

Hurricane Hazards and Being Prepared During 2020 Hurricane Season



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Hurricane Dorian, 2019

Hurricane/Tropical Cyclone Hazards

Every storm is different, brings these in different proportions.



Damaging Winds

Alicia, 1983



Storm Surge Flooding

Ike, 2008



Flooding Rains

Harvey, 2017



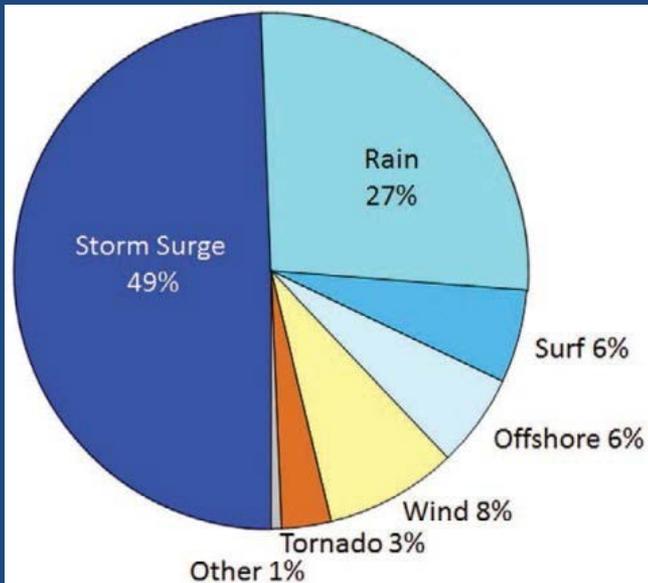
Tornadoes

High surf, rip currents

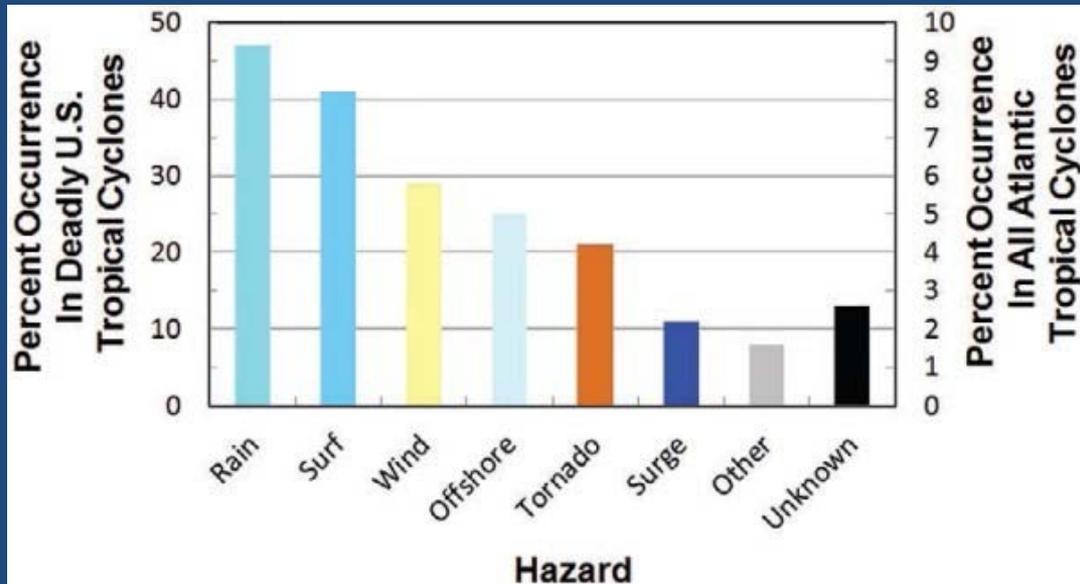
Harvey, 2017

Which Hazards are the Most Dangerous?

The water-related hazards cause about 90% of fatalities!



Cause of death in the United States directly attributable to Atlantic tropical cyclones, 1963–2012.

