

**FORECAST OF ATLANTIC HURRICANE ACTIVITY FOR SEPTEMBER 2008
AND SEASONAL UPDATE THROUGH AUGUST**

Well above-average activity has occurred so far during the 2008 hurricane season. We expect a very active September.

(as of 2 September 2008)

By Philip J. Klotzbach¹ and William M. Gray²

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

Emily Wilmsen, Colorado State University Media Representative, (970-491-6432) is available to answer various questions about this forecast

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ATLANTIC BASIN SEASONAL HURRICANE FORECAST FOR 2008

Forecast Parameter and 1950-2000 Climatology (in parentheses)	Full Season Forecast Adjusted 5 August 2008	Observed Activity Through August	September Monthly Forecast
Named Storms (NS) (9.6)	17	8	5
Named Storm Days (NSD) (49.1)	90	45.50	35
Hurricanes (H) (5.9)	9	3	4
Hurricane Days (HD) (24.5)	45	11.75	20
Intense Hurricanes (IH) (2.3)	5	2	2
Intense Hurricane Days (IHD) (5.0)	11	2.25	8
Accumulated Cyclone Energy (ACE) (96)	175	63	85
Net Tropical Cyclone Activity (NTC) (100%)	190	68	90

Notice of Author Changes

By William Gray

The order of the authorship of these forecasts was reversed in 2006 from Gray and Klotzbach to Klotzbach and Gray. After 22 years (1984-2005) of making these forecasts, it was appropriate that I step back and have Phil Klotzbach assume the primary responsibility for our project's seasonal, monthly and landfall probability forecasts. Phil has been a member of my research project for the last eight years and was second author on these forecasts from 2001-2005. I have greatly profited and enjoyed our close personal and working relationships.

Phil is now devoting much more time to the improvement of these forecasts than I am. I am now giving more of my efforts to the global warming issue and in synthesizing my projects' many years of hurricane and typhoon studies.

Phil Klotzbach is an outstanding young scientist with a superb academic record. I have been amazed at how far he has come in his knowledge of hurricane prediction since joining my project in 2000. I foresee an outstanding future for him in the hurricane field. I expect he will make many new seasonal and monthly forecast innovations and skill improvements in the coming years. He was awarded his Ph.D. degree in 2007. Klotzbach is currently spending most of his time working towards the improvement of these Atlantic basin seasonal hurricane forecasts.

ABSTRACT

Information obtained through 31 August 2008 shows that we have so far experienced 68 percent of the average full season Net Tropical Cyclone (NTC) activity. We correctly predicted above-average August NTC, although we predicted more activity than was observed. In an average year, 33 percent of the seasonal average NTC of 100 occurs before the end of August.

Our September-only forecast calls for five named storms, four hurricanes, two major hurricanes and NTC activity of 90 which is well above the September-only average value of 48.

We continue to anticipate that the 2008 Atlantic basin tropical cyclone (TC) season will be much more active than the average 1950-2000 season. Atlantic basin sea surface temperatures remain at above-average values, while ENSO conditions remain near neutral. Tropical Atlantic sea level pressure values were at near-record low levels during August.

AUGUST FORECAST VERIFICATION

Our August 2008 forecast called for well above-average NTC activity. August 2008 witnessed slightly above-average activity. We have now correctly predicted above- or below-average August NTC in seven out of nine years. Forecast error standard deviations are provided based upon hindcast errors over the 1948-2007 period. Assuming a normalized error distribution, we expect that 2/3 of our forecasts will fall within one standard deviation of observations, with 95% of our forecasts falling within two standard deviations of observations. We prefer to verify our forecasts based upon aggregate measures such as ACE and NTC. Although not our most accurate forecast, both observed ACE and observed NTC lie within two standard deviations of our forecast value. Obviously, our goal is to verify within one standard deviation of our predicted value. A more in-depth analysis of the atmospheric and oceanic conditions that were present during August 2008 follows in our discussion (Section 3).

