Hurricane and Tropical Storm Predictions

13 Prediction Zones
United States and the Lesser Antilles

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Predictions for
2020

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1.0 Background and Introduction

There are a number of factors that are related to the formation and tracks of tropical cyclones during the hurricane season for the North Atlantic Basin which includes the tropical and sub-tropical Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico.

One factor is the temperatures of the sea surface; are they running near normal, above normal, or below normal? Warmer temperatures are more favorable conditions for development of stronger storms and more major hurricanes, whereas colder ocean temperatures would lead to less intense storms.

A second factor in predicting the number of storms for the season is the three phases of the ENSO (El Niño Southern Oscillation). Will there be extensive warming of the Tropical South Pacific Ocean water in the eastern Pacific to cause an El Niño to form? Will there be too much cooling of the ocean water in this region to cause a La Niña, the opposite phase of an El Niño? Or, will it be a period in which neither is present? This is referred to as ENSO Neutral conditions.

The El Niño is a global coupled ocean-atmosphere phenomenon, and when an El Niño is in place, Atlantic Ocean tropical cyclone activity is typically less than average. Conversely when a La Niña or Neutral conditions are in place, Atlantic Ocean tropical cyclone activity is enhanced (see section 3.1 for the GWO El Niño, La Niña outlook).

Another major factor in predicting seasonal hurricane tracks is the average position and strength of the “Azores-Bermuda High”, which is also known as the North Atlantic (Subtropical) High Pressure Center (Anticyclone). Much like the North Pacific High off of the west coast of the United States, the Bermuda-Azores high is what meteorologists call a large “semi-permanent” area of high-pressure center. Semi-permanent means it is normally in that location but does meander from time to time. The Bermuda-Azores High is found south of the Azores in the Atlantic Ocean.

As seen in Figure 1.1, the clockwise wind flow and atmospheric steering currents around the high determines the eventual path of tropical cyclones during the Atlantic Hurricane Season. However, the High-Pressure center meanders in position from season to season, thus influencing the tracks of tropical cyclones (hurricanes and tropical storms). For example; if the ridge of the High is displaced to the north, this can lead to devastating storm paths such as the one taken by the New England Hurricane of 1938.

If the High is strongly displaced to the south such as it did in 2014, the strong ridge of high pressure will also displace the Inter-tropical Convergence Zone (ITCZ), a favorable area for storm development, too far to the south. This displacement in turn causes more sand to be blown off the African coast, making a hostile eastern Atlantic environment that causes abnormally fewer storms to form in the middle and eastern tropical Atlantic region.

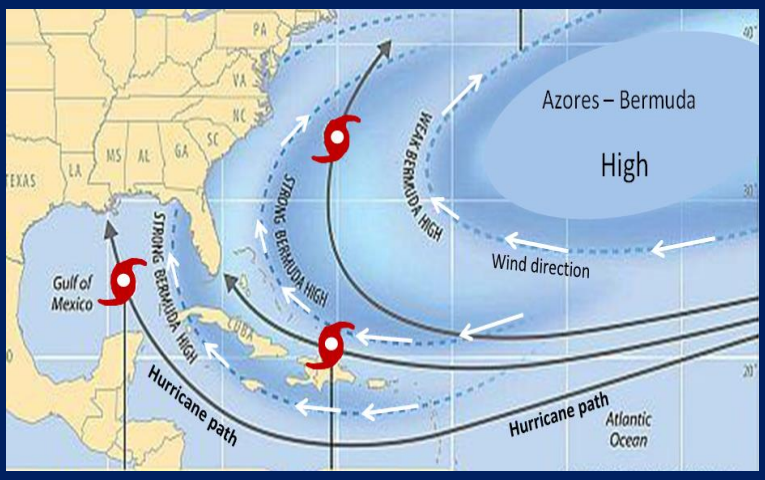

Figure 1.1 - Depicts the Azores-Bermuda semi-permanent area of high pressure that meanders in latitude and longitude from one season to the next. Clockwise wind circulation around the high sets up steering currents for hurricanes. Changes in position of the high in latitude and longitude will change the steering currents from year to year, and also determine how much Sahara Desert sand is blown off of Africa.

The variables discussed in the paragraphs above are very important when it comes to predicting what will happen during upcoming hurricane seasons. But the major variable has not been discussed yet, the one that is the primary mechanism that puts all these variables in place for a given season, and what changes these variables from one season to the next.

