COLORADO STATE UNIVERSITY FORECAST OF ATLANTIC HURRICANE ACTIVITY FROM SEPTEMBER 29–OCTOBER 12, 2022 AND OUTLOOK FOR OCTOBER-NOVEMBER CARIBBEAN ACCUMULATED CYCLONE ENERGY

We believe that the most likely category for Atlantic hurricane activity in the next two weeks is above-normal (55%), with normal (40%) and below-normal (5%) being less likely. We also anticipate well above-median October-November Caribbean Accumulated Cyclone Energy.

(as of 29 September 2022)

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In Memory of William M. Gray[4]

This discussion as well as past forecasts and verifications are available online at
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1   Introduction

This is the 14th year that we have issued shorter-term forecasts of tropical cyclone (TC) activity starting in early August. These two-week forecasts are based on a combination of observational and modeling tools. The primary tools that are used for this forecast are as follows: 1) current storm activity, 2) National Hurricane Center Tropical Weather Outlooks, 3) forecast output from global models, 4) the current and projected state of the Madden-Julian oscillation (MJO) and 5) the current seasonal forecast.

Our forecast definition of above-normal, normal, and below-normal Accumulated Cyclone Energy (ACE) periods is defined by ranking observed activity in the satellite era from 1966–2021 and defining above-normal, normal and below-normal two-week periods based on terciles. Since there are 56 years from 1966–2021, we include the 19 years with the most ACE from September 29–October 12 as the upper tercile, the 19 years with the least ACE as the bottom tercile and the remaining 18 years are counted as the middle tercile.

Table 1: ACE forecast definition for TC activity for September 29–October 12, 2022.

Parameter	Definition	Probability in Each Category
Above-Normal	Upper Tercile (>12 ACE)	55%
Normal	Middle Tercile (4–12 ACE)	40%
Below-Normal	Lower Tercile (<4 ACE)	5%

2   Forecast

We believe that the next two weeks have the highest probability of being in the above-normal category (>12 ACE). Tropical Storm Ian is likely to last for about two more days as a named storm before dissipating. Tropical Depression 11 is being slammed by high levels of vertical wind shear and is not likely to become a named storm. The National Hurricane Center currently is not monitoring any areas for tropical cyclone formation in the next five days. Global models have become quite aggressive this morning with development of a system coming off of Africa in the next couple of days. The Madden-Julian oscillation (MJO) is forecast to potentially amplify into phases 4-5 in the next two weeks. These two phases are typically associated with near average Atlantic tropical cyclone (TC) activity.

