QUALITATIVE DISCUSSION OF ATLANTIC BASIN SEASONAL HURRICANE ACTIVITY FOR 2016

We discontinued our early December quantitative hurricane forecast in 2012 and are now giving a more qualitative discussion of the factors which will determine next year's Atlantic basin hurricane activity. One big question mark for 2016 is how quickly the current strong El Niño will weaken. In addition, the current phase of the Atlantic Multi-Decadal Oscillation (AMO) is highly uncertainty.

Our first quantitative forecast for 2016 will be issued on Thursday, April 14.

(as of 11 December 2015)

By Philip J. Klotzbach[1]

With special assistance from William M. Gray[2]

This discussion as well as past forecasts and verifications are available online at http://hurricane.atmos.colostate.edu

Anne Ju Manning, Colorado State University Media Representative, (970-491-7099) is available to answer various questions about this outlook.

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ABSTRACT

We are providing a qualitative discussion of features likely to impact the 2016 Atlantic basin hurricane season rather than a specific numbers forecast. This outlook for 2016 will give our assessment of the probability of four potential scenarios for Net Tropical Cyclone (NTC) activity.

We have developed a new way of assessing next year's activity in terms of two primary physical parameters:

1. the strength of the Atlantic Multi-Decadal Oscillation (AMO) or Atlantic thermohaline circulation (THC)

2. the phase of ENSO

Following three quiet Atlantic hurricane seasons in a row, there is considerable uncertainty as to whether or not we remain in an active AMO/THC phase (Klotzbach et al. 2015). Another big questions for 2016 is what impacts the current strong El Niño event will play in next year's hurricane season. While we anticipate that the strong El Niño will have dissipated by the peak of next year's hurricane season, there is the potential for lingering atmospheric impacts.

For the 2016 hurricane season, we anticipate four possible scenarios with the probability of each as indicated on the next page:

1. AMO/THC becomes above average in 2016 and no El Niño impacts remain (resulting in a seasonal average Accumulated Cyclone Energy (ACE) activity of ~ 170) – **25% chance**.

2. AMO/THC is above average in 2016 but some El Niño impacts remain (ACE ~ 120) – **35% chance**.

3. AMO/THC is below average and no El Niño impacts remain (ACE ~ 80) – **20% chance**.

4. AMO/THC is below average and some El Niño impacts remain (ACE ~ 50) – **20% chance**.

Typically, seasons with the above-listed ACE values have TC activity as follows:

170 ACE – 14-17 named storms, 9-11 hurricanes, 4-5 major hurricanes
120 ACE – 12-15 named storms, 6-8 hurricanes, 2-3 major hurricanes
80 ACE – 8-11 named storms, 3-5 hurricanes, 1-2 major hurricanes
50 ACE – 5-7 named storms, 2-3 hurricanes, 0-1 major hurricane

Acknowledgment

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Bill Gray gratefully acknowledges the valuable input to his CSU seasonal forecast research project over many years by former graduate students and now colleagues Chris Landsea, John Knaff and Eric Blake.

DEFINITIONS AND ACRONYMS

Accumulated Cyclone Energy (ACE) - A measure of a named storm's potential for wind and storm surge destruction defined as the sum of the square of a named storm's maximum wind speed (in 10^4 knots^2) for each 6-hour period of its existence. The 1950-2000 average value of this parameter is 96 for the Atlantic basin.

Atlantic Multi-Decadal Oscillation (AMO) – A mode of natural variability that occurs in the North Atlantic Ocean and evidencing itself in fluctuations in sea surface temperature and sea level pressure fields. The AMO is likely related to fluctuations in the strength of the oceanic thermohaline circulation. Although several definitions of the AMO are currently used in the literature, we define the AMO based on North Atlantic sea surface temperatures from 20-70°N, 40-10°W and sea level pressure from 15-50°N, 60-10°W.

Atlantic Basin – The area including the entire North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico.

El Niño – A 12-18 month period during which anomalously warm sea surface temperatures occur in the eastern half of the equatorial Pacific. Moderate or strong El Niño events occur irregularly, about once every 3-7 years on average.

Hurricane (H) - A tropical cyclone with sustained low-level winds of 74 miles per hour (33 ms^{-1} or 64 knots) or greater.

Hurricane Day (HD) - A measure of hurricane activity, one unit of which occurs as four 6-hour periods during which a tropical cyclone is observed or is estimated to have hurricane-force winds.

Indian Ocean Dipole (IOD) - An irregular oscillation of sea surface temperatures between the western and eastern tropical Indian Ocean. A positive phase of the IOD occurs when the western Indian Ocean is anomalously warm compared with the eastern Indian Ocean.

Madden Julian Oscillation (MJO) – A globally propagating mode of tropical atmospheric intra-seasonal variability. The wave tends to propagate eastward at approximately 5 ms^{-1}, circling the globe in roughly 40-50 days.

Main Development Region (MDR) – An area in the tropical Atlantic where a majority of major hurricanes form, which we define as 7.5-22.5°N, 20-75°W.

Major Hurricane (MH) - A hurricane which reaches a sustained low-level wind of at least 111 mph (96 knots or 50 ms^{-1}) at some point in its lifetime. This constitutes a category 3 or higher on the Saffir/Simpson scale.

Major Hurricane Day (MHD) - Four 6-hour periods during which a hurricane has an intensity of Saffir/Simpson category 3 or higher.

Multivariate ENSO Index (MEI) – An index defining ENSO that takes into account tropical Pacific sea surface temperatures, sea level pressures, zonal and meridional winds and cloudiness.

Named Storm (NS) - A hurricane, a tropical storm or a sub-tropical storm.

Named Storm Day (NSD) - As in HD but for four 6-hour periods during which a tropical or sub-tropical cyclone is observed (or is estimated) to have attained tropical storm-force winds.

Net Tropical Cyclone (NTC) Activity –Average seasonal percentage mean of NS, NSD, H, HD, MH, MHD. Gives overall indication of Atlantic basin seasonal hurricane activity. The 1950-2000 average value of this parameter is 100.

Saffir/Simpson Hurricane Wind Scale – A measurement scale ranging from 1 to 5 of hurricane wind intensity. One is a weak hurricane; whereas, five is the most intense hurricane.

Southern Oscillation Index (SOI) – A normalized measure of the surface pressure difference between Tahiti and Darwin. Low values typically indicate El Niño conditions.