CSU forecast and verification of August-only hurricane activity made in early August. Error bars are provided based upon one standard deviation of forecast errors over the 1948-2007 hindcast period.

Tropical Cyclone Parameters and 1950-2000 August Average (in parentheses)	August 2008 Forecast	August 2008 Verification
Named Storms (NS) (2.8)	4 (± 1.1)	4
Named Storm Days (NSD) (11.8)	20 (± 4.4)	19.75
Hurricanes (H) (1.6)	3 (± 0.8)	1
Hurricane Days (HD) (5.7)	10 (± 3.2)	3
Intense Hurricanes (IH) (0.6)	1 (± 0.4)	1
Intense Hurricane Days (IHD) (1.2)	3 (± 1.5)	1.50
Accumulated Cyclone Energy (ACE) (24)	40 (± 12)	26
Net Tropical Cyclone Activity (NTC) (26)	45 (± 12)	31

1 Introduction

Our Colorado State University research project has shown that a sizable portion of the year-to-year variability of Atlantic tropical cyclone (TC) activity can be hindcast with skill significantly exceeding climatology. These forecasts are based on a statistical methodology derived from 60 years of past global reanalysis data and a separate study of prior analog years which have had similar global atmospheric and oceanic precursor circulation features. Qualitative adjustments are added to accommodate additional processes which may not be explicitly represented by our statistical analyses. We believe that seasonal forecasts must be based on methods showing significant hindcast skill in application to long periods of prior seasonal and monthly data.

2 Seasonal Update through August 2008

Through August, the 2008 hurricane season has had 68 percent of the NTC activity of the average hurricane season. June-July 2008 had near-record activity while August had slightly above-average activity. As of 1 September, eight named storms, three hurricanes and two major (Cat. 3-4-5) hurricanes have developed. Through August, the climatological (1950-2000) average number of named storms, hurricanes and major hurricanes is 4.2, 2.4, and 0.7, respectively. Through August of 2008, the Atlantic basin has witnessed 190, 125 and 286 percent of average named storm, hurricane, and major hurricane activity, respectively. Overall, based on NTC, we have experienced slightly more than twice the average tropical cyclone season through August 31.

3 September Monthly Forecast

We have extensively revised our monthly forecasts this year. We are now issuing individual monthly predictions for the months of August, September and October during the early part of the month being predicted. That is, our early September forecast will be released with this update, and our early October forecast will be released on **1 October**. Our statistical model for September monthly activity utilizes a much smaller predictor pool than was used in the original forecast scheme, and, as is done with our seasonal predictions, we only attempt to hindcast NTC. The new model utilizes one of the predictors (low-level wind difference between the tropical and sub-tropical Atlantic) from the original September monthly forecast (Klotzbach and Gray 2003). Table 1 and Figure 1 discuss and display the predictors utilized in this year's September monthly forecast.

Table 1: Listing of predictors for September’s hurricane activity. A plus (+) means that positive deviations of the parameter indicate increased hurricane activity for September, and a minus (-) means that positive deviations of the parameter indicate decreased hurricane activity for September.

Predictor	Values for 2008 Forecast	Effect on 2008 Hurricane Season
1) July-August 1000 MB U (5-15°N, 25-55°W) – (22.5-32.5°N, 45-65°W) (+)	+1.2 SD	Enhance
2) August SST (15-40°N, 15-35°W) (+)	+0.5 SD	Enhance
3) Prior to 1 Sep – Major Hurricane in the Main Development Region (+)	Yes	Enhance

