carteret county Shore protection office
protectthebeach.com

SHORELINES – July 2010

As presented to the *Island Review* magazine

2010 Hurricane Season Preview

June 1st serves as important date for Bogue Banks and just about all beaches along the southeast Atlantic and Gulf of Mexico seaboards as we usher in the annual Hurricane Season, which will continue to run through November 30th. Despite a very benign and below average 2009 hurricane season, most experts agree the Atlantic Ocean basin continues to be in the middle of a heightened trend of tropical cyclone activity compliments of cyclical ocean-atmosphere interactions coupled with possible impacts from warming climate and seas (there's still a lot of debate on this). Also, with sea surface temperatures currently at record levels in the equatorial Atlantic and a waning *El Niño,* there appears to be the fuel for cyclone development (warm water) and a favorable atmospheric environment in place that have forecasters predicting a possibly "hyperactive" hurricane season for 2010.

El Niño or ENSO warm phase

The term "*El Niño*" is always the first topic mentioned in hurricane discussions and as mentioned in our introduction immediately above, this article provides no exception. *El Niño* Southern Oscillation, or "ENSO" occurs in the Pacific Ocean basin - **ENSO "warm phase"** occurs once every 2 to 7 years and generally produces higher than average wind shear and dry air in the atmosphere that suppresses formation of tropical cyclones in the Atlantic. Interestingly, the term *El Niño* means Little Boy or Christ Child, which was coined by South American fishermen noting the appearance of unusually warm water in the Pacific Ocean occurring near Christmas. As you may have guessed by now, *"La Niña"* (the girl child) is the "cold phase" of ENSO and tends to produce atmospheric conditions more conducive for tropical cyclone development.

Traditionally, ENSO cycles were determined empirically based upon the differences in surface air pressure between Tahiti and Darwin, Australia. Today, scientists use sea surface temperature measurements along the equatorial Pacific as an indicator of *El Niño* or *La Niña* (particularly in a region known as *Niño* 3.4). If the sea surface temperature variance is greater than or equal to +0.5° C in region *Niño* 3.4, then the conditions are classified as *El Niño* and vice-versa (i.e., if the temperature variance is lower than or equal to -0.5° C, then *La Niña* conditions are prevalent). And finally if the temperature variance is between +0.5° C and -0.5° C, then ENSO neutral phase is dominant (neither *El Niño* nor *La Niña*). This is probably a little bit too much information for this edition of *Shorelines*, but one of the take away messages is that a full-fledged *El Niño* or *La Niña* is only officially designated if the sea surface temperature thresholds are exceeded for a period of at least 5 consecutive overlapping 3-month seasons. Hence we may have *El Niño* or *La Niña* "conditions", but the history books may never reveal that an *El Niño* or *La Niña* episode ever occurred. At the time this edition of *Shorelines* is being prepared, we are on the downswing of an officially classified *El Niño* with ENSO neutral conditions, or quite possibly *La Niña* conditions predicted for the summer of 2010.

Hurricane Vocabulary

It's also important to discuss some basic hurricane terminology so we can understand and finally dive into this season's preview. A ***tropical cyclone*** is a warm-core,

atmospheric closed circulation rotating counter-clockwise in the Northern Hemisphere (that's us) and clockwise in the Southern Hemisphere. A tropical cyclone becomes a ***tropical storm*** when the maximum sustained surface wind speed ranges from 39 mph to 73 mph using the U.S. 1-minute average, and is designated as a ***hurricane*** when the cyclone reaches a maximum sustained surface wind of 74 mph or more.

Hurricanes are further segregated utilizing the Saffir Simpson scale that includes a 1 to 5 rating based upon wind speeds, again utilizing the U.S. 1-minute average. A category 1 hurricane has winds ranging from 74 to 95 miles per hour (mph), category 2 ranges from 96 to 100 mph, category 3 ranges from 111 to 130 mph, category 4 ranges from 131 to 155 mph, and a category 5 hurricane has sustained winds exceeding 155 mph. Category 3 or higher is classified as a major hurricane. Interestingly, category 5 hurricanes very rarely make landfall while maintaining their category 5 intensity - only three have ever made landfall in the U.S. – the Labor Day hurricane (1935), *Camille* (1969), and *Andrew* (1992).

The terms "extratropical" and "subtropical" are also mentioned sometimes during the hurricane season and deserve an explanation here as well. An ***extratropical storm*** is a *cold-core* atmospheric cyclone deriving its energy when cold and warm air masses interact, not as part of the positive feedback loop identified with tropical storms as warm, moist air rises causing continual heat exchange. Unlike tropical storms, extratropical storms can have one or more fronts connected to them, and can occur over land or ocean. An extratropical cyclone can have winds ranging to levels associated with a tropical depression, or as strong as a hurricane. Examples of extratropical cyclones include blizzards and nor'easters, which often form in winter and fall months off the mid-Atlantic and drift slowly along the north Atlantic seaboard and eventually east. If it drifts back west towards land, it is called a retrograded nor'easter.