GWO has pioneered in identifying the Primary Forcing Mechanism (PFM) that controls the Earth's Natural Climate Pulse, which in turn influences the average location of the Bermuda High and the formation or non-formation of the ENSO El Niño and La Niña. The Climate Pulse is associated with many climate cycles, and GWO has noted a direct correlation of the Climate Pulse Cycles to periods of higher or lower tropical activity, such as the low activity in 2013, 2014 and during the El Niño of 2015. GWO has also correlated historical hurricane landfalls to the Climate Pulse Cycles to perfect highly accurate hurricane landfall models for 11 prediction zones along the coastal areas of the United States from New England to northern Mexico.

2.0 2019 Hurricane Season Review

GWO predicted that 2019 would not be as destructive as the 2018 season for the United States - but did predict two hurricane landfalls and the possibility for a major impact storm.

Two hurricanes did make landfall in the United States. Category 1 Hurricane Barry

made landfall in Central Louisiana on 13 July. Then came the Major Category 5 Hurricane Dorian that caused major destruction in the Northwestern Bahama's. It fortunately diminished to a Category 3 as it stayed just to the east of the Florida coast and finally made landfall as a Category 2 in North Carolina.

And then came a major impact storm, although it was only a tropical storm. Tropical Storm Imelda was the 5th wettest tropical system (of any strength!) to make landfall in the mainland United States on record. More than 40 inches of rain fell in spots which was more than Tropical Storm Allison in 2001. Allison is the only storm that never reached hurricane status, but its severe impact let to the name's retirement.

An average hurricane season has 12 named storms, six hurricanes, and three major hurricanes. The 2019 season produced 18 named storms, including six hurricanes of which three were "major" (Category 3, 4 or 5). And, as predicted by GWO, the 2019 Atlantic hurricane season was the 4th consecutive series of above average and damaging Atlantic hurricane seasons. GWO predicted there would be 6 hurricanes, two of which would be major hurricanes, and at least one would be a major impact hurricane.

The 2019 season marked the fourth consecutive above-normal Atlantic hurricane season. The only other period on record that produced four consecutive above-normal seasons was 1998-2001. The season also produced five tropical cyclones that formed in the Gulf of Mexico, which ties a record with the years 2003 and 1957 for the most storms to form in that region. Of those, three — Barry, Imelda and Nestor — made landfall in the U.S.

Hurricane Dorian shattered records as it quickly strengthened into a category 5 hurricane as it approached the northern Bahamas. Sustained winds were estimated at 185 mph in the worst of the storm which sat over Abaco island for about a day before slowly moving to the west. Gusts were estimated at over 200 mph in the worst part of the storm. Dorian's slow pace devastated the northern Bahamas, but spared Florida as the storm skirted up the east coast. Coastal South Carolina experienced wind, rain, and a few tornadoes from Dorian, but the storm's only official landfall in the mainland United States was in North Carolina as it briefly skirted along the outer banks.

3.0 El Niño, La Niña or Neutral

Overview - El Niño, La Niña and Neutral Conditions:

The occurrence of a moderate to strong El Niño often displays a major influence on the Atlantic Basin hurricane season. The El Niño Southern Oscillations (ESNO) has three phases; El Niño, La Niña and the ENSO Neutral phase defined as a period in which neither an El Niño or La Niña is present.

The typical Neutral phase (see Figure 3.1) displays a strong area of atmospheric high pressure in the eastern Tropical Pacific, and very cold ocean temperatures from South America westward into the Central Pacific, and a very warm pool of water in the western Pacific. This pattern is conducive for strong hurricane seasons in the Atlantic Basin from the Caribbean eastward across the Atlantic.

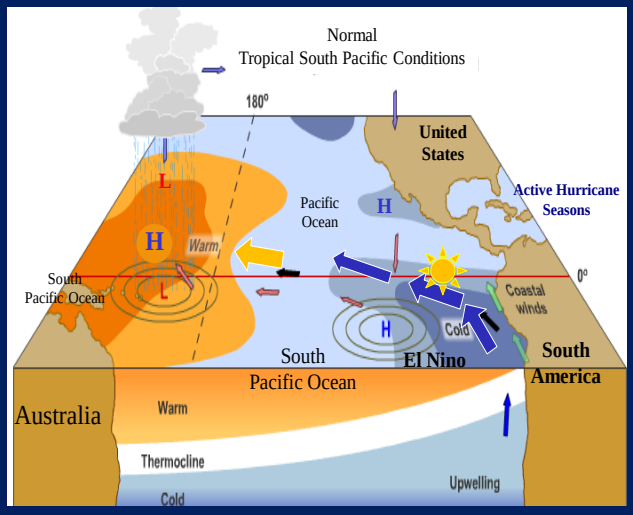

Figure 3.1 - Shows typical Tropical Pacific sea surface temperatures observed during what is called "Neutral El Niño Southern Oscillation" conditions.

