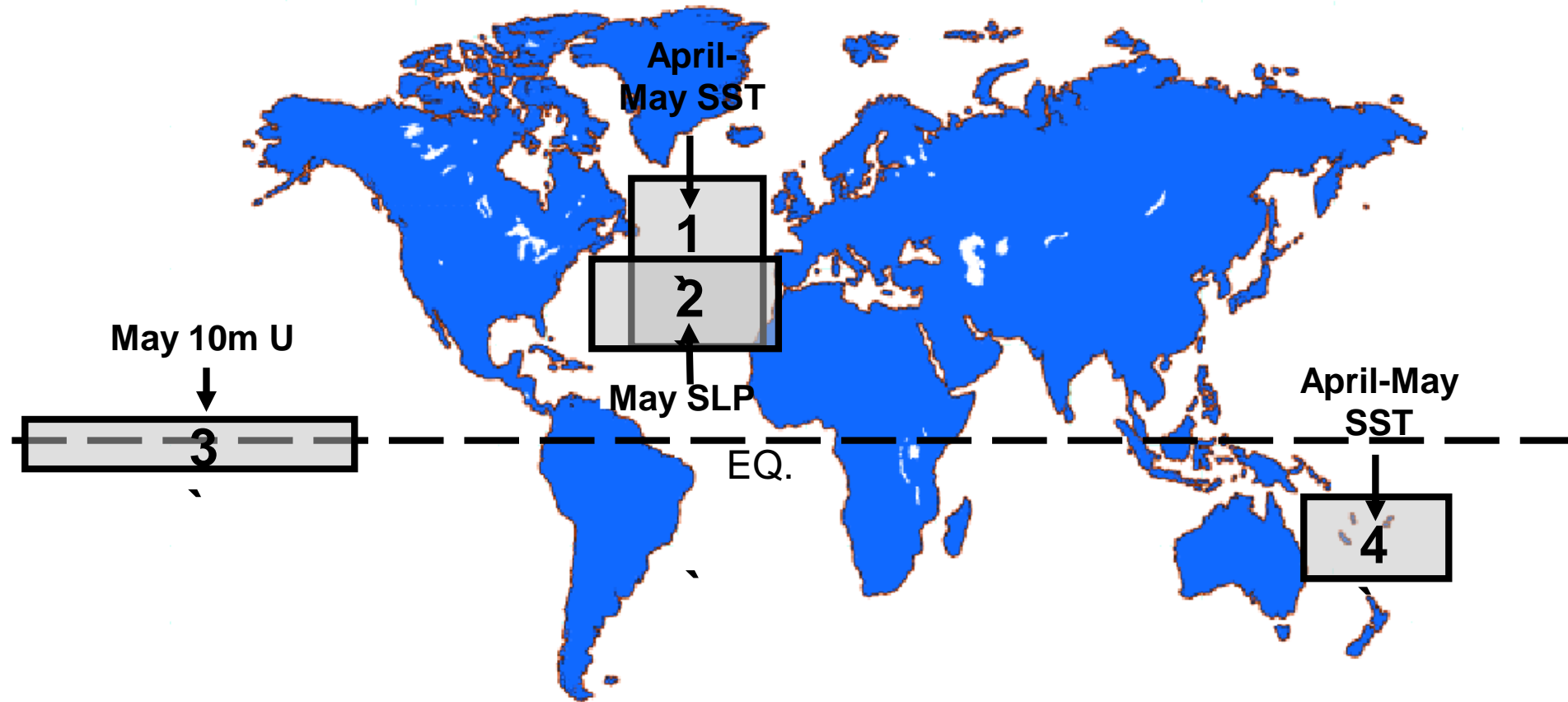
MJO Influence on 1933 Atlantic Hurricane Season

