FORECAST OF ATLANTIC SEASONAL HURRICANE ACTIVITY AND LANDFALL STRIKE PROBABILITY FOR 2015

We continue to foresee a below-average 2015 Atlantic hurricane season. A moderate to strong El Niño is underway, and the tropical Atlantic remains cooler than normal. We are still calling for a below-average probability of United States and Caribbean major hurricane landfall. A more detailed forecast will be released on 4 August.

(as of 1 July 2015)

By Philip J. Klotzbach[1] and William M. Gray[2]

This forecast as well as past forecasts and verifications are available via the World Wide Web at http://hurricane.atmos.colostate.edu/Forecasts

Kate Jeracki, Colorado State University Media Representative, (970-491-2658) is available to answer various questions about this forecast.

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ATLANTIC BASIN SEASONAL HURRICANE FORECAST FOR 2015

Forecast Parameter and 1981-2010 Median (in parentheses)	Issue Date 9 April 2015	Issue Date 1 June 2015	Issue Date 1 July 2015
Named Storms (NS) (12.0)	7	8	8*
Named Storm Days (NSD) (60.1)	30	30	30
Hurricanes (H) (6.5)	3	3	3
Hurricane Days (HD) (21.3)	10	10	10
Major Hurricanes (MH) (2.0)	1	1	1
Major Hurricane Days (MHD) (3.9)	0.5	0.5	0.5
Accumulated Cyclone Energy (ACE) (92)	40	40	40
Net Tropical Cyclone Activity (NTC) (103%)	45	45	45

PROBABILITIES FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE LANDFALL ON EACH OF THE FOLLOWING COASTAL AREAS:

1) Entire U.S. coastline - 28% (average for last century is 52%)

2) U.S. East Coast Including Peninsula Florida - 15% (average for last century is 31%)

3) Gulf Coast from the Florida Panhandle westward to Brownsville - 15% (average for last century is 30%)

PROBABILITY FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE TRACKING INTO THE CARIBBEAN (10-20°N, 60-88°W)

1) 22% (average for last century is 42%)

*This forecast includes the two named storms that have already formed (Ana and Bill).

ABSTRACT

Information obtained through June 2015 indicates that the 2015 Atlantic hurricane season will likely have much less activity than the median 1981-2010 season. We estimate that 2015 will have only 3 hurricanes (median is 6.5), 8 named storms (median is 12.0), 30 named storm days (median is 60.1), 10 hurricane days (median is 21.3), 1 major (Category 3-4-5) hurricane (median is 2.0) and 0.5 major hurricane days (median is 3.9). The probability of U.S. major hurricane landfall is estimated to be about 55 percent of the long-period average. We expect Atlantic basin Accumulated Cyclone Energy (ACE) and Net Tropical Cyclone (NTC) activity in 2015 to be approximately 45 percent of their long-term averages.

All new June data support our 1 June forecast and add more confidence to our anticipation of a strongly suppressed season. Negative factors for hurricane activity that persisted through June include: 1) continued emergence of a strong El Niño event, 2) continued unfavorable Atlantic basin sea surface temperature (SST) and sea level pressure (SLP) conditions, and 3) continued unfavorable horizontal and vertical wind shear conditions throughout the Atlantic.

Acknowledgment

We are grateful for support from Interstate Restoration, Ironshore Insurance and Macquarie Group that partially support the release of these predictions. We acknowledge a grant from the G. Unger Vetlesen Foundation for additional financial support. We thank the GeoGraphics Laboratory at Bridgewater State University (MA) for their assistance in developing the United States Landfalling Hurricane Probability Webpage (available online at http://www.e-transit.org/hurricane).

The second author gratefully acknowledges the valuable input to his CSU seasonal forecast research project over many years by former graduate students and now colleagues Chris Landsea, John Knaff and Eric Blake. We also thank Professors Paul Mielke and Ken Berry of Colorado State University for statistical analysis and guidance over many years. We thank Bill Thorson for technical advice and assistance.