September Monthly Forecast Predictors

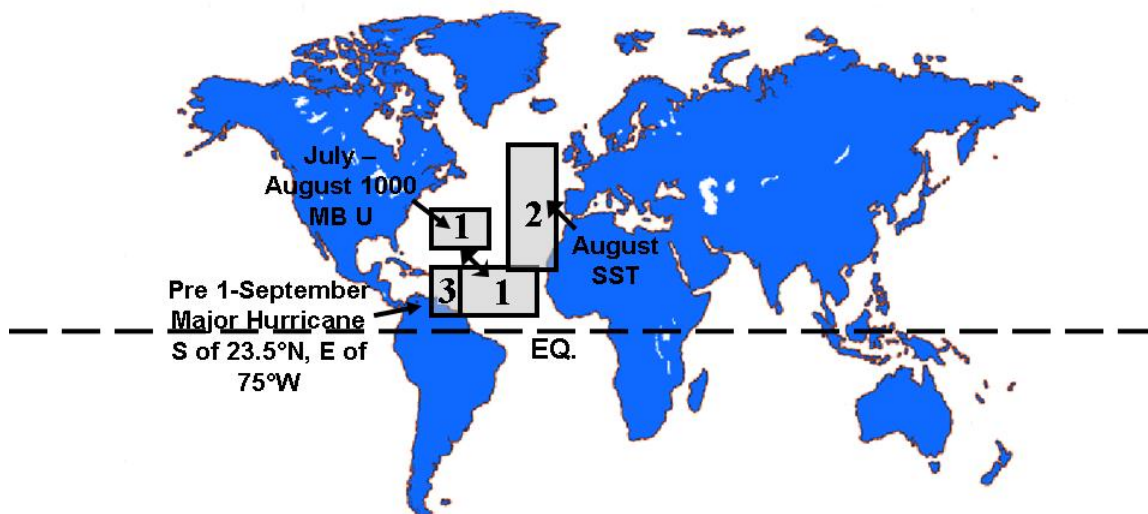


Figure 1: Global map showing locations of September-only TC predictors. Table 1 provides a listing and description of these predictors. The numbers in the boxes are keyed to the descriptions given in Table 1.

This new September statistical forecast model has shown considerable skill at hindcasting NTC over the period from 1948-2007. Using a linear regression model and the same ranking technique that was used in our seasonal forecast schemes from December, April, and June, we were able to hindcast 54 percent of the variance over the 1948-2007 period. Each predictor had to explain an additional 3 percent of the variance explained over the period from 1948-1987, 1988-2007, and over the full 1948-2007 period to be included in the model. Figure 2 shows hindcasts of September NTC along with observations over the past sixty years. Table 2 displays our September monthly forecast

for this year. All other parameters are calculated from the statistical model's NTC prediction using a similar methodology to what was used for the seasonal forecast calculations. Final September equations are shown below. For a September NTC prediction of 90, our statistical forecast for the number of named storms would be $2.5 + (0.02 * 90) = 4.3$.

Named Storms = $2.5 + (0.02 * \text{NTC})$
 Named Storm Days = $6.8 + (0.32 * \text{NTC})$
 Hurricanes = $0.9 + (0.03 * \text{NTC})$
 Hurricane Days = $-0.5 + (0.25 * \text{NTC})$
 Intense Hurricanes = $-0.1 + (0.03 * \text{NTC})$
 Intense Hurricane Days = $-2.3 + (0.11 * \text{NTC})$
 Accumulated Cyclone Energy = $-4.4 + (1.05 * \text{NTC})$

