COLORADO STATE UNIVERSITY FORECAST OF ATLANTIC HURRICANE ACTIVITY FROM OCTOBER 14 – OCTOBER 27, 2021

We believe that the most likely category for Atlantic hurricane activity in the next two weeks is normal (60%), with above-normal and below-normal both assigned a 20% chance of occurring, respectively.

(as of 14 October 2021)

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In Memory of William M. Gray[3]

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 October 14 – October 27 are classified as the upper tercile, the 18 years with the least active ACE periods from October 14 – October 27 are classified as the lower tercile, while the remaining 18 years are classified as the middle tercile.

Table 1: ACE forecast definition for TC activity for October 14 – October 27, 2021 and the forecast probabilities for each category in the next two weeks.

Parameter	Definition	Probability in Each Category
Above-Normal	Upper Tercile (>7 ACE)	20%
Normal	Middle Tercile (1–7 ACE)	60%
Below-Normal	Lower Tercile (<1 ACE)	20%

2 Forecast

We believe that the most likely category for ACE during the next two weeks is normal (60% chance), with above-normal and below-normal both having a 20% chance of occurring. There are currently no active Atlantic tropical cyclones, and the National Hurricane Center is only monitoring one area with a very low chance of formation in the next couple of days before interacting with a front, likely ending its chances of tropical cyclone development. However, vertical wind shear does look to become anomalously weak by next week over the western Caribbean, due to more conducive phases of the Madden-Julian oscillation (MJO), combined with the continued developing La Niña event. The western Caribbean is an area where strong hurricanes tend to develop during the latter part of the season (Figure 1).

Figure 1 displays the formation locations of TCs from October 14 – October 27 for the years from 1966 – 2019 (e.g., the satellite era), along with the maximum intensities that these storms reached. Figure 2 displays the October 14 – October 27 forecast period with respect to climatology. The primary threat area for major hurricane formations during mid- to late October is in the western Caribbean.