1 Introduction

This is the 32nd year in which the CSU Tropical Meteorology Project has made forecasts of the upcoming season's Atlantic basin hurricane activity. We have shown that a sizable portion of the year-to-year variability of Atlantic tropical cyclone (TC) activity can be hindcast with skill exceeding climatology. Klotzbach (2014) developed a 1 July seasonal forecast model which was utilized for the first time in real time last year. This 1 July forecast was based on 36 years of hindcast data since 1979 and maximized 1 July prediction skill over the last 36 years. The model's forecast for 2015 (see Table 2) calls for hurricane activity about one-third higher than our official forecast, although still well below the long-term average. Due to this year's emerging strong El Niño and other negative factors, we expect that seasonal levels of activity will be somewhat less than indicated by our 1 July statistical model and more in line with activity predicted by our 1 June statistical model.

2 July Forecast Methodology

Figure 2 displays the locations of our two 1 July predictors, while Table 1 displays the values of each predictor for the 2015 hurricane season. Table 2 displays the combination of the two predictors as model output for the 2015 Atlantic hurricane season.

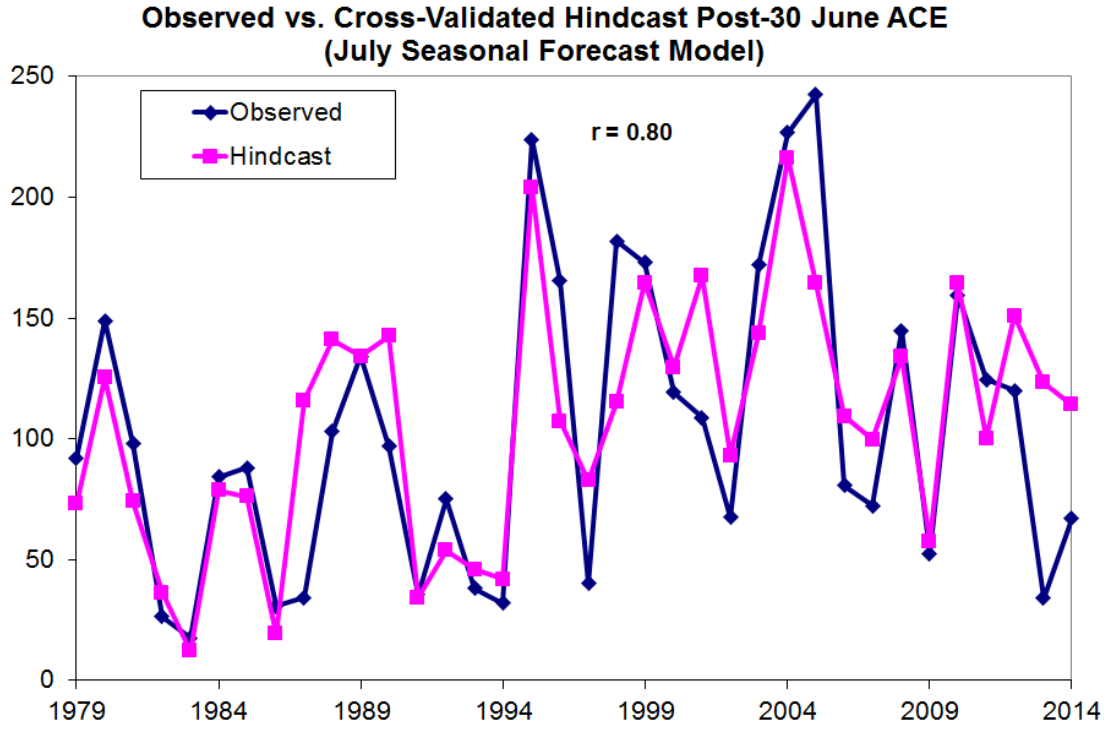

Figure 1: Observed versus early July jackknifed hindcast values of ACE for 1979-2014. The hindcast model explains approximately 64% of the variance from climatology.