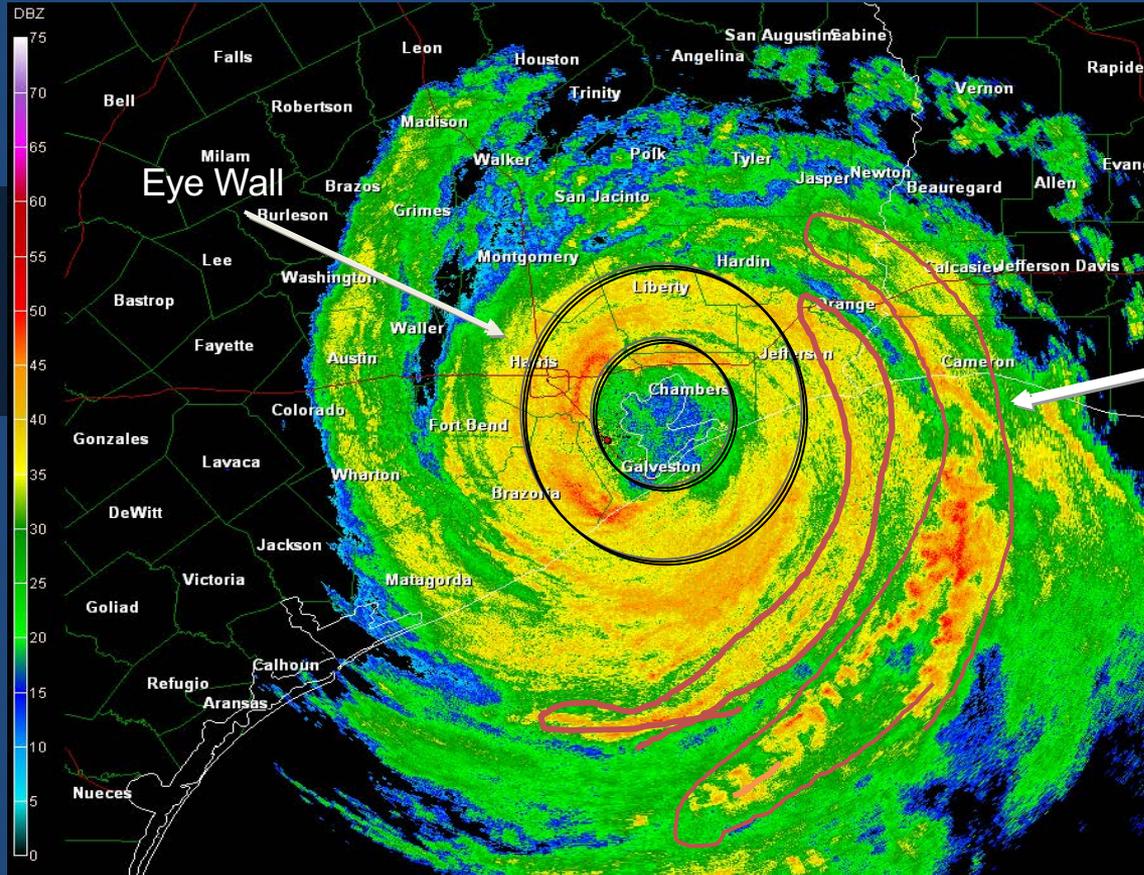


Percentage of 1963–2012 Atlantic tropical cyclones (right scale) and deadly U.S. tropical cyclones (left scale) in which noted types of fatalities occurred in the United States.