Figure 1 displays the formation locations of tropical cyclones from September 29–October 12 for the years from 1966–2021, along with the maximum intensities that these storms reached. Figure 2 displays the September 29–October 12 forecast period with respect to climatology. The primary threat area for major hurricane formations shifts farther to the west, with formations picking up considerably in the western Caribbean.
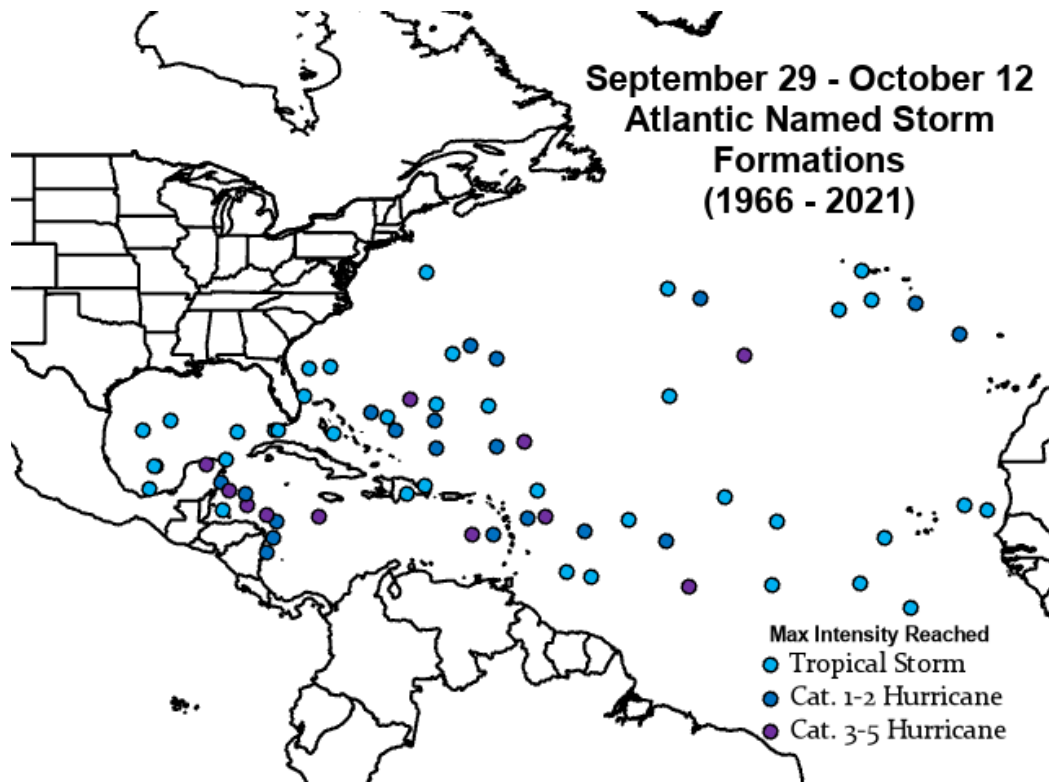
Figure 1: Atlantic named storm formations from September 29–October 12 during the years from 1966-2021 and the maximum intensity that these named storms reached.
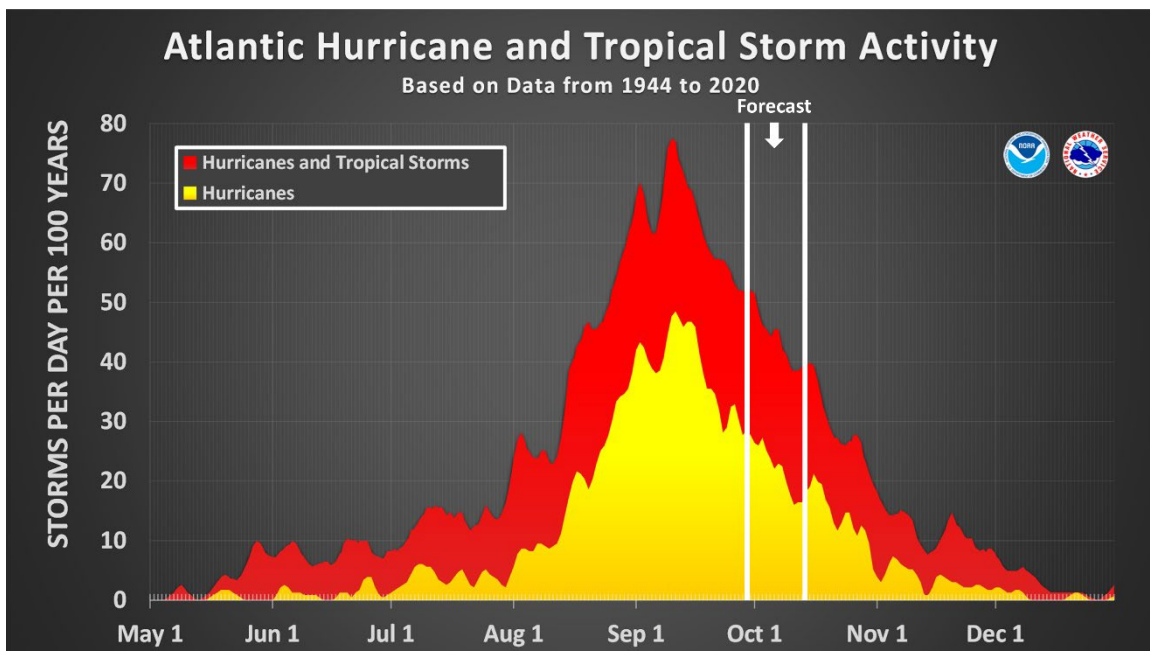

Figure 2: The current forecast period (September 29–October 12) with respect to climatology. Figure courtesy of NOAA.

We now examine how we believe each of the five factors discussed in the introduction will impact Atlantic TC activity for the period from September 29–October 12.

