ACRISURE RE℠

2025 Pre-Season Hurricane Outlook

June 1, 2025

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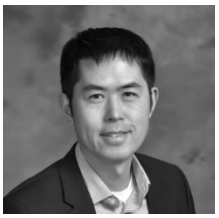

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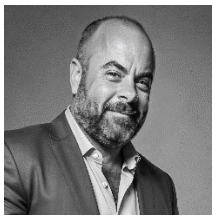

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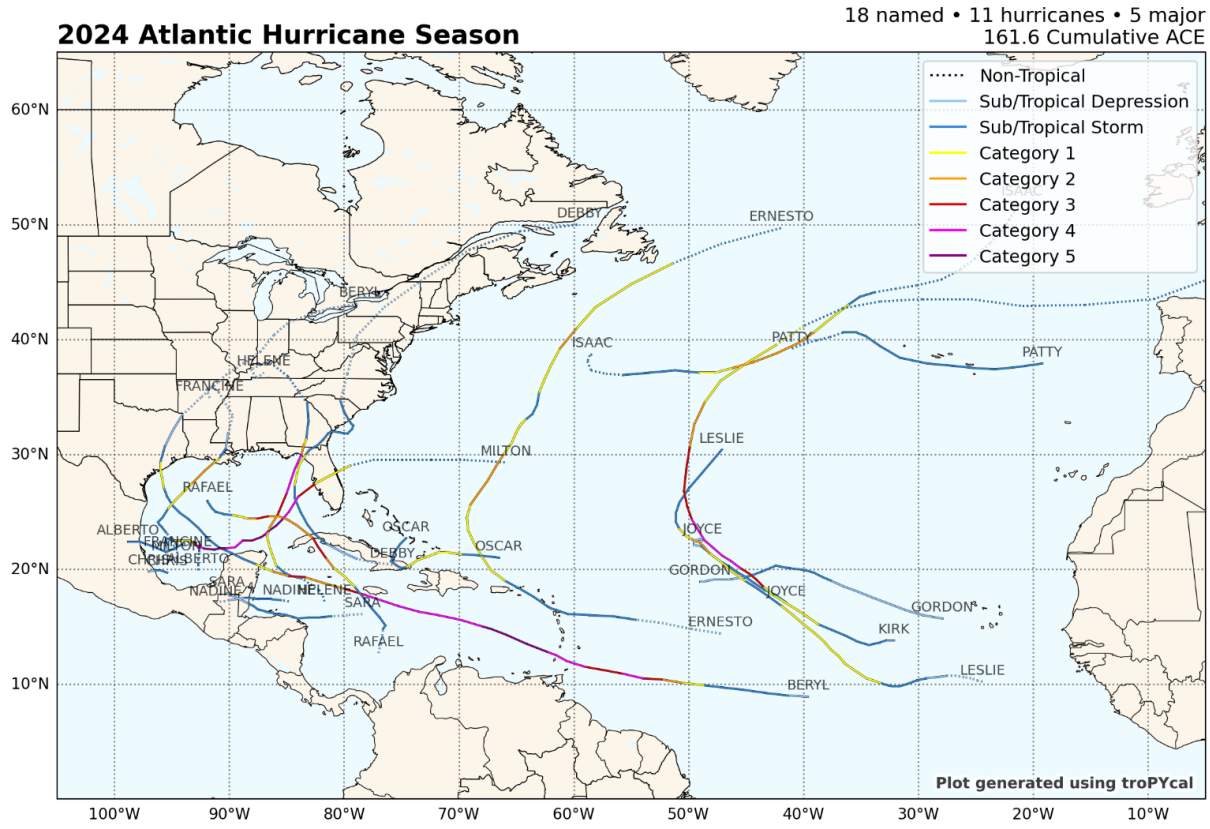
1. Executive Summary

After an active 2024 Atlantic hurricane season, which spawned 5 major hurricanes, including the devastating impacts of Hurricanes Helene and Milton to the Southeastern and Mid-Atlantic U.S., the upcoming 2025 season is expected to see above average activity, although not quite as extreme as last year.

While North Atlantic Sea Surface Temperatures (SSTs) are not at the record levels observed in 2024, they remain above normal across the basin, particularly in the western Atlantic, Caribbean, and Gulf of Mexico. Concurrently, the El Niño-Southern Oscillation (ENSO) phase in the tropical Pacific basin is projected to remain neutral throughout the peak of hurricane season. This neutral state implies a reduced likelihood of the hurricane-suppressing wind shear typically associated with El Niño conditions. The combined influence of the warmer-than-average Atlantic SSTs and the anticipated neutral ENSO phase, along with other meteorological and oceanic variables, suggests an average to slightly above-average North Atlantic hurricane season for 2025.

Despite these projections, forecasting hurricane activity inherently involves considerable uncertainty. Forecasting models show a range of possible outcomes, but most point toward a season with more activity than usual, although not to the levels seen in 2024. Intraseasonal variability will play a role in when and where we see storms form, and it only takes one storm to make it an active season for those impacted. Acrisure Re will continue to monitor evolving conditions closely and provide timely updates to help clients prepare and respond effectively throughout the season.

2. 2024 Hurricane Season in Review



The 2024 North Atlantic hurricane season finished with a total of 18 named storms, 11 of which strengthened into hurricanes. Five of these hurricanes further escalated to major hurricane status, reaching wind speeds in excess of 111 mph. Relative to the average hurricane season, which typically includes 14 named storms, 7 hurricanes, and 3 major hurricanes, the 2024 season activity was above normal in terms of storm count, and well above average for hurricane and major hurricane count. In terms of Accumulated Cyclone Energy (ACE), a measure of total storm energy, 2024 was 32% above the normal 123 ACE with 162 ACE. Overall, the 2024 North Atlantic hurricane season was significantly above average by nearly every measure, just eclipsing the National Oceanic and Atmospheric Administration's (NOAA) definition of a hyperactive season (>160 ACE).

