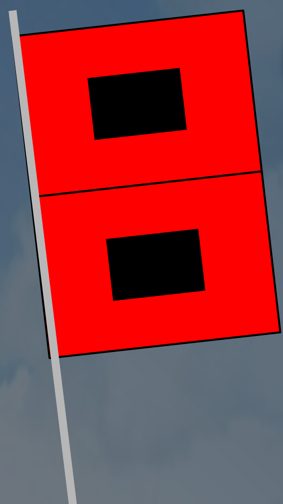
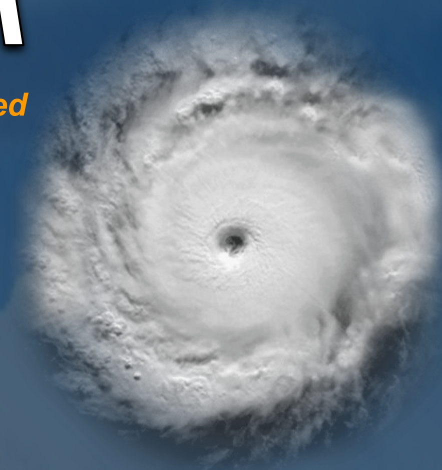
ChrisMartzWX

Weather for the curious and open-minded



2020 Atlantic Hurricane Outlook



May 1, 2020

By Chris Martz, **ChrisMartzWeather.com**

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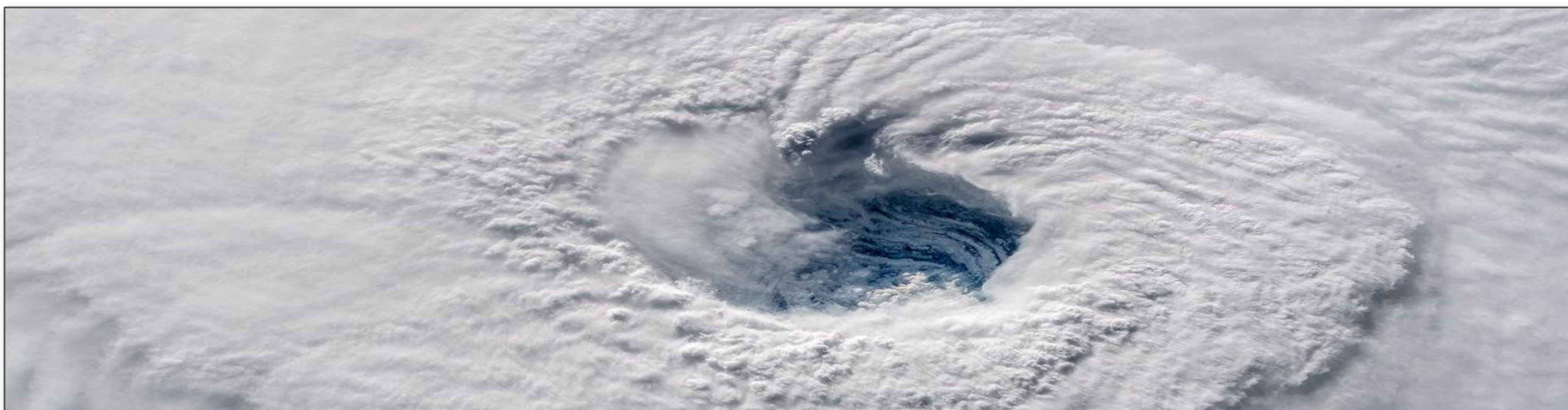
INTRODUCTION

As with any hurricane season, it's important to be prepared for anything, including worst-case scenarios. While some seasons are far busier than others, all it takes is one storm to change someone's life forever. This is why it's necessary to know what your risks are in areas you live that are prone to such natural disasters. While it's impossible to know exactly how many storms we'll see or what areas will see exact landfall, using science, math, and history can guide us, giving a general idea of what's to come. If you do not want to see how I came to my conclusion, please skip ahead to page 6. If you are eager to understand the science behind the forecast, familiarize yourself with various terms and acronyms on pages 3, 4, 5, and 6 before moving forward on page 8.



BE FAMILIAR WITH THESE TERMS & ACRONYMS

• **ACE: Accumulated Cyclone Energy** - A measure of the total energy produced by a named storm (tropical cyclone) over the course of its life cycle. It is defined as the sum of the square of the maximum sustained winds for each 6-hour period the system exists. That sum is then divided by 10,000 or multiplied by 10^{-4} in order to make the numbers more manageable. The formula is, $ACE = 10^{-4} \Sigma v^2_{max}$, where v^2_{max} is the estimated wind speed in knots. Each individual storm's ACE can be added up to calculate the season total.

• **AMO: Atlantic Multidecadal Oscillation** - A mode of natural climate variability in the North Atlantic Ocean that exhibits fluctuations in sea surface temperature and sea-level pressure fields. Both warm and cool modes fluctuate on short-term time scales, however, overall, it is predominantly in one phase or another for approximately 30 years creating a 60-year cycle. The AMO is likely related to changes in the strength of the thermohaline circulation and has significant climatic impacts, particularly over the Northern Hemisphere whether some people choose to believe in natural variability or not.

• **CanSIPS:** A multi-model ensemble system consisting of two climate models used for long-range seasonal forecasting. It was developed by the Canadian Centre for Climate Modeling and Analysis (CCCma) and the Canadian Meteorological Centre (CMC).

• **CFSv2: Climate Forecasting System Version 2** - Developed by NCEP and became fully operational in March 2011. It's used for long-range seasonal forecasts.

BE FAMILIAR WITH THESE TERMS & ACRONYMS

- **Convection** - The movement of a fluid (including air) of higher temperature to rise above colder, denser material, which sinks due to gravity. A method of heat transfer that leads to cloud formation, and sometimes thunderstorms and hurricanes depending on other environmental conditions.

- **ECMWF: European Centre for Medium-Range Weather Forecasts** - The European Centre for Medium-Range Weather Forecasts is an intergovernmental organization of over 30 European nations that produced the infamous ECMWF weather forecast model, often called the “European” model or just “Euro” for short. It’s a global model, meaning it produces forecasts across the entire globe and it goes out 10 days. The model is run every 12 hours and is one of the most accurate medium-range forecast models out there.

- **ENSO: El Niño Southern Oscillation** - A see-saw pattern of climate variability between the atmosphere and ocean over the tropical Pacific Ocean. The warm mode is known as El Niño while the cool mode is known as La Niña. The Niño 3.4 region (5°N to 5°S, 170°W to 120°W) in the Equatorial Pacific is used as the best proxy for measuring the strength of ENSO by means of sea surface temperatures. The Niño 3.4 index correlates well with the air pressure difference between Tahiti and Darwin, Australia which changes and modulates the wind speed and/or direction over the tropical atmosphere above the Pacific. ENSO has profound effects on Atlantic hurricane variability, the polar jet stream, and other weather patterns around the globe.

- **Isotherm** - A line on a weather map or chart connecting points of equal temperature at a given time.

BE FAMILIAR WITH THESE TERMS & ACRONYMS

• **Latent heat** - The heat required to change the phase of a substance without change in temperature.

• **Major hurricane** - A hurricane of category 3 strength or higher based on the Saffir-Simpson Wind Scale, 111 mph (178.6 km/h) winds or higher.

• **MDR: Main Development Region** - A region in the tropical Atlantic ocean (7.5° to 22.5°N, 70 to 20°W) where climatologically speaking, most major Atlantic hurricanes develop.

• **MJO: Madden-Julian Oscillation** - A globally propagating wave extending through high levels of the atmosphere that can either enhance or suppress upward vertical movement of air, which if enhanced, leads to cloudiness and rainfall over the tropical Indian and Western Pacific oceans. It tends to move east at 5 ms^{-1} circling the globe roughly every 30 to 60 days. The MJO is known to affect North Atlantic and Pacific tropical cyclone activity as well as the polar jet stream.

• **NOAA: National Oceanic and Atmospheric Administration** - The leading American scientific agency within the Department of Commerce focusing on oceanic, waterway, and atmospheric conditions.

• **SST: Sea surface temperature** - The temperature of the surface of ocean water. Sea surface temperature anomalies describe how far above or below ocean surface temperatures are from average.

BE FAMILIAR WITH THESE TERMS & ACRONYMS

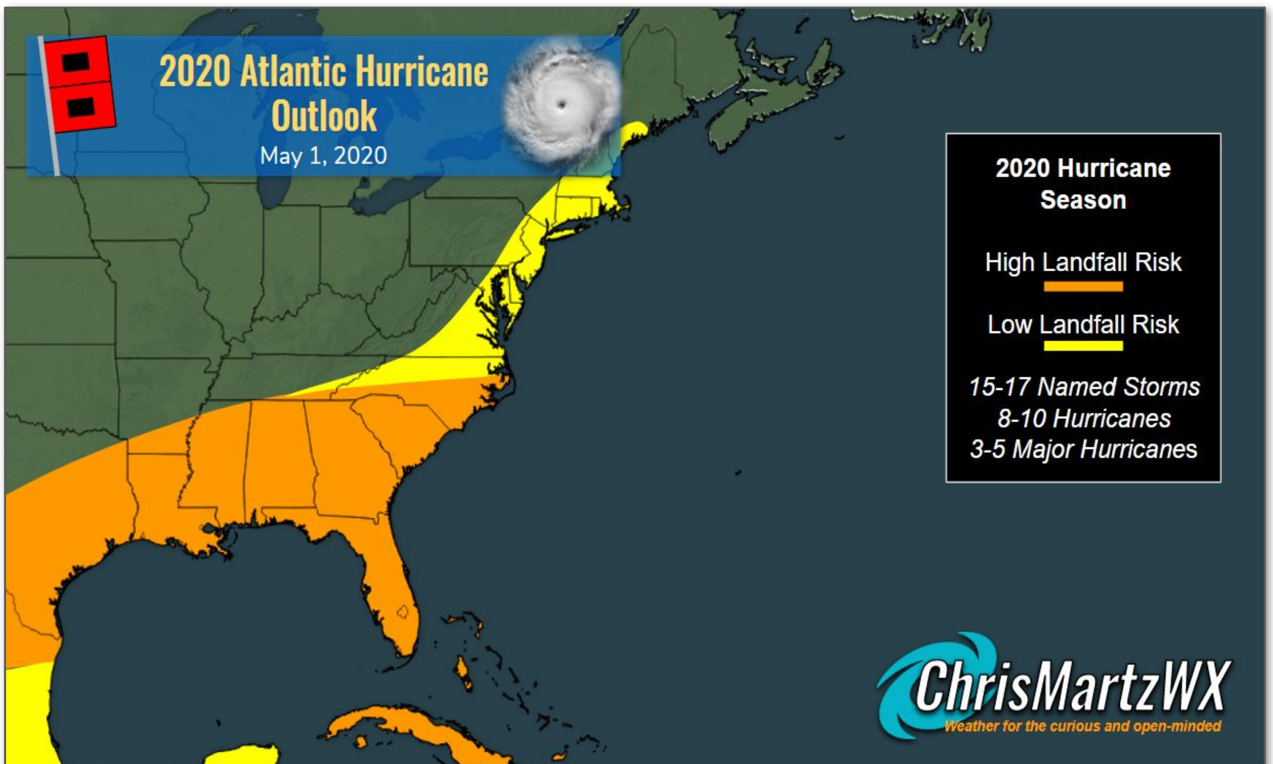
• **Tropical cyclogenesis** - The scientific term used to describe the formation of a warm-core cyclone associated with no frontal boundaries and is fairly symmetric, otherwise known as a tropical cyclone.

