



Storm Signals

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Remembering Tropical Storm Allison 10 Years Later

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An Unwelcome Surprise

Residents of southeastern Texas woke up to an unwelcome surprise on June 5, 2001. A tropical storm had formed and was close to moving onshore along the upper Texas coast. After Allison made landfall, more uninvited events unfolded – four days of heavy rainfall episodes that culminated in devastating flooding across the Houston area. This article is a look back at Allison's formation, why the storm dumped so much rainfall, and some details on the rainfall and devastating flooding in Texas. To sum things up, we will look at actions you can take to avoid the dangers and minimize the impacts of a devastating flood event.

Allison's Formation

The formation of Tropical Storm Allison can be traced back to a tropical wave. The Tropical Prediction Center began to track the wave on May 21st after it moved off the west coast of Africa. Very little rainfall was associated with this system as it progressed westward and it eventually reached the Gulf of Tehuantepec off the western coast of Mexico on June 1st. A disorganized area of thunderstorms then formed over the Gulf of Mexico as moisture associated with the remnants of the tropical wave interacted with an upper low located over South Texas on June 3rd and 4th. By the morning of Tuesday June 5th, Tropical Storm Allison formed about 140 miles south of Galveston (see Figure 1 for a track of Allison). The storm moved inland later that afternoon, quickly weakened, and became a tropical depression that evening as it drifted inland over Houston. Flooding would accompany Allison over the next four days as the remnants of the storm meandered north to Lufkin, southwest to between Huntsville and College Station, and then south to off the coast near Freeport.



Figure 1 – Track of Allison (Courtesy of the National Hurricane Center)

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Why did Allison Generate So Much Rainfall?

The devastating flooding from Allison is a stark reminder that rainfall from tropical cyclones does not depend upon the strength of the system. In other words, it does not matter if the tropical cyclone is a tropical depression (with wind speeds up to 38 mph), a tropical storm (winds of 39 to 73 mph), or a hurricane (winds from 74 mph or greater). The Hydrometeorological Prediction Center has found six factors that impact the rainfall potential of land-falling tropical cyclones: the storm track (or movement), time of day, storm size, topography, wind shear, and nearby weather features. Allison was a small storm and the topography of Southeast Texas is rather flat; so, these two factors played a minor role. Between June 5th and the 9th, there was virtually no wind shear and no nearby weather features to affect the storm. The two which then became major factors leading to heavy rainfall over Southeast Texas turned out to be Allison's slow movement and the time of day. These were aided by an abundance of available Gulf moisture.

Allison's slow movement after landfall was caused by weak steering currents in the mid and upper atmosphere. On average, the steering currents over Southeast Texas during the tropical season are much weaker than for more northern latitudes. However, these were virtually non-existent while Allison was over Texas because the storm became caught between two centers of high pressure, one to the east and the other to the west. This caused the storm to do a slow counterclockwise loop similar to what a spinning top would do on a flat surface. Allison finally moved away from the state only after the eastern high pressure area became more dominant and generated westerly flow aloft.

The time of day factor played a major role during Allison's meandering over Texas. In general, the heavy rainfall area in a tropical cyclone over land tends to become concentrated closer to the center of the storm during the night and early morning. This phenomenon is known as a core rain event. As the day progresses, the core rain area then has a tendency to dissipate with the heavy rainfall becoming more concentrated into one or more bands well away from the storm's center. These rain bands then lose dominance and contract back into a core rain area toward the storm's center during the evening. Because of Allison's slow movement and its daily rain band and core rain process, some communities in Southeast Texas experienced repeated episodes of flooding rainfall.

Allison's Rainfall and Flooding

An incredible amount of rain fell across Southeast and East Texas during the five day period ending on June 10, 2001 (see Tables 1 and 2, and Figures 2 and 3). The highest amounts measured were just over 38 inches. Even though there was widespread flooding during the first three days of the event, no flood-related deaths were reported. However, 22 deaths occurred during flooding caused by the extreme rainfall that fell across Houston on the 8th and 9th. Of those, 19 were related to driving or walking through flood waters.

