268Weather 2019 Atlantic Hurricane Season Forecast

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268Weather continues to project the 2019 Atlantic hurricane season to be likely above normal, with a notable increase in confidence over the previous forecast. The forecast spans the full season – June to November. In obtaining the forecast, data available through July 14, 2019 were used.

The main reason for the above normal forecast is due to the likely near to above normal sea surface temperatures (SSTs) across the tropical North Atlantic (TNA). 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. Notwithstanding the forecast, there remains some uncertainty, as it is unclear as to how warm the TNA well get. Further, there exists, at most, a weak El Nino Southern Oscillation (ENSO). Actually, at least one reputable forecast centre has declared that ENSO has returned to neutral. Warm ENSOs usually inhibit hurricane activity and cold ENSOs do the opposite. Neutral and sometimes weak ENSOs neither inhibit nor enhance.

My updated forecast calls for 13 named storms with 6 becoming hurricanes and 3 becoming major hurricanes, excluding Tropical Storm Andrea. The Accumulated Cyclone Energy (ACE) is forecast to be 127 (13 more than previous). Further, there is a 70% likelihood/confidence of

- 9 to 16 named storms;
- 4 to 9 becoming hurricanes;
- 2 to 5 becoming major hurricanes and
- 71 to 198 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 expected ranges are centred above or near the 1981-2010 seasonal averages of 106 ACE, 12 named storms, 6 hurricanes and 3 major hurricanes. Most of the predicted activity is likely to occur during the peak of the season – August to September.

There is a 54% probability of an above normal season (up 9%), 32% probability of a near normal season and a 14% probability of a below normal season, based on the ACE for the climate period 1981-2010. This forecast is to be taken as a guide and not as gospel.

Figures 1 and 2 shows there is good skill in forecasting the season, in this case, using the CCSM4 SSTs to predict the ACE.
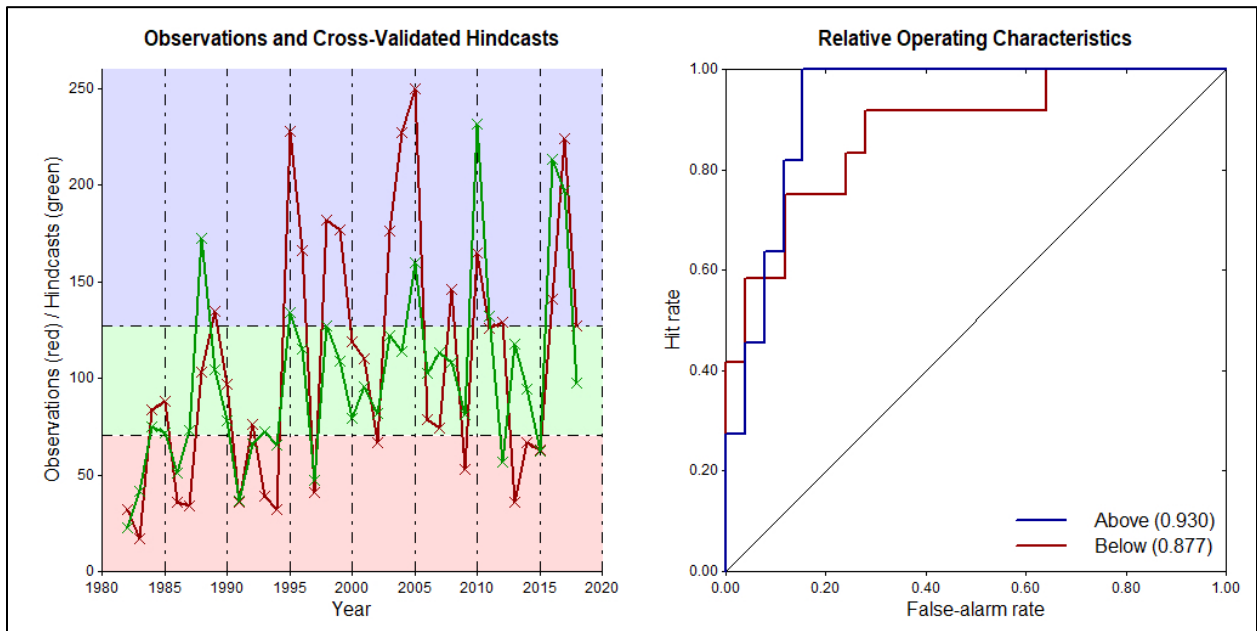