Sea Surface Temperature – SST

Sea Surface Temperature Anomaly – SSTA

Thermohaline Circulation (THC) – A large-scale circulation in the Atlantic Ocean that is driven by fluctuations in salinity and temperature. When the THC is stronger than normal, the AMO tends to be in its warm (or positive) phase, and more Atlantic hurricanes typically form.

Tropical Cyclone (TC) - A large-scale circular flow occurring within the tropics and subtropics which has its strongest winds at low levels; including hurricanes, tropical storms and other weaker rotating vortices.

Tropical North Atlantic (TNA) index – A measure of sea surface temperatures in the area from 5.5-23.5°N, 15-57.5°W.

Tropical Storm (TS) - A tropical cyclone with maximum sustained winds between 39 mph (18 ms^{-1} or 34 knots) and 73 mph (32 ms^{-1} or 63 knots).

Vertical Wind Shear – The difference in horizontal wind between 200 mb (approximately 40000 feet or 12 km) and 850 mb (approximately 5000 feet or 1.6 km).

1 knot = 1.15 miles per hour = 0.515 meters per second

1 Introduction

This is the 33rd year in which the CSU Tropical Meteorology Project has made forecasts of the upcoming season's Atlantic basin hurricane activity. Our research team has shown that a sizable portion of the year-to-year variability of Atlantic tropical cyclone (TC) activity can be hindcast with skill exceeding climatology. These forecasts are based on a statistical methodology derived from 30-60 years of past data. Qualitative adjustments are added to accommodate additional processes which may not be explicitly represented by our statistical analyses. These evolving forecast techniques are based on a variety of climate-related global and regional predictors previously shown to be related to the forthcoming seasonal Atlantic basin TC activity and landfall probability. We believe that seasonal forecasts must be based on methods that show significant hindcast skill in application to long periods of prior data. It is only through hindcast skill that one can demonstrate that seasonal forecast skill is possible. This is a valid methodology provided that the atmosphere continues to behave in the future as it has in the past.

The best predictors do not necessarily have the best individual correlations with hurricane activity. The best forecast parameters are those that explain the portion of the variance of seasonal hurricane activity that is not associated with the other forecast variables. It is possible for an important hurricane forecast parameter to show little direct relationship to a predictand by itself but to have an important influence when included with a set of 2-3 other predictors.

A direct correlation of a forecast parameter may not be the best measure of the importance of this predictor to the skill of a 2-3 parameter forecast model. This is the nature of the seasonal or climate forecast problem where one is dealing with a very complicated atmospheric-oceanic system that is highly non-linear. There is a maze of changing physical linkages between the many variables. These linkages can undergo unknown changes from weekly to decadal time scales. It is impossible to understand how all these processes interact with each other. No one can completely understand the full complexity of the atmosphere-ocean system. But, it is still possible to develop a reliable statistical forecast scheme which incorporates a number of the climate system's non-linear interactions. Any seasonal or climate forecast scheme must show significant hindcast skill before it is used in real-time forecasts.

2 The Atlantic Ocean Thermohaline Circulation (THC) and the Strength of the Atlantic Gyre on Atlantic Hurricane Activity

Over the next few pages, we discuss two large-scale physical features which we know are fundamental for how active the 2016 Atlantic hurricane season is likely to be.

The longer-period SST changes which the Atlantic Ocean experiences are due primarily to variations in the strength of the southwest to northeast upper branch of the THC in the high latitude Atlantic, which are then reflected in changes in the AMO. The THC (which is observed and modeled to vary considerably in strength on multi-decadal timescales) is strong when there is an above-average poleward advection of warm tropical waters to the high latitudes of the Atlantic. This poleward-moving water can then sink to deep levels if it has high enough salinity content. This sinking process has been termed North Atlantic Deep Water Formation (NADWF). The deep water then moves southward into the Southern Hemisphere. The amount of North Atlantic water that sinks is roughly proportional to the water's density which at high latitudes, where water temperatures are low, is primarily dependent on salinity content. The strong association between our proxy for the AMO/THC and North Atlantic salinity is shown in Figure 1. High salinity implies higher rates of NADWF. When the salinity rates are lower, less NADWF formation occurs. During these periods, the water tends to recirculate and increase the ocean's clockwise circulating gyre motion.

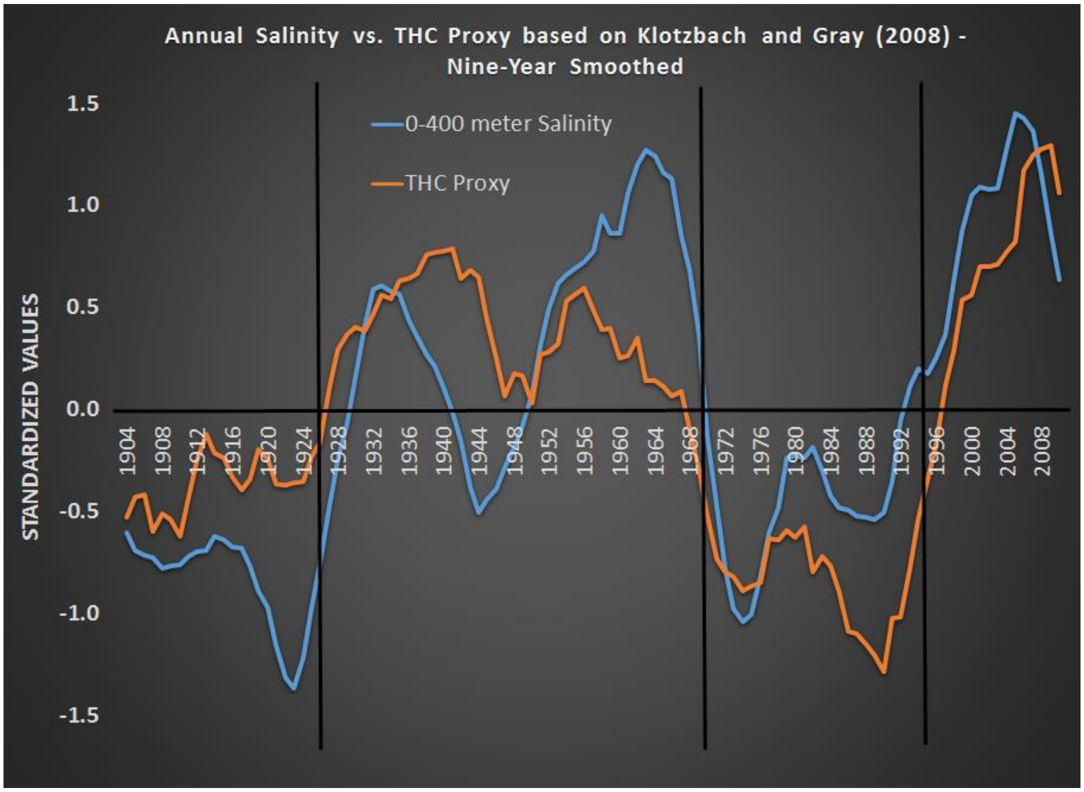


Figure 1: Illustration of the strong association of yearly average North Atlantic SSTA and North Atlantic salinity content from 1900-2014.