Table 1 Selected Rainfall Totals in Southeast Texas for June 5–10, 2001 (from the Tropical Storm Allison Service Assessment Report)		
Location	County	Rainfall in Inches
Port of Houston	Harris	36.99
Pennington	Houston	15.60
Beaumont Research	Jefferson	27.24
Tomball Hooks Airport	Harris	15.02
Pearland Clover Field	Brazoria	21.41
Huntsville	Walker	13.01
Houston Hobby Airport	Harris	20.84
Segno	Polk	12.99
Deer Park	Harris	20.50
Sugarland Airport	Fort Bend	12.17
Westbury	Harris	19.53
Newton	Newton	12.08
League City, NWS	Galveston	19.41
Alvin	Brazoria	11.23
Conroe	Montgomery	17.48
Baytown	Harris	9.83
Bush Intercontinental	Harris	16.48
Galveston	Galveston	9.77

Table 2 Harris County ALERT System Selected Rainfall Totals for June 5–10, 2001 (from the Tropical Storm Allison Service Assessment Report)		
Gage	Location	Rainfall in Inches
Greens Bayou	Mt. Houston Pkwy	38.78
Garners Bayou	Beltway 8	24.72
Hunting Bayou	I-10	35.83
Buffalo Bayou	Turning Basin	22.91
Greens Bayou	Ley Road	33.66
Clear Creek	Telephone Road	22.56
Cowart Creek	Baker (Friendswood)	28.31
Greens Bayou	Bammel N Houston	20.39
Vince Bayou	West Ellaine	26.85
Brays Bayou	Stella Link	19.76
Hunting Bayou	Lockwood	25.12
Buffalo Creek	Milam	16.02

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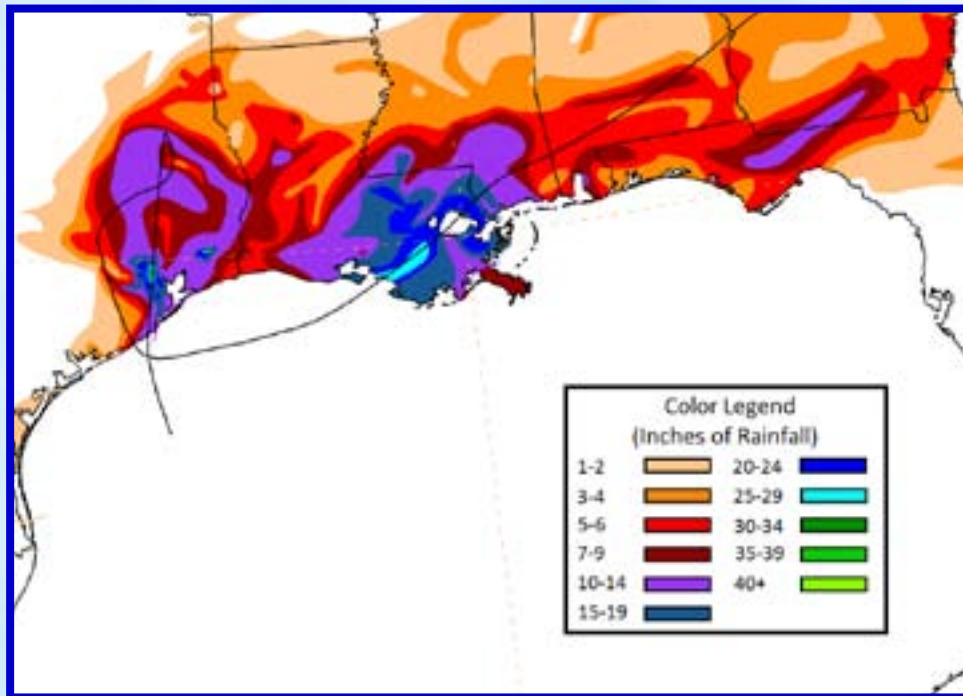


Figure 2 – Allison Rainfall along the Gulf Coast for June 5 – 10, 2001
(Adapted from a Hydrometeorological Prediction Center Graphic)