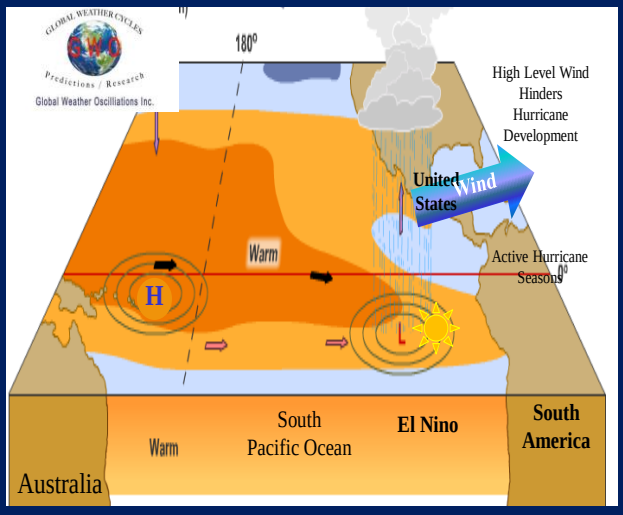

Figure 3.2 - Shows Tropical Pacific sea surface temperatures observed during El Niño Southern Oscillation" conditions (ENSO). Notice the warm water in the Eastern Pacific.

The La Niña phase is much like the ENSO Neutral phase, with the exception that it has much colder water in the tropical eastern Pacific. This typically does not produce fewer hurricanes in the Pacific Basin but may change atmospheric steering currents enough in inhibit hurricane and/or tropical storm landfalls along the United States coastal areas. About every 3 to 5 years the Earth's Natural Climate Pulse induces dramatic changes in the atmosphere and oceans. Suddenly the area of High Pressure over the Eastern Pacific becomes displaced well to the west and north. This causes a rapid change in the atmospheric circulation and essentially discontinues the pooling of warm water in the western Pacific. With these changes, much warmer water moves east all the way across the central Pacific to South America (see Figure 3.2). The warmer water causes atmospheric low pressure to form off South America, and dramatic changes in the atmospheric circulation to the north across much of North America.

This rapid and dramatic change in the atmospheric circulation is of great importance to the Atlantic Basin hurricane season. As seen in Figure 3.2 (blue arrow) strong high-altitude westerly winds form in the atmosphere across the Caribbean and much of the Atlantic as well. These winds are usually very disruptive to the hurricane season by causing higher than normal upper atmospheric wind shear. This shear inhibits explosive development of tropical storms and hurricanes and thus a reduction in the number of hurricanes and named storms.

Developing tropical cyclones that would normally become a Category 3 hurricane, may only development into a category 1 hurricane due to El Niño wind shear that tends to tear apart the developing storms. On the same note, a potential category 1 or 2 hurricane may be hindered enough by El Niño wind shear to only develop into a tropical storm. As an example of years with an El Niño and without an El Niño: during the 2009 El Niño season, only 3 hurricanes and 8 named storms formed, but during the 3 seasons from 2010 through 2012 when Neutral and/or La Nina conditions occurred, each season had 19 named storms. The El Niño season of 2015 had 11 named storms (near normal), 4 hurricanes and 2 major hurricanes. The number of hurricanes and major hurricanes were slightly below the long-term average due to the El Niño.

2010 Through 2019 Seasons: El Niño and Climate Pulse Hurricane Suppression Cycles

GWO was the only organization that correctly predicted the 2009 hurricane season "would" have an El Niño, and that the 2010, 2011, 2012, 2013, 2014 and 2018 seasons would "not" have an El Niño. GWO was also the only organization to predict that 2013 and 2014 hurricane seasons would be weaker than normal, with this not being due to an El Niño, but rather by what GWO refers to as a cyclical Climate Pulse Hurricane Suppression Cycle (CPHSC).

The CPHSC is a cyclical 2-year cycle that returns approximately every 4 to 7 years and is often associated with El Niño events, but if it occurs without an El Niño it normally causes abnormally strong wind shear and diminished hurricane seasons much like an El Nino does. For example; although an El Niño did not occur in 2013, persistent winds shear caused by the CPHSC suppression cycle caused the weakest hurricane season since the 2009 El Niño, and the 5th weakest season in 60 years. Then the second year of the CPHSC cycle caused a relatively weak (but near normal) number of hurricanes and major hurricanes in 2014, and no El Niño occurred.

