Storm Signals

Houston/Galveston National Weather Service Office

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The Historical 2005 Hurricane Season

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Gulf coast residents will not soon forget the 2005 hurricane season. During the spring of 2005, experts predicted well above normal tropical cyclone activity across the Atlantic basin; however, none could have forecasted the degree to which this statement would come true. The 2005 season has approached, tied, or surpassed virtually every major tropical cyclone activity record. When attempting to describe the historical significance of this season, it is hard to know where to begin. The first part of this article will focus on the records that have been equaled or broken this year, and the second part will highlight the devastating major U.S. landfalling hurricanes - Katrina and Rita.

Part I: A Season of Records

A record 23 named storms have developed through October, surpassing the previous record total of 21 named storms that formed during the 1933 season (Figure 1). Since tropical cyclones have been given names (1953), this is the first year that a "V" or "W" named storm has formed. It is also the first time that the Greek alphabet has been utilized, having exhausting the standard list of 21 named storms. The record breaking 22nd tropical storm Alpha formed on October 22nd in the east-central Caribbean Sea (Figure 2).

Table 1
The Saffir-Simpson Hurricane Scale

Category	Winds (mph) Damage Potential	Storm Surge (feet) (with bays & inlets)	Examples (U.S. Landfall)
1	75 – 95 Minimal	4 – 5 (4 – 7)	Chantal 1989 Claudette 2003
2	96 – 110 Moderate	6-8 (8-12)	Frances 2004 Irene 1999
3	111 – 130 Extensive	9-12 (13-18)	Alicia 1983 Rita 2005
4	131 – 155 Extreme	13-18 (19-24)	Carla 1961 Katrina 2005
5	156 and greater Catastrophic	Over 18 (Over 24)	Labor Day (FL) 1935 Camille 1969 Andrew (FL) 1992

As you might expect, the 2005 hurricane season got off to a fast start. The earliest formation of the fourth, fifth, sixth, seventh and eighth named storms occurred during July and early August. This frenzy of early activity resulted in a record five named storms developing during the month of July alone. This has also been the only season in which two hurricanes reached Category 4 strength before the end of July - Emily and Dennis. Emily became the strongest tropical cyclone on record before the month of August, having reached a peak intensity of just below Category 5 status. See Table 1 for details concerning hurricane categories.

A record breaking 13 hurricanes have formed so far in 2005. This surpasses the 1969 season for the most hurricanes to form in a single season. Seven have become major hurricanes (Category 3 or greater), a total which is just short of the record of eight set in the 1950 season. This is also the first season in which three Category 5 hurricanes have developed (Figure 3).

Hurricane Wilma further distinguished herself from this elite group by exploding from a Category 1 to a Category 5 hurricane in just 9 hours. As the hurricane hunter crew flew through Wilma at the end of this rapid intensification period, they reported an eye that was remarkably just two miles wide (Figure 4). At that point, the extrapolated sea-level pressure was 892 millibars, which was close to a record low pressure. They had just enough fuel for one more pass through the eye to look for a new record pressure

Table 2

Rank	Storm	Pressure	Year
1	**Wilma**	882 mb	**2005**
2	Gilbert	888 mb	1988
3	FL Keys	892 mb	1935
4	**Rita**	897 mb	**2005**
5	Allen	899 mb	1980
6	**Katrina**	902 mb	**2005**

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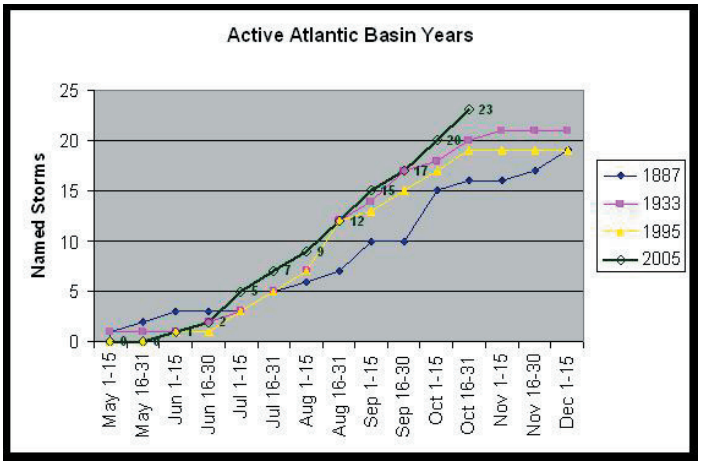


Figure 1. The graph above displays a running total of the number of named storms during bi-monthly periods throughout the 3 most active Atlantic basin seasons from the 1851-2004 period. This year's season is also shown (in green) through October 31th for comparison purposes.

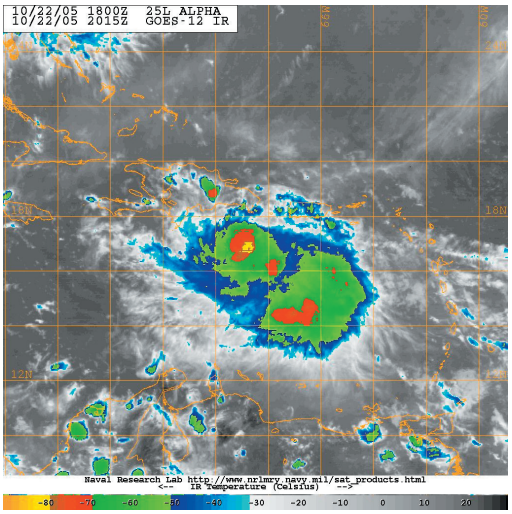


Figure 2. Infrared satellite image of Tropical Storm Alpha near time of formation.

and found just that during the early morning hours of Wednesday, October 19th. Wilma became the strongest tropical cyclone on record in the Atlantic basin with a minimum pressure of 882 millibars, breaking the existing record lowest pressure of 888 millibars (Hurricane Gilbert, 1988) (Figure 5).

Perhaps the most amazing and somewhat ominous statistic to occur this hurricane season is the collective intensities the three Category 5 hurricanes attained in 2005, as this season has seen 3 of the 6 most intense hurricanes on record. See Table 2.

When Hurricane Wilma made a United States landfall across south Florida as a Category 3 hurricane on the morning of October 24th, another record fell. Wilma was the fourth major hurricane to make landfall in the U.S. during the 2005 season. The previous record of three major hurricanes has occurred in several hurricane seasons, with the most recent occurrence last year. In fact, if you consider the 2004 and 2005 seasons collectively, additional records emerge. The two seasonal total of 38 named storms does not have a close second since reliable record keeping began in 1851. The total of seven major U.S. landfalling hurricanes during 2004 and 2005 is the most to occur in consecutive seasons, eclipsing the five major U.S. landfalls during the 1954 and 1955 seasons. Two of these seven major landfalls affected the northern Gulf coast this year – Katrina and Rita.