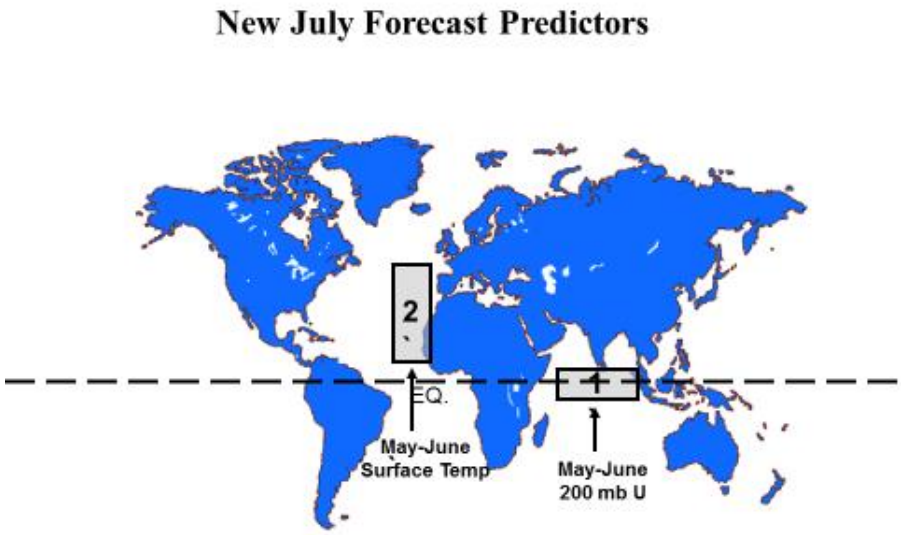

Figure 2: Location of predictors for our early July statistical prediction for the 2015 hurricane season.

Table 1: Listing of 1 July 2015 predictors for the 2015 hurricane season. A plus (+) means that positive values of the parameter indicate increased hurricane activity.

Predictor	**2015 Forecast Value**	**Favorable/Unfavorable for TCs**
1) May-June 200 mb U (10°S-5°N, 60-90°E) (-)	+1.4 SD	Unfavorable
2) May-June Surface Temp (10-50°N, 30-10°W) (+)	0.0 SD	Neutral

Table 2: 1 July statistical model output for the 2015 Atlantic hurricane season.

Forecast Parameter and 1981-2010 Median (in parentheses)	Statistical Forecast
Named Storms (12.0)	8.5
Named Storm Days (60.1)	36.2
Hurricanes (6.5)	4.4
Hurricane Days (21.3)	13.9
Major Hurricanes (2.0)	1.3
Major Hurricane Days (3.9)	2.2
Accumulated Cyclone Energy Index (92)	57
Net Tropical Cyclone Activity (103%)	65

3 Analog-Based Predictors for 2015 Hurricane Activity

Certain years in the historical record have global oceanic and atmospheric trends which are similar to 2015. These years also provide useful clues as to likely trends in activity that the forthcoming 2015 hurricane season may bring. For this early July extended range forecast, we determine which of the prior years in our database have distinct trends in key environmental conditions which are similar to current May-June 2015 conditions. Table 3 lists our analog selections. These analogs are the same as the analogs that we utilized in our early June forecast.

We select prior hurricane seasons since 1950 which have similar atmospheric-oceanic conditions to those currently being experienced. We searched for years that were characterized by moderate to strong El Niño conditions and generally cool conditions in the tropical Atlantic during the upcoming hurricane season.

There were six hurricane seasons since 1950 with characteristics most similar to what we expect to see in August-October of 2015. We anticipate that the 2015 hurricane season will have slightly less activity than the average of our six analog years, given the significant impact that a moderate to strong El Niño has on Atlantic hurricane activity. We believe that this season should experience well below-average activity.

Table 3: Best analog years for 2015 with the associated hurricane activity listed for each year.

