COLORADO STATE UNIVERSITY FORECAST OF ATLANTIC HURRICANE ACTIVITY FROM SEPTEMBER 1–14, 2022

We believe that the most likely category for Atlantic hurricane activity in the next two weeks is normal (70%), with above-normal (25%) and below-normal (5%) being less likely.

(as of 1 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 1–14 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 1–14, 2022.

Parameter	Definition	Probability in Each Category
Above-Normal	Upper Tercile (>32 ACE)	25%
Normal	Middle Tercile (12–32 ACE)	70%
Below-Normal	Lower Tercile (<12 ACE)	5%

2   Forecast

We believe that the next two weeks have the highest probability to be in the normal tercile (12–32 ACE). Tropical Storm Danielle has formed west of the Azores and is forecast to become a hurricane in a couple of days. The National Hurricane Center currently is also monitoring two areas for tropical cyclone development in the next five days. The Madden-Julian oscillation (MJO) is forecast to be weak over the next two weeks, with tropical variability primary dominated by shorter-term variability associated with convectively-coupled Kelvin waves.

Figure 1 displays the formation locations of tropical cyclones from September 1–14 for the years from 1966–2021, along with the maximum intensities that these storms reached. Figure 2 displays the September 1–14 forecast period with respect to climatology. This period typically marks the climatological peak of the Atlantic hurricane season. The primary threat formation area for major hurricanes in early- to mid-September is in the eastern and central tropical Atlantic.
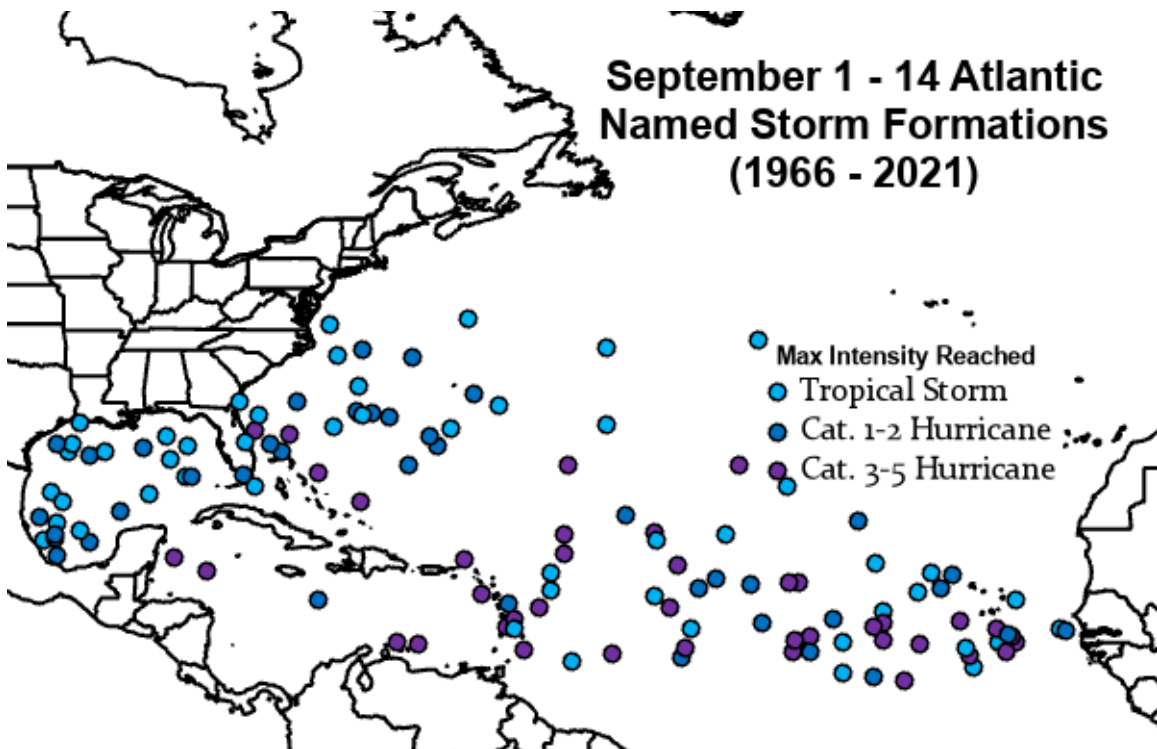
Figure 1: Atlantic named storm formations from September 1–14 during the years from 1966–2021 and the maximum intensity that these named storms reached.
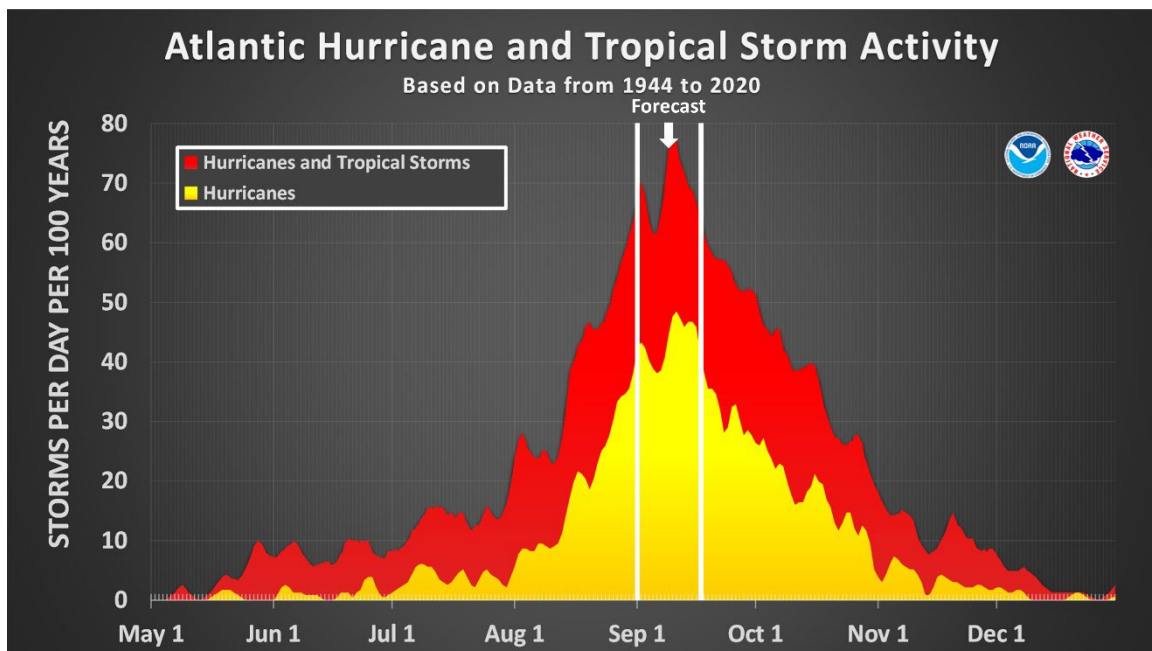

Figure 2: The current forecast period (September 1–14) with respect to climatology. Figure courtesy of NOAA.

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 1–14.

1) Current Storm Activity

Danielle has formed in the North Atlantic, west of the Azores. The storm is forecast to become a hurricane in a couple of days. The current National Hurricane Center five-day forecast for Danielle yields ~9 ACE, with some additional ACE potentially generated by the storm before it becomes post-tropical.