Through a progression of associations the strength of the NADWF and inverse strength of the Atlantic gyre is hypothesized to bring about alterations of the tropospheric vertical wind shear, trade wind strength, SSTs, middle-level water vapor, and other conditions in the Atlantic Main Development Region (MDR – 7.5-22.5°N; 20-75°W). Changes of SST in the MDR are a consequence of a combination of the THC's influences on a variety of other parameters in the MDR (Figure 2). A stronger than average THC causes more ocean sinking in area 1. This in turn reduces the strength of the Atlantic gyre. There is then a change in all of the other conditions shown in Figure 2 to bring about more or less favorable parameters in the MDR for TC formation and intensification. This figure illustrates how the changing rate of southward advection of cold water in the east Atlantic (2) brings about alterations of SLP (3), SST (4), and rainfall (5). These changes in turn lead to changes in trade wind strength (6) and 200 mb zonal wind (7). Changes in hurricane activity and especially major hurricane activity follow (8). It is also found that in periods with a strong THC, El Niño frequency and intensity is typically reduced (9) and tropical South Atlantic SSTs are decreased (10).

The influence of the warmer Atlantic SST is not primarily to enhance lapse rates and cumulus convection in the MDR but to act as a net overall positive or negative influence on a combination of parameters that must all change in a positive way to enhance MDR TC activity. These features typically all go together as a package to either enhance or to inhibit TC formation and/or TC intensity change (Figure 3). The simple argument of increasing or decreasing SST alone, without other important parameter changes is not typical of what we observe with TC activity variation in this region.

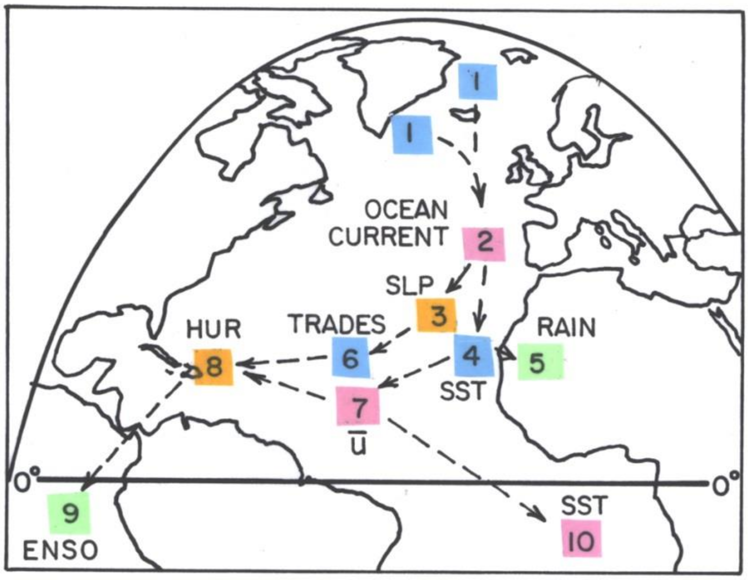


Figure 2: Idealized analysis of how changes in North Atlantic SST and salinity (area 1) lead to progressive ocean current, wind, pressure, SST, vertical shear and rain changes as portrayed in nine areas. It is this complete package of Atlantic/eastern Pacific ocean/atmosphere parameter changes on multi-decadal time scales which cause large changes in Atlantic major hurricanes on this time scale.

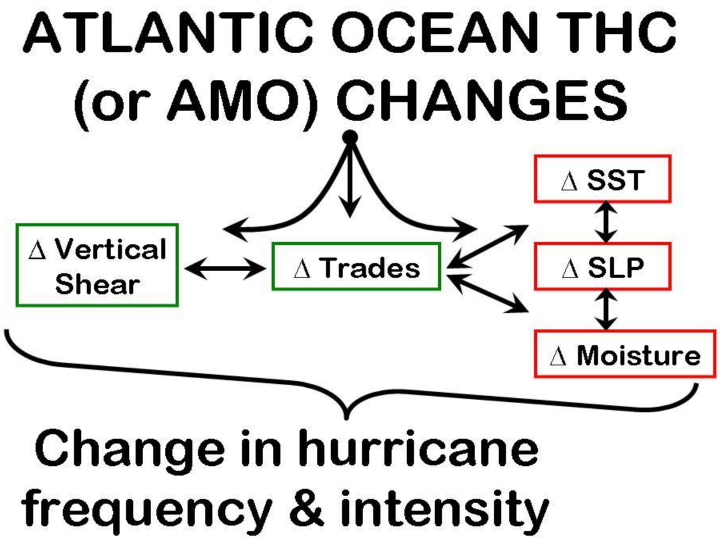


Figure 3: Idealized portrayal of how changes in the Atlantic THC bring about various parameter changes in the Atlantic's MDR between 7.5-22.5°N; 75-20°W. Vertical shear, trade-wind strength, and SST are the key parameters which respond to the THC changes. Favorable SLPA and mid-level moisture changes occur in association with the shear, trade wind, and SST changes. It is the THC's ability to affect a favorable alteration of a combination of these parameters within the MDR which leads to such a strong association between the strength of the THC and major hurricane frequency.

One of the primary physical drivers for active versus inactive Atlantic basin hurricane seasons is the strength of the THC or AMO (Gray et al. 1996, Goldenberg et al. 2001, Klotzbach and Gray 2008). A positive phase of the AMO (or strong phase of the THC) typically leads to 3-5 times more major Atlantic basin hurricane activity than does a negative phase. The typical period of the THC is about 60 years, with the period length varying between as short as 40-50 years and as long as 70-80 years. This means that we typically have 25-35 years of above-average Atlantic basin major TC activity and similar length periods with considerably reduced amounts of major TC activity. Recently, we have had three quiet Atlantic hurricane seasons in a row (e.g., 2013-2015) which have led us to question whether we have moved out of the active era that began in 1995 (Klotzbach et al. 2015).