June-August
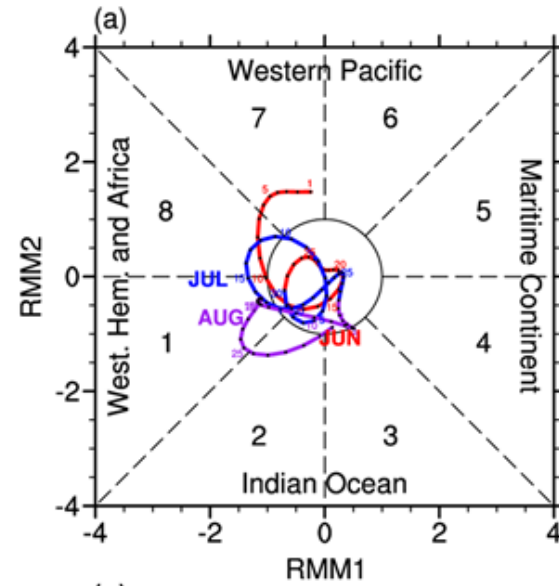
September-November
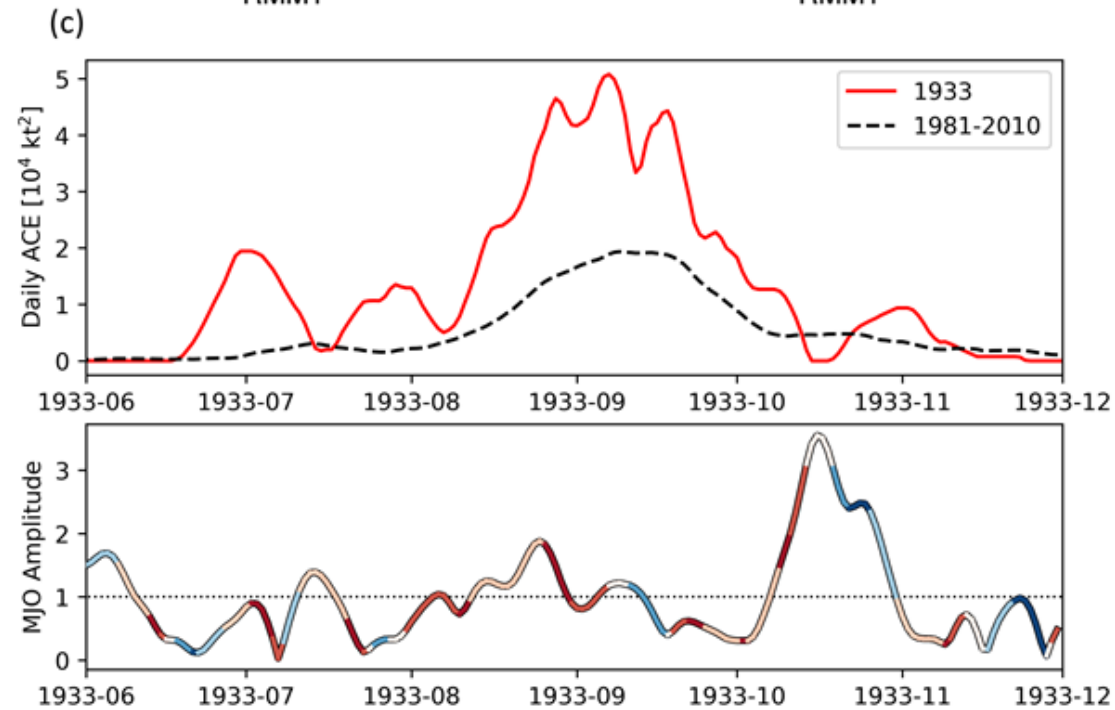