



268Weather 2020 Atlantic Hurricane Season Forecast

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268Weather continues to forecast that the 2020 Atlantic hurricane season will be above normal, with likely hyperactivity – Accumulated Cyclone Energy (ACE) greater than 187 or in the top 10 percentile of the climate period 1981-2010. My confidence in the forecast and the activity of the season has increased over the [previous forecast](#). The forecast spans the full official season – June to November. In obtaining the forecast, data available through June 9, 2020 were used.

The main reasons for the above normal forecast are the likely continued above normal sea surface temperatures (SSTs) across the tropical North Atlantic (TNA) and a cold-neutral El Niño Southern Oscillation (ENSO) or a weak cold ENSO, i.e. weak La Niña, during the peak of the hurricane season – August to October. A warmer than usual TNA often translates into lighter than usual trade winds and lower vertical wind shear – both very conducive for an above normal Atlantic hurricane season. La Niñas enhance hurricane activity and warm ENSOs (El Niños) do the opposite. Cold-neutral ENSOs sometimes have a similar effect to La Niñas. Notwithstanding, there are notable uncertainties with the forecast largely due to uncertainties regarding the evolution of ENSO. Models tend to do a poor job of forecasting ENSO at this time of the year, due to what is called the “[spring predictability barrier](#)”, which is just about coming to an end.

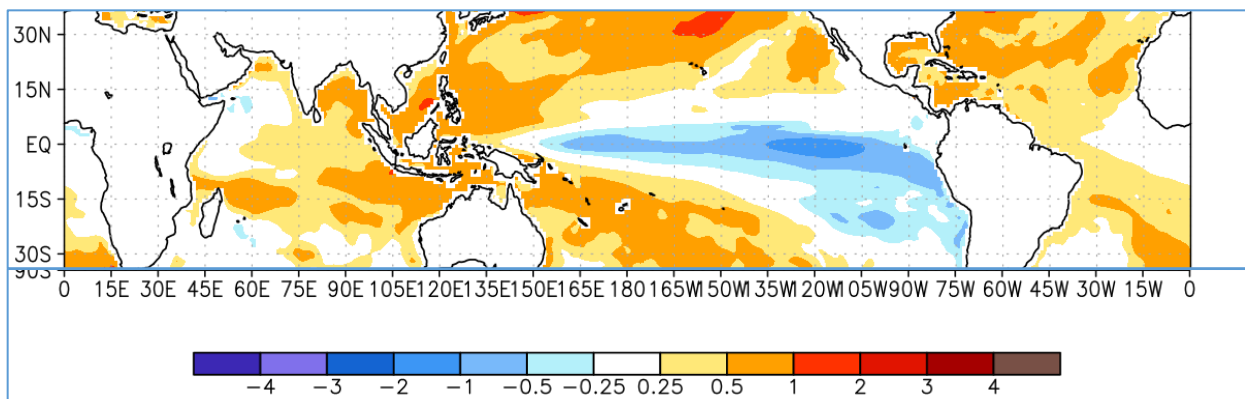


Figure 1: North American Multi-Model Ensemble (NMME) forecast of SSTs – La Niña forecast for the Pacific and warmer than usual SSTs for the TNA.

In addition to Tropical Storms Arthur and Bertha, which formed outside of the official season, my forecast calls for the **official season** to have 19 named storms (unchanged), including Tropical Storm Cristobal, with 9 becoming hurricanes (unchanged) and 5 becoming major hurricanes (up one). The ACE is forecast to be 200 (up 11). Further, there is a 70% confidence of

- 15 to 24 named storms;
- 6 to 13 becoming hurricanes;
- 2 to 7 becoming major hurricanes and
- 120 to 287 ACE.

