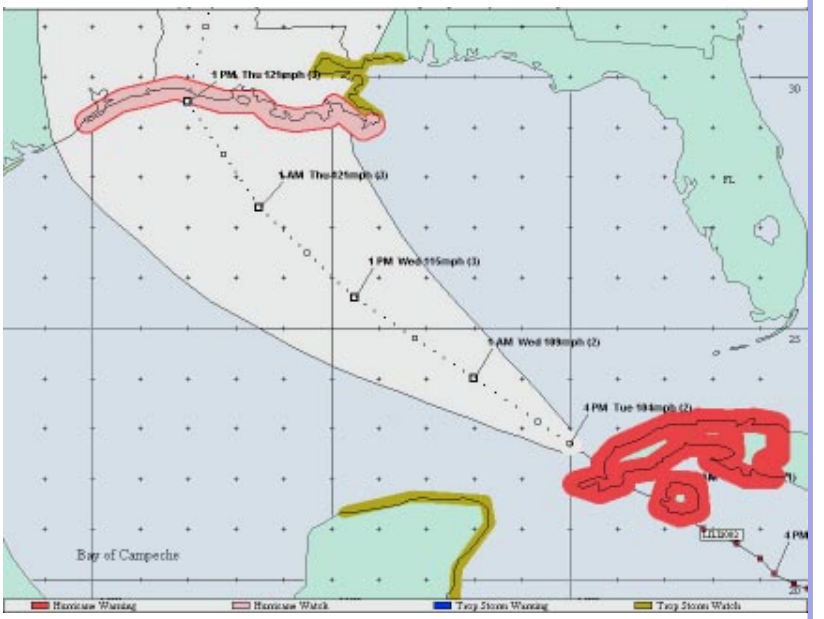
Storm Signals

Houston/Galveston National Weather Service Office Volume 63

Hurricane Lili
Educated Evacuation Decision Making

By Gene Hafele

Hurricane Lili was the first major hurricane to test the Evacuation Decision Making Process that has been put into place in recent years along the upper Texas coast. The upper Texas coast has been threatened and impacted by numerous tropical storms but Lili was the first real major hurricane threat since Andrew in 1992. The decision to evacuate is ultimately made by local officials (mayors and county judges) with advice from emergency management coordinators. The Houston/Galveston National Weather Service provides meteorological advice on what impact the storm will have on the upper Texas coast from Port O'Connor to High Island. Each year the National Weather Service educates emergency management officials on the state of the art of hurricane forecasting.



Graph 1:Hurricane Lili Forecast and Error Cone 4PM Tuesday October 1

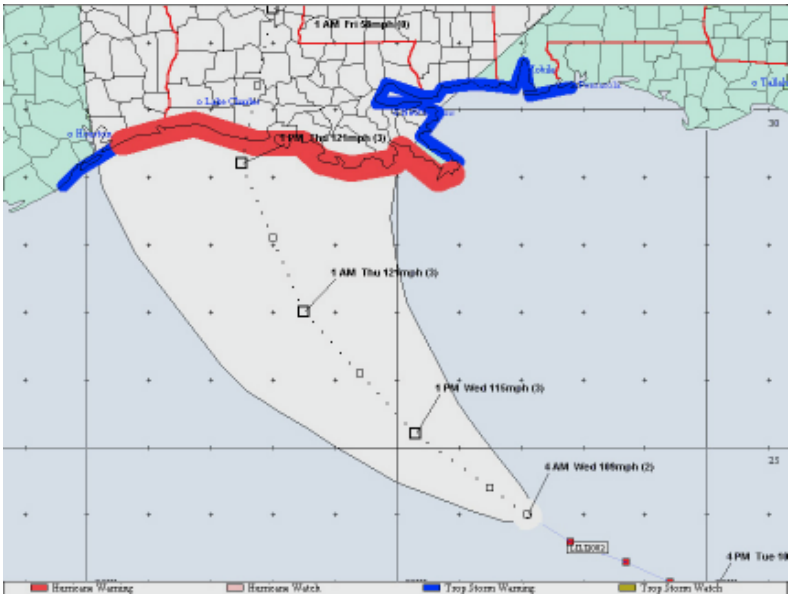
In this Issue:

It is important that local decision makers understand the errors inherent in the hurricane forecast, especially in forecasts beyond 24 hours before landfall. During the decision making process, the National Weather Service must convey their confidence in the forecast or lack of confidence in the forecast based on the current and forecast meteorological parameters.

On Tuesday, October 1st, Hurricane Lili moved into the Gulf of Mexico as a category 2 storm moving west northwest at 15 mph. At 4PM that afternoon, partially due to the speed of the storm, a hurricane watch was posted from San Luis Pass to the mouth of the Mississippi River. Lili was forecast

to become a category 3 hurricane in 24 hours, so due to uncertainty in forecast intensity, the upper Texas coast was beginning to plan for a category 4 hurricane. A "what if" scenario was run taking Lili directly at Galveston. This scenario would bring tropical storm force winds to the coastal region by 10AM Thursday, or in about 42 hours. Based on this information, a decision to begin a phased evacuation would have to be made using the 4AM Wednesday morning forecast package, before schools opened and before most folks would have headed to work. Graph 1 shows the 4PM advisory's projected path and the average error cone. At this time, the average error cone extended west of the hurricane watch end point to near Matagorda. At 48 hours, the average error in the Hurricane Center's forecast is a little over 150 nautical miles. Another piece of information to look at is the probability the storm will pass within 65 miles of certain points along the coastline. At 4PM New Iberia, LA and Port Arthur, TX had the highest total probabilities with 21%. Galveston was close behind with 20%. It is important to monitor the probabilities and see how the probability nearest you changes with time and how it also compares to adjacent locations. At 4PM Tuesday, it was looking like a large evacuation of Galveston, Chambers and portions of Harris County was indeed a possibility on Wednesday, mainly due to the uncertainties in the forecast. This evacuation recommendation if issued would include around a half- million folks. This would be in addition to the folks that would also be leaving extreme southeast Texas around the Beaumont/Port Arthur region.