2) National Hurricane Center Tropical Weather Outlook

The latest NHC Tropical Weather Outlook has two areas that are highlighted for potential TC formation. A region in the central tropical Atlantic (Invest 91L) has a 80% chance of TC development in the next five days, while an area in the eastern tropical Atlantic (Invest 94L) has a 30% chance of TC development in the next two days, before encountering TC-unfavorable conditions (Figure 3). Any ACE generated by Invest 94L would be minimal, while Invest 91L could generate moderate levels of ACE if it were to develop.
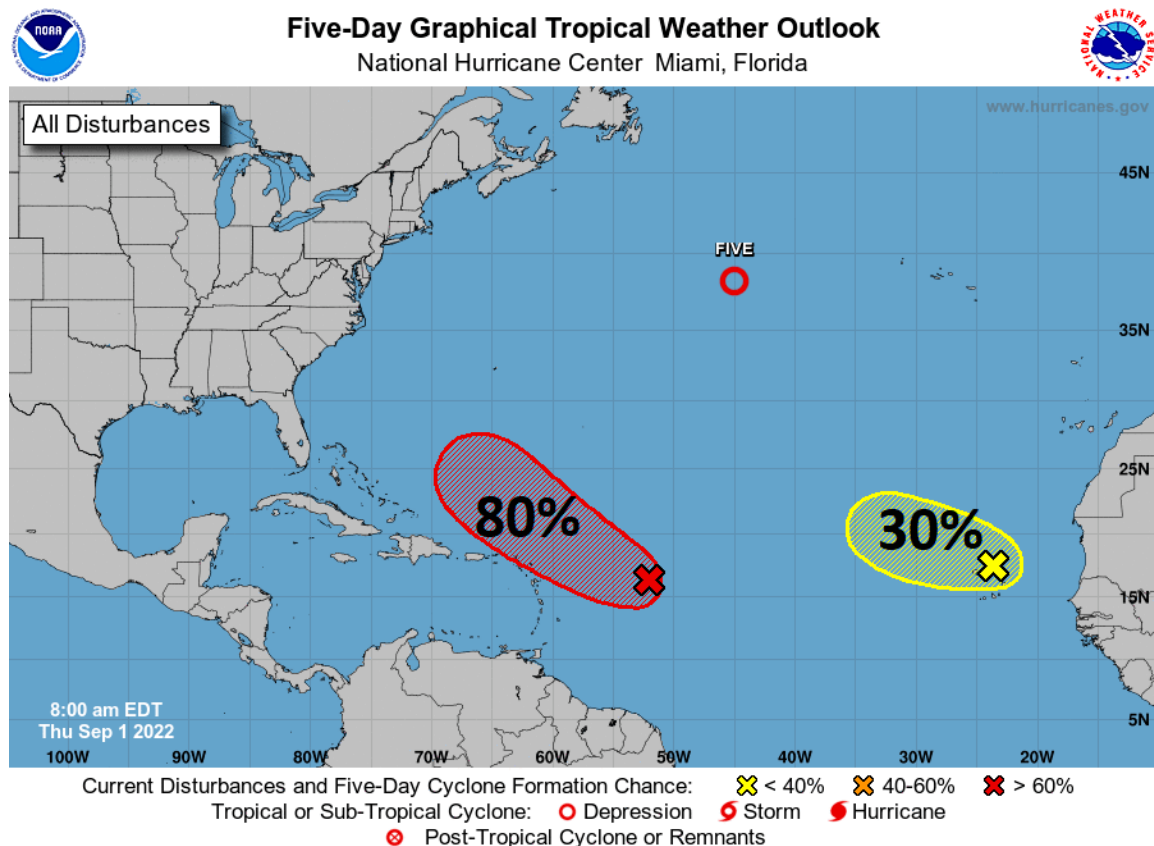

Figure 3: Latest tropical weather outlook from the National Hurricane Center.