Cycles of the ENSO (El Nino Southern Oscillation)

An El Niño typically forms every 3 to 5 years, on occasion it takes an 8-year hiatus. The last two El Niño events occurred back in 2009 and in 2015, a separation of 6 years. Every El Niño event is typically followed by what is termed ENSO (El Niño Southern Oscillation) Neutral Conditions, which are conditions that are neither El Niño nor La Niña. The El Niño events typically form in the eastern Tropical Pacific when ocean waters warm to about 1 degree Celsius above the long-term average. Figure 3.3 shows the dramatic warming with the 2009 El Niño, followed by dramatic sea surface cooling that in turn caused a La Nina to occur from the summer of 2010 through 2011. The Tropical Eastern South Pacific Ocean again warmed in 2012, 2013, 2014 and 2019 seasons – but not enough or long enough to cause and El Niño to form. These warming events maintained what is called ENSO Neutral Conditions (defined as a period in which neither an El Niño nor La Niña is present).

3.1 Predictions:

2020 Hurricane Season: prepared by GWO

ClimatePulse Suppression Cycle: ClimatePulse Suppression Cycles typically lowers tropical storm and hurricane active. However, we are still in a 70-year ClimatePulse Enhanced Landfall Cycle. the Enhanced Landfall Cycle will provide a higher than normal number of tropical storm and hurricane landfalls this year (2020).

The 2019 season (last year) saw signs of a ClimatePulse Suppression cycle in the Lesser Antilles where they had two tropical storms, but no hurricanes in the region. This is expected again this year (2020) for the Lesser Antilles, but not for the northern Gulf region and Western Atlantic.

Prediction: Number of United States Hurricane Landfalls

GWO is predicting an above normal hurricane season for this year (2020.

2020 Prediction by Numbers:
The United States will have 4 to 6 hurricanes make landfall, at least 1 will likely be a major hurricane.

GWO will provide updates during the 2020 weekly outlook webinars. Updates are also available on GWO's El Nino page by going to

5.0 Predictions for Specific Coastal Zones - for hurricane or tropical storm conditions occurring somewhere within the zone

GWO Prediction Model and Climatology:
In the sections that follow, GWO presents annual risk probability predictions for 11 United States zones for the period covering the next 4 Atlantic Hurricane seasons. The zones extend from New England on the northeast Atlantic Coast southwest to Texas on the Gulf of Mexico Coast. Although each zone has an identical format, 11 different prediction zones are required due to weather and climate cycles controlled by earth's natural climate pulse. This is because every zone is located at a different latitude and longitude, and each zone has its own unique hurricane cycle with hurricane tracks and landfalls changing from one year to the next in conjunction with the Climate Pulse Cycles.

GWO's unique predictions are based on GWO's Climate Pulse Technology Model (GWO-CPTM). The CPT model incorporates the natural Primary Forcing Mechanism

(PFM) that controls cycles of the Earth's climate pulse and other variables to produce reliable zone predictions for future events during the next 4-years.

GWO has computed at least 100 years of historical tropical cyclone climatology for each zone to produce the Climatological Average Annual Return Risk (CAAR) for tropical cyclone events. This allows the reader to compare the GWO predicted risk probabilities for either a hurricane or tropical storm, to the long-term average annual return risk (CAAR) for the zone. This puts the GWO predictions and outlooks in perspective to what has occurred in the past.

Risk Prediction Definitions:

Global Weather Oscillations (GWO) "Climate Pulse Technology" Model (GWO-CPT) assigns a risk probability expressed in percent for the likelihood that a predicted event will occur.

The upper value is 65% to 80% and denotes a high risk that the predicted event is expected to occur. The low end of the scale is 5% to 40% and denotes a predicted low risk the event will occur. GWO also issues risk predictions for major hurricanes. If a hurricane does occur in the zone that year, the upper value that it will be a major hurricane is 50% to 70% and denotes a high risk that a major hurricane event will occur.

The GWO-CPTM predicted risk is compared to the CAAR (average - annual return risk) to the right of the prediction in the prediction table. This provides a reference point for the user to quickly compare the prediction risk for that specific year to the long-term average annual risk.