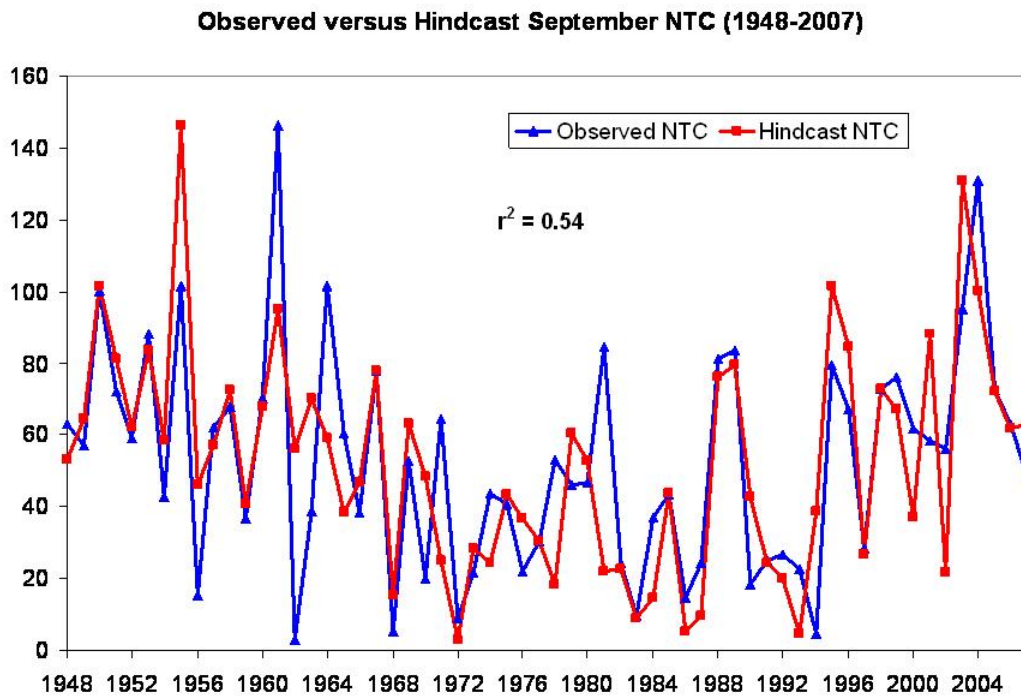


Figure 2: Observed versus hindcast September NTC over the period from 1948-2007.

Table 2: Independent September-only prediction of 2008 hurricane activity. September climatology is shown in parentheses. Forecast error standard deviations are provided based upon hindcast errors over the 1948-2007 period. Assuming a normalized error distribution, we expect that 2/3 of our forecasts will fall within one standard deviation of observations, with 95% of our forecasts falling within two standard deviations of observations.

Parameter	Statistical	
	Model	Qualitative Adjustment
NS	4.4 (3.4)	5 (± 1.3)
NSD	37.8 (21.7)	35 (± 8.5)
H	3.8 (2.4)	4 (± 1.0)
HD	23.8 (12.3)	20 (± 5.1)
IH	2.8 (1.3)	2 (± 0.6)
IHD	8.3 (3.0)	8 (± 2.7)
ACE	97.5 (48)	85 (± 20)
NTC	97.0 (48)	90 (± 16)

An individual monthly prediction for October will be issued on 1 October.

4 Discussion

4.1 June-July Activity

June-July 2008 was very active, with three named storms and two hurricanes forming during these two months. The long-period average from 1950-2000 is approximately 1.5 named storm formations and 0.6 hurricane formations. July 2008 was especially notable for Hurricane Bertha, which was a named storm for 17.25 days and became the longest-lived July storm on record. Hurricane Dolly made landfall in south Texas as a Category 2 hurricane and did approximately 1.5 billion dollars in total damage to the state.

4.2 August Activity

The first two weeks of August were quite quiet, with only Tropical Storm Edouard forming and making landfall in eastern Texas. However, the tropics became much more active during the second half of the month, with Tropical Storm Fay forming on August 15 and dumping copious amounts of rain on Haiti, the Dominican Republic, Cuba and the southeast United States. Hurricane Gustav formed on August 25 and intensified into a major hurricane in the northwest Caribbean. At the end of August 31, Gustav was nearing the coast of Louisiana as a Category 3 hurricane. Tropical Storm Hanna formed in the sub-tropical Atlantic on August 28. When investigating an aggregate measure such as ACE or NTC, August 2008 had slightly above-average activity.