At 4AM Wednesday morning, Lili was a strong category 2 hurricane with a forecast to become a category 3 by that afternoon. The storm was located about 500 miles southeast of Galveston moving west northwest at 14 mph (graph 2). If the storm were to follow this same course with the same speed, the 34 knot winds would reach the coast in around 26 hours, or around sunrise on Thursday. The storm, however, was still forecast to make a gradual turn to the northwest and eventually to the north before making landfall in southwest Louisiana. Hurricane warnings were issued from east of High Island to the mouth of the Mississippi River. A tropical storm warning was issued from Freeport to High Island. Confidence was high in this forecast as most computer models were in agreement that Lili would curve around the western edge of a surface high pressure system that was slowly shifting to the east. As mentioned earlier, the probabilities are a clue to the threat for your area. The 4AM bulletin now showed New Iberia with the highest total probability of 26% which is a 5% increase from the 4PM bulletin. In Galveston, the probability was now 21%, or only 1% more than at the 4PM bulletin despite the storm being 12 hours closer to landfall. The other item in our favor was that Lili was a fast moving storm. Errors in the forecast normally associated with fast moving storms occur more in the timing of the landfall than the location of the landfall. The average forecast error for a 36 hour forecast for the last 10 years is 118 nautical miles. Since this storm was a fast moving storm, the error to the left or right of the predicted path would be about 25% less, or around 90 miles to the left or right of the predicted path. A "what if" scenario was put together to see what the effects would be if the storm indeed made landfall 90 miles further west than was projected by the 4AM forecast. This scenario would take the storm into Jefferson County near Port Arthur. The hurricane force winds only extended 35 miles to the west of the eye which would take the hurricane force winds to near High



Graph 2: Hurricane Lili Forecast and Error Cone
4AM Wednesday October 2

Island in what we felt was a worse case scenario based on the latest meteorological data. Based on this forecast, reasoning and confidence in the forecast, local officials in Chambers, Galveston and Harris Counties decided not to recommend any evacuation at that time. However, further to the east in Jefferson and Orange Counties, the decision to recommend an evacuation was made since they were still in the forecast margin of error.

Once the decision had been made not to recommend evacuation of Galveston and portions of Harris County, there was no chance to change that decision later in the day. There would not have been sufficient time left to accomplish a safe and complete evacuation. At 1PM, Lili had rapidly intensified to a Category 4 storm. The forward motion of the storm however was now toward the northwest at 15 mph. The gradual turn to the north had begun. At 4PM, Lili had continued to strengthen and was now a strong Category 4 hurricane with maximum sustained winds near 140 mph. The forecasters at the National Hurricane Center were increasingly more confident that the storm was going to make landfall in Louisiana. The main threat for the Texas coast from High Island west to San Luis Pass would be high tides caused by large swells being generated by Lili. At 4PM, emergency management officials in Galveston and Chambers County were recommending a voluntary evacuation of the Bolivar Peninsula and low lying areas of Chambers County due to the fact they might be cut off from the mainland by high tides overnight.

Lili made landfall Thursday morning around 9AM in Vermilion County as a minimum Category 2 hurricane (graph 3). Fortunately for the folks in south central Louisiana, Lili lost much of her strength during the 8 hours prior to landfall. Lili made landfall only 40 miles east of the 48 hour forecast position, issued at 4PM Tuesday. That same forecast also predicted Lili would make landfall around 2PM Thursday afternoon. Lili made landfall 5 hours earlier at 9AM which equates to a 75 mile error when you consider the average speed of the storm of 15 mph.

The decision not to recommend an evacuation was a difficult and as it turned out a correct decision. The emergency management officials should be commended for following their plans and procedures in making a difficult yet correct decision. In 1992 when Andrew, also a fast moving major hurricane, threatened the upper Texas coast, decisions about evacuation were made independently by each county and in many cases by each city within a county. Coordination with the National Weather Service was done over the phone with each separate decision making organization. During Lili, conference calls were held with all the key players so everyone had the same information to make a decision. All the key players had an opportunity to ask the Houston/ Galveston NWS specific questions that were relevant to their city or county. When it was all said and done, a well coordinated and educated decision had been made with the best available data at the time.

Graph 3: Landfall of Hurricane Lili

When the next storm shows up in the gulf, the forecasters might not be as confident. The error in the forecasts might actually be higher than the average errors. The emergency management community might have to make a recommendation to evacuate over a half-million people from the Galveston Bay area for a similar storm forecast to make landfall in southwest Louisiana due to the uncertainty. These decisions will be educated and coordinated decisions with the safety of the citizens of southeast Texas the top priority.

Tropical Storm Fay Summary

by Lance Wood

Tropical Storm Fay began as an area of disturbed weather associated with a broad low pressure system in the northwest Gulf of Mexico during the first week of September. On Thursday, September 5th, this disturbance became the 6th tropical depression of the 2002 hurricane season with a poorly defined center located approximately 125 miles southeast of Galveston, Texas. That evening just 6 hours after formation, the depression became Tropical Storm Fay as winds strengthened to 40 mph.