• **Tropical cyclone** - A typically large, but not always, warm-core cyclone not associated with frontal boundaries that forms over the tropical oceans and is powered by latent heat of condensation. These are typically, aside from tornadoes, the most violent forms of weather on Earth with their strongest winds at the low levels. Typhoons, cyclones, cyclonic storms, tropical storms, and hurricanes are examples of this type of storm, and their nomenclature depends on strength and ocean basin. I wish they were all based on the same scale in each basin and didn't have various names, but that's just my preference. I'm probably in the minority on that, but I don't really care.

• **Wind shear** - Vertical wind shear is the difference in horizontal wind speed and/or direction between 200 millibars (~40,000 feet in altitude) and 850 millibars (~5,000 feet).

2020 NORTH ATLANTIC HURRICANE SEASON SUMMARY

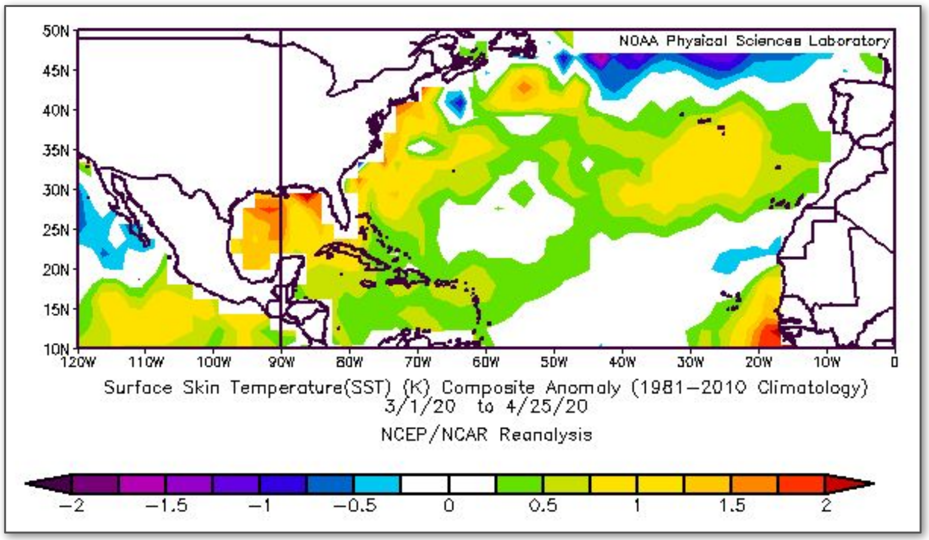
Thorough analysis and data crunching has led me to the conclusion that the upcoming Atlantic hurricane season (June 1 - November 30) will be a busy one. Typically, busy seasons produce numerous landfalls, but, that's not always the case. However, this season looks to be part of the rule, ***not*** the exception.



Given likely onset of cool ENSO-neutral conditions within the coming weeks or months, I expect vertical wind shear to simultaneously decrease over the MDR, Caribbean, and Gulf, which is more conductive for tropical cyclogenesis. Additionally, long-range models indicate active MJO Phases 2 and 3, favoring landfall in the Caribbean, and along both the U.S. Gulf Coast and southeast.

1. TROPICAL ATLANTIC SSTs

Tropical cyclones are essentially large heat engines that require both a warm, moist atmosphere and warm ocean waters to sustain their structure and power. ***Sea surface temperatures (SSTs)*** of at least 79.7°F (26.5°C) down to a depth of approximately 150 feet (45.7 meters) are considered necessary for both development and maintenance.[1] The warmer those SSTs are, the more likely a developed system will intensify through positive feedback loops through ***latent heat*** release. It is therefore important to have an understanding of how warm SSTs are in the ***MDR*** and Atlantic itself over the coming weeks.



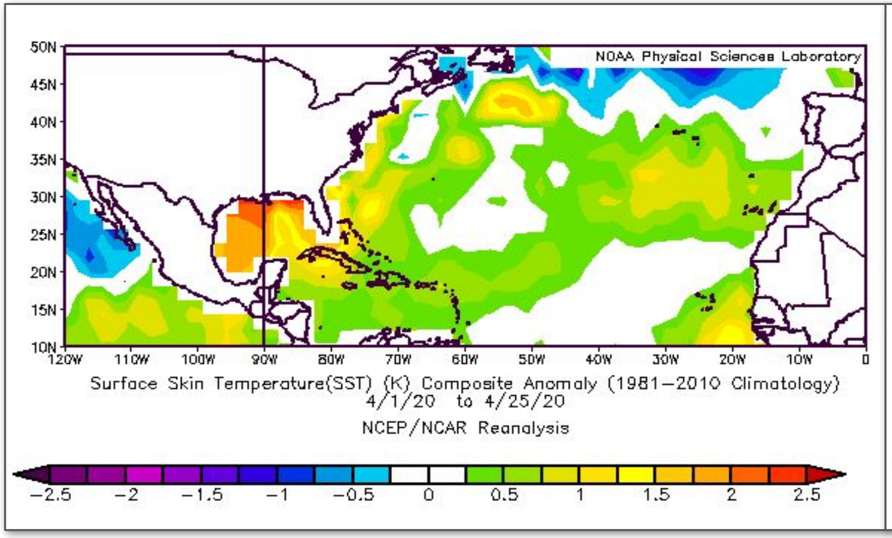
NOAA has a fantastic online database where you can plot maps of various parameters at various levels of the atmosphere.[2]

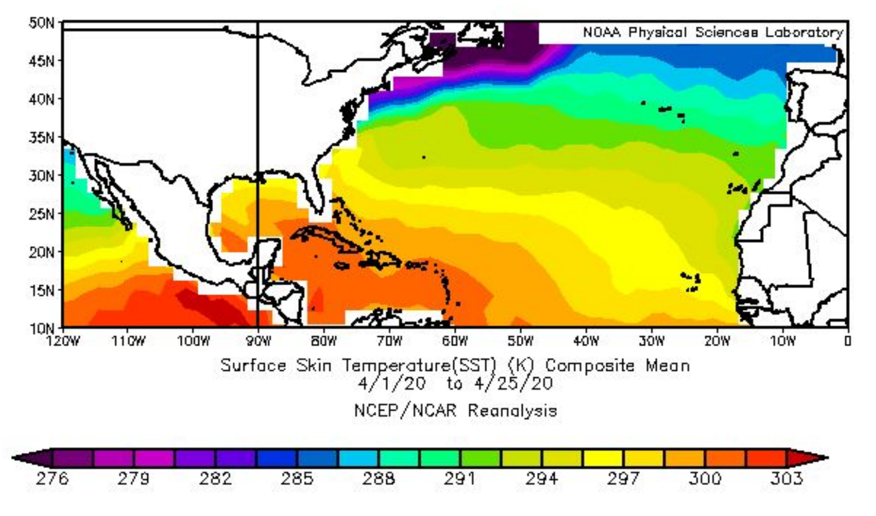
As shown on the left,[2] over the last two months, SSTs across the Atlantic basin have been above average, especially off of western Africa, along the east coast, and in the Gulf of Mexico. The far North Atlantic has been remarkably cool, a result of the negative state of the ***AMO***.

[1] "Frequently Asked Questions." Hurricane FAQ – NOAA's Atlantic Oceanographic and Meteorological Laboratory. Accessed April 26, 2020. https://www.aoml.noaa.gov/hrd-faq/#anatomy-and-lifecycle.

1. TROPICAL ATLANTIC SSTs (Continued)

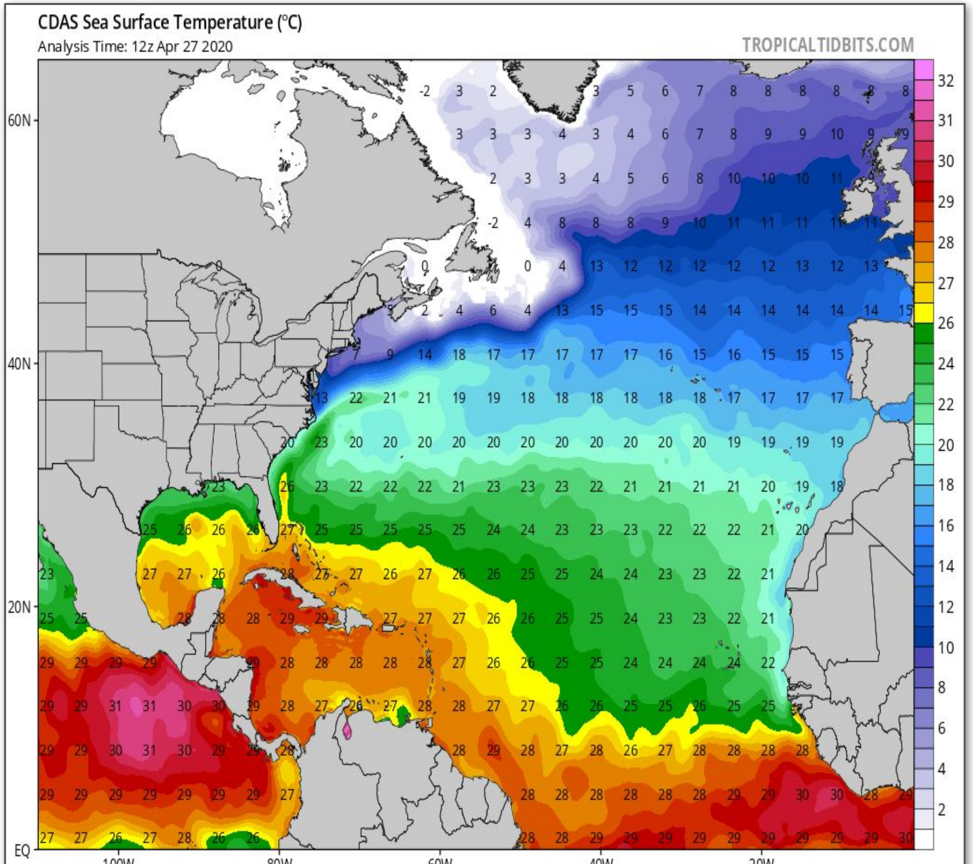
Since April 1, you can clearly see how warm compared to average the SSTs in the Gulf and along the east coast have been (bottom left).[2] Anomalies can only tell us so much, however. Us humans do *not* feel temperature departures from average. Thus, it's important to highlight the actual mean SSTs; and as shown on the bottom right panel,[2] ***isotherms*** across the tropical Atlantic range from 68.0°F to 85.0°F (20.0°C to 29.4°C) with the warmest of these conveyed over the Caribbean and Gulf of Mexico, locations where pre-existing systems commonly rapidly intensify.





[2] "Daily Mean Composites." NOAA Physical Sciences Laboratory. Accessed April 26, 2020. https://psl.noaa.gov/data/composites/day/.

1. TROPICAL ATLANTIC SSTs (Continued)



Given that a significant part of the Atlantic basin and MDR (with the exception of approximately 20°W - 50°W, 10°N - 25°N) SSTs are approaching or exceeding the minimal threshold for ***tropical cyclogenesis***, as shown in the figure below,[3] it can safely be assumed that they will soon get warm enough (as they're still above average) as we progress closer to summer and early autumn, when peak activity climatologically occurs.

It should also be taken into consideration that extreme variation in temperature over a short time span is not characteristic of water, given its high ***specific heat capacity***.

