# 2023 Seasonal Hurricane Outlook

Matthew Rosencrans

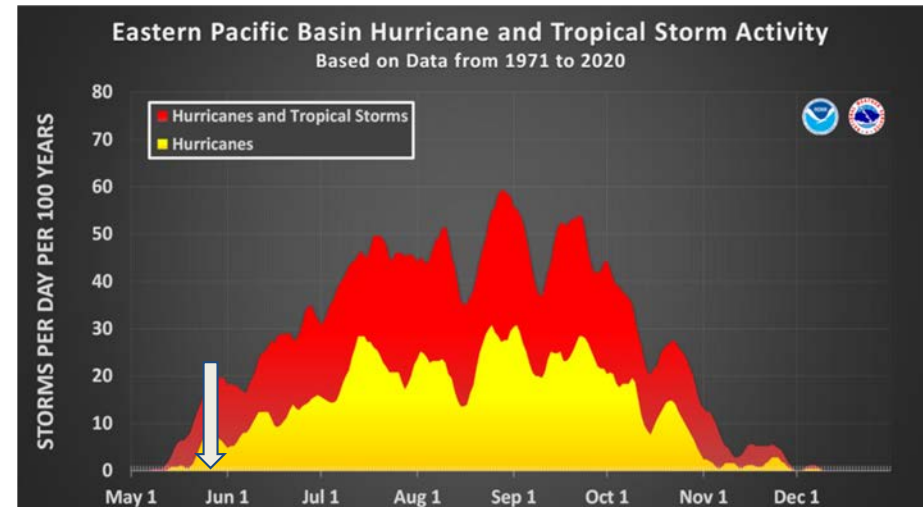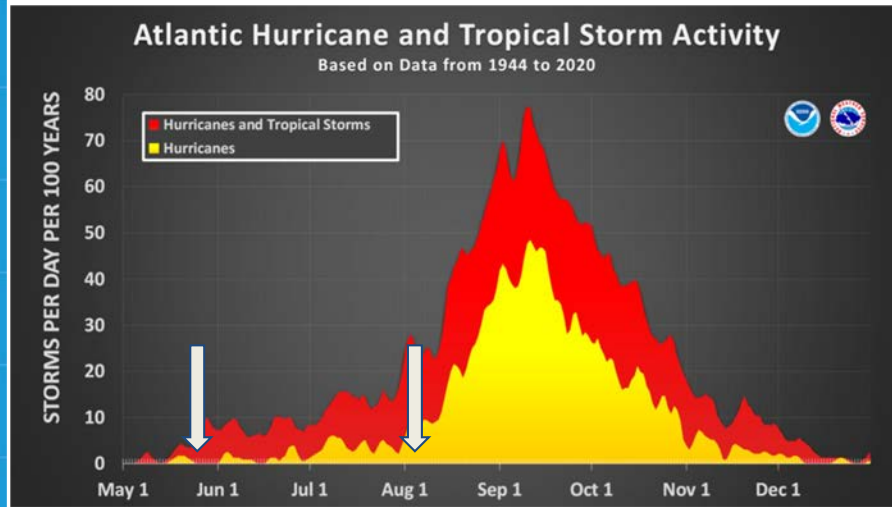NOAA's Lead for the Seasonal Hurricane Outlook

# Seasonal Hurricane Outlooks - When

Seasonal Hurricane Outlooks are released in late May and early August.

May - Atlantic, East Pacific, Central Pacific, West Pacific

August - Atlantic only  (West Pacific is "if needed")



Atlantic Hurricane and Tropical Storm Activity
Based on Data from 1944 to 2020



Eastern Pacific Basin Hurricane and Tropical Storm Activity
Based on Data from 1971 to 2020

# NOAA's 2023 Atlantic Hurricane Season Outlooks

These outlooks are for the overall seasonal activity. They are not a hurricane landfall forecast.

For the Atlantic hurricane region, the updated outlook indicates a 60% chance of an above-normal season, a 25% chance of a near-normal season, and a 15% chance of a below-normal season.

Caption: Red areas represent above-normal, green represents near-normal, and blue for below- normal. Below the chart are the predicted ranges of named storms, hurricanes, major hurricanes, and ACE, with climatology to the bottom right.
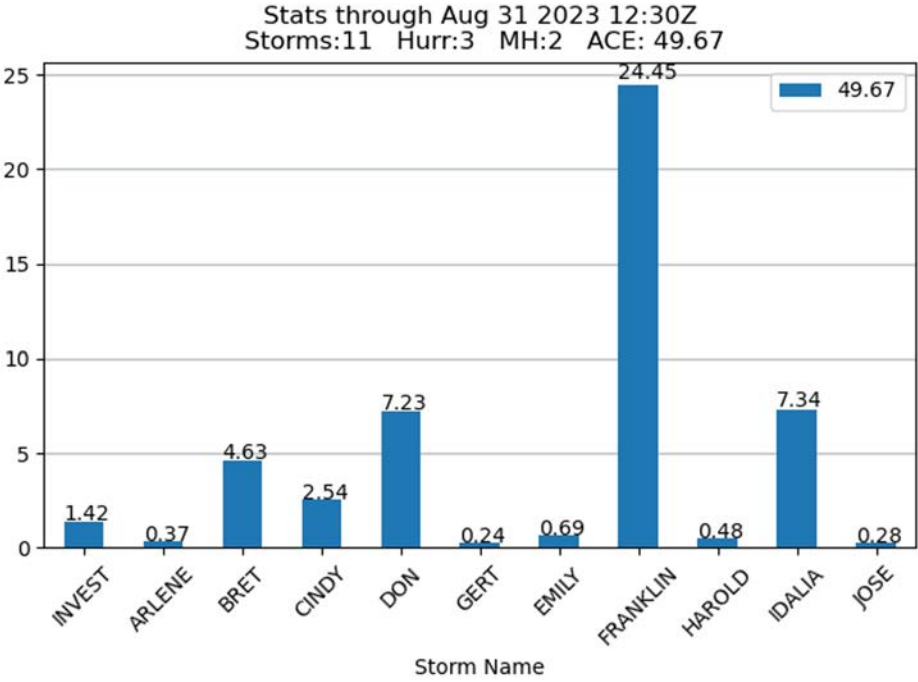
# Last 2 years in review

2021
10 total by Sept 1

Above-Normal


2022
3 total by Sept 1

Near-Normal

# 2023 Atlantic Hurricane Season to date

Stats through Aug 31 2023 12:30Z
Storms:11  Hurr:3  MH:2  ACE: 49.67



| Thru 8/23 | Named Storms | Hurr | Major Hurr | ACE |
|---|---|---|---|---|
| Climo | 6.4 | 2.4 | 1.8 | 36 |
| Obs | 11 | 3 | 2 | 49 |

Caption: Bar chart showing the Accumulated Cyclone Energy (ACE) for each named storm in the Atlantic Basin this year.  Title also includes the total number of named storms, hurricanes, major hurricanes, and ACE to date.

