



# Storm Signals



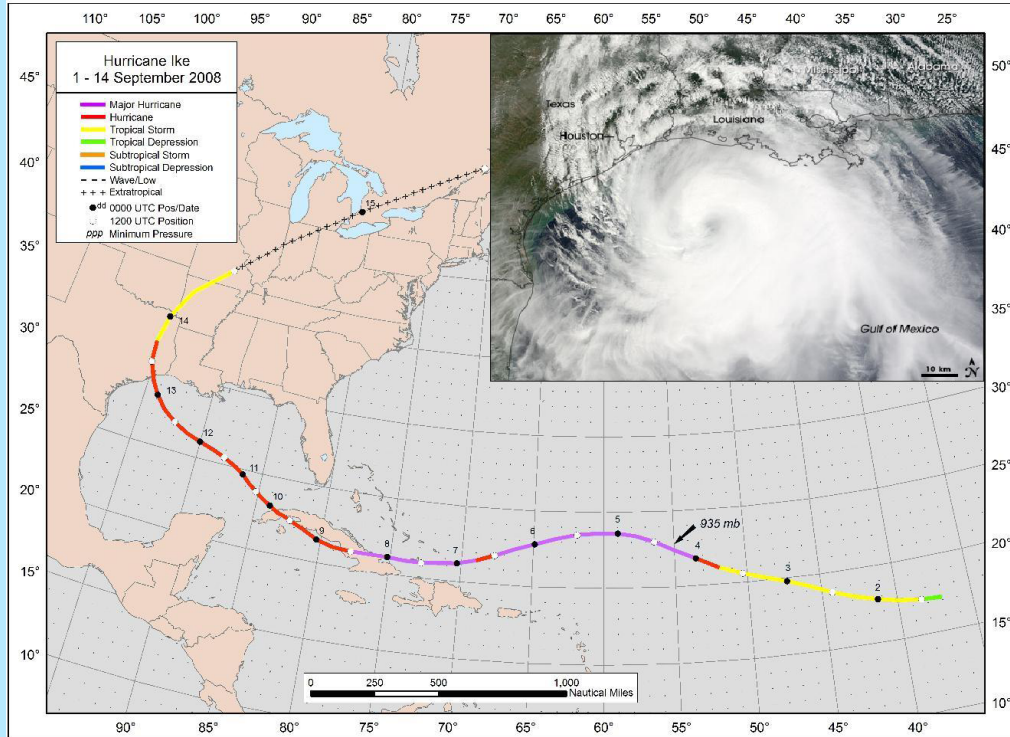
Houston/Galveston National Weather Service Office

Volume 80 Spring 2009

## Hurricane Ike

### Meteorological History

Hurricane Ike was a long-lived tropical cyclone that originated from a well defined tropical wave which moved off of the western African coast on August 28, 2008. Bursts of convection associated with a developing area of low pressure occurred along the wave axis for the next several days; however, it was not estimated to be a tropical depression until 1 AM CDT on September 1, 775 miles west of the Cape Verde Islands. The depression continued to become better organized and quickly strengthened to become Tropical Storm Ike later that day. Moving west-northwest, Ike continued to strengthen and became a hurricane early on the afternoon of September 3<sup>rd</sup>, when an eye became apparent on satellite imagery. Rapidly intensifying, Ike reached a maximum intensity of



145 mph on Thursday, September 4<sup>th</sup>. A building upper level high to Ike's north induced an unclimatological west-southwest motion beginning on September 4<sup>th</sup>, and this motion continued through the 7<sup>th</sup>. Worth noting is the fact that Ike is only the fifth tropical cyclone to reach a similar position in the Atlantic (near 24°N 60°W) and later move into the Gulf of Mexico, the last being Hurricane Andrew (1992). Ike went farther south and west than any of these storms. During this unusual storm motion, Ike impacted the Turks and Caicos Islands, and moved across the island of Great Inagua. By late on the 7<sup>th</sup>, Ike made the first of two landfalls along the Cuban coast near Cabo Lucrecia with maximum winds around 130 mph. After moving off and paralleling the Cuban coastline, Ike made a second landfall near the city of San Cristobal. Just prior to crossing the northwest tip of Cuba as a category one hurricane, with winds close to 80 mph, Ike began producing tropical storm force winds across portions of the Florida Keys on Tuesday morning, September 9<sup>th</sup>. Fortunately for the Keys, Ike only delivered a glancing blow, as the hurricane continued to move west-northwest toward the US Gulf coast.