Taking into account Arthur and Bertha and the two ACE they produced, the overall forecast for the year for named storms and ACE is **21 and 202 with a 70% confidence of 17 to 26 named storms and 122 to 289 ACE.**

The seasonal activity is expected to fall within these ranges in 70% of seasons with similar SST patterns, across the tropical Pacific and Atlantic Oceans, and uncertainties to those expected this year. These ranges do not represent the total possible ranges of activity seen in past similar years. These likely ranges are centred above or well above the 1981-2010 seasonal averages of 106 ACE, 12 named storms, 6 hurricanes and 3 major hurricanes. Most of the predicted activity is expected to occur during the peak of the season – August to September.

There is an 83% probability of an above normal season (up 2%), 14% probability of a near normal season (down 2%) and a 3% probability of a below normal season (unchanged), based on the ACE for the climate period 1981-2010. This forecast is to be taken as a guide and not as gospel. Forecasts issued in June generally have only moderate skill, historically. The skill generally increases as we get closer to August. Figures 2 and 3 show there is good skill in forecasting the season, in this case, using the GFDL-FLOR-A02 (GFDL) model SSTs to predict the ACE.

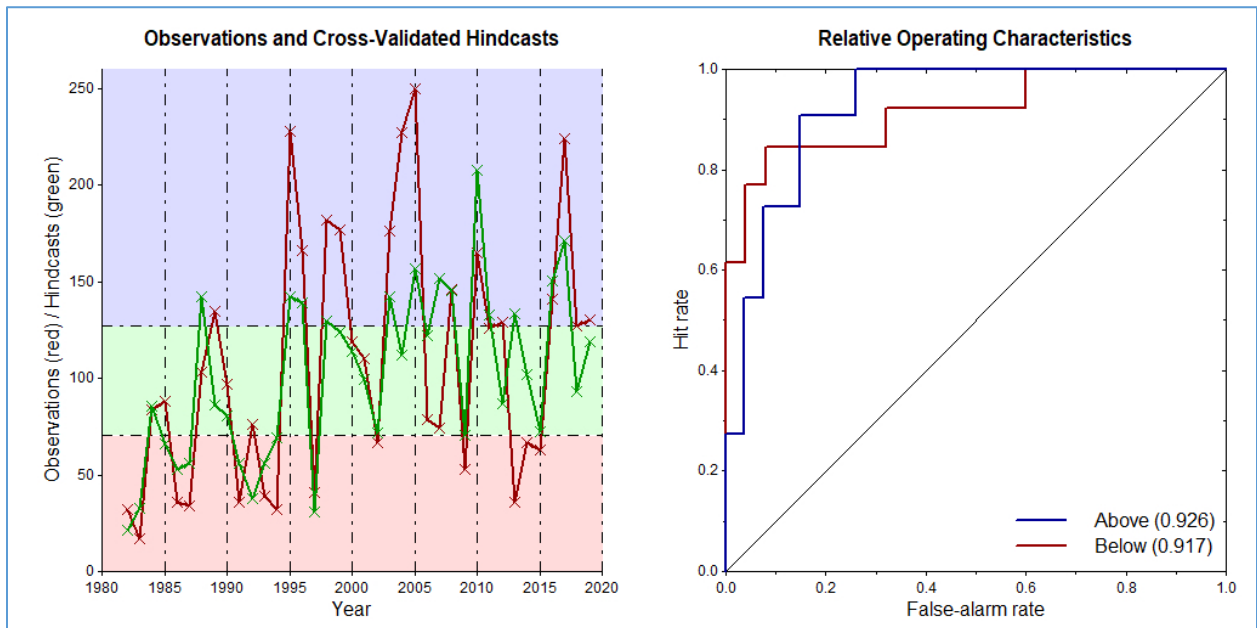


Figure 2a (left): Shows observed vs forecast ACE. The variance is over 53%, using GFDL mean SSTs for June to November 1982-2019, as the training period. Figure 2b (right): The ROC diagram shows very high discrimination by the model in forecasting above and below normal ACE for the season using GFDL SSTs. The GFDL mean SSTs was initialised early June.