Coming into the season, forecasts predicted one of the most active seasons on record, with some forecasts calling for 23-25 named storms and 210 ACE, nearly 75% above the recent 30-year average. This was due to another year of record sea surface temperatures (SST) in the North Atlantic basin, especially in the Main Development Region (MDR) and the Gulf of Mexico, as well as a cool neutral El Nino-Southern Oscillation (ENSO) phase, which favors below-average vertical wind shear, both of which are conducive to increased tropical cyclone activity. Initially, it looked like forecasts were going to be spot on. Despite the slowest start to the season in nearly a decade - with the first storm not forming until June 19th – the activity picked up immediately. Major Hurricane Beryl formed in late June and rapidly

intensified into the earliest category 5 hurricane in the Atlantic basin on record, with the storm active for nearly 11 days and racking up roughly 35 ACE, before making landfall in South Texas as a category 1 hurricane. Some mid-season forecasts even increased their initial outlook due to the early-season activity. However, between August 20th and September 23rd, there was an uncharacteristic lull during what is usually peak hurricane season, likely due to a combination of factors including increased dry air in the MDR, above-average upper-level warmth which leads to a more stable environment, too much wind shear in the eastern and central Atlantic where storms usually form that time of year and an unfavorable phase of the Madden-Julian Oscillation (MJO) which generally inhibits storm formation. After this drought of activity, the tropical cyclone activity in the basin came to life. More than half of the seasonal ACE (~84) occurred in the months of October and November and there was 100 ACE generated after September 24th, the second most on record. While the season did not materialize to the extremes expected, the 2024 Atlantic hurricane season was still very busy, with the season tying for the second most hurricane landfalls in the continental US with 5, including Beryl (Cat. 1), Debby (Cat. 1) and Francine (Cat. 2) and additional landfalls throughout the Caribbean.

The other two hurricanes to make landfall in the US were significantly more impactful. Major Hurricane Helene became the strongest hurricane on record to strike the Big Bend region of Florida, a year after Hurricane Idalia made landfall in the same region. The storm made landfall on September 26th as a category 4 storm, with maximum sustained winds of 140 mph. While the storm caused major damage due to high winds and storm surge near the landfall location, the biggest impacts were felt far from the center of the storm. The Tampa Bay area experienced record storm surge due to the large size of the hurricane, despite the storm never tracking closer than 100 miles west of the region. However, the worst impacts were felt in the Appalachian region of western North Carolina, eastern Tennessee and southwestern Virginia. The decaying cyclone dumped copious amounts of rainfall, leading to catastrophic flooding throughout the region with some areas receiving more than 30 inches of rain over the course of 2-3 days. Helene caused 250 direct and indirect deaths, with nearly 100 of them occurring in North Carolina. Helene's estimated insured industry loss is more than $15 billion USD[1], with the economic loss likely much higher around $75-$80 billion USD[2], due to the large coverage gap in flood insurance in the areas most impacted.

Less than 2 weeks later, Major Hurricane Milton formed in the Gulf of Mexico. The storm underwent explosive intensification, with the wind speed increasing more than 90 mph in a 24-hour period, one of the quickest increases on record, peaking at 180 mph. The storm reached a minimum central pressure of 897 mb, the lowest in the Atlantic basin since Hurricane Wilma (2005) and the 5th lowest on record. Milton weakened as it approached land and made landfall south of the Tampa area on October 9th as a category 3 storm with maximum sustained winds of 115 mph. While the rainfall from Milton was not as severe as Helene, the wind and storm surge impacts were much more widespread given the larger population in the path of the storm. Additionally, the hurricane caused a massive tornado outbreak, with a confirmed 46 tornadoes touching down in Florida, a single-day record for the state. Milton's estimated insured industry loss is close to $20 billion USD[1], while the economic loss is about $35 billion USD. Due to their record-setting nature and substantial impacts, the World Meteorological Organization retired the names Beryl, Helene and Milton from the seasonal cycle list.

[1] PCS Industry Estimate
[2] NOAA

3. Atlantic Sea Surface Temperature

Hurricanes require sea surface temperatures (SSTs) in excess of 26.5°C (79.7°F) before they can form, as hurricanes are effectively heat engines powered by warm ocean water. High sea surface temperatures alone do not ensure an active season, but there is strong association between positive Atlantic sea surface temperature anomalies and active seasons.

As of May 24th, 2025, areas with sea surface temperatures over 26.5°C were less extensive than May 24th last year in some parts of the Atlantic (Fig. 2), especially in the eastern Main Development Region (MDR) and near the US coast of the Gulf of Mexico. The year over year SST difference map (Fig. 3) shows some interesting details as well. Nearly the entire MDR is colder than last year, as well as most of the Caribbean and Gulf of Mexico.

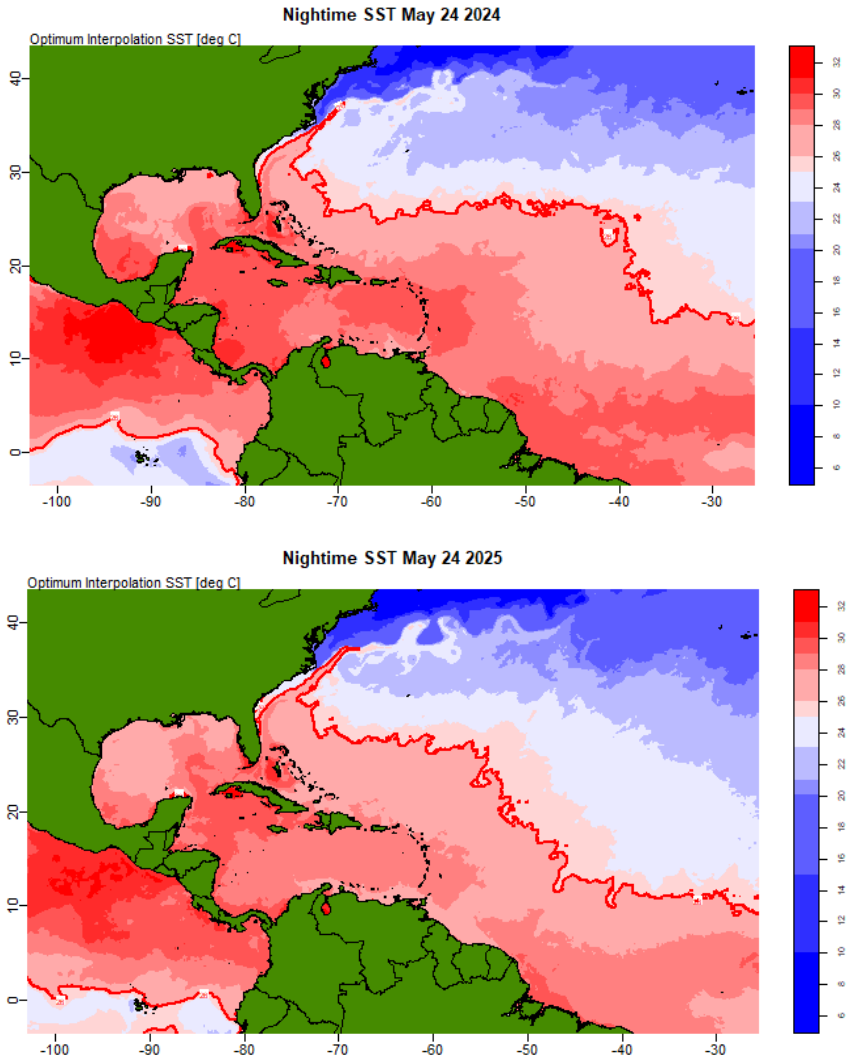


Fig. 2: Nightime Sea surface temperatures for May 24, 2024 and May 24, 2025. The 26°C contour is shown as a red line. (Source: NOAA)

This could lead to less storm activity in the regions that are generally the most conducive for developing storms. However, the SST anomalies for the Atlantic are still above average (Fig. 4), so while we will likely not see an extremely active season like last year, conditions are still conducive for an above-normal season.

