Forecast of the 2023 Hurricane Activities over the North Atlantic

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In several ways, 2022 was the least active year since 2015, preceeded by a stretch of several active years including the very active 2020 and 2017 seasons. This year will be an interesting year as ENSO is likely to move out of the cool phase for the first time since 2020. Here we provide our view of the 2023 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 of storms at least of 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 forecast 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. Our method uses 25 ensemble members from 1981-2016 and 51 members from 2017-2023.

We calibrate the model using data from 1981 to 2007: we first train the model on the first ensemble member (from the model control run) on all data from 1981 to 2007, use that model to predict for the other members over the same time period, and average predictions from all members as our prediction for that year. Then we validate the model using data from 2008 to 2022 in "real time" (for example, for 2015, we would train the model using data from 1981 to 2014 and use the 2015 SST data to make a prediction for 2015).

Table 2 compares our model's performance during the calibration and validation periods against the 5-year running average, or a no-skill metric. The model outperforms the no-skill category in all variables except named storms due to the errors associated with the record breaking 2020 season.

For our April forecast, we expect an active season over the North Atlantic. Tropical Atlantic SSTs are forecast to be the highest since 2010 and even hotter than 2020, and for the Nino 3.4 region, forecast SSTs are among the highest. The high Nino SSTs should help bring down hurricane activities; it will be an interesting battle between the two sides this summer.

	2023 Prediction	Probability Range	Median Since 1980
Hurricanes	9	7-11 (69%)	7
Major Hurricanes	5	4-6 (71%)	2
Named Storms	19	16-22 (74%)	13
ACE	163	123-203 (64%)	103

Table 1. 2023 tropical outlook.

We will update our prediction in early June 2023.

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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Category	Calibration	Validation	5-yr Average
Named Storms	2.4	4.0	3.9
Hurricane	1.5	2.4	2.5
Major Hurricane	1.2	1.1	1.5
ACE	38.3	41.4	52.3

Table 2. Mean absolute errors of our forecasts and those using the 5-year average as the prediction. All three columns use data from 1981.