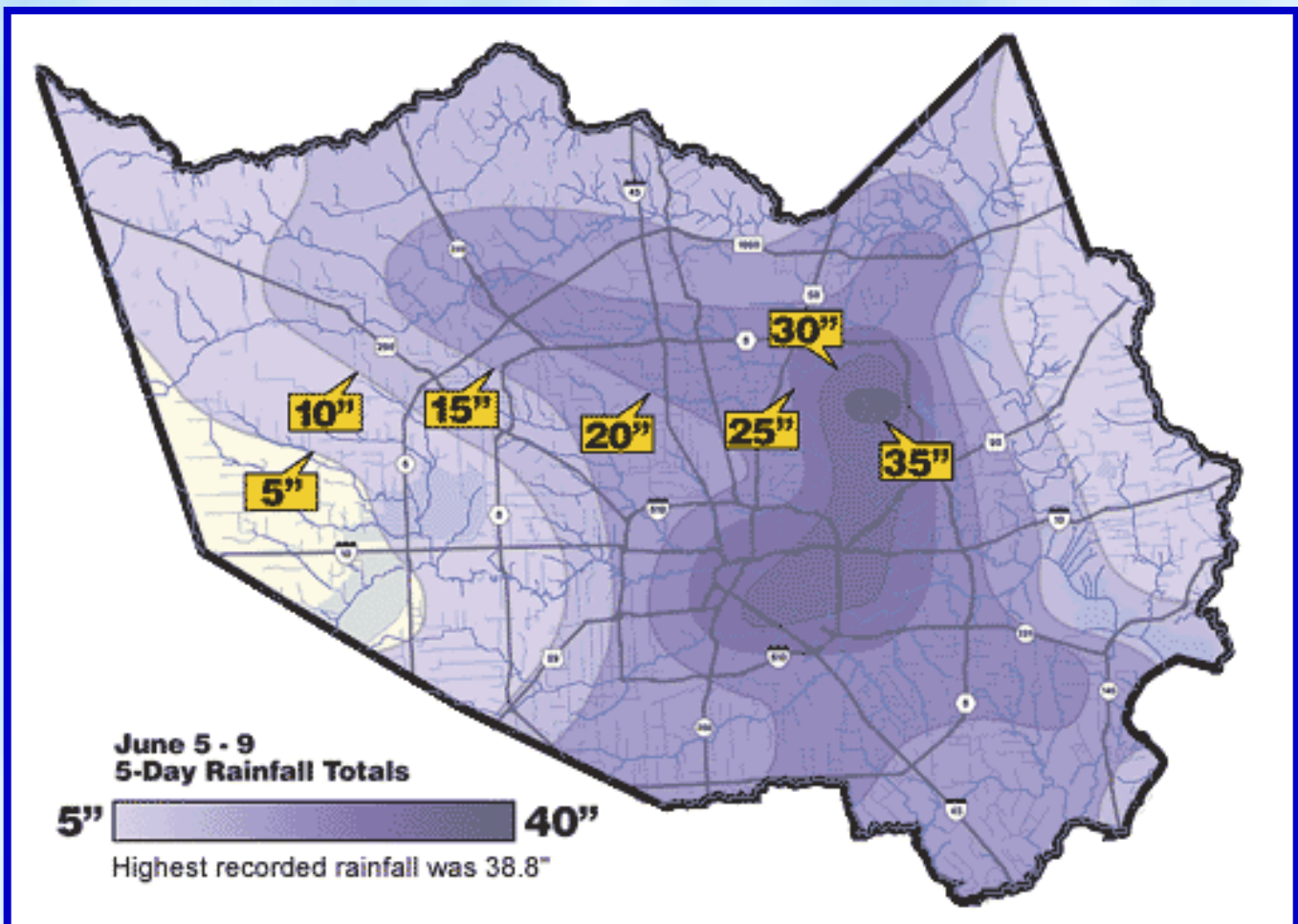


Figure 3 – Harris County Rainfall for June 5 – 10, 2001
(Courtesy of Tropical Storm Allison Recovery Project...www.tsarp.org)

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The first significant flood event associated with Allison occurred during landfall on June 5th. A large spiral band moved inland and caused widespread street flooding and some flooding of homes across northern Galveston and eastern Harris Counties. On the 6th and 7th, a core rain area affected locations to the north of Houston and rain bands dropped heavy rain to the south and east. Nearly continuous moderate rainfall over this two-day period resulted in flooding between Conroe and Crockett. Early on Thursday morning the 7th, a heavy rain band that extended from near Beaumont westward into Sugar Land caused flooding of roadways and homes in the Sugar Land and Stafford areas. Late on Thursday into early Friday, another rain band dropped nearly 12 inches of rainfall in and around the towns of Freeport and Brazoria.

Houston then experienced significant flooding late Friday the 8th into early Saturday the 9th as a core rain event occurred just east of Allison's center. Much of Friday was actually sunny over the city. The resulting abundance of daytime heating combined with the excessive tropical moisture enhanced the dangerous flood potential. This potential became manifest by the midafternoon as rain bands developed and moved northward from the coast. The bands fed into a rain area that was moving southward into Montgomery County. The resulting core rainfall produced incredible totals over Harris County later that night. Additional flooding occurred along the coast Saturday morning before the rain finally ended.

The two-day rainfall totals across Harris County ranged from almost 1 inch in the extreme west at Katy to in excess of 26 inches over Green's Bayou in the east (see Figure 4). Heavy rainfall was observed for up to 10 hours in some locations. Flooding became widespread and major freeways experienced severe flooding, especially in locations where the freeway was built to below ground level. In two vivid examples, water levels rose to just below the overpasses on Interstate 10 just north of the Uptown district and on US Highway 59 just west of the Downtown district. In all, the severe flooding across the Houston metropolitan area in Harris County affected more than 2 million people (see Figures 5 through 12).