Although the interaction with Cuba disrupted the inner core of the hurricane and prevented rapid strengthening over the warm waters of the Gulf of Mexico, Ike did quickly grow in size with the extent of tropical storm force winds reaching 275 miles and hurricane force winds stretching 115 miles across the Gulf. Ike did slowly intensify to a category two hurricane with maximum winds of 100 mph by Wednesday evening, September 10<sup>th</sup>. On Thursday, September 11<sup>th</sup>, Ike began to move due northwest towards the upper Texas coastline. Although Ike's intensity remained in the category two range, the tropical cyclone continued to grow and became a very large hurricane with the diameter

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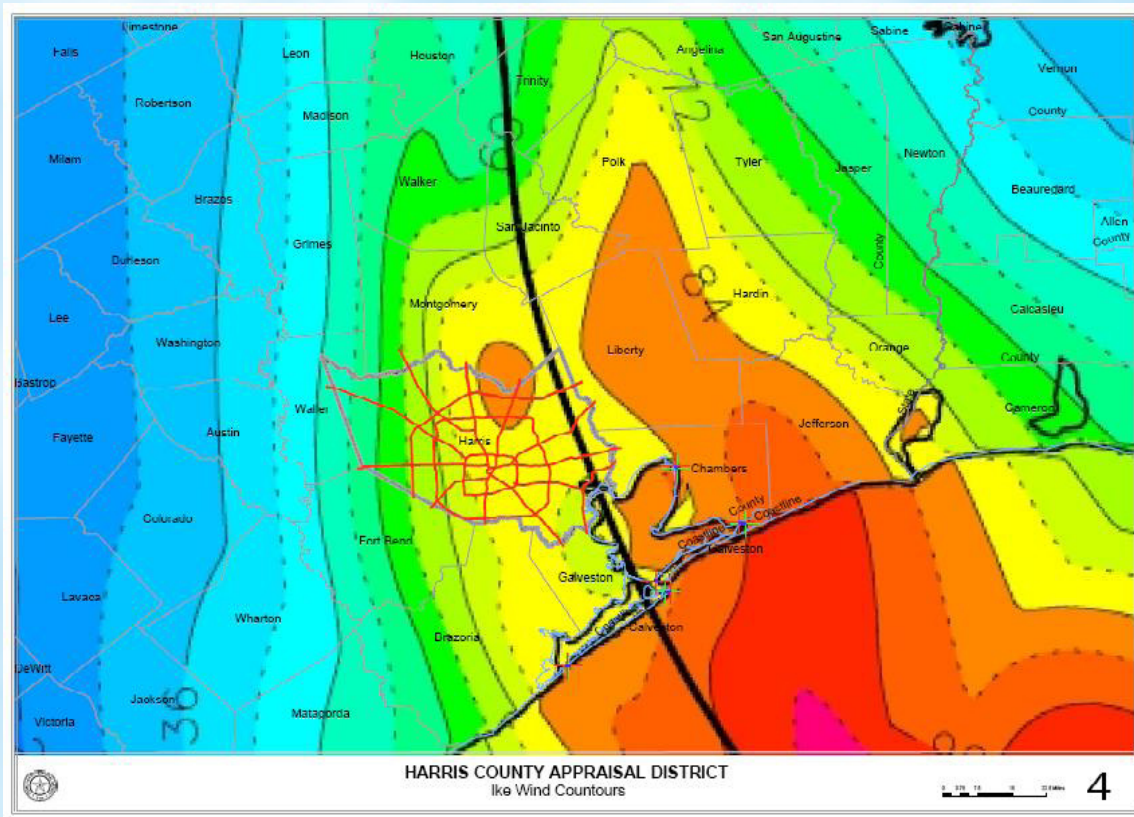
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of tropical storm force winds stretching a total of 425 miles from the northwest to southeast as it approached the upper Texas coast on Friday, September 12<sup>th</sup>. Ike made landfall at 2:10 AM CDT on Saturday, September 13<sup>th</sup> near Galveston, Texas, with maximum sustained winds of 110 mph. Once inland, Ike moved north-northwest just east of Interstate 45 and brought hurricane force winds to a large portion of southeast Texas (Figure 1).