Fay remained nearly stationary Thursday night and through most of Friday. However, Fay did manage to slowly strengthen with winds reaching 60 mph late Friday morning (September 6th). On Friday evening, Fay began to redevelop further west near a cluster of strong thunderstorms. These thunderstorms began pushing inland along the southeast Texas coastline between San Luis Pass and Palacios around 11 PM CDT. As this cluster of thunderstorms moved inland, it produced extremely heavy rainfall, tornadoes, and strong damaging wind gusts. The center of Fay moved inland early Saturday morning near Palacios and weakened to a tropical depression by late Saturday morning.

Fortunately, there were no deaths associated with Fay. Three people were injured when a tornado damaged a mobile home in eastern Fort Bend county Friday night. The storm produced a total of 5 tornadoes along a path from Freeport in Brazoria county to near Hungerford in Wharton county. The combination of high winds and tornadoes damaged over 800 homes and close to 100 businesses in Brazoria county. The highest reported wind gust recorded was in the town of Clute in Brazoria county, where an 83 mph wind gust was recorded at 120 AM CDT Saturday.

Figure 1: Beach Erosion in Bermuda Beach. (Photo courtesy of the Texas General Land Office)

Flooding was significant in Brazoria, Matagorda, and Wharton counties where over 1800 homes were flooded due to high tides and severe rainwater flooding. Between 10 and 20 inches of rain fell in an area from Freeport north-northwest to Boling in eastern Wharton county. The hardest hit area was near the community of Sweeny in southwest Brazoria county. It is estimated that beach erosion from high tides produced 3.5 million dollars in damage to public roads, bridges and recreational areas across Galveston county. The highest recorded tide level occurred at Jamaica Beach where the tide level reached 5.40 feet above Mean Low-Lower Water (MLLW) at 830 AM CDT Saturday morning, September 7th. An example of beach erosion in Galveston county is shown in Figure 1.

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 frost bite 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.

2002 Hurricane Season

From the National Hurricane Center's Monthly Tropical Weather Summaries and the National Climatic Data Center

As the 2002 Atlantic Basin hurricane season comes to an end, it is time to take a look back at what has happened this year. The 2002 season had twelve named storms, of which four became become hurricanes. In addition, there were two tropical depressions that never reached tropical storm strength. Lili was the first U.S. mainland landfalling hurricane since 1999. Eight named storms formed in September - the highest number on record for any month. Perhaps most amazing was the life of Kyle which lasted twenty-two days - the third longest living Atlantic basin tropical cyclone on record.

Tropical Storm Arthur was first detected on July 9th in the northeastern Gulf of Mexico as a weak low that developed along an old frontal zone. The low moved northeastward to the coast of North Carolina by the 14th where it acquired organized convection and became Tropical Depression One. It strengthened to a 60-mph tropical storm by the 16th while located several hundred miles south of Nova Scotia and accelerating east-northeastward. Arthur became extratropical on the next day while located a few hundred miles south of Newfoundland.

Tropical Storm Bertha peaked as a minimal tropical storm near the northern Gulf coast. It originated from a trough of low pressure that extended from the western Atlantic across Florida into the northern Gulf of Mexico - the same trough that would eventually spawn Tropical Storm Cristobal. A low pressure area formed in the trough on August 3rd, and this low developed into a tropical depression just east of the mouth of the Mississippi River on the 4th. The depression became Tropical Storm Bertha later that day. Bertha moved northwestward over southeastern Louisiana early on the 5th and weakened to a tropical depression later that day. The depression meandered over southern Louisiana on the 6th, then moved southwestward into the Gulf of Mexico on the 7th. After continuing southwestward on the 8th, a westward turn brought the depression to the lower Texas coast on the 9th. It dissipated over south Texas later that day.

Bertha produced tropical storm winds over the coastal waters of Mississippi and southeastern Louisiana. The storm brought rainfall amounts of 5 to 10 inches to portions of southeastern Louisiana and Southern Mississippi which produced minor damage from flooding. Bertha caused one death - a drowning in high surf off the western Florida panhandle.

Tropical Storm Cristobal was a relatively weak tropical cyclone that meandered in the western Atlantic prior to being absorbed into a frontal zone. Cristobal had a non-tropical origin, forming from a trough of low pressure that extended from the northern Gulf of Mexico across Florida into the western North Atlantic Ocean. As this trough spawned Tropical Storm Bertha in the Gulf of Mexico on August 4th, a second area of low pressure was developing near the South Carolina coast. This second low moved slowly eastward and gradually became better organized, becoming a tropical depression about 175 miles east-southeast of Charleston, South Carolina on the 5th. The depression moved slowly south-southeastward over the next day and a half. A reconnaissance aircraft late on the 6th found that the depression had strengthened to a tropical storm. On the 7th, Cristobal began a slow eastward motion as it began to feel some influence of a large mid to upper level trough moving off the U. S. East coast. The peak intensity of 50 mph was reached early on the 8th. Later that day, Cristobal began a sudden acceleration to the east-northeast, and by late in the day the cyclone had become absorbed within a frontal zone.

Tropical Storm Dolly was the first tropical cyclone of 2002 to develop in the deep tropics. It formed from a tropical wave about 630 miles southwest of the Cape Verde Islands early on August 29th and its maximum winds reached 60 mph on the 30th. Dolly initially moved westward and gradually turned northwest and north over open water and became absorbed by a frontal trough on September 5th.

2002 Hurricane Season continued

Tropical Storm Edouard developed about 110 miles east of Daytona Beach, Florida on September 1st. The depression soon strengthened into a tropical storm, and then moved in a clockwise loop off the northeast Florida coast for a few days. Edouard strengthened to a peak intensity of 65 mph on the 3rd but strong upper-level winds soon weakened the storm as it headed for the coast. Edouard was barely of tropical storm strength when it made landfall just north of Daytona Beach on the evening of the 4th. Tropical Depression Edouard crossed north-central Florida and moved into the northeast Gulf of Mexico on the 5th. Strong winds aloft prevented any redevelopment, and Edouard dissipated over the northeast Gulf on the 6th. Its remnants were entrained into the large circulation of Tropical Storm Fay centered off the Texas coast. Aside from some flooding due to locally heavy rains over north-central Florida, there were no significant impacts from Edouard.