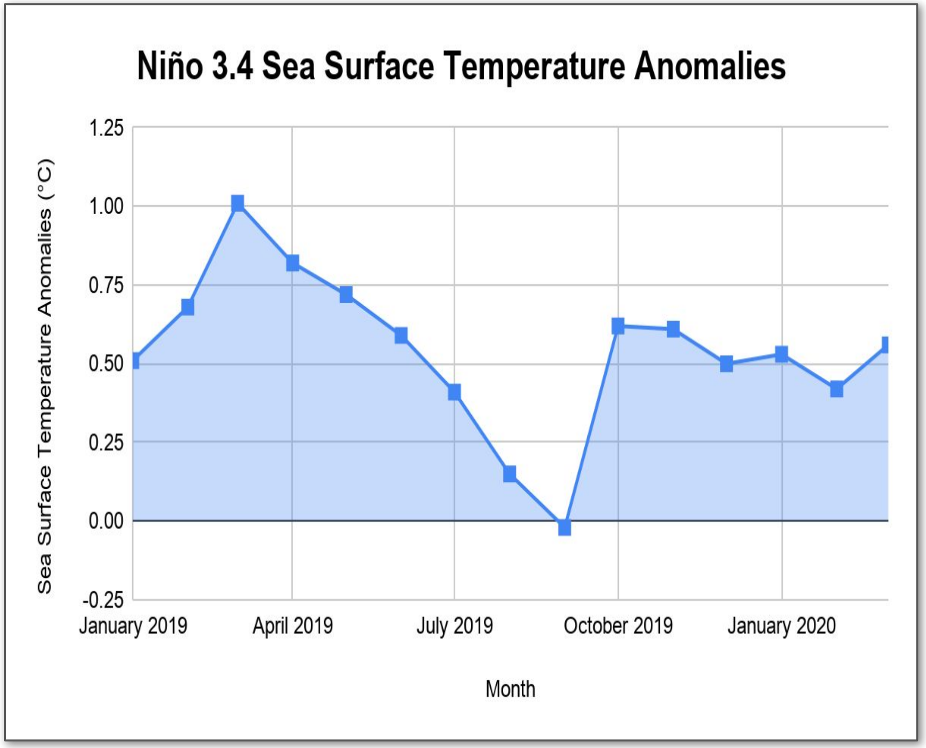
Overall, this setup, if it continues, is largely correlated with above average Atlantic hurricane seasons as we'll discuss later.

[3] Cowan, Levi. "Ocean Analysis - Tropical Tidbits." Tropical Tidbits. Accessed April 26, 2020. https://www.tropicaltidbits.com/analysis/ocean/.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO)

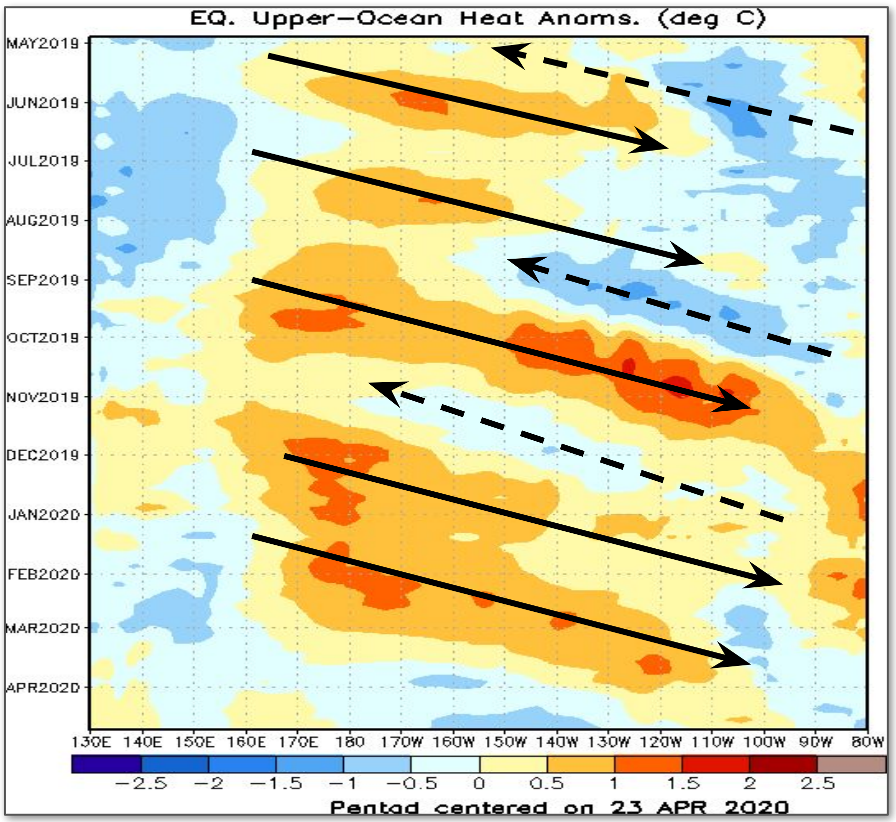
When equatorial SSTs in the designated Niño 3.4 region in the equatorial Pacific are 0.5°C above the mean or higher, ***ENSO*** is in the warm state known as El Niño. This is caused by slow low-level easterly or even low-level westerly winds associated with the ***Walker Circulation***. Conversely, the cool phase (SSTs 0.5°C below or cooler than average) is known as La Niña and occurs with stronger than normal low-level easterly winds.

The SSTs in the equatorial Pacific Ocean have been largely in warm neutral ENSO conditions (neither El Niño or La Niña) since July of last year with the exception being September.[4] Even with that little blip, however, SSTs have been fairly stationary since October with a net cooling of only 0.06°C.[4]



[4] Equatorial Pacific Sea Surface Temperatures. (txt file here: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices.)

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)



The presence of warm neutral ENSO conditions is obvious in central and eastern Pacific ***OHC*** levels (see the plot on the left).[5]

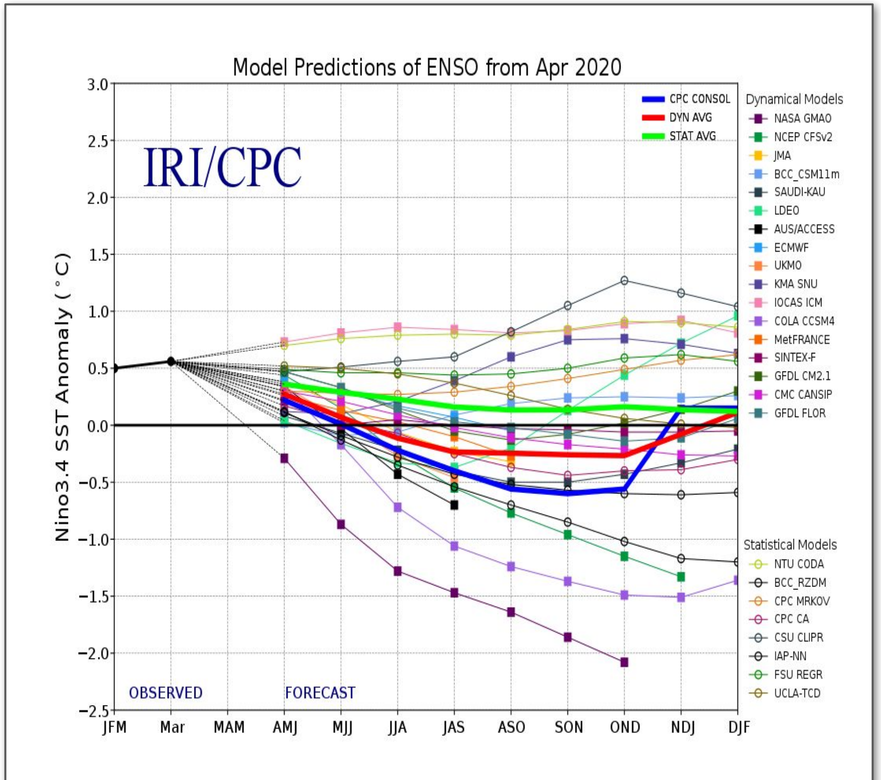
As a result of weak low-level easterly trade winds blowing across the equatorial Pacific, downwelling Kelvin waves have caused a rise in OHC across the tropical Pacific since last summer (as denoted by the orange and red contours and my annotation of solid, black arrows).

Typically, but not always, downwelling Kelvin waves will be followed by upwelling of cooler water from deep ocean depths.

Given the overwhelming prevalence of above average OHC, it can be safely assumed that in the months to follow, there will be upwelling.

[5] "Upper Ocean Heat Content Anomaly." Climate Prediction Center. Accessed April 27, 2020. https://www.cpc.ncep.noaa.gov/products/intraseasonal/heat_tlon.shtml.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)



Knowing exactly how the state of ENSO shapes up is very uncertain during the Northern Hemisphere's springtime given that this is typically a transition phase, but not always. This leads to more *noise* than a *signal*.

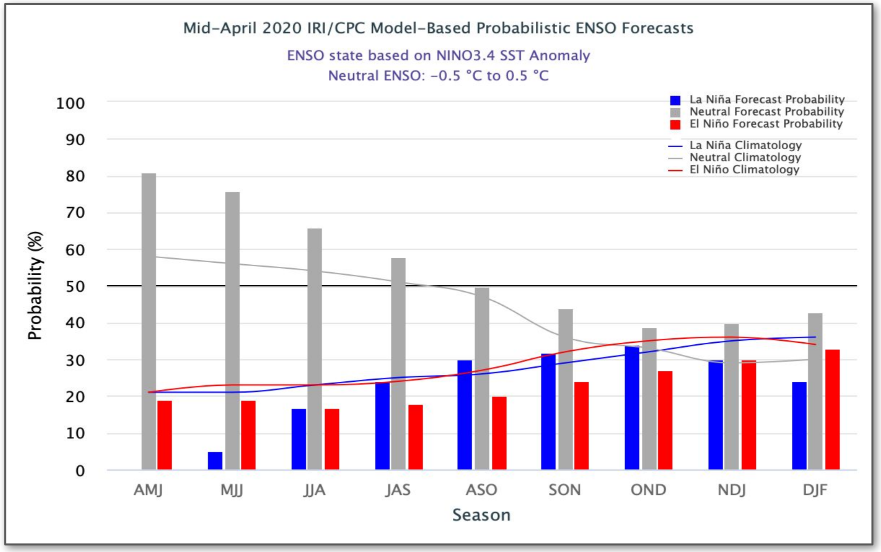
Model consensus from both statistical and dynamical models at *NOAA* and *IRI* has been largely the same over the last few months; that is projections show cool neutral ENSO conditions prevailing during early-to-mid-summer.[6] However, the spread increases once we approach the climatological peak of the Atlantic hurricane season; August through October.

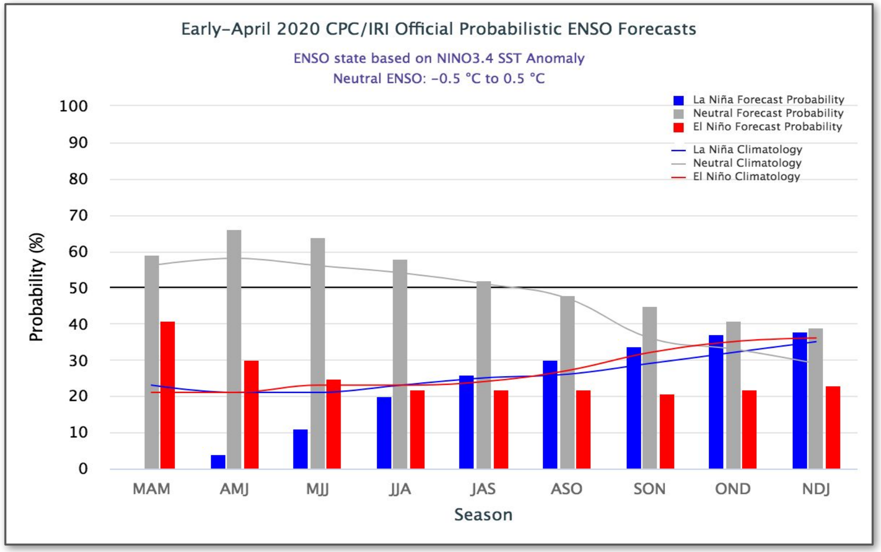
Recent model guidance suggests an increased probability of cool ENSO-neutral conditions as compared to earlier runs favoring La Niña.