Year	NS	NSD	H	HD	MH	MHD	ACE	NTC
1957	8	38.00	3	21.00	2	6.50	84	86
1965	6	39.50	4	27.25	1	7.50	84	86
1972	7	30.75	3	6.25	0	0.00	36	35
1982	6	18.50	2	5.75	1	1.25	32	38
1987	7	37.25	3	5.00	1	0.50	34	46
1997	8	30.00	3	9.50	1	2.25	41	54
Average	7.0	32.3	3.0	12.5	1.0	3.0	52	57
2015 Forecast	**8**	**30**	**3**	**10**	**1**	**0.5**	**40**	**45**

3 ENSO

El Niño has continued to intensify over the past several weeks. Upper ocean heat content anomalies have remained at well above-average levels (Figure 3).

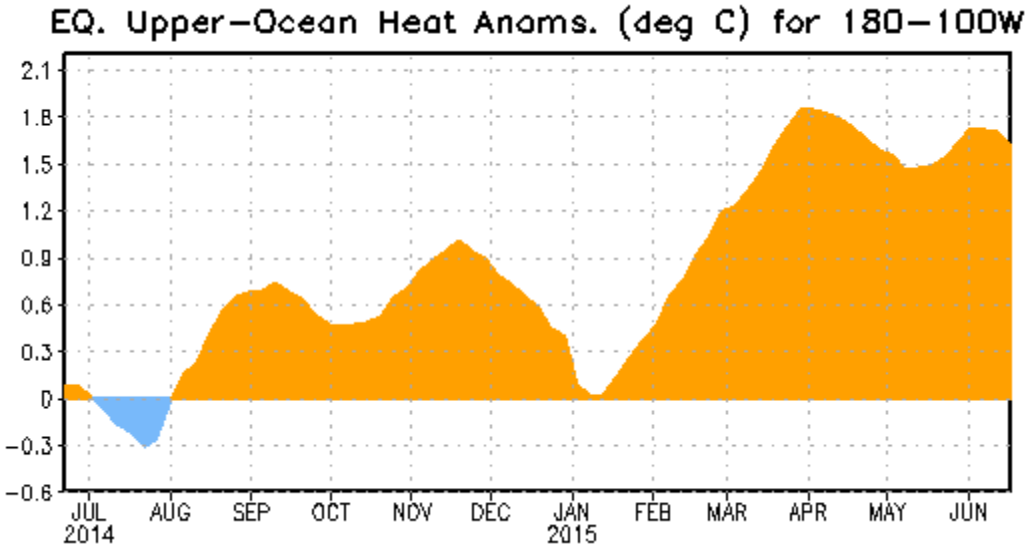

Figure 3: Central and eastern tropical Pacific upper ocean (0-300 meters) heat content anomalies over the past year. Anomalies dropped during the early portion of the winter, rapidly increased into early April and have remained at highly elevated levels since that time. Figure courtesy of the Climate Prediction Center.

Several strong Kelvin waves propagated across the tropical Pacific during the past few months. These waves have contributed to significant warming throughout the central and eastern tropical Pacific. Currently, another downwelling (warming) Kelvin wave is propagating across the tropical Pacific, which should lead to additional warming in the various Nino regions (Figure 4).