Part II: Hurricanes Katrina and Rita

Hurricane Katrina has taken in excess of 1200 lives along the northern Gulf coast, and has changed the lives of an order of magnitude more. The catastrophic flooding in New Orleans alone has displaced more than 250,000 people, which is a higher number than during the dust bowl years of the 1930s. Katrina has replaced hurricane Andrew (1992) as the costliest U.S. natural disaster and is also the deadliest since a devastating storm surge took 2500 lives during the 1928 Lake Okeechobee Hurricane. Katrina was comparable to Hurricane Camille (1969) which also made landfall near the Mississippi/Louisiana border; however,

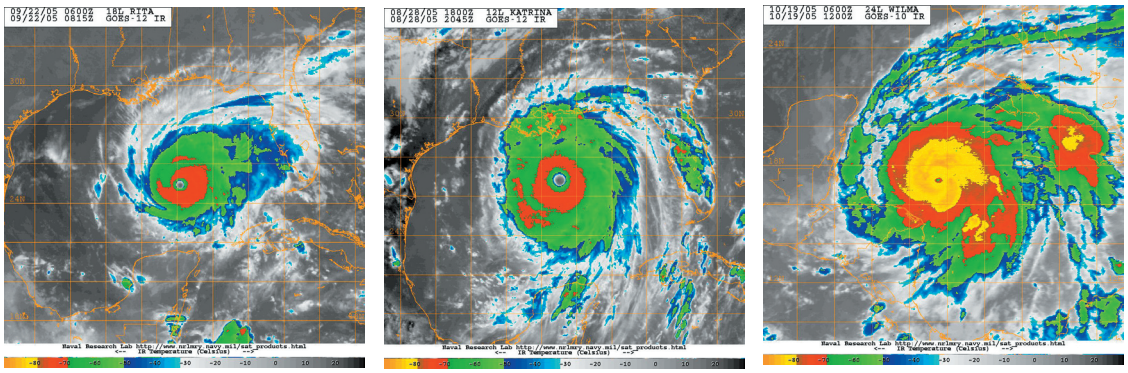


Figure 3. Infrared satellite images near peak intensity for Rita (left), Katrina (center), and Wilma (right).

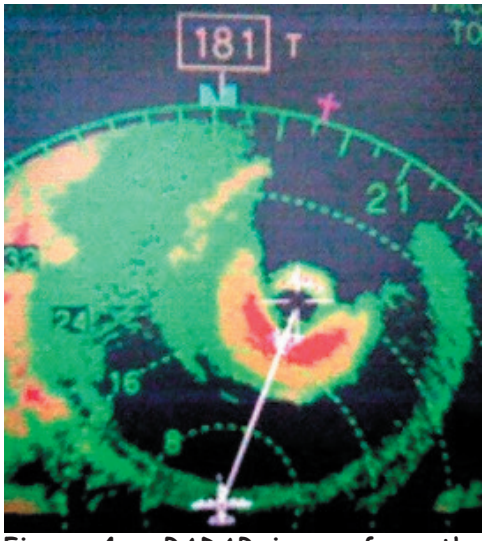


Figure 4. RADAR image from the hurricane hunter aircraft 22 miles from the eye of Wilma.

Katrina was larger than Camille (Figure 7). Therefore, the devastating storm surge brought by Katrina affected a larger portion of the Mississippi coastline. What follows is a summary of Katrina's life beginning with the hurricane's first U.S. landfall and ending with her final landfall along the Louisiana/Mississippi border.

Katrina was a Category 1 hurricane when she made landfall on August 25th over the southern peninsula of Florida and caused widespread damage from 80 to 90 mph wind gusts. The storm dropped an average of eight inches of rainfall across a large part of southern Florida with flooding brought about by isolated amounts of twelve to fifteen inches.

After moving into the Gulf of Mexico, Katrina encountered ideal conditions for tropical cyclone intensification as she moved over very warm water within the loop current in the Gulf of Mexico (Figure 6), and experienced favorable mid- and upper-level winds. On August 28th, Katrina grew very large – almost 300 miles across. By that afternoon, wind speeds topped out near 175 mph when the eye was 250 miles south-southeast of the mouth of the Mississippi River. Katrina did not retain this Category 5 strength for long; yet, she was still a Category 4 storm at landfall in far southeastern Louisiana on August 29th with winds of 140 mph. The eye continued northward over the Gulf of Mexico and reached the coastline a second time near the Louisiana/Mississippi border as a Category 3 storm with winds near 125 mph (Figure 8).

Katrina's landfall along the northern Gulf coast was devastating to an area that extended from southeastern Louisiana to Mobile, Alabama. Strong Category 3 wind speeds affected a large area between Bay Saint Louis and Biloxi, Mississippi. Wind gusts of 80 to 90 mph were measured as far east as Mobile, Alabama. Preliminary post-storm analyses estimated the storm surge was 15 to 20 feet along the Louisiana and the Mississippi coasts along and east of where the eye made landfall. However, it appears to have exceeded 25 feet in some locations. Wind driven waves on top of the surge compounded the damage. A combination of the storm surge and 125 mph wind speeds caused extreme damage along the coast. The surge in the Gulfport and Biloxi areas was unprecedented, topping the surge from Hurricane Camille's surge by 5 to 10 feet. See Figure 9 for a before and after photo of Biloxi, MS.

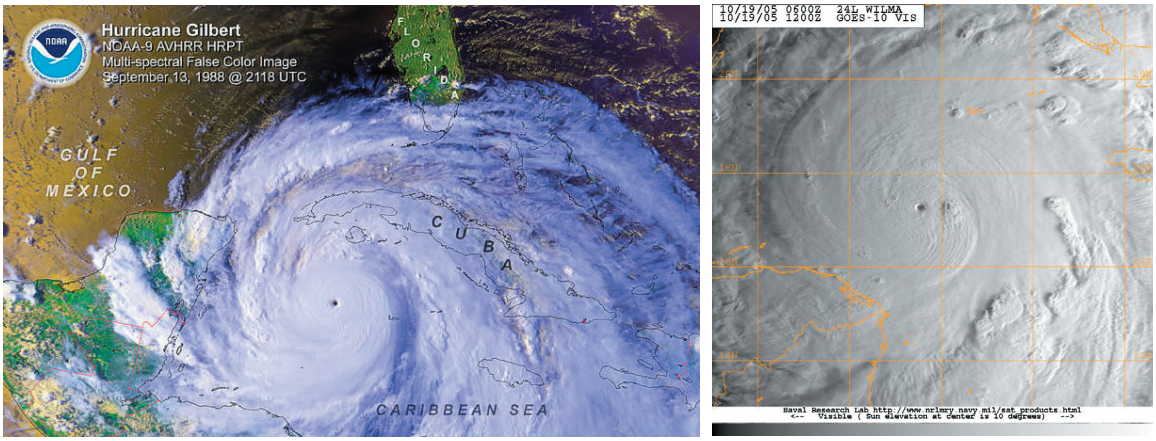


Figure 5. Visible satellite images of Hurricane Gilbert (left) and Hurricane Wilma (right) around the times of peak intensity.

A day after landfall, flooding became the most devastating event associated with Katrina. The surge caused the water level of Lake Pontchartrain to rise, straining the levee system protecting New Orleans. Failures of the levee system began to occur on August 30th and resulted in breeches that allowed water to pour into New Orleans, a city which sits below sea level (Figure 10). The levee breeches left 80% of New Orleans under water with depths of up to 20 feet at some locations. It is this flooding of New Orleans that will be Katrina's legacy and what made this hurricane unique and so devastating when compared to the many other major U.S. landfalling hurricanes.

Just two and a half weeks after Hurricane Katrina made her final landfall along the northern Gulf coast, all eyes turned to Tropical Storm Rita as she moved westward through the central Bahamas. On September 20th, Rita rapidly intensified while moving west through the Florida Straits into the Gulf of Mexico. Rita reached Category 2 intensity as the center passed about 50 miles south of Key West and significantly impacted the Florida Keys. Even though the center of Rita did not make landfall in the Florida Keys, strong winds downed trees and produced storm tides of up to five feet across portions of the island chain, flooding sections of U.S. highway 1 and many other streets, as well as several homes and businesses.

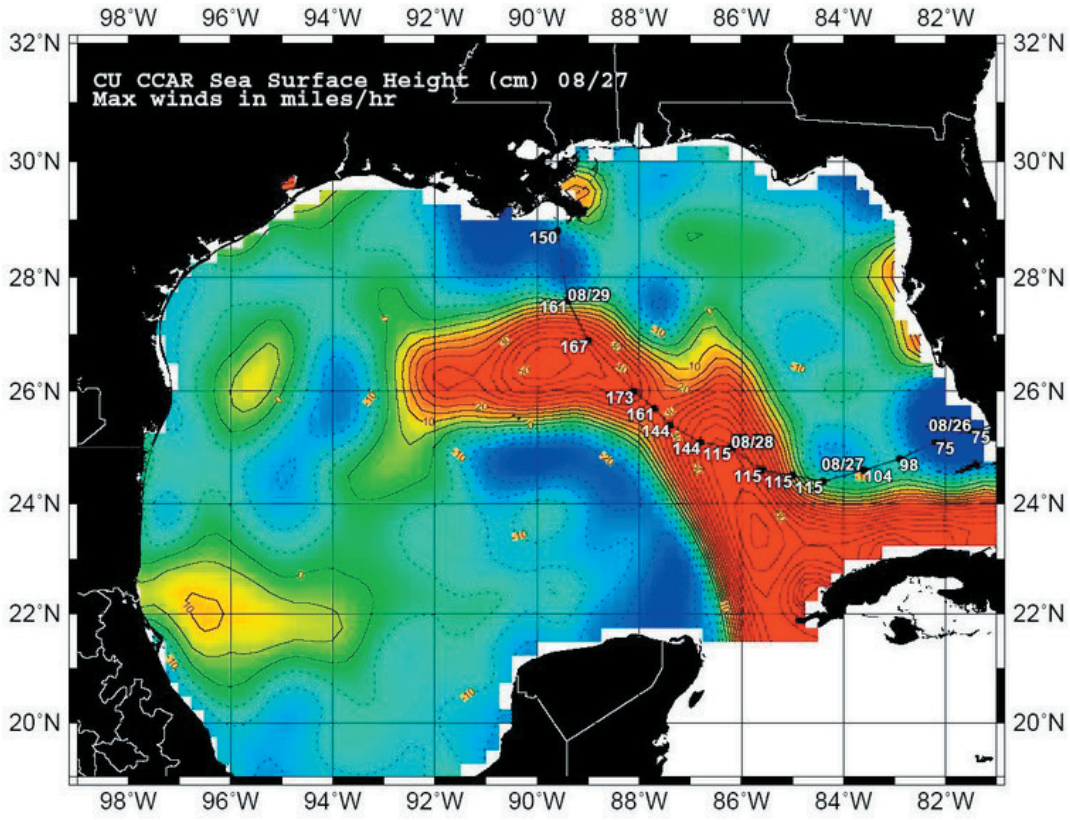


Figure 6. Wind speeds of Hurricane Katrina increasing dramatically as it passes through the warm waters of the Gulf of Mexico's Loop Current (Image from the University of Colorado at Boulder).

After entering the Gulf of Mexico, Rita intensified at an astounding rate going from a Category 2 to a Category 5 in 24 hours. Following this rapid intensification period, sustained winds reached 165 mph on the afternoon of Wednesday, September 21st. Since early Monday, Rita had been consistently forecast to make landfall along the upper southeast Texas coast, when the 120 hour forecast from the National Hurricane Center depicted a landfall near San Luis Pass (Figure 11). Emergency management officials, members of the media, and residents of southeast Texas had been watching Rita closely and planning their course of action on Monday and Tuesday. Therefore, even though the hurricane was still 620 miles southeast of Galveston, everyone had the images of Katrina's impact still fresh in mind, and an unprecedented, largely voluntary evacuation began on Wednesday across southeast Texas. Emergency management officials ordered a mandatory evacuation for coastal sections of southeast Texas beginning at 6 PM on Wednesday. However, residents waiting until then to begin their evacuation found roadways in and around the densely populated Houston/Galveston area already jammed with motorists who had left earlier in the day.

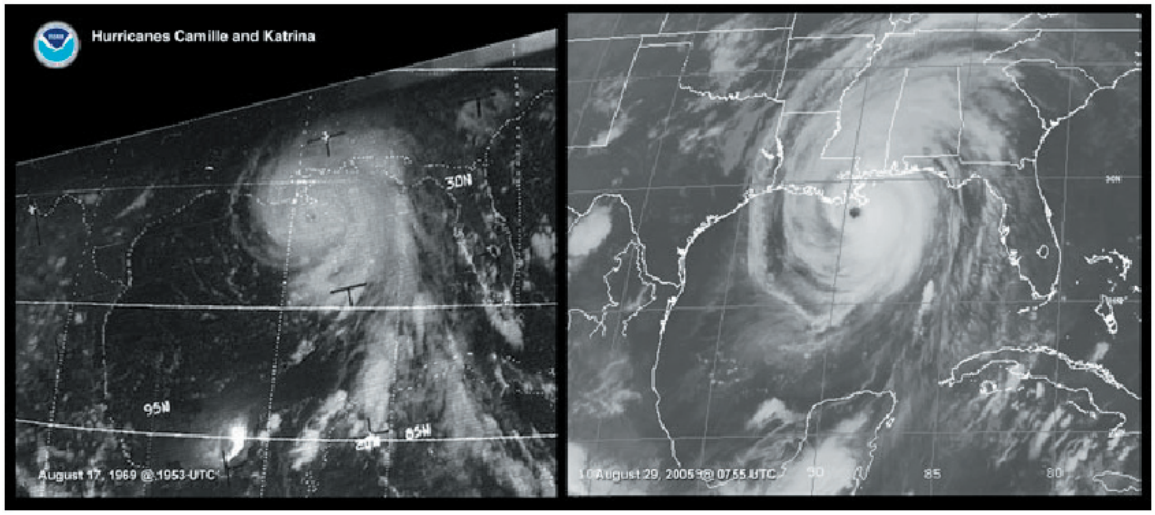


Figure 7. Visible satellite images of Hurricane Camille (1969) (left) and Hurricane Katrina (right).

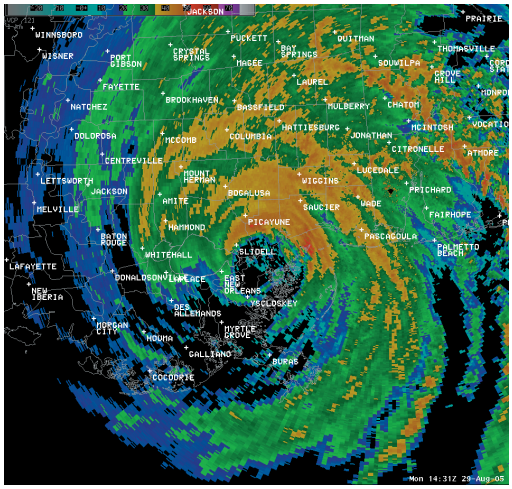


Figure 8. RADAR Base reflectivity image of Hurricane Katrina near landfall.

northwest to northwest. Although this change in motion was only slight, it spared the densely populated Houston/Galveston area from a direct hit and shifted the forecast track and eventual landfall point to the right. Residents of extreme southeast Texas and southwest Louisiana were then expected to experience the brunt of Rita. Fortunately, Rita weakened to a Category 3 hurricane on Friday, September 23rd, prior to landfall which occurred around 2:30 AM Saturday morning just east of the Texas/Louisiana border between Sabine Pass and Johnson's Bayou. Rita caused devastating storm surge flooding and wind damage in southwest Louisiana and extreme southeast Texas. Communities located along the Calcasieu parish coastline in southwest Louisiana will never be the same as 15 to 20 feet of water moved inland, destroying any structure in the path of the surge (Figure 12). Hurricane Rita was the strongest hurricane to make landfall across this portion of the U.S. coastline since Hurricane Audrey (1957) (Figure 13).

Rita affected a large inland area from southeast Texas across southwest and into south-central Louisiana. Widespread damage consisting of downed trees and power lines occurred generally along and east of a Crystal Beach to Liberty to Livingston to Lufkin line in Texas, and west of an Abbeville to Leesville line in Louisiana. Both Lake Charles and Beaumont/Port Arthur experienced significant damage as the strongest winds in the eyewall region affected both communities. Lake Charles was in the path of the eastern portion of Rita's eyewall, while Beaumont/Port Arthur was in the path of the western portion of the eyewall. See Figure 14 for a map of gusts associated with Rita across the National Weather Service

The fear of Katrina-like impacts prompted many inland residents to evacuate even though they were not at risk from storm surge flooding. Therefore, an incredible number of people left, with officials estimating the total to be over 2.5 million. Although the gridlock and gasoline shortages frustrated many evacuees, the evacuation had been ordered very early, and there was ample time for residents to escape the region before the onset of adverse conditions, which were expected on Friday afternoon.

By early Thursday morning, September 22nd, Rita had strengthened further and reached a peak intensity of 175 mph winds with a minimum central pressure of 897 millibars. This was the third lowest pressure on record at that time for the Atlantic basin, and displaced Katrina to fifth on the most intense hurricane list. An upper-level disturbance passing well north of Katrina early on Thursday briefly induced a more northward motion and altered Rita's motion from west-

Figure 9. Before and after images of Biloxi, MS showing the impact of the catastrophic surge from Hurricane Katrina.

Lake Charles warning area. Although Rita tracked 50 miles east of Lake Livingston, sustained northerly winds of 40 to 60 mph occurred across the lake, generating a lake surge that damaged the dam. Fear that the dam could break forced an evacuation of communities immediately downstream as a precautionary measure. Emergency water releases from the dam on Saturday quickly abated this danger.

References:
Technical Report 2005-01 Hurricane Katrina - A Climatological Perspective, National Climatic Data Center

2005 Tropical Cyclone Monthly Summary – September, National Hurricane Center

Figure 10. Levee breech allowing water from Lake Pontchartrain to pour into New Orleans.

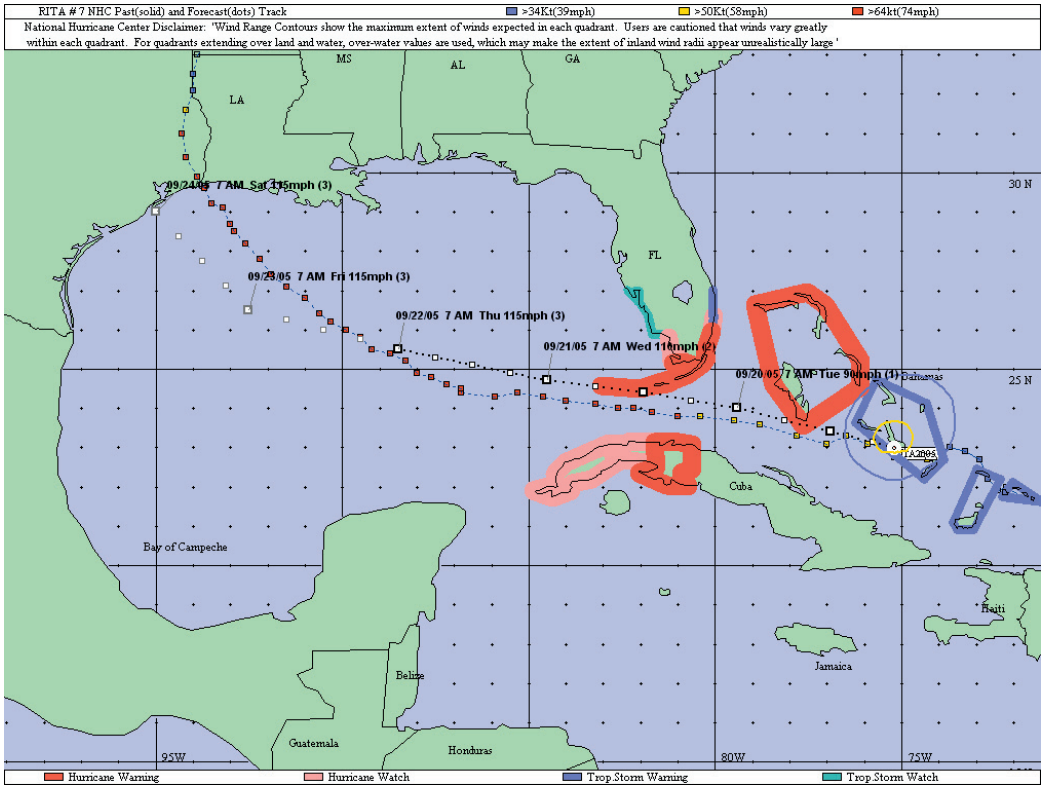


Figure 11. Hurrevac image of the National Hurricane Center forecast and eventual track of Hurricane Rita from the 4 AM CDT advisory on Monday, September 19th, 2005.

Figure 12. Damage from Hurricane Rita in Cameron, LA

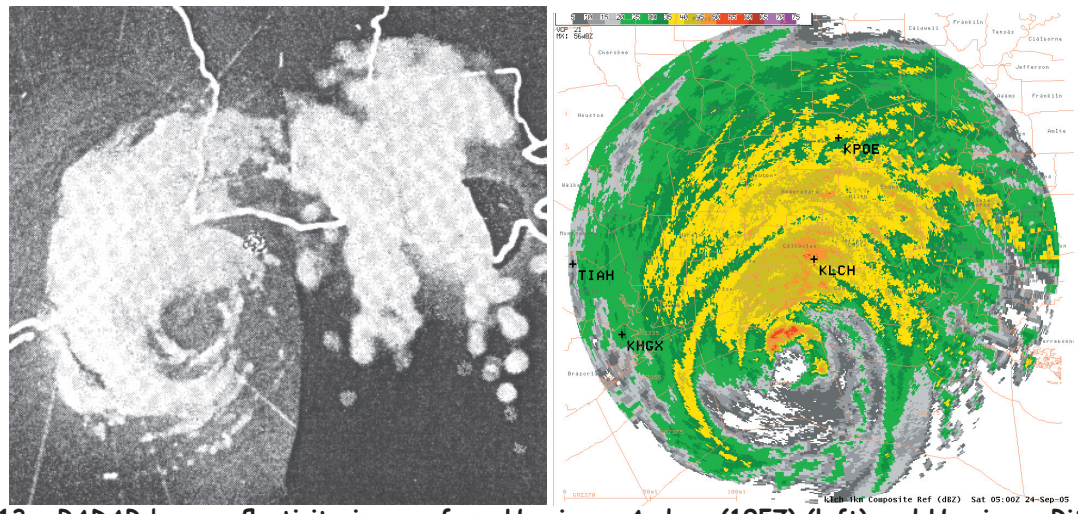


Figure 13. RADAR base reflectivity images from Hurricane Audrey (1957) (left) and Hurricane Rita (right).

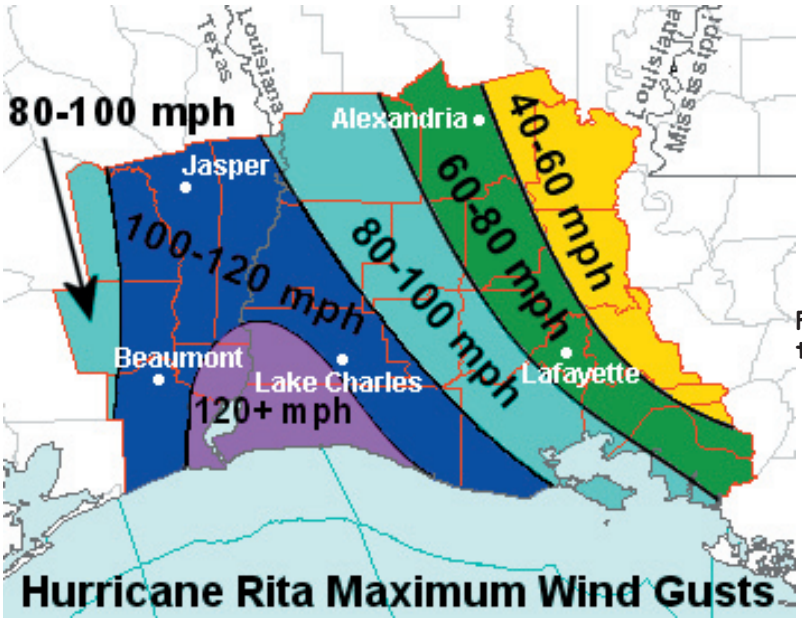


Figure 14. Wind gusts from Hurricane Rita across the NWS Lake Charles warning area.

FEMA/NHC Hurricane Liaison Team Experience: During Katrina

By Bill Read

In case you all are as tired of the FEMA bashing stories as I am, I thought a "good news" FEMA article was in order.

President George W. Bush is handed a map by Deputy Chief of Staff Joe Hagin, center, during a video teleconference with HLT on Hurricane Katrina from his Crawford, Texas ranch on Sunday August 28, 2005. White House photo by Paul Morse

I had the extraordinary opportunity to have served on the Hurricane Liaison Team (HLT) at the National Hurricane Center during Hurricane Katrina. The HLT is a collaboration between FEMA and the National Hurricane Center and was established during the mid 1990s. The purpose of the HLT is to support hurricane response operations through the rapid exchange of critical information between the National Hurricane Center and emergency managers at all levels. The number one priority for the HLT is to assist in giving officials the information they need to make timely, life saving evacuation decisions. The need for focused extra staff at the hurricane center became evident during the 1990s as media and EMC briefing demands on the NHC Director and staff increasingly took them away from important decision making concerning hurricane forecasts and advisories. There is a cadre of NWS field managers and forecasters who have been designated as potential detailees to the HLT. Both Gene Hafele and I have been on the list for a number of years. Last year, Gene served during Ivan while I was there for Charley. For each storm, three NWS staff are deployed; usually two meteorologists and one hydrologist.

The FEMA staff includes their staff meteorologist, who is full time at NHC, and two teams consisting of a team leader with professional emergency management training, two or more information technology experts, and usually two or three former or current county/local EMCs with knowledge of the hurricane issues. The two teams work twelve hour shifts until the storm makes landfall.

The briefings are conducted via video teleconference and/or audio teleconference technology. A web based slide briefing is also maintained by the HLT. The NWS team member is responsible for putting together the information needed for the graphics and in most cases actually presents the briefings. As a team, we work closely with the specialists as they prepare the latest advisory in order to know what their forecast reasoning, concerns, and confidence factors were going into the advisory. The team leader leads the briefing efforts to keep all apprised of the situation. The IT specialists pull together the web slides and briefing slides, run the A/V, and generally keep the show moving. The briefing as conducted is in many respects the same as we do our Houston/Galveston area conference calls for counties in our area of responsibility. The HLT briefs the latest information from the hurricane center, then each participant discusses actions taken, concerns, etc. Because a large and diverse audience is sometimes on the call, the main daily briefing at noon EST can last over an hour. Most of the state calls are similar to those done by Texas DEM.

I was contacted on Wednesday, August 24 to see if I was available to travel on Thursday and start working at the HLT Friday at 7:00 AM. At that time, Katrina was in the Bahamas and forecast to reach Florida Thursday night as either a TS or category 1 hurricane. What follows is a diary of events I experienced.

- Flight was arranged, motel reserved, car reserved. Thursday, August 25, small glitch. Got to IAH and as I was getting ready to board the plane, the flight was cancelled due to MIA being closed for Katrina. Mad dash to service desk landed me on a flight to Orlando. Last car available at Hertz was a Corolla, so I took it and headed south. Good transportation and no tickets! Got as far as West Palm but Katrina had landed so I wisely overnighted in Jupiter. Still managed to get to the Hurricane Center by 7:00 AM. No traffic, no lights, no power in the neighborhood, trees down everywhere and lots of relatively minor damage. You see, the eye of Katrina had passed right over the NHC Thursday evening with gusts to 85 mph…

• No rest for the weary as Katrina was popping out into the Gulf just north of the Keys and showing signs of intensifying. The noon briefing Friday was one of transition – assessing the damage in Florida and need for response, then begin focusing on the second landfall somewhere along the central to east gulf coast. Concern was expressed as to how much further west Katrina would go before turning north. Still too much uncertainty midday Friday for anyone to make the call to evacuate.

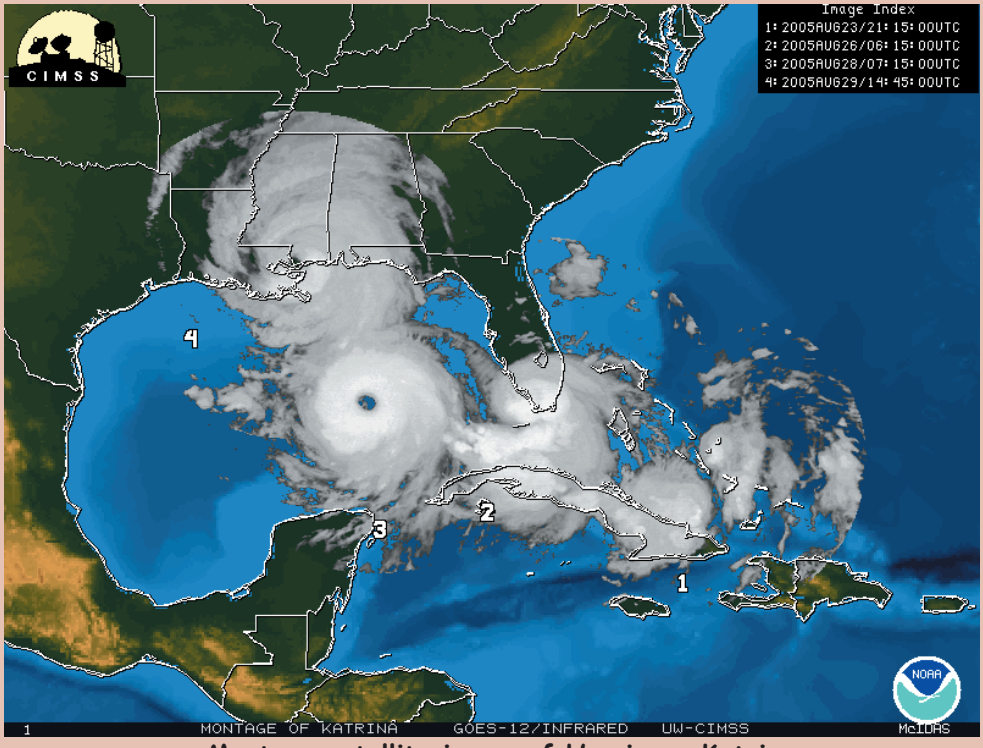
• By late Friday evening Katrina had continued to gradually intensify and the forecast track had shifted west to southeast Louisiana and southern Mississippi. At that time, uncertainty was slowly giving way to realization that a major hurricane would strike the gulf coast in about 60 hours. All involved in the discussions on the HLT briefings acknowledged Saturday would be a busy and important day for decision making.

• Saturday morning…Katrina still moving west but all indications now pointed to the turn to the northwest then north. The track forecast stuck to southeast LA and southern MS. Hurricane Hunter aircraft found a deepening Katrina that was growing larger in area. The forecast called for a large category 4 at landfall with the possibility for it to reach Cat 5. The HLT briefing took on a most serious atmosphere – even Crawford ranch was on the noon video teleconference. In addition to the formal briefings, the HLT team leaders and NHC director were answering and making many calls to the potentially impacted areas. From my view at that time, critical evacuation decisions were made and a lot of folks were moving to activate local, state and federal plans in preparation for the coming disaster.

• Sunday … Cat 5!… it was like being in some kind of made for TV movie, only it was reality. Briefing EMCs and elected officials from Florida through Louisiana about a storm as powerful as Camille, only three times bigger, was heady stuff. There was no doubt at that point that people in charge knew a catastrophe was in the making. President Bush himself spoke during the HLT video teleconference. Confidence in the track and even in the intensity was as high as I can remember and this was expressed through the HLT to decision makers at all levels. The challenge on this day was to get as many people out of the surge areas as possible.

• Monday… landfall… HLT actually becomes rather quiet. Once the storm makes landfall, the extra staffing returns home. Like everyone else, we observed the 12 hour progression of a giant major hurricane as it hit arguably the most vulnerable section of the U.S. coastline…then moved inland and dissipated. While we in the business pretty much knew what was happening, it was still hard to believe the catastrophe that we all viewed as the days and weeks have passed.

My hat is off the cadre of FEMA folks who make the Hurricane Liaison Team. I think studies of the evacuation process will show many if not most decision makers had the best information possible and called for evacuation in reasonable time. As of this writing I hear the figure of 80% as the response to calls for evacuation. That is historically a pretty high figure. For me, it was an honor to be a bit player with the FEMA team at NHC during Katrina.



Montage satellite image of Hurricane Katrina
(courtesy of CIMSS - Cooperative Institute for Meteorological Studies)

Summer Ends on a Warm and Dry Note

Summer, defined as June, July and August was slightly drier than normal. Temperatures were near to slightly above normal for the three month period. Most of the rainfall southeast Texas received over the summer was delivered via the sea breeze. Cold fronts were hard pressed to penetrate this far south and upper level winds were not favorable for meso-scale convective complexes to propagate south. Sea breeze convection is generally scattered in nature and rainfall totals between locations can vary greatly. That has been the case this year.

Occasionally, sea breeze induced thunderstorms can produce wind damage or even small hail. Widespread severe weather did not occur over the summer, but isolated wind and hail damage occurred on July 6th, 7th, 11th, 13th and 29th. Other wind damage reports occurred on August 7th, 9th and the 22nd.

Temperatures were warmer than normal over the three month summer period. In fact, Galveston had its warmest August in recorded history. The average temperature in August was 86.6 degrees. The previous warmest August was 86.1 degrees and occurred in 1999. Galveston also endured its third warmest June in recorded history. The records don't stop there as Galveston recorded its warmest summer in recorded history with a three month average temperature of 85.8 degrees. The previous warmest June-August was 85.5 degrees and occurred in 1875. The normal temperature for the three month period is 83.6 degrees. Five of the ten warmest summers and seven of the ten warmest Augusts have occurred since 1990.

Houston endured its 13th warmest June through August period with an average temperature of 84.1 degrees. The warmest three month period was 86.4 degrees and occurred during the blistering summer of 1980. The second warmest summer occurred back in 1998 with an average temperature of 85.6 degrees. The normal temperature for the three month period is 82.7 degrees.

College Station averaged 84.4 degrees over the three summer months. This is the 23rd warmest summer period in history. The warmest summer occurred back in 1998 with an average temperature of 86.8 degrees. The average temperature for the most recent August was actually cooler than normal.

The summer began on a dry note and June was the driest month of the year. Rainfall increased in July and was one of the wettest months of the year. August rainfall was below normal near the coast and central parts of the region, and near to slightly above normal over the north. Summer rainfall can be scattered and intense. It is difficult to draw conclusions on rainfall patterns this summer because some areas received excessive rain in July and the three month total is above normal. Other areas were much drier in June and August and rainfall totals were below normal.

The dry weather extended into September and October. Rainfall across the area was well below normal. College Station endured it's driest September on record. Only a trace of rain fell at Easterwood Field. All three primary climate sites established new monthly temperature records and recorded their warmest Septembers on record. With the exception of Hurricane Rita, hazardous weather was at a minimum. Rita did produce strong winds east of a Crockett to Houston to Galveston line. Some of the stronger wind speeds include gusts exceeding 100 mph near Lake Livingston and near 60 mph near Intercontinental Airport.

October was another quiet weather month. Temperatures were near normal and rainfall was again below normal. The only excitement during the month occurred on Halloween when a squall line raced across the region. These storms were accompanied by strong winds and large hail in Brazos, Burleson and Waller counties.

Overall, the region seemed to be suffering from a rainfall deficit this summer. Here are the monthly temperature and rainfall totals for some sites across southeast Texas for this summer:

June 2005						
Site	Avg High	Avg Low	Avg Daily	Departure	Rainfall	Departure
IAH	93.5	73.0	83.3	+2.0	0.08	-5.27
GLS	89.7	79.8	84.7	+2.5	0.24	-3.80
CLL	94.4	73.3	83.9	+2.3	0.45	-3.34
HOU	92.6	74.7	83.6	+1.3	0.29	-6.55
PSX	89.9	75.2	82.5	+1.4	0.80	-3.51
UTS	96.3	73.1	84.7	N/A	0.11	N/A
CXO	94.3	69.0	81.7	N/A	1.50	N/A
LVJ	92.3	74.0	83.2	N/A	0.41	N/A
LBX	90.8	71.3	81.1	N/A	0.32	N/A
SGR	93.7	72.7	83.2	N/A	0.79	N/A
DWH	93.6	71.5	82.6	N/A	0.53	N/A
HGX	90.7	72.6	81.6	N/A	1.39	N/A

July 2005						
Site	Avg High	Avg Low	Avg Daily	Departure	Rainfall	Departure
IAH	93.7	75.2	84.4	+0.8	5.30	+2.12
GLS	91.7	80.5	86.1	+1.8	4.02	+0.57
CLL	95.3	74.4	84.8	+0.2	4.63	+2.71
HOU	92.6	75.5	84.1	-0.4	12.96	+8.60
PSX	92.0	76.5	84.3	+0.9	6.93	+2.94
UTS	95.4	73.7	84.5	N/A	3.06	N/A
CXO	94.1	72.5	83.3	N/A	5.27	N/A
LVJ	93.2	75.9	84.5	N/A	7.74	N/A
LBX	92.3	73.8	83.1	N/A	4.17	N/A
SGR	94.2	74.4	84.3	N/A	5.15	N/A
DWH	94.2	73.8	84.0	N/A	7.14	N/A
HGX	91.6	74.0	82.8	N/A	7.50	N/A

August 2005						
Site	Avg High	Avg Low	Avg Daily	Departure	Rainfall	Departure
IAH	94.1	75.1	84.6	+1.3	1.52	-2.31
GLS	92.0	81.2	86.6	+2.2	1.00	-3.22
CLL	94.4	74.6	84.5	-0.2	3.26	+0.63
HOU	93.7	76.9	85.3	+0.9	2.54	-2.00
PSX	93.0	78.2	85.6	+2.6	0.35	-3.01
UTS	94.8	74.1	84.5	N/A	5.68	N/A
CXO	94.9	71.8	83.3	N/A	1.58	N/A
LVJ	93.7	76.1	84.9	N/A	1.17	N/A
LBX	93.6	73.3	83.5	N/A	0.86	N/A
SGR	93.7	73.9	83.8	N/A	4.59	N/A
DWH	94.9	73.7	84.3	N/A	1.82	N/A
HGX	92.2	74.3	83.2	N/A	5.39	N/A

September 2005						
Site	Avg High	Avg Low	Avg Daily	Departure	Rainfall	Departure
IAH	93.2	73.6	83.4	+4.5	2.63	-1.70
GLS	90.2	78.9	84.6	+3.5	2.06E	-3.70
CLL	96.7	73.2	85.0	+5.3	Trace	-3.91
HOU	93.2	75.8	84.5	+4.0	1.47	-4.15
PSX	93.0	77.5	85.2	+6.2	4.12	-2.46
UTS	94.2	71.6	82.9	N/A	0.66	N/A
CXO	95.1	69.4	82.2	N/A	0.36	N/A
LVJ	92.1	74.7	83.4	N/A	1.83	N/A
LBX	93.3	72.9	83.1	N/A	1.97	N/A
SGR	93.5	73.1	83.3	N/A	0.94	N/A
DWH	94.9	72.2	83.6	N/A	1.07	N/A
HGX	90.9	73.4	82.1	N/A	3.19	N/A

October 2005						
Site	Avg High	Avg Low	Avg Daily	Departure	Rainfall	Departure
IAH	83.3	58.9	71.1	0.7	1.69	-2.81
GLS	80.8	67.3	74.0	-.01	2.51	-0.98
CLL	83.5	58.5	71.0	0.5	2.11	-2.11
HOU	82.9	62.4	72.6	0.4	1.41	-3.85
PSX	84.0	63.1	73.5	2.2	4.24	-0.77
UTS	81.9	55.9	68.9	N/A	2.64	N/A
CXO	82.6	53.5	68.7	N/A	2.08	N/A
LVJ	82.4	61.0	71.7	N/A	1.50	N/A
LBX	82.8	59.1	70.9	N/A	4.85	N/A
SGR	83.4	59.1	71.2	N/A	2.38	N/A
DWH	84.2	57.3	70.7	N/A	1.89	N/A
HGX	80.9	59.4	70.1	N/A	2.01	N/A

Southeast Texas Flooding

By Mike Rehbein

The recent devastation of New Orleans by Hurricane Katrina is a reminder of the power of water. Southeast Texas has not experienced any major flooding this year due to a relatively dry summer season. The Gulf of Mexico supplies abundant moisture year round. This moisture helps to fuel showers and thunderstorms which brings beneficial rain to sustain crops and replenish water supplies in lakes and reservoirs. However, since there is usually a large amount of moisture for these storms to work with, they all too often can produce very heavy rainfall in a fairly short time period. This can lead to flooding that ranges from nuisance street flooding to major urban or river flooding.

Flooding kills more people in the United States than other types of severe weather. Only heat has killed more people than flooding in recent years. Why is flooding so deadly? Moving water is a very powerful force. It can easily move vehicles or other large objects. Vehicles can begin to float in as little as two feet of water. Once a vehicle loses contact with the road or pavement, it can easily be swept off a road and into a creek or river bed. A person's chance for survival once a vehicle is in motion is very low. If you are driving and come across an area where water covers the road and you do not know the depth of the water, the best thing to do is to turn around and find an alternate route to your destination.

Urban flooding is perhaps the most common type of flooding experienced in Southeast Texas. Rapid urbanization affects the land in many different ways. First of all, natural streams, creeks, etc. are disrupted when homes are built or infrastructures are built. Secondly, urban areas are predominantly concrete or asphalt. This prevents natural percolation of water into the soil and most of the rain that falls simply runs off the pavement. Since Southeast Texas experiences thunderstorms that produce very heavy rainfall, water often falls faster than the drainage systems can remove it. This creates flooding situations, particularly in low lying areas like underpasses.

The National Weather Service urges everyone to follow this one statement when they come across a flooded road: Turn Around, Don't Drown! Either find another route to get to your destination or wait for flood waters to recede. Getting to your destination quickly is not worth risking your life!

2006 SKYWARN

As southeast Texas residents, we are all well aware that severe weather can occur every month of the year. However, statistically, the majority of severe weather episodes occur in the springtime months of March, April, and May. Another peak time for severe weather is the months of October and November. Is your town, county, or community properly prepared to handle a severe weather outbreak? One of the ways you and those around you can be better prepared is to become more aware of these violent storms. Our office hosts SKYWARN training sessions preceding spring's severe weather season with the goal of educating the public to be safe, informative storm spotters.

What is SKYWARN?
SKYWARN is a program sponsored by your local National Weather Service Office to train you and your neighbors to be storm spotters. When the threat for severe weather arises, these trained spotters will watch the skies and report important weather information back to their local emergency manager's office, law enforcement agency, or National Weather Service Office. This information is vital in aiding the forecaster's decision process in warning local citizens and schools of severe weather. Your information is also utilized by the National Weather Service to enhance the warning program.

Who can be a Storm Spotter?
Anyone who has the interest in helping their community can be a spotter. Folks who make good spotters are generally people who have an interest in weather and the safety of their fellow man or woman in mind. In the past, people from all walks of life have attended our sessions with the highest representation being those who work in the law enforcement, fire-fighting, or EMT fields. There are always a few amateur radio operators in the audience, as well! The key is good communication. It is important to relay your reports as quickly as possible to the local authorities or weather service office.

How do you become a trained spotter?
SKYWARN training classes take place throughout southeast Texas from late winter through early spring; generally from early February through mid April. Classes last between two to three hours and are usually given during the evening hours or on Saturdays. Each participant receives a certificate, a SKYWARN sticker for their vehicle, and additional informational materials to further enhance their severe weather understanding. How and what types of information to report are also discussed during our time together. If you are interested in helping the National Weather Service by becoming a trained SKYWARN spotter, please plan on attending one of our early 2006 training sessions. You can check out our website for the times and locations of upcoming SKYWARN classes.

If you are an emergency manager, sheriff, or other public official and are interested in scheduling a SKYWARN class, please contact the Houston/Galveston National Weather Service Office at 281-337-5074. This coming season's class schedule will be posted on the web at: www.srh.noaa.gov/hgx/severe/skywarn/schedule06.htm which will be continuously updated throughout the spring months.

Winter Safety Rules

Although rare in southeast Texas, winter weather does occasionally occur. January is the month when snow, sleet, or freezing rain is mostly likely to be observed; yet, winter weather conditions can occur at anytime during the winter and early spring months. Also, people traveling into other parts of the country will likely encounter winter weather harsher than what occurs along the upper Texas Gulf coast. The leading cause of death during winter storms is transportation accidents. Hypothermia and frostbite are other dangers from very cold winter temperatures. The Houston/Galveston National Weather Service Office would like to review some important safety information to help you and your family to prepare for winter weather.

- Limit travel during periods of winter weather. Bridges, overpasses, and elevated roadways are especially vulnerable to ice and snow conditions given the lack of ground insulation under these structures.
- Before the onset of winter precipitation, check your supplies and, if necessary, stock up on groceries, gasoline, and other necessities.
- Have flash lights and extra batteries on-hand in case of possible power outages.
- Wear layers of protective clothing if you are venturing outside—wind makes the air feel much colder.
- Be alert to the signs of hypothermia. These include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.
- If hypothermia signs occur, seek immediate medical attention. If medical attention is not available, slowly warm the person's body core first by getting them into dry clothing and wrapping them in a warm blanket covering the head and neck. Giving warm broth and warm food is better than giving beverages or food that is hot. Alcohol should not be taken.
- Be alert to the signs of frostbite. The most susceptible parts of the body are the extremities such as fingers, toes, ear lobes, or the tip of the nose. If frostbite occurs, seek immediate medical attention. If it is not available, the affected areas should be warmed slowly.

Concerning travel, make sure your vehicle is prepared for the onset of winter weather. Have a mechanic check the coolant system and fluid levels, the electrical system and lights, and the heater and defroster. Also, ensure good winter tires are installed. Keep a windshield scraper and small broom available for ice and snow removal. During periods of winter weather it is a good idea to maintain at least a half tank of gas. If you must travel, allow extra time to reach your destination and leave plenty of space between you and other vehicles. Ice- or snow-covered roadways are especially treacherous and stopping distances are greatly increased. In the event of a winter storm, it is a good idea to carry a winter storm survival kit in your vehicle. Suggested items for the kit for southeast Texas residents include:

- Flashlights with extra batteries
- A first aid kit with a pocket knife
- Necessary medications
- Blankets and an extra set of winter clothes and rain gear
- Matches and a candle for heat
- A brightly colored cloth to use as a flag
- A supply of food and water
- A shovel and a small bag of sand for generating traction under wheels
- Small tools and booster cables.

Remember, even though harsh winter weather is rare in southeast Texas, it still occasionally occurs. It is very important to stay informed about the possibility of winter weather in your area. This can be done by tuning into NOAA weather radio, commercial radio, or your local television station. If you would like more winter weather information, you can contact the Houston/Galveston National Weather Service Office.

Staff Spotlight: Kim Mikesell

Position: Administrative Support Assistant (ASA)
Favorite Movie: "Corrina, Corrina"
Last Movie Saw: "The Up Side Of Anger"

Personal Information
Hometown: Pensacola, FL
Status: Married, 2 kids, 1 dog

NWS Background
1989 - Present: Administrative Support Assistant, NWSFO Houston/Galveston, TX

Career Highlights / Achievements / Duties / Other Tidbits

- Duties: Managing the budget, paying the bills, personnel paperwork, ordering all of the supplies, making travel arrangements, keeping peace in the office with "Chocolate Days".
- Favorite holiday is "Chocolate Day" which is usually held on days when forecasters and management are really grumpy
- Navy brat having lived in (in chronological order): Pensacola, FL; Hutchinson, KS; Jacksonville, FL; Lubbock, TX; Corpus Christi, TX; Leonardtown, MD; Patuxent Naval Station, MD; San Jose, CA; Buffalo Grove, IL; New Orleans, LA; Abilene, TX; Springfield, VA; Arlington, VA; Austin, TX; San Antonio, TX; and finally, Alvin, TX (where I have lived the longest)

Favorite Song from the '70s: Anything by Elton John especially "Your Song" (I had all of his 8-tracks!), anything from the Doobie Brothers, because I met them and almost had dinner with them, and absolutely nothing that has to do with Disco!

What is the main difference with the NWS Houston Office from when you started?
The office was in Alvin with 9 employees; now we are in a new office building in Dickinson and have 24 employees.

Favorite weather?
80F with no humidity.

Favorite weather event worked:
I have worked two events: December 1992 Flooding and Tropical Storm Allison; neither one was my favorite.

Houston/Galveston
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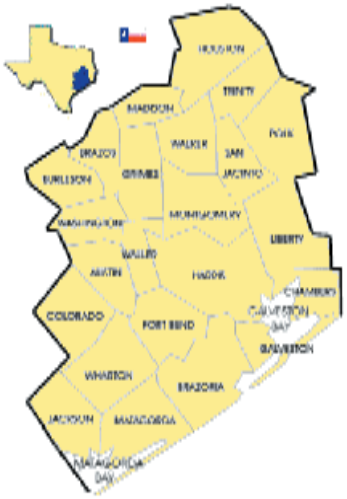

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