3) Global Model Analysis

Both the ECMWF (Figure 4) and GFS (Figure 5) ensembles have some support for development of 91L, with both the operational and ensemble runs from GFS being more aggressive with its development. A tropical wave is forecast to move off of Africa in ~5-6 days, and the ECMWF ensemble is generally more robust with its development than the GFS. Given it is the climatological peak of the season and environmental conditions look modestly conducive for its development and intensification, especially in the eastern Atlantic, we think that formation of this system is relatively likely.
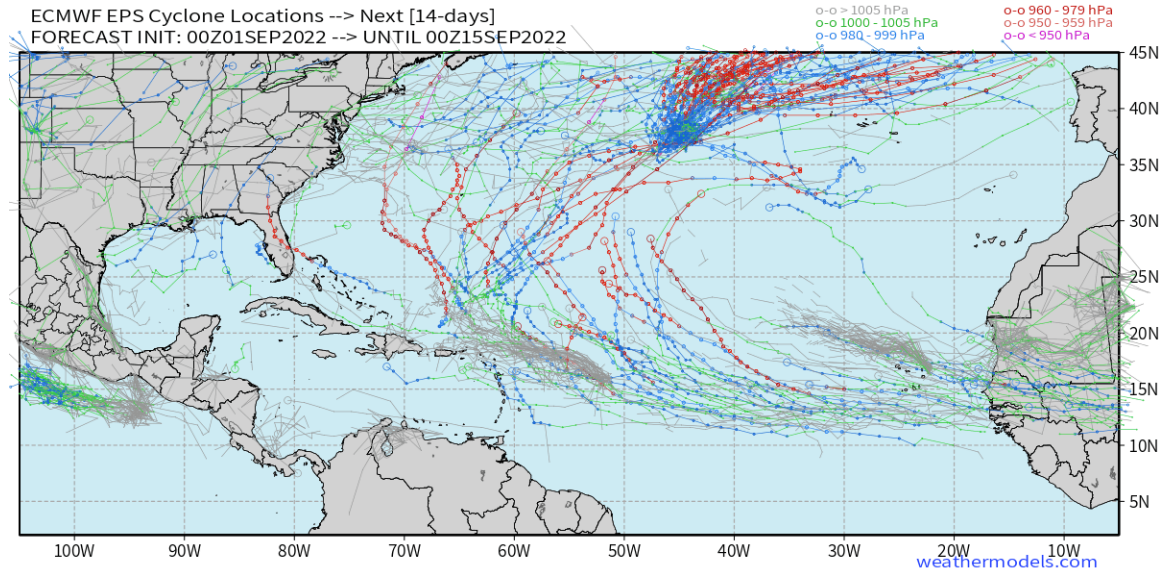

Figure 4: Cyclone locations from the ECMWF EPS ensemble for the next two weeks. Figure courtesy of weathermodels.com

NCEP GEFSv12 Ensemble Cyclones +330 Hours
INIT: 06Z01SEP2022 --> UNTIL 00Z15SEP2022

