Forecast of the 2025 Hurricane Activities over the North Atlantic

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According to our model, hurricane activities over the North Atlantic are expected to be near average for 2025 as showin in Table 1. 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.

We utilize a Random Forest approach based on seasonal forecast data from the European Centre for Medium-Range Weather Forecasts (ECMWF). We use 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 2017-2025. 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 2024 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.

The forecast for sea surface temperatures in the tropical Atlantic during peak hurricane season are for them to be a little above average, signficantly less warm than the last couple years. ENSO appears to be a nonfactor for this year – projections show the Niño 3.4 region to be a little above average. All this should combine to be a fairly normal year in terms of of all categories – hurricanes, major hurricanes, named storms, and ACE.

	2025 Prediction	Probability Range	Median Since 1980
Hurricanes	7	6-9 (66%)	7
Major Hurricanes	3	2-4 (66%)	3
Named Storms	15	12-18 (68%)	14
ACE	110	70-150 (67%)	107

Table 1. 2025 tropical outlook.

We will update our prediction in early June 2025.

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	2.6	3.4	4.3
Hurricane	1.9	2.2	2.8
Major Hurricane	1.2	1.1	1.5
ACE	43.8	33.6	43.8

Table 2. Mean absolute errors of our forecasts and those using the 5-year average as the prediction. All three columns use data as described above. 5-yr average is for the same period as the validation test.