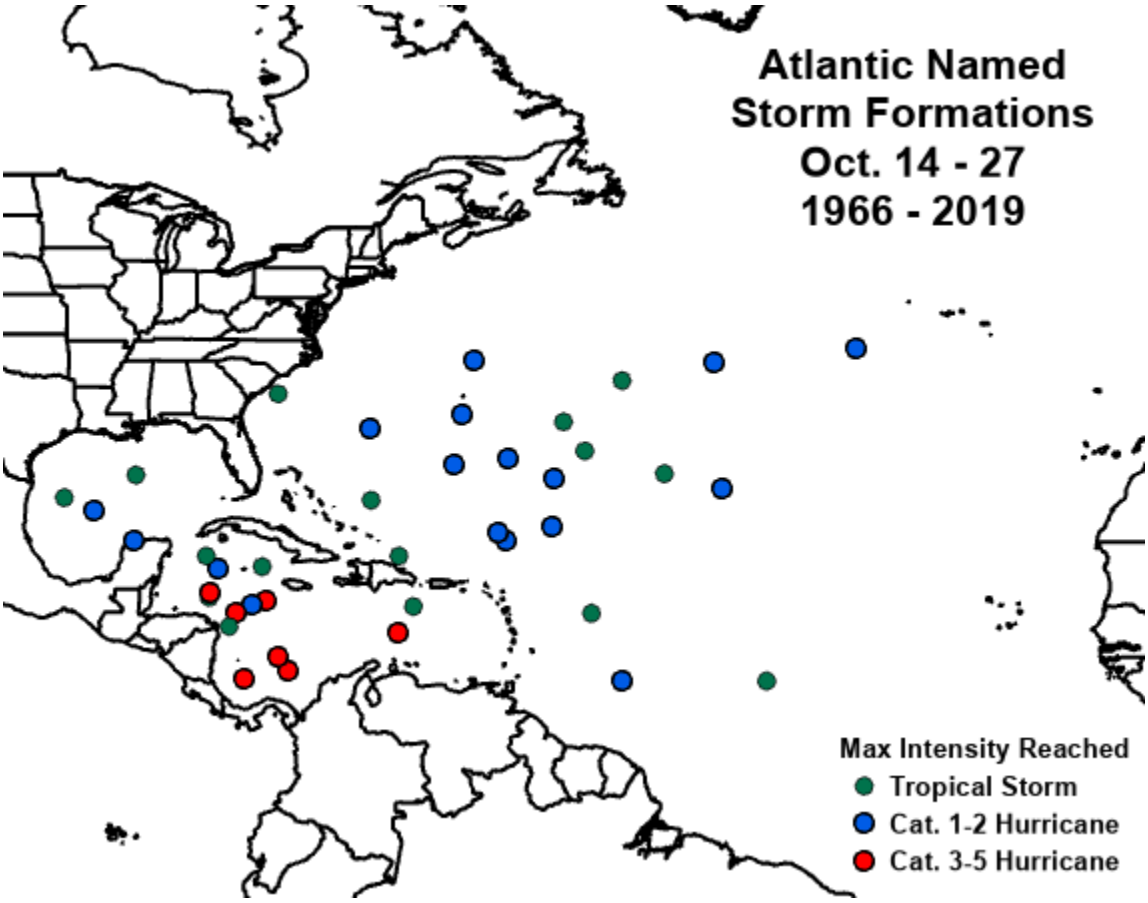

Figure 1: Atlantic named storm formations from October 14 – October 27 during the years from 1966 – 2019 and the maximum intensity that these named storms reached.

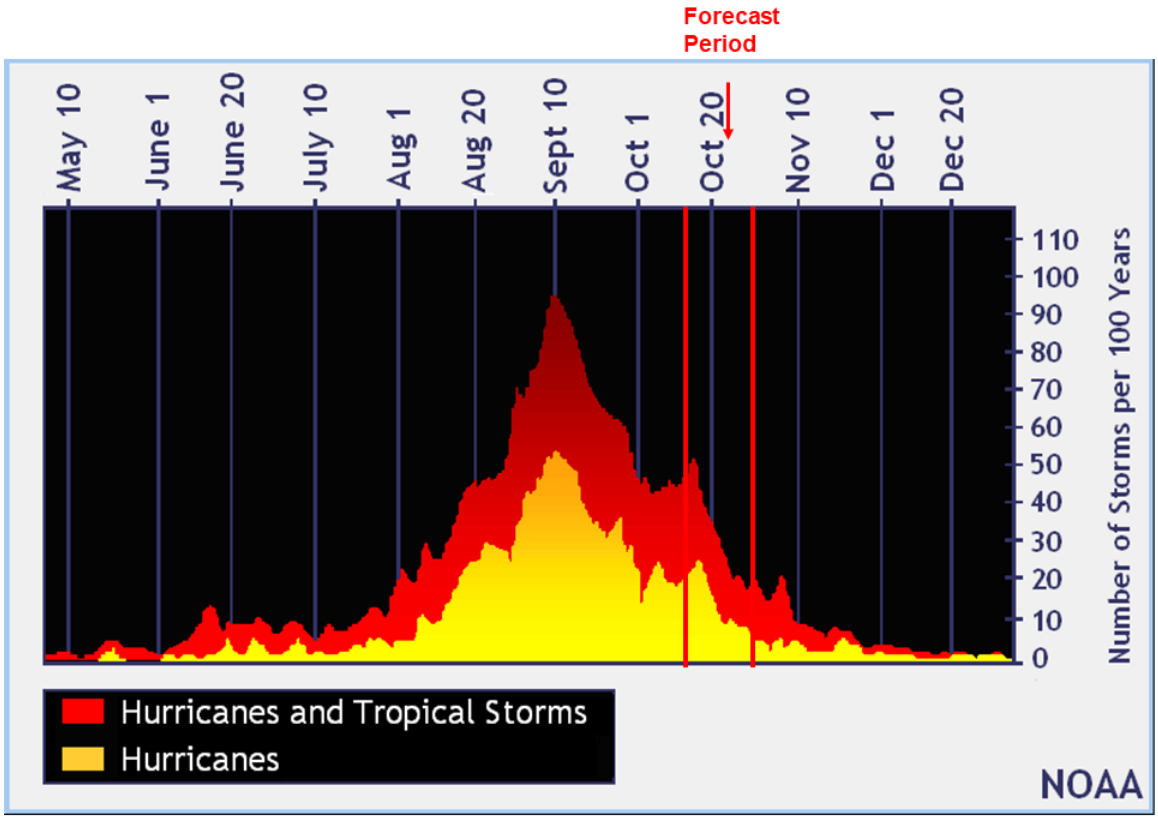

Figure 2: The current forecast period (October 14 – October 27) with respect to climatology. Figure courtesy of NOAA.