On the other hand, the Western Atlantic is currently warmer than last year. Last year we saw minimal activity in this region, with Ernesto being the only storm to pass through the area. This year, we could see more storms form in that region and any storms that do move over that area might strengthen due to the relatively warmer waters.

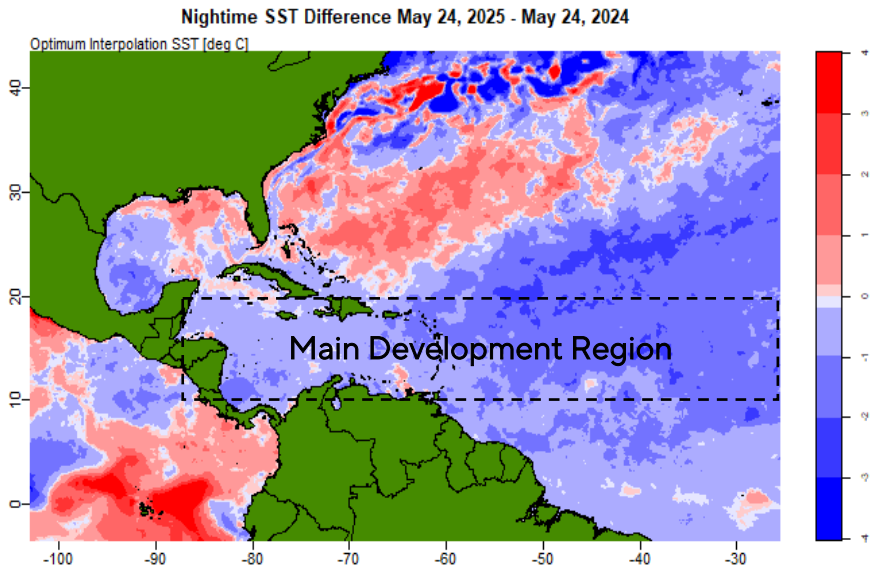


Fig. 3: Sea surface temperature difference in the North Atlantic from May 24, 2024 to May 24, 2025. Red areas are warmer this year than in 2024, while blue areas are colder. (Source: NOAA)

Although current SST patterns are strongly correlated with what we are likely to see in the peak hurricane months of August, September and October, it is very useful to look at model predictions as well. We include two examples below where the predicted SST data is presented as temperature anomalies. Positive anomalies, where the water is warmer than average, are shown in red, and blue is used to denote areas where it is cooler. The examples shown are from the NMME (North American Multi Model Ensemble) and the ECMWF (European Centre for Medium Range Weather Forecasting). Direct comparison is difficult as the plots are based on different reference periods for mean temperature.

Both show warmer-than-average temperatures in the mid-latitude portion of the Atlantic Basin. However, they are also showing average to below average conditions in the MDR and Caribbean, as well as the cool-neutral ENSO pattern in the Pacific (see Section 4). Although there is some uncertainty in these forecasts, given the similar current conditions and the consensus from multiple model simulations, there is a high confidence of these conditions verifying. If this forecast does play out, it would suggest average to slightly above average seasonal activity.

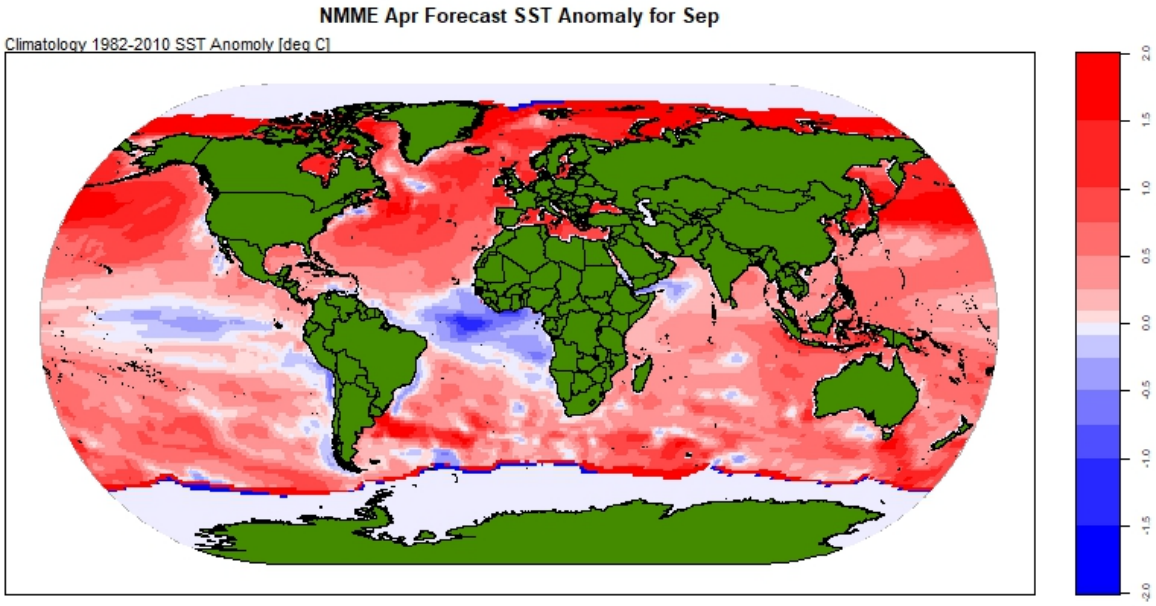


Fig. 4: Sea surface temperature anomaly map created based on the April ensemble of the North American Multi Model Ensemble forecast for September. The baseline for the forecast anomalies is hindcast average SST from 1982 to 2010. (Source: NOAA)