While the THC typically remains in an above-average or in a below-average state for periods of 25-35 years, there can be monthly, seasonal or longer breaks up to a year or two within these decadal periods when the THC (or AMO) conditions of features such as SST, salinity, pressure, wind, and moisture become substantially weaker in positive THC phases or stronger during negative THC phases. It remains to be seen if the three quiet seasons that we have just experienced are part of a short-term AMO/THC weakening or a long-term phase shift.

General Discussion. There is a strong inverse relationship between the strength of the THC and the strength of the Atlantic gyre (Bermuda-Azores High). This has been well documented in our analysis of various yearly and seasonal gyre and THC proxy variations. Hurricane activity, particularly the most intense hurricane activity, is much more frequent when the Atlantic Bermuda-Azores gyre circulation system is weak and the Atlantic Ocean THC system is strong. Hurricane activity is generally reduced when the reverse conditions occur. Increased gyre strength acts to bring about cooler air (and reduced moisture) and cooler ocean water advection in the eastern half of the Atlantic. This acts to increase the strength of the trade winds and increase the low latitude (5-20°N) south to north tropospheric temperature gradient and the upper tropospheric westerly winds. All of these changes are inhibiting factors for hurricane formation and intensification.

One of the primary reasons why we believe the 2013 Atlantic hurricane season was so quiet was due to a very strong weakening of the THC/AMO during the spring months of that year. The AMO/THC has generally been average to below-average the past two years as well. We currently monitor a THC proxy that utilizes SST in the region from 50-60°N, 50-10°W and SLP in the region from 0-50°N, 70-10°W (Figure 4). The index is created by weighing the two parameters as follows: 0.6*SST – 0.4*SLP. The THC/AMO is currently running below-normal and has generally been below-average since January 2014, with the notable exception of a recovery to positive values during August-October, 2014 (Figure 5).

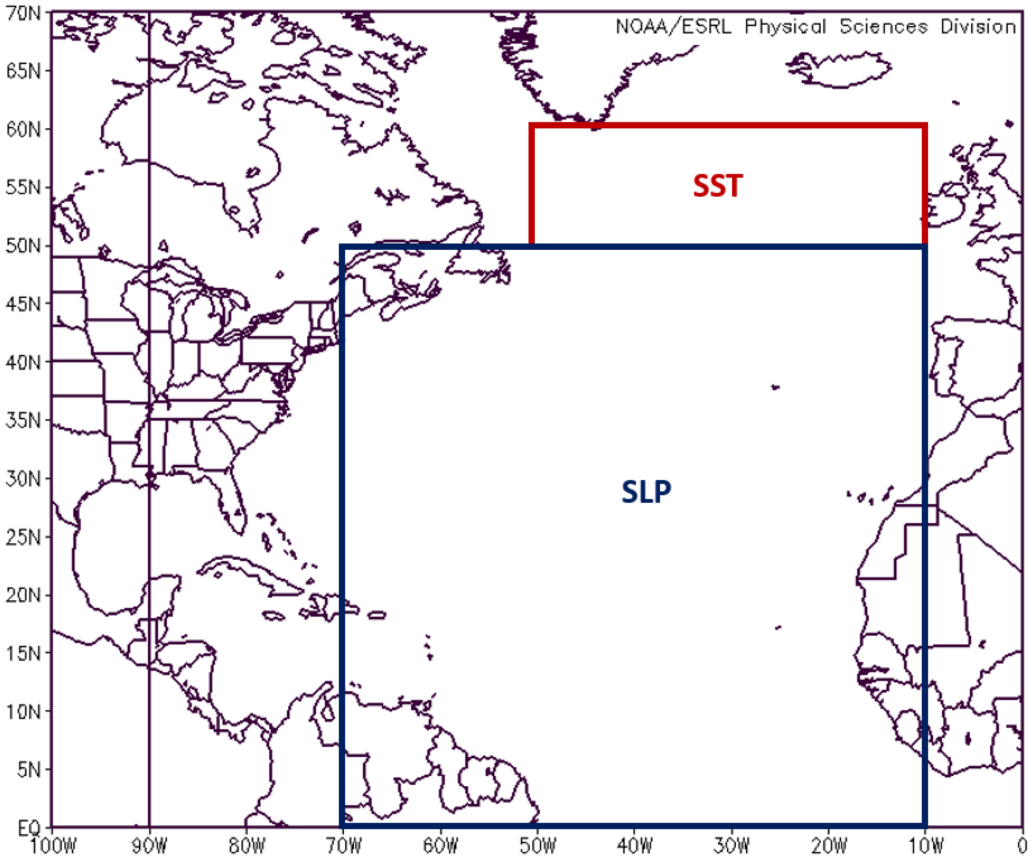


Figure 4: Regions which are utilized for calculation of our THC/AMO index. These regions are as defined in Klotzbach and Gray (2008).

