

**COLORADO STATE UNIVERSITY FORECAST OF ATLANTIC HURRICANE
ACTIVITY FROM SEPTEMBER 2 – SEPTEMBER 15, 2021**

We expect that the next two weeks will be characterized by above-normal amounts of hurricane activity.

(as of 2 September 2021)

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In Memory of William M. Gray³

This discussion as well as past forecasts and verifications are available online at
<http://tropical.colostate.edu>

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1 Introduction

This is the 13th year that we have issued shorter-term forecasts of tropical cyclone activity (TC) 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 1966-2019 and defining above-normal, normal and below-normal two-week periods based on terciles. Since there are 54 years from 1966-2019, each tercile is composed of 18 years. The 18 years with the most active ACE periods from September 2 – September 15 are classified as the upper tercile, the 18 years with the least active ACE periods from September 2 – September 15 are classified as the lower tercile, while the remaining 18 years are classified as the middle tercile. Beginning with this outlook and moving forward, we now also include probabilities for ACE being in each tercile.

Table 1: ACE forecast definition for TC activity for September 2 – September 15, 2021.

Parameter	Definition	Probability in each Category
Above-Normal	Upper Tercile (>34 ACE)	90%
Normal	Middle Tercile (12–34 ACE)	10%
Below-Normal	Lower Tercile (<12 ACE)	<1%

2 Forecast

We believe that the most likely outcome (with high confidence) for the next two weeks is above-normal TC activity (>34 ACE). The primary reason for the above-normal forecast is that Hurricane Larry is likely to remain at hurricane strength for the next 7-9 days, generating ~30 ACE in the process. The National Hurricane Center is monitoring one area near Central America with a low chance of TC formation in the next 5 days. This system is relatively unlikely to form, and if it does so, its prospects to generate much ACE appear low. The ECMWF model is pretty aggressive at developing another TC off of Africa in about ten days. Following a suppression of additional TC formation in the next week due to a convectively-suppressed phase of a convectively-coupled Kelvin wave, the large-scale pattern broadly looks to remain quite conducive for Atlantic hurricane formation and intensification.

The Madden-Julian Oscillation (MJO) is currently located near the phase 2/3 border over the Indian Ocean and is predicted to generally be in phase 3 (albeit at a fairly weak magnitude) over the next two weeks. The latest large-scale forecast from the ECMWF continues to indicate enhanced vertical motion over Africa and the Indian

Ocean with suppressed vertical motion over the tropical Pacific, which typically favors Atlantic hurricane activity.

Figure 1 displays the formation locations of TCs from September 2 – September 15 for the years from 1966–2019 (e.g., the satellite era), along with the maximum intensities that these storms reached. Figure 2 displays the September 2 – September 15 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.