From a large-scale perspective, atmospheric and oceanic conditions were generally favorable for an active month. Sea level pressures were at near-record low levels during the month (Figure 3). Typically, low sea level pressures lead to active Atlantic basin hurricane seasons through an implied increase in instability and weaker-than-normal trades. August sea level pressures across the tropical Atlantic were estimated to be near their lowest values since 1948. The only August with SLP anomalies comparable to August 2008 was August 1955. The 1955 season was one of the most active seasons on record.

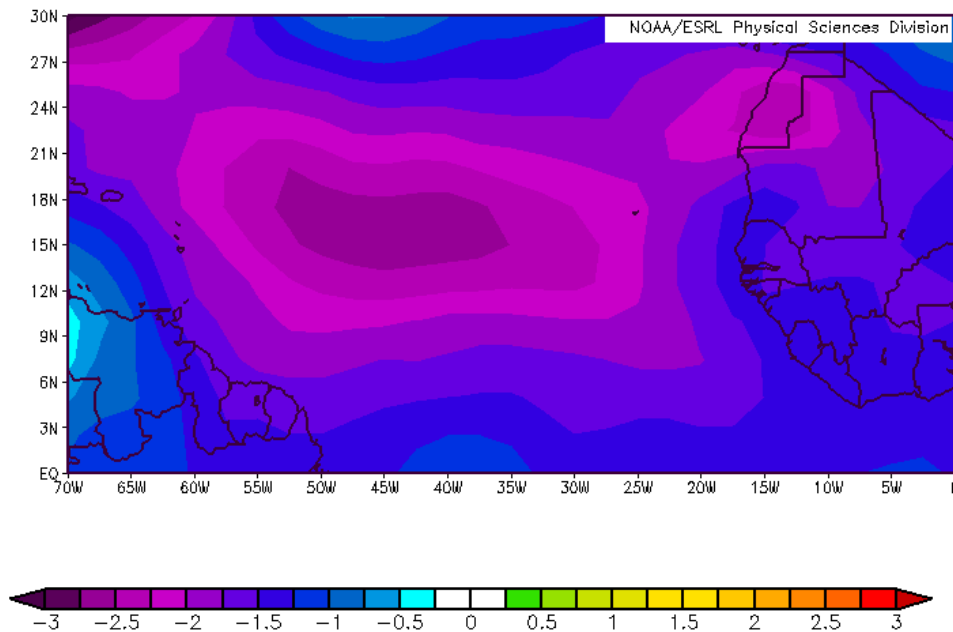


Figure 3: Tropical Atlantic sea level pressure anomalies during August.

Vertical wind shear values across the tropical Atlantic have been at about average values (Figure 4) according to CIRA’s real-time genesis parameter (DeMaria et al. 2001). Low-level trade winds have been weaker than normal, while upper-level westerlies have been slightly stronger than normal. We do not believe that these vertical wind shear values are due to anomalously warm eastern Pacific SSTs, as vertical wind shear levels in the Caribbean have been below normal during August (Figure 5). Typically, if vertical wind shear anomalies are driven primarily by ENSO, strongest effects would be seen in the Caribbean. This has not occurred.