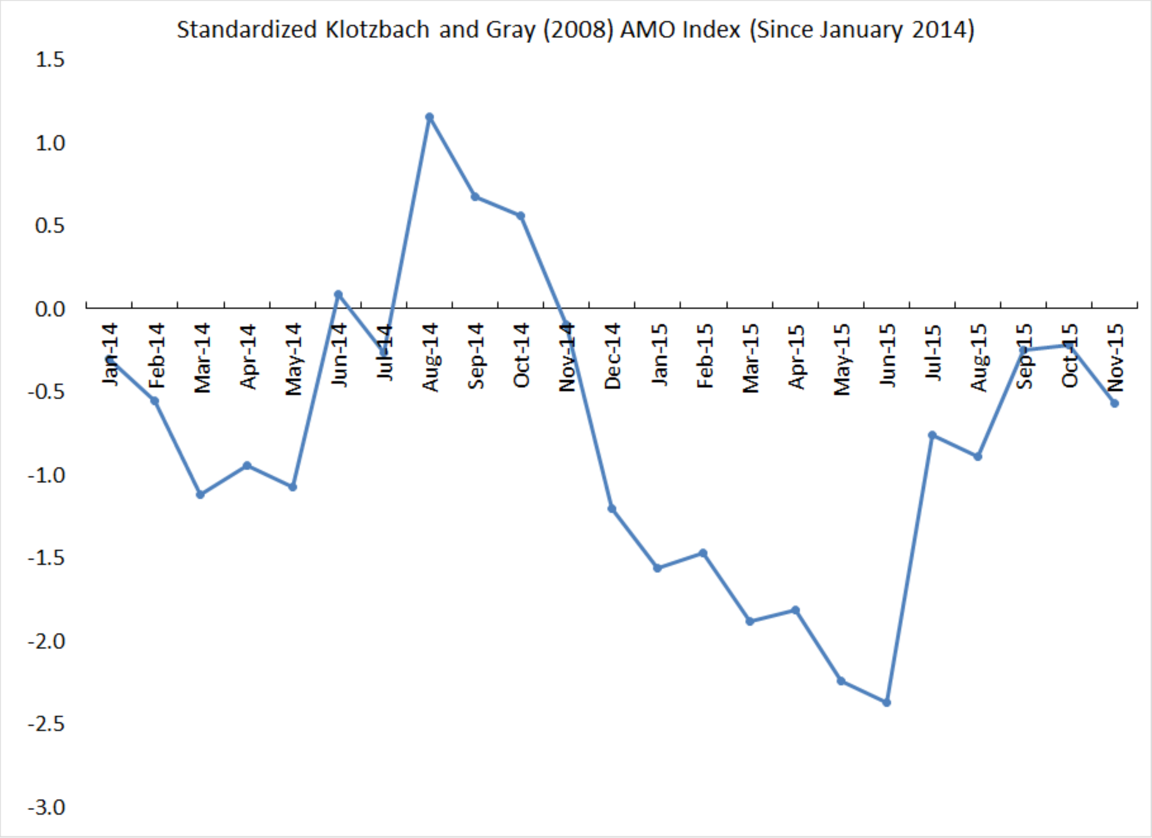


Figure 5: Standardized values of the THC/AMO index by month since January 2014.

3 ENSO

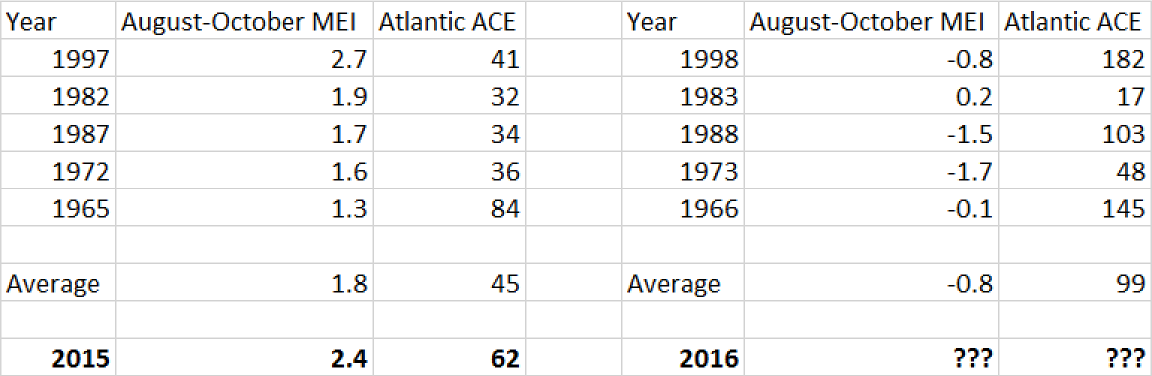
There is currently a strong El Niño in place across the tropical Pacific. We discussed the development of the strong El Niño in detail in our recently released 2015 hurricane seasonal forecast verification.

One of the important questions for the upcoming hurricane season is what impacts the current strong El Niño could have on next year's hurricane season. Table 1 displays the five strongest El Niño years based on the August-October Multivariate ENSO Index (MEI) since 1950, along with ACE accrued in these years. The MEI utilizes a combination of atmospheric and oceanic indicators to assess the state of ENSO. We find that the MEI correlates better with Atlantic hurricane activity than any oceanic-only ENSO index. More information on the MEI is available here:

http://www.esrl.noaa.gov/psd/enso/mei/

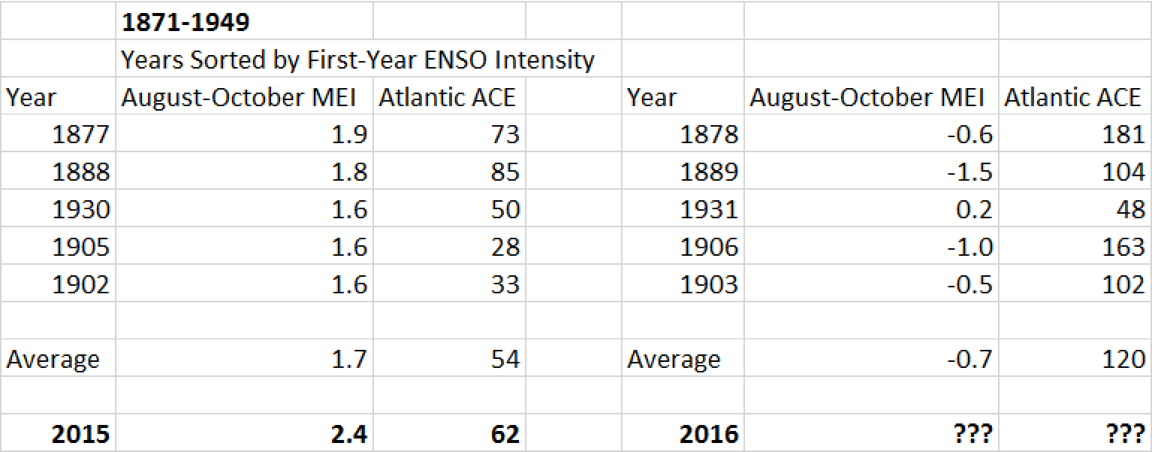
Also displayed are the MEI and ACE values for the year following the strong El Niño. Table 2 shows similar data but for the five strongest El Niños from 1871-1949. All of these ten strongest events had either neutral or La Niña conditions by the following season, but Atlantic ACE the following year had quite a large spread. Some years such as 1878, 1906 and 1998 were very active, while other years such as 1931, 1973 and 1983 were very inactive. In general, most of the ENSO models agree that the current strong El Niño will dissipate by next year's hurricane season (Figure 6).