Tropical Storm Fay was the only tropical cyclone to strike the Upper Texas Coast this season. For more details on Fay including its impact on Southeast Texas, please refer to "Tropical Storm Fay Summary" in this issue of "Storm Signals." The remnants of Fay meandered for several days after dissipation across southern Texas and northeast Mexico and produced torrential rainfall and widespread flooding across the region.

Tropical Depression Seven was first tracked as a weak circulation on September 1st near the coast of Africa. Moving west-northwestward, it finally developed enough convection to be a 35 mph tropical depression on the 7th in the central tropical Atlantic. It dissipated the next day while located about 950 miles southeast of Bermuda.

Hurricane Gustav developed as a subtropical depression on September 8th about 550 miles south-southeast of Cape Hatteras, North Carolina. It moved northwestward and quickly became a subtropical storm. Gustav continued northwestward on the 9th, then turned northward on the 10th. The system transitioned to a tropical storm before the center passed near Cape Hatteras late that day (3 to 6 inches of rain fell in eastern North Carolina). Gustav turned northeastward into the Atlantic early on the 11th and then strengthened into the first hurricane of the 2002 season. Maximum winds reached 90 mph before Gustav made landfall in eastern Nova Scotia early on the 12th. The storm became extratropical later that day near western Newfoundland. Gustav produced hurricane-force wind gusts in portions of Nova Scotia and sustained tropical storm-force winds in the coastal areas of North Carolina. The storm caused one death due to high surf along the South Carolina coast. Damage figures are incomplete at this time but are believed to be minor.

Tropical Storm Hanna developed out of a broad area of disturbed weather and low pressure in the Gulf of Mexico. A tropical depression formed from the disturbance late on September 11th 240 miles south-southwest of Apalachicola, Florida. The depression meandered slowly in the central Gulf, becoming a tropical storm on the 13th about 255 miles south-southwest of Pensacola. Hanna then moved northwestward and then northward, passing over southeastern Louisiana near the mouth of the Mississippi River early on the 14th, and making landfall near the Alabama-Mississippi border near midday on the 14th with 50 mph winds. The remnants of Hanna produced 14.59 inches of rain in 24 hours at Donalsonville, Georgia.

Hurricane Isidore formed from a westward moving tropical wave and became a tropical depression as it was approaching the Windward Islands on September 14th. After a brief period of weakening it reformed near Jamaica and hit western Cuba as a category two hurricane on the 20th and the northern Yucatan peninsula as a category three hurricane (125 mph winds) on the 22nd. It weakened over land and then moved northward over the Gulf of Mexico and made landfall on the Louisiana coast just west of Grand Isle as a 70 mph tropical storm early on the 26th. Isidore brought torrential rain to Jamaica and caused damage to western Cuba (over 24 inches of rain recorded), northern Yucatan (at least two dead and over 300,000 left homeless) and portions of the Louisiana/Mississippi Coast (rainfall in New Orleans locally exceeded 20 inches causing widespread flooding). Widespread heavy rains of 2 to 4 inches spread well inland, affecting much of the Tennessee Valley region.

Tropical Storm Josephine was a short-lived cyclone located several hundred miles southeast of Newfoundland. It formed within an old frontal zone on September 17th. It immediately moved northeastward embedded on the east side of a trough in the westerlies. Josephine was a minimal 40 mph tropical storm until the 19th, and a little later that day it merged with a cold front and accelerated northeastward as a 60 mph extratropical storm.

Hurricane Kyle developed from a non-tropical low in the central North Atlantic on September 20th about 300 miles east-southeast of Bermuda. Under weak steering currents, Kyle drifted erratically toward the southwest for ten days. Its winds are estimated to have reached 85 mph on the 26th and 27th. On October 1st...Kyle was a nearly stationary tropical depression located about 255 miles south of Bermuda. For the next nine days, Kyle moved slowly to the southwest and west toward the northeast coast of Florida. An upper level low pressure trough moving eastward across the United States finally lifted Kyle off to the north and northeast along the southeast U.S. coast. Kyle became extratropical on October 12th. In its lifespan, Kyle intensified to tropical storm status five different times, and eventually became the third longest living Atlantic Basin tropical cyclone in history (see the table at the end of this article).

Hurricane Lili developed as a tropical depression in the central Atlantic Ocean on September 21st and became a tropical storm two days later. Lili brought heavy rains and gusty winds over 70 mph to the southern Windward Islands on September 23rd (139 homes badly damaged and 275,000 people lost electric power in Barbados) before briefly losing its identity on the 26th. The storm regained intensity and skirted the north coast of Jamaica on the 29th. Lili reached hurricane strength on the 30th, passing near the Cayman Islands and crossing western Cuba on October 1st. Lili was the second hurricane in less than two weeks to strike western Cuba, and it forced the evacuation of thousands of people. Lili pulled away from the western tip of Cuba and strengthened into a major category 4 hurricane on October 2nd, reaching maximum sustained winds of 145 mph in the central Gulf of Mexico. As Lili passed just west of a moored meteorological buoy (42001) approximately 235 miles south of Buras, LA, a wind gust to 150 mph was recorded, along with wave heights of 37 feet! Another buoy along Lili's path (42041) approximately 145 miles south of Houma, LA recorded wave heights of 40 feet! Prior to Lili, the highest wind gust ever recorded by a National Weather Service buoy in the Gulf of Mexico was 131 mph (during Hurricane Kate on November 20, 1985) and the highest wave height ever recorded by a National Weather Service buoy was 35.6 feet on May 24, 1996). Luckily for Louisiana residents, Lili weakened prior to making landfall along the central coast in Vermillion Bay early on October 3rd. Maximum sustained winds were near 100 mph, or category 2 intensity, as the storm crossed into Vermillion Parish. The storm prompted the evacuation of an estimated nearly half-million people as it approached the Louisiana coast. Lili was the first landfalling U.S. hurricane since Irene in October 1999, and the preliminary damage estimate to insured property is $170 million in Louisiana.