1) Current Storm Activity

Tropical Storm Ian has just emerged off of the east coast of Florida. It is forecast to intensify back to a hurricane and then turn back to the northwest, likely making landfall as a hurricane in South Carolina. Given that our forecast verification period begins at 0 UTC on 29 September, Ian should likely get us close to the normal category of ACE by itself, which is why the below-normal category has such a low probability of verifying.

2) National Hurricane Center Tropical Weather Outlook

The latest NHC Tropical Weather Outlook does not show any areas for potential TC development in the next five days (Figure 3).
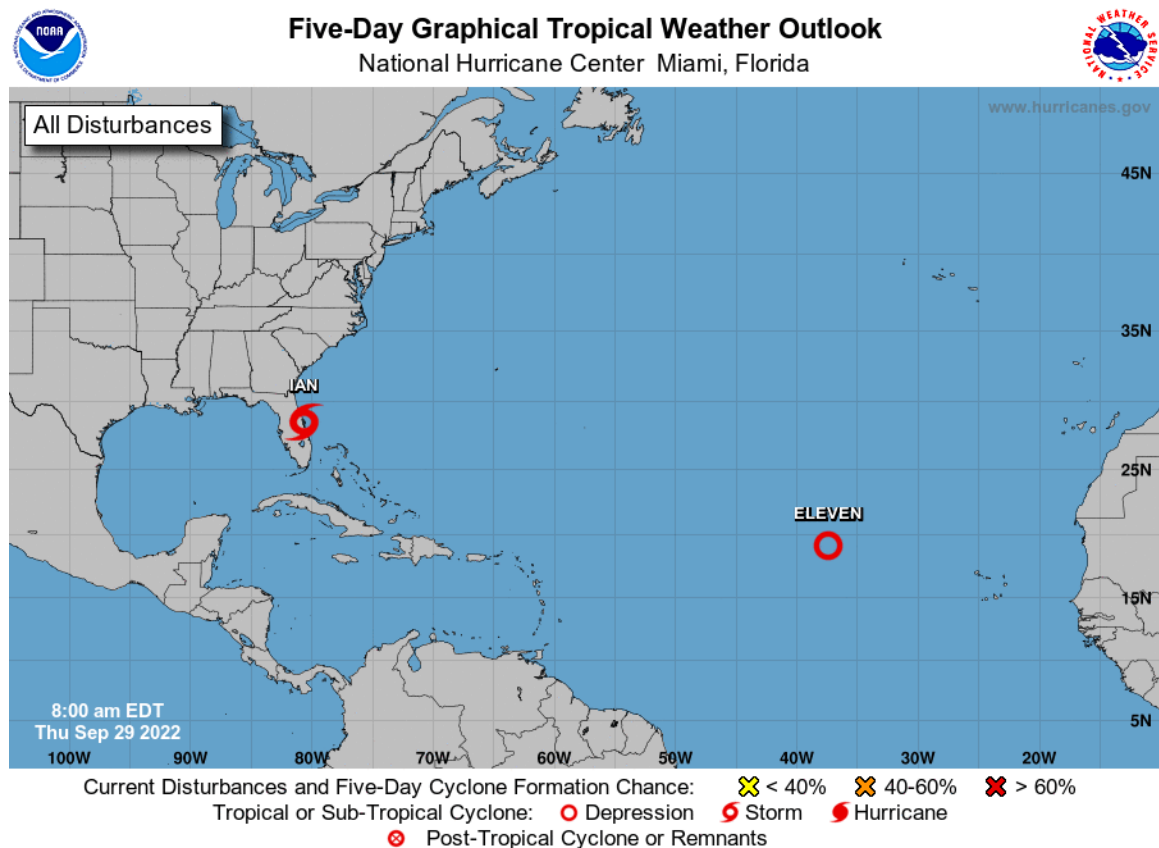

Figure 3: Latest tropical weather outlook from the National Hurricane Center.