Anatomy of the Hurricane: Ike View from Radar

Note Hurricane Eye, Eyewall and Spiral Bands

Highest winds typically in the eyewall of the hurricane



Gusty winds and tornadoes in the spiral bands (especially on the right side of the track)

Spiral Bands

Hurricane Winds



Photo Credit: FEMA



Photo Credit: Jeff Evans, NWS/NOAA

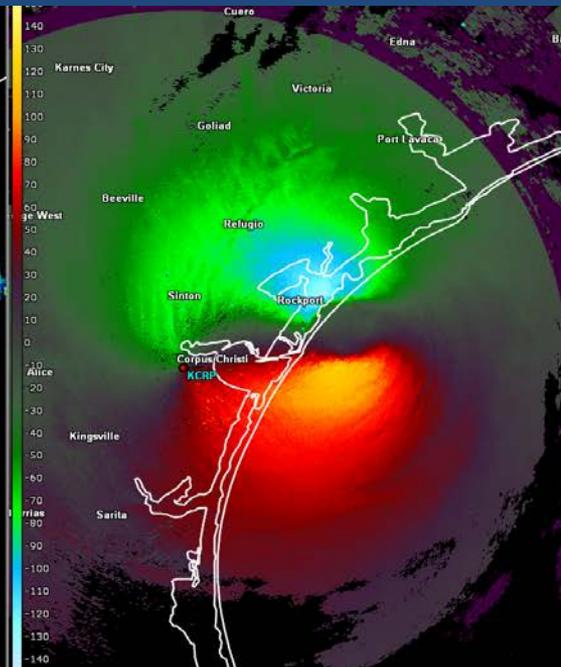
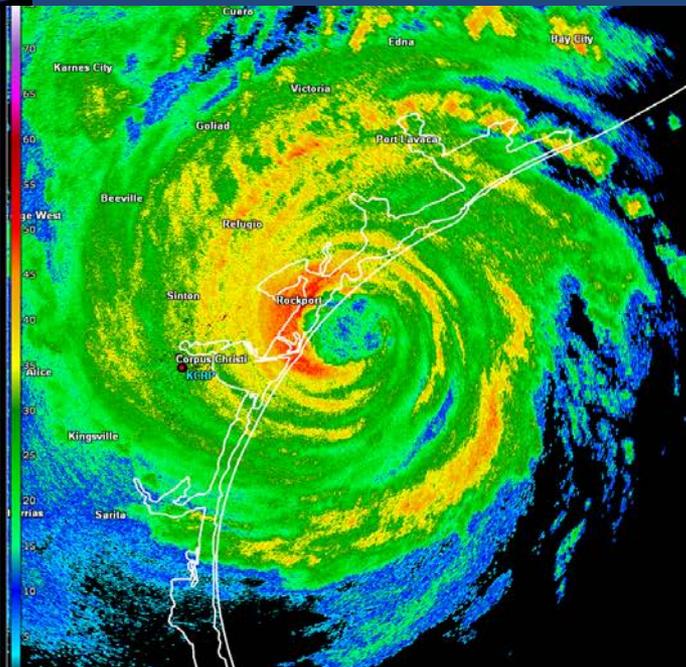
Saffir Simpson Hurricane *Wind* Scale

Describes the wind hazard; only partially related to surge and unrelated to flooding rains and tornadoes. NOT an overall severity index, need to consider the other hazards!

https://www.nhc.noaa.gov/pdf/sshws_table.pdf

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Hurricane Harvey Category 4 at Landfall, 10 pm Friday August 25th, 2017