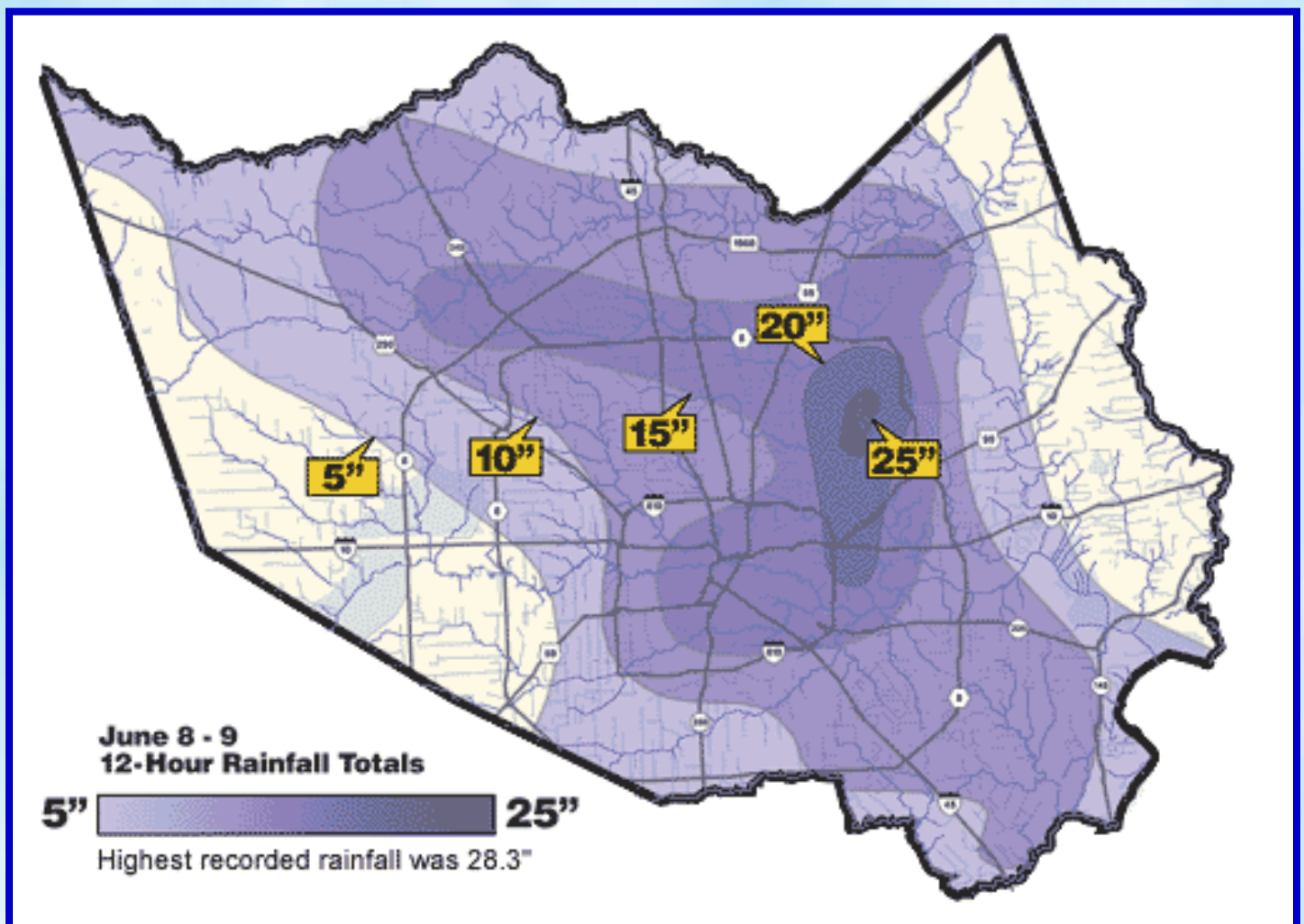


Figure 4 – Harris County Rainfall for June 8 – 9, 2001
(Courtesy of Tropical Storm Allison Recovery Project...www.tsarp.org)

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Figure 5 – Major Freeway Flooding at I-610 and Kelly
(Courtesy of Harris County Flood Control)



Figure 6 – Major Flooding in the Woodshadow Subdivision
(Courtesy of Harris County Flood Control)



Figure 7 – Major Flooding in Greenfield Village
(Courtesy of Harris County Flood Control)



Figure 8 – Major Flooding along US-59
(Courtesy of Harris County Flood Control)

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Figure 9 – Major Flooding near US-59
(Courtesy of Harris County Flood Control)



Figure 10 – Major Flooding at Meredith Manor
(Courtesy of Harris County Flood Control)



Figure 11 – Major Flooding in Houston
(Courtesy of Harris County Flood Control)