3) Global Model Analysis

Both the ECMWF (Figure 4) and GFS (Figure 5) ensembles have much more vigorous support than yesterday for development of a tropical wave that has recently exited the coast of West Africa. Both model ensembles indicate potential development in the Caribbean in about ~10 days as well. Vertical wind shear is forecast to be at least marginally conducive for both of those systems. We do note that model support for the tropical Atlantic system was quite a bit weaker yesterday, and it is also getting late in the season climatologically for storms to form in the eastern Atlantic.
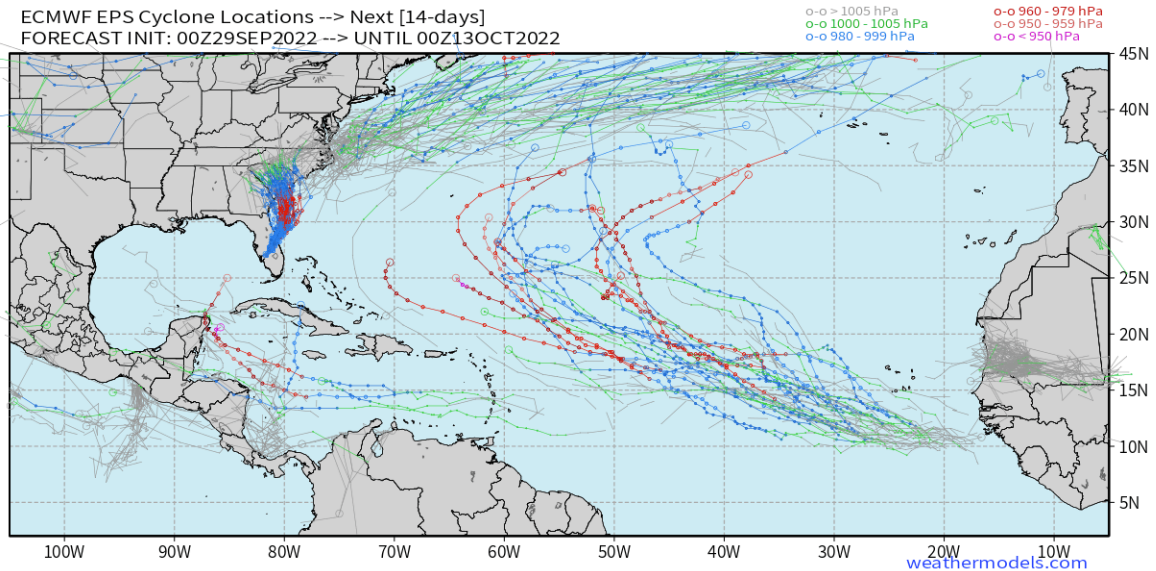

Figure 4: Cyclone locations from the ECMWF EPS ensemble for the next two weeks. Figure courtesy of weathermodels.com

o-o > 1010 hPa
o-o 1000 - 1010 hPa
o-o 980 - 999 hPa
o-o 960 - 979 hPa
o-o 950 - 959 hPa
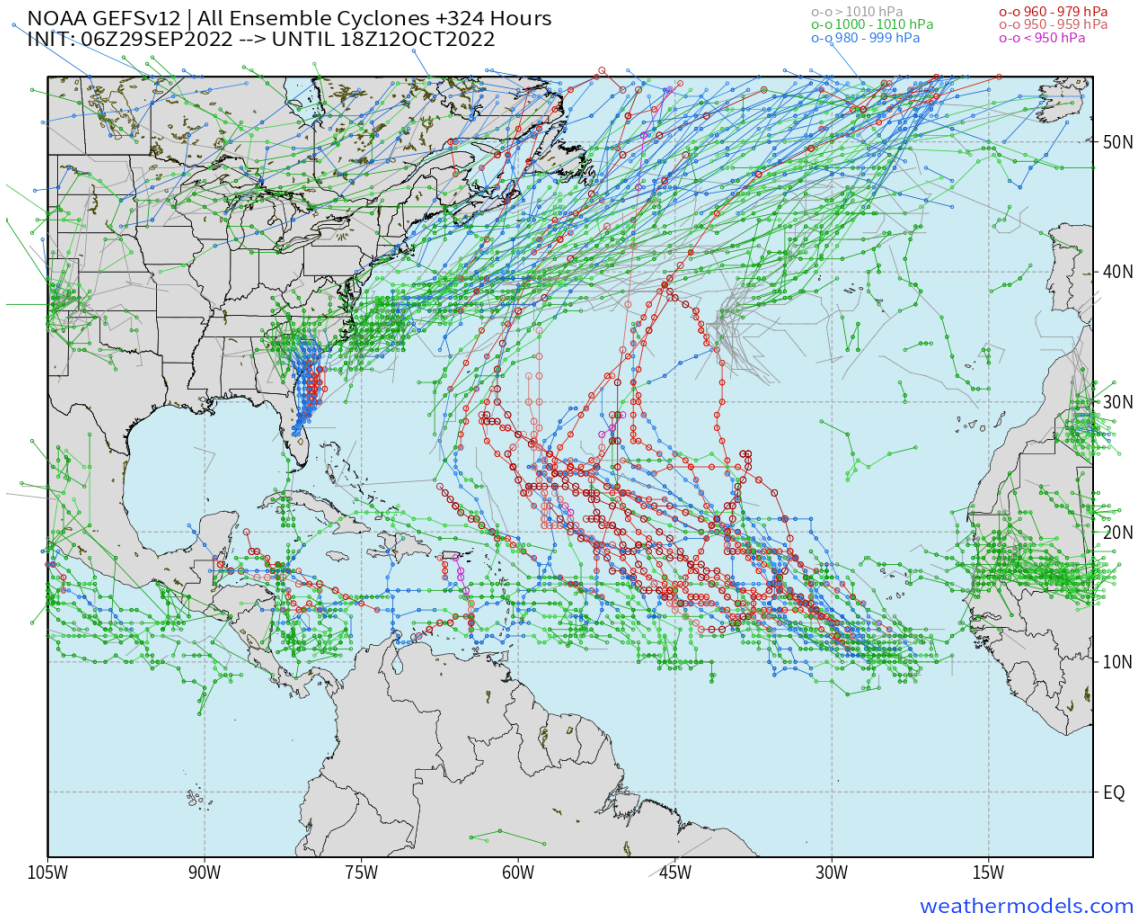o-o < 950 hPa