# Atlantic Outlook - Historical Context
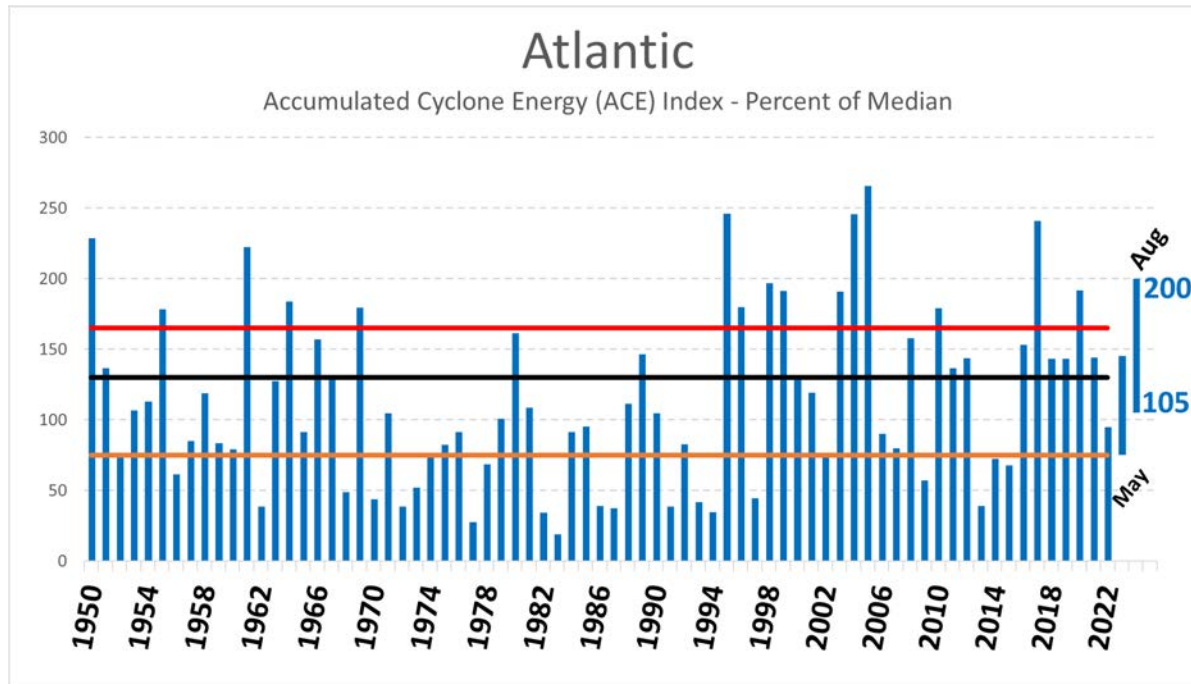


Caption: Seasonal Accumulated Cyclone Energy (ACE) indices (Blue bars) and NOAA's 2023 outlook range with a 70% probability of occurrence (rightmost column) for the Atlantic basin. Black (orange) lines indicates NOAA's ACE thresholds for classifying hurricane season strength as above (below). For the Atlantic, the 165% threshold (red line) reflects a hyper-active season.

# Model Forecast Summary

The guidance mean for ACE is 173% of median, well into the above normal category

ACE range for near-normal season is 75% - 130% of median
ACE >= 165% indicates hyper-active.

# Hurricane Landfalls - Activity Era

49% Increase

25% Increase

100% Increase

During high activity eras, largest increase in hurricane landfalls is along Atlantic coast

U.S. sees almost a doubling of seasons with <u>multiple</u> landfalling hurricanes: Occur about every other year compared to about every fourth year.

# ENSO Outlook

# ENSO Materials

Weekly ENSO Update (Monday morning):

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

Monthly ENSO Diagnostic Discussion (2nd Thursday, 0900 ET)

https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml

Monthly Climate Diagnostics Bulletin (mid-month, approx 13th)

http://www.cpc.ncep.noaa.gov/products/CDB/

ENSO Tutorial:

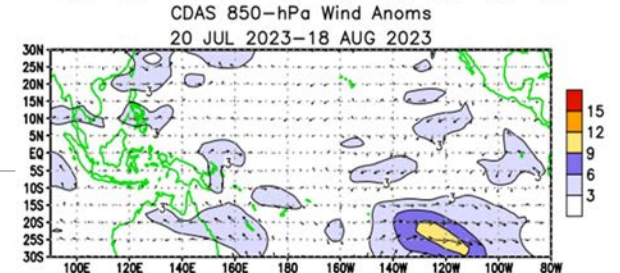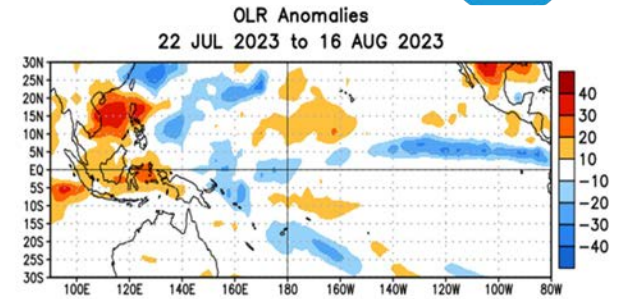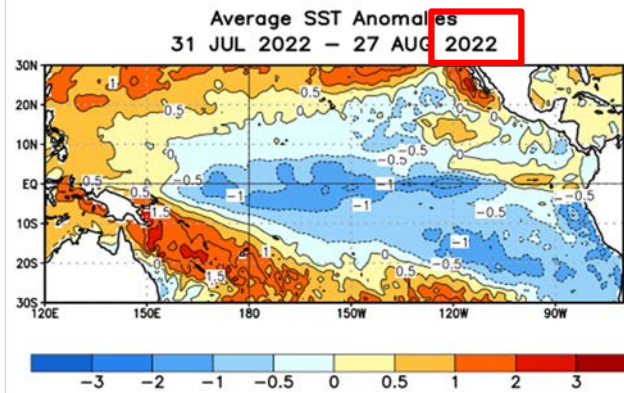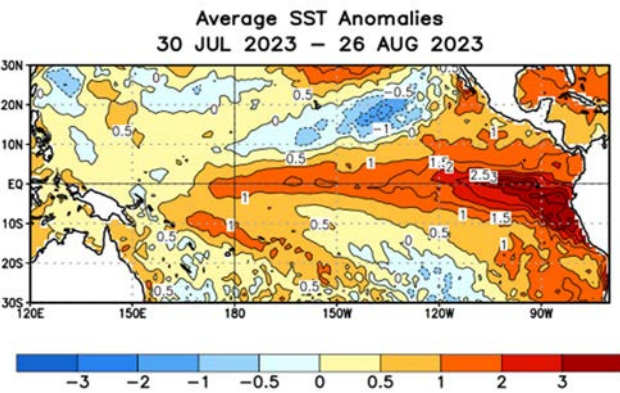http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensocycle/enso_cycle.shtml