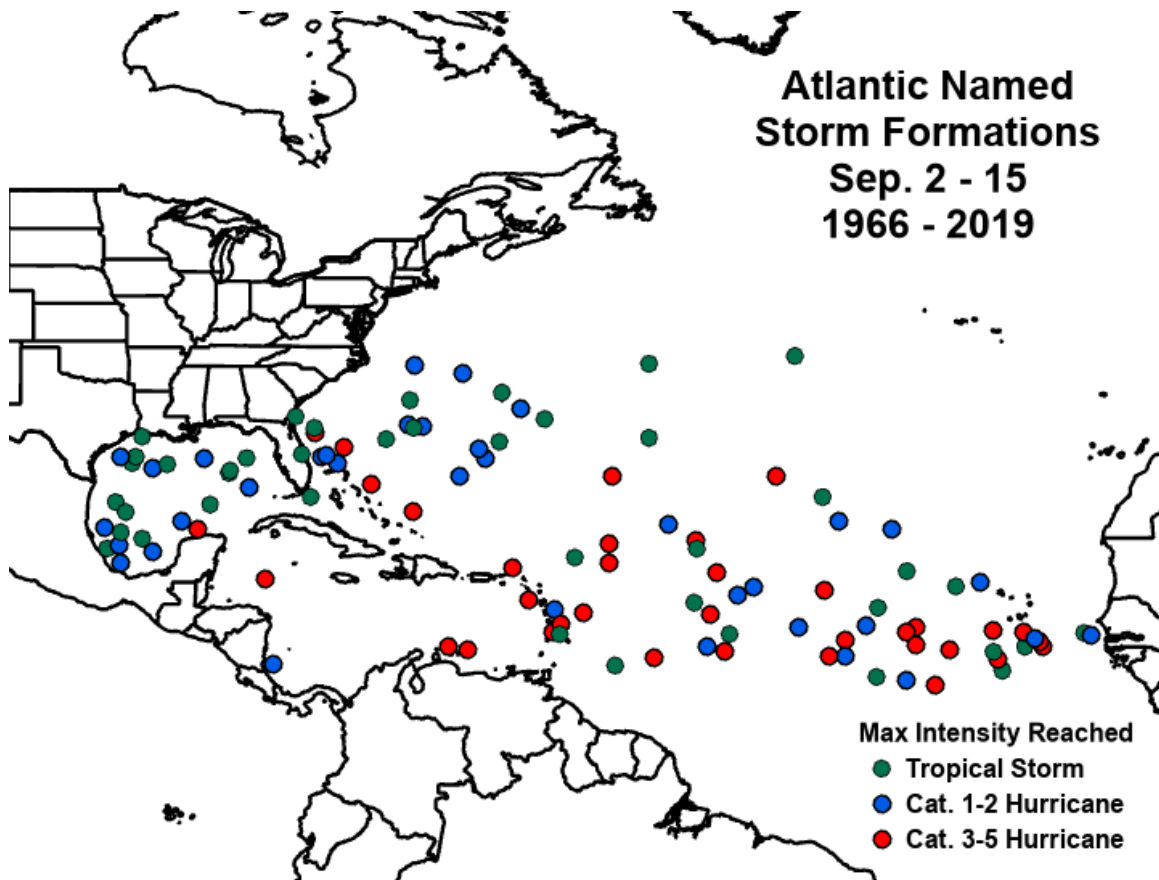


Figure 1: Atlantic named storm formations from September 2 – September 15 during the years from 1966-2019 and the maximum intensity that these named storms reached.