Table 1: Five strongest El Niño events since 1950, with ACE generated in the Atlantic basin during the year. Also listed is the following year's MEI and Atlantic ACE value.



Year	August-October MEI	Atlantic ACE		Year	August-October MEI	Atlantic ACE
1997	2.7	41		1998	-0.8	182
1982	1.9	32		1983	0.2	17
1987	1.7	34		1988	-1.5	103
1972	1.6	36		1973	-1.7	48
1965	1.3	84		1966	-0.1	145
Average	1.8	45		Average	-0.8	99
2015	**2.4**	**62**		**2016**	**???**	**???**

Table 2: Five strongest El Niño events from 1871-1949, with ACE generated in the Atlantic basin during the year. Also listed is the following year's MEI and Atlantic ACE value.



	1871-1949					
	Years Sorted by First-Year ENSO Intensity					
Year	August-October MEI	Atlantic ACE		Year	August-October MEI	Atlantic ACE
1877	1.9	73		1878	-0.6	181
1888	1.8	85		1889	-1.5	104
1930	1.6	50		1931	0.2	48
1905	1.6	28		1906	-1.0	163
1902	1.6	33		1903	-0.5	102
Average	1.7	54		Average	-0.7	120
2015	**2.4**	**62**		**2016**	**???**	**???**

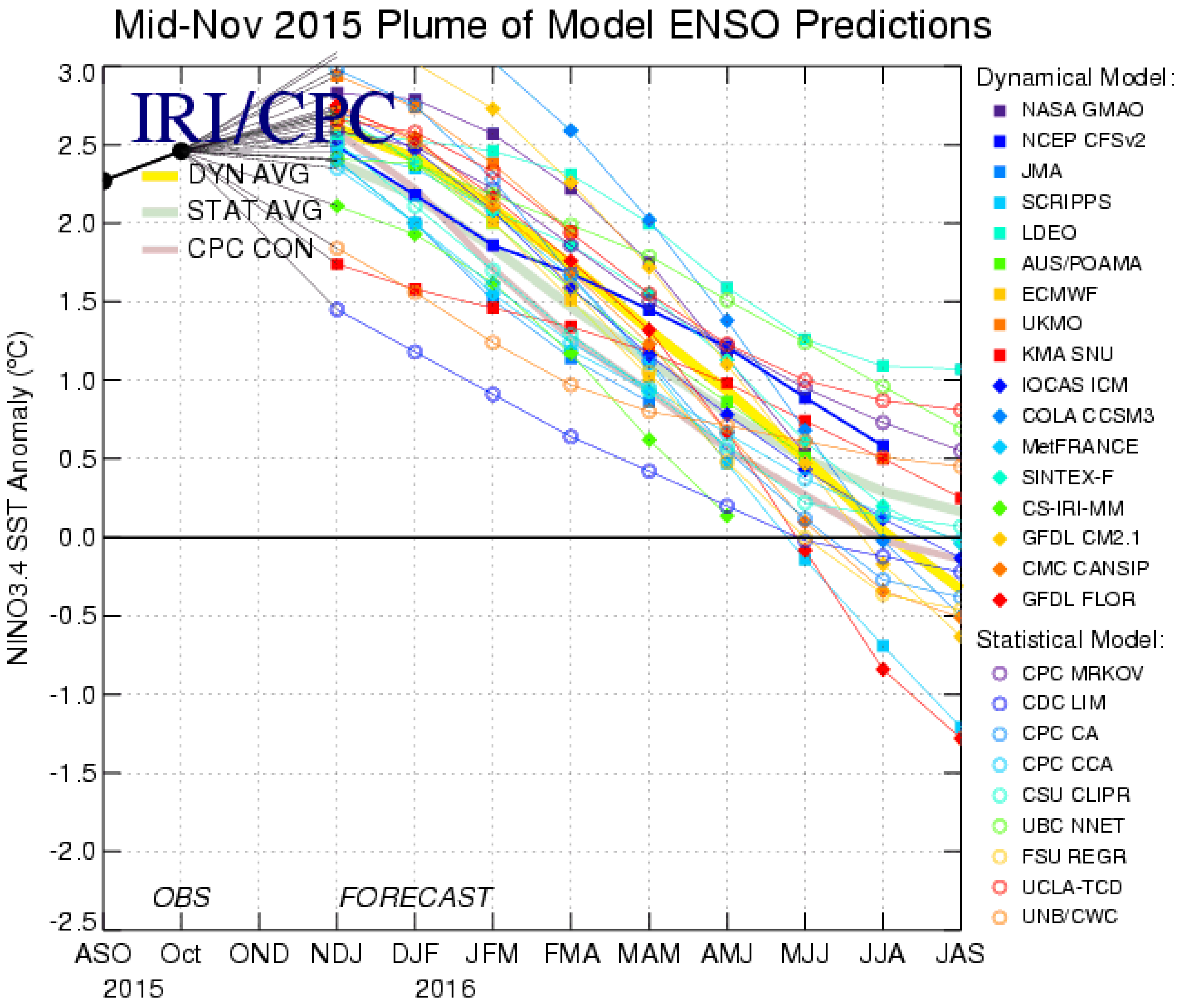


Figure 6: ENSO forecasts from various statistical and dynamical models. Figure courtesy of the International Research Institute (IRI).

4 Climatological Landfall Probabilities

A significant focus of our recent research involves efforts to develop forecasts of the probability of hurricane landfall along the U.S. coastline and in the Caribbean. While we are not issuing a quantitative forecast in this early outlook, we can still provide interested readers with the climatological probabilities of landfall for various portions of the United States coastline.

Table 3 lists climatological strike probabilities for the hurricane season for different TC categories for the entire U.S. coastline, the Gulf Coast and the East Coast including the Florida peninsula. We also issue probabilities for various islands and landmasses in the Caribbean and in Central America.

Table 3: Climatological probability (expressed in percent) of one or more landfalling tropical storms (TS), category 1-2 hurricanes (HUR), category 3-4-5 hurricanes, total hurricanes and named storms along the entire U.S. coastline, along the Gulf Coast (Regions 1-4), and along the Florida Peninsula and the East Coast (Regions 5-11). Probabilities of a tropical storm, hurricane and major hurricane tracking into the Caribbean are also provided.