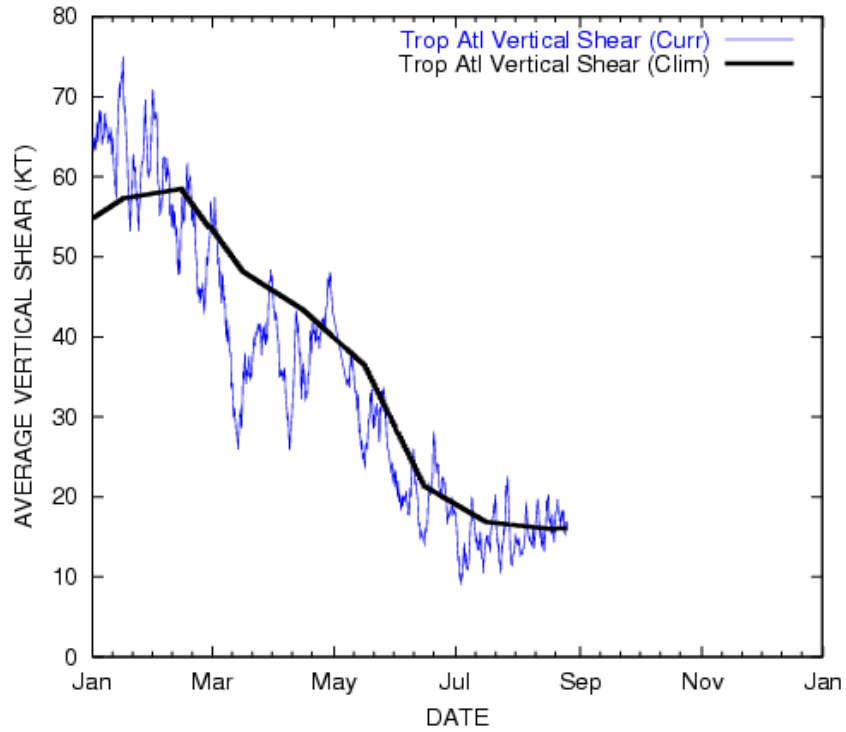


Figure 4: Tropical Atlantic vertical shear. Figure courtesy of the Cooperative Institute for Research in the Atmosphere (CIRA).

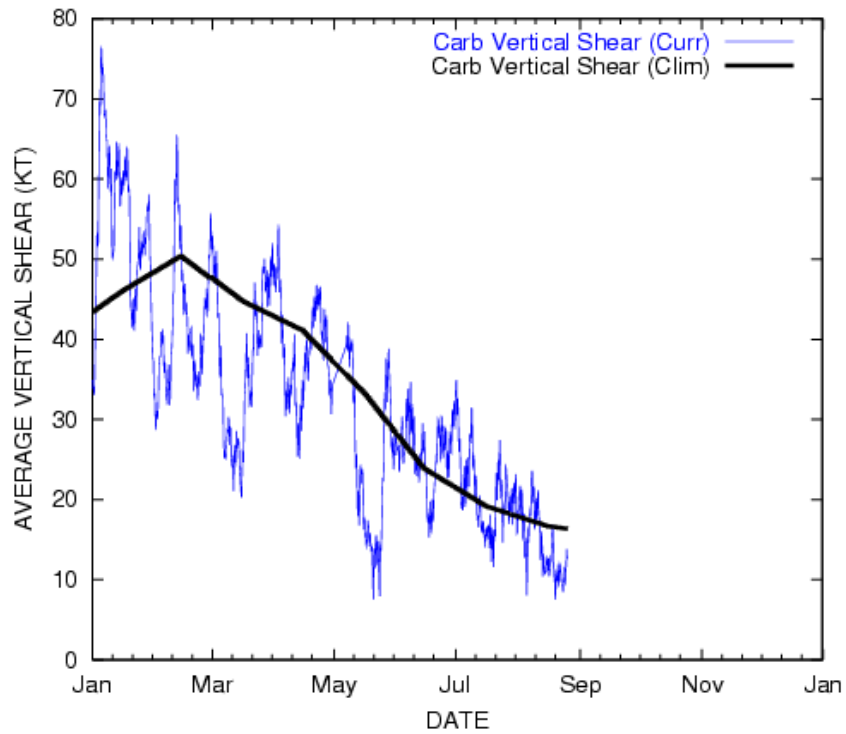


Figure 5: Caribbean vertical shear. Figure courtesy of CIRA.

Generally, moisture and thermodynamics have been quite favorable in the tropical Atlantic during August. The genesis parameter from CIRA (a combination of dynamic and thermodynamic factors) has been running quite high throughout the month (Figure 6).