We now examine how we believe each of the five factors discussed in the introduction will impact Atlantic TC activity for the period from October 14 – October 27.

1) Current Storm Activity

There are currently no active TCs in the Atlantic basin.

2) National Hurricane Center Tropical Weather Outlook

NHC has one area with a 10% chance of TC development in the next five days (Figure 3). This area is currently battling strong vertical wind shear, and is then forecast to interact with a front, likely ending its chances for TC development.

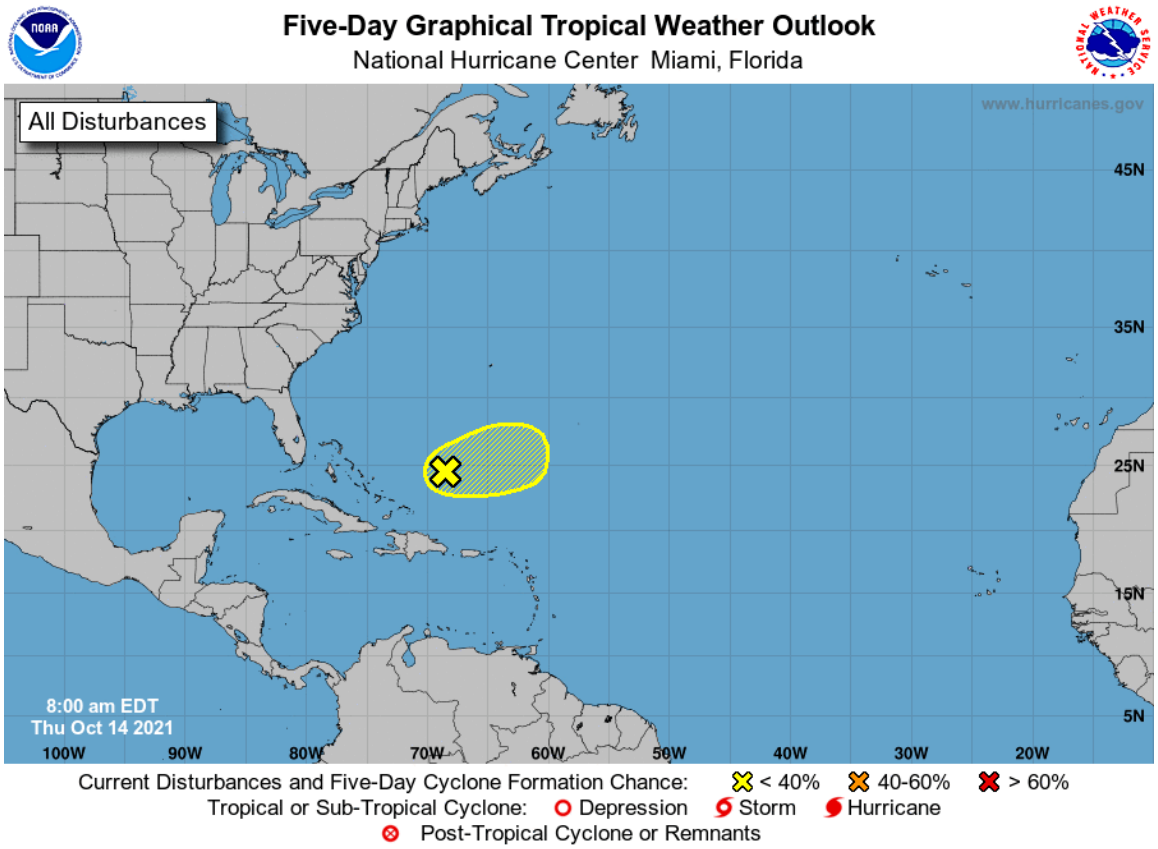

Figure 3: Current five-day Tropical Weather Outlook from the National Hurricane Center.

3) Global Model Analysis

The ECMWF ensemble is pretty anemic at Atlantic TC development during the next two weeks, while the GFS ensemble is highlighting potential TC development in the Caribbean in 10-14 days.