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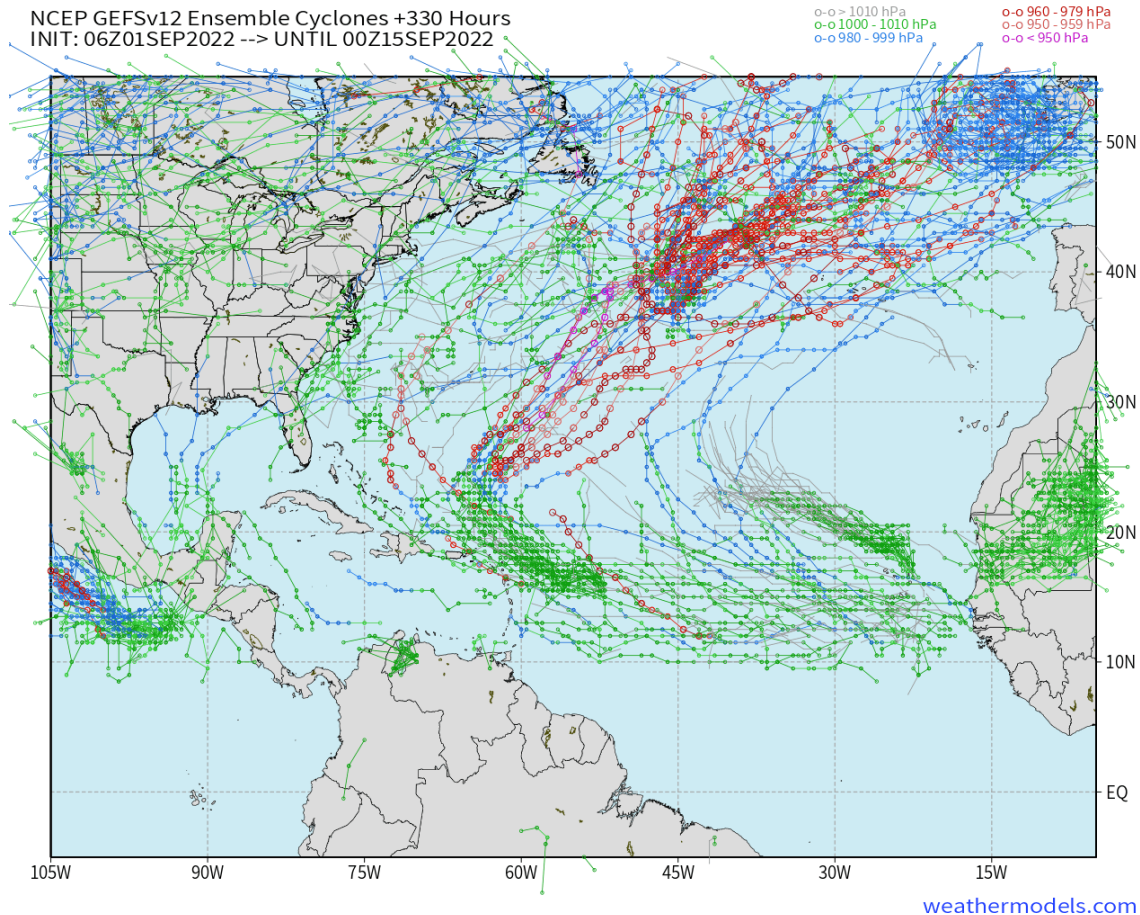o-o 950 - 959 hPa
o-o < 950 hPa

weathermodels.com

Figure 5: Cyclone locations from the GFS ensemble (GEFS) 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 in phase 2 over Africa. The MJO is forecast to quickly propagate eastward at a relatively weak magnitude (Figure 6). This rapid eastward propagation is likely imprints of a convectively-suppressed phase of an atmospheric Kelvin wave (Figure 7). While the suppressed phase of the Kelvin wave will negatively impact Atlantic TC formation changes in the tropical Atlantic in the short term, the enhanced phase of the Kelvin wave may be propagating across the Atlantic at about the time that the next African easterly wave emerges in ~5-6 days, potentially favoring its development.