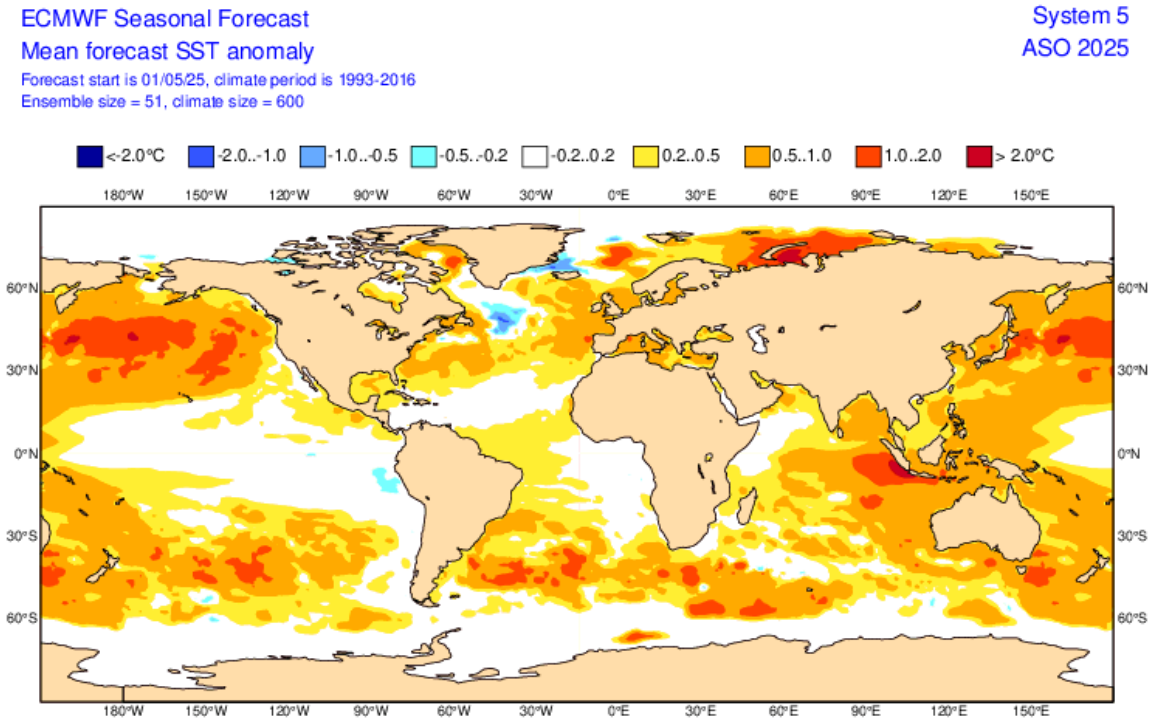


Fig. 5: Sea surface temperature anomaly map created based on the May ensemble of the ECMWF model for the August-September-October period. The baseline for the forecast anomalies is hindcast average SST from 1993 to 2016. (Source: ECMWF)

Atlantic Multi-Decadal Oscillation ("AMO")

Atlantic SST appears to oscillate with a period of multiple decades and has been linked by numerous studies with changes in numbers of hurricanes. This sea surface temperature variation is often quantified using the AMO index, calculated by averaging the SST across the whole Atlantic, and is frequently used for statistical hurricane prediction. Though AMO indices can be defined using a couple of different approaches, there is general agreement that the AMO has been in a positive phase since 1995, and that this positive phase has been associated with an above average number of hurricanes.