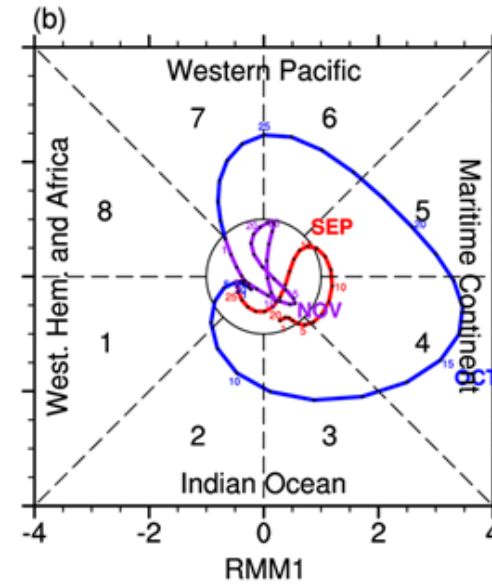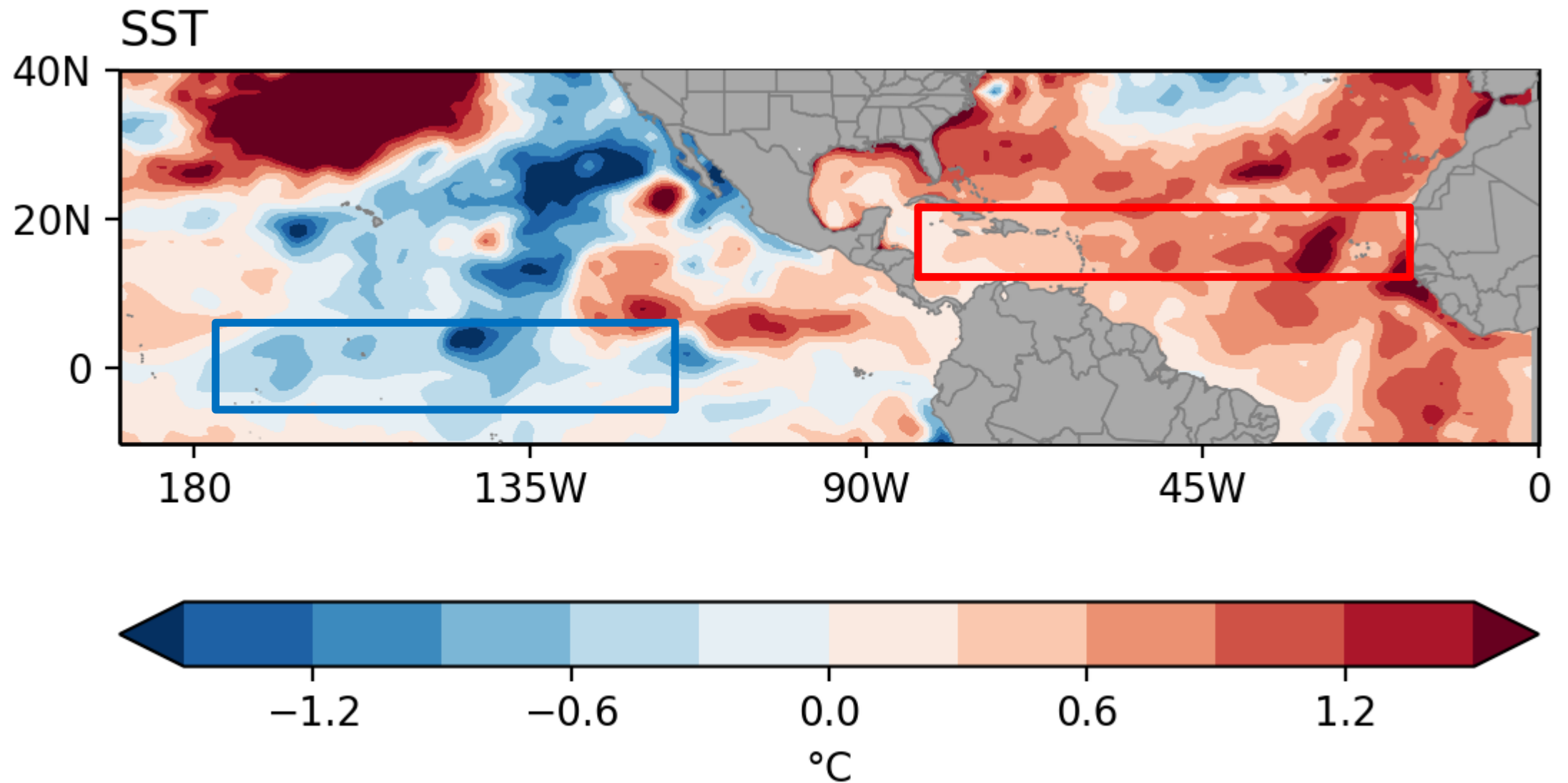
June Seasonal Forecast Predictors