Figure 1a (left): Shows observed vs forecast ACE. The variance is over 45%, using CCSM4 mean SSTs for July to November 1982-2018, initialized July, as the training period. Figure 1b (right): The ROC diagram shows very high discrimination by the model in forecasting above and below normal ACE for the season.
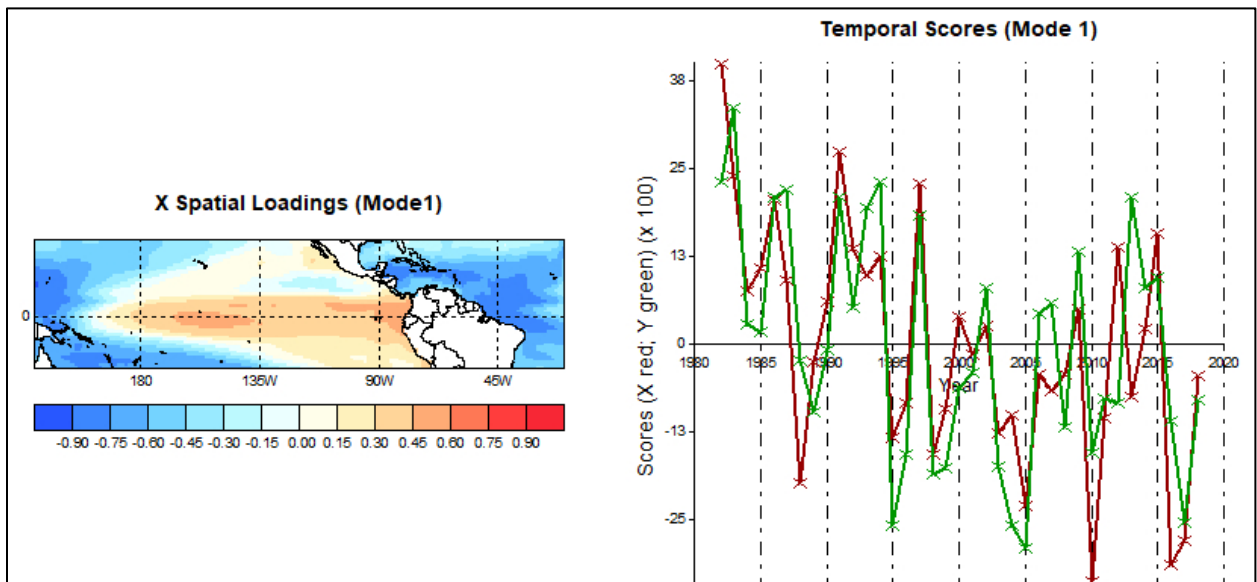

Figure 2: The X special loadings (mode 1) shows the most dominant pattern in SSTs correlation associated with below normal ACE (the reverse pattern is correlated with above normal ACE). The canonical correlation for this pair of variables (SSTs and ACE) is over 0.76. From the temporal scores (mode 1), warm SSTs across the Pacific Ocean simultaneously with cool SSTs across the tropical Atlantic Ocean tend to coincide with below normal ACE (or season) and vice versa. Obtained using CCSM4 mean SSTs for July-November 1982-2018, initialized July, as the training period.