# ENSO Status

El Niño ( Robust, coupling a bit behind

Aug 21 - Niño3.4 +1.5°C

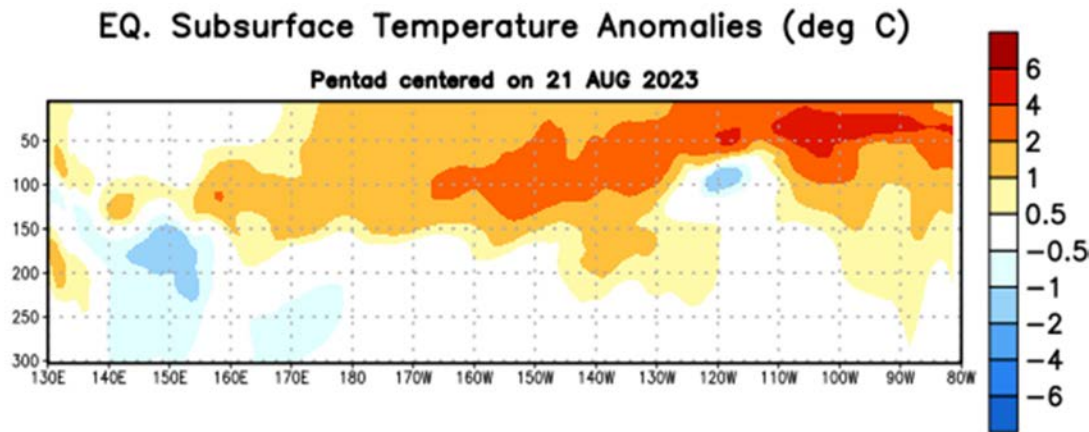   (tied - 5th warmest in Aug) using 1981+
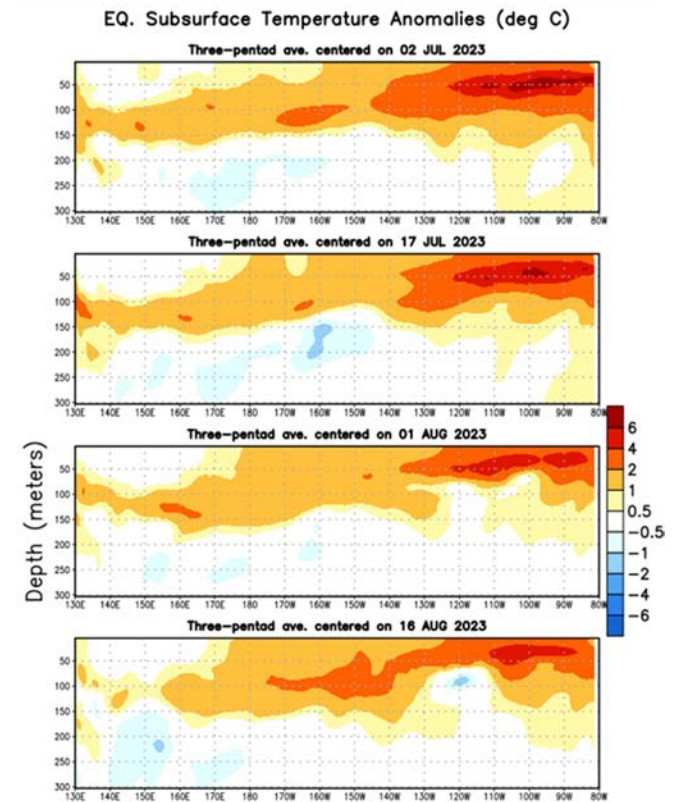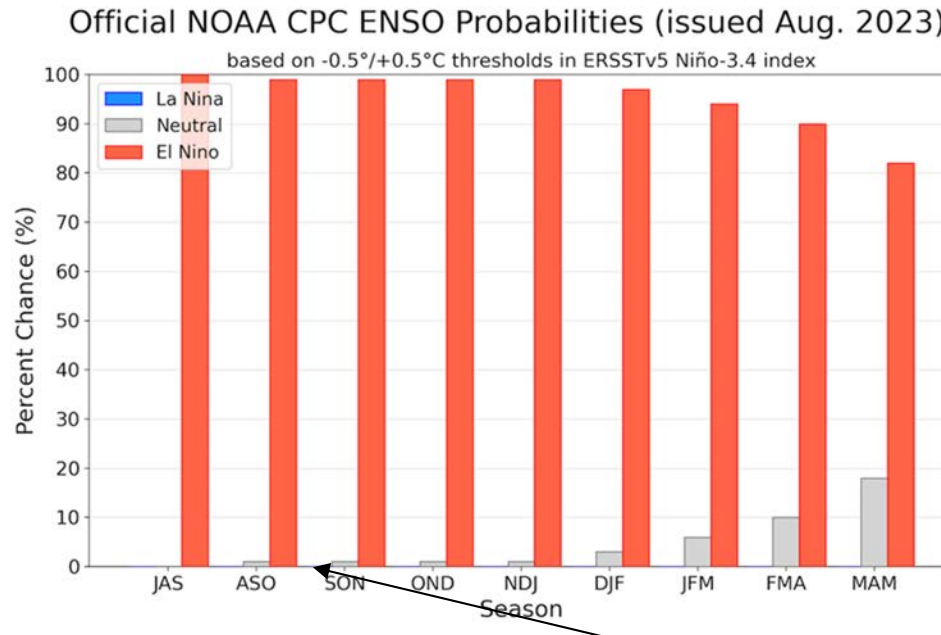
MJJ ONI - 5th highest - 1950+
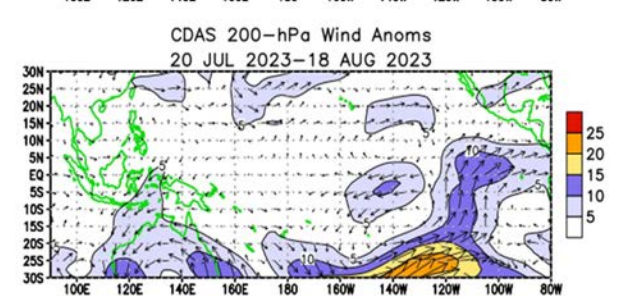
# ENSO Status

Positive subsurface temperature anomalies dominate the equatorial Pacific Ocean.