**Figure 1. Hurricane Ike's sustained wind (mph) contour map. Image courtesy of Hurricane Research Division.**

### **Size and Surge**

For residents of southeast Texas, Ike will forever be remembered for its large and significant storm surge. Although just under the wind speed criteria for a major hurricane (115 mph or greater), Ike produced the greatest storm surge along the Texas coast since Hurricane Carla (category four) made landfall near Port Lavaca in 1961. Interestingly, although Ike was considerably weaker than Carla as far as maximum wind speeds are concerned, the tropical cyclone did have a larger area of hurricane force winds at landfall and a comparable tropical storm force wind field. Therefore, from a total energy standpoint, Ike was very similar to Carla, and this explains why the magnitude of the surge events was similar. Ike also produced a greater storm surge than that produced by Hurricane Alicia (1983), which was southeast Texas' last major landfalling hurricane (category three). Ike was approximately four times larger than Alicia when comparing the size of the hurricane force wind fields.

The highest storm surge occurred on the Bolivar Peninsula and in parts of Chambers County (including the east side of Galveston Bay), roughly between the Galveston Bay entrance and just northeast of High Island (Figure 2). Complete tide gauge records for this area are unavailable since many of the sensors failed from salt water intrusion and large wave action, although ground assessment teams determined that the surge was generally between 15 and 20 feet. The highest water mark was 17.5 feet located about ten miles inland in Chambers County. Much of the southern part of Chambers County was also inundated by at least 10 feet of water. Storm surge levels on Galveston Island and on the west side of Galveston Bay are estimated to be between 10 and 15 feet. The highest inundation, of at least 10 feet, occurred on the bay side of Galveston Island, the coast of mainland Galveston County, as well as over Appfel Park at the northern tip of Galveston Island where Ike made landfall.

Farther to the south, a storm surge of 5 to 10 feet was recorded in Brazoria County, including near Freeport. The remainder of the Texas coast south of Brazoria County recorded surge heights of 2 to 5 feet. See Figure 3 for before and after storm surge damage pictures.

Note: Storm surge heights are referenced to NAVD88.