Please refer to "Hurricane Lili: Educated Evacuation Decision Making" in this issue of "Storm Signals" for some details on the impact Lili had on the Upper Texas coast.

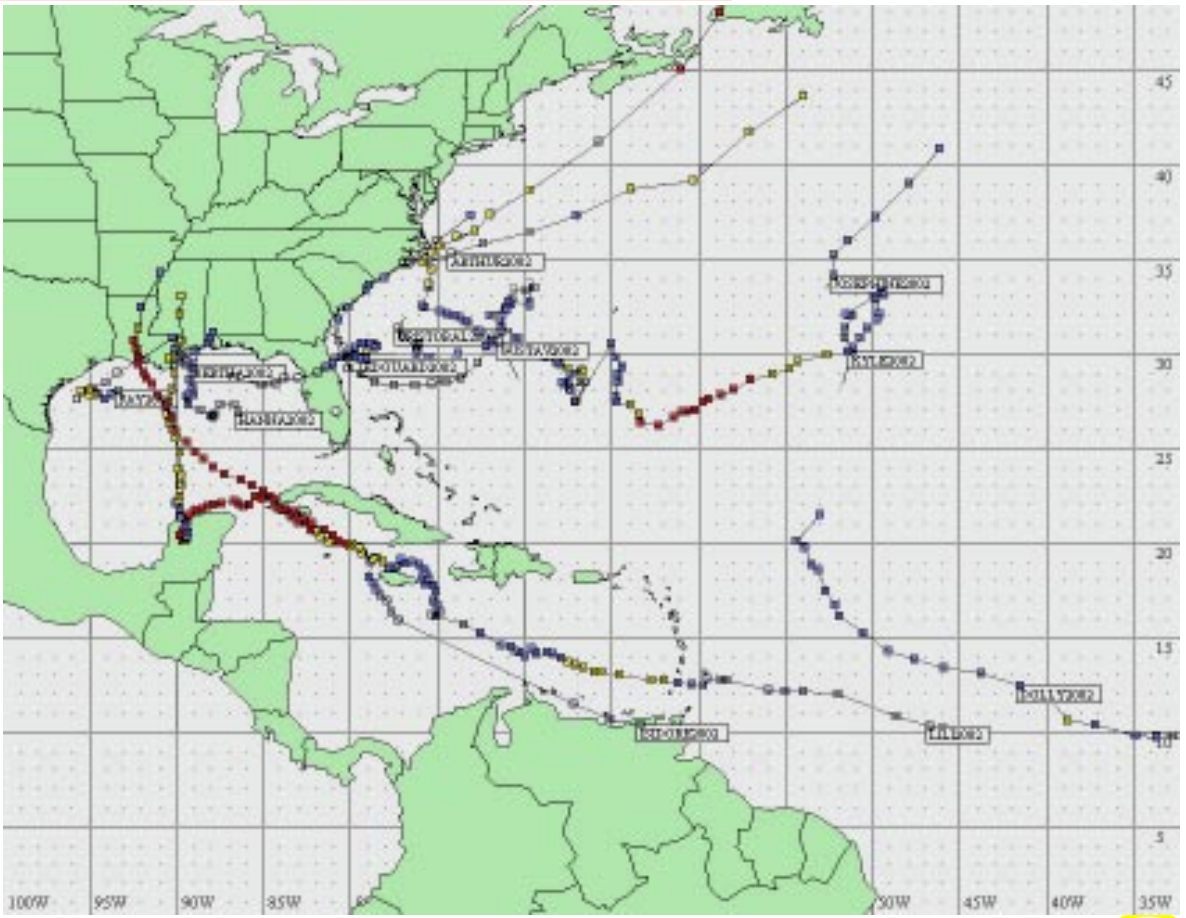
Tropical Depression Fourteen formed from a broad area of low pressure in the northwestern Caribbean Sea on October 14th. The depression center moved to the north-northeast passing just west of the Cayman Islands. As the system approached the south central coast of Cuba, strong southwesterly upper-level shear and dry air entrainment caused the system to lose its tropical characteristics. The system was declared non-tropical on the 16th.

