

SHORELINES – January 2014

As presented to the *Island Review* magazine

The 2013 Hurricane Season Recap

The month of December usually means two things for many of us at and near the coast – (1) the holiday season is upon us, and even more comforting, (2) the hurricane season came and went unexpectedly and is quietly past us! The 2013 hurricane season (June 1st – November 30th) bucked the trend of possessing a very high number of named cyclones (storms and hurricanes) – some of which hit land and others did not. Actually in the past three years (2012, 2011, and 2010) we had 19 cyclones annually, which tied the years of 1995 and 1887 as the 3rd highest number of cyclones ever recorded for a single season - only 2005 (28 named cyclones) and 1933 (21 named cyclones) were busier. The 2013 hurricane season set records of a different kind – it was the first time in 45 years (1968) that the strongest storm to form was a minor Category 1 hurricane; it possessed the fewest number of hurricanes since 1982; and was the first hurricane season since 1994 to go without the formation of a major hurricane (category 3 or higher).

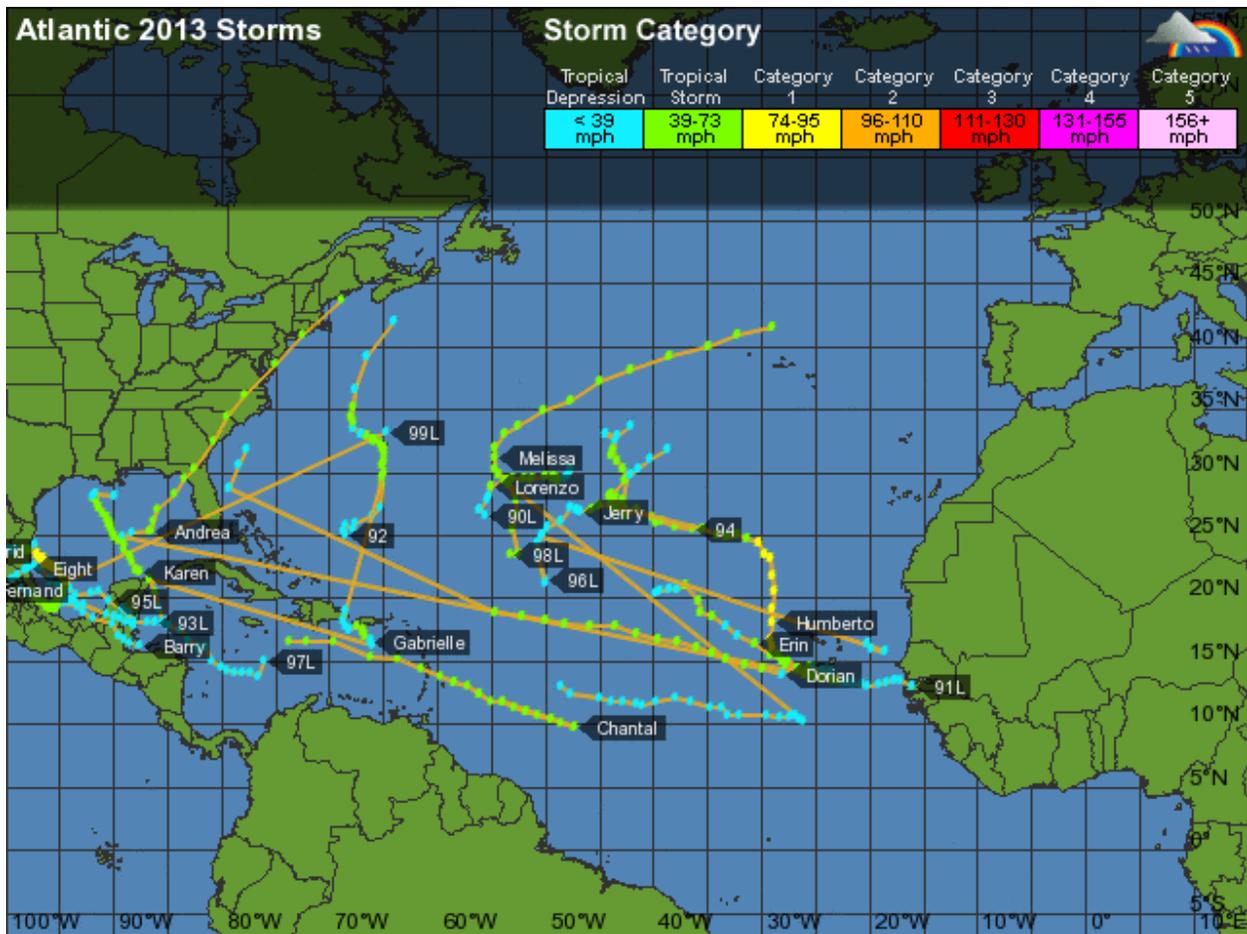


Figure 1 – Graphic prepared by WeatherUnderground depicting all cyclone positions (tracks) and intensities reported for the 2013 hurricane season.

While from a broader perspective 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, a convergence of factors helped suppress cyclone formation in 2013. Dust storms from Africa's Sahara Desert were stronger than expected this year, which helped blanket the Atlantic Ocean in dry air. Cyclones need moist air, not dry air to develop and when coupled with sinking air that dominated the summer, the conditions were almost exactly opposite of what cyclones need to form (note: sinking air tends to stabilize the atmosphere). The dust and wind patterns are difficult to predict months in advance and forecasters were working off a premise of warmer ocean temperatures, low pressure over the Atlantic, and the absence of *El Niño* as factors that would otherwise favor cyclone development.

However before we judge the 2013 hurricane season forecasts, there is plenty of terminology associated with the hurricane season that we have already and will continue to use freely. Therefore it will be worth our effort to introduce and demystify some of the basic hurricane vernacular as presented below.