How well did June statistical forecast model predict 1933 ACE?

Observed ACE Rank vs. Hindcast ACE Rank (1878-1933)

r = 0.62

165 ACE
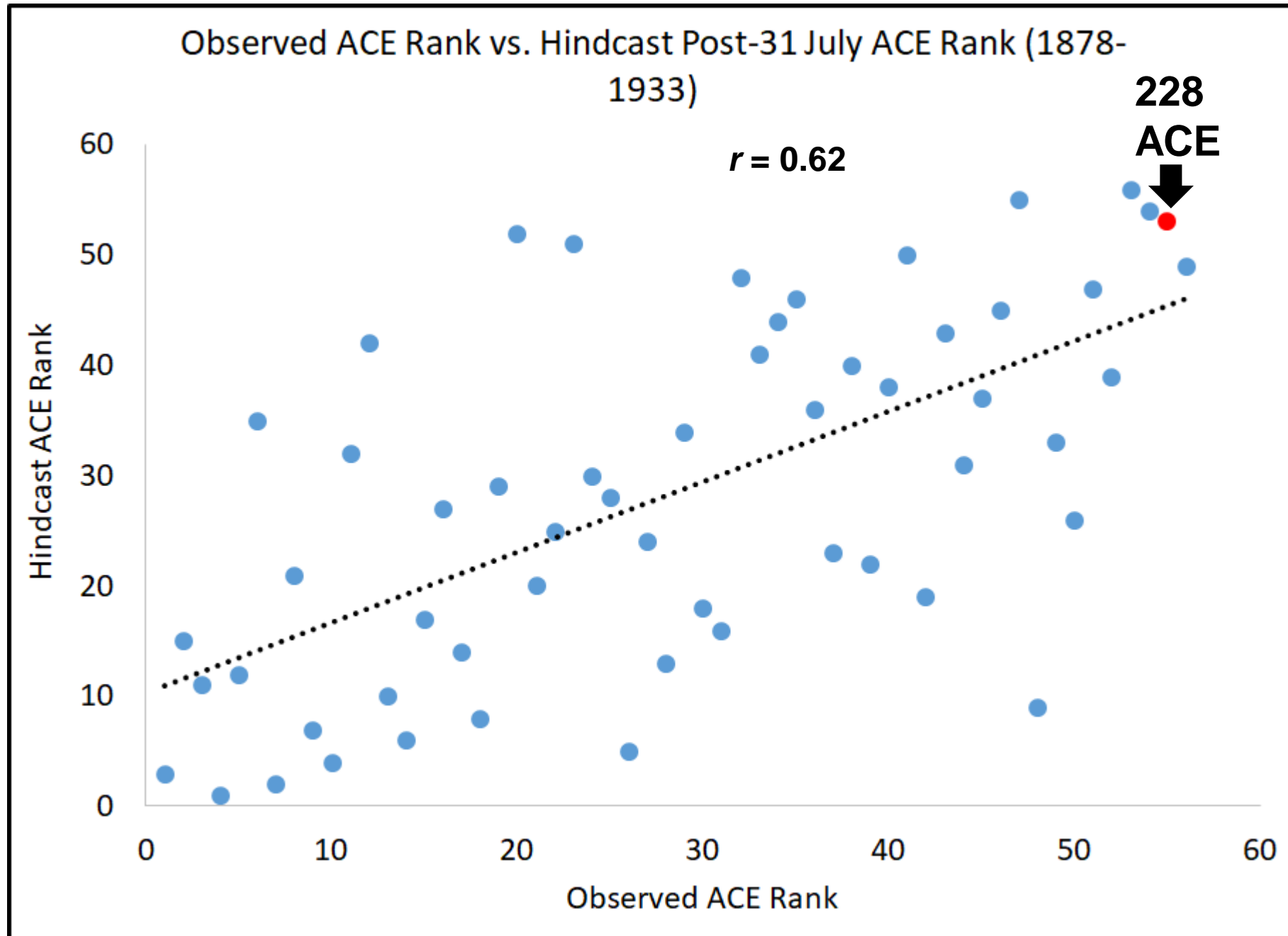
Hindcast ACE Rank

Observed ACE Rank