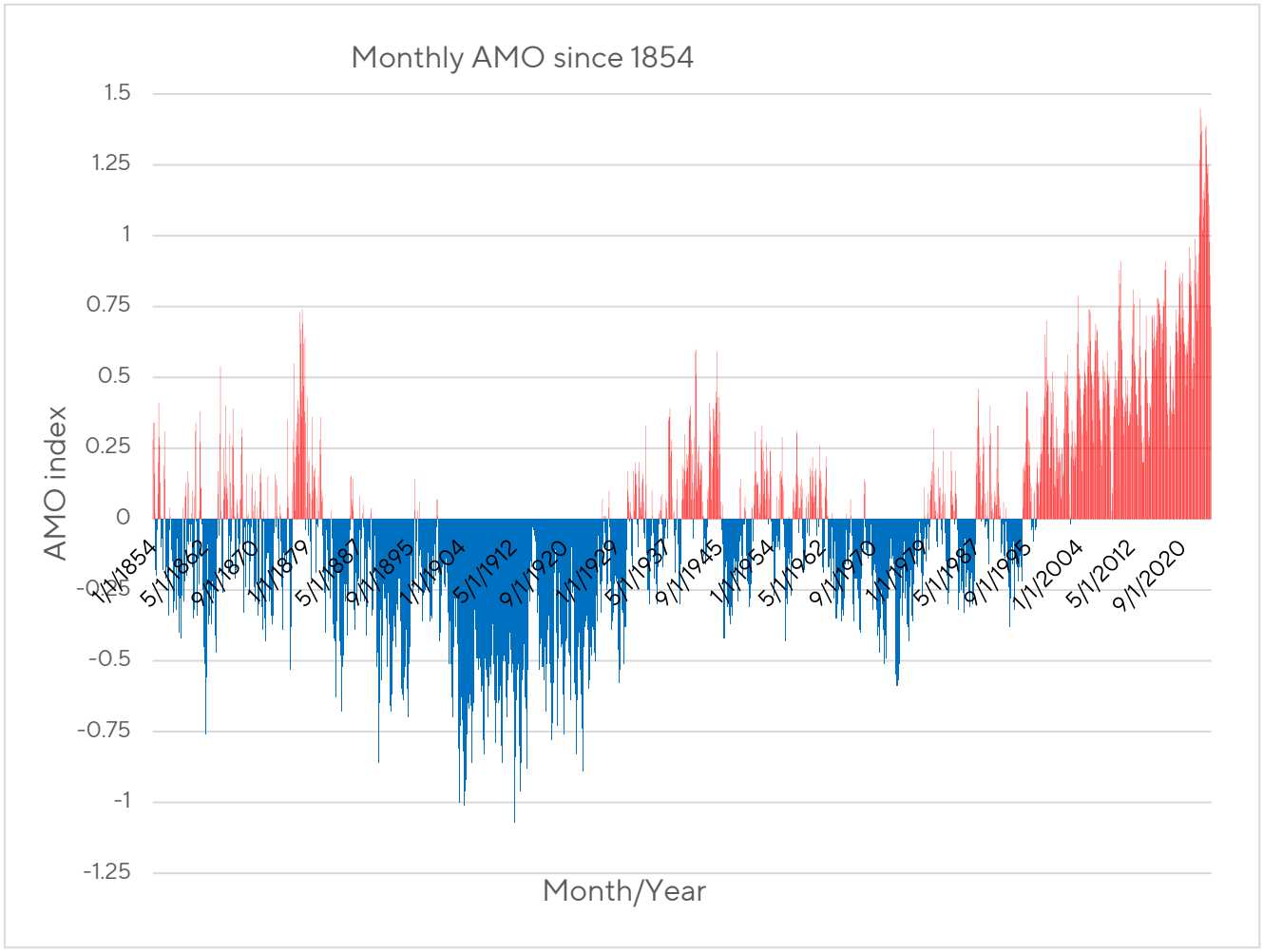


Fig. 6: Annual Atlantic Multidecadal Oscillation (AMO) index values since 1854. The multi decade periods of positive and negative AMO are clearly visible. The record high AMO index last September can be seen as the large red spike towards the end of the time series. (Source: NOAA/NCEI, based on the NOAA ERSSTV5)

The AMO has been consistently setting records over the last couple of years. In February and March of 2020, we had the highest values of the AMO since 1950, and it remained very high throughout the highly active 2020 season. Since then, each season has subsequently seen that record broken, with 2023 seeing the highest levels yet during the peak of hurricane season. In 2024, the index was on pace to break the previous year's record but leveled off during peak season. Since then, the index has fallen consistently to a slightly above the 15-year average. This data point, in conjunction with the SST forecasts suggest a less active season than last year, leading to a slightly above-average hurricane season.

Ocean Heat Content (OHC)

The Ocean Heat Content (OHC) is a quantity that describes the thermal energy stored in a volume of the ocean. The units of OHC are expressed in terms of an energy per area since it is the vertically integrated quantity from the surface to the 26°C isotherm (line of constant temperature). While tropical cyclones require a minimum sea surface temperature to form, their lifecycle afterwards can be dependent on the OHC in the path of the storm. When a developing hurricane moves over a region with high OHC, the storm will be able to tap into the available energy in the ocean and potentially rapidly intensify. Like SSTs in the MDR, the OHC in the MDR has come down from the record levels we saw last year. Throughout the basin, the OHC is either near average or slightly above average. The combination of average to above average SSTs and OHC could lead to normal to above-normal activity. However, this does not rule out the possibility that a storm could form and pass over an area of high OHC, leading to rapid intensification.

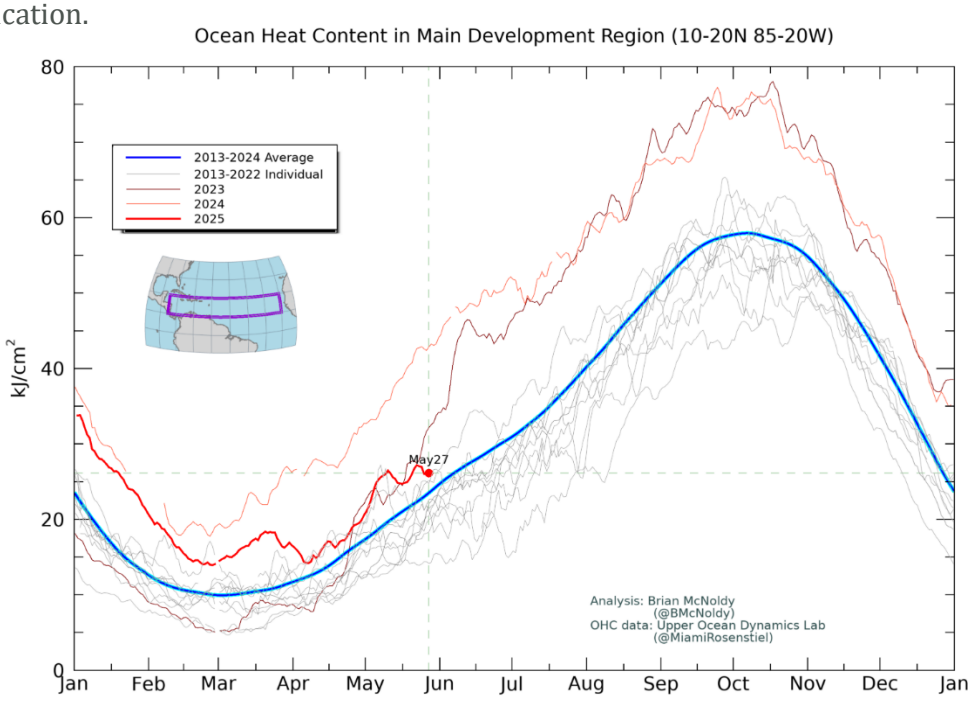


Fig. 7: The Ocean Heat Content (OHC) in the Main Development Region. As of May 27, the OHC is well below last year's record levels for this region of the Atlantic. Despite the lower values, the OHC is still above the previous decade's average for this time of year. (Source: Upper Ocean Dynamics Lab, University of Miami's Rosenstiel School of Marine, Atmospheric and Earth Science; Brian McNoldy)

4. Tropical Pacific Sea Surface Temperature (ENSO)

There is a strongly established link between the sea surface temperatures in the Tropical Pacific and hurricane activity. There are a range of indices used to quantify SST in the Pacific, and they all oscillate with a period of 3-7 years, defining what is known as the El Niño Southern Oscillation (ENSO). The NINO 3.4 Index is the most widely used in forecasts.

For Neutral conditions the anomaly value is between 0.5 and -0.5. Above 0.5 is defined as El Niño, and less than -0.5 corresponds to La Niña conditions.