[6] "ENSO Forecast Navigation." IRI – International Research Institute for Climate and Society, April 20, 2020. Accessed April 27, 2020 https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

NOAA's early-April model-based probabilistic ENSO forecast (below) suggests that there is a 35% chance of a La Niña developing by peak hurricane season, while there is a 45% chance of neutral conditions and a 20% chance of El Niño.[6]

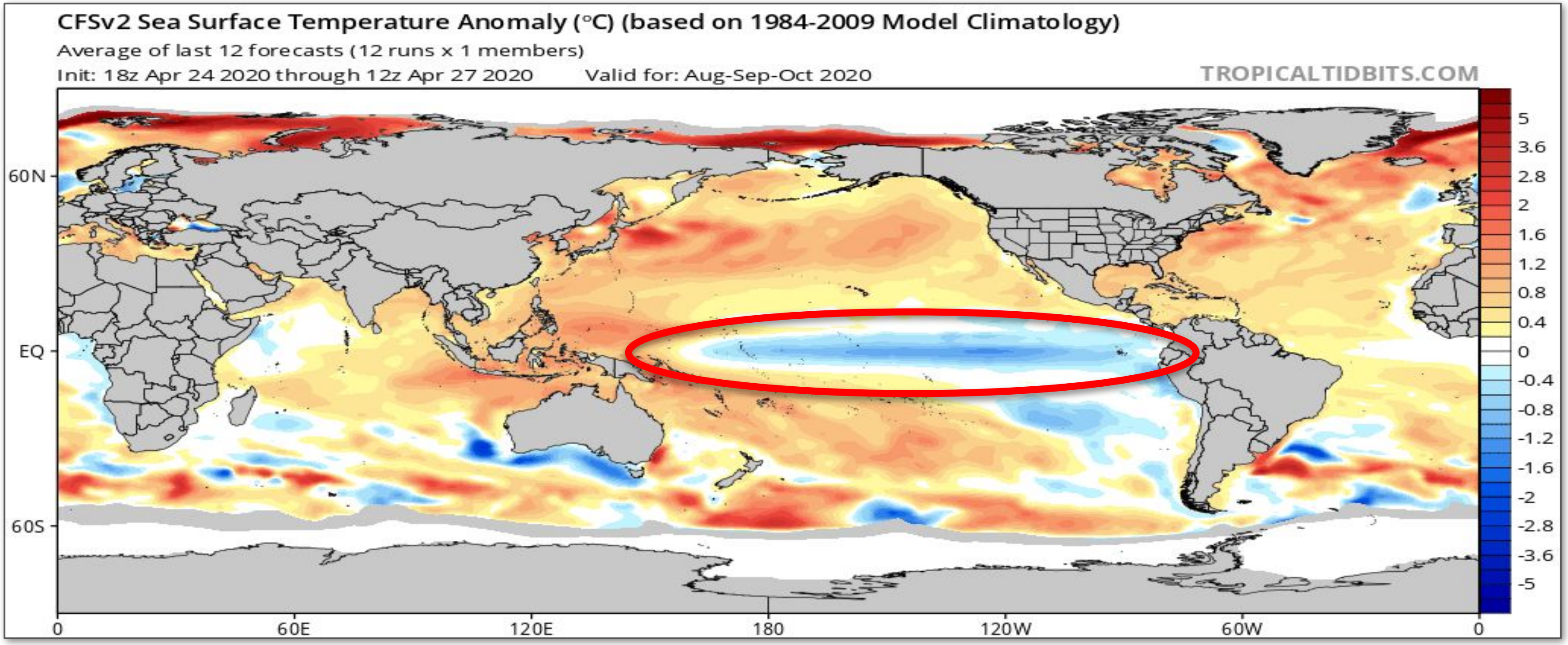




New mid-April forecasts (above) suggests a 30% chance of La Niña, a 50% chance of cool ENSO-neutral, and still a 20% chance of El Niño.[6] The increased probability of cool ENSO-neutral conditions here is reflected by model consensus.

[6] "ENSO Forecast Navigation." IRI – International Research Institute for Climate and Society, April 20, 2020. Accessed April 27, 2020 https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/.

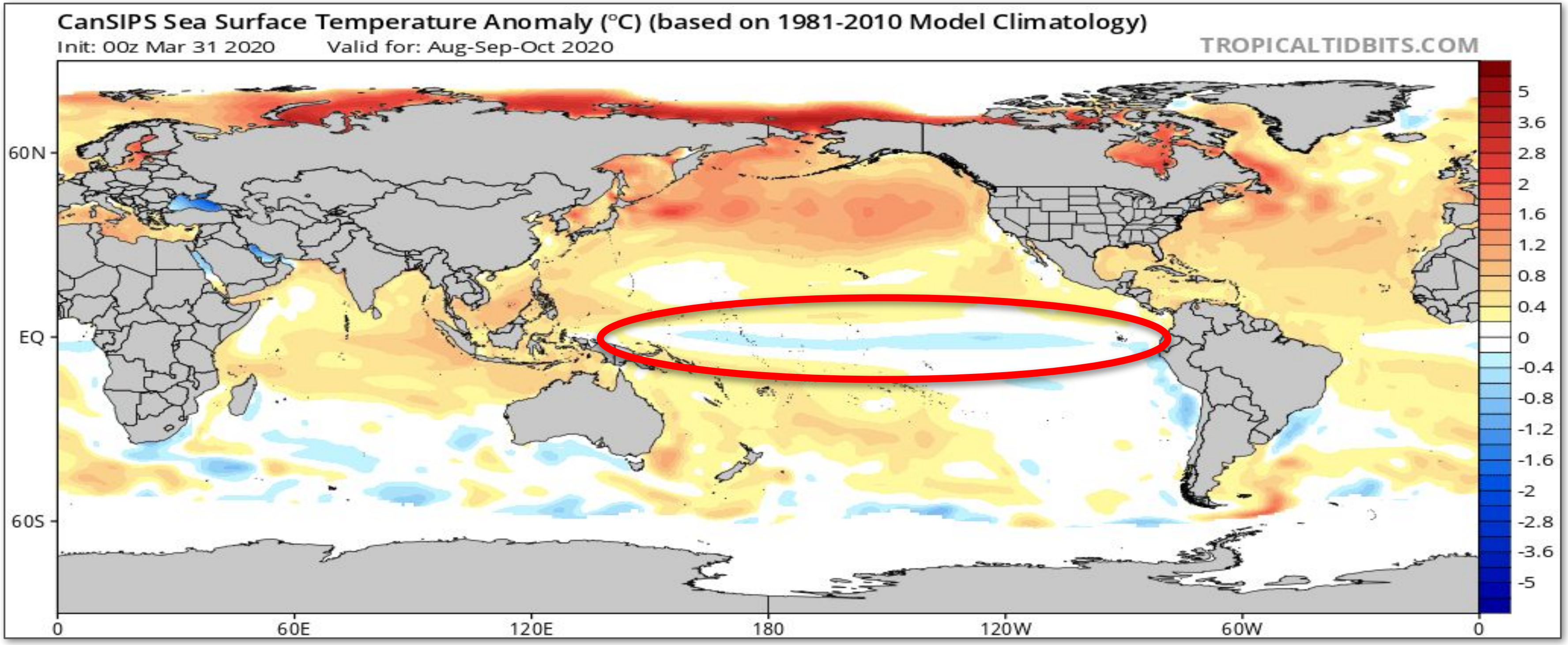
2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)



For those who aren't into statistics and bar graphs, here's a visual representation.[7] The ***CFSv2*** model (above) has been very persistent in developing a weak La Niña by peak hurricane season as noted by the large blue area extending west off of South America. But what does this mean?

[7] Cowan, Levi. "Forecast Models." Tropical Tidbits. Accessed April 28, 2020. https://www.tropicaltidbits.com/analysis/models/.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

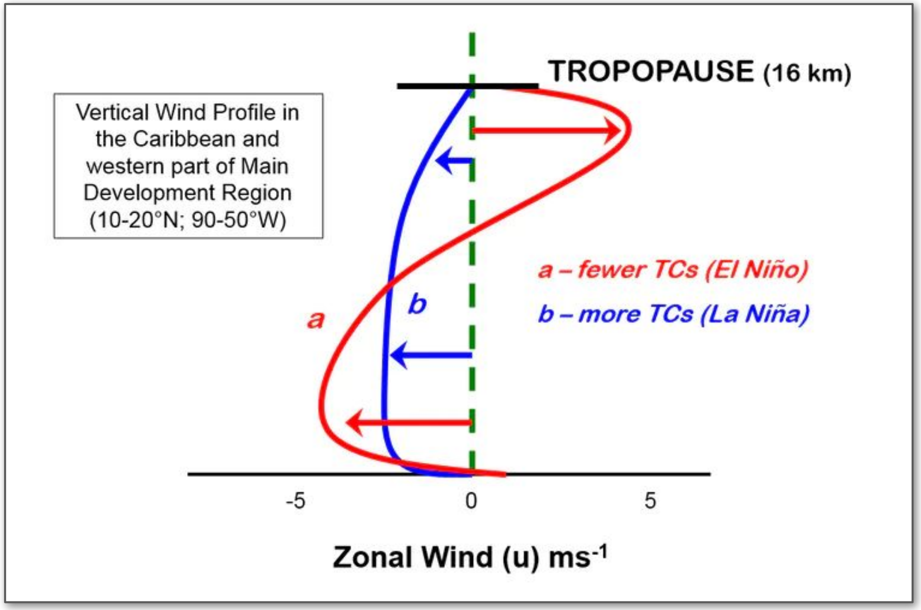


The Canadian ***CanSIPS*** model is showing a similar trend, however it's more conservative and keeps ENSO in the cool neutral state through October.[7] *(Also take note of the anomalously warm Atlantic SSTs; that will be more important later during this analysis.)*

[7] Cowan, Levi. "Forecast Models." Tropical Tidbits. Accessed April 28, 2020. https://www.tropicaltidbits.com/analysis/models/.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

Based on what the model projections show, as well as what the official *NOAA CPC* outlook shows, it'll be important to monitor low-level trade winds, (SSTs, and OHC) over (in) the Pacific over the forthcoming weeks and months to see exactly how ENSO shapes up. ***Assuming** the models are correct* in that either cool ENSO-neutral conditions, *or* weak La Niña conditions transpire, this could and certainly will have profound effects on the upcoming hurricane season in the Atlantic.



El Niño years generally create unfavorable hurricane environments in the Atlantic basin because changes in the Walker Circulation associated with pressure pattern arrangements and sea surface temperatures cause changes in both low and upper-level winds over the Atlantic leading to high levels of vertical **wind shear**. Sheared hurricane environments are not conductive for development as it tilts the core. La Niña years, on the other hand, are notorious for producing favorable tropical cyclone environments. Some of our most destructive seasons occurred during La Niña states.

Image above:
Vertical wind shear profile over the Caribbean and western Atlantic Main Development Region (MDR), courtesy of Dr. Philip Klotzbach.