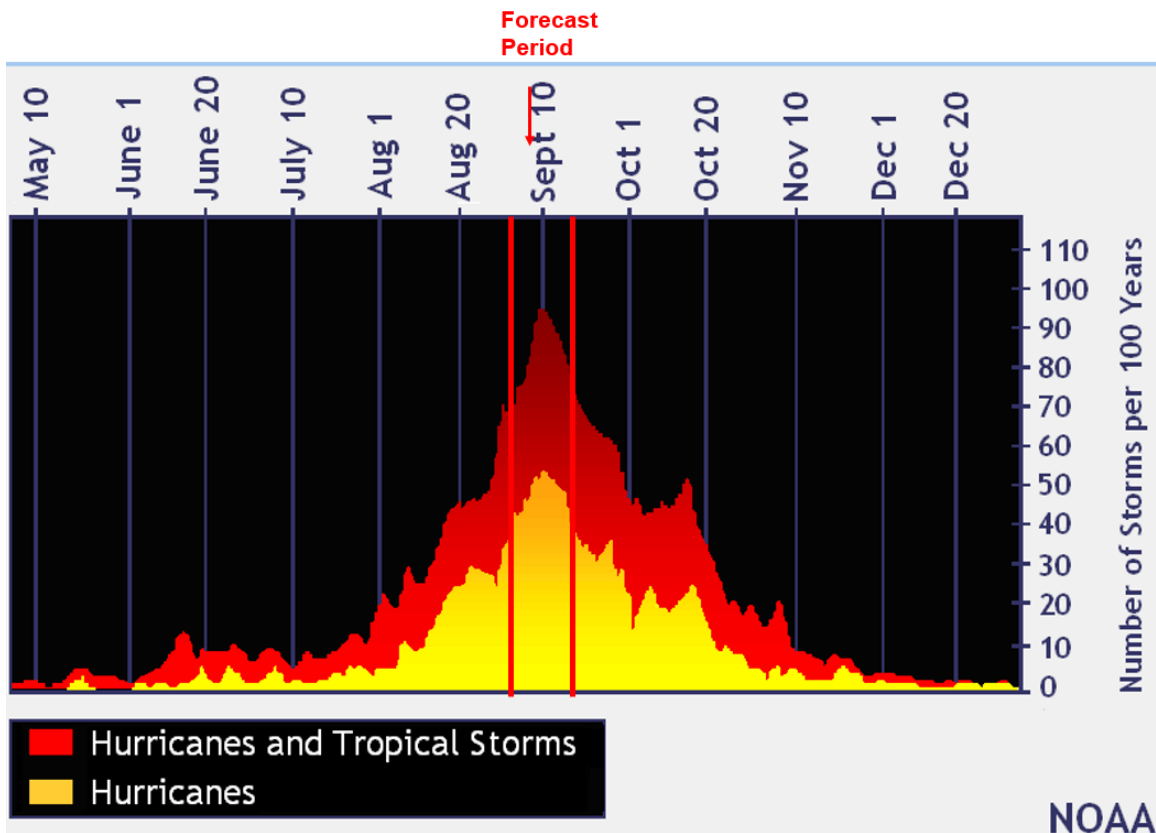


Figure 2: The current forecast period (September 2 – September 15) with respect to climatology. Figure courtesy of NOAA.

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 2 – September 15.

1) Current Storm Activity

Larry has just been upgraded to a hurricane and is forecast to intensify to a major hurricane in the next couple of days, and then persist at that intensity through at least day five. Most global models indicate a hurricane with a central pressure of ~945-960 hPa on days 6-7 which is typical for a major hurricane.

2) National Hurricane Center Tropical Weather Outlook

The latest NHC Tropical Weather Outlook has one area located near the coast of Central America with a low chance of TC formation in the next five days (Figure 3). This area does not look to generate significant levels of ACE if it does form. As noted by the National Hurricane Center, vertical wind shear in the southern Gulf of Mexico will likely be quite strong when the system emerges from land into the Gulf.



Five-Day Graphical Tropical Weather Outlook National Hurricane Center Miami, Florida

