



SHORELINES – July 2021

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2021 Hurricane Season Preview with our “New Normal” in mind.

Officially speaking, the 2021 hurricane season starts on June 1st and will come to an end six months later on November 30th. Of course there’s a big “wink-wink nod-nod” involved here as *Ana* formed on May 22nd marking the seventh (yes, seventh) year in a row the hurricane season was underway before the traditional June 1st start date. There’s also another “new normal” to keep in mind as well – the National Oceanic and Atmospheric Administration (NOAA) utilizes a rolling, three-decade window to determine the Climate Normal following a procedure first established by the International Meteorological Organization (now World Meteorological Organization) beginning with the 1901-1930 Climate Normal. Thus with the onset of the year 2021, our new average is calculated from 1991-2020 rather than from 1981-2010 and one could argue the last three decades better encapsulate the uptick of tropical cyclone activity that most experts agree started in the 1990s and continues today. So for those of you keeping track at home – the total annual number of cyclones (that’s the number of tropical storms and those that turn into hurricanes) has bumped up from 12 to 14, with 7 storms and 7 hurricanes (up from 6 storms and 6 hurricanes). Those that develop into a major hurricane stays at 3 per year.

And lastly, there’s my favorite metric - the *Accumulated Cyclone Energy Index* or “ACE” Index, which is an important measurement taking a storm’s wind velocity 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 indicator of whether or not a hurricane season is truly “active” or not. The longer duration and/or more intense each named cyclone; the more contribution to the ACE Index Value – and *vice versa*. And true to form, our new annual ACE average for 1991-2020 is 121, up from 104 - that’s a pretty big jump, but as mentioned above is not all that unexpected.

So with this discussion of a new normal in mind, what are we expecting for 2021? Well first of all, despite our seventh year in a row of an early named storm; climatology provides no assurances that early season cyclone activity correlates to an active hurricane season. Rather trends in the dynamics associated with *El Niño*-Southern Oscillation, sea surface temperatures, vertical wind shear, moist or dry air, and the Saharan Air Layer (dust) can provide a clue of whether or not the environmental conditions are favorable for cyclone development. Meteorologists in turn often use this information to forecast the general level of activity we can expect for the year.

However predicting intensities for each cyclone and landfall strike locations in advance of the hurricane season are going to continue to be a bit speculative for a while. There’s just too many variables at play to get at that granular level and of course there’s unpredictable weather patterns that develop and fade over and near land which also steer cyclones – all impossible to predict/forecast weeks and months ahead of time.

This again is why we like to look at the overall activity expected, which can foreshadow our probability of being impacted. To these ends, the Barcelona Supercomputing Center in cooperation with Colorado State University maintain a [website](#)

summarizing twenty-three Atlantic hurricane season forecasts for 2021 generated by government agencies, universities, or the private sector. Yes – twenty-three. That’s a lot, and our preference is to drill down and review the predictions produced by groups that make not just their forecasts 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 - [NOAA](#). We subsequently take these groups’ last prediction before or near when the hurricane season starts and begin to “torture the statistics until they confess” as one my favorite professors used to say.

	NOAA (median) 5/20/2021	CSU Co., US 6/3/2021	TSR London, UK 5/27/2021	Average of Forecasts	Historical Average (1991-2020)
Named Tropical Cyclones (total)	17	17	18	17	14
Tropical Storms	9	9	9	9	7
Hurricanes / Major	8/4	8/4	9/4	8/4	7/3
Accumulated Cyclone Energy (ACE) Index	146	149	140	145	121

Table 1 - Summary comparing publicly available pre-season predictions for the 2021 Hurricane Season with average activity.

As the accompanying forecast summary table indicates, there is excellent agreement that we could expect 17 named cyclones, 8 of which will generate into hurricanes, with 4 of these becoming a major hurricane --- all above historical values for each category.

It’s important to keep in mind this above average type of forecast is really predicated upon not what factors are in place now but will be once we hit peak season in September. To this end, sea surface temperatures are expected to be warmer-than-normal in the Main Development Region (MDR) of the Atlantic where most cyclones form and weak tradewinds are also expected in the MDR. Hence the fuel (warm water) is in place for cyclones to develop and little shear to stymie cyclones that do begin to form. Also, very weak *La Niña* or *El Niño* Southern Oscillation (ENSO) “cool phase” conditions could be present during the peak of hurricane season, which also can favor rather than curb cyclone development. “ENSO warm phase” is *El Niño*, which can limit cyclone formation and of course “ENSO neutral” is just that – agnostic if you will to either *La Niña* or *El Niño*. In fact the most recent [forecast](#) from NOAA's Climate Prediction Center places the odds highest for ENSO-neutral (50%), followed by *La Niña* (42%), and *El Niño* conditions as the least favored outcome (8%).

The average ACE Index forecasted for 2021 is **145** (Table 1). ACE Index values can also be scaled to describe cyclone activity as follows; “below normal” (<73), “near normal” (73 – 126), “above normal” (126 – 160), and even “hyperactive” (>160). Thus in theory, all three major forecast groups are in agreement that we should expect an “above normal” hurricane season.

Below (Table 2) is a summary of the past 18 years with respect to the ACE Index – again, it’s a great barometer (no pun intended) of tropical cyclone activity. However regardless of the level of activity, “it only takes one” with the year of 1992 serving as a prime example – just 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. Also, the National Hurricane Center (NHC) *track* forecasts during the past few Atlantic hurricane seasons were generally very accurate once a cyclone did develop, but forecasters are still wrestling with intensity estimates and especially for the hurricanes that undergo rapid intensification; so again and as always - be prepared and be safe.

YEAR	ACE Index	Notes
2020	180	Record-breaking year with the most cyclones in a season (30), most cyclones in a month (10 in Sept.), and most U.S. landfalls (12). Many cyclones were short-lived/weak (10 had an individual ACE contribution of <2 points) that muted the season ACE considering the number of cyclones.
2019	130	10 cyclones formed between Aug. 21 – Sept. 23, tying 1949 and 2010 for the most during this timeframe. Conversely, 7 cyclones lasted 24 hours or less as a named storm – most on record. Hurricane <i>Dorian</i> had 48 ACE points alone and may have just crossed Cape Lookout.
2018	129	Above normal season including the land-falling hurricanes of <i>Florence</i> and <i>Michael</i> that severely impacted the Carolinas and panhandle area of Florida, respectively. Hurricanes <i>Florence</i> , <i>Leslie</i> , and <i>Michael</i> contributed 74 ACE points collectively (57% of annual total).
2017	223	7th highest ACE index on record punctuated by September, which had the highest ACE contribution ever for a single month (175). Hurricanes <i>Irma</i> , <i>Jose</i> , and <i>Maria</i> contributed more than 40 ACE a piece – first time three tropical cyclones each produced >40 in a single season.
2016	134	Uncommonly prolonged (January 12 to November 25) yet very little activity in the climatological peak of the season as October had a higher ACE Index input (69) than August and September.
2015	62	Somewhat surprising near average numbers of tropical storms and hurricanes despite the 2015-16 moderate to strong <i>El Niño</i> event. ACE Index higher than forecasted yet still "below normal"
2014	66	Fewest amount of total cyclones (8) since 1997 (7). Hurricanes <i>Edouard</i> and <i>Gonzalo</i> accounted for over 60% of the ACE Index. Hurricane <i>Arthur</i> crossed Shackleford Banks.
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
2010	163	Tied for 3rd-most most cyclones for a season at 19, and tied for 2nd-most hurricanes for a
2009	51	<i>El Niño</i> year - 15th lowest ACE Index since 1950, 12 cyclones (most 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
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 – 2020).