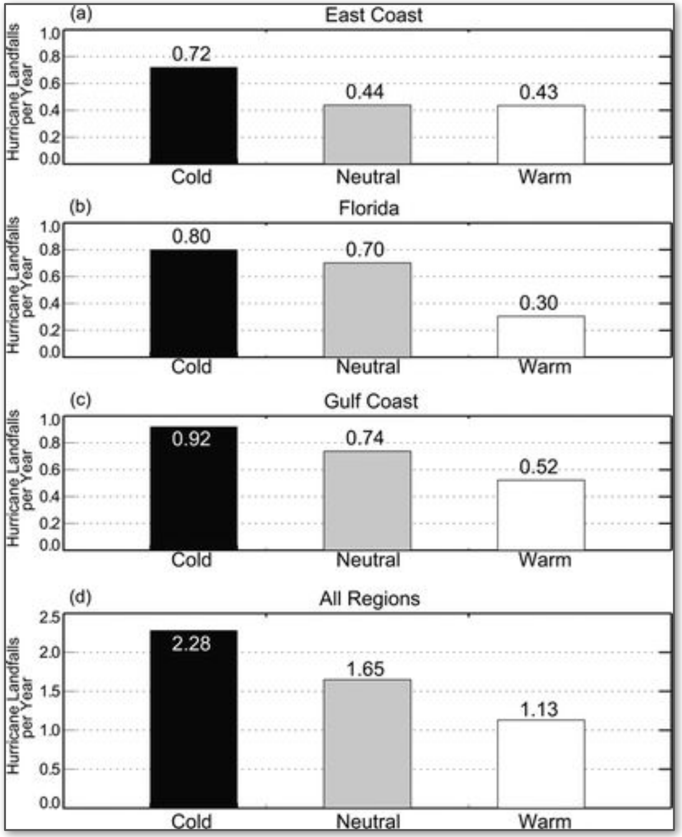
2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

Smith et al. (2007) examined the relationship between ENSO phase and U.S. landfall frequencies by region; the east coast (except Florida), Florida, and the Gulf Coast.[8]

The study concluded that through regional analysis, La Niña years produced only slightly higher landfall frequencies along the Gulf Coast and Florida than during ENSO-neutral seasons.[8] However, La Niña resulted in much more east coast landfalls than in both ENSO-neutral and El Niño phases.[8]

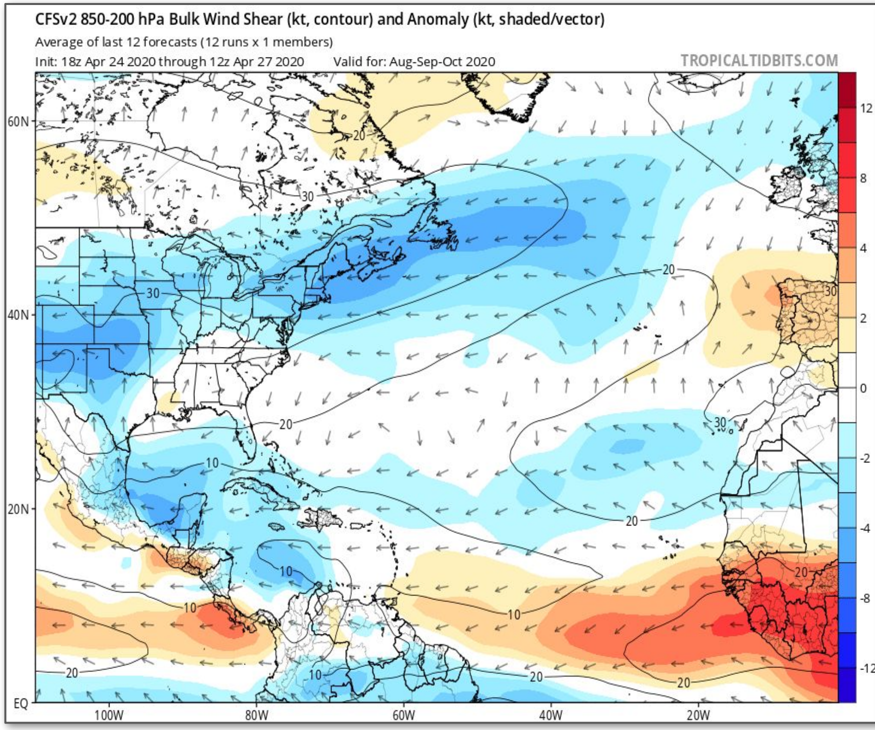
Furthermore, the authors found that landfall probabilities were much lower in El Niño phases as compared to the other two across the Gulf Coast and in Florida.[8]

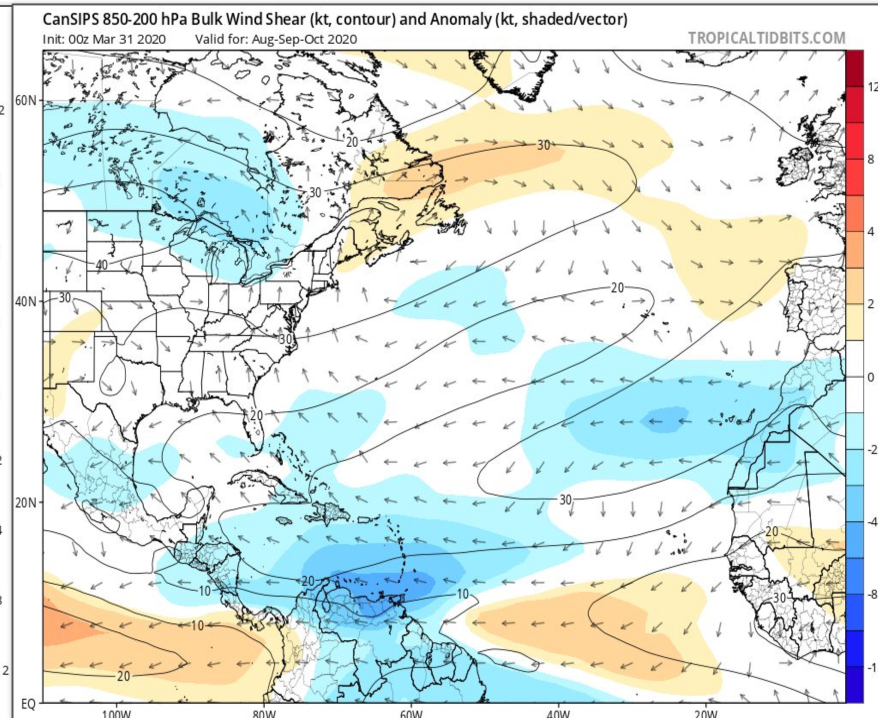
The chart accompanying this research, from the study, is shown on the right.



[8] Smith, S.R., J. Brolley, J.J. O'Brien, and C.A. Tartaglione, 2007: ENSO's Impact on Regional U.S. Hurricane Activity. J. Climate, 20, 1404–1414, https://doi.org/10.1175/JCLI4063.1.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)



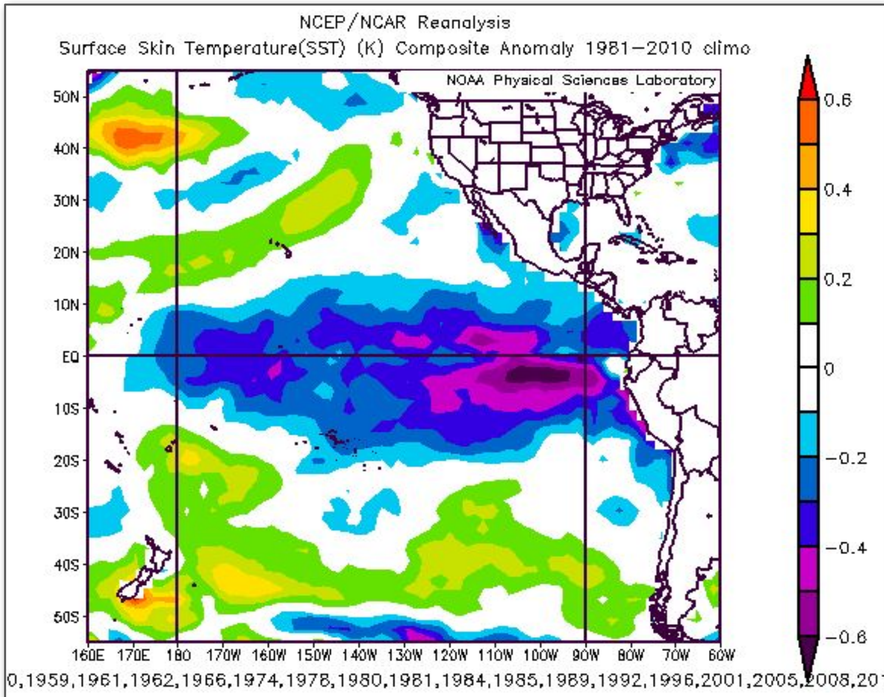


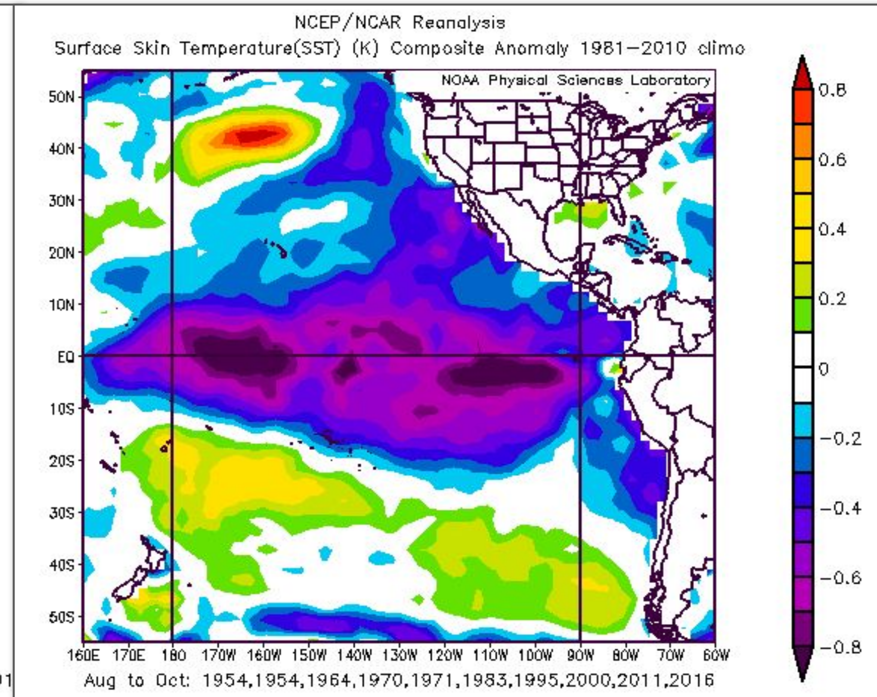
The downstream effects of cool ENSO-neutral to weak La Niña conditions computed by the models are heavily reflected in projected Atlantic basin 850 to 200 ***mb*** wind shear profiles. As shown below, wind shear is below average which, again, is conductive for tropical cyclogenesis.[8]

[7] Cowan, Levi. “Forecast Models.” Tropical Tidbits. Accessed April 28, 2020. https://www.tropicaltidbits.com/analysis/models/.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

Suppose we either get cool ENSO-neutral or weak La Niña conditions by August. . .[9]





Equatorial Pacific SST composite
COOL **ENSO-NEUTRAL** YEARS

Equatorial Pacific SST composite
WEAK **LA NIÑA** YEARS

[9] "Monthly/Seasonal Climate Composites." NOAA Physical Sciences Laboratory. Accessed April 28, 2020. https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl.

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

Here's how the average hurricane season unfolded compared to average. . .