4) Madden-Julian Oscillation

The MJO, as measured by the Wheeler-Hendon index, is currently in phase 6 over the western Pacific. This phase is generally not conducive for Atlantic TC development, but there is fairly good agreement that the MJO should propagate fairly rapidly into phases 8-1 over the next two weeks (Figure 4). These phases tend to be more conducive for Atlantic TC formation, as they typically have anomalously weak levels of vertical wind shear. While the ECMWF model is forecasting the MJO to move into phases 8-1 in the next two weeks, there is considerable spread amongst the ensemble members, likely due to the current La Niña development and potential interference between subseasonal variability and the La Niña-like background state (Figure 4). Table 2 summarizes the typical MJO impacts on Atlantic TC activity. The upper-level velocity potential field generally favors suppressed vertical motion over the tropical Atlantic in week one, but

the large-scale pattern looks to be more conducive for Atlantic hurricane activity in week two, with suppressed vertical motion over the central and eastern tropical Pacific and enhanced vertical motion over the Caribbean and tropical Atlantic (Figure 5).

The Climate Forecast System (CFS) model is generally predicting below-normal shear across the Caribbean during week two, which could favor Atlantic TC development in the Caribbean during that time (Figure 6).

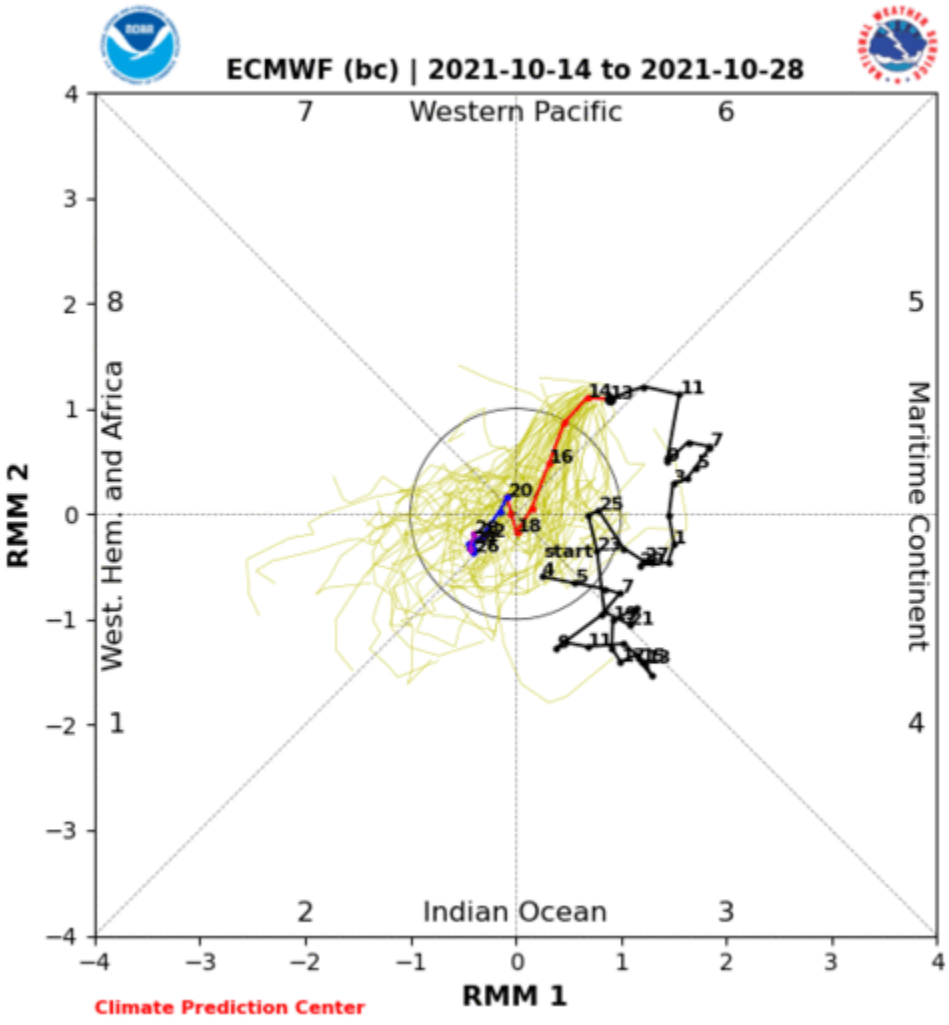

Figure 4: Predicted propagation of the MJO by the ECMWF model. Figure courtesy of NOAA.