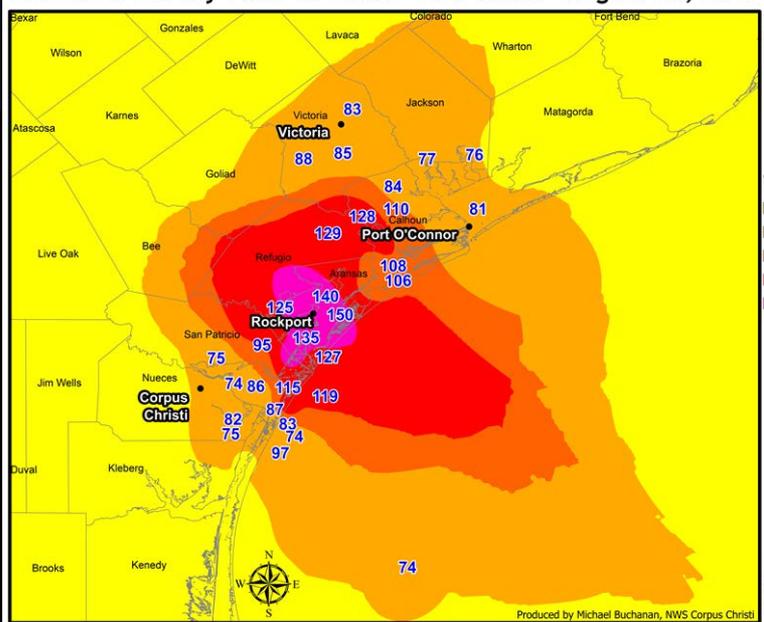
Hurricane Harvey

Category 4 Wind Damage

Rockport, TX



Hurricane Harvey Peak 10-meter Wind Gusts - Aug 25-29, 2017



Wind Gusts (mph)

- 39-73 (TS)
- 74-95 (Cat 1)
- 96-110 (Cat 2)
- 111-129 (Cat 3)
- 130-156 (Cat 4)

Hurricane wind gusts are highlighted in blue.



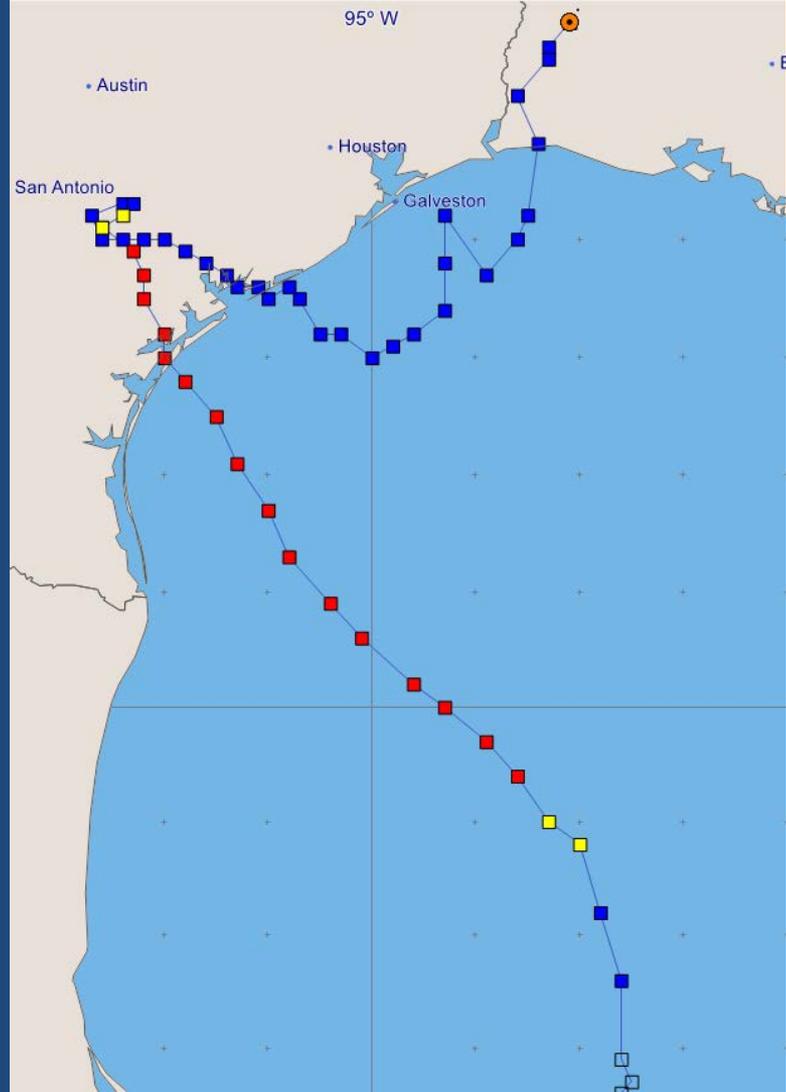