The Climate Forecast System (CFS) model is generally predicting near to slightly above-normal shear over the tropical Atlantic and Caribbean over the next two weeks (Figure 8). This increased shear is likely due to a vigorous tropical upper-tropospheric trough which has been one of the primary reasons why the Atlantic hurricane season has not been as active as projected.
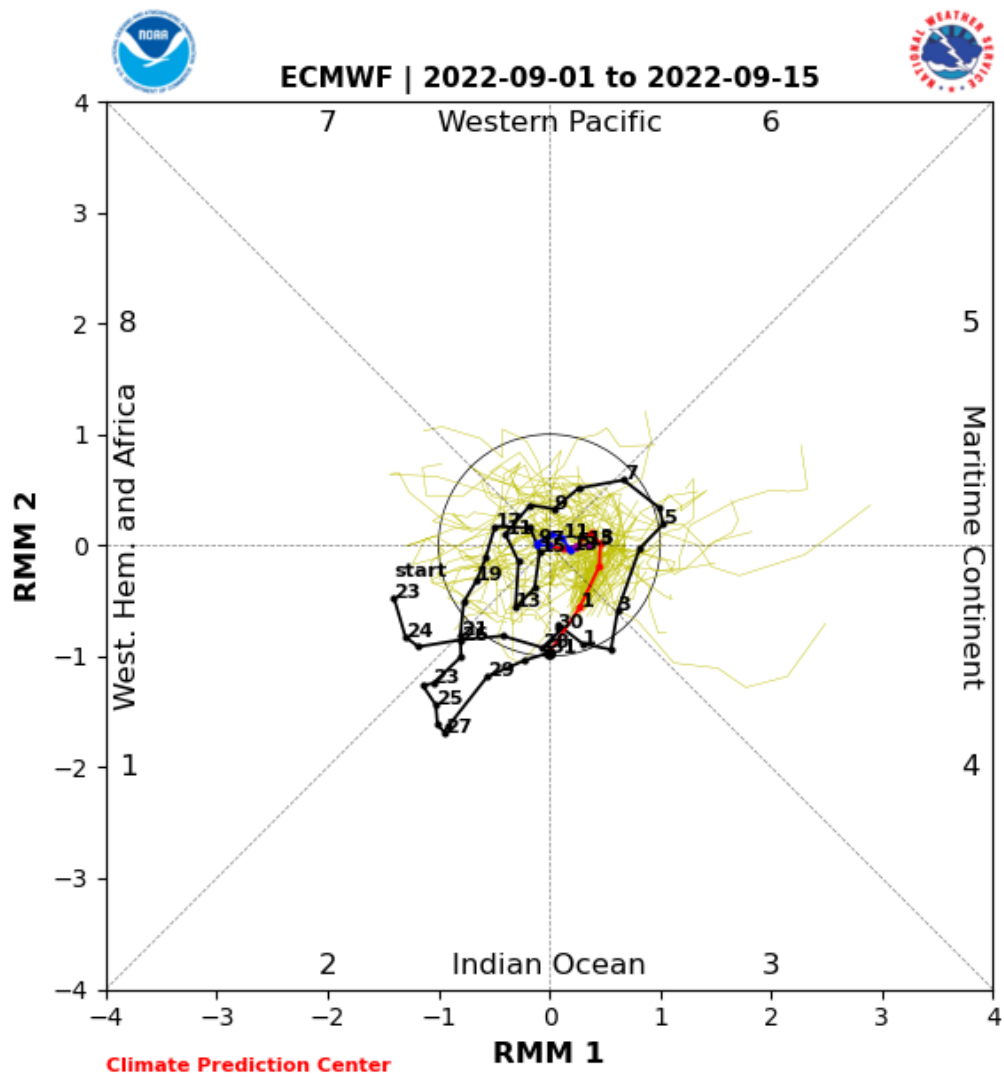
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Figure 6: Predicted propagation of the MJO by the ECMWF model. Figure courtesy of NOAA.
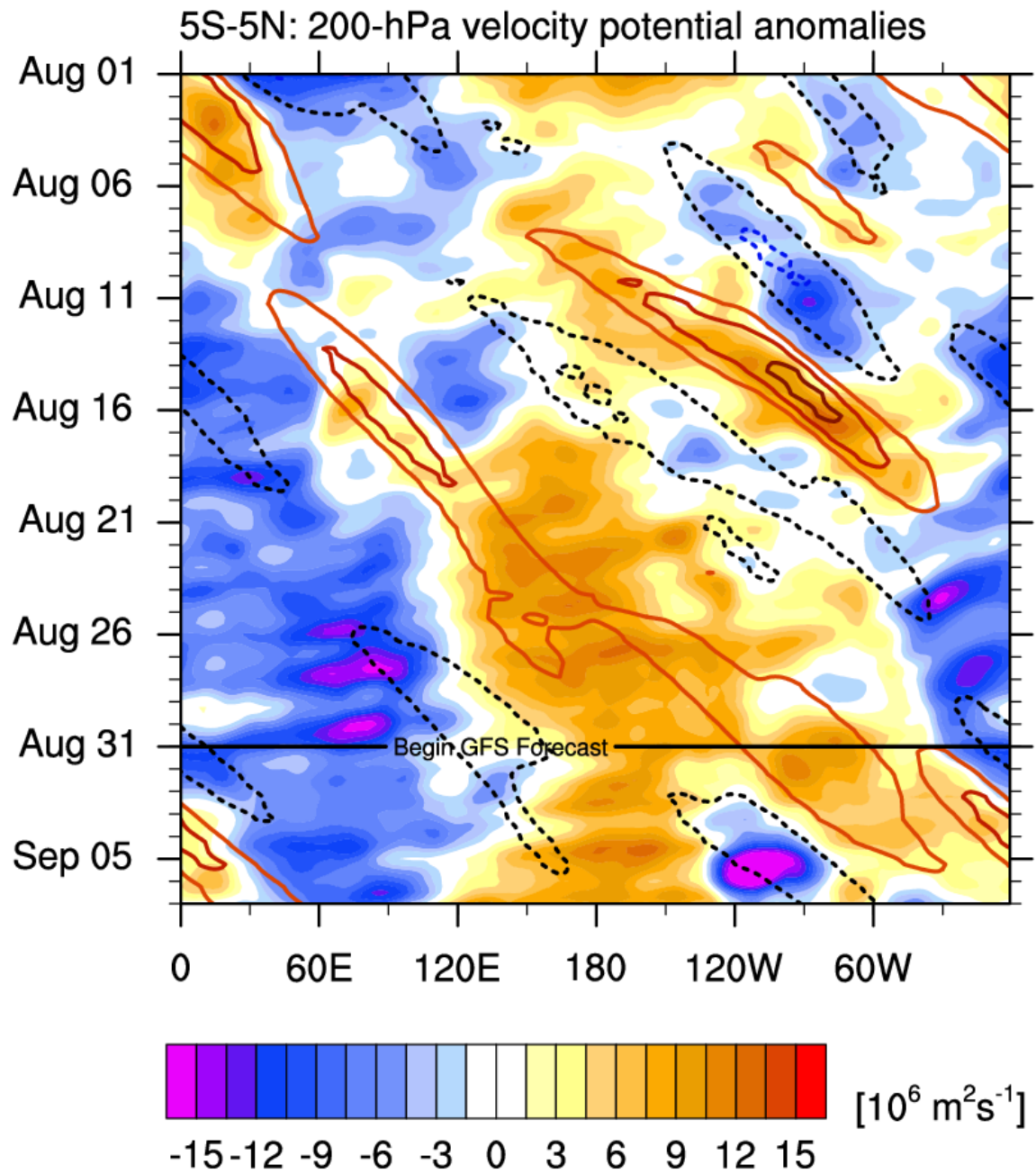