weathermodels.com

Figure 5: Cyclone locations from the GFS ensemble for the next two weeks. Figure courtesy of weathermodels.com

4) Madden-Julian Oscillation

The Madden-Julian oscillation (MJO), as measured by the Wheeler-Hendon index, is currently weak. The ECMWF model is aggressive at calling for the MJO to amplify in phases 4-5 over the next two weeks (Figure 6). These phases are typically associated with near average Atlantic hurricane activity.

The Climate Forecast System (CFS) model is generally predicting near-average vertical wind shear across the tropical Atlantic and Caribbean over the next week (Figure 7), with above-normal shear in the tropical Atlantic likely associated with the MJO propagating into less conducive phases for Atlantic hurricane formation. Caribbean shear is broadly forecast to be below-normal for the next two weeks, likely due to the background La Niña state. Weaker vertical wind shear is favorable for Atlantic TC formation and intensification.
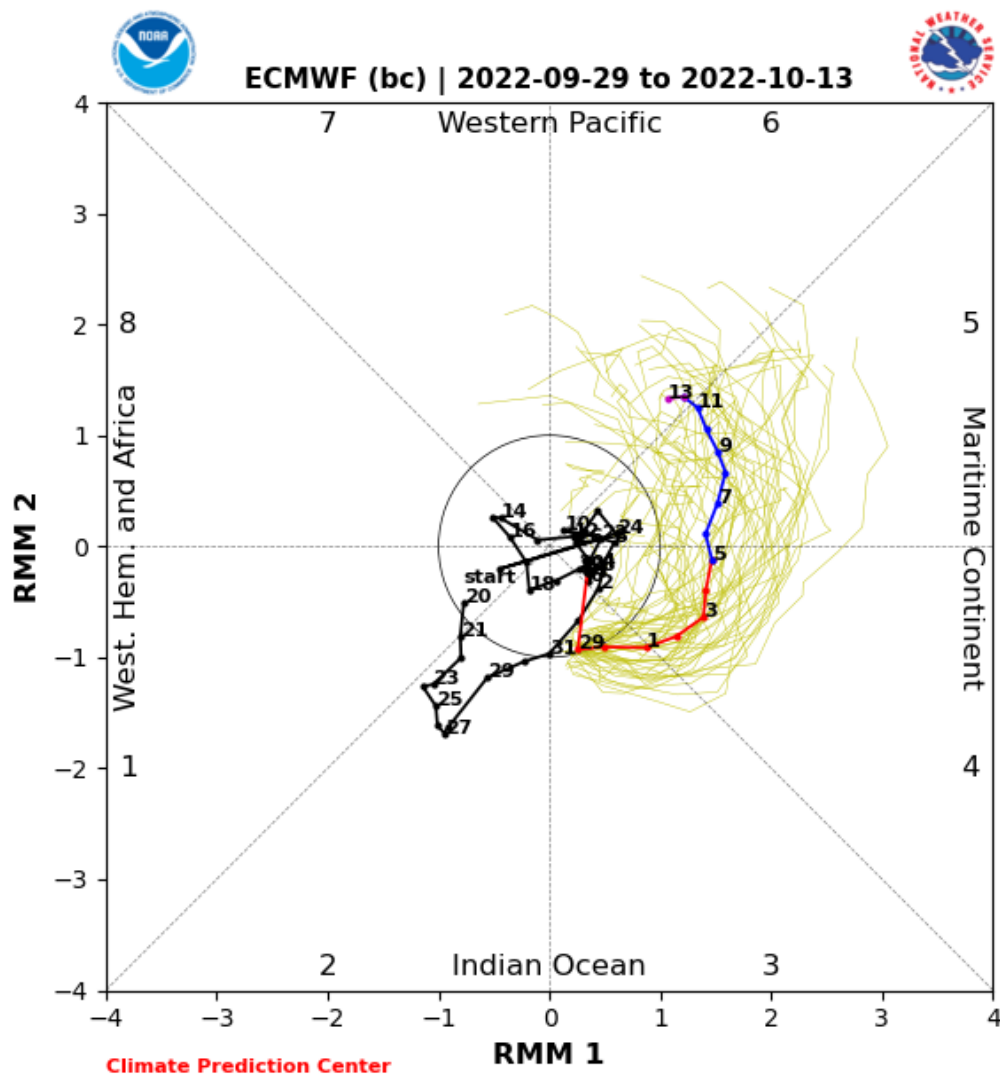
Figure 6: Predicted propagation of the MJO by the ECMWF model (bias-corrected). Figure courtesy of NOAA.
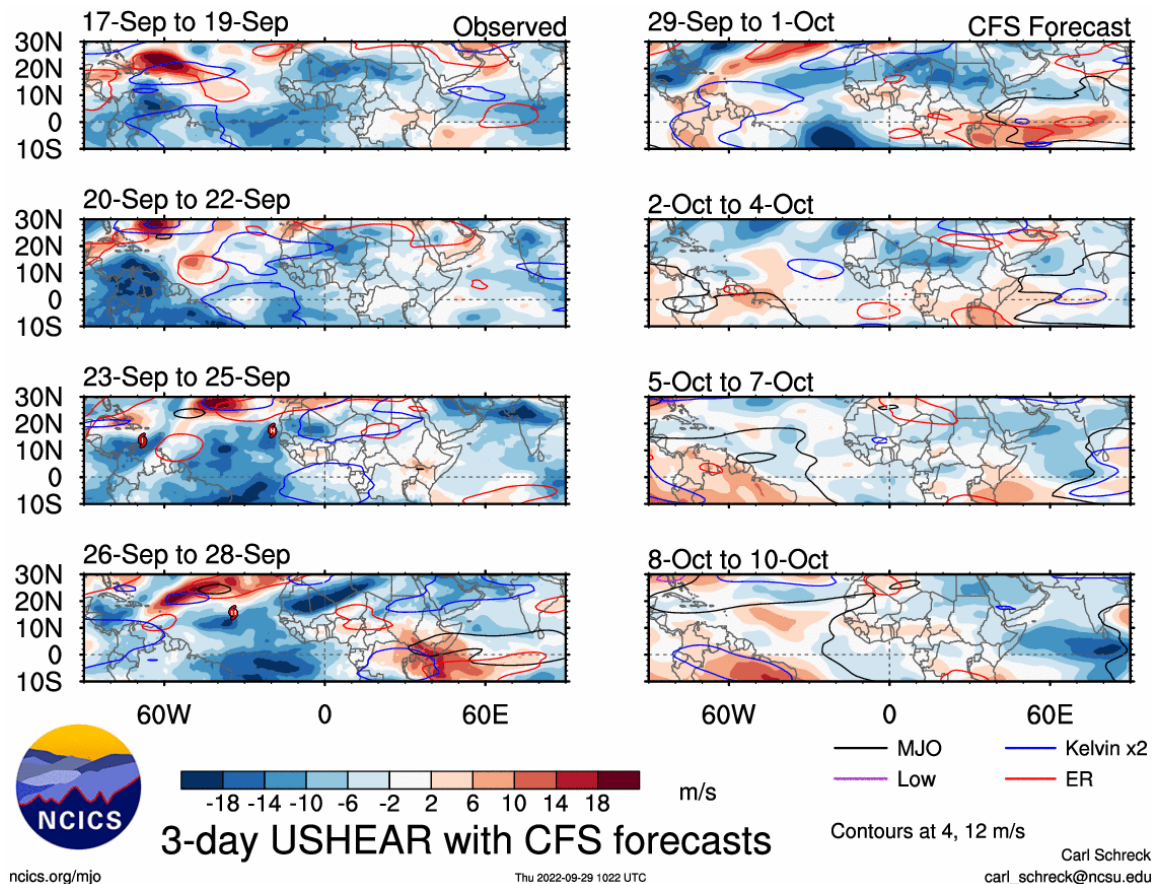
Figure 7: Observed and predicted anomalous 200 minus 850 hPa vertical wind shear from the Climate Forecast System through October 10. Figure courtesy of Carl Schreck.