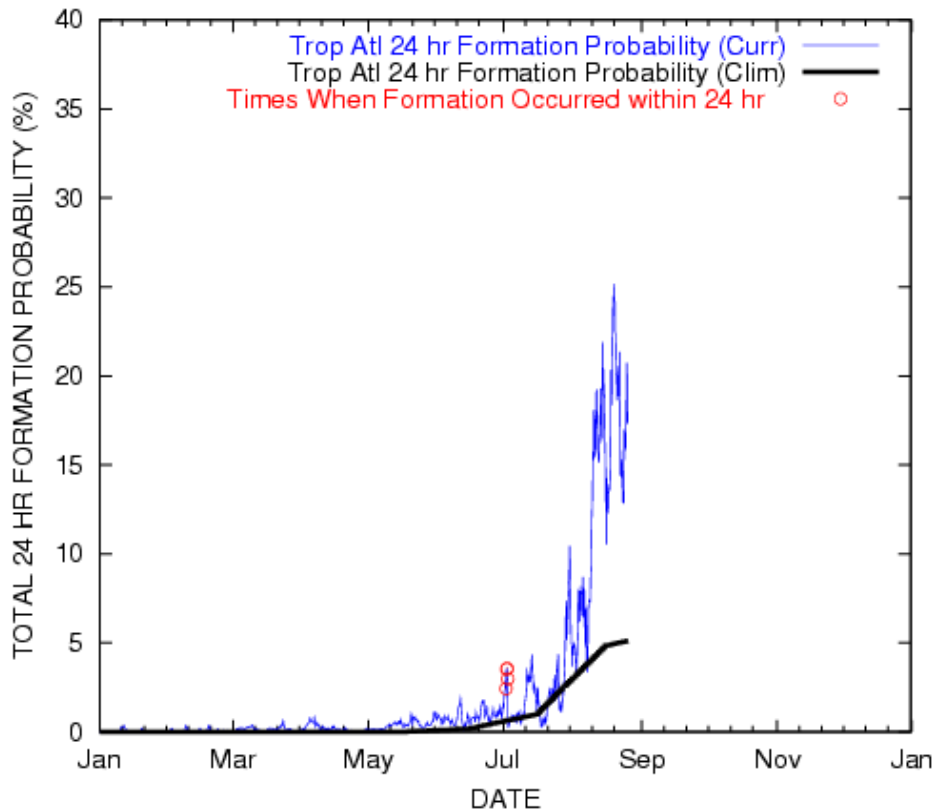


Figure 6: Tropical Atlantic genesis parameter. Figure courtesy of CIRA.

See our 5 August 2008 full season forecast for more background information on this year's predicted hurricane activity. The full season forecast is located here: <http://tropical.atmos.colostate.edu/Forecasts/2008/aug2008/aug2008.pdf>

5 Forecast Theory and Cautionary Note

Our forecasts are based on the premise that those global oceanic and atmospheric conditions which preceded comparatively active or inactive hurricane seasons in the past provide meaningful information about similar trends in future seasons. It is important that the reader appreciate that these seasonal forecasts are based on statistical schemes which, owing to their intrinsically probabilistic nature, will fail in some years. Moreover, these forecasts do not specifically predict where within the Atlantic basin these storms will strike. The probability of landfall for any one location along the coast is very low and reflects the fact that, in any one season, most U.S. coastal areas will not feel the

effects of a hurricane no matter how active the individual season is. However, it must also be emphasized that a low landfall probability does not insure that hurricanes will not come ashore. Regardless of how active the 2008 hurricane season is, a finite probability always exists that one or more hurricanes may strike along the U.S. coastline or in the Caribbean Basin and do much damage.

6 Forthcoming Updated Forecasts of 2008 Hurricane Activity

We will be issuing a prediction for October tropical cyclone activity on **Wednesday 1 October 2008**. A verification and discussion of all 2008 forecasts will be issued in late November 2008. Our first seasonal hurricane forecast for the 2009 hurricane season will be issued in early December 2008. All of these forecasts will be available on the web at: <http://hurricane.atmos.colostate.edu/>.