**COLORADO STATE UNIVERSITY FORECAST OF ATLANTIC HURRICANE ACTIVITY FROM OCTOBER 14 – OCTOBER 27, 2020**

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

(as of 14 October 2020)

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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 12th 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, 2020.

| Parameter | Definition |
|---|---|
| Above-Normal | Upper Tercile (>7 ACE) |
| Normal | Middle Tercile (1–7 ACE) |
| Below-Normal | Lower Tercile (<1 ACE) |

# 2    Forecast

We believe that the next two weeks will be characterized by above-normal TC activity (>7 ACE). While there are currently no active tropical TCs in the Atlantic, we think it is likely that a system will develop in the western Caribbean next week. This system looks to develop in an environment that should be conducive for intensification, and our current thinking is that this potential TC may generate enough ACE to reach the above-normal threshold. In addition to western Caribbean development, the large-scale environment looks to be conducive for additional TC formation in the subtropical Atlantic, which is a region that often sees development during this time of year (Figure 1). The large-scale pattern looks to generally remain conducive for Atlantic hurricane formation and intensification, especially in the western Caribbean and subtropical Atlantic.

The Madden-Julian Oscillation (MJO) is currently located in phase 5 over the Maritime Continent. The MJO has largely stagnated over the past few weeks, likely due to constructive interference with the background state which has trended towards La Niña conditions. Some models are calling for continued eastward propagation of the MJO into the western North Pacific. The latest large-scale forecast from the ECMWF calls for suppressed vertical motion over the tropical Atlantic in week one, with a reestablishment

of a more La Niña-like pattern with suppressed vertical motion over the central and eastern tropical Pacific in week two. During week two, the atmosphere looks to favor upward motion over the Caribbean and tropical Atlantic as well, which would support TC formation during that time. A suppressed phase of a convectively-coupled Kelvin wave is likely somewhat responsible for the suppressed convective signal over the tropical Atlantic forecast by ECMWF in week one.

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.
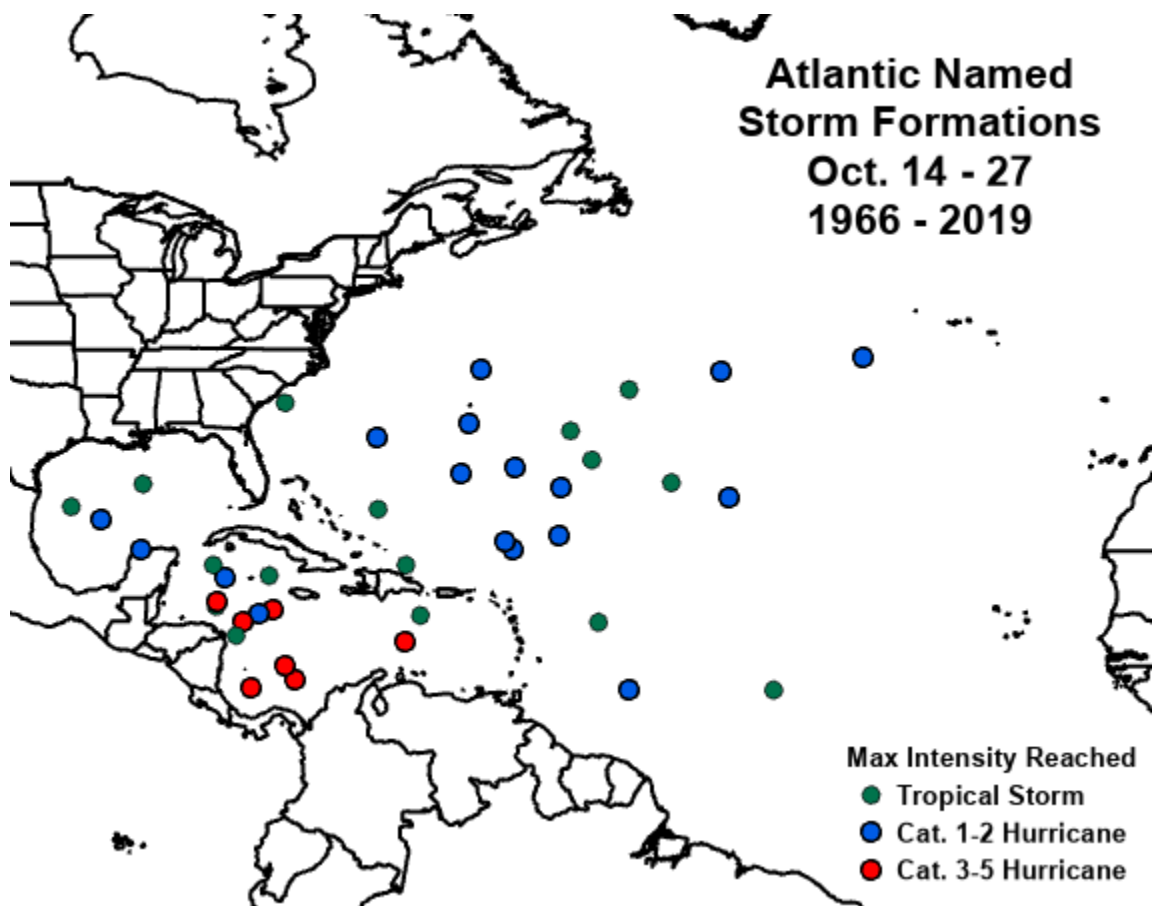