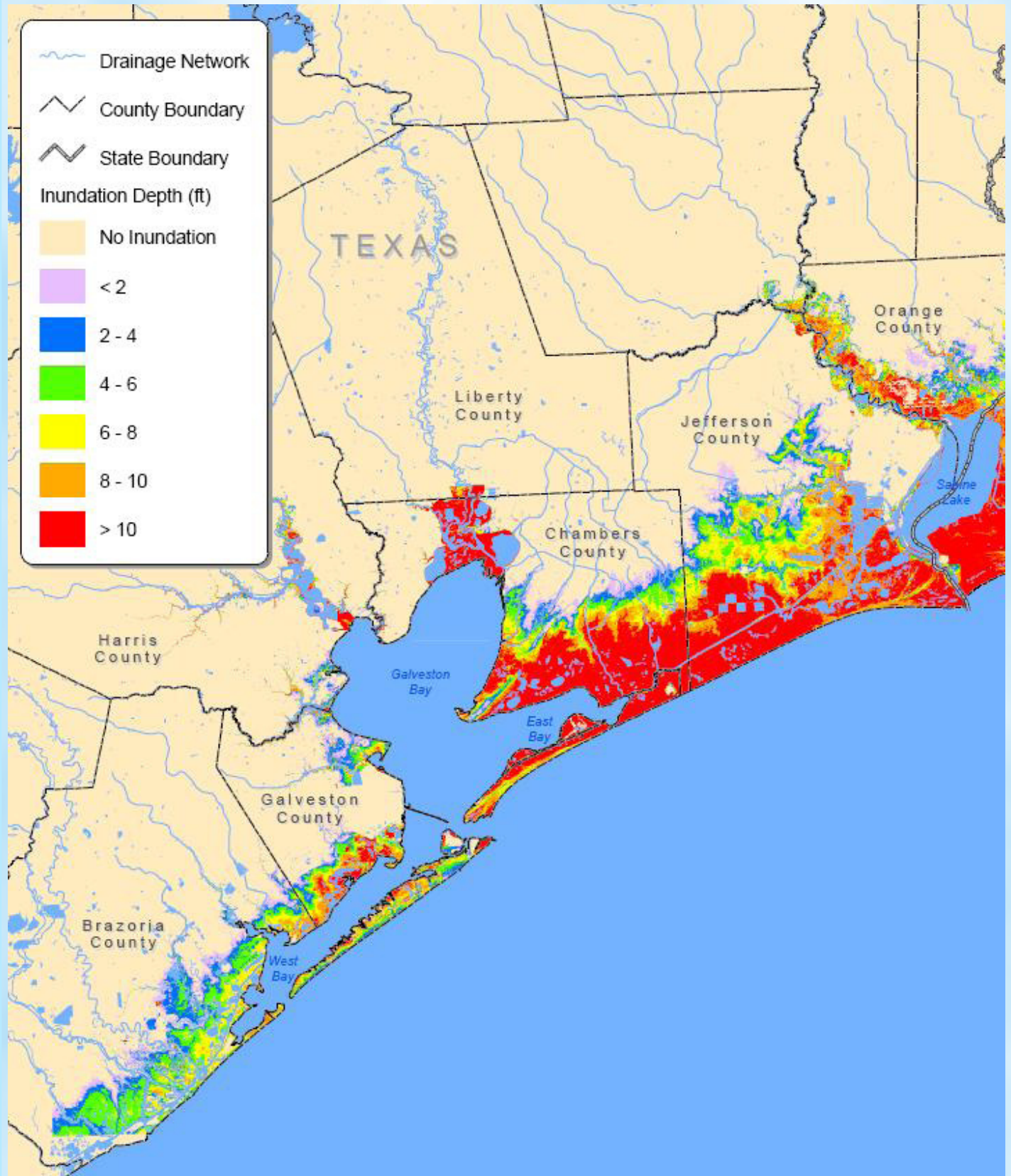


Figure 2. Hurricane Ike inundation map of southeast Texas.  
Image courtesy of the Harris County Flood Control District.



**Figure 3. Aerial photography of the Bolivar Peninsula on September 9, 2008 (top) and September 15, 2008, two days after landfall of Hurricane Ike (bottom), showing storm surge damage.**

Ike caused an estimated \$19.3 billion in damage. These estimates suggest that Ike is the fourth costliest hurricane to affect the United States, after Hurricanes Katrina (2005), Andrew (1992), and Wilma (2005).

The following websites contain more information on Hurricane Ike. Links to additional Ike information can be found on these websites:

- [www.srh.noaa.gov/hgx/projects/ike08.htm](http://www.srh.noaa.gov/hgx/projects/ike08.htm) (WFO HGX's Hurricane Ike page)
- [www.nhc.noaa.gov/pdf/TCR-AL092008\\_Ike.pdf](http://www.nhc.noaa.gov/pdf/TCR-AL092008_Ike.pdf) (NHC's Tropical Cyclone Report on Ike)
- [coastal.er.usgs.gov/hurricanes/ike/index.html](http://coastal.er.usgs.gov/hurricanes/ike/index.html) (USGS's Hurricane Ike page)

# Earliest Snow on Record Falls on December 10, 2008

By Charles Roeseler

A cold upper level low pressure system moved across southeast Texas on December 10<sup>th</sup>. This feature brought a band of moderate snow across the region in the afternoon and evening. High temperatures on December 9<sup>th</sup> were in the upper 70s to around 80 degrees. A cold front rolled through the area during the evening of December 9<sup>th</sup> and temperatures fell rapidly into the middle 30's over the north and into the middle 40's over the south. Enough moisture lingered behind the cold front to produce precipitation once the upper level low pressure system neared the area. Light snow fell during the early morning hours on the 10<sup>th</sup> over parts of Washington, Burleson and Brazos counties. Snow redeveloped in the afternoon when the upper level low moved into the Houston area. Some areas across the region experienced a rain and sleet mixture which changed to snow by early evening. Snowfall on the 10<sup>th</sup> was heaviest between 5 PM and 10 PM with the heaviest totals east of I-45. Snow amounts ranged from a trace over parts of western Wharton, Matagorda and Brazoria counties to as much as 5.5 inches in eastern Chambers County. An inch of snow fell on Galveston Island with generally an inch to two inches over the inland portions of Galveston County. The heaviest band of snow fell from Chambers County through Liberty County into Polk County.