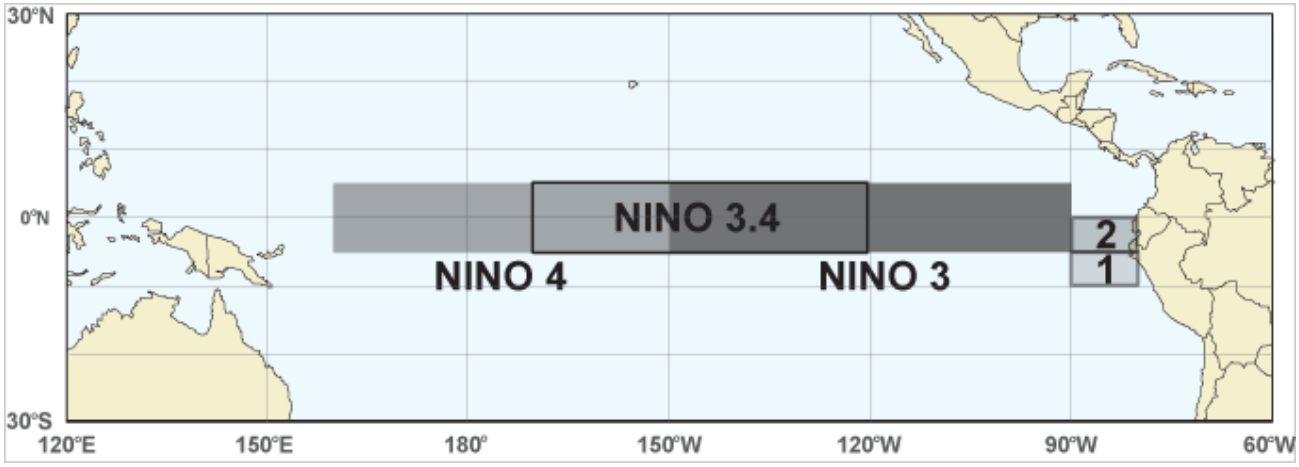


Fig. 8: The regions used to calculate the various ENSO indices. One of the most commonly used indices is a three-month average of the NINO 3.4 index. (source: BOM, Australia)

ENSO has been linked to a wide range of additional climate variations including Pacific typhoon activity, rain in California and tornado activity in parts of the US.

Warm (positive) phases of ENSO, El Niño events, are associated with above average wind shear in the Atlantic at latitudes where stronger hurricanes normally form leading to below average activity. La Niña (negative ENSO) events are conversely associated with more favorable conditions for Atlantic hurricane formation due to less wind shear, and more active seasons.

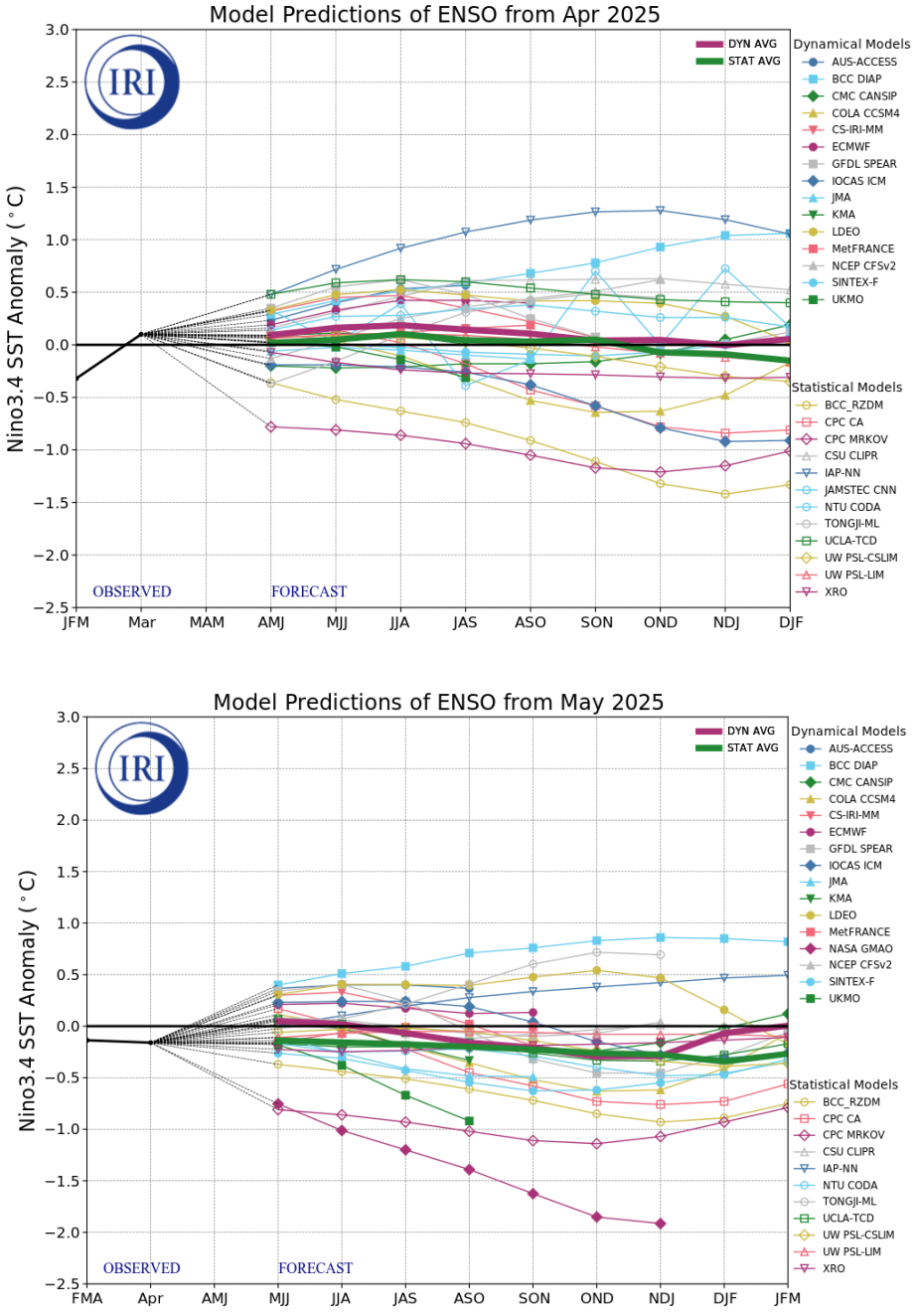


Fig. 9: April and May forecast plumes for ENSO defined as the NINO 3.4 Index averaged over 3 months. There are a range of dynamic and statistical models used to forecast ENSO, and generally the consensus forecasts shown in solid blue (dynamic model average) and green (statistical model average) have more skill than most individual forecasts. The consensus is generally neutral conditions for the key months of the hurricane season. (Source: IRI, Columbia Climate School)

After briefly entering a weak La Nina phase this past winter, the central and eastern equatorial Pacific has warmed slightly, with ENSO indices indicating a transition to neutral conditions has occurred. Models are in general agreement that the tropical Pacific will maintain neutral conditions throughout the peak months of hurricane season. While the outlook in April favored a consistent neutral phase through the rest of the year, the May outlook suggests that there could be some cooling later in the season, with a weak La Nina forming, although neutral conditions are still favored (Fig. 9). Either way, as of early May, the Climate Prediction Center (CPC) is giving a greater than 70% chance of neutral conditions being present during the beginning of hurricane season and a 50% chance that continues through the peak of the season.