Figure 1: Atlantic named storm formations from October 14 – October 27 during the years from 1966 – 2019 and the maximum intensity that these named storms reached.
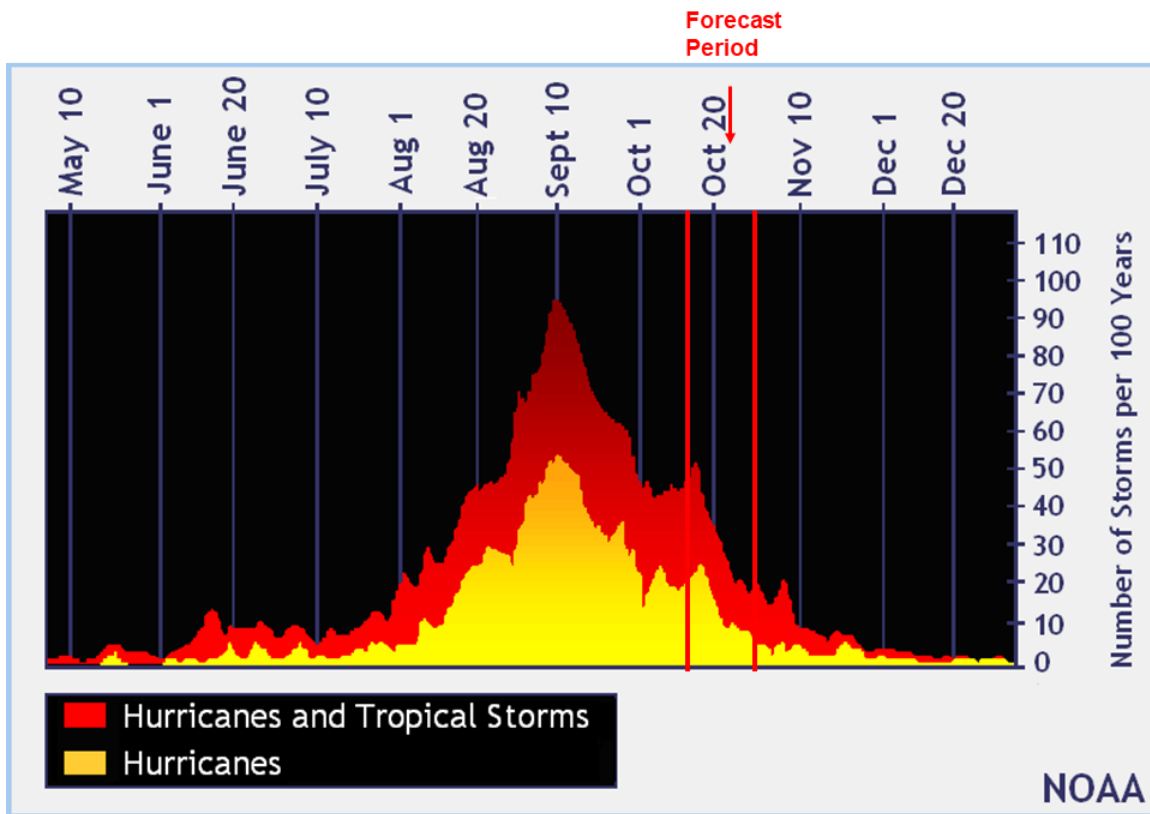
Figure 2: The current forecast period (October 14 – October 27) with respect to climatology. Figure courtesy of NOAA.