Positive subsurface temperature anomalies weakened in the western equatorial Pacific and near 120W at 50-100m.
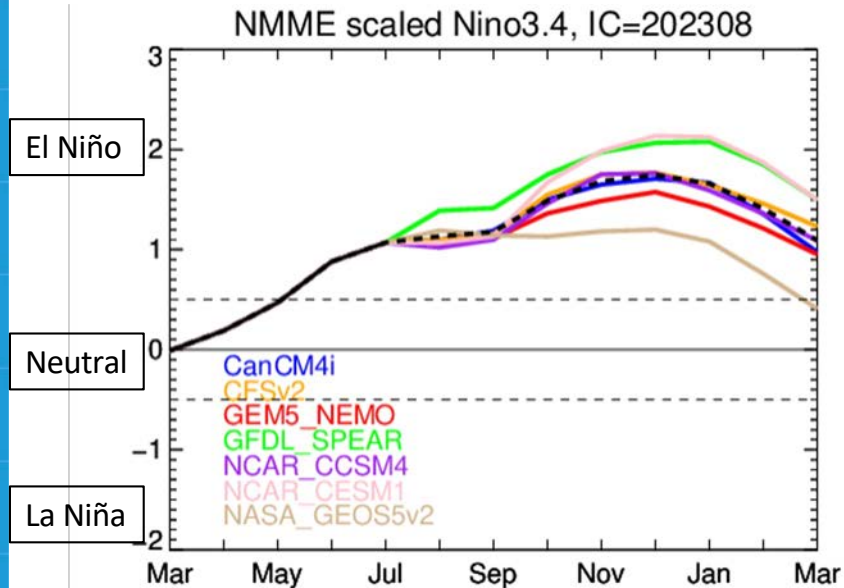
# CPC/ IRI ENSO Probability Forecast (Aug 10th)



Official NOAA CPC ENSO Probabilities (issued Aug. 2023)
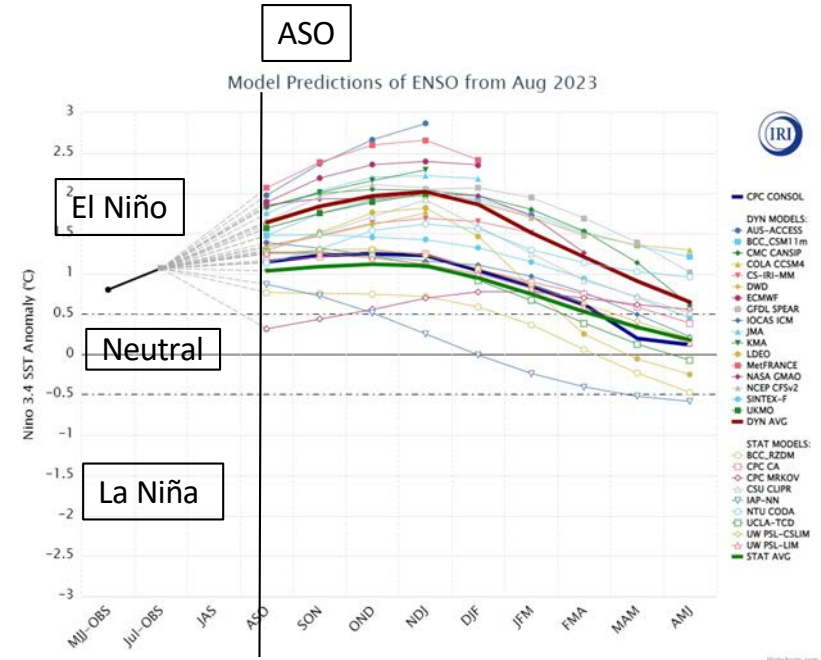based on -0.5°/+0.5°C thresholds in ERSSTv5 Niño-3.4 index

The official CPC/IRI forecast from Aug indicates El Niño as most likely through ASO 2023.
Odds for El Niño during ASO have increased since the initial outlook. (**to 98% from 82%**)
The outlook indicates a 90+% chance of El Niño through 2023.

Caption: Seasonal probabilities for El Niño (Red bars), ENSO-neutral (Grey bars), and La Niña (Blue bars). Seasons are indicated by their 3-letter abbreviation (JJA is June-July-August, etc.). This is issued by the NOAA Climate Prediction Center (CPC) and NOAA associated partners.

# ENSO Forecast Plumes



NMME scaled Nino3.4, IC=202308

El Niño

Neutral

La Niña

CanCM4i
CFSv2
GEM5_NEMO
GFDL_SPEAR
NCAR_CCSM4
NCAR_CESM1
NASA_GEOS5v2



ASO

Model Predictions of ENSO from Aug 2023

El Niño

Neutral

La Niña

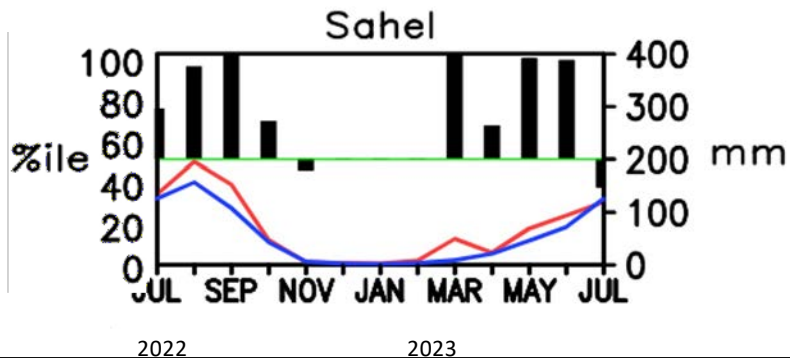(Left) The NMME average shows the continuation of El Niño through Winter 2023.

(Right) Multi-model dynamical and statistical model averages predict El Niño to continue through Winter 2023.