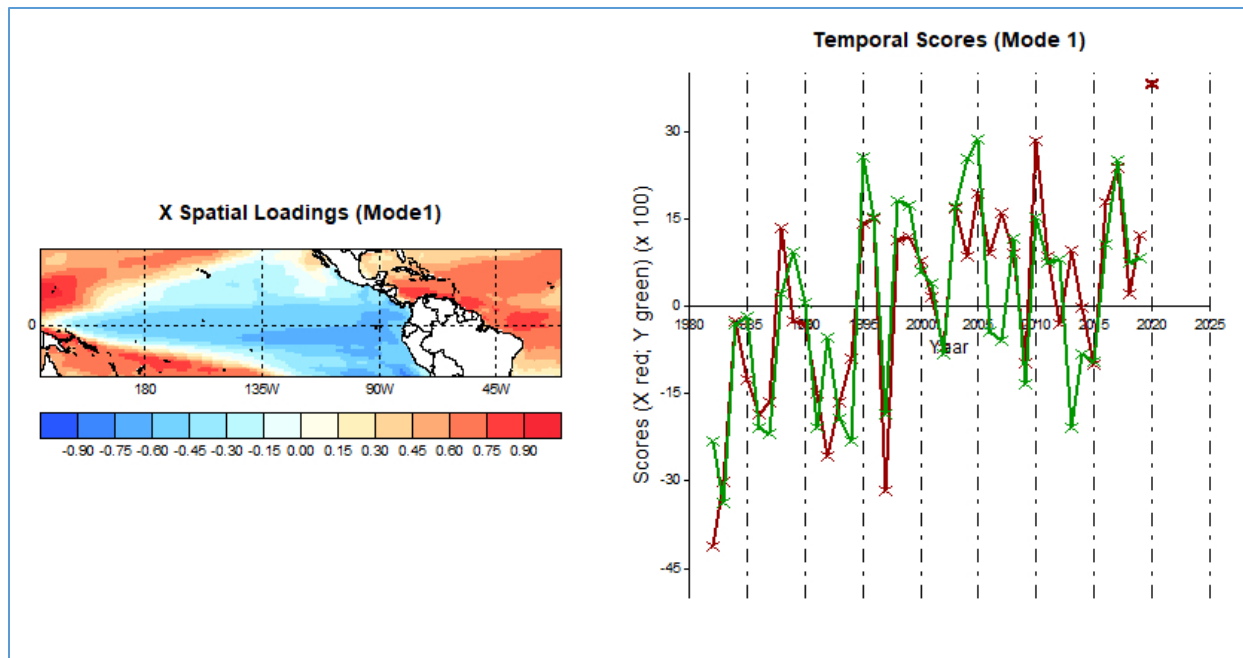


Figure 3: The X special loadings (mode 1) shows the most dominant pattern in SSTs correlation associated with above normal ACE; the reverse pattern is true for below normal ACE. The canonical correlation for this pair of variables (SSTs and ACE) is near 0.79 (79%). From the temporal scores (mode 1), warm SSTs across the tropical Atlantic Ocean simultaneously with cool SSTs across the tropical Pacific Ocean tend to coincide with above normal ACE (or season) and vice versa. Obtained using GFDL mean SSTs for June-November 1982-2019, initialised early June.

Methodology

This forecast was obtained with the use of the Climate Predictability Tool ([CPT](#)) version 16.5.4, 2020 by Simon J. Mason, Michael K. Tippett, Lulin Song and Ángel G. Muñoz. The software was viewed in canonical correlation analysis (CCA) mode. Input explanatory (X) files used were NOAA NCDC ERSSTv5 mean SSTs for: May 1971-2020 and March to May 1971-2020; CFS2 1982-2020; NCAR CCSM4 1982-2020 and GFDL (FLOR-A02, FLOR-B01 and CM2p1-aer04) 1982-2020 mean SSTs for June to November, initialized early June. The SSTs for CFS2, CCSM4 and GFDL were ensembled (5 Model Ensemble) by finding the simple arithmetic mean of the of the output i.e. the response (Y) variable of all five. The X domain used was 20°S to 30°N and 140°E to 20°W. The Y variables were ACE values, named storms, hurricanes and major hurricanes for the Atlantic Basin (including the Caribbean Sea and the Gulf of Mexico) for the period 1971 to 2019.