Looking back through the weather records, it appears that this is the earliest accumulating snow that has affected southeast Texas. College Station received 2.0 inches of snow on December 10<sup>th</sup>. The previous earliest accumulating snow was 0.5 inches and that occurred on December 11, 1945. The earliest 1.0 inch or greater snowfall occurred on December 20, 1929, when 2.0 inches was measured. Houston Intercontinental Airport received 1.4 inches of snow on December 10<sup>th</sup>. The earliest accumulating snow event for the Houston area was December 10, 1944, when a tenth of an inch of snow was measured at the downtown Houston weather office. The earliest one inch of snow occurred on December 22, 1989, when 1.7 inches of snow was measured. Even Galveston received 1.0 inch of snow on December 10<sup>th</sup>. This is the earliest snowfall recorded for the island. Previous to this new record, 1.0 inch snowfall or greater occurred on December 22, 1989, when an inch of snow was measured.

When did southeast Texas receive its last snowfall? Snow flurries fell across the extreme northern parts of southeast Texas on March 7, 2008. But the last measurable snow occurred on April 7, 2008 north of a Caldwell to Livingston line. One to two inches of snow fell on that Saturday before Easter. The last accumulating snow over the southern half of the region occurred on Christmas Eve 2004. Six to ten inches of snow fell south of an Edna to Alvin to Galveston line.

The last accumulating snow at Intercontinental Airport occurred on February 1, 1994. The snow amount only tallied a tenth of an inch. The last time any snow fell in the Houston area occurred on Christmas Eve 2004 when scattered snow showers clipped the city.



Figure 1 - Parking lot at the National Weather Service Office in League City

*Earliest Snow on Record continued ...*

Below are some snow totals for southeast Texas:

Location	Snow Amounts (Inches)
Winnie	5.5
Liberty	5.0
Mont Belvieu	5.0
Anahuac	4.0
Baytown	4.0
San Jacinto County	3.0
Brenham	3.0
La Porte	3.0
Pasadena	2.5
Channelview	2.5
Livingston	2.0
Santa Fe	2.0
Madisonville	3.0
Navasota	2.0
College Station	2.0
Kingwood	2.0
Danbury	2.0
NWS Office League City	1.5
Houston Bush Intercontinental	1.4
Lake Jackson	1.2
Conroe	1.2
Clear Lake	1.0
Galveston	1.0
Ellington Field	1.0
Seabrook	1.0
Pearland (East Side)	1.0
Trinity	1.0
Rural Houston County	1.0
City Of Houston (Southeast)	0.5
Sweeny	0.5
Pearland (West Side)	0.5
Cypress	0.5
West University	0.5
Houston Hobby Airport	0.3
Sugarland	0.2
Houston Westbury	0.1
DW Hooks Airport	0.1
Bay City	TRACE
Wharton	TRACE