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

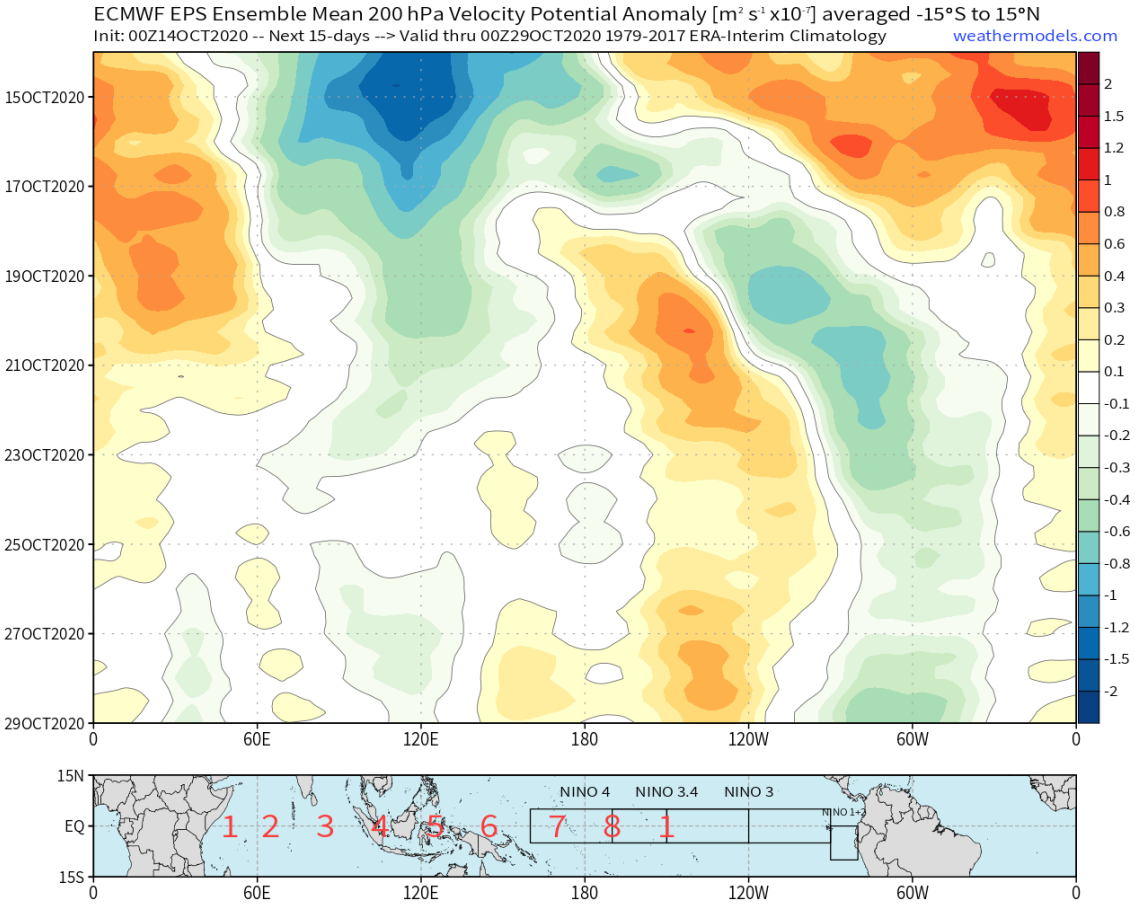

Figure 5: Ensemble mean forecast from the ECMWF model for 200 hPa velocity potential anomalies over the next 15 days.