5.10

Zone 10 - Texas and western Louisiana coast - from near Corpus Christi in south central Texas to western Louisiana

Predicted Hurricane and Tropical Storm Risks – by GWO

2020 Hurricane Season

Climatology

Based on 111-years of record (1903-2013) for either hurricane conditions occurring somewhere within the zone during that year, or if no hurricane, a year with tropical storm conditions occurring somewhere within the zone.

During the 111-year period, there were 58 tropical cyclone years in which either hurricane or tropical storm conditions affected at least a portion of the zone (52% annual risk). There were 31 years in which hurricane conditions occurred somewhere within the zone, with a total of 38 hurricanes due to years with multiple strikes. Of the 38 hurricanes, 15 were major category 3 to 5 hurricanes. Tropical storm conditions (without hurricane conditions in the zone during the year) occurred on 27 years with a total of 31 tropical storms due to years with multiple strikes and/or in years that hurricanes also occurred. This number indicates that tropical storms do not occur often in years that hurricanes occur in this zone.

Climatologically; during the entire 111-year period (1903-2013) the climatological average annual risk frequency (CAAR) for hurricane conditions is once every 4 years in the region from central Texas into western Louisiana. But averages can be misleading. There are approximate 8-year cycles in which absolutely no hurricanes occurred in this region, and approximate 10 to 15-year cycles in which hurricanes occurred approximately once every 2 or 3 years in the zone. GWO's Climate Pulse Technology Model (GWO-CPTM) identifies these cycles and incorporates them into the predicted risks.

Average Annual Risk:

A total of 58 tropical cyclone years occurred during the 111-year period, and a total of 69 tropical cyclones due to some years having multiple events.

Climatological average annual risk (CAAR) for Hurricane and/or Tropical Storm Conditions	= 52 %
Climatological average annual risk (CAAR) for Tropical Storm "only" conditions	= 24 %
Climatological average annual risk (CAAR) for hurricane conditions	= 28 %
Climatological average annual risk (CAAR) for major hurricane (CAT 3 or greater)	= 14 %
Percent of hurricanes that were major hurricanes (CAT 3 or greater)	= 39 %

Definitions: Risk Prediction Categories

Global Weather Oscillations (GWO) assigns a risk category and probability expressed in percent for the likelihood that a predicted event will occur, or not occur.
Risk percent ranges define three categories of risk; Low, Moderate and High.

Hurricanes - Tropical Storms:

Category	Probability	Prospect
High Risk	**60% to 80%**	**will likely occur**
Moderate Risk	40% to 55%	possible – but not likely
Low risk	5% to 35%	will not occur

Major Hurricane: If a hurricane actually occurs – risk it will be a major hurricane

Category	Probability	
High Risk	**50% to 70%**	**(if a hurricane occurs)**
Moderate Risk	25% to 45%	(if a hurricane occurs)
Low Risk	less than 25%	(if a hurricane occurs)

Zone 10 Predictions: Year 2020

		Predicted Risk	Average Annual Risk
2020	Hurricane conditions	65 % High	28 %
	Major Hurricane - if a hurricane occurs	50 % High	39 %
	Tropical Storm conditions	75 % High	52 %

* When GWO-CPT model predicts a zone has at least a 20% risk for a major Category 3-5 hurricane landfall, it is shown in the indicated forecast and/or outlook period(s) for that zone.

Analysis and Summary

This Zone is Now in the Most Active and Powerful Hurricane Cycle – in 60 Years

During the past 130 years - there has been a total of 7 extended quiet periods in which no hurricanes struck this zone. A typical quiet cycle lasts between 8 to 10 years. The latest 8-year Quiet Cycle ended three years ago in 2017 with the Major Impact Category 4 Hurricane Harvey.

Tracking ClimatePulse Hurricane Cycles
The annual return risk (ASR) for hurricanes for this zone is 28%. On the average, hurricane conditions occur approximately once every 4 years in this zone. This is about 25 percent of the years.

The ClimatePulse Hurricane Model is tracking similar analog years that have occurred since the late 1800s and are most like this year (2020). Refer to the analog section below.

Out of the 11 analog years being tracked, 4 years were weakened either by an El Nino occurring that year or a ClimatePulse Hurricane Suppression Cycle for this zone.

The remaining 7 years occurred on active ClimatePulse Hurricane analog years similar to this year (2020). All 7-years had hurricanes within this zone, the only exception was a major hurricane that hit south of this prediction zone. Thus, the 6 years with hurricanes in this zone - saw 2 Major Category 4 hurricanes, and four Category 1 hurricane years. The landfall locations were pretty much evenly divided between Western Louisiana to near Galveston Texas.