	Neutral (Cool)	Weak La Niña	Average Season
Named Storms	13	13.9*	12.1*
Hurricanes	7.2*	6.6*	6.4*
Major Hurricanes	3.1*	3.1*	2.7*
ACE**	124.7	110.5	106

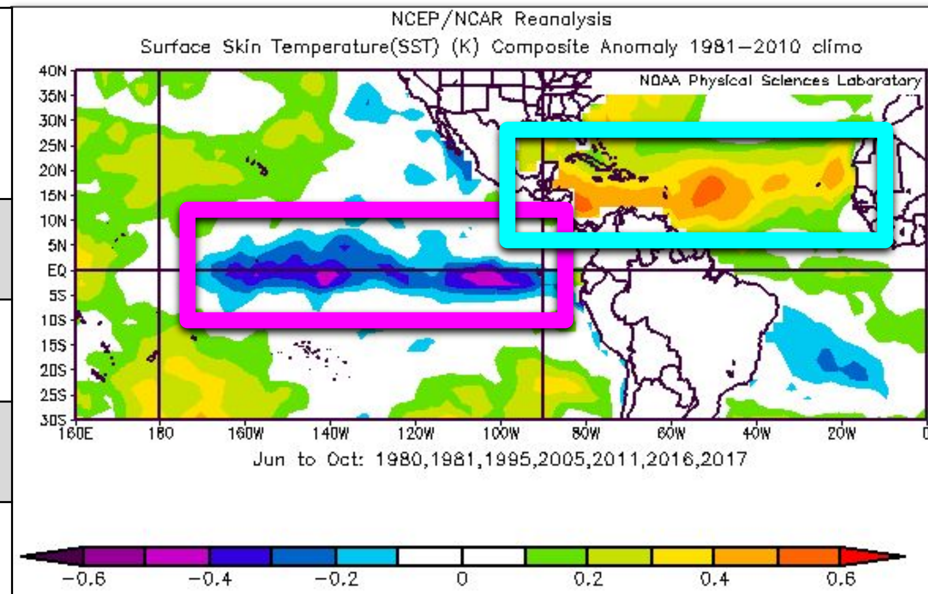
** Yes, I realize you can not have 0.7 of a storm.*
these are just numerical averages.

*** ACE stands for Accumulated Cyclone Energy.*

2. THE EL NIÑO SOUTHERN OSCILLATION (ENSO) (Continued)

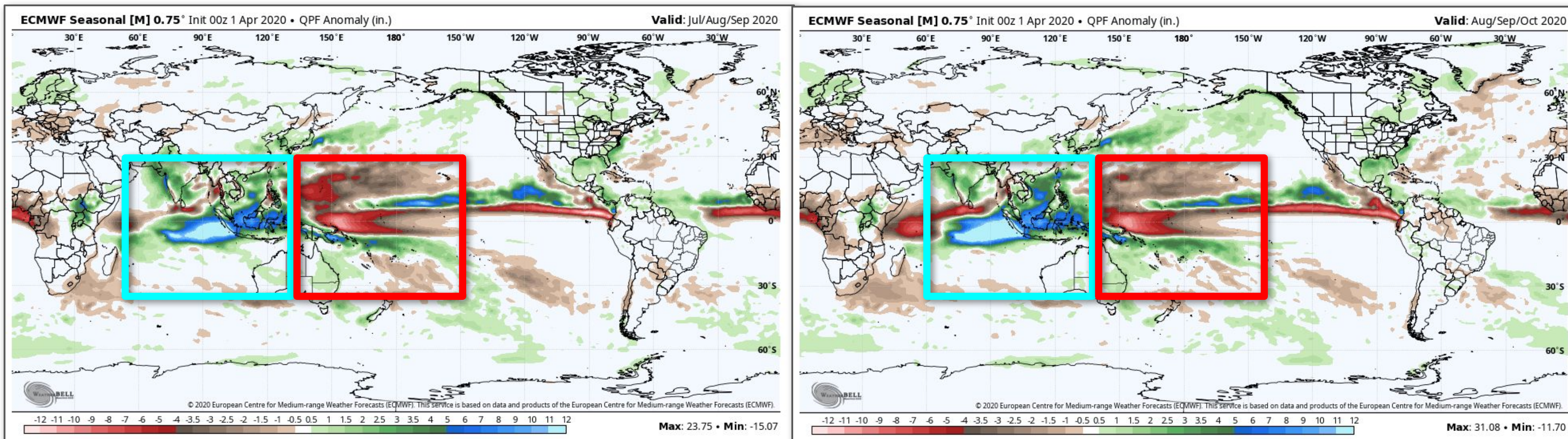
Not all cool-based ENSO-neutral or weak La Niña years have produced busy hurricane seasons, in part due to Atlantic SSTs, among other factors. While there have been a total of 30 such events during hurricane season since 1950, only a few of those seasons also had anomalously warm Atlantic SSTs.[9] Analog years with such a couplet were 1980, 1981, 1995, 2005, 2011, 2016, and 2017.[9] All produced above average ***ACE*** (except 1981) and all had average, above average, or hyperactive seasons.

	Top Analogs	*Average*
NS	17.3	12.1
H	9.4	6.4
MH	4.4	2.7
ACE	174.1	106



[9] "Monthly/Seasonal Climate Composites." NOAA Physical Sciences Laboratory. Accessed April 28, 2020. https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl.

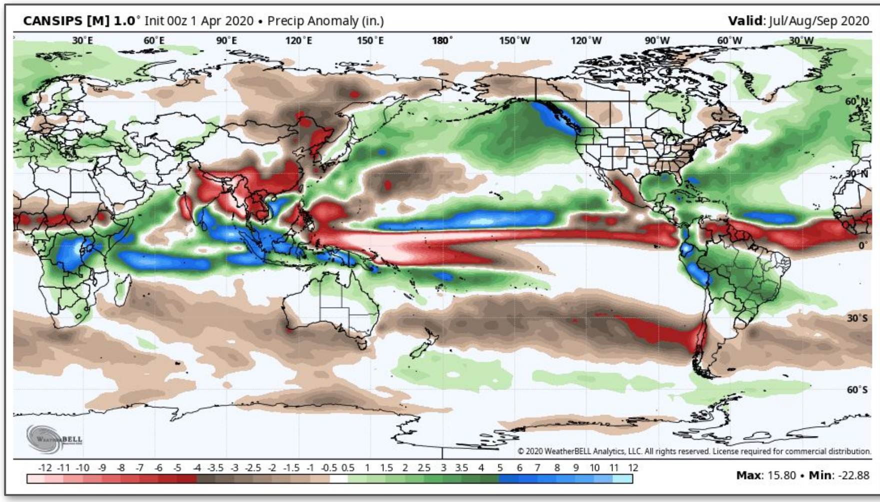
2. THE MADDEN-JULIAN OSCILLATION (MJO)

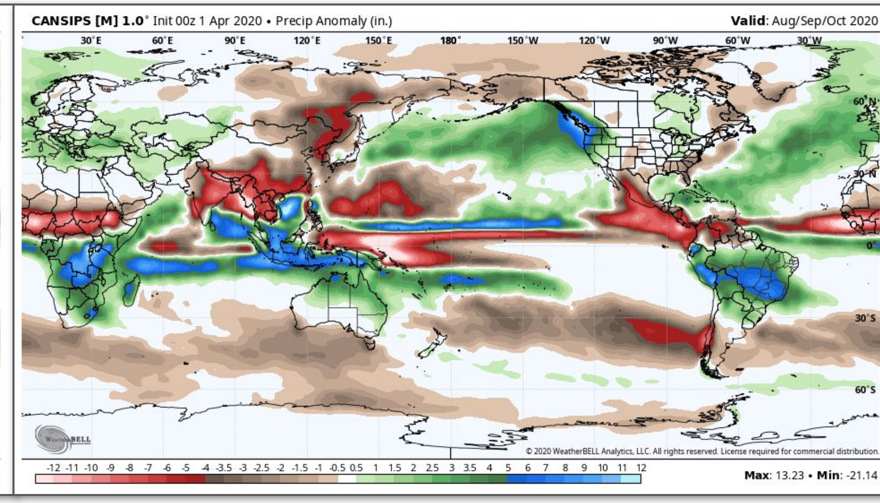


The seasonal European (**ECMWF**) model[10] clearly shows that rainfall anomalies over the tropical Indian ocean will be above average for the period June through August, and likewise again, but further east from July through September suggesting enhanced ***convection*** (boxed in light blue). At the same time, rainfall over the tropical West Pacific are in huge deficits from average during that four-month period, therefore suggesting suppressed convection (boxed in red).

[10] "WeatherBell Maps." WeatherBELL Analytics. Accessed April 28, 2020. https://maps.weatherbell.com/.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)

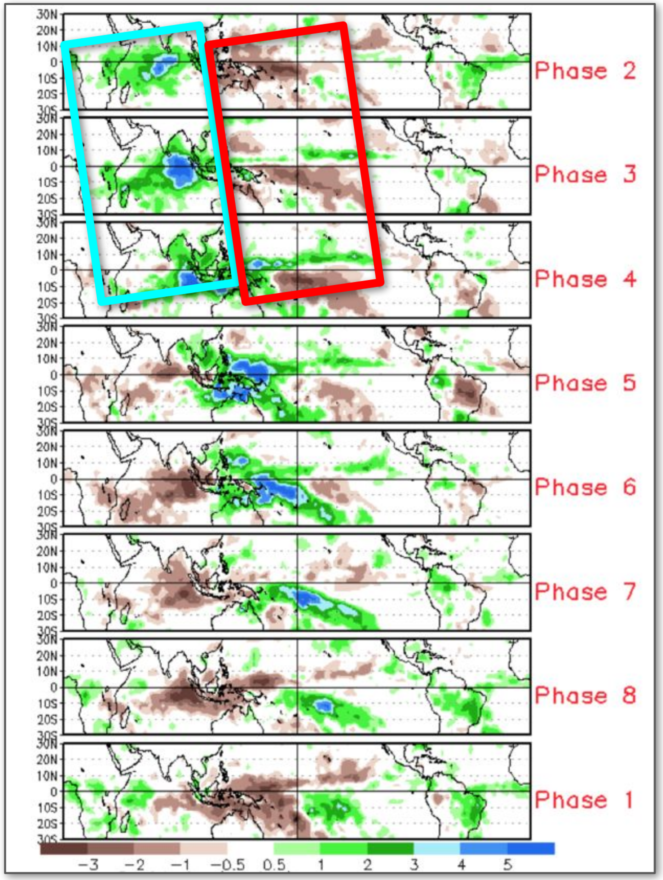




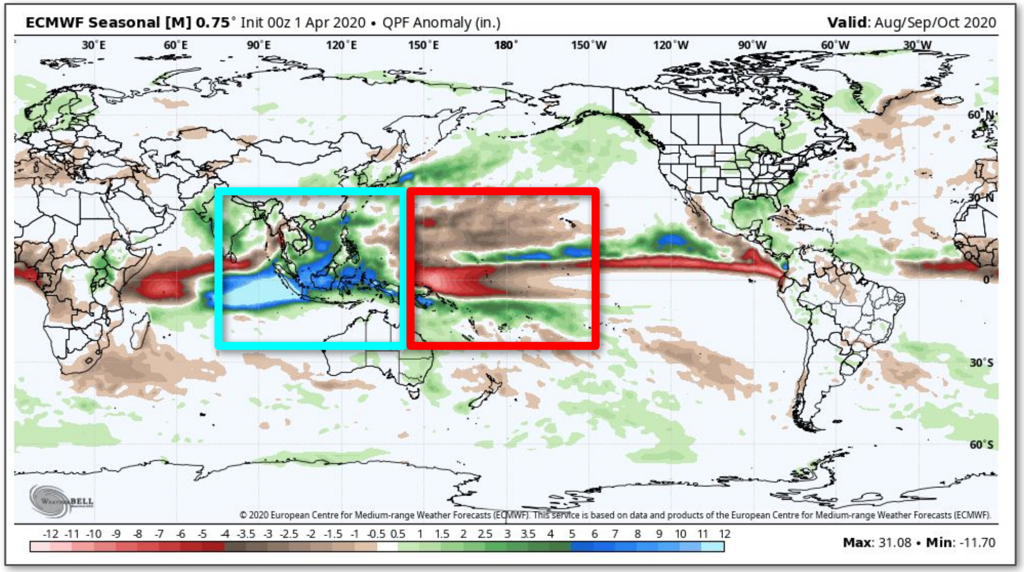
Canada's long-range model, CanSIPS,[10] is largely in agreement with the ECMWF model output, increasing my confidence that what the model is simulating will likely come to fruition.