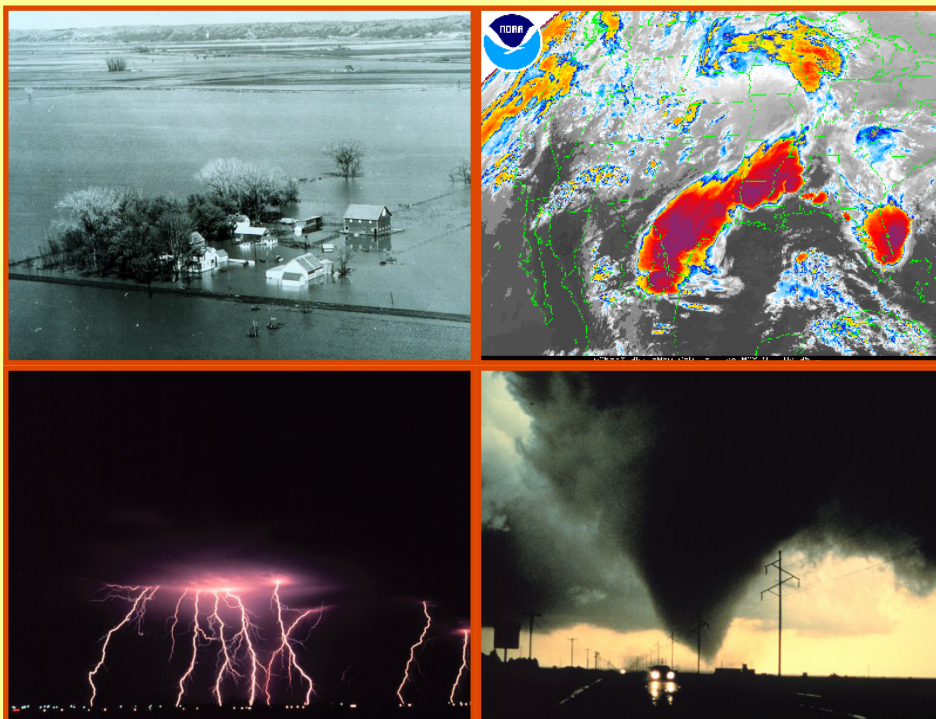


Figure 2 - A snowy yard in College Station



Figure 3 - A snowy landscape in Bedias

# Severe Weather Awareness Week February 22 - 28, 2009



Governor Rick Perry has proclaimed the week of February 22 - 28 as Severe Weather Awareness Week in Texas. In an official proclamation, he has reminded Texans of the threat to life that severe thunderstorms and tornadoes pose, and has stressed that no part of Texas is immune to them. Governor Perry has urged local officials to work with schools, libraries, the media and civic groups to disseminate awareness information and help prepare Texans for the coming severe weather season.

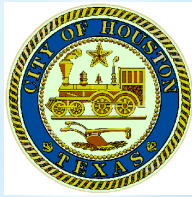
Spring marks the time of year when severe thunderstorms and tornadoes occur most often in Texas. They bring all the devastating elements - tornadoes, lightning, large hail, damaging winds and flash flooding. This is a time when Texans begin to take increasing advantage of the state's great outdoor opportunities. So, it is particularly important that everyone be aware of the weather when outdoors. Each Texan must know what to do when severe weather threatens him or her at home, at work, at school, at play or even when traveling on the road. Severe Weather Awareness Week is an excellent time to review safety plans for the coming weather threats.

Newspapers, broadcast media, safety organizations, and other local government officials are encouraged to work with their communities to disseminate severe weather awareness information to prepare them for the upcoming severe weather season. This information is designed to serve as a guide to the dangers of severe weather and its impacts on southeast Texas, and to serve as a guide to community groups around southeast Texas. It is important to remember that severe weather can occur in any month of the year in southeast Texas.

The Houston/Galveston National Weather Service office highly recommends everyone check out our Severe Weather Awareness Week information on the web at:

[www.srh.noaa.gov/hgx/severeweatherawareness](http://www.srh.noaa.gov/hgx/severeweatherawareness)

# 2009 Houston/Galveston Hurricane Workshop to be held on May 30<sup>th</sup>



The 2009 Houston/Galveston Hurricane Workshop, the largest free public event of its kind, will take place on May 30<sup>th</sup> from 10 a.m. until 2 p.m. at the George R. Brown Convention Center. The theme of the 2009 workshop will be *"Remembering Hurricane Ike, Ready or Not"*...as we continue to stress that everyone must always be prepared for a major hurricane visiting our region of the Gulf Coast.

Focused on providing families with the information they need as hurricane season begins, the event has grown each year and will likely draw more than 1,200 attendees in 2009. During the workshop, Bill Read, the Director of the National Hurricane Center, will give an update on recent improvements in hurricane forecasting and what the 2009 Hurricane Season has in store for Texas. Also, local Emergency Management experts will be on hand to explain the latest plans for hurricane preparedness along the upper Texas coast.

The popular kids' area will once again feature interactive learning activities. Kids will learn about tropical cyclones and how to prepare for an approaching hurricane through a fun, educational experience that teaches them to respect, but not fear, these strong storms.

There will also be at least thirty vendors on hand displaying items related to hurricane preparedness. Many items will also be given away on a first-come, first-served basis, such as hurricane tracking charts, tip sheets, a comprehensive booklet on hurricanes from the National Weather Service, as well as other vendor-provided items.