Caption: Model predictions for Niño 3.4 region from NMME (left) and multiple modeling centers (right - source IRI)
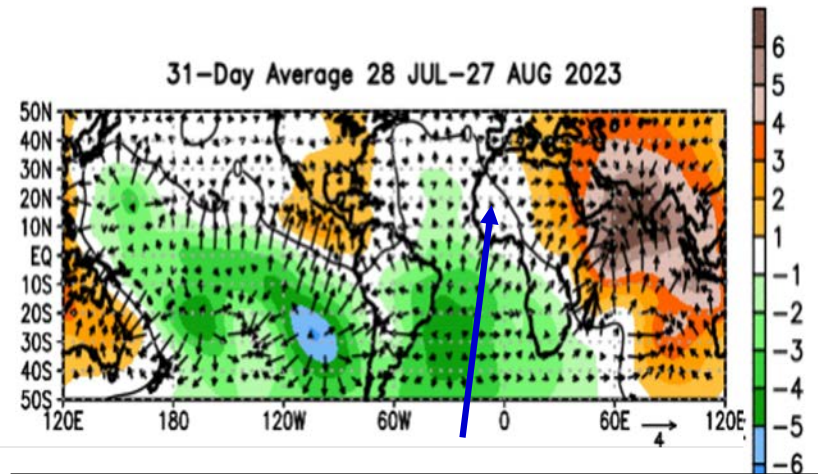
# Atlantic Conditions

# West African Monsoon



**Sahel**

The African Sahel wet Mar-Jun, July dry - Mixed signals.

200-hPa Anomalous Velocity Potential and Divergent Wind Vector

31-Day Average 28 JUL–27 AUG 2023

Implied weak to normal monsoon vertical circulation during last 31 days.
Been oscillating from weak to strong, more often weaker than normal - Big change from last couple of years.

Caption: (Left) Areal estimates of monthly mean precipitation amounts (mm, red lines) and precipitation percentiles (%, bars) for the most recent 13 months. The monthly precipitation climatology (mm, blue line) is from the 1981-2010 base period monthly means. Percentiles are not shown if the mean < 5 mm.  (Right) The upper-level circulation shows anomalous convergence (oranges) over Africa, suggesting a more near-normal start to the west African monsoon, or some interaction on intraseasonal time scales.

# Observed Low-level Circulation

Last 31 Days

700-hPa Wind Speed (shading) and Vector

31-Day Average 28 JUL-27 AUG 2023

700-hPa Anomalous Wind Speed (shading) and Vector

31-Day Average 28 JUL-27 AUG 2023
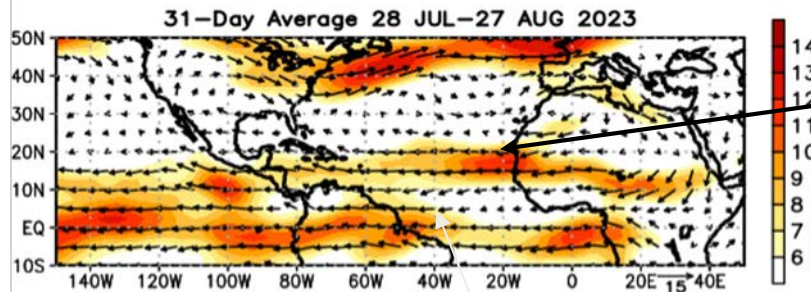
African Easterly Jet axis is near 15N. A bit south of where it was last year and 2021. And just near climo position (neither favorable nor unfavorable for activity)
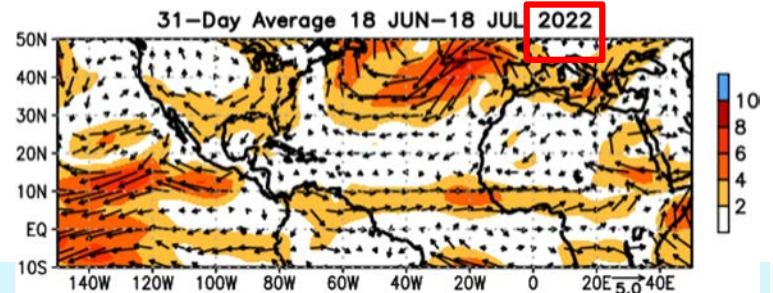
Small anomalies for most of the MDR (Green Box), (Weaker than last year)

This pattern is not normally associated with the high activity era, so something else is influencing the pattern. (Increasing the uncertainty).

700-hPa Anomalous Wind Speed (shading) and Vector
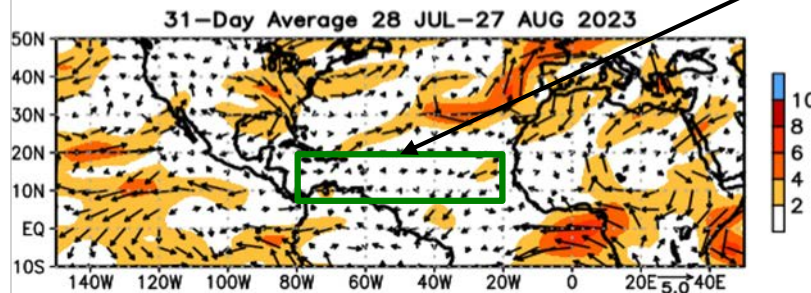
31-Day Average 18 JUN-18 JUL 2022