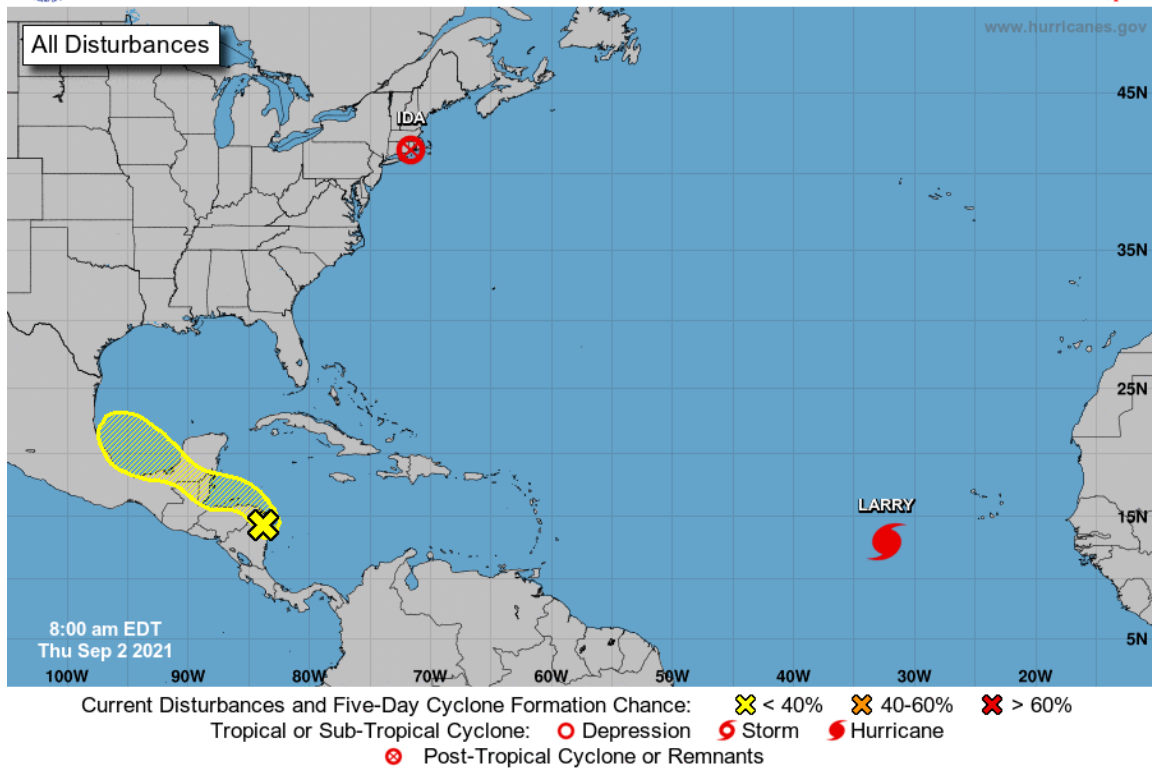


Figure 3: Current five-day Tropical Weather Outlook from the National Hurricane Center.

3) Global Model Analysis

The ECMWF ensemble is fairly aggressive with another African easterly wave-spawned TC emerging off of Africa in about ten days, with potentially another system following in that one's footsteps a few days later. The latest ensemble minimum MSLP output from ECMWF shows quite a few members with low pressure areas in fifteen days in the eastern tropical Atlantic (Figure 4).

ECMWF EPS Ensemble Perturbed Members Minimum MSLP [hPa]
Init: 00Z02SEP2021 -- [360] hr --> Valid Fri 00Z17SEP2021