Figure 12 – Major Flooding in Houston
(Courtesy of Harris County Flood Control)

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Avoiding the Dangers and Minimizing the Impacts of Inland Flooding

The flooding from Allison was the theme for the annual Houston/Galveston Hurricane Workshop in May of 2002. Since inland flooding is one of the major hazards of a slow-moving tropical cyclone, the workshop promoted five ways people could protect themselves and others from the dangers of inland flooding. For this tenth anniversary of Allison's flooding over Southeast Texas, the National Weather Service would like to remind you of these practical keys to avoiding flood dangers and minimizing flood impacts:

- 1) **Protect your personal documents and special items**
 - Store valuables in plastic tubs with locking tops.
 - In case of evacuation, you should be able to secure and move all your valuables within 15 minutes.
- 2) **Buy flood insurance – a plan for replaceable items**
 - The National Flood Insurance Program (NFIP) is available from an insurance agent or the NFIP.
 - More information about the NFIP can be found at www.floodsmart.gov
- 3) **Flood proof your home – take steps to minimize flood damage**
 - Shut off the main circuit breaker to prevent short circuiting and eliminate the threat of electrocution.
 - Place outside air conditioning units onto platforms above ground level.
 - Store rarely used or expensive items in the attic or on high shelves.
- 4) **Develop a family flood plan**
 - Develop a plan of action to keep from panicking during an emergency.
 - Have an evacuation route and alternatives planned in the event you are asked to evacuate.
 - Communicate your plans with friends or family outside of your home area.
 - Battery powered radios or televisions can be used in the event of a power outage.
- 5) **Never drive on flooded roads**
 - Driving into flooded roadways puts your life and the lives of others at risk.
 - Unless told to evacuate, you are probably safest staying at your current location.
 - If you encounter flood waters when driving, turn around, don't drown!
 - More Information about Turn Around Don't Drown can be found at www.weather.gov/os/water/tadd

Conclusion

Tropical Storm Allison caused flooding across southeastern and eastern Texas for four days after making landfall. The lack of steering currents aloft and the daily cycle of core rain and rain band events led to major flooding over a very large area. To cap off the event, severe flooding affected over 2 million people in the city of Houston as Allison drifted back toward the coast. Since inland flooding is a major hazard from slow-moving tropical cyclones like Allison, the National Weather Service would like to remind everyone to take steps to protect themselves and others from the dangers of flooding.

Resources

More information on Tropical Storm Allison and tropical cyclones in general can be found at the following Internet resources:

- Tropical Cyclone Report for Allison from the Tropical Prediction Center
<http://www.nhc.noaa.gov/2001allison.html>
- Houston/Galveston web page resource, "SE TX Hurricane Climatology"
http://www.srh.noaa.gov/hgx/?n=hurricanes_climatology_2000s#Allison2001
- Special Storm Signals volume on Tropical Storm Allison
<http://www.srh.noaa.gov/images/hgx/stormsignals/vol58.pdf>
- Tropical Storm Allison Service Assessment Report
<http://www.nws.noaa.gov/om/assessments/pdfs/allison.pdf>
- "Texas Hurricane History" by David Roth
<http://www.srh.noaa.gov/images/lch/tropical/txhurricanehistory.pdf>
- Tropical Prediction Center's Hurricane History Page Allison entry
<http://www.nhc.noaa.gov/HAW2/english/history.shtml#allison>
- Tropical cyclone rainfall graphics from the Hydrological Prediction Center
<http://www.hpc.ncep.noaa.gov/tropical/rain/tcrainfall.html>
- Frequently asked questions about tropical cyclones from the Tropical Prediction Center
<http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqG.html>

NWS Houston/Galveston Joins Facebook!



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If you have visited our web site recently, you will notice a link to our new Facebook fan page under our Top News of the Day section. We hope to use Facebook as a way to interact with our users, and provide pertinent weather information. While Facebook will help disseminate weather information, it will also help us improve our services because of useful feedback we can receive from our users and fans. Our goal with Facebook is to provide you with any heads up about severe weather, potential flooding should the current drought ever break, information on tropical weather that could impact SE Texas as well as any information on Skywarn presentations and hurricane preparedness meetings. Usually we will post a photo of one of our Graphicasts from our webpage, or post a video of our multimedia briefing. Sometimes we will provide a link to information we want to pass along like a link to our annual hurricane workshop or perhaps an updated drought statement. During high impact weather events, we hope to provide you with information concerning severe weather watches and areas of concern. Unfortunately, our Facebook page is not



meant as an official way to receive severe weather warnings. We do appreciate your patience and cooperation during severe weather and tropical warning operations as we may not be able to answer all your comments as we issue warnings. We will be monitoring the page for any weather reports or photos you may post on our page. It is always helpful to know how the weather affects our users.