While La Niña conditions increase hurricane activity in the North Atlantic basin, there is not an especially strong relationship between neutral conditions and tropical storm activity. However, there are some studies[3] that suggest neutral conditions are only marginally less conducive for landfalls along the Gulf coast compared to the cold phase. While negative ENSO conditions have also been shown to increase the likelihood of a US landfall along the eastern seaboard, as storms in the western Atlantic are less likely to recurve out to sea given the prevailing upper-level winds, neutral conditions lead to a significant decrease in landfall frequency in that region.

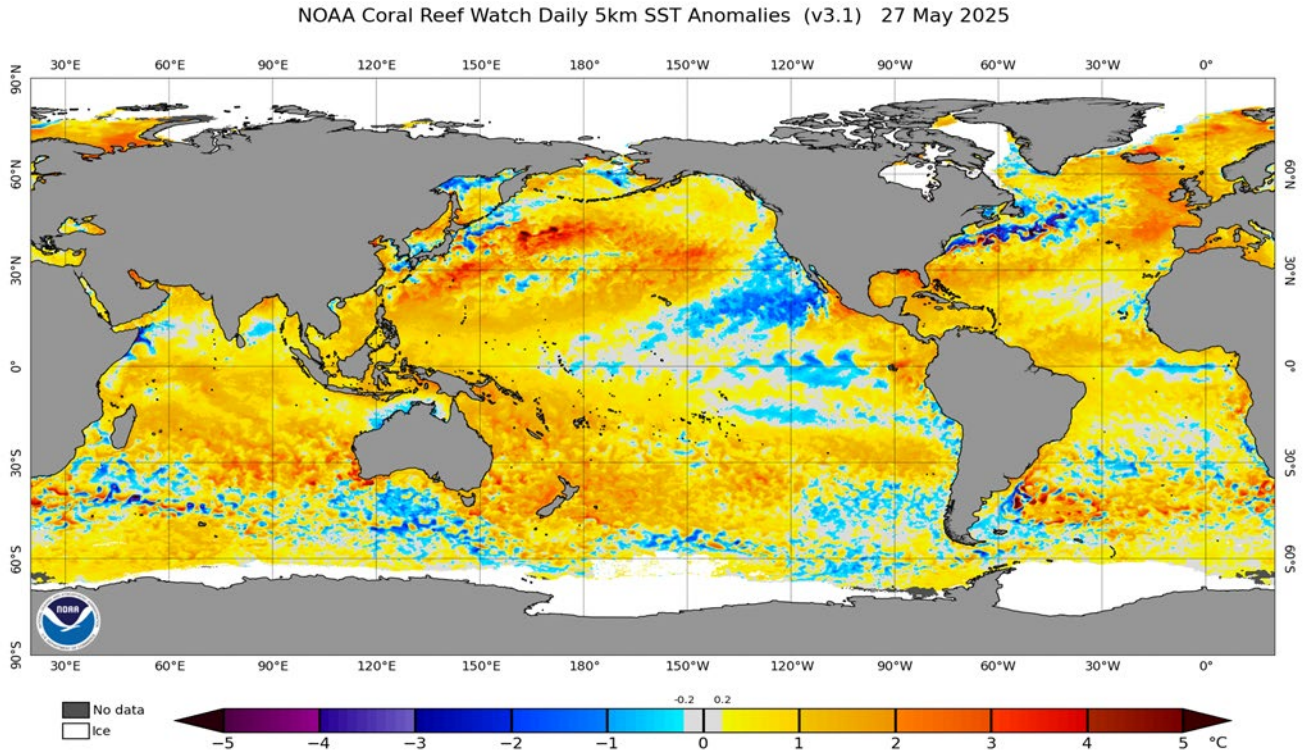


Fig. 10: 5km Global SST Anomalies as of May 27 2025 (Source: NOAA).

[3] https://journals.ametsoc.org/view/journals/clim/20/7/jcli4063.1.xml

5. Saharan Dust

During the hurricane season, Saharan dust can have a significant effect on hurricane activity, as dust inhibits activity in two key ways:

- Dust absorbs relatively more infrared radiation than a dust free atmosphere, and thus heats up the atmospheric layers where it is present. In summer, the dust is generally transported out over the Atlantic at heights of a few kilometers, well within the lower atmosphere. The creation of a warm layer at a relatively low to mid-level within the troposphere (lowest layer of the atmosphere where all of Earth's weather occurs) inhibits the rising of warm moist air from near the ocean surface, and thus suppresses the convection required to generate the thunderstorms that develop into tropical storms and hurricanes.
- Dust captures the incoming energy in the atmosphere, stopping it from reaching the ocean and further heating it.

The Saharan dust is produced by erosion of soil in Saharan Africa, and this erosion is more pronounced when the dust producing regions are dry. Hence the rainfall in the Western Sahel (near Saharan Africa), has a direct link with the amount of dust available to transport, which in turn influences the rate of hurricane formation in the Atlantic.

The current precipitation data, and that for the last three months, are similar to last year, with some regions seeing above or below average rainfall, but no substantial anomalies, although there are some regions just to the south with dryer than average conditions recently. Therefore, we expect a near average Saharan Air Layer (SAL). This means dust is unlikely to play a major role suppressing hurricane activity, but we could see some outbreaks early in the season.

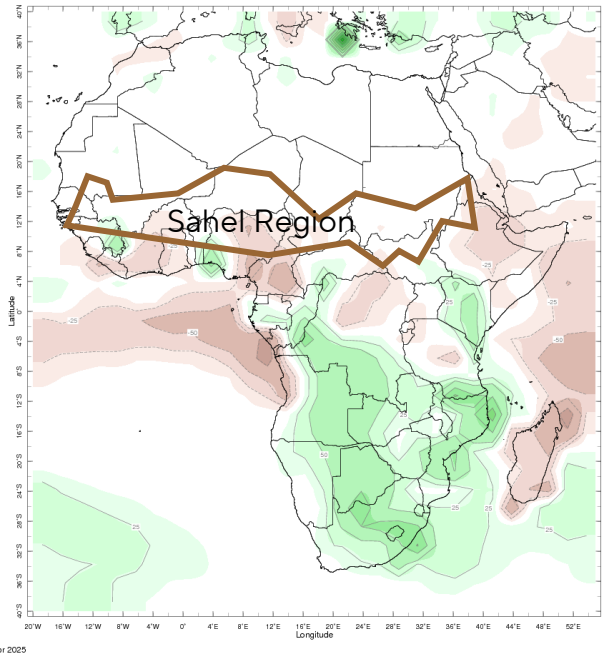


Fig. 11: Precipitation anomaly map of Africa as of April 2025. (Green colors) represent areas of higher than average precipitation and the (brown colors) represent areas of lower than average precipitation (Source: NOAA NCEP Climate Prediction Center, CAMS_OPI; IRI, Columbia Climate School)