Prediction for 2020:
After two quiet hurricane years following the landfall of Major Hurricane Harvey, this zone is now back into a higher frequency cycle that will see hurricane landfalls on 2 out of the next 3 years.

When a Quiet Cycle ends (2017 with Harvey) the next hurricane typically occurs 3 to 4 years later – thus, this year (2020) is on the third year following Harvey and fact alone provides a 50/50 probability that 2020 will have a hurricane landfall within this zone.

When an El Nino does not occur (and GWO does not expect one in 2020) – all 6 ClimatePulse analog years similar to this year (2020) had hurricanes, with 33% of the years having Major Category 4 hurricane landfalls.

The prediction for 2020 expects a hurricane to make landfall in this prediction zone. It will most likely be a Category 1 near Galveston Texas or in Western Louisiana – and a risk for a Major Category 4 Hurricane with the most likely location being near Galveston to the Western portion of Louisiana Texas.

GWO's Weekly Outlook Webinars and Tracking Webinars should be monitored closely in 2020 – very well could be a major impact hurricane year.

Historical ClimatePulse Analog Years Similar to the 2020 Season

In 2001 **Tropical Storm Allison** moved north making landfall just south of Galveston and near Houston on 05 June with 60 mph wind. It then went inland and looped back to the south exiting Texas south of Galveston Island and curved east striking eastern Louisiana with 45 mph wind on 11 June.

In 1985 **Category 1 Hurricane Danny** moved north-northwest making landfall in Western Louisiana on 15 August with 90 mph wind. It then weakened rapidly to a Tropical Storm and moved northeast into northeastern Louisiana.

Category 1 Hurricane Juan moved north with landfall along the Western Louisiana Coast on October 18 and 29 with 85 mph wind. It then looped and weakened to a Tropical Storm as it moved east and then north into Alabama.

In 1967 **Major Category 5 Hurricane Beulah** moved northwest making landfall between the Texas-Mexico border and Corpus Christi on September 10 with 150 mph wind. It slowly weakened to a Category 1 as it moved northwest and then looped southwest as a Tropical Storm.
Tropical Storm conditions likely into the south portion of zone 10.

In 1949 **A Major Category 4 Hurricane** moved north making landfall near Galveston on 04 October with 135 mph wind. It then weakened quickly to a Tropical Storm as it moved northeast across extreme eastern Texas into extreme northwest Louisiana.

In 1932 **A Major Category 4 Hurricane** moved northwest making landfall **near Galveston** on 14 August with 145 mph wind. It quickly weakened to a Tropical Storm and continued up through eastern Texas.

In 1913 **A Category 1 Hurricane** moved west-northwest making landfall near Corpus Christi on June 28 with 75 mph wind. It quickly weakened to a Tropical Storm as it continued moving inland.

Secondary – ClimatePulse Analog Years Similar to the 2020 Season

In 1993 **This Zone was in a ClimatePulse Suppression Cycle – weakening storms**
Tropical Storm Arlene moved northwest making landfall near Corpus Christi on June 20 with 40 mph wind.

In 1971 **Category 1 Hurricane Edith** moved northeast staying just east of the Texas Coast and then made landfall as a Category 2 on the southwest Louisiana Coast on September 16 with 100 mph wind. It then weakened and continued northeast into southwest Mississippi.

Category 1 Hurricane Fern formed in the Western Gulf and then moved northwest and then turned west weakening to a strong tropical storm as it made landfall on the mid-Texas coast halfway between Galveston and Corpus Christi with 70 mph wind on September 11. It then moved southwest all the way to Mexico.

In 1958 **Strong Tropical Storm Ella** moved northwest making landfall north of Corpus Christi on the mid-Texas coast on 05 September with 70 mph wind. It then weakened quickly and continued northwest inland.

In 1940 **A Category 1 Hurricane** intensified just south of Louisiana and then moved northwest making landfall on the Texas-Louisiana border on 06 August with 75 mph wind. It then moved north as a Tropical Storm into northwest Arkansas.

A Tropical Storm moved northwest making landfall near Galveston on 22 September with 45 mph wind. It then curved east-northeast into southern Louisiana weakening to a Tropical Depression over eastern Louisiana.

In 1923 **El Nino and ClimatePulse Suppression Cycle for this Zone**
A Category 1 Hurricane moved north making landfall in eastern Louisiana on 06 October.

In 1905 **ClimatePulse Suppression Cycle and El Nino – Protected this Zone**
Tropical Storms made landfall just east of this zone