The 2009 Hurricane Workshop is once again being sponsored by CenterPoint Energy, the City of Houston and the National Weather Service. Harris County Office of Emergency Management, Interfaith Ministries, and the Weather Museum are also active participants in making this a successful educational event. The workshop is free and open to the public. Updates on the event program and registration information can be found prior to the event on the web at:

[hurricaneworkshop.com](http://hurricaneworkshop.com)







## Hurricane Preparedness Week May 24 - 30, 2009

Southeast Texas has a history of being struck by some very destructive tropical cyclones. In just the past three years, the area has been affected by two hurricanes and one tropical storm. Hurricane Ike (September 2008) made landfall on Galveston Island and produced a destructive and deadly storm surge along the coast and across Galveston Bay. Just one year earlier, Tropical Storm Erin (August 2007) produced flooding rains across portions of southeast Texas, and Hurricane Humberto (September 2007) produced wind damage in and around the High Island area. Many of us will never forget the names from previous years like Rita (September 2005), Allison (June 2001), Alicia (August 1983), Claudette (July 1979), Carla (September 1961) and the Great Galveston Hurricane (September 1900), which still stands as the deadliest natural disaster in United States history.

It is never too early to prepare for the start of the 2009 Hurricane Season set to begin on June 1<sup>st</sup>. In an effort to assist your preparation, Hurricane Preparedness Week will be held May 24-30. During each day of this week, information will be released by the National Hurricane Center and the National Weather Service which will cover a wide range of topics including...

**Hurricane History (Sunday, May 24)** - Information on the formation of tropical storms and hurricanes, tropical cyclone stages, the Saffir-Simpson Hurricane Scale, upcoming hurricane names and an extensive list of tropical cyclones of the past.

**Storm Surge and Marine Safety (Monday, May 25)** - Information on storm surge, which has the greatest potential for loss of life related to a hurricane, and marine safety, which is needed as more merchant, fishing, and recreational sailors take to the sea.

**High Winds and Tornadoes (Tuesday, May 26)** - Information on hurricane force winds, including high wind safety actions for both before hurricane season begins and when a tropical cyclone approaches, and tornadoes, which add to the cyclone's destructive power.

**Inland Flooding (Wednesday, May 27)** - Information on inland flooding, which in the 1970's, '80s and '90s was responsible for more than half of the deaths associated with tropical cyclones in the United States.

**Forecast Process (Thursday, May 28)** - Information on procedures the National Hurricane Center and the National Weather Service take to notify emergency managers, decision makers and the public of any tropical cyclone threat.

**Be Prepared (Friday, May 29)** - Information on disaster preparation and ways to prepare yourself, your business and your family before the arrival of the next tropical cyclone.

**Take Action (Saturday, May 30)** - Information on what you should do before hurricane season starts and when watches and/or warnings are issued.

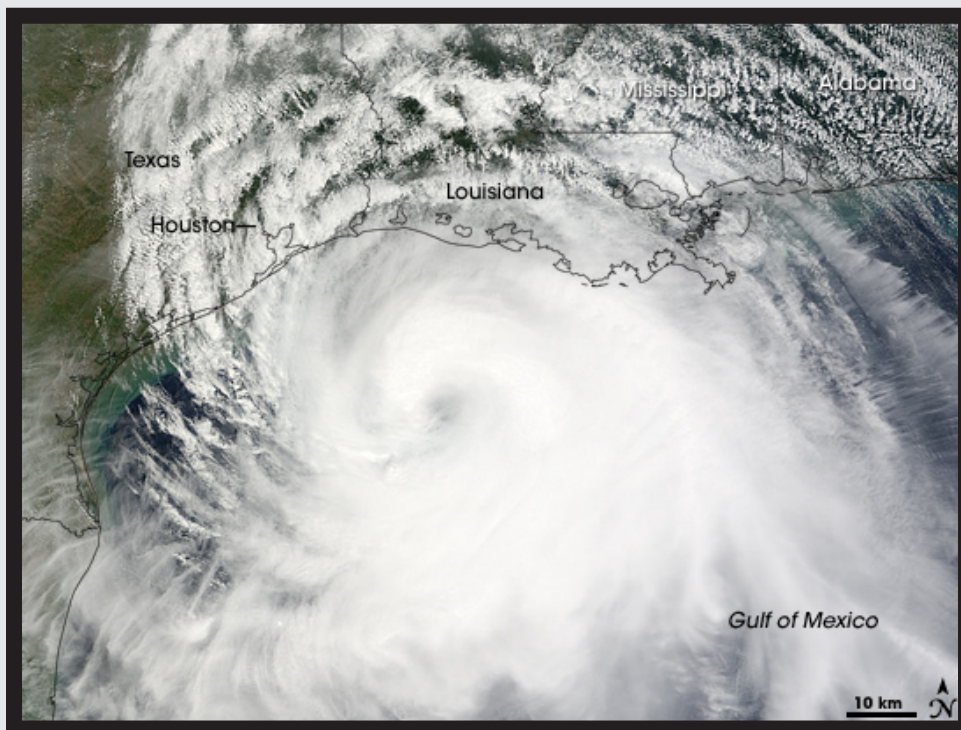
The Houston/Galveston National Weather Service Office highly recommends everyone read the releases during Hurricane Preparedness Week. More information on Hurricane Preparedness Week is available on the internet at:

[www.nhc.noaa.gov/HAW2/english/intro.shtml](http://www.nhc.noaa.gov/HAW2/english/intro.shtml)

## Schedule your Hurricane Talks now!

The Houston/Galveston National Weather Service Office offers our very informative and very popular hurricane presentations to schools, businesses and organizations. These talks include details on the dangers of tropical storms and hurricanes, the history of activity along the upper Texas coast and ways to protect your life and property during a tropical threat. Brochures on hurricanes can also be made available to all attendees.

If you are interested in having a meteorologist come to you and talk about hurricanes, please contact Dan Reilly ([dan.reilly@noaa.gov](mailto:dan.reilly@noaa.gov)) or Joshua Lichter ([joshua.lichter@noaa.gov](mailto:joshua.lichter@noaa.gov)) at (281)337-5074. The more you know about tropical storms and hurricanes, the better you will be prepared to survive when the next one strikes.



# Southeast Texas Skywarn

As southeast Texas residents, we are all well aware that severe weather can occur every month of the year. However, statistically, most of the 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, firefighting, 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 and three hours and are usually given during the evening hours or on Saturdays. Each participant receives a certificate 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 2009 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 season's class schedule, which will be continuously updated throughout the spring months, will be posted on the web at:

[www.srh.noaa.gov/hgx/severe/skywarn/schedule09.htm](http://www.srh.noaa.gov/hgx/severe/skywarn/schedule09.htm)

## COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK

*"Because every drop counts"*

### ABOUT COCORAHHS

CoCoRaHS is a grassroots volunteer network of backyard weather observers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow) in their local communities. By using low-cost measurement tools, stressing training and education, and utilizing an interactive Web-site, our aim is to provide the highest quality data for natural resource, education and research applications. The only requirements to join are an enthusiasm for watching and reporting weather conditions and a desire to learn more about how weather can effect and impact our lives.

Our Web page provides the ability for our observers to see their observations mapped out in "real time", as well as providing a wealth of information for our data users.

CoCoRaHS began in Colorado and has expanded to cover most of the country. As of mid-February 2009, there are 142 CoCoRaHS members in southeast Texas.

You can be a part of the CocoRaHS network and provide a valuable service to your community. Joining is as easy as visiting the web site at: [www.cocorahs.org](http://www.cocorahs.org)  
Check it out!



TEXAS COCORAHHS

# Flood Safety Awareness Week

## March 16-20, 2009

Flooding is a coast to coast threat to the United States and its territories in all months of the year. Flood Safety Awareness Week is intended to highlight some of the many ways floods can occur, the hazards associated with floods, and what you can do to save life and property. Important information on the following topics is available on the website at:

[www.floodsafety.noaa.gov](http://www.floodsafety.noaa.gov)

### **Advanced Hydrologic Prediction Service (AHPS)**

AHPS is the National Weather Service's ongoing effort to modernize National Weather Service hydrologic services. AHPS provides improved river and flood forecasts and water information across America to protect life and property and ensure the Nation's well-being.

### **Turn Around Don't Drown (TADD)**

TADD is a NOAA National Weather Service campaign to warn people of the hazards of walking or driving a vehicle through flood waters.

### **Floods, Droughts and other Related Phenomenon**

Tropical Cyclone Inland Flooding, the leading cause of southeast Texas fatalities in the past ten years, is covered here.

### **Flood Insurance**

Do you need flood insurance? How do you get it?

### **Flood Safety**

How can you and your family stay safe in a flood.





Storm Signals is a publication of the  
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