6. Intraseasonal Variability

While the above factors may impact the big picture for the season, there are some variables that influence the month-to-month variations in tropical cyclone formation. For example, the Madden-Julian Oscillation (MJO) has been shown to effect when and where hurricanes form. The MJO is an eastwardly migrating tropical wave that traverses the equator every 30 to 60 days. It is characterized by an area of enhanced rainfall and an area of supressed rainfall. Tropical storms and hurricanes are more likely to form when the area of enhanced precipitation is moving over the ocean, especially the Gulf of Mexico and Caribbean. In regions of below average convection, hurricane activity is reduced. During the 2024 Atlantic hurricane season, we saw how the MJO can suppress or enhance activity. During late August and most of September, the MJO was primarily in phases 4-7, the most unfavorable for tropical cyclone (TC) formation, and those months saw well below normal activity relative to the average. During late September to October, the MJO became very favorable in the Atlantic and there was a flurry of activity, including the formation of Hurricanes Helene and Milton. Additionally, the late season activity in late October/early November lined up with another favorable MJO phase period. Nearly all the TC formations occurred during the favorable phases, highlighting how the MJO phase can influence when we see the most activity during the season.

While it is difficult to predict how the MJO will play out over the course of the season, we can look at the early season forecast to get an idea if we will have a head start to the season in June. Current model predictions expect the MJO to be in phases 4, 5, 6 and 7 over the next 2 weeks, which are generally the least favorable for storm formation. Longer range predictions, which are less reliable, do expect the MJO to transition to phases 8 and 1 by the end of June, so that could be the time when we see an uptick in activity. We will continue to monitor the MJO throughout the season to give us a sense when we might see potential spikes or lulls in activity.

Another feature that impacts when storms may form are convectively coupled Kelvin waves (CCKW). These are also eastward-propagating tropical waves but move much faster than the MJO. CCKWs can influence tropical cyclone formation by enhancing convection (rainfall) and triggering African easterly waves (AEWs) which are known to be a main precursor for hurricanes to form over the Atlantic in the Main Development Region.

Three years ago, we saw another component of the atmosphere that contributes to intraseasonal variability. During August of 2022, there was anomalous cooling of the subtropical Atlantic sea surface temperatures between 25° N and 40° N latitude. These below average temperatures along with above average temperatures in the main development region led to a strong temperature gradient in the Atlantic. These conditions favor the development of mid-latitude anticyclonic wavebreaking, an event where the mid-latitude jet stream becomes highly amplified. Wavebreaking events can lead to dry air intrusions in the tropics and higher wind shear in the main development region. Both conditions suppress tropical cyclone activity, and we saw this first hand in the extremely long dry spell of August 2022 and likely during the even more unusual dry spell of August/September of 2024. Monitoring the subtropical Atlantic SSTs will be another key indicator for potential active or inactive periods during the hurricane season, especially given the current below-average SSTs in the MDR and warmer waters in the subtropical Atlantic relative to last year.

7. Reinsurance Market Impact

Hurricanes Helene and Milton have caused a combined economic loss exceeding $110 billion, with insured losses estimated at around $40 billion, according to multiple sources. These losses are lower than initially feared. By comparison, Hurricane Ian in 2022 resulted in insured losses exceeding $50 billion. Thanks to several years of market hardening and improved terms and conditions, the reinsurance industry is now in a much stronger position to absorb the impact of events like Helene and Milton. These two hurricanes have been treated more as earnings events rather than capital events. Reinsurance capital is at an all-time high, and reinsurers' composite returns on capital exceed the cost of capital, further supported by strong investment income. Currently, there is more capital supply than demand in the reinsurance market. The January 2025 renewal season saw U.S. property catastrophe reinsurance rates decline by 5% to 15% on a risk-adjusted basis. For the mid-year Florida renewals, rates have further declined from last year, with more rate reduction pressure on the high and middle layers than on the lower ones. Investor demand for Cat bonds in the ILS space remains very strong and is a key reason why the upper and middle layers are well-capitalized. Reinsurers continue to hold firm on higher attachment points, though there have been some improvements in terms and conditions.

Looking ahead to the 2026 renewals, much will depend on weather activity. With abundant capital and increasing reinsurer appetite for property catastrophe risk, a quiet hurricane season would likely place additional downward pressure on rates. The market appears well-equipped to manage another slightly above average hurricane season, even alongside the earlier impacts from the LA wildfire and a notably intense severe convective storm season. However, an exceptionally severe hurricane season would likely place meaningful pressure on the balance between capital supply and reinsurance demand.

8. Conclusions

There are many groups making pre-season hurricane forecasts, and this report is designed to help put those forecasts into context. We have examined several key variables that have been associated with hurricane activity in numerous published scientific studies to create a qualitative overview of the likely conditions this summer and fall.

The strongest predictors of hurricane activity are Atlantic and Pacific sea surface temperatures often expressed in terms of SST anomalies. This season, models are predicting a warm Atlantic which is generally associated with more storm activity, although not nearly as warm as last season. In addition, we can expect a reasonable likelihood of neutral conditions in the Pacific. These two combined have historically been associated with average to above-average seasons.

Additional factors like Saharan dust likely won't have a dramatic effect on the overall activity but can intervene at critical moments to suppress some activity. However, based on the current Sahel conditions there is no reason to expect especially large amounts of dust this year. While intraseasonal variables are hard to predict, they will need to be monitored to understand when and where increases in storm formation may occur.

Overall, statistical and dynamical models, as well as a review of key variables, suggest a slightly above-average hurricane season for 2025. Additionally, there is larger uncertainty this year given no factor will likely dominate the season, with the potential for different variables to compete. If the Atlantic is warmer than expected and the tropical Pacific surprisingly transitions to a La Nina phase, it could lead to a more active season with the oceanic conditions synchronizing like last year. An alternative scenario where the Atlantic is cooler than expected and the ENSO phase remains neutral could lead to a below-average season. As always, Acrisure Re will be monitoring the tropics and providing real-time updates both before and after any potential events using our suite of tools and analytics.

9. References and Further Reading

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