The following CPT settings were used:

- X modes: maximum was 8 and the minimum was 1
- Training period (NOAA NCDC ERSSTv5): 1971-2019, 49 years.
- Training period (Models: CFS, CCSM4, GFDL): 1982-2019, 38 years.
- Climatological period – 1981-2010
- Transformation setting: Gamma distribution
- Confidence level: 70%

- Missing value replacement: best near-neighbor
- Target season: June to November
- All other settings are by default

Results

Three sets of forecasts were produced, and the final forecast issued is based on the simple arithmetic mean of the three – see tables 1 and 2 below. Note that the forecast spread may not be symmetric around the mean value, given the historical distribution of tropical cyclone activity.

Forecast Parameters	SSTs			Ensemble Mean Forecast
	May 1971-2020	Mar to May 1971-2020	Jun to Nov 5 Model Ensemble 1982-2020	
ACE	181 (101-260)	175 (98-253)	243 (162-348)	200 (120-287)*
Named Storms	18 (13-22)	18 (14-22)	22 (17-29)	19 (15-24)*
Hurricanes	9 (5-12)	8 (5-11)	11 (7-16)	9 (6-13)
Major Hurricanes	5 (2-7)	5 (3-8)	6 (3-8)	5 (2-7)

Table 1: Forecast parameters with 70 percent confidence intervals in (parentheses) *Excluding Arthur and Bertha.

Forecast Parameters	SSTs			Ensemble Mean Forecast
	May 1971-2020	Mar to May 1971-2020	Jun to Nov 5 Model Ensemble 1982-2020	
ACE	A 78, N 18, B 4	A 76, N 19, B 5	A 94, N 5, B 1	A 83, N 14, B 3
Named Storms	A 87, N 11, B 2	A 89, N 10, B 1	A 96, N 3, B 1	A 91, N 8, B 1
Hurricanes	A 68, N 24, B 8	A 62, N 27, B 11	A 88, N 10, B 2	A 73, N 20, B 7
Major Hurricanes	A 74, N 20, B 6	A 75, N 19, B 6	A 87, N 11, B 2	A 79, N 17, B 4

Table 2: Forecast parameters expressed probabilistically. A - above normal; N - near normal and B - below normal.

Comparison of forecasts for the season

Forecast Parameters and 1981-2010 Average in [brackets]	2020 Forecasts for the Atlantic Hurricane Season		
	Issued April 10, 2020	Issued May 10, 2020	Issued June 10, 2020
ACE [105.6]	191 (106-288)	189 (112-276)	200 (120-287) ¹
Named Storms [12]	20 (14-25)	19 (14-23)	19 (15-24) ²
Hurricanes [6]	9 (6-12)	9 (6-12)	9 (6-13)
Major Hurricanes [3]	5 (3-8)	4 (2-7)	5 (2-7)

Table 3: Forecast parameters with 70 percent confidence intervals in (parentheses). ²Plus, Arthur and Bertha = **21 (17-26)** named storms and the ¹ACE they produced (2) = **202 (122-289)**.

2020 Forecasts for the Atlantic Hurricane Season			
Forecast Parameters and 1981-2010 Average [in brackets]	Issued April 10, 2020	Issued May 10, 2020	Issued June 10, 2020
ACE [105.6]	A 79, N 16, B 5	A 81, N 16, B 3	A 83, N 14, B 3
Named Storms [12]	A 89, N 9, B 2	A 88, N 10, B 2	A 91, N 8, B 1
Hurricanes [6]	A 72, N 21, B 7	A 69, N 23, B 8	A 73, N 20, B 7
Major Hurricanes [3]	A 82, N 14, B 4	A 76, N 20, B 4	A 79, N 17, B 4

Table 4: Forecast parameters expressed probabilistically. A - above normal; N - near normal and B - below normal.