Region	TS	Category 1-2 HUR	Category 3-4-5 HUR	All HUR	Named Storms
Entire U.S. (Regions 1-11)	79%	68%	52%	84%	97%
Gulf Coast (Regions 1-4)	59%	42%	30%	60%	83%
Florida plus East Coast (Regions 5-11)	50%	44%	31%	61%	81%
Caribbean (10-20°N, 60-88°W)	82%	57%	42%	75%	96%

More recently, we have also calculated probabilities of each state being impacted by a tropical cyclone, using the impacts database available from the National Hurricane Center. Table 4 displays the climatological probabilities for each state along the United States coastline being impacted by a hurricane and major hurricane, respectively.

Table 4: Climatological probability of each state along the United States coastline being impacted by a hurricane and major hurricane, respectively.

State	**Hurricane**	**Major Hurricane**
Texas	33%	12%
Louisiana	30%	12%
Mississippi	11%	4%
Alabama	16%	3%
Florida	51%	21%
Georgia	11%	1%
South Carolina	17%	4%
North Carolina	28%	8%
Virginia	6%	1%
Maryland	1%	<1%
Delaware	1%	<1%
New Jersey	1%	<1%
New York	8%	3%
Connecticut	7%	2%
Rhode Island	6%	3%
Massachusetts	7%	2%
New Hampshire	1%	<1%
Maine	4%	<1%

The Landfall Probability Website (http://www.e-transit.org/hurricane) has additional probability information including county-level probabilities for 205 coastal counties from Brownsville, Texas to Eastport, Maine. These probabilities will be updated on Thursday, April 14 with our first quantitative outlook for 2016.

5 Recent Lack of United States Landfalling Hurricane Activity

The United States has had a remarkable lack of landfalling major hurricane activity since Hurricane Wilma in 2005. None of the 27 major hurricanes that have formed since Wilma have made US landfall. The ten-year period that the US has gone without any major hurricane landfalls exceeds the previous record of eight years set between 1861-1868.

One of the big questions is why none of these major hurricanes have made US landfall. There is obviously a luck component that has played a significant role, in that several systems were located quite close to the US coast and recurved at the last minute (such as Hurricane Earl in 2010) or were just below major hurricane strength at landfall (such as Hurricane Ike in 2008). Another reason is that unlike 2004 and 2005, when seven of 13 major hurricanes made US landfall, anomalous troughing has tended to dominate the US East Coast since 2006 (Figure 7). This anomalous troughing has caused westward tracking TCs to gain latitude and recurve before they could encounter the US coastline.

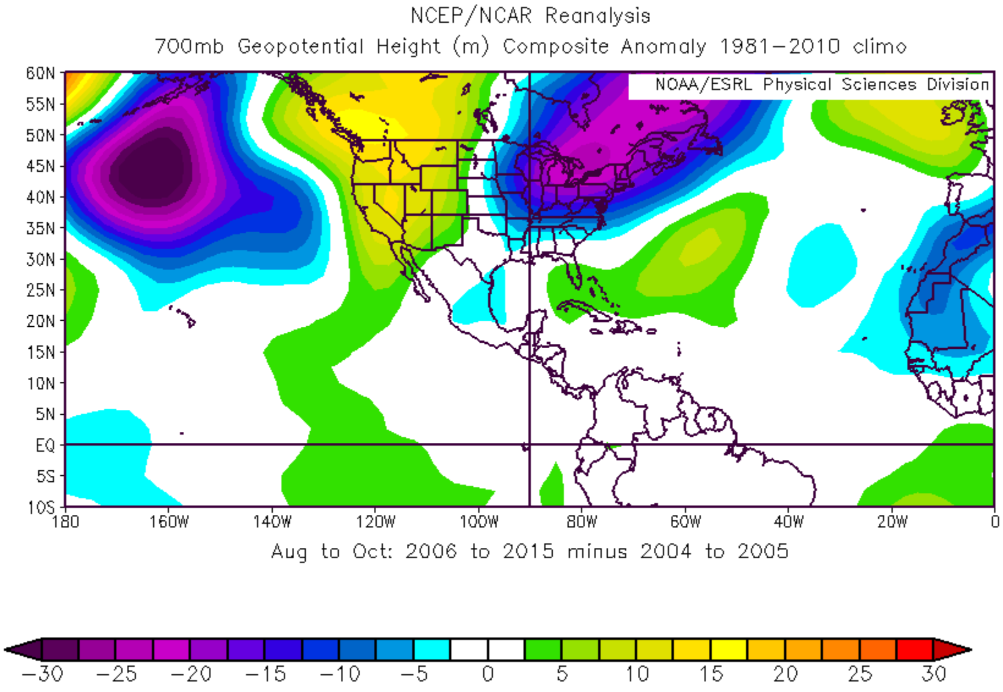


Figure 7: August-October 700-mb heights averaged from 2006-2015 minus August-Occtober 700-mb heights averaged from 2004-2005. Note the anomalous low pressure along the East Coast of the United States.

The state of Florida has also been remarkably lucky to have not been impacted by any hurricanes since Wilma in 2005. The longest period on record that Florida was not hit by a hurricane was the five-year period from 1980-1984 prior to the current ten-year period from 2006-2015.

There has also been a marked decrease in Florida Peninsula and East Coast major hurricane landfalls over the past 50 years when compared with the previous 50 years. Figure 8 shows the tracks of major hurricane landfalls during the 50-year period from 1966-2015 compared with the previous 50-year period from 1916-1965. There have been 40% as many major hurricanes during the more recent period compared with the earlier period.