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. This area looks unlikely to develop during this time due to strong vertical wind shear.
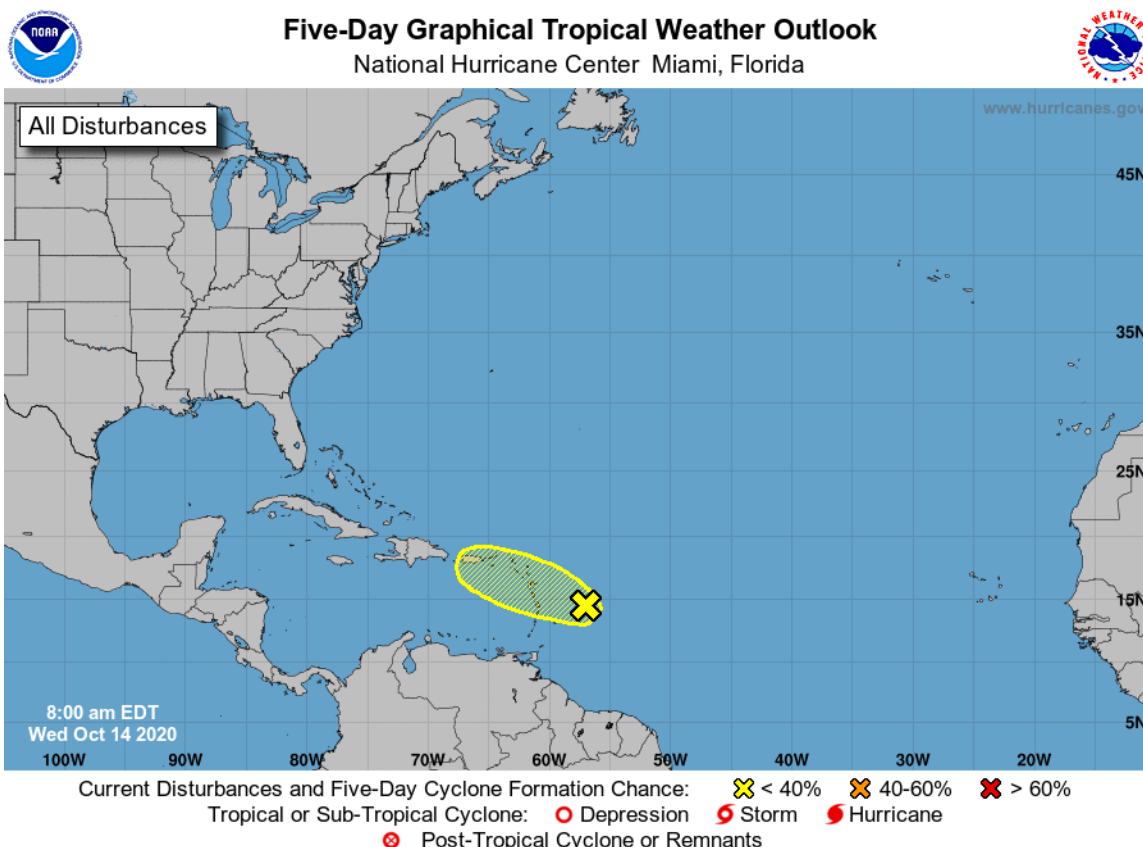
Figure 3: Current five-day Tropical Weather Outlook from the National Hurricane Center.

3) Global Model Analysis

The GFS has been aggressively developing a TC in the western Caribbean between October 20-22 and intensifying it after that time. The large-scale environment looks to be conducive to support the intensification forecast by the model. Both GFS and ECMWF are also hinting at other development possibilities in the subtropical Atlantic.