Caption: Climate Data Analysis System (CDAS) analysis of wind anomalies at 700-hPa. Green boxes denote the Main Development Region (MDR) of the Atlantic.
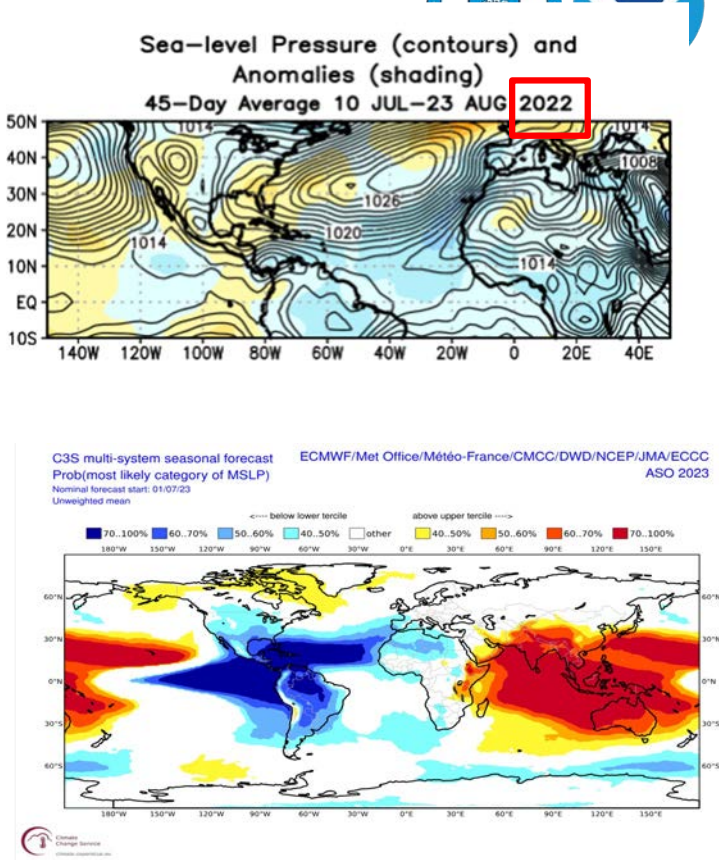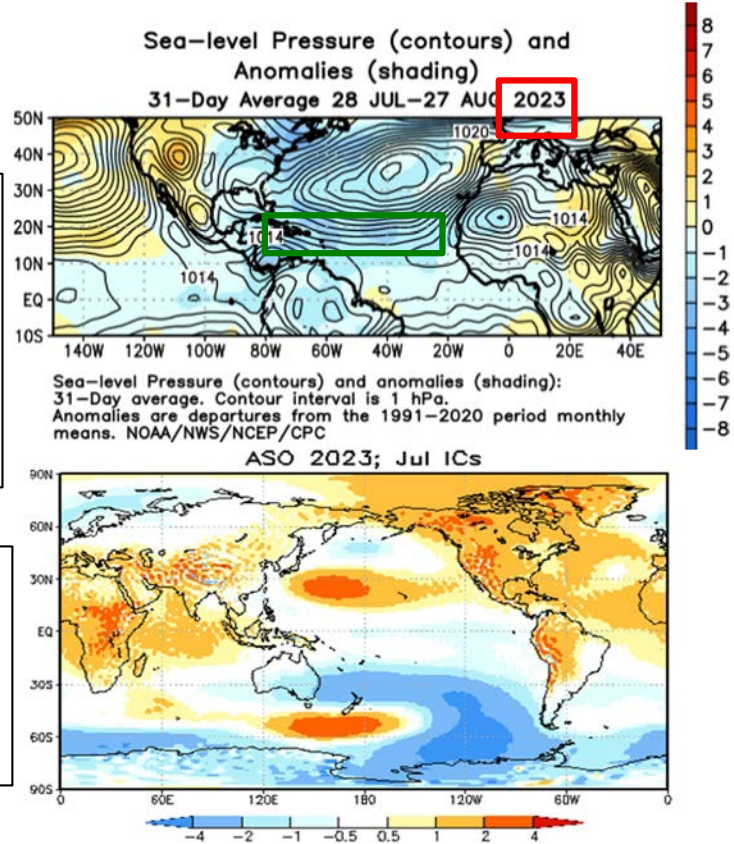
# Sea-level Pressure

Across the MDR, sea-level pressure has been below average (blue shading) throughout the summer.

Lower than last year, different pattern overall (STR not as intense and elongated)

CFS Hi-Res is predicting above-average SLP during ASO across the MDR. Same as 2022

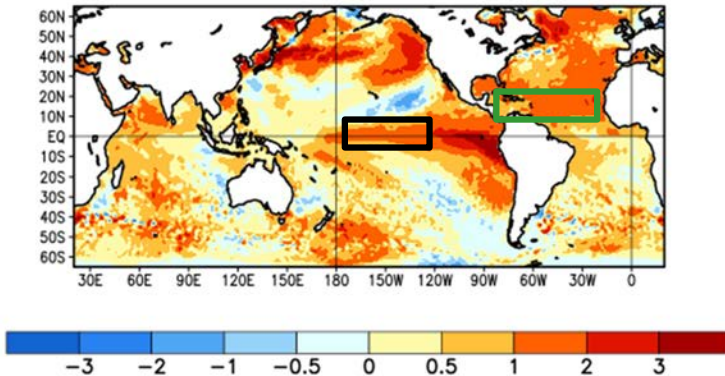C3S is predicting near to below normal SLP in the MDR.



Caption: Climate Data Analysis System (CDAS) analysis of SLP anomalies. Green boxes denote the Main Development Region (MDR) of the Atlantic. (Bottom) Forecasts of SLP from CFSv2 and the C3S multi-model.
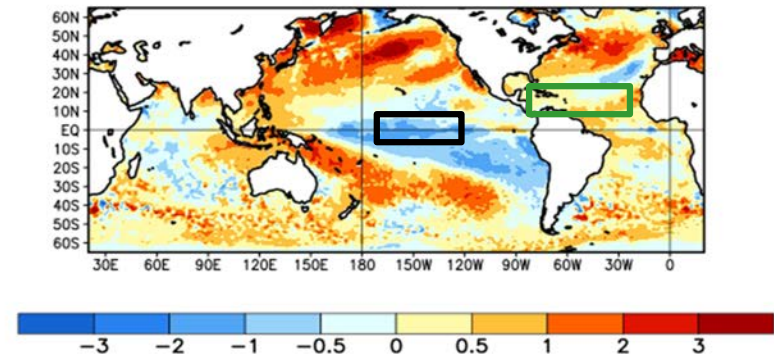
# Sea-surface Temperature Anomalies



Last year at this time

During May and June, El Niño conditions were present across the equatorial Pacific Ocean (blue box). A mix of SST anomalies is observed in the off equatorial Pacific. In the Atlantic hurricane MDR (green box), SSTs were above-average (record warmth). Strongly above-normal temperatures are evident over much of the western and eastern North Atlantic. Some below-normal temperatures are in the central extratropical Atlantic. **A warm Atlantic and warm Pacific would produce competing forcings for Atlantic tropical cyclone activity.**

Caption: Sea surface temperature anomalies (°C) during July of 2023 and 2022. Green box is the Atlantic MDR, black box is the Niño 3.4 region. Departures from the 1991-2020 means.