Lightning Safety Week is June 19-25, 2011

Summer is the peak season for one of the nation's deadliest weather phenomena— lightning. But don't be fooled, lightning strikes year round. In the United States, an average of 58 people are killed each year by lightning.

Hundreds of people are permanently injured each year. People struck by lightning suffer from a variety of long-term, debilitating symptoms, including memory loss, attention deficits, sleep disorders, chronic pain, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and more.

Lightning is a serious danger. Find more information at...

www.lightningsafety.noaa.gov



Schedule a 2011 Hurricane Talk Now!

If you are not able to make it to one of our area's Hurricane Town Meetings, your Houston/Galveston National Weather Service Office continues to offer 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) or Joshua Lichter (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. This could be the year we see our next Tropical Storm Allison, Hurricane Humberto or Hurricane Ike.



Hurricane Names

The lists are re-cycled every six years, i.e., the 2011 list will be used again in 2017. Several names have been changed since the lists were created.

In the event that more than 21 named tropical cyclones occur in the Atlantic basin in a season, additional storms will take names from the Greek alphabet: Alpha, Beta, Gamma, Delta, and so on. If a storm forms in the off-season, it will take the next name in the list based on the current calendar date. For example, if a tropical cyclone formed on December 28th, it would take the name from the previous season's list of names. If a storm formed in February, it would be named from the subsequent season's list of names.

2011 Hurricane Names

Arlene
Bret
Cindy
Don
Emily
Franklin
Gert
Harvey
Irene
Jose
Katia
Lee
Maria
Nate
Ophelia
Philippe
Rina
Sean
Tammy
Vince
Whitney

Weather Safety: Hurricanes

Before the Hurricane Season:

- ▶ Determine safe evacuation routes inland.
- ▶ Learn location of official shelters.
- ▶ Make emergency plans for pets.
- ▶ Check emergency equipment, such as flashlights, generators and battery-powered NOAA Weather Radio All Hazards and cell phones.
- ▶ Buy food that will keep and store drinking water.
- ▶ Buy plywood or other material to protect your home.
- ▶ Clear loose and clogged rain gutters and downspouts.
- ▶ Trim trees and shrubbery.
- ▶ Decide where to move your boat in an emergency.
- ▶ Review your insurance policy.

During the Storm

When in a **Watch** area...

- ▶ Listen frequently to radio, TV or NOAA Weather Radio All Hazards for bulletins of a storm's progress.
- ▶ Fuel and service your vehicles.
- ▶ Inspect and secure mobile home tie-downs.
- ▶ Board up windows in case the storm moves quickly and you have to evacuate.
- ▶ Stock up on batteries, food that will keep, first aid supplies, drinking water and medications.
- ▶ Store lawn furniture and other loose, light-weight objects, such as garbage cans and garden tools.
- ▶ Have cash on hand in case power goes out and ATMs don't work.

Plan to evacuate if you...

- ▶ Live in a mobile or manufactured home. They are unsafe in high winds no matter how well fastened to the ground.
- ▶ Live on the coastline, an offshore island or near a river or flood plain. In addition to wind, flooding from storm surge waves is a major killer.
- ▶ Live in a high-rise. Hurricane winds can knock out electricity to elevators, break windows and more.

TERMS TO KNOW

Hurricane Watch: Hurricane conditions are possible within the specified coastal area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of the anticipated onset of tropical-storm-force winds.

Hurricane Warning: Hurricane conditions are expected in the specified area of the warning. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds.

Tropical Storm Watches and Warnings: Take these alerts seriously. Although Tropical Storms have lower wind speeds than hurricanes, they often bring life-threatening flooding and dangerous winds. Take precautions!

When in a **Warning** area...

- ▶ Closely monitor radio, TV or NOAA Weather Radio All Hazards for official bulletins.
- ▶ Close storm shutters.
- ▶ Follow instructions issued by local officials. **Leave immediately if ordered!**
- ▶ If evacuating, leave as soon as possible. Stay with friends or relatives, at a low-rise inland motel or at a designated public shelter outside the flood zone.
- ▶ DO NOT stay in a mobile or manufactured home.
- ▶ Notify neighbors and a family member outside of the warned area of your evacuation plans.
- ▶ Take pets with you if possible, but remember, most public shelters do not allow pets other than those used by the handicapped. Identify pet-friendly motels along your evacuation route.

Weather Safety: Hurricanes

If Staying in a Home...

- ▶ Turn refrigerator to maximum cold and keep closed.
- ▶ Turn off utilities if told to do so by authorities.
- ▶ Turn off propane tanks.
- ▶ Unplug small appliances.
- ▶ Fill bathtub and large containers with water in case tap water is unavailable. Use water in bathtubs for cleaning and flushing only. Do NOT drink it.