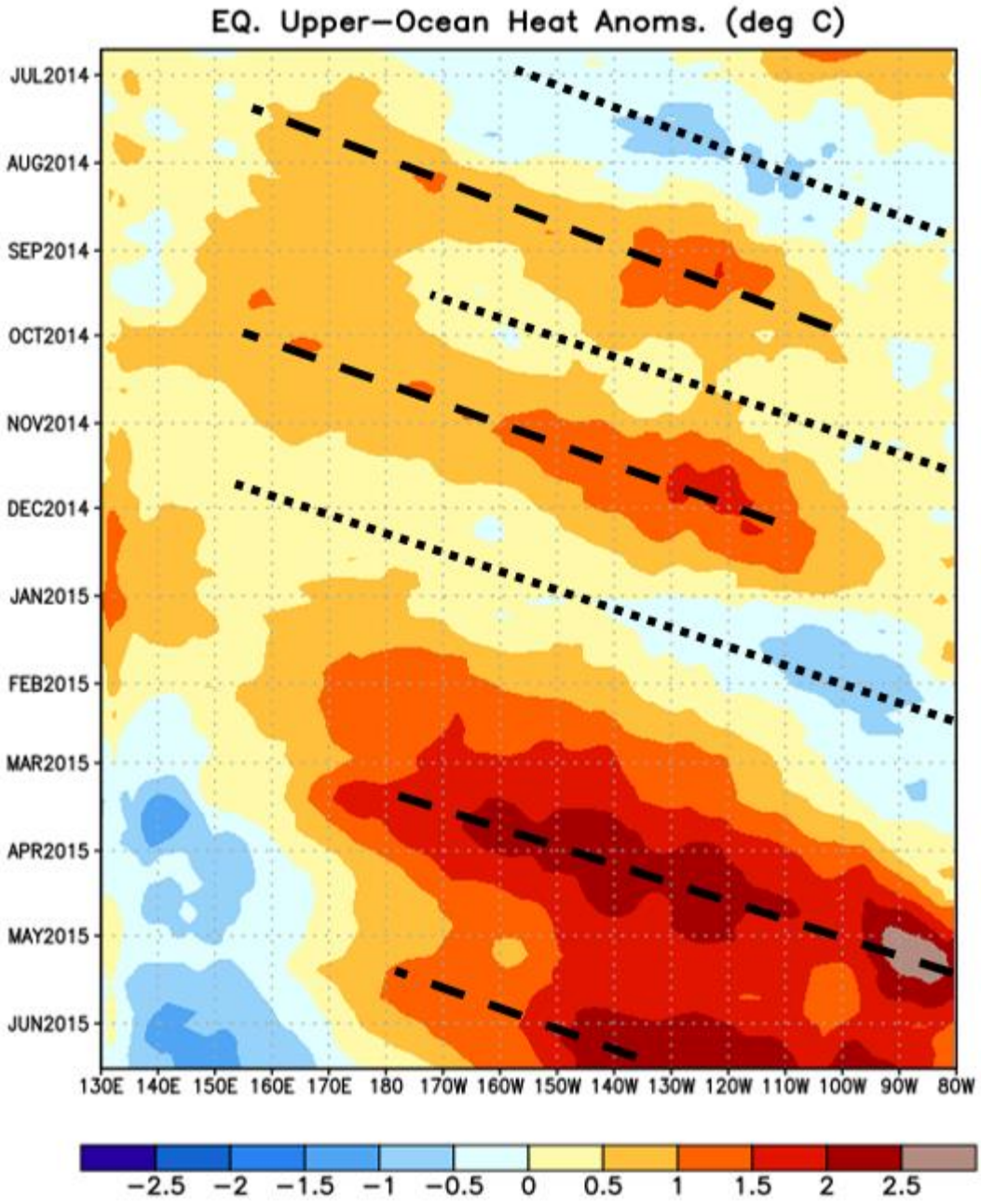

Figure 4: Upper ocean content heat anomalies (0-300 meters depth) across the tropical Pacific. Downwelling (warming) phases of Kelvin waves are highlighted by dashed lines, while upwelling (cooling) phases of Kelvin waves are highlighted by dotted lines. Figure courtesy of Climate Prediction Center.

Currently, SSTs are running well above average across most of the eastern and central tropical Pacific. Anomalies across most of the tropical Pacific have now reached levels not seen since the very strong 1997/1998 El Niño event. Table 4 displays the May

and June SST anomalies across the tropical Pacific. There has been a general continued warming across the tropical Pacific over the past month.

Table 4: May and June SST anomalies for Nino 1+2, Nino 3, Nino 3.4, and Nino 4, respectively. June minus May SST anomaly differences are also provided.

Region	May SST Anomaly (°C)	June SST Anomaly (°C)	June minus May SST Anomaly (°C)
Nino 1+2	+2.4	+2.5	+0.1
Nino 3	+1.2	+1.7	+0.5
Nino 3.4	+1.0	+1.3	+0.3
Nino 4	+1.1	+1.1	0.0

Based on the above information, our best estimate is that we will have a moderate to strong El Niño in place for the peak of the 2015 Atlantic hurricane season. Additional discussion of ENSO will be included with the 3 August update.