Figure 7: Observed Kelvin-wave filtered 200-hPa velocity potential anomalies and forecast velocity potential anomalies from the Global Forecast System.
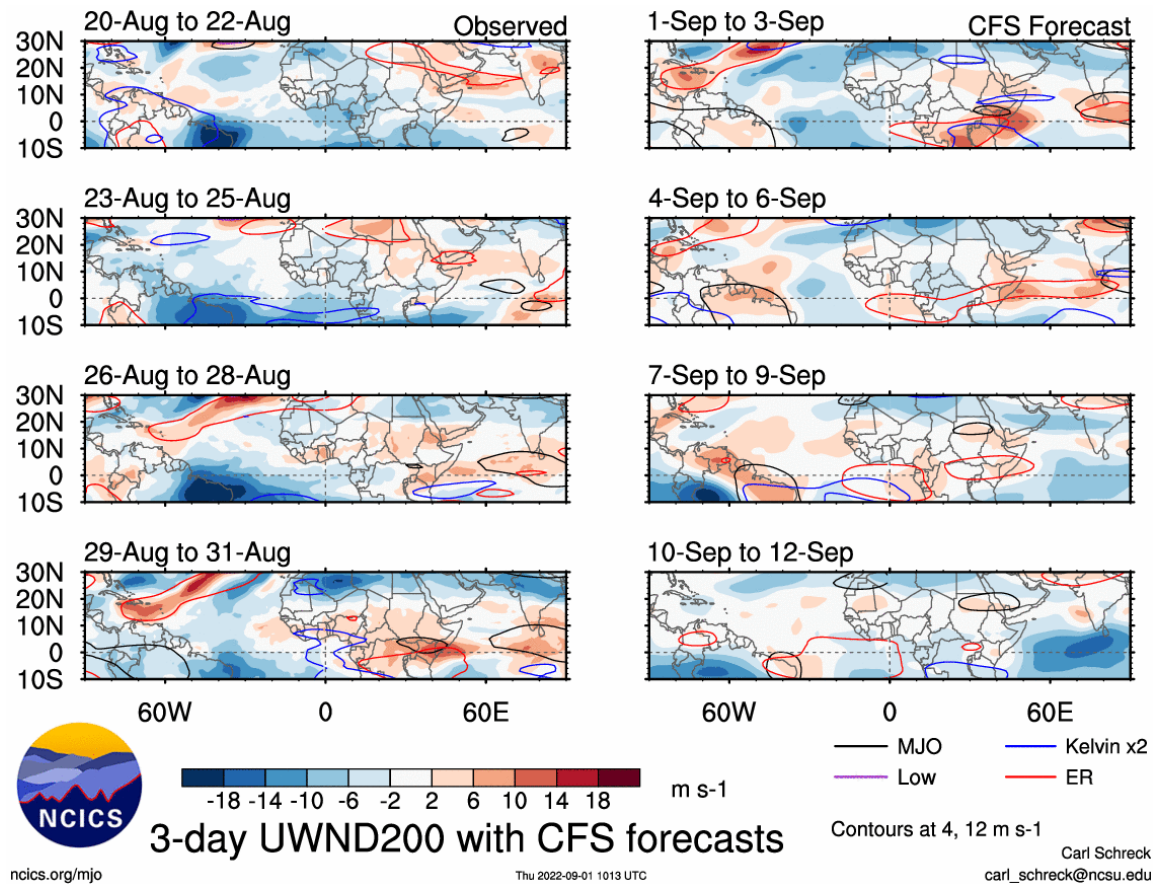
Figure 7: Observed and predicted anomalous 200 minus 850 hPa vertical wind shear from the Climate Forecast System through September 12. Figure courtesy of Carl Schreck.

5) Seasonal Forecast

The most recent seasonal forecast calls for an above-average season. However, the season has been much quieter than anticipated, likely due to a combination of relatively strong shear and drier mid levels across the tropical Atlantic and Caribbean, driven by an anomalously strong tropical upper tropospheric trough.

3   Upcoming Forecasts

The next two-week forecast will be issued on September 15 for the September 15–28 period. Additional two-week forecasts will be issued on September 29 and October 13.

VERIFICATION OF AUGUST 18–31 FORECAST

No Atlantic named storms occurred during the two-week period.

Table 2 displays the percentage chance that we gave for each category being reached and observed ACE.

Table 2: ACE forecast for TC activity for August 18–31, the probability assigned for each category being reached and observed ACE.

ACE Category	Definition	Probability in each Category	Observed ACE
Above-Normal	Upper Tercile (>21 ACE)	15%	
Normal	Middle Tercile (7–21 ACE)	70%	
Below-Normal	Lower Tercile (<7 ACE)	15%	0