# July 2023 SSTA in MDR



July 2023
Sea Surface Temperature Departures (°C)

MDR Anomaly (°C)
JUL 2023 Anomaly is 1.20°C

Anomaly Difference (MDR–Tropics) (°C)
JUL 2023 Anomaly Difference is 0.66°C
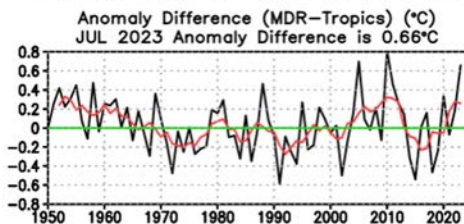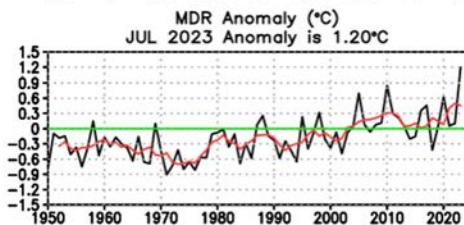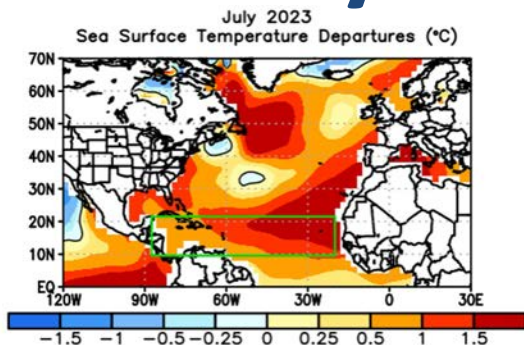
Area-averaged SSTs in the MDR were about 1.20°C above average during July.

SSTA's in the MDR were about +0.66°C warmer than those for the global Tropics.

Very different last year (+0.10°C in MDR and +0.19°C from Global Tropics)

July 2022
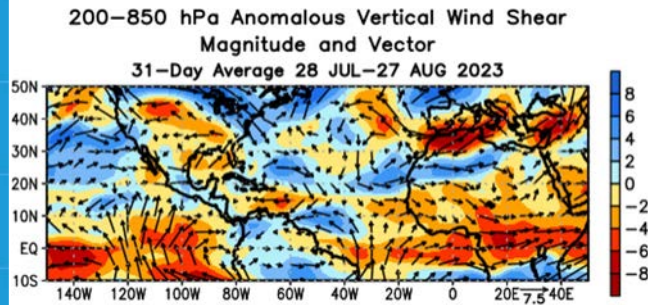Sea Surface Temperature Departures (°C)
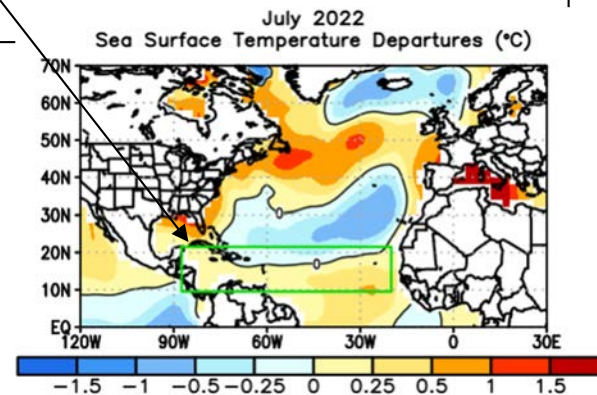
Caption: SST anomalies spatial plot, areal average time series for the MDR, and MDR minus the Global Tropics. Calculated value (black) and 5-year running means (red). ERSSTv5 dataset. Left is 2023, right is 2022. Departures relative to 1991-2020.

# 200-850 hPa vertical wind shear and Anomalies

**Observed**

**CFS Hi Res**

**CFS**



200-850 hPa Anomalous Vertical Wind Shear Magnitude and Vector 31-Day Average 28 JUL–27 AUG 2023

ASO 2023; Jul ICs

NOAA Climate Forecast System (CFS)

MDR

NMME

NMME ASO 2023 absolute zonal shear anomaly (July initialization)

-0.522 m/s

Vertical wind shear in June-July was stronger than average over the Gulf of Mexico Recently shear has weakened of GMex and parts of MDR.
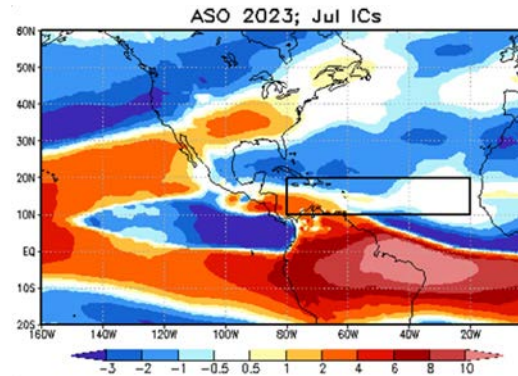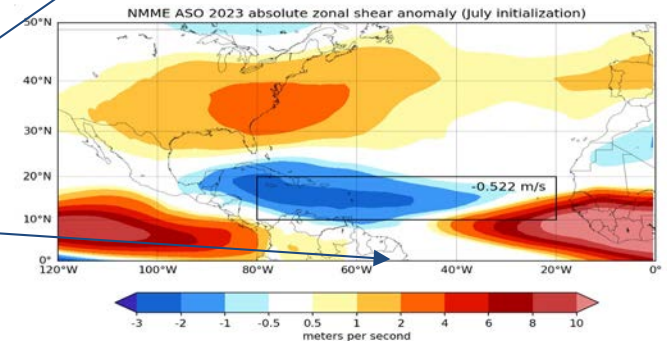
CFS-HiRes predicts below normal shear (Aug +, Sep -, Oct + but barely)

CFS predicts below normal shear.