4 Current Atlantic Basin Conditions

Most of the tropical Atlantic is relatively cold right now (Figure 5). The overall SST pattern across the Atlantic basin appears to resemble the negative phase of the AMO or weak phase of the THC. This is a significant negative factor in this current prediction. The combination of a relatively cold tropical Atlantic and a moderate to strong El Niño event is the primary reason why we are predicting a very quiet Atlantic hurricane season in 2015.

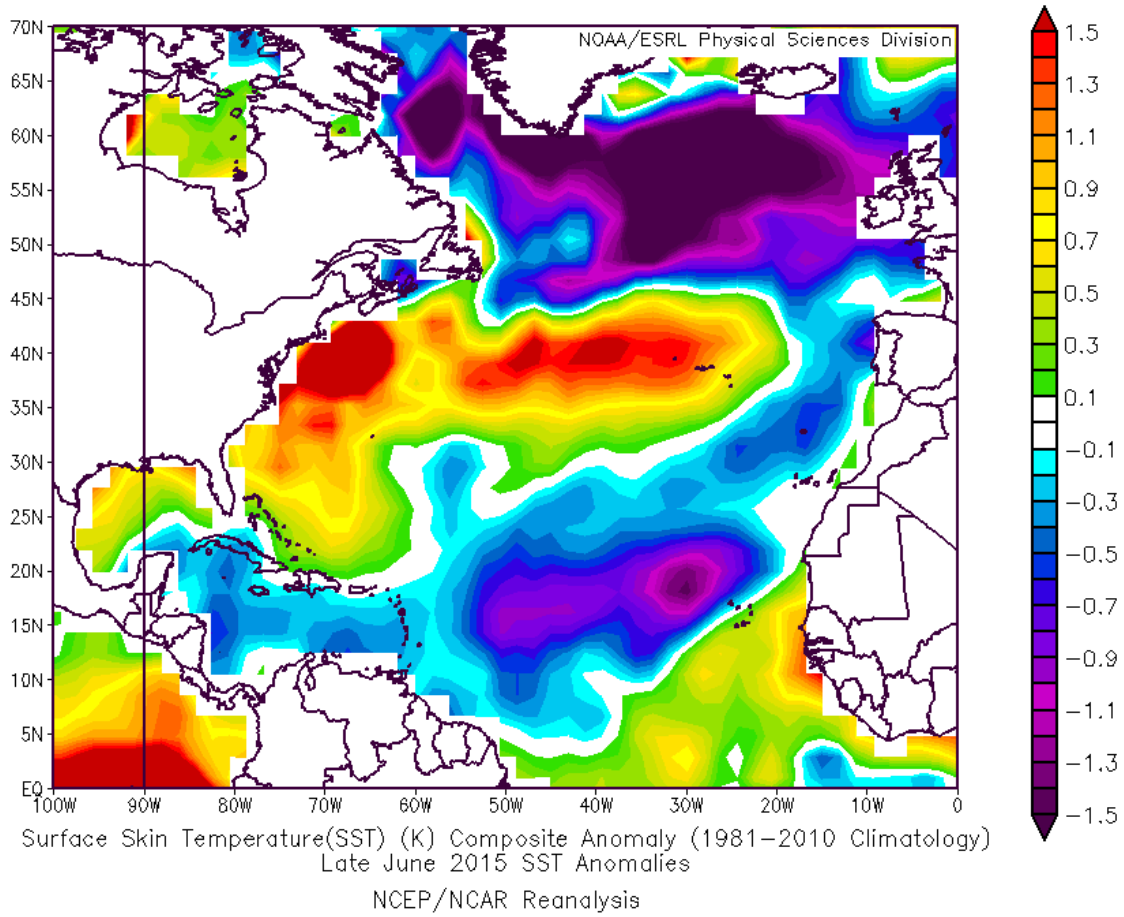

Figure 5: Late June SST anomalies across the Atlantic.