MIN|MAX: 961.3 | 1021.4 hPa

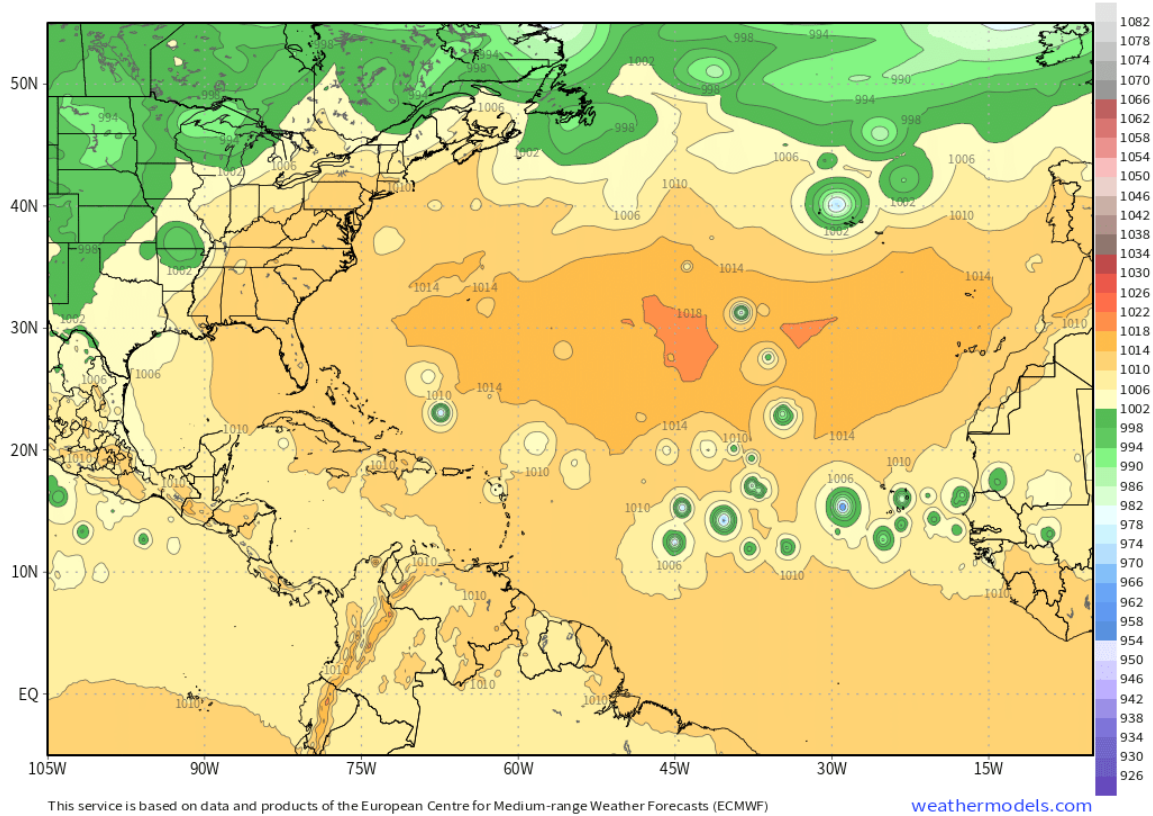


Figure 4: ECMWF ensemble minimum pressure values on 17 September. The ECMWF continues to highlight an active period for TCs in the eastern Atlantic.

4) Convectively-coupled Kelvin waves/Madden-Julian Oscillation

The chance for additional TC formation in the tropical Atlantic in the next 5-7 days looks relatively low given a suppressed phase of a convectively-coupled Kelvin wave propagating across the tropical Atlantic (Figure 5). These suppressed phases tend to stifle deep thunderstorm activity that is necessary for Atlantic TC formation.