If Winds Become Strong...

- ▶ Stay away from windows and doors, even if they are covered. Take refuge in a small interior room, closet or hallway.
- ▶ Close all interior doors. Secure and brace external doors.
- ▶ If you are in a two story house, go to an interior 1st floor room.
- ▶ If you are in a multi-story building and away from water, go to the 1st or 2nd floor and stay in the halls or other interior rooms away from windows.
- ▶ Lie on the floor under a table or other sturdy object.

This information is adapted from a joint NWS, FEMA and American Red Cross brochure:
www.weather.gov/os/brochures/hurr.pdf

For links to forecasts, billion dollar hurricanes, service assessment, brochures, and more go to:
www.weather.gov/os/hurricane
NOAA Weather Radio All Hazards:
www.weather.gov/nwr
National Hurricane Center
www.nhc.noaa.gov

What to Bring to the Shelter

- First aid kit
- Medicine
- Baby food and diapers
- Cards, games, books, music players with headphones
- Toiletries
- Battery-powered radio, cell phone
- Flashlights, one per person
- Extra batteries
- A blanket or sleeping bag for each person
- Identification
- Valuable papers such as insurance policies
- Cash, credit card

REMINDER: If you are told to leave, do so immediately!

Be Alert For...

- ▶ Tornadoes: They are often spawned by hurricanes.
- ▶ The calm “eye” of the storm. It may seem like the storm is over but after the eye passes, the winds will change direction and quickly return to hurricane force.

After the Storm

- ▶ Keep listening to radio, TV or NOAA Weather Radio.
- ▶ Wait until an area is declared safe before entering.
- ▶ Watch for closed roads. If you come upon a barricade or a flooded road, Turn Around Don't Drown!™
- ▶ Avoid weakened bridges and washed out roads.
- ▶ Stay on firm ground. Moving water only 6 inches deep can sweep you off your feet. Standing water may be electrically charged from power lines.
- ▶ Once home, check gas, water and electrical lines and appliances for damage.
- ▶ Use a flashlight to inspect for damage. Never use candles and other open flames indoors.
- ▶ Do not drink or prepare food with tap water until officials say it is safe.
- ▶ If using a generator, avoid electrocution by following manufacturers instructions and standard electric code.

Heat Waves

Know What These Terms Mean...

- * Heat wave: Prolonged period of excessive heat and humidity. The National Weather Service steps up its procedures to alert the public during these periods of excessive heat and humidity.
- * Heat index: A number in degrees Fahrenheit (F) that tells how hot it really feels when relative humidity is added to the actual air temperature. Exposure to full sunshine can increase the heat index by 15 degrees F.
- * Heat cramps: Heat cramps are muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are an early signal that the body is having trouble with the heat.
- * Heat exhaustion: Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a form of mild shock. If not treated, the victim may suffer heat stroke.
- * Heat stroke: Heat stroke is life-threatening. The victim's temperature control system, which produces sweating to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly.
- * Sunstroke: Another term for heat stroke.

If a Heat Wave Is Predicted or Happening...

- * Slow down. Avoid strenuous activity. If you must do strenuous activity, do it during the coolest part of the day, which is usually in the morning between 4:00 a.m. and 7:00 a.m.
- * Stay indoors as much as possible. If air conditioning is not available, stay on the lowest floor, out of the sunshine. Try to go to a public building with air conditioning each day for several hours. Remember, electric fans do not cool the air, but they do help sweat evaporate, which cools your body.
- * Wear lightweight, light-colored clothing. Light colors will reflect away some of the sun's energy.
- * Drink plenty of water regularly and often. Your body needs water to keep cool.
- * Drink plenty of fluids even if you do not feel thirsty.
- * Water is the safest liquid to drink during heat emergencies. Avoid drinks with alcohol or caffeine in them. They can make you feel good briefly, but make the heat's effects on your body worse. This is especially true about beer, which dehydrates the body.
- * Eat small meals and eat more often. Avoid foods that are high in protein, which increase metabolic heat.
- * Avoid using salt tablets unless directed to do so by a physician.

Signals of Heat Emergencies...

- * Heat exhaustion: Cool, moist, pale, or flushed skin; heavy sweating; headache; nausea or vomiting; dizziness; and exhaustion. Body temperature will be near normal.
- * Heat stroke: Hot, red skin; changes in consciousness; rapid, weak pulse; and rapid, shallow breathing. Body temperature can be very high-- as high as 105 degrees F. If the person was sweating from heavy work or exercise, skin may be wet; otherwise, it will feel dry.