4) Madden-Julian Oscillation

The Madden-Julian Oscillation (MJO), as measured by the Wheeler-Hendon index, is currently in phase 5 over the Maritime Continent. There is considerable spread as to exactly what the MJO will do over the next two weeks, with generally slow propagation into phase 6 forecast by the ECMWF model (Figure 4). Some of this uncertainty is likely due to the current La Niña-like background state. 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). As noted earlier, a

suppressed phase of a convectively-coupled Kelvin wave will likely reduce any TC formation in the tropical Atlantic in week one (Figure 6).

The Climate Forecast System (CFS) model is generally predicting below-normal shear across the Caribbean over the next two weeks, with anomalous weak shear also forecast in parts of the subtropical Atlantic in week two (Figure 7).
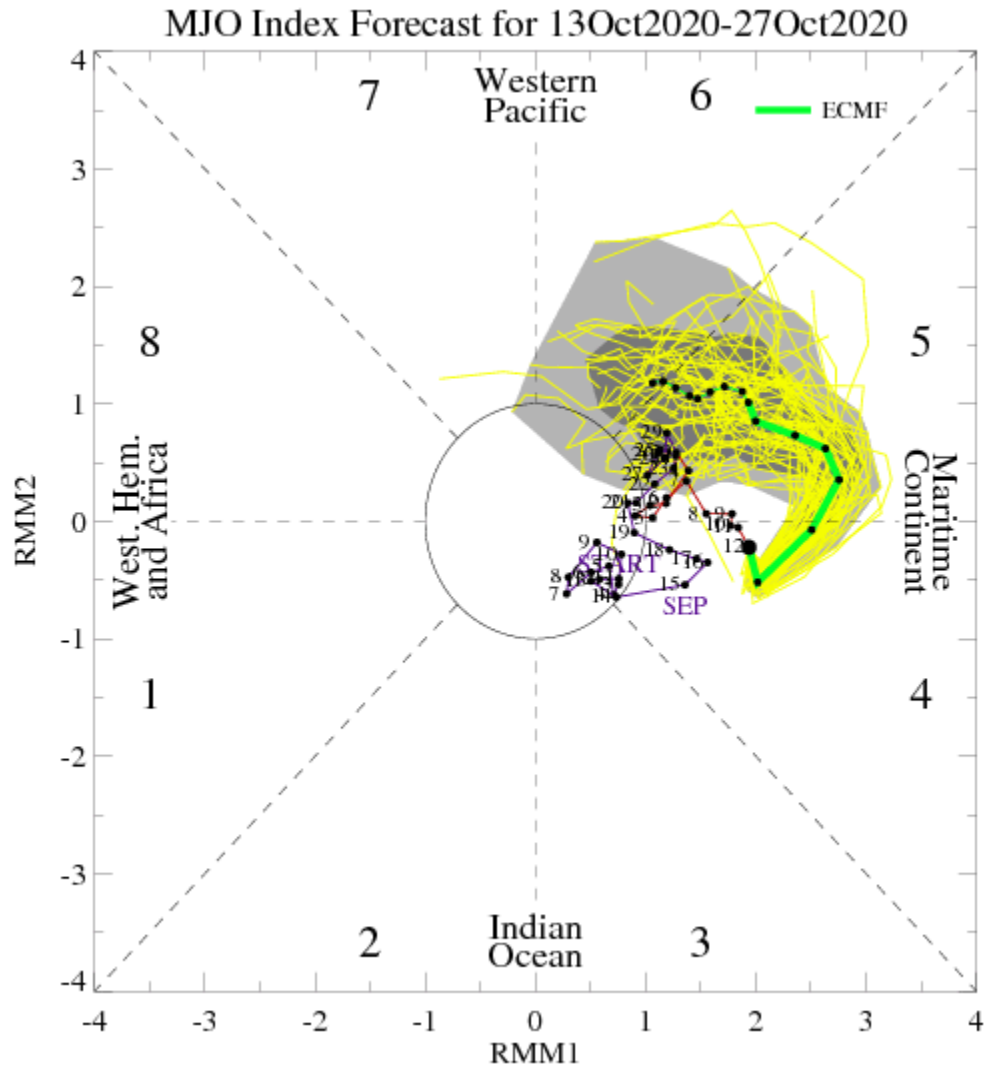


Figure 4: Predicted propagation of the MJO by the ECMWF model. Figure courtesy of NOAA.