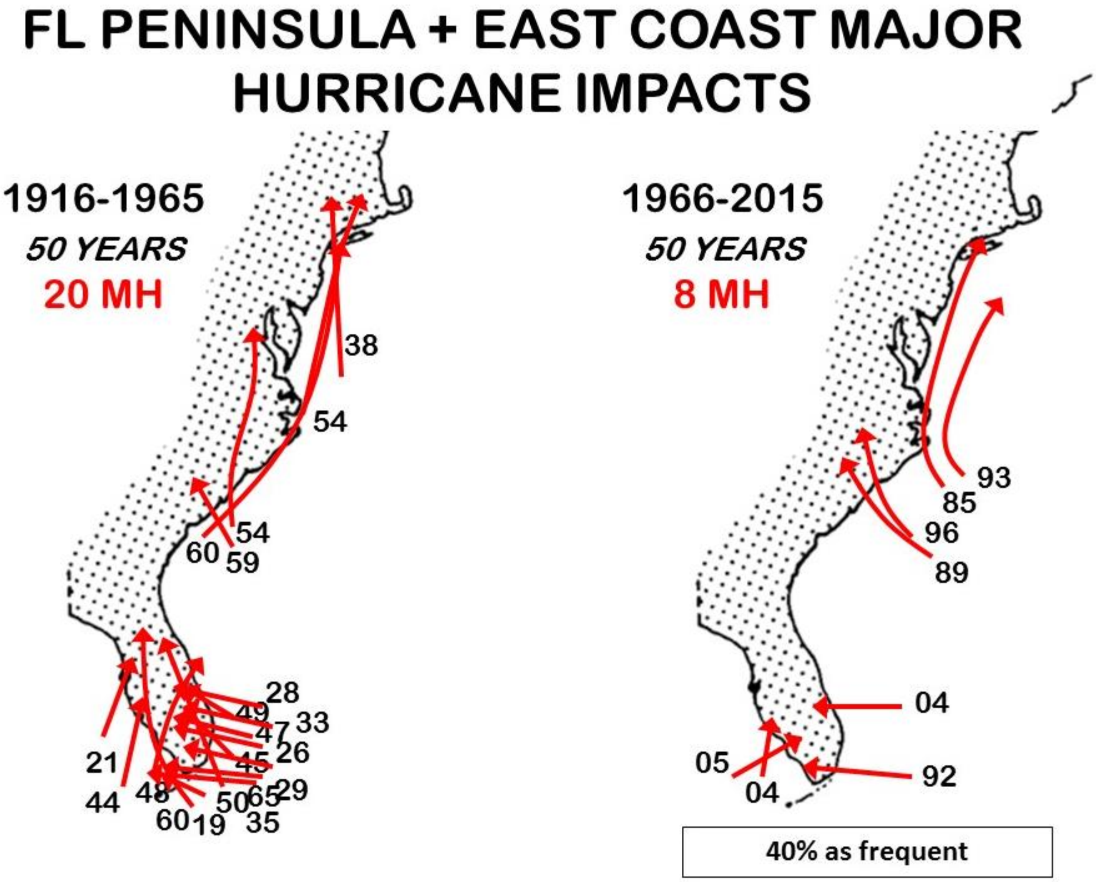


Figure 8: Tracks of major hurricanes making Florida Peninsula/East Coast landfall during the period from 1916-1965 and 1966-2015, respectively.

This luck cannot continue. Climatology will eventually reassert itself with many more US landfalling hurricanes. Coastal residents must realize that hurricanes remain a serious threat and should take preparedness actions before every season.

6 Forthcoming Updated Forecasts of 2016 Hurricane Activity

We will be issuing seasonal updates of our 2016 Atlantic basin hurricane forecasts on **Thursday April 14**, **Wednesday 1 June**, **Friday 1 July, and Wednesday 3 August**. We will also be issuing two-week forecasts for Atlantic TC activity during the climatological peak of the season from August-October. A verification and discussion of all 2016 forecasts will be issued in late November 2016. All of these forecasts will be available on the web at: http://hurricane.atmos.colostate.edu/Forecasts.

7 Acknowledgments

Besides the individuals named on page 3, there have been a number of other meteorologists that have furnished us with data and given valuable assessments of the current state of global atmospheric and oceanic conditions. These include Brian McNoldy, Art Douglas, Ray Zehr, Mark DeMaria, Todd Kimberlain, Paul Roundy and Amato Evan. In addition, Barbara Brumit and Amie Hedstrom have provided excellent manuscript, graphical and data analysis and assistance over a number of years. We have profited over the years from many in-depth discussions with most of the current and past NHC hurricane forecasters. Bill Gray would further like to acknowledge the encouragement he has received for this type of forecasting research application from Neil Frank, Robert Sheets, Robert Burpee, Jerry Jarrell, Max Mayfield, and Bill Read former directors of the National Hurricane Center (NHC), and the current director, Rick Knabb.

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9 Verification of Previous Forecasts

Table 5: Summary verification of the authors' five previous years of seasonal forecasts for Atlantic TC activity from 2011-2015.

2011	8 Dec. 2010	Update 6 April	Update 1 June	Update 3 August	Obs.
Hurricanes	9	9	9	9	7
Named Storms	17	16	16	16	19
Hurricane Days	40	35	35	35	25
Named Storm Days	85	80	80	80	90.50
Major Hurricanes	5	5	5	5	3
Major Hurricane Days	10	10	10	10	4.50
Accumulated Cyclone Energy	165	160	160	160	125
Net Tropical Cyclone Activity	180	175	175	175	137

2012	4 April	Update 1 June	Update 3 August	Obs.
Hurricanes	4	5	6	10
Named Storms	10	13	14	19
Hurricane Days	16	18	20	26
Named Storm Days	40	50	52	99.50
Major Hurricanes	2	2	2	1
Major Hurricane Days	3	4	5	0.25
Net Tropical Cyclone Activity	75	90	105	121

2013	10 April	Update 3 June	Update 2 August	Obs.
Hurricanes	9	9	8	2
Named Storms	18	18	18	13
Hurricane Days	40	40	35	3.75
Named Storm Days	95	95	84.25	38.50
Major Hurricanes	4	4	3	0
Major Hurricane Days	9	9	7	0
Accumulated Cyclone Energy	165	165	142	33
Net Tropical Cyclone Activity	175	175	150	44

2014	10 April	Update 2 June	Update 1 July	Update 31 July	Obs.
Hurricanes	3	4	4	4	6
Named Storms	9	10	10	10	8
Hurricane Days	12	15	15	15	17.75
Named Storm Days	35	40	40	40	35
Major Hurricanes	1	1	1	1	2
Major Hurricane Days	2	3	3	3	3.75
Accumulated Cyclone Energy	55	65	65	65	67
Net Tropical Cyclone Activity	60	70	70	70	82

2015	9 April	Update 1 June	Update 1 July	Update 4 August	Obs.
Hurricanes	3	3	3	2	4
Named Storms	7	8	8	8	11
Hurricane Days	10	10	10	8	11.50
Named Storm Days	30	30	30	25	43.75
Major Hurricanes	1	1	1	1	2
Major Hurricane Days	0.5	0.5	0.5	0.5	4
Accumulated Cyclone Energy	40	40	40	35	60
Net Tropical Cyclone Activity	45	45	45	40	81