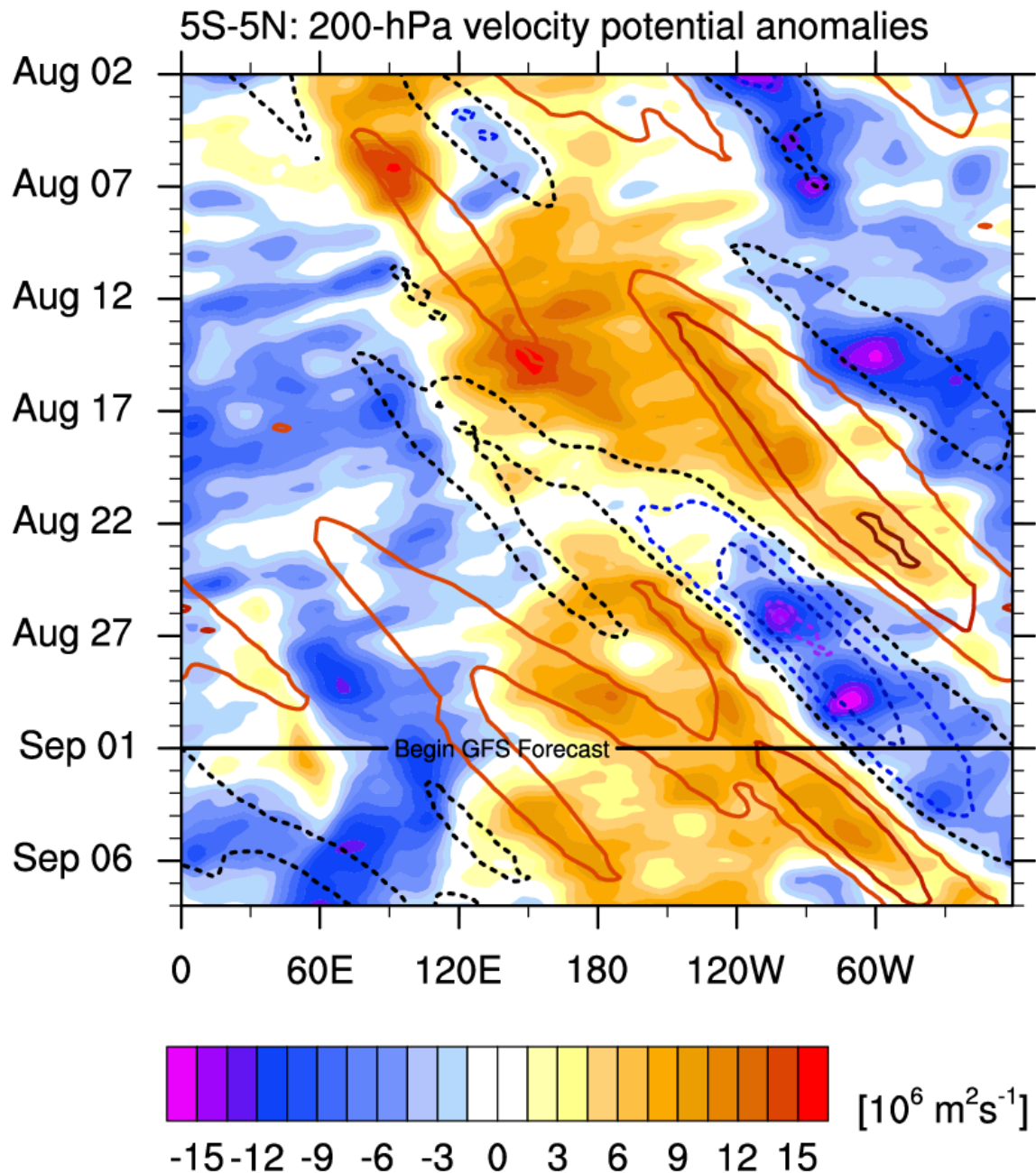


Figure 5: 200-hPa velocity potential anomalies with a Kelvin-wave filtered applied. Positive velocity potential anomalies indicate suppressed vertical motion, that typically stifles Atlantic TC formation. Figure courtesy of Mike Ventrice.

The Madden-Julian Oscillation (MJO), as measured by the Wheeler-Hendon index, is currently in phase 2/3 over the Indian Ocean. The MJO is forecast to propagate slowly through phase 3, although at a relatively weak magnitude for the next two weeks (Figure 6). Table 2 summarizes the typical MJO impacts on Atlantic TC activity. Phase 3 is typically associated with relatively favorable conditions for Atlantic TC formation. The forecast upper-level velocity potential field favors upward motion over Africa and the

Indian Ocean (especially in week two), with suppressed vertical motion over the tropical Pacific (Figure 7). This large-scale setup reduces vertical wind shear over the tropical Atlantic and Caribbean.