Methodology

This forecast was obtained with the use of the Climate Predictability Tool ([CPT](#)) version 15.7.6, 2018 by Simon J. Mason, Michael K. Tippett and Lulin Song. The software was viewed in canonical correlation analysis (CCA) mode. Input explanatory (X) files used were NOAA NCDC ERSSTv4 mean SSTs for: June 1971-2019 and April to June 1971-2019; CFS2 1982-2019; CMC1CanCM3 1982-2019, CMC1CanCM4 1982-2019; GFDL-FLOR_A02 1982-2019; GFDL-FLOR_B01 1982-2019 and NCAR CCSM4 1982-2019 forecast mean SSTs for July to November, initialized early July 2019. The forecast SSTs were ensembled (6 Model Ensemble) by finding the simple arithmetic mean of the of the output i.e. the response (Y) variable of all six. 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 CPT settings used were:
- X modes: maximum was 8 and the minimum was 1
- Training period: 1971-2018, 48 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 the simple arithmetic mean of the three. The individual results are listed below in tables 1 and 2.

	SSTs			
Forecast Parameters	**Jun 1971-2019**	**Apr to June 1971-2019**	**Jun to Nov 6 Model Ensemble 1982-2019**	**Ensemble Mean Forecast**
ACE	121 (61-194)	120 (65-181)	140 (86-218)	127 (71-198)
Named Storms	12 (9-15)	12 (8-15)	14 (10-19)	13 (9-16)
Hurricanes	6 (4-9)	5 (3-8)	7 (5-11)	6 (4-9)
Major Hurricanes	3 (2-5)	3 (1-4)	4 (2-6)	3 (2-5)

Table 1: Forecast parameters with 70 percent confidence intervals in (parentheses).

	SSTs			
Forecast Parameters	**Jun 1971-2019**	**Apr to May 1971-2019**	**Jul to Nov 6 Model Ensemble 1982-2019**	**Ensemble Mean Forecast**
ACE	A 50, N 32, B 18	A 49, N 35, B 16	A 62, N 30, B 8	A 54, N 32, B 14
Named Storms	A 45, N 41, B 14	A 43, N 41, B 16	A 64, N 29, B 7	A 51, N 37, B 12
Hurricanes	A 40, N 37, B 23	A 30, N 35, B 35	A 54, N 33, B 13	A 41, N 35, B 24
Major Hurricanes	A 50, N 34, B 16	A 38, N 36, B 26	A 59, N 31, B 10	A 49, N 34, B 17

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

Comparison of forecasts for the season

	2019 Forecasts for the Atlantic Hurricane Season			
Forecast Parameters and 1981-2010 Average in [brackets]	**Issued April 10, 2019**	**Issued May 16, 2019**	**Issued June 12, 2019**	**Issued July 15, 2019**
ACE [105.6]	124 (67-201)	113 (62-184)	114 (62-181)	127 (71-198)
Named Storms [12]	13 (10-18)	12 (9-17)	13 (10-17)	13 (9-16)
Hurricanes [6]	7 (4-10)	7 (4-10)	6 (4-9)	6 (4-9)
Major Hurricanes [3]	3 (1-5)	2 (1-5)	3 (1-5)	3 (2-5)

Table 3: Forecast parameters with 70 percent confidence intervals in (parentheses).

	2019 Forecasts for the Atlantic Hurricane Season			
Forecast Parameters and 1981-2010 Average [in brackets]	**Issued April 10, 2019**	**Issued May 16, 2019**	**Issued June 12, 2019**	**Issued July 15, 2019**
ACE [105.6]	A 49, N 32, B 19	A 45, N 34, B 21	A 45, N 35, B 20	A 54, N 32, B 14
Named Storms [12]	A 45, N 34, B 21	A 44, N 37, B 19	A 49, N 38, B 13	A 51, N 37, B 12
Hurricanes [6]	A 42, N 31, B 27	A 40, N 34, B 26	A 38, N 36, B 26	A 41, N 35, B 24
Major Hurricanes [3]	A 40, N 34, B 26	A 38, N 36, B 26	A 41, N 38, B 21	A 49, N 34, B 17

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

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 knots^2) 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.

ERSSTv4 – Extended Reconstructed Sea Surface Temperature version four.

CCSM4 – Community Climate System Model version 4.

CFSv2 – Climate Forecast System version 2 GCM.

CMC – Canadian Meteorological Centre.

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 Atlantic Hurricane Season (June 1 to November 30, 2019) around the 10th of every month until August.