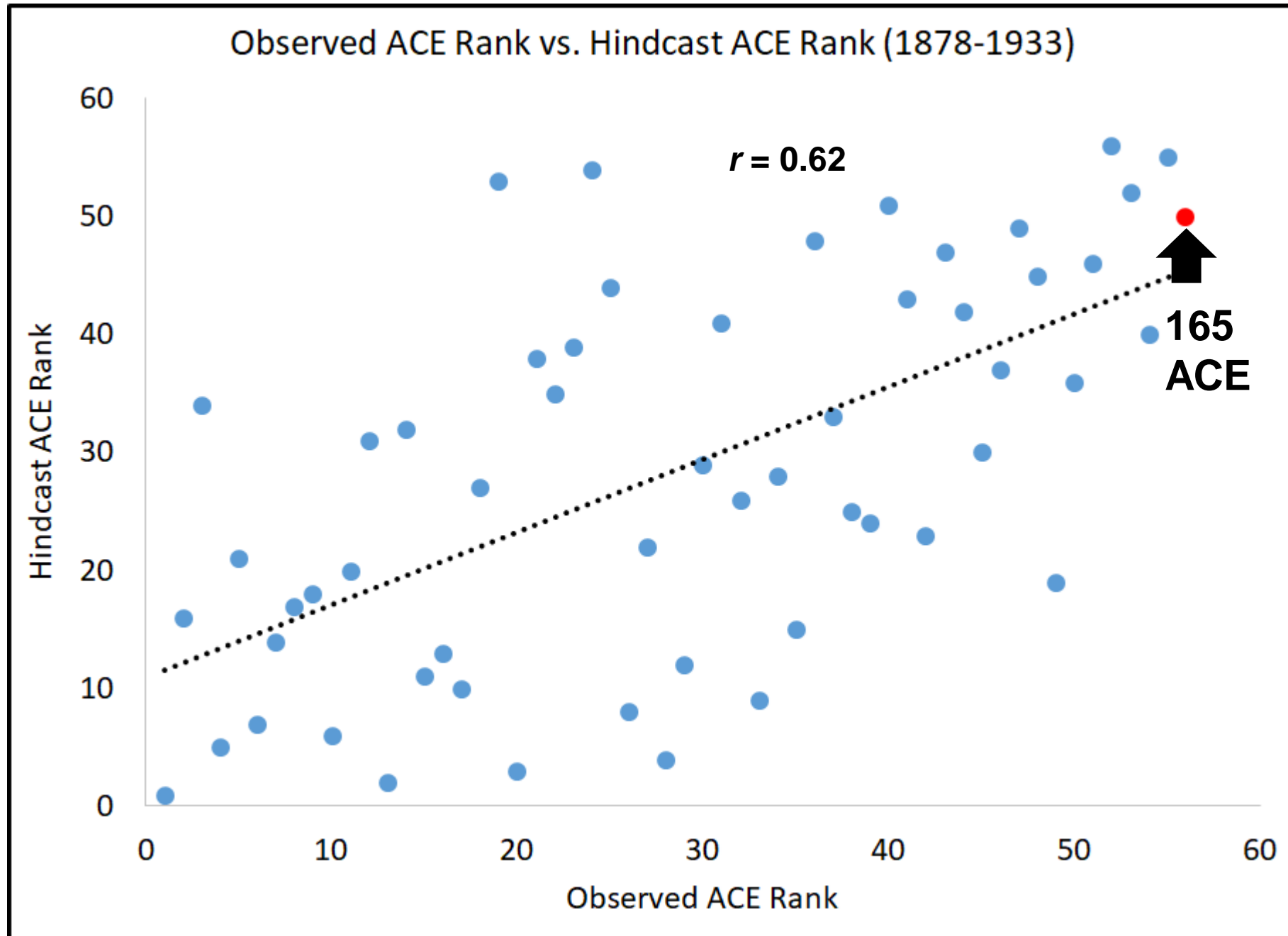
July 1933 Sea Surface Temperature Anomalies
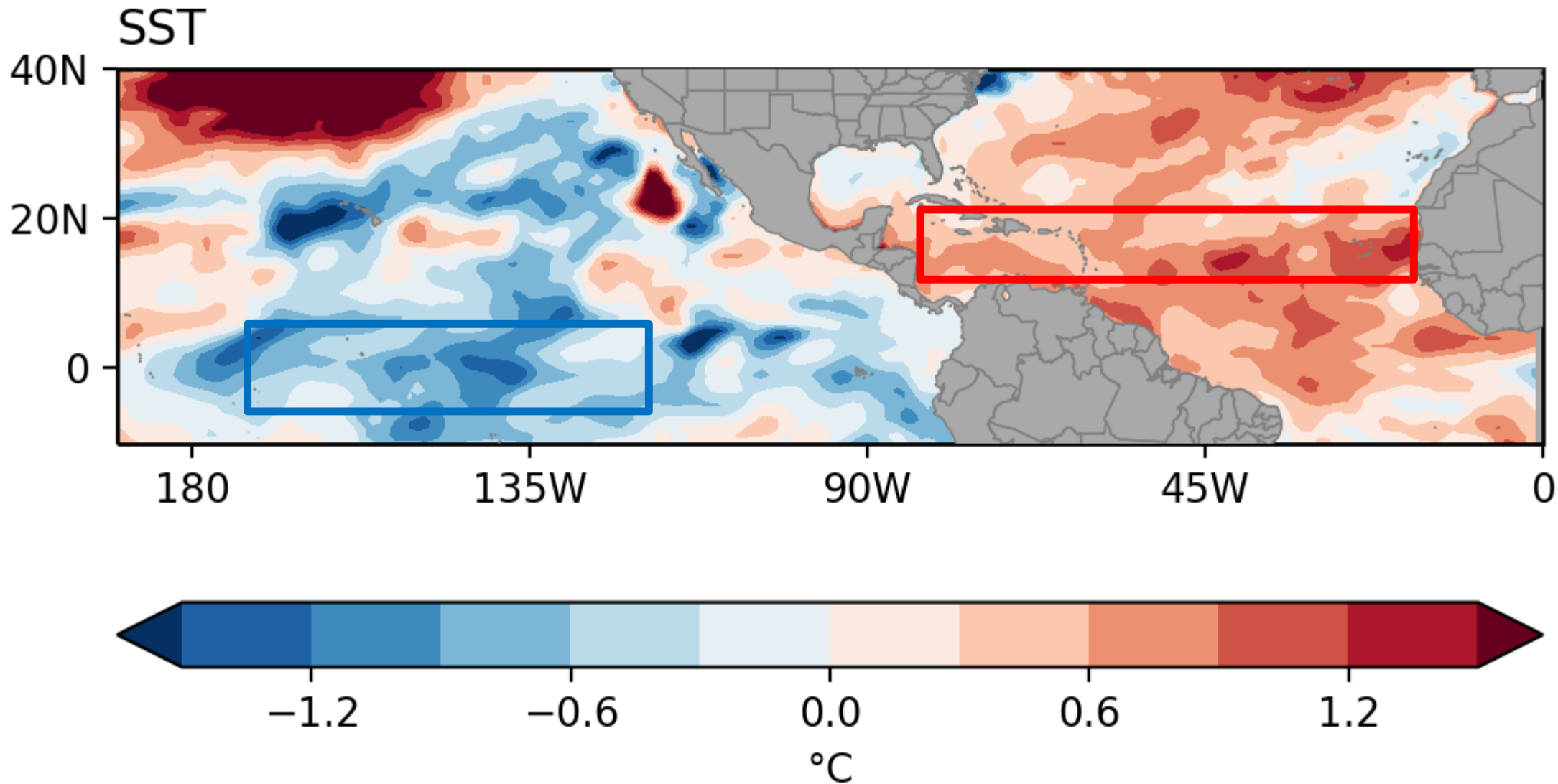
Post-31 July Seasonal Forecast Predictors
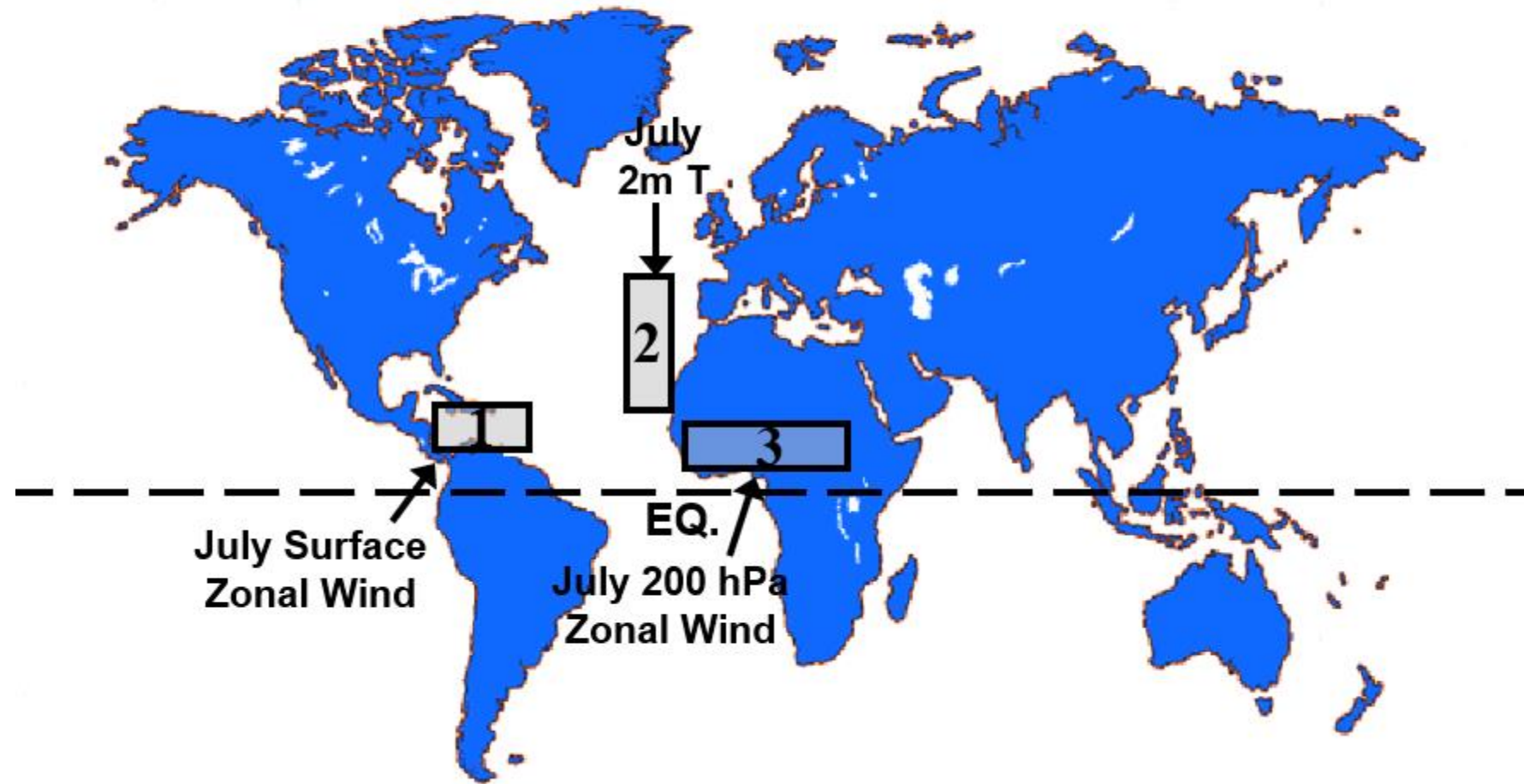
How well did early August statistical forecast model predict 1933 ACE?

Observed ACE Rank vs. Hindcast Post-31 July ACE Rank (1878-1933)

r = 0.62

228 ACE

Hindcast ACE Rank

Observed ACE Rank

Conclusions

- 1933 was extremely active – both from a basinwide and landfalling perspective

- Large-scale environmental factors strongly favored an active season

- Early June and early August statistical seasonal forecast models from CSU would have well anticipated a very active hurricane season