Forecast of the 2024 Hurricane Activities over the North Atlantic

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April 2024

Here we provide our view of the 2024 hurricane season(Table 1), 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.

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 2017-2024. 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 2023 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.

Sea surface temperatures were boiling in 2023, but a strong El Niño counteracted what could have been a very intense season last year. This year, we are seeing forecasted sea surface temperatures during peak season even higher than last year, according to ECMWF. ENSO will be trending towards neutral, possibly La Niña, which will be the major difference from last year.

For our April forecast, we expect an active season over the North Atlantic. Tropical Atlantic SSTs are forecast to be the highest in our dataset. For the Niño 3.4 region, forecast SSTs are somewhat cooler than average, which at least should not inhibit activities. Storms should form easily and often this year.

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|  | 2024 Prediction | Probability Range | Median Since 1980 |
| Hurricanes | 11 | 9-13 (65%) | 7 |
| Major Hurricanes | 5 | 4-6 (65%) | 2 |
| Named Storms | 21 | 18-24 (67%) | 14 |
| ACE | 156 | 116-196 (65%) | 107 |

*Table 1. 2024 tropical outlook.*

We will update our prediction in early June 2024.

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.](https://journals.ametsoc.org/doi/abs/10.1175/WAF-D-18-0125.1) Wea. Forecasting, 34, 221–232, [doi: 10.1175/WAF-D-18-0125.1](https://doi.org/10.1175/WAF-D-18-0125.1)

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| **Category** | **Calibration** | **Validation** | **5-yr Average** |
| Named Storms | 2.6 | 3.4 | 4.4 |
| Hurricane | 1.9 | 2.3 | 2.8 |
| Major Hurricane | 1.2 | 1.1 | 1.5 |
| ACE | 43.8 | 35.4 | 45.1 |

*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. 5-yr average is for the same period as the validation test.*