Forecast of An Active 2020 Hurricane Season over the North Atlantic

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This is the first time[1] for us to issue a prediction in April for the amount of tropical activity expected in the upcoming hurricane season, which runs from June 1 to November 30. The prediction includes total numbers of named storms, hurricanes, major hurricanes, and accumulated cyclone energy (ACE, defined as the sum of the squares of the 6-hourly windspeeds in knots above tropical storm strength). Our forecast combines dynamic forecasts with machine learning, as informed by our physical understanding of hurricane activities.

Specifically we utilize a Random Forest approach based on seasonal forecast data from the European Centre for Medium-Range Weather Forecasts (ECMWF). We utitlize the forecasted July/August/September tropical Atlantic area-averaged sea surface temperatures (SSTs) in the same region used in our June predictions (Davis, Zeng, and Ritchie 2015; Davis and Zeng 2019) as well as August/September area-averaged SSTs in the Nino 3.4 region over the Pacific. Our method uses 25 ensemble members from 1993-2016 and 51 members from 2017-2019 from the ECMWF.

We calibrate the model using data from 1993 to 2006: we first train the model on the first member (from the model control run) on all data from 1993 to 2006; use it to predict for the other members from 1993 to 2006; and average predictions from all members for a year as our prediction for that year. Then we validate the model using data from 2007 to 2019 in "real time" (for example, for 2015, we would train the model using data from 1993 to 2014 and use the 2015 data to make a prediction for 2015).

Figure 1 compares our model's performance during the calibration and validation periods against observations and the 5-year running average, or a no-skill metric. Table 1 shows that our model during the validation period is 18% better than the 5-year running average for the predicted hurricane number, 41% better for the major hurricane number, 22% better for the named storm number, and 31% better for the ACE based on the mean absolute error.

For our April forecast this year, we expect an active hurricane season over the North Atlantic. The values in parentheses are the percentages of years from 1993-2019 when observations were within the predicted range of ∓ 2 hurricanes, ∓ 1 major hurricanes, ∓ 3 named storms, and ∓ 40 ACE units.

	2020 Prediction	Probability Range	Median Since 1980
Hurricanes	10	8-12 (70%)	7
Major Hurricanes	5	4-6 (63%)	2
Named Storms	19	16-22 (66%)	13
ACE	163	123-203 (52%)	102

The primary reason is: Atlantic SST is forecasted to be one of the warmest since 1993 and ENSO conditions are forecast to be neutral during the peak of hurricane season.

We will update our prediction in early June 2020.

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[1] We issued our forecast in early June in prior years.

Reference:

Davis, K., X. Zeng, and E. A. Ritchie, 2015: A New Statistical Model for Predicting Seasonal North Atlantic Hurricane Activity. Wea. Forecasting, 30, 730–741, doi: 10.1175/WAF-D-14-00156.1

Davis, K. and X. Zeng, 2019: Seasonal Prediction of North Atlantic Accumulated Cyclone Energy and Major Hurricane Activity. Wea. Forecasting, 34, 221–232, doi: 10.1175/WAF-D-18-0125.1

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Table 1. Mean absolute errors of our forecasts and those using the 5-year average as the prediction.

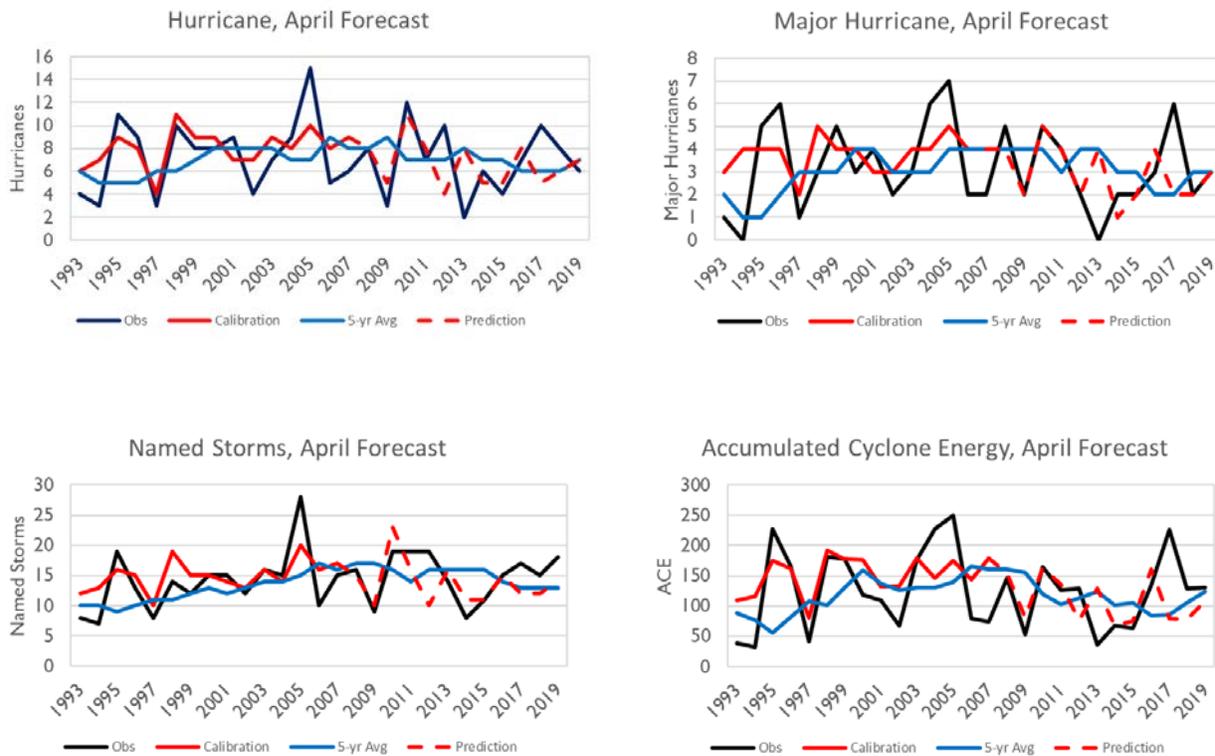| Category	Calibration	Validation	5-yr Average
Hurricane	2.1	2.3	2.8
Major Hurricane	1.6	1.0	1.7
Named Storms	3.0	2.9	3.7
ACE	44.9	42.8	62.3

Figure 1. The observed and predicted (using our model and the 5-year average) hurricane number, major hurricane number, named storm number, and ACE.