Tropical cyclone - warm-core, atmospheric closed circulation rotating counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Tropical storm – a tropical cyclone with a maximum sustained surface wind speed ranging from 39 mph to 73 mph using the U.S. 1-minute average.

Hurricane - a tropical cyclone with a maximum sustained surface wind speed reaching 74 mph or more.

Saffir Simpson Scale – a scale including 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.

Major Hurricane – a hurricane reaching category 3 or higher on the Saffir Simpson Scale. 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).

Now to account for some of the weather oddballs, we also need to include;

Extratropical Storm - 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. Extratropical cyclones can have winds ranging to levels associated with a tropical depression, or as strong as a hurricane and examples 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.

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.

Note: 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.

Post-tropical Cyclone – a hybrid term describing a cyclone no longer possessing the characteristics to be considered a tropical cyclone, and are further divided into either “extratropical” (see above) or “remnant lows”.

2013 “Pre-season” Forecasts – Ooops...

Hurricane forecasters were way off the mark in 2013 as hinted above. How can we objectively make this assessment? If you’re a frequent reader of the *Island Review*, then you will already know our personal preference is to review the predictions generated 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 just before or near the start of hurricane season on June 1st and compare the predictions to the actual results at the end of the season (November 30th).

As the accompanying prediction summary chart indicates (Table 1), the average prediction included 17 total cyclones (the actual was 13), 9 of which were predicted to generate into hurricanes (the actual was 2), with 4 of these becoming major hurricanes (the actual was 0). This means 8 tropical storms were predicted and the actual number was 11.

	NOAA (median) 5/23/13	Colorado State University, US 6/3/13	University College London, UK 6/4/13	Average of Predictions	ACTUAL 2013	Historical Average (1981-2010)
Total No. of Named Tropical Cyclones	17	18	16	17	13	12
Tropical Storms	6	9	8	8	11	5
Hurricanes / Major	9/5	9/4	8/4	9/4	2/0	7/2
Accumulated Cyclone Energy (ACE) Index	151	165	134	150	33	92

Table 1 - Summary comparing publicly available pre-season predictions for the 2013 Hurricane Season with actual results and average activity.