[10] "WeatherBell Maps." WeatherBELL Analytics. Accessed April 28, 2020. https://maps.weatherbell.com/.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)



Much of the convection in the long-range is reflected in the precipitation patterns, and where we see the above average precipitation on the models is strikingly in sync with Phases 2, 3, and 4 of the ***MJO***, which could potentially be significant for the upcoming hurricane season, which begins June 1st. But why?



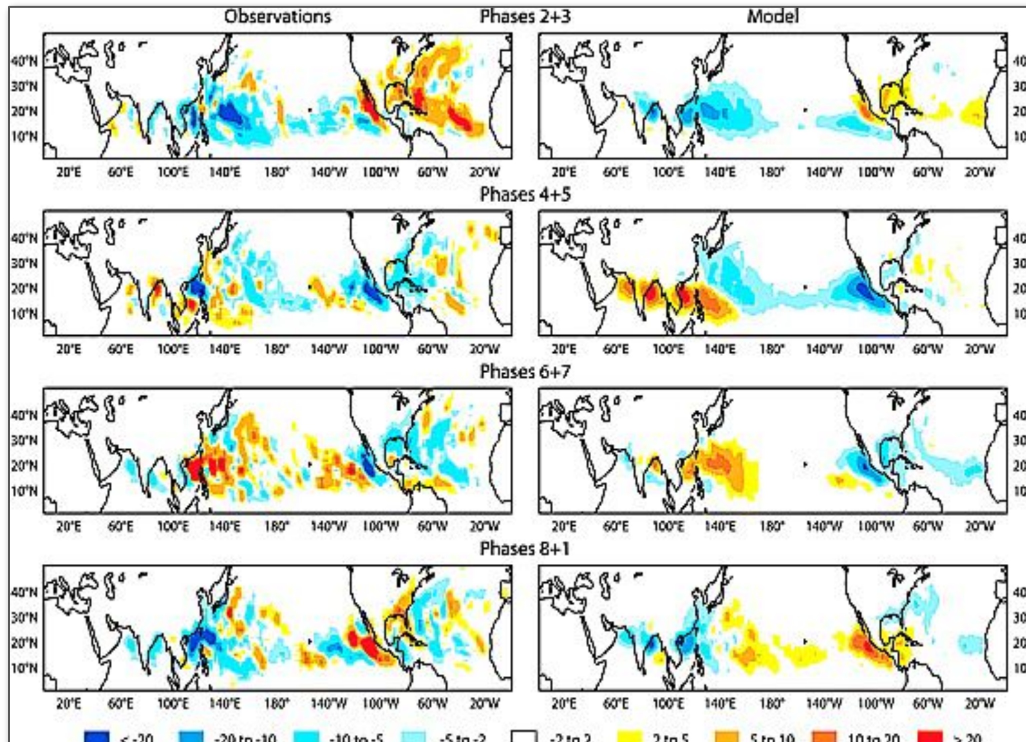
[10] “WeatherBell Maps.” WeatherBELL Analytics. Accessed April 28, 2020. https://maps.weatherbell.com/.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)

Several studies have examined the relationship between the MJO and Atlantic hurricane activity, including tropical cyclogenesis, storm track, and landfall.

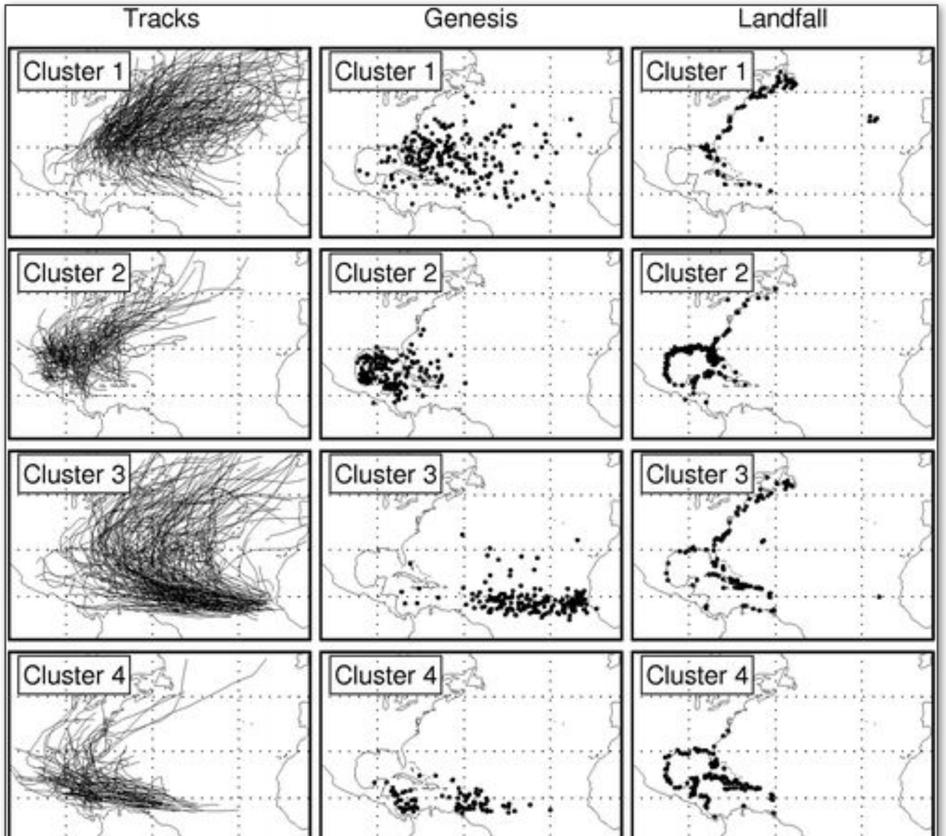
With respect to tropical development, Vitart (2009) found that over the Atlantic basin, both model simulations and observations showed an increase in activity during Phases 2 and 3, while there was a significant reduction in Phases 6 and 7.[11] This is important because, once again, models suggest 2 and 3 will be active phases during the summer and early autumn.

The maps on the right convey the study's findings for the Atlantic.[11]



[11] Vitart, F. "Impact of the Madden Julian Oscillation on Tropical Storms and Risk of Landfall in the ECMWF Forecast System." Geophysical Research Letters 36, no. 15 (August 1, 2009): 3–4. https://doi.org/10.1029/2009gl039089..

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)



Kossin et al. (2010) examined the relationship between North Atlantic tropical cyclone activity and modes of natural climate variability such as ENSO and the MJO.[12] The study grouped tracks into four separate by cluster analysis.[12]

As you can see in Figure 1 from the study,[12] the most common tracks are storms that:

1.) Originate in Bahamas or off U.S. southeast coast. Make landfall on east coast.[12]

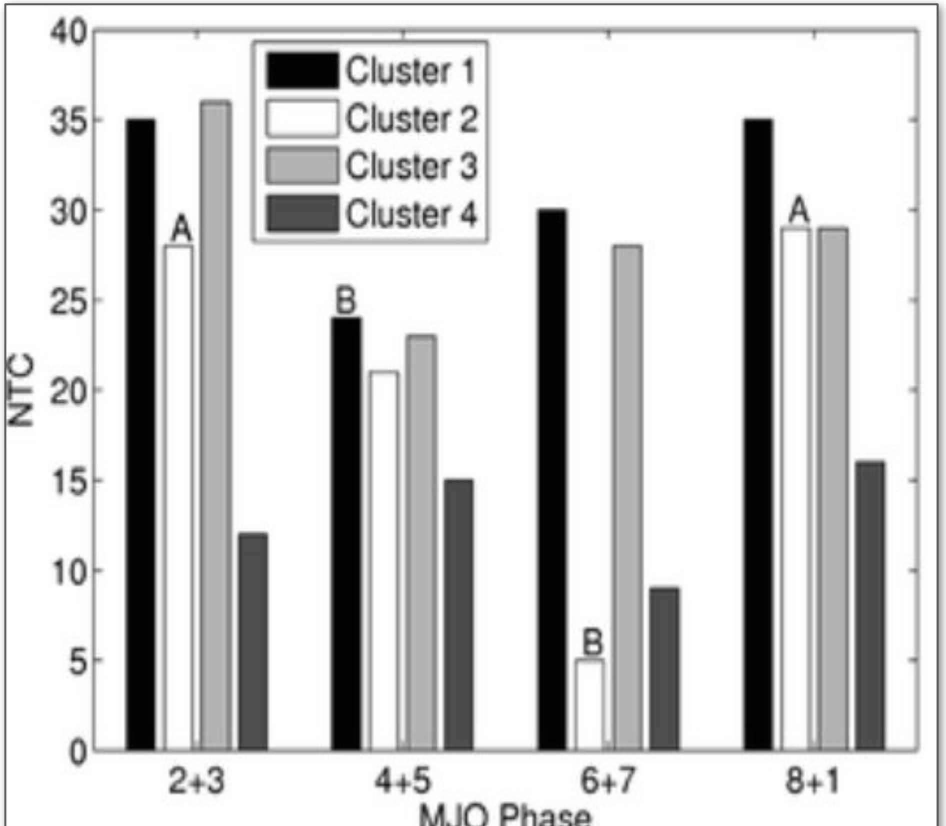
2.) Form in the Gulf. Make landfall on Gulf Coast.[12]

3.) Develop off Cape Verde. Make landfall in the Caribbean, Gulf, or east coast.[12]

4.) Originate in the Caribbean. Make landfall in Caribbean or Gulf of Mexico.[12]

[12] Kossin, J.P., S.J. Camargo, and M. Sitkowski, 2010: Climate Modulation of North Atlantic Hurricane Tracks. J. Climate, 23, 3057–3076, https://doi.org/10.1175/2010JCLI3497.1.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)



The important thing about those cluster tracks is that they are heavily influenced by MJO phase.