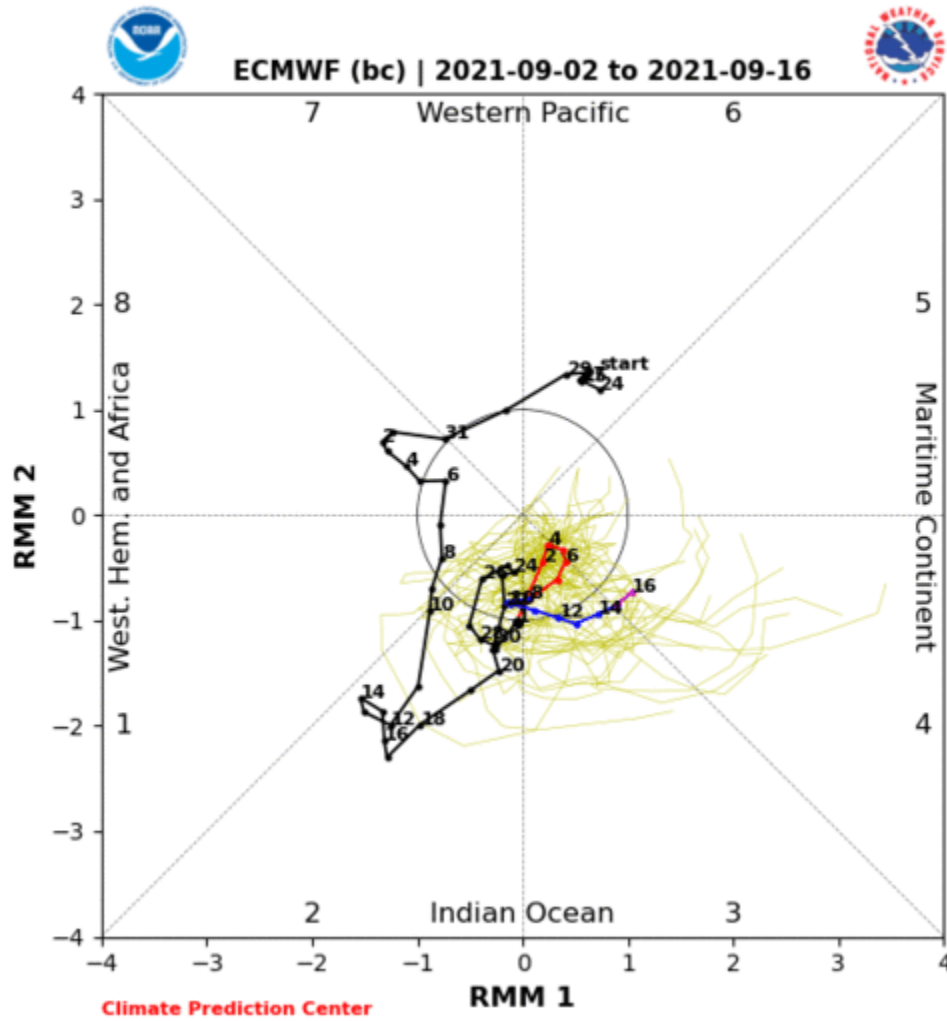


Figure 6: Predicted propagation of the MJO by the ECMWF model. Figure courtesy of NOAA.

Table 2: Normalized values of named storms (NS), named storm days (NSD), hurricanes (H), hurricane days (HD), major hurricanes (MH), major hurricane days (MHD) and Accumulated Cyclone Energy (ACE) generated by all tropical cyclones forming in each phase of the MJO over the period from 1974-2007. Normalized values are calculated by dividing storm activity by the number of days spent in each phase and then multiplying by 100. This basically provides the level of TC activity that would be expected for 100 days given a particular MJO phase.

MJO Phase	NS	NSD	H	HD	MH	MHD	ACE
Phase 1	6.4	35.9	3.7	17.9	1.8	5.3	76.2
Phase 2	7.5	43.0	5.0	18.4	2.1	4.6	76.7
Phase 3	6.3	30.8	3.0	14.7	1.4	2.8	56.0
Phase 4	5.1	25.5	3.5	12.3	1.0	2.8	49.4
Phase 5	5.1	22.6	2.9	9.5	1.2	2.1	40.0
Phase 6	5.3	24.4	3.2	7.8	0.8	1.1	35.7
Phase 7	3.6	18.1	1.8	7.2	1.1	2.0	33.2
Phase 8	6.2	27.0	3.3	10.4	0.9	2.6	46.8
Phase 1-2	7.0	39.4	4.3	18.1	1.9	4.9	76.5
Phase 6-7	4.5	21.5	2.5	7.5	1.0	1.5	34.6
Phase 1-2 / Phase 6-7	1.6	1.8	1.7	2.4	2.0	3.2	2.2