As can be quickly gleaned from this prediction chart, the key elements for the 2013 hurricane season were somewhat on par with the 1981-2010 *historical* average, yet considerably lower than what was *predicted*. Even more technically speaking, we had a “below normal” hurricane season, which is actually determined by looking at term we haven’t discussed yet - the *Accumulated Cyclone Energy Index* (ACE Index). The ACE Index 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 Index is actually one of the more revealing parameters we can use and serves as a better barometer of whether or not a hurricane season is truly “active” or not. This past decade and even this year (2013) have some great examples to support this assertion.

For instance as mentioned earlier in this article, 2012, 2011 and 2010 are tied with 1995 and 1887 for the third-most named cyclones in one year at nineteen. However the ACE Index Values were different. Why? In 2012 we had **10** of the nineteen cyclones develop into hurricanes (ACE = 128), while only **7** of the nineteen cyclones developed into hurricanes in 2011 (ACE = 119). 2010 had the highest ACE value of these past three years (ACE = 163) with **12** of the nineteen cyclones developing into hurricanes, including the particularly intense and long-lasting hurricane *Igor* that had an ACE value/contribution of 42 in itself. This all makes sense because again the mathematical formula takes each cyclone’s wind speed and duration into account. The average ACE Index is 92. This year (2013) the ACE Index was a dramatically low 33, which again makes a lot of sense upon further inspection. Yes we had 6 more tropical storms than normal but most of these were ‘weak’

and short-lived, while we had 5 less hurricanes than normal – none of which were major hurricanes.

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; 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 eleven years and a few notes justifying the value.

YEAR	ACE Index	Notes
2013	33	6th lowest ACE Index since 1950; 13 cyclones with 2 that developed into hurricanes - fewest number of hurricanes since 1982.
2012	128	Third consecutive year with 19 cyclones that ties record for 3rd-most most cyclones ever for a season (2011, 2010, 1995, and 1887 all had 19 cyclones). Eight cyclones formed in August alone, which tied 2004 for the most to form in that particular month, and only 7 seasons had more hurricanes than 2012 (10).
2011	119	Tied with 2010, 1995, and 1887 for the 3rd-most most cyclones for a season at 19, but fewer of the cyclones developed into hurricanes (7 hurricanes in 2011 compared to 12 in 2010), yielding a lower ACE value. <i>Irene</i> was the first U.S landfalling hurricane since <i>Ike</i> in 2008.
2010	163	Tied for 3rd-most most cyclones for a season at 19, and tied for 2nd-most hurricanes for a season at 12. <i>Igor</i> had an ACE Index of 42 alone - highest since <i>Ivan</i> (2004).
2009	51	<i>El Niño</i> year - 15th lowest ACE Index since 1950, 12 cyclones (most were short-lived), 3 hurricanes.
2008	145	<i>Ike</i> and <i>Gustav</i> were two major hurricanes that impacted Tx. and La., <i>Bertha</i> 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 (<i>Dean</i> and <i>Felix</i>).
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 (<i>Wilma</i>).
2004	225	4th highest ACE Index value on record, hurricane <i>Ivan</i> alone had an ACE Index of 70, 2004 had six major hurricanes.
2003	175	Hurricane <i>Isabel</i> will long be remembered in Carteret County for Down East flooding, and for the island breach near Hatteras Village in Dare County. <i>Isabel's</i> ACE Index alone was 63, one of the highest recorded for an individual cyclone.

Table 2 – ACE Index summary chart (2003 – 2013).

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). Hence why **below normal** is used here as an objective term to characterize the 2013 hurricane season – again, the ACE Index for 2013 was 33 (average is 92). The lead agencies predicted an average ACE Index of 150 for 2013, or “above normal” and almost flirting with “hyperactive”. They were obviously way off – the 33 ACE Index value for 2013 is the 6th lowest since 1950, and if there was a “lethargic” category for ACE values, then this year may have qualified.

Unfortunately and bringing things back home, 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. This underscores the need to be prepared for each and every hurricane season regardless if it is an “active” season or not.