5) Seasonal Forecast

The most recent seasonal forecast called for an above-average season. While the season started very slowly, the season has really ramped up in September, with activity now at near-average levels through late September.

3   Upcoming Forecasts

The final two-week forecast of 2022 will be issued on October 13 for the October 14–27 period.

VERIFICATION OF SEPTEMBER 15–28 FORECAST

The two-week forecast of tropical cyclone activity from September 15–28 verified in the above-normal category (>26 ACE). A total of 45 ACE was observed during the two-week period. We assigned a probability of 50% for above normal ACE given Fiona's forecast track and intensity as well as what looked like TC-favorable large-scale conditions. Those TC-favorable conditions verified, and we had three additional named storm formations during the two-week period. Obviously Hurricane Ian was by far the most notable of those three named storms. During the two-week period, Fiona generated 26 ACE, Ian generated 13 ACE, Gaston generated 5 ACE, while Hermine generated <1 ACE.

Table 3 displays the percentage chance that we gave for each category being reached and observed ACE.

Table 3: ACE forecast for TC activity for September 15–28, the probability assigned for each category being reached and observed ACE.

ACE Category	Definition	Probability in each Category	Observed ACE
Above-Normal	Upper Tercile (>26 ACE)	50%	45
Normal	Middle Tercile (10–26 ACE)	40%	
Below-Normal	Lower Tercile (<10 ACE)	10%	

COLORADO STATE UNIVERSITY FORECAST OF OCTOBER-NOVEMBER CARIBBEAN ACE

In 2011, we published a paper detailing a model that forecast October-November Caribbean hurricane days (Klotzbach 2011) using the state of ENSO and sea surface temperatures in the western tropical Atlantic and Caribbean. In an analysis of a recently published article on the October-November portion of the 2021 Atlantic hurricane season (Klotzbach et al. 2022), we revised the model slightly to use the ENSO Longitude Index (Williams and Patricola 2018) to assess the state of ENSO.

For this outlook, we use SSTs from the ERA5 reanalysis to estimate the strength of the Atlantic warm pool, while Christina Patricola has kindly provided an estimated value of the ENSO Longitude Index using daily NOAA OI SSTs. We find that using three-month averages optimizes the hindcast skill of this model over the period from 1979-2019. Table 4 displays the locations and time periods of the predictors, their standardized values relative to 1991-2020 and their effect on October-November Caribbean ACE.

For 2022, the ENSO Longitude Index is quite negative, indicating a robust La Niña event. The Atlantic warm pool is slightly warmer than normal. These two predictors, in combination, favor an active end to the Atlantic hurricane season in the Caribbean.

Table 4: Listing of predictors of October-November Caribbean ACE. A plus (+) means that positive deviations of the parameter indicate increased October-November Caribbean ACE this year, and a minus (-) means that positive deviations of the parameter indicate decreased October-November Caribbean ACE this year.