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.

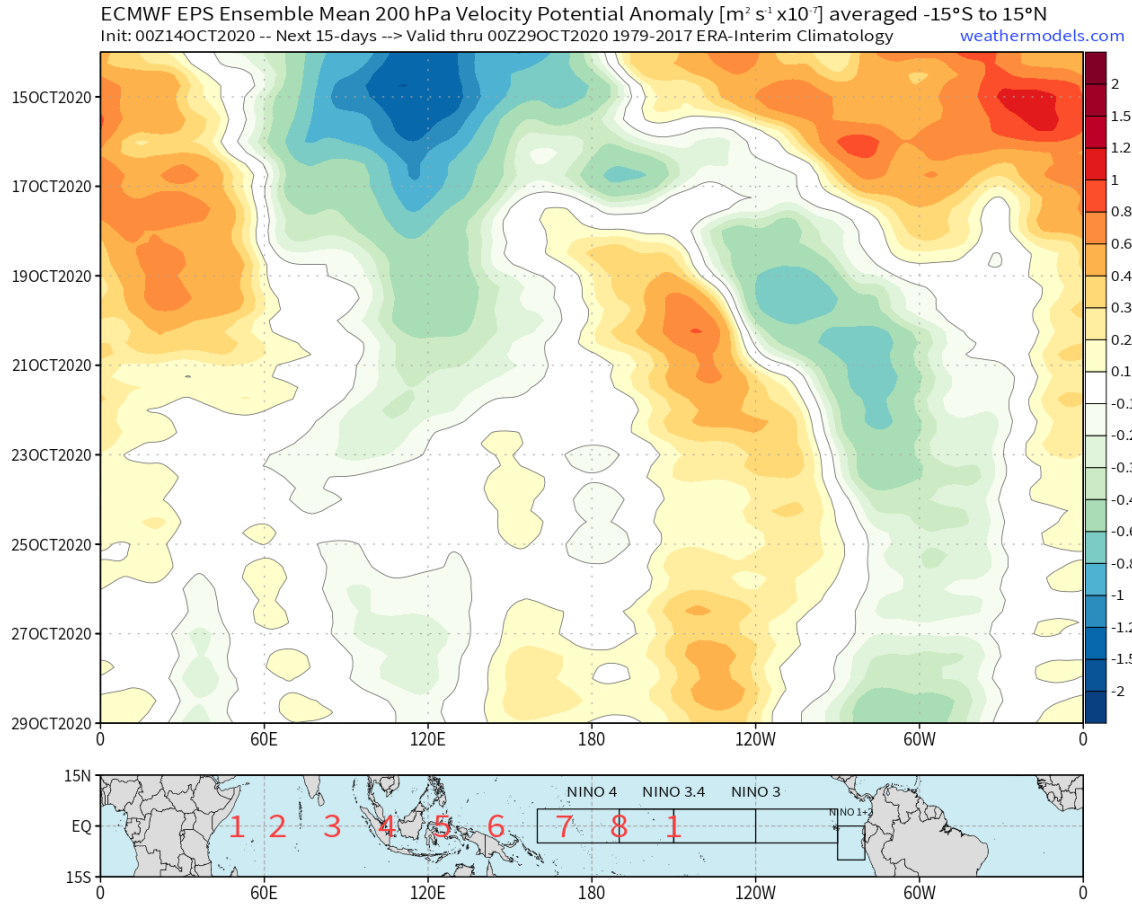| MJO Phase | NS | NSD | H | HD | MH | MHD | ACE |
|---|---|---|---|---|---|---|---|
| Phase 1 | 6.4 | 35.9 | 3.7 | 17.9 | 1.8 | 5.3 | 76.2 |
| Phase 2 | 7.5 | 43.0 | 5.0 | 18.4 | 2.1 | 4.6 | 76.7 |
| Phase 3 | 6.3 | 30.8 | 3.0 | 14.7 | 1.4 | 2.8 | 56.0 |
| Phase 4 | 5.1 | 25.5 | 3.5 | 12.3 | 1.0 | 2.8 | 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.
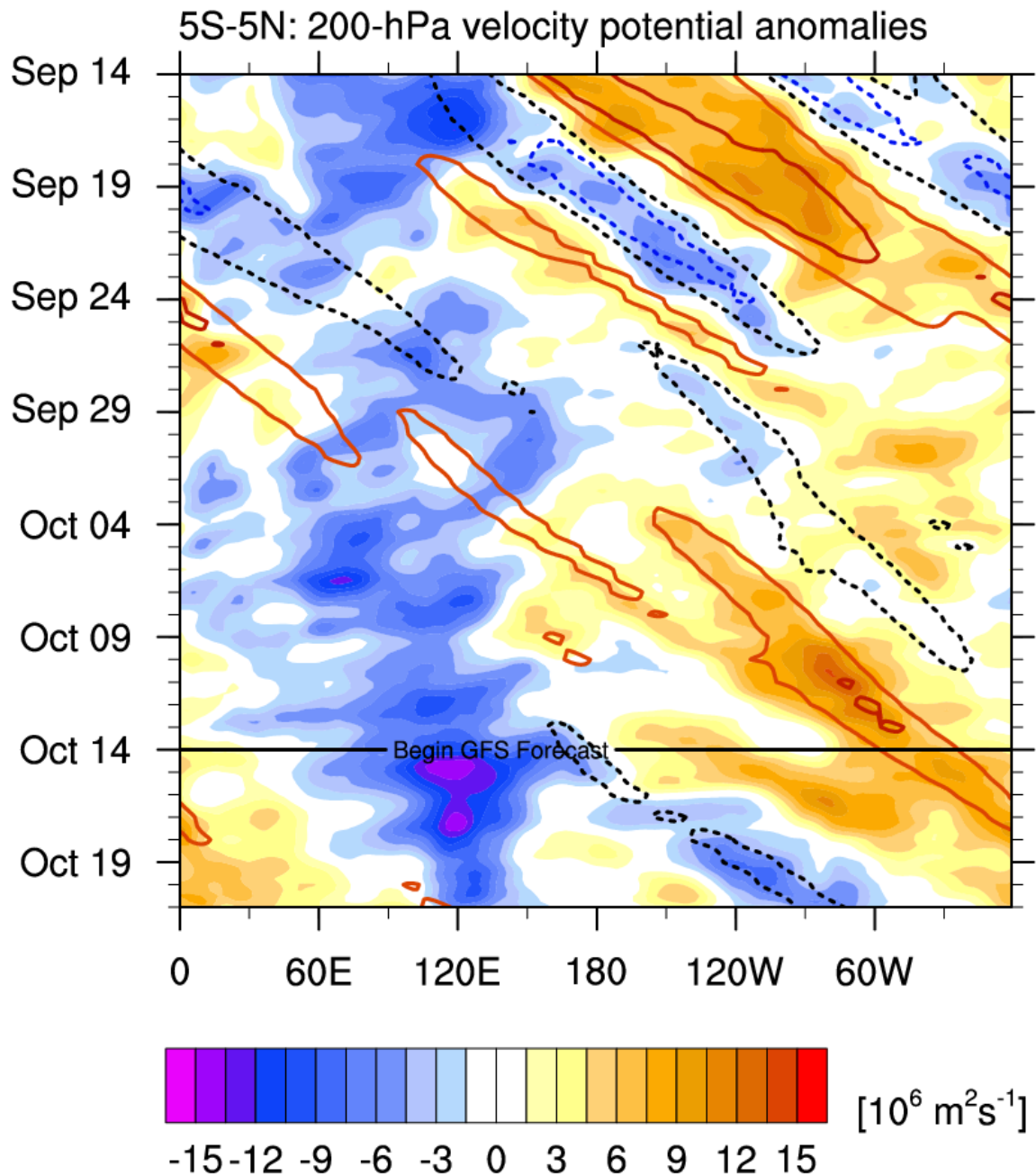