Preliminary 2002 Hurricane Summary Table

Name	Dates	Wind mph	Deaths	U.S. Damage
T.S. Arthur	14 - 16 Jul	60	0	0
T.S. Bertha	4 - 9 Aug	40	1	minor
T.S. Cristobal	5 - 8 Aug	50	0	0
T.S. Dolly	29 Aug - 4 Sep	60	0	0
T.S. Edouard	1 - 6 Sep	65	0	minor
T.S. Fay	5 - 7 Sep	60	0	> $4 million
T.D. Seven	7 - 8 Sep	35	0	0
H. Gustav	8 - 12 Sep	90	1	minor
T.S. Hanna	11 - 14 Sep	50	3	minor
H. Isidore	14 - 26 Sep	125	4	$200 million
T.S. Josephine	17 - 19 Sep	40	0	0
H. Kyle	20 Sep - 12 Oct	85	0	minor
H. Lili	21 Sep - 4 Oct	145	8	$800 million
T.D. Fourteen	14 - 16 Oct	35	0	0

Longest Lasting Tropical Cyclones

Rank	# of Days	Name/Year
1.	27.25	Ginger/1971
2.	24.75	Inga/1969
3.	22.00	Kyle/2002
4.	20.75	Carrie/1957 and Storm 9/1893
5.	20.25	Inez/1966
6.	19.75	Alberto/2000
7.	19.50	Storm 4/1926
8.	18.50	Storm 6/1893
9.	18.00	Storm 2/1930
10.	17.75	Storm 2/1899



Tracking map for the 2002 Altlantic Hurricane Season

Skywarn 2003

by Matt Moreland

The Skywarn program was developed by the National Weather Service to train storm spotters to provide specific severe weather event information to the office. With trained storm spotters in the field, meteorologists at the National Weather Service have an eagle-eye view of current weather conditions and how they compare with what appears on radar. Skywarn spotters also enable us to have a severe weather verification program which helps us to improve accuracy on severe weather warnings.

What is a Skywarn storm spotter?

A storm spotter is a trained volunteer who reports severe weather in his area to local emergency management and law enforcement officials or the National Weather Service. The reports include hail, high winds, funnel clouds, tornadoes, heavy rainfall, flooding, and wind damage. The storm spotter is not a storm chaser; he usually "spots" close to home or work. The trained spotter provides eyes in the field and can provide us with severe weather information even at times when the radar data may lack.

How do you become a trained spotter?

Skywarn training classes take place in select southeast Texas counties during the late winter and early spring of each year, usually from February to April. The training course is about two hours long, held in the evening, and is open to the general public. At the end of the course, each participant will be given a certificate and a Skywarn emblem for their vehicle, and information on how to participate in the Skywarn program.

If you are interested in helping the National Weather Service with the valuable cause of severe weather detection, you are encouraged to attend. Even if you attended a course a few years ago, the 2003 course will provide a refresher. Each year, the course is updated to account for the changing NWS requirements for severe weather detection, and new storm spotter related material that we have received.

If you are an emergency manager, sheriff, or other public official, and you are interested in scheduling a training class, please contact the Houston/Galveston National Weather Service Office at 281-337-5074.

Starting in December, the NWS Houston/Galveston website at: www.srh.noaa.gov/hgx/severe/skywarn/skywarn03.htm will be updated with more specific information on dates, locations, and times of training classes that will be held in your area.

StormReady
NATIONAL WEATHER SERVICE

When Seconds Count, StormReady Communities are Prepared

NWS STORM-READY - Ninety percent of all presidentially declared disasters are weather related, leading to around 500 deaths per year and nearly $14 billion in damage. To help Americans guard against the ravages of severe weather, the National Weather Service has designed StormReady, a program aimed at arming America's communities with the communication and safety skills necessary to save lives and property. www.stormready.noaa.gov

Where Did You Hear That We Are Going To Have A Tornado Tomorrow!

By Kent Prochazka

The National Weather Service has begun issuing a Hazardous Weather Outlook. The Hazardous Weather Outlook is a product that gives a heads up to emergency managers, media, and the general public concerning the threat of hazardous weather. The Hazardous Weather Outlook will be issued around 7:00 a.m. every morning summarizing significant weather threats for the following seven days. The product gives a brief description of the hazardous weather threats, if any, and when and why these hazards may occur.

Forms of hazardous weather addressed in our Hazardous Weather Outlook include winter weather phenomenon such as freezing rain, blizzards, heavy snow, severe thunderstorms producing large hail, tornadoes, and flooding rainfall and tropical depressions, tropical storms, and hurricanes. Non-precipitation weather such as strong winds, fog, extreme heat or cold, and extreme fire dangers will also be addressed in the Hazardous Weather Outlook. Marine hazards such as wind induced extreme high or low tides will also be covered in this product.

The Houston/Galveston office began issuing hazardous weather outlooks on a daily basis at the beginning of October. You can hear this product on NOAA Weather Radio or view it on the web at:

www.srh.noaa.gov/data/sat/hwo/sathwohgx.txt

Late Summer Weather Climate Summary

By Charles Roeseler

Rainfall was generally above normal from July through October. Over the last several summers, an upper level ridge of high pressure dominated area weather. This feature brought dry conditions and unseasonably high temperatures. This year, the weather patterns shifted somewhat. A split in the upper level high pressure ridge allowed easterly disturbances to push westward around the periphery of the Bermuda high and then slide into Texas. This situation enhanced sea breeze convection and produced higher rainfall totals across the region. Strong tropical waves affected the area on July 13-14th and again on August 15th. Tropical Storm Fay moved inland September 6-7th producing another round of heavy rain.

Temperatures across Southeast Texas averaged near normal values. Although average temperatures were near normal, average high temperatures were actually cooler than normal due to the clouds and above normal rainfall noted above. The clouds which kept daytime temperatures cooler also helped insulate the atmosphere at night thus keeping low temperatures above normal. College Station only had two days reach or exceed the century mark while Houston had only one day when the temperature reached the 100 degree threshold.