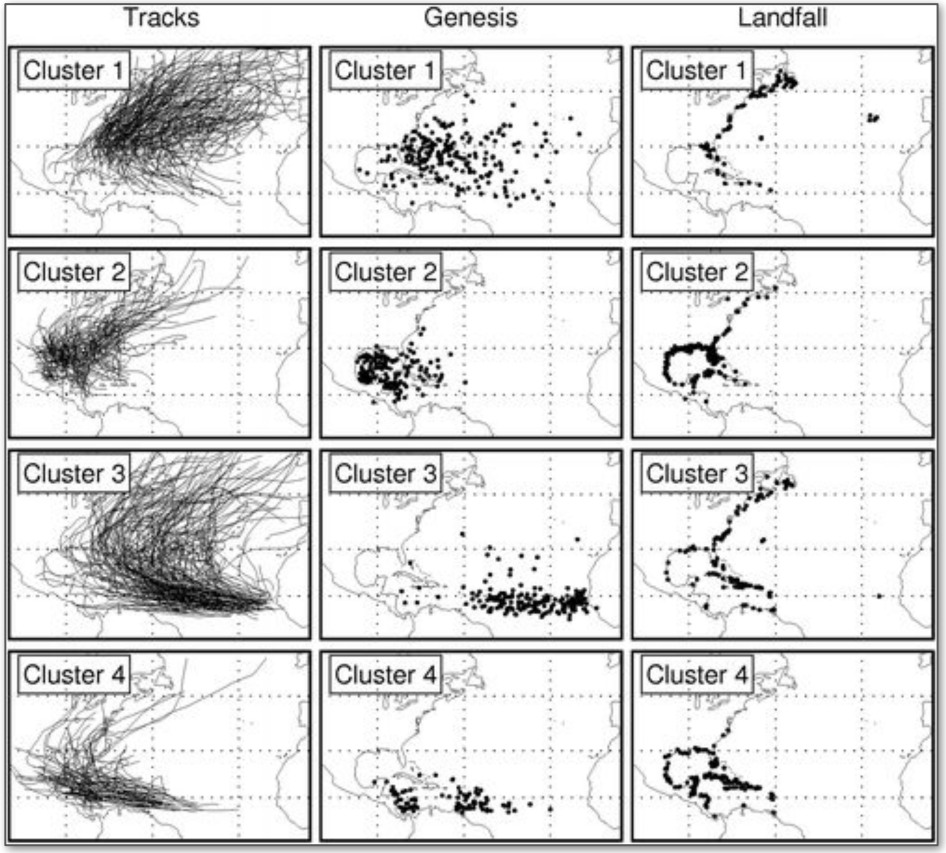
Because we are most likely going to be dealing with Phases 2, 3, and 4 this hurricane season, it's important to know which cluster tracks are more likely to materialize.

As shown in Figure 14 from Kossin et al. (2010), MJO Phases 2 and 3 are more likely to support cluster tracks 1, 2, and 3 than it is cluster 4.

Cluster track 3 is most common with Phases 2 and 3, but cluster 1 isn't far behind.

[12] Kossin, J.P., S.J. Camargo, and M. Sitkowski, 2010: Climate Modulation of North Atlantic Hurricane Tracks. J. Climate, 23, 3057–3076, https://doi.org/10.1175/2010JCLI3497.1.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)



Grant you that clusters 1 and 3 are most prominent, it can be safely assumed that if models are correct and all goes as favored climatology suggests, I wouldn't be surprised to see many of our systems develop in the MDR and/or off of the west coast of Africa (easterly waves).

Whether or not waves actually develop into full-blown tropical cyclones is heavily dependent on three parameters:

a.) Sea surface temperatures (SSTs).
b.) The amount of ***Saharan dust*** and dry air.
c.) Vertical speed and/or directional shear.

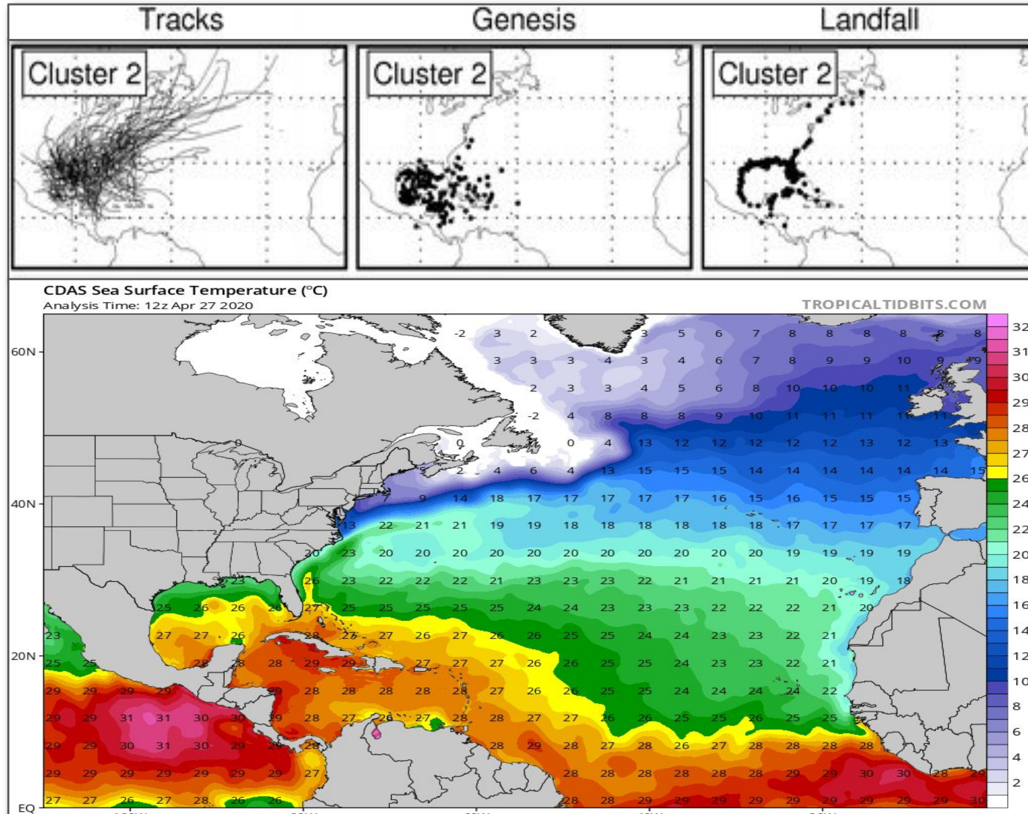
As such, I will have to closely monitor all three over the coming weeks and months.

[12] Kossin, J.P., S.J. Camargo, and M. Sitkowski, 2010: Climate Modulation of North Atlantic Hurricane Tracks. J. Climate, 23, 3057–3076, https://doi.org/10.1175/2010JCLI3497.1.

2. THE MADDEN-JULIAN OSCILLATION (MJO) (Continued)

Given how warm that the Gulf of Mexico has been both anomalously, and in terms of absolute temperature (bottom panel), I would not be surprised to see a few, perhaps several, systems form or at least attempt to develop there.

While cluster 2 (top panel) isn't the most favored set of tracks in MJO Phases 2 and 3, it's statistically much more likely to occur than cluster 4.



[12] Kossin, J.P., S.J. Camargo, and M. Sitkowski, 2010: Climate Modulation of North Atlantic Hurricane Tracks. J. Climate, 23, 3057–3076, https://doi.org/10.1175/2010JCLI3497.1.

[3] Cowan, Levi. "Ocean Analysis - Tropical Tidbits." Tropical Tidbits. Accessed April 26, 2020. https://www.tropicaltidbits.com/analysis/ocean/.

THE VERDICT! NUMBER OF NAMED STORMS & HURRICANES

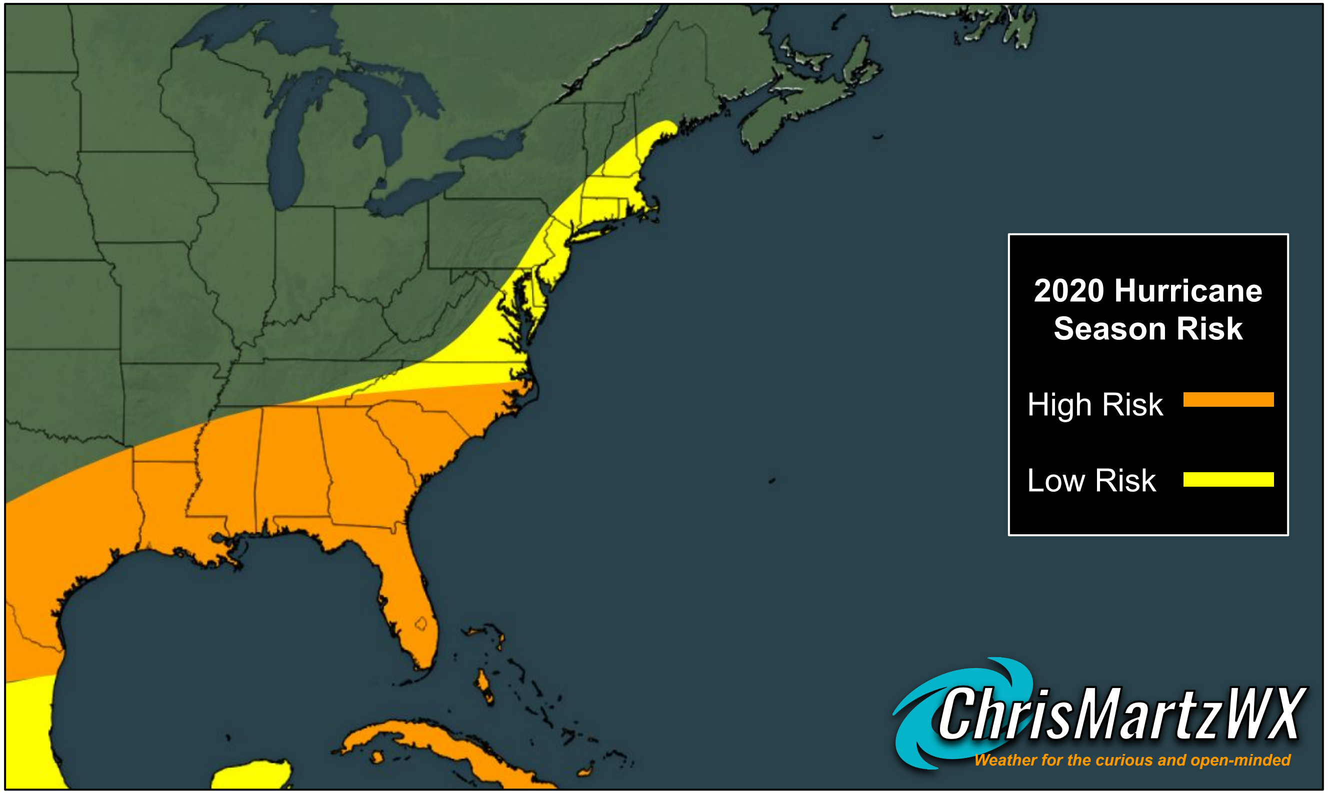
Based on all of the data examined, plus some behind the scenes number crunching, I anticipate an active and busy North Atlantic hurricane season. I think that the numbers provided in the chart below offer useful insight for the months ahead given all of the factors, including models, climatology, and research incorporated into formulating this outlook. During a *typical* season, we see approximately 12 named storms (NS), 6 hurricanes (H), and 3 major hurricanes (MH) with a mean Accumulated Cyclone Energy (ACE) index of 106.

	Average	*Last Year*	***FORECAST***
NS	12.1	18	15 - 17
H	6.4	6	8 - 10
MH	2.7	3	3 - 5
ACE	106	131.1	160 - 180

However, given the current and projected environmental conditions over the coming weeks and months, including a likely transition to cooler ENSO-neutral conditions, maybe even perhaps a Weak La Niña, I am confident in saying I think we will see *15-17 named storms*, *8-10 hurricanes*, and *3-5 major hurricanes* with an ACE index between 160 and 180 by the time the season wraps up.

THE VERDICT! AREAS MOST LIKELY AFFECTED

Based on the MJO cluster track analysis as well as North Atlantic basin SSTs, it seems very likely that the Caribbean; Gulf Coast states; and areas along the southeast coast, including Florida are at a high risk for hurricane landfalls this season. Areas north of the Outer Banks and along the Gulf Coast of Mexico will be at lower risk, but landfalls are *still* possible. It's best to be prepared for any scenario.



ChrisMartzWX

Weather for the curious and open-minded

Thanks for reading. . .

Prepare now.

Be safe. Be smart.