A ***subtropical storm*** occurs if waters under an extratropical cyclone are warm, followed by thunderstorms that gradually build inside the storm. The storm core may subsequently and gradually go from cold to warm, and the storm will be called subtropical. Both subtropical and extratropical cyclones have the highest winds and thunderstorms a good distance away from the center, and may have frontal boundaries associated with the systems. The two (extra- and subtropical) are usually broader systems than a tropical system, but the subtropical system will produce more rain compared to an extratropical one.

Season Preview (finally)

If you're a frequent reader of the *Island Review*, then you will already know that my personal preference is to review the predictions produced by groups that make not just their prediction public, but verify their prediction skill in the public arena as well. This really leaves us with; **(1)** the Tropical Meteorology Project at Colorado State University, **(2)** the University College London, U.K. for Tropical Storm Risk, and **(3)** our Federal voice for climatology/meteorology matters, the National Oceanic & Atmospheric Administration (NOAA). We then take these groups' last prediction before or near when the hurricane season starts and begin to crunch the numbers.

As the accompanying prediction summary chart indicates, we could expect 18 total cyclones, 10 of which will generate into hurricanes, with 5 of these becoming major hurricanes (on average). This results in a prediction of a "hyperactive" hurricane season, which again is credited to possible *La Niña* conditions developing over the summer (explained above), and record high sea surface temperatures in the Atlantic.

	NOAA (median)	Colorado State University, US	University College London, UK	Average of Predictions	Average (1950-2000)
Total No. of Named Tropical Cyclones	19	18	18	**18**	**10**
Tropical Storms	8	8	8	**8**	**4**
Hurricanes / Major	11/5	10/5	10/4	**10/5**	**6/2**
Accumulated Cyclone Energy (ACE) Index	204	185	182	**190**	**96**

Table 1 - Summary comparing publicly available pre-season predictions for the 2010 Hurricane Season with average activity.

However, one term we haven't discussed that appears on the prediction chart is the *Accumulated Cyclone Energy Index* (ACE Index), which is simply a measurement taking a storm's wind speed strength for each 6-hour period of its existence into account. The larger the ACE Index value, the more active the season. The ACE is actually one of the more revealing parameters in my humble opinion (and others) and likely serves as a better barometer of whether or not a hurricane season is truly "active" or not. This past decade has some great examples to support this assertion.

For instance last year (2009) we had an ACE Index that was a dramatically low 51 – the average ACE Index is 96 and since 1950, only 14 hurricane seasons had a lower ACE Index than the 2009 value. There were 12 cyclones in 2009 – most were relatively weak with the exception of three hurricanes, of which, two became major. There were no cyclones (tropical storms or hurricanes) that made landfall along the Atlantic U.S. seaboard, making 2009 the fourth consecutive year the Atlantic coast has not absorbed a single hurricane strike (there have been tropical storm landfalls).

On the flip side, 2005 had an ACE Index of 248 – the highest on record and was punctuated by more tropical storms, total hurricanes, and category 5 hurricanes than in any season previously recorded for the Atlantic; and included *Ophelia* for North Carolina and the infamous major hurricanes of *Katrina*, *Wilma*, and *Rita* in the Gulf of Mexico. Table 2 includes the ACE Index for the past seven years and a few notes justifying the value.

YEAR	ACE Index	Notes
2009	**51**	*El Niño* year - 15th lowest ACE Index since 1950, 12 cyclones (most were short-lived), 3 hurricanes.
2008	**145**	*Ike* and *Gustav* were two major hurricanes that impacted Tx. and La., *Bertha* was an extremely long-lived cyclone, and collectively accounted for 60% of the total ACE Index for 2008.
2007	**72**	Five more tropical cyclones than average, but most were very short-lived or rather weak, with the exception of two category 5 hurricanes that impacted Central America (*Dean* and *Felix*).
2006	**79**	Ten cyclones total (lowest number since the 1997 season)
2005	**248**	Highest ACE Index on record and included the most cyclones (28), hurricanes (15), and category 5 hurricanes (4) in a single season, and the most intense hurricane on record (*Wilma*).
2004	**225**	4th highest ACE Index value on record, hurricane *Ivan* alone had an ACE Index of 70, 2004 had six major hurricanes.
2003	**175**	Hurricane *Isabel* will long be remembered in Carteret County for Down East flooding, and for the island breach near Hatteras Village in Dare County. *Isabel's* ACE Index alone was 63, one of the highest recorded for an individual cyclone.

Table 2 – ACE Index summary chart (2003 – 2009).

In closing, the ACE Index is also used to determine whether a hurricane season is termed as "below normal" (<68), "near normal" (68 – 106), "above normal" (106 – 168) or

even “hyperactive” (>168). And while most experts are indeed forecasting a hyperactive season (average ACE Index of 190), these predictions do not represent landfall probabilities because cyclone paths are dependent on short-term factors such as interactions with other systems and fluctuating steering patterns. Unfortunately, it only takes one cyclone to make or break a hurricane season, with 1992 being a perfect example – 7 named cyclones, 4 of which were hurricanes, with one of those classified as major, and an ACE index value of 75. Sounds like a very quiet year, except the one major hurricane was *Andrew*, which struck Florida and was the costliest natural disaster in U.S. history until *Katrina* in 2005. With a hyperactive year predicted for 2010, the potential cumulative impacts of multiple cyclones impacting our area is also something we’ll be monitoring.