Verification of previous forecasts

The tables contain the forecast for each parameter with the 70 percent confidence interval in (parentheses) i.e. 70% of forecasts are likely to fall in this range. ACE is Accumulated Cyclone Energy index. So, for example, the 2017, July 5 (best) forecast is for 16 named storms with a 70% confidence that the number of named storms will be in the range 11-22.

2017	Apr	May	Jun	Jul 5 ¹	Update Aug 4	Obs.
Named Storms	-	-	-	16 (11-22)	18 (13-22)	17
Hurricanes	-	-	-	7 (4-10)	7 (4-10)	10
Major Hurricanes	-	-	-	4 (2-5)	3 (2-5)	6
ACE	-	-	-	140 (75-216)	152 (84-222)	223

Table 5: ¹My maiden forecast of the hurricane season

2018	Apr 10	Update May 10	Update Jun 11	Update Jul 15	Update Aug 10	Obs.
Named Storms	15 (11-19)	13 (10-17)	11 (8-15)	12 (8-15)	11 (9-15)	14 ²
Hurricanes	7 (4-10)	6 (4-10)	5 (3-8)	5 (3-8)	5 (3-8)	8
Major Hurricanes	4 (2-5)	3 (1-4)	2 (1-4)	3 (1-4)	2 (1-4)	2
ACE	135 (70-200)	119 (63-190)	93 (48-153)	99 (51-167)	93 (51-151)	130 ³

Table 6: ²There were 15 named storms in 2018 with an ACE of 132³ (2.4 from Alberto), which formed in May, outside the range of my forecasts of the hurricane season proper – June 1 to Nov 30.

2019	Apr 10	Update May 16	Update Jun 12	Update Jul 15	Update Aug 15	Obs.
Named Storms	13 (10-18)	12 (9-17)	13 (10-17)	13 (9-16)	12 (9-16)	17 ⁴
Hurricanes	7 (4-10)	7 (4-10)	6 (4-9)	6 (4-9)	6 (4-9)	6
Major Hurricanes	3 (1-5)	2 (1-5)	3 (1-5)	3 (2-5)	3 (2-5)	3
ACE	124 (67-201)	113 (62-184)	114 (62-181)	127 (71-198)	136 (77-209)	131

Table 7: ⁴There were 18 named storms in 2019 with an ACE of 131 (0.245 from Alberto), which formed in May, outside the range of my forecasts of the hurricane season proper – June 1 to Nov 30.

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 knots²) for each 6-hour period of its existence. The 1981-2010 average value of this parameter is 106 for the Atlantic basin.

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.

ERSSTv5 – Extended Reconstructed Sea Surface Temperature version five.

CCSM4 – Community Climate System Model version 4.

CFSv2 – Climate Forecast System version 2 GCM.

CMC4 – Canadian Meteorological Centre version 4 GCM.

EMC – Environmental Modeling Center of the United States.

GCM – General Circulation Model.

GFDL-FLOR – Geophysical Fluid Dynamics Laboratory-Forecast-Oriented Low Ocean Resolution GCM.

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

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.

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

NCAR – US National Centre for Atmospheric Research.

NCDC – National Climate Data Center of the United States

NCEP – National Centers for Environmental Prediction of the United States.

NOAA – National Oceanic Atmospheric Administration of the United States.

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

SSTs – Sea surface temperatures.

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 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 40,000 feet or 12 km) and 850 mb (approximately 5000 feet or 1.6 km).

268Weather will issue an update to this forecast for the 2020 Atlantic Hurricane Season (June 1 to November 30, 2019) around the 10th of every month until August. The next update will be issued around July 10, 2020.