Levels of vertical wind shear across the Caribbean are quite strong (Figure 6). Vertical shear in the Caribbean (10-20°N, 90-60°W) was the second strongest during the month of June, trailing only the vertical shear measured in the Caribbean in June last year. Strong Caribbean vertical shear is typically associated with moderate to strong El Niño events.

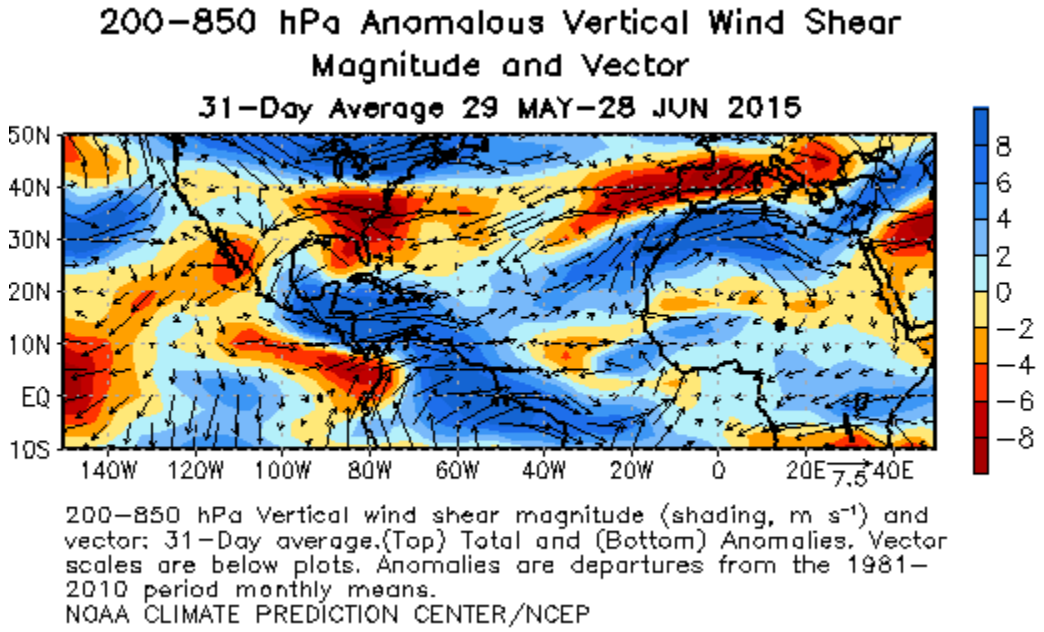

Figure 6: Vertical wind shear across the Atlantic and eastern tropical Pacific over the period from 29 May – 28 June 2015.

5 Forthcoming Updated Forecasts of 2015 Hurricane Activity

We will be issuing a final seasonal update of our 2015 Atlantic basin hurricane forecasts on **Tuesday, 4 August**. We will also be releasing two-week forecasts for Atlantic TC activity during the climatological peak of the season from August-October. A verification and discussion of all 2015 forecasts will be issued in late November 2015. All of these forecasts will be available on the web at: http://hurricane.atmos.colostate.edu/Forecasts.

6 Acknowledgments

Besides the individuals named on page 3, there have been a number of other meteorologists that have furnished us with data and given valuable assessments of the current state of global atmospheric and oceanic conditions. These include Brian McNoldy, Art Douglas, Ray Zehr, Mark DeMaria, Todd Kimberlain, Paul Roundy and Amato Evan. In addition, Barbara Brumit and Amie Hedstrom have provided excellent manuscript, graphical and data analysis and assistance over a number of years. We have profited over the years from many in-depth discussions with most of the current and past NHC hurricane forecasters. The second author would further like to acknowledge the encouragement he has received for this type of forecasting research application from Neil Frank, Robert Sheets, Robert Burpee, Jerry Jarrell, Max Mayfield, and Bill Read former directors of the National Hurricane Center (NHC), and the current director, Rick Knabb.