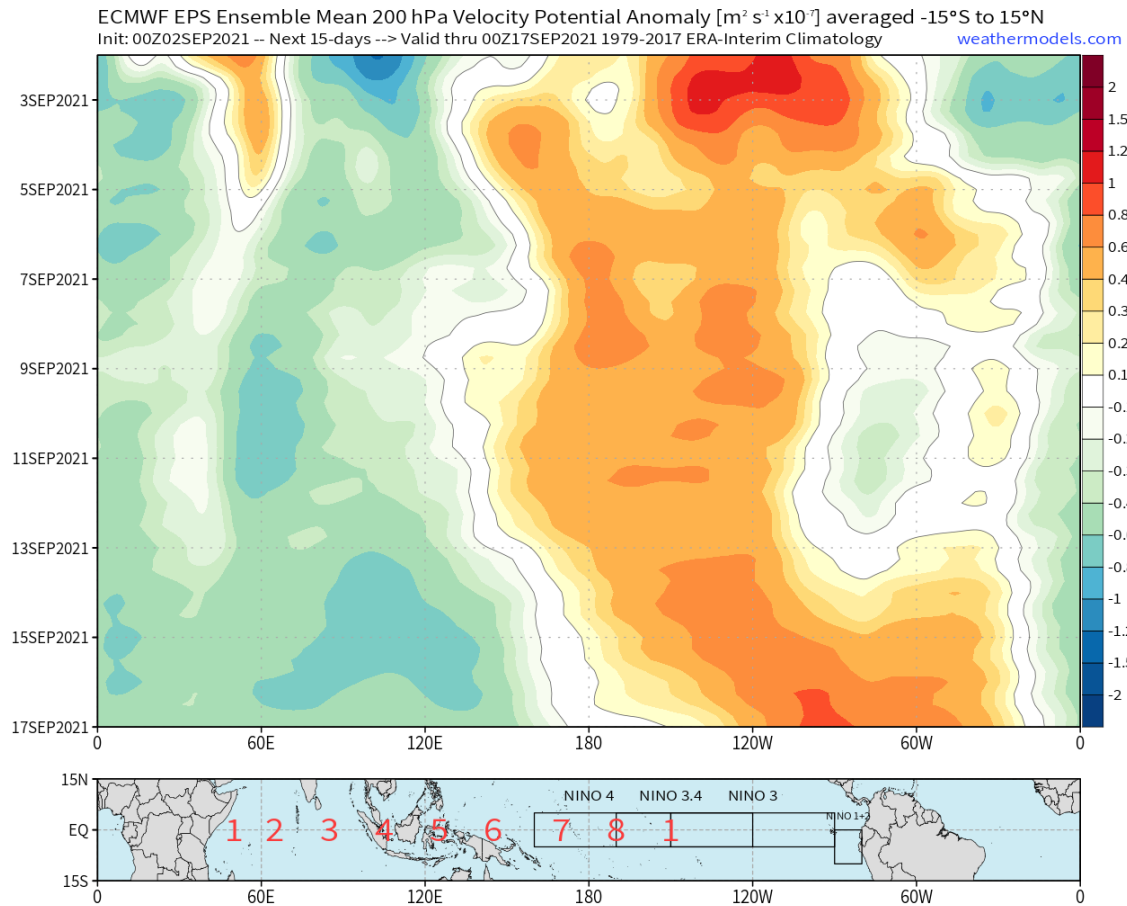


Figure 7: Ensemble mean forecast from the ECMWF model for 200 hPa velocity potential anomalies over the next 15 days.

5) Seasonal Forecast

The most recent seasonal forecast calls for an active season. The next two weeks look like they should generate above-normal activity.

3 Upcoming Forecasts

The next two-week forecast will be issued on September 16 for the September 16– 29 period. Additional two-week forecasts will be issued on September 30 and October 14.

VERIFICATION OF AUGUST 19–SEPTEMBER 1, 2021 FORECAST

The two-week forecast of tropical cyclone activity from August 19–September 1, 2021 verified in the above-normal category (~24 ACE), while near-normal ACE was predicted (11-22 ACE). Hurricane Ida generated the most ACE during the two-week period (10.8 ACE), while Grace (6.4 ACE), Henri (5.4 ACE), Kate (0.6 ACE), Larry (0.6 ACE) and Julian (0.5 ACE) also contributed.