Treatment of Heat Emergencies...

- * Heat cramps: Get the person to a cooler place and have him or her rest in a comfortable position. Lightly stretch the affected muscle and replenish fluids. Give a half glass of cool water every 15 minutes. Do not give liquids with alcohol or caffeine in them, as they can make conditions worse.
- * Heat exhaustion: Get the person out of the heat and into a cooler place. Remove or loosen tight clothing and apply cool, wet cloths, such as towels or sheets. If the person is conscious, give cool water to drink. Make sure the person drinks slowly. Give a half glass of cool water every 15 minutes. Do not give liquids that contain alcohol or caffeine. Let the victim rest in a comfortable position, and watch carefully for changes in his or her condition.
- * Heat stroke: Heat stroke is a life-threatening situation. Help is needed fast. Call 9-1-1 or your local emergency number. Move the person to a cooler place. Quickly cool the body. Immerse victim in a cool bath, or wrap wet sheets around the body and fan it. Watch for signals of breathing problems. Keep the person lying down and continue to cool the body any way you can. If the victim refuses water or is vomiting or there are changes in the level of consciousness, do not give anything to eat or drink.

Heat Index °F (°C)

Relative Humidity (%)

Temperature		40	45	50	55	60	65	70	75	80	85	90	95	100
	110 (47)	136 (58)												
	108 (43)	130 (54)	137 (58)											
	106 (41)	124 (51)	130 (54)	137 (58)										
	104 (40)	119 (48)	124 (51)	131 (55)	137 (58)									
	102 (39)	114 (46)	119 (48)	124 (51)	130 (54)	137 (58)								
	100 (38)	109 (43)	114 (46)	118 (48)	124 (51)	129 (54)	136 (58)							
	98 (37)	105 (41)	109 (43)	113 (45)	117 (47)	123 (51)	128 (53)	134 (57)						
	96 (36)	101 (38)	104 (40)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	132 (56)					
	94 (34)	97 (36)	100 (38)	103 (39)	106 (41)	110 (43)	114 (46)	119 (48)	124 (51)	129 (54)	135 (57)			
	92 (33)	94 (34)	96 (36)	99 (37)	101 (38)	105 (41)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	131 (55)		
	90 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	103 (39)	106 (41)	109 (43)	113 (45)	117 (47)	122 (50)	127 (53)	132 (56)
	88 (31)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	98 (37)	100 (38)	103 (39)	106 (41)	110 (43)	113 (45)	117 (47)	121 (49)
	86 (30)	85 (29)	87 (31)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	102 (39)	105 (41)	108 (42)	112 (44)
	84 (29)	83 (28)	84 (29)	85 (29)	86 (30)	88 (31)	89 (32)	90 (32)	92 (33)	94 (34)	96 (36)	98 (37)	100 (38)	103 (39)
	82 (28)	81 (27)	82 (28)	83 (28)	84 (29)	84 (29)	85 (29)	86 (30)	88 (31)	89 (32)	90 (32)	91 (33)	93 (34)	95 (35)
80 (27)	80 (27)	80 (27)	81 (27)	81 (27)	82 (28)	82 (28)	83 (28)	84 (29)	84 (29)	85 (29)	86 (30)	86 (30)	87 (31)	

Category	Heat Index	Possible heat disorders for people in high risk groups
Extreme Danger	130°F or higher (54°C or higher)	Heat stroke or sunstroke likely.
Danger	105 - 129°F (41 - 54°C)	Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
Extreme Caution	90 - 105°F (32 - 41°C)	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	80 - 90°F (27 - 32°C)	Fatigue possible with prolonged exposure and/or physical activity.

Precautions To Take Against Excessive Heat

Increase your intake of non-alcoholic, non-carbonated, caffeine free beverages such as water and juice.
 Wear clothing that is light in color and loose fitting.
 Avoid the outdoors during extreme heat. Stay out of the sun.
 Stay in an air-conditioned environment if possible. Shopping malls offer relief if your home is not air-conditioned.
 Check on the elderly. They are especially susceptible to heat related illness.
 Eliminate strenuous activity such as running, biking and lawn care work when it heats up.

Heat Related Illnesses And Their Symptoms

SUNBURN - Redness and pain in the skin. In severe cases there is also swelling, blisters, fever, and headaches.
HEAT CRAMPS - Heavy sweating and painful spasms usually in the leg or abdomen muscles.
HEAT EXHAUSTION - The person becomes weak and is sweating heavily. The skin is cold, pale and clammy. Fainting and vomiting accompanies heat exhaustion.
HEATSTROKE/SUNSTROKE - High body temperature (106 degrees or higher) along with hot dry skin and a rapid and strong pulse. Unconsciousness is possible.



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