NMME predicts below normal shear (23rd percentile)
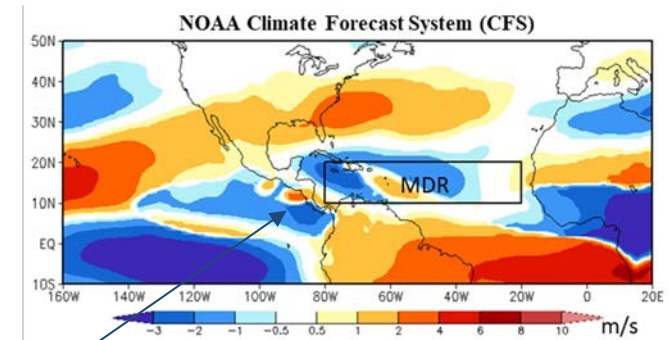
Caption: Upper left, Climate Data Analysis System (CDAS) 200-850-hPa wind shear. Predictions of 200-850-hPa wind shear from CFSv2-HiRes (middle), CFSv2 regression (top right), and NMME (bottom right).
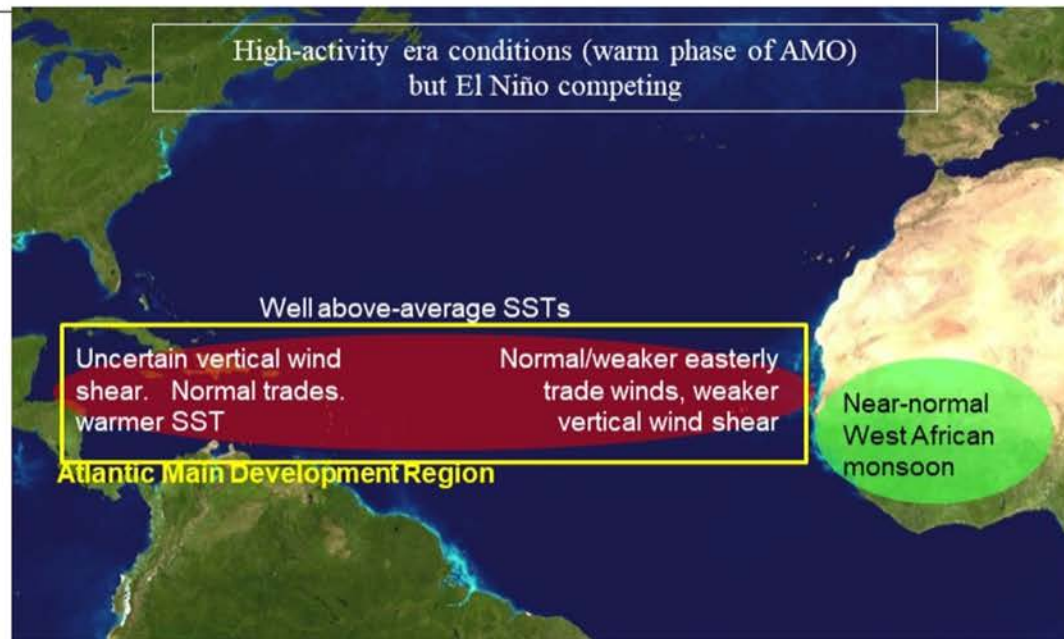
# Expected Atlantic Conditions During August-October 2023

Ongoing high-activity era conditions favor more hurricane activity. These conditions include:
- Above-average sea surface temperatures in the North Atlantic, and especially the Main Development Region
- Normal trade winds, weaker vertical wind shear, normal West African monsoon.

Predicted El Niño will likely increase wind shear and increase vertical stability but not until part way into ASO.

High-activity era conditions (warm phase of AMO) but El Niño competing

Well above-average SSTs

Uncertain vertical wind shear. Normal trades. warmer SST

Normal/weaker easterly trade winds, weaker vertical wind shear

Atlantic Main Development Region

Near-normal West African monsoon

Caption: Infographic summarizing the expected conditions during August-October for the Atlantic Ocean and surrounding land masses.

# Summary

## 2023 Atlantic Outlook

<u>Above-normal</u> season most likely.

14-21 Named Storms

6-11 Hurricanes

2-5 Major Hurricanes

*Factors: VERY Warm AMO vs El Niño*

<u>To date</u>
11 NS
3 H
2 MH

<u>*It Only Takes One!*</u>

***Prepare now!***

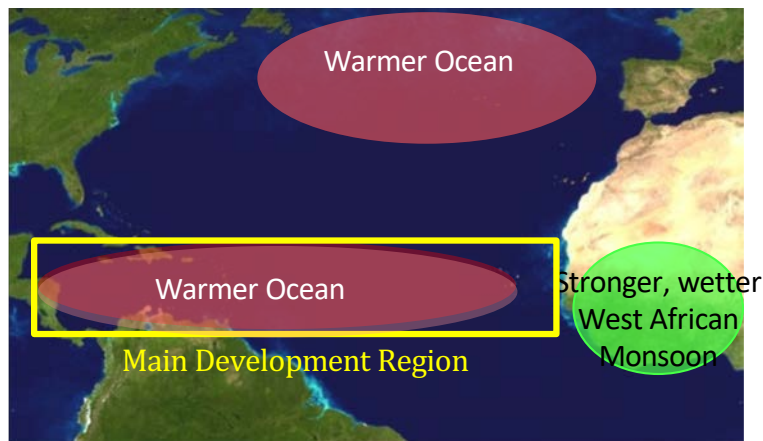*Help Build a <u>Weather and Climate</u> -Ready Nation*

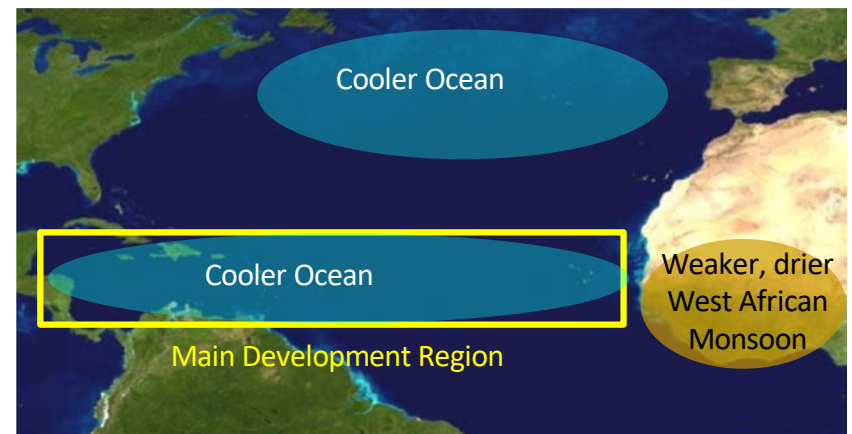# Supplemental

# The Atlantic Multi-Decadal Oscillation (AMO)

Warm (Positive) Phase of AMO
Climate Pattern for High-Activity Era

Cold (Negative) Phase of AMO
Climate Pattern for Low-Activity Era



Warmer Ocean

Warmer Ocean

Stronger, wetter West African Monsoon

Main Development Region

Atlantic: High-activity era
East Pacific: Lower activity



Cooler Ocean

Cooler Ocean

Weaker, drier West African Monsoon

Main Development Region

Atlantic: Low-activity era
East Pacific: Higher activity

Caption: Schematic showing sea surface temperature and west African monsoon conditions for opposing phases of the Atlantic Multi-Decadal Oscillation (AMO): (Left) warm phase and (Right) cold phase.