Late Summer Weather continued

Severe weather was somewhat limited in July and only isolated reports of hail and wind damage were reported. Things changed in August and severe weather occurred at various times of the month. The first severe weather occurred on August 3rd. A strong disturbance approached Southeast Texas from the north-east on the 3rd. This feature coupled with afternoon temperatures near 100 degrees triggered widespread thunderstorms across the area. Tree, powerlines and billboards were blown down by strong winds. There were two fatalities on this day, one person was killed by lightning and another person killed when a tree fell on a vehicle. There were also several people injured when high winds overturned a mobile home. On August 15th, a large thunderstorm complex developed over the region and remained nearly stationary. Very heavy rain fell over Brazoria, Galveston and Harris counties. The city of Galveston received in excess of 11 inches of rain on that day. This is a new 24 hour rainfall record for the day and for the month of August. Other parts of the region received between 5 and 10 inches of rain for the day. Widespread flooding was reported over much of the region.

Here are the climatological statistics for the cities of Houston, Galveston and College Station for the months of July through October:

Houston Intercontinental Airport - 2002 Data						
Month	Average High	Average Low	Average Daily	Departure	Rain	Departure
July	93.1	75.8	84.5	+0.9	7.10	+3.92
August	92.7	75.0	83.9	+0.6	5.47	+1.64
September	88.1	71.2	79.7	+0.8	8.02	+3.69
October	78.3	64.8	71.5	+1.1	14.65	+10.15

Galveston Scholes Field - 2002 Data						
Month	Average High	Average Low	Average Daily	Departure	Rain	Departure
July	88.8	79.4	84.1	-0.2	3.73	+0.28
August	90.1	79.5	84.8	+0.4	14.67	+10.45
September	86.1	75.5	80.8	-0.3	11.38	+5.62
October	79.5	69.7	74.6	+0.5	11.81	+8.32

College Station Easterwood Field - 2002 Data						
Month	Average High	Average Low	Average Daily	Departure	Rain	Departure
July	92.3	73.3	82.8	-1.8	5.66	-3.74
August	94.5	73.3	83.9	-0.8	3.62	+0.99
September	90.4	69.1	79.8	+0.1	0.77	-3.14
October	76.8	61.9	69.4	-1.1	9.79	+5.57

Houston AMS

Gene Hafele
President 2002-2003

The Houston Local Chapter of the American Meteorological Society is dedicated to the development and dissemination of the knowledge of meteorology as well as the space and earth sciences. Our members include meteorologists from both the public and private sector, broadcast meteorologist, emergency management officials, amateur radio operators and just plain weather enthusiasts. Each year we try to appeal to our broad member community with wide ranging topics from weather impacts on sailboat racing, discussions on lightning safety and global warming, to weather photography taken from the space shuttle. Meetings normally take place once a month at a local restaurant at various locations throughout the Houston area.

There are several activities that have become annual events for our chapter such as judging the Houston Regional Science Fair and traveling to Texas A&M University to present a career fair to members of the TAMSCAMS local student chapter. This year among our other activities we will be working closely with the Houston Children's Museum on a project call Magic School Bus. The Houston Children's Museum received a grant to develop a Magic School Bus on Meteorology that will travel to Children's Museums across the country. The exhibit will open in late January in Houston and our chapter plans to have some of our members participate in the exhibit.

We have had a great start to the 2002-2003 year. In September Dr. Nielsen-Gammon, from Texas A&M University, made a presentation on his work on the meteorological influence on air quality in Houston. In October, Sher Wagoner, Research Coordinator, Colorado State University Cooperative Institute for Research In the Atmosphere (C.I.R.A.), spoke on her work dealing with using GPS Meteorology as a Weather Forecasting Tool. In November, we visited the Air Route Traffic Control Center near Intercontinental Airport to discuss how weather affects the airlines and who provides that weather support. In December, we plan to have an evening out in Galveston. The meeting will be at the Galveston County Historical Museum where we will hear about "Winters in Galveston".

We have a web site at www.houstonams.org. Check it out whether you are interested in joining our chapter or just want to see what events we have planned. Whether you are working in the field of meteorology or you are just a weather buff, everyone is welcome!

Good-Bye, Old Friend...

After a long and winding career that spanned nearly three decades, Mr. Tom Fountain officially retired October 1, 2002...finally! Tom was serving as a Hydro-Meteorological Technician with the Houston/Galveston National Weather Service Office when he called it quits.

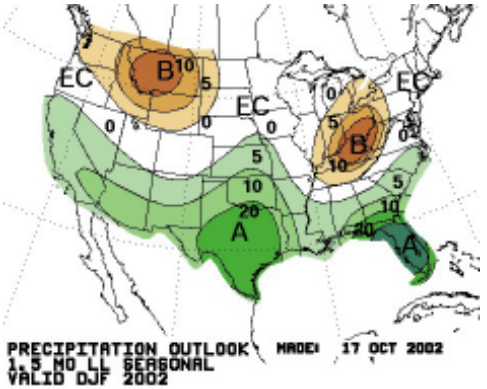
Tom Fountain's National Weather Service career began in Lubbock in 1974 after stints with the Army and Air Force. He eventually found his way to the Galveston NWS Office in 1978...to the Houston NWS office in 1984 and then finally to the combined Houston/Galveston NWS Office in 1990. The most memorable weather event of his long career was Hurrican Alicia which struck in 1983.

Tom's immediate retirement plans include a lot of travelling and relaxing. However, his deep roots to the local community and the many friends and relations he has made here over the years will ensure that we will still see his smiling face every now and then.