Figure 6: Observed and GFS forecast convectively-coupled Kelvin wave filtered 200 hPa velocity potential anomalies. Positive velocity potential anomalies indicate suppressed vertical motion. Figure courtesy of Mike Ventrice (http://mikeventrice.weebly.com/cckwmjo.html)
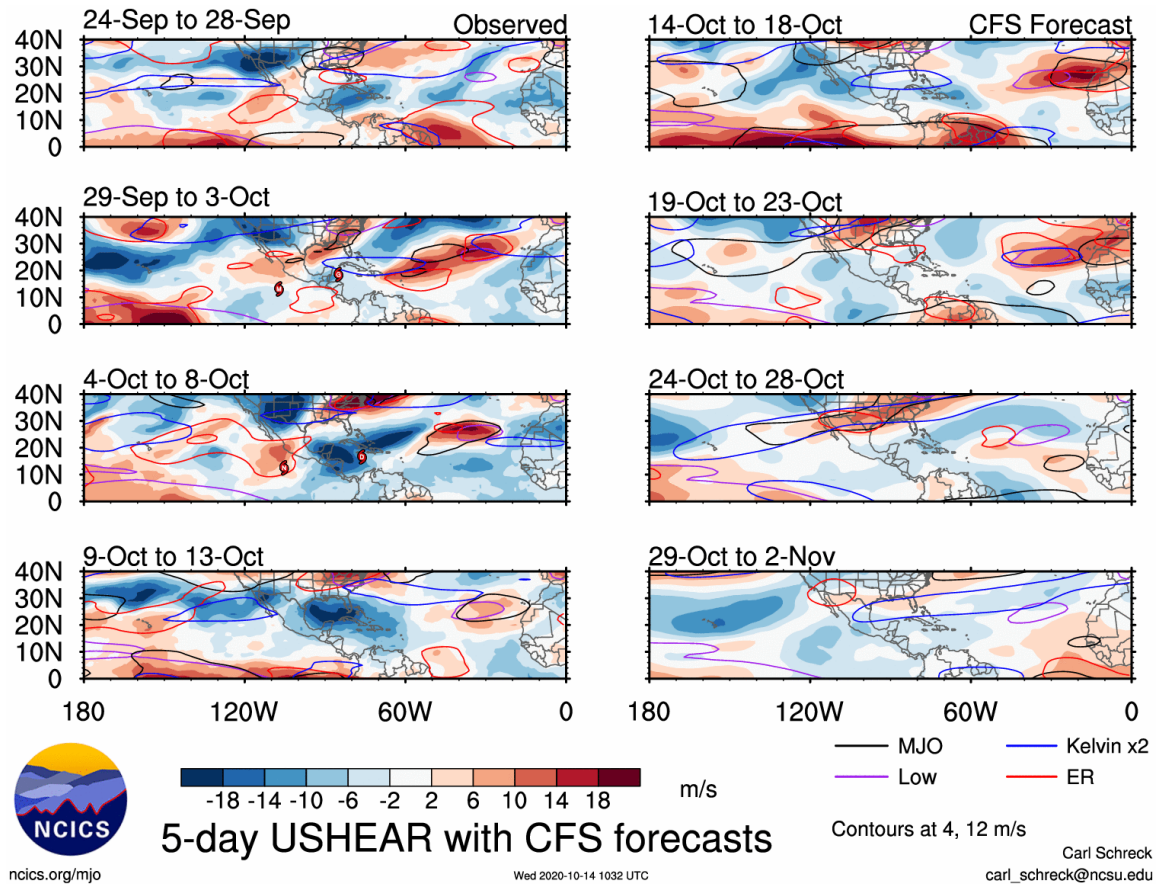
Figure 7: Observed and predicted anomalous 200 minus 850 hPa vertical wind shear from the Climate Forecast System through November 2. Figure courtesy of Carl Schreck.

5) Seasonal Forecast

The most recent seasonal forecast calls for a very active season. The season has been quite active to date, and we anticipate that the next two weeks will continue this trend.

# 3 Upcoming Forecasts

This is the final two-week forecast issued by CSU for the 2020 Atlantic hurricane season.

## VERIFICATION OF SEPTEMBER 30 – OCTOBER 13, 2020 FORECAST

The two-week forecast of Atlantic TC activity from September 30 – October 13, 2020 correctly verified in the above-normal category (>9 ACE).  A total of ~18 ACE was observed during the two-week period.  Hurricane Delta generated most of the ACE (15.7 ACE), with Tropical Storm Gamma (2.5 ACE) generating lesser amounts of ACE during the two-week period.