Predictor	Values for 2021 Forecast	Effect on Oct-Nov Caribbean ACE
1) July-September ENSO Longitude Index (-)	-1.2 SD	Enhance
2) July-September SST (10-20°N, 85-50°W) (+)	+0.3 SD	Slightly Enhance

These two predictors are then combined in a rank regression model to forecast October-November Caribbean ACE. The model shows hindcast correlation skill of 0.80 over the period from 1979-2021 (Figure 8).
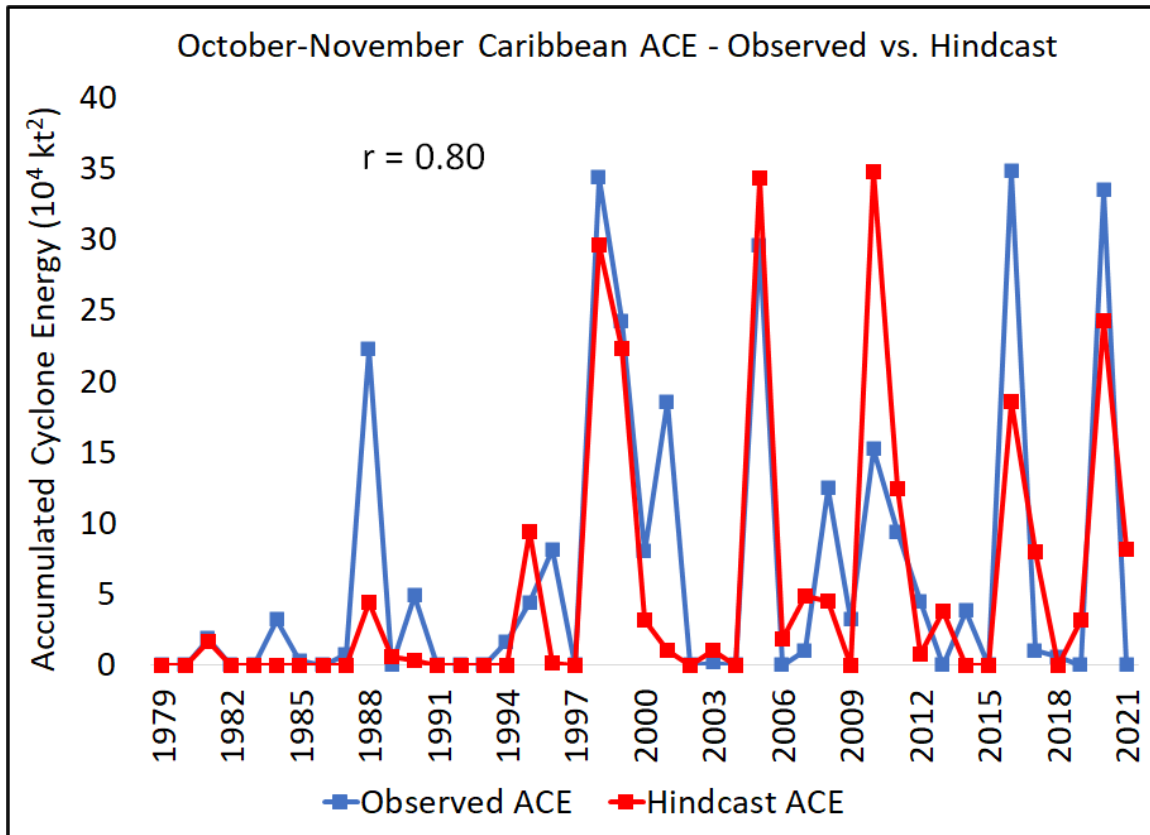
Figure 8: Observed vs. hindcast October-November Caribbean from 1979-2020.

As you can see from the above graph, Caribbean ACE is strongly positively skewed with several years having 0 ACE in the Caribbean during October-November, while other years (such as last year) having over 30 ACE. The median 1991-2020 ACE is 2, while the mean 1991-2020 ACE is 8.

The final forecast for October-November Caribbean ACE in 2022 is 15, which is well above the average and median ACE for the two-month period.

References

Klotzbach, P. J., 2011: Forecasting October-November Caribbean hurricane days. *J. Geophys. Res.,* **116,** D18117, doi:10.1029/2011JD016146.

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