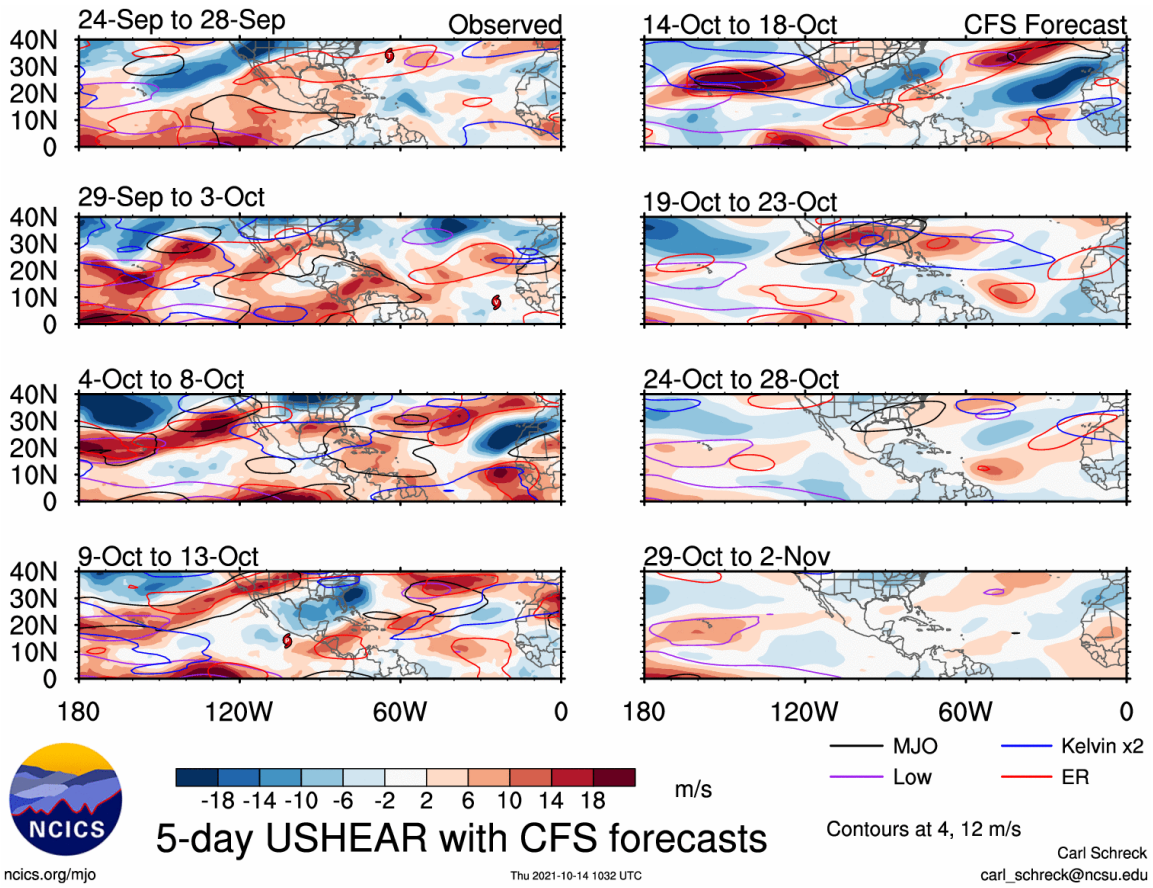

Figure 6: Observed and predicted anomalous 200 minus 850 hPa vertical wind shear from the Climate Forecast System through November 2. Figure courtesy of Carl Schreck.

5) Seasonal Forecast

The most recent seasonal forecast called for an active season. We believe that the next two weeks are most likely to generate near-normal levels of Atlantic hurricane activity, given the current relatively unfavorable sub-seasonal conditions and the paucity of TCs developed by the global models for at least the next ten days.

3 Upcoming Forecasts

This is the final two-week forecast issued by CSU for the 2021 Atlantic hurricane season.

VERIFICATION OF SEPTEMBER 30 – OCTOBER 13, 2021 FORECAST

The two-week forecast of tropical cyclone activity from September 30 – October 13, 2021 verified in the above-normal category (>9 ACE). A total of 27 ACE was observed during the two-week period. We assigned a probability of >99% for above normal ACE given Sam's forecast track and intensity. Sam produced 25 ACE from September 30 until its dissipation on October 5. Victor also contributed modest levels of ACE (2 ACE) during the latter part of its lifetime.

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 30 – October 13, 2021, the probability assigned for each category being reached and observed ACE.

ACE Category	Definition	Probability in each Category	Observed ACE
Above-Normal	Upper Tercile (>9 ACE)	>99%	27
Normal	Middle Tercile (4–9 ACE)	<1%	
Below-Normal	Lower Tercile (<4 ACE)	<1%	