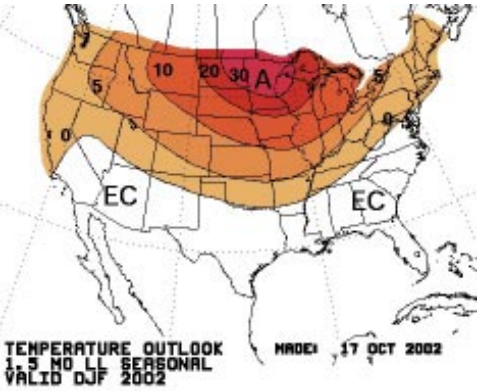
Southeast Texas Winter Season Outlook

by Paul Lewis II

According to the Climate Prediction Center, residents of Southeast Texas can look forward to a relatively mild and wet winter. El Niño was the main factor in the forecast, though current weather trends played a part, also. A moderate El Niño event had already begun by mid October of this fall and is forecast to continue into the first of 2003. A moderate El Niño tends to keep temperatures near normal and precipitation above normal for the southern Plains and lower Mississippi Valley. The normal mean temperature for December through February for Houston is 54.1 degrees Fahrenheit and normal precipitation is 9.9 inches.



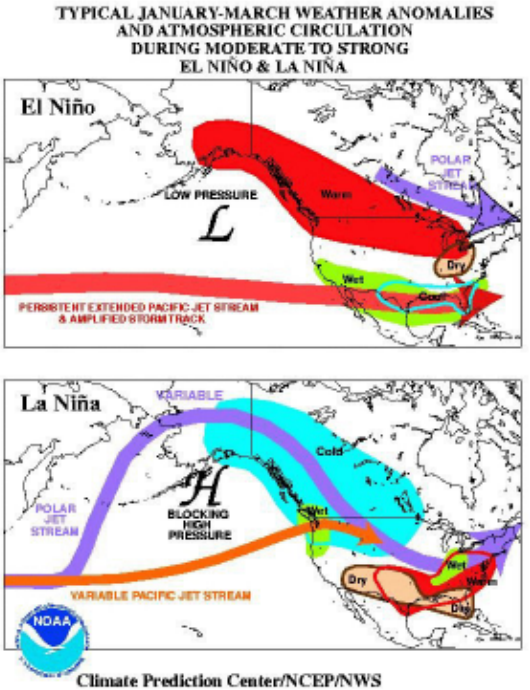
December 2002 to February 2003 Rainfall Outlook



December 2002 to February 2003 Rainfall Outlook

El Niño has been observed to be a semiannual event in the eastern Pacific Ocean along the coasts of Ecuador and northern Peru for hundreds of years. Local residents in these countries began referring to the seasonal warming of the ocean water as "El Niño"–translated as "The Child" or "The Little One" in English–since the phenomenon occurs around the Christmas season. Every two to seven years a much stronger warming event happens and is often accompanied by beneficial rainfall in the arid coastal regions of Ecuador and Peru. Another event related to El Niño is the Southern Oscillation. This phenomenon occurs when lower than normal air pressure is observed over the eastern tropical Pacific Ocean and higher than normal pressure is observed over Indonesia and northern Australia. During both phenomena the trade winds relax or even reverse over the tropical Pacific Ocean. These features characterize the warm phase of the Southern Oscillation and are referred to as an ENSO, which is an acronym of the phrase "El Niño/ Southern Oscillation."

During ENSO events, the normal patterns of tropical precipitation and atmospheric circulation become disrupted. The increased heating of the tropical atmosphere over the central and eastern Pacific affects atmospheric circulation features, such as high atmospheric level jet streams in the subtropics and the temperate latitudes of the winter hemisphere. The jet streams over the eastern Pacific Ocean tend to be stronger, with extratropical storms and frontal systems following paths significantly different from



normal. The result is persistent temperature and precipitation anomalies in many regions.

Past El Niño events have affected Southeast Texas in a variety of ways. The most recent was the strong El Niño of 1997 to 1998. Well above normal precipitation was observed and severe weather was about three times higher than normal between November and February. It should be noted that the current El Niño is forecast to be weaker than the 1997-1998 event.

Since 1980, moderate to strong El Niño events occurred from 1982 to 1983, 1986 to 1988, 1990 to 1993, 1994 to 1995, and 1997 to 1998. The 1982 to 1983 event was one of the strongest on record and generated devastating floods in parts of South America and drought in portions of Australia, Africa, and Indonesia. The impact to the Houston area was mainly from rainfall. The following table shows the average low and high temperatures and the average precipitation with departures from normal for each El Niño event since 1980. These are for Intercontinental Airport in Houston for the period from October to March.

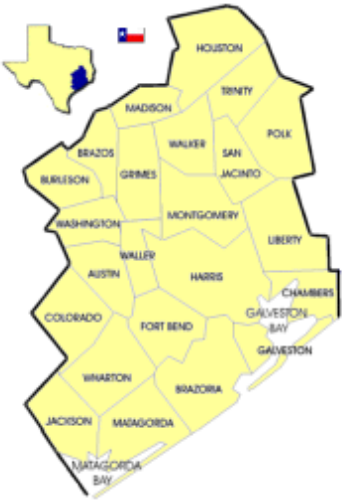
Moderate to Strong El Niño Events Since 1980 For Intercontinental Airport in Houston, Texas

Year	Average Low	Departure	Average High	Departure	Precipitation	Departure
1982-1983	47.7	+0.7	67.8	-1.6	30.28	+9.60
1986-1987	48.6	+1.6	67.7	-1.7	26.76	+6.08
1991-1992	49.8	+2.8	70.2	+0.8	36.91	+16.23
1994-1995	52.1	+5.1	71.4	+2.0	29.80	+9.12
1997-1998	47.6	+0.6	68.2	-1.2	28.43	+7.75

To learn more about El Niño, ENSO, and La Niña, you can look at the following websites:

www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/
www.srh.noaa.gov/lch/research/BPTLCH.HTM
www.noaanews.noaa.gov/stories/s1051.htm
www.srh.noaa.gov/hgx/index3/misc3.htm#elnino

Houston/Galveston
National Weather Service
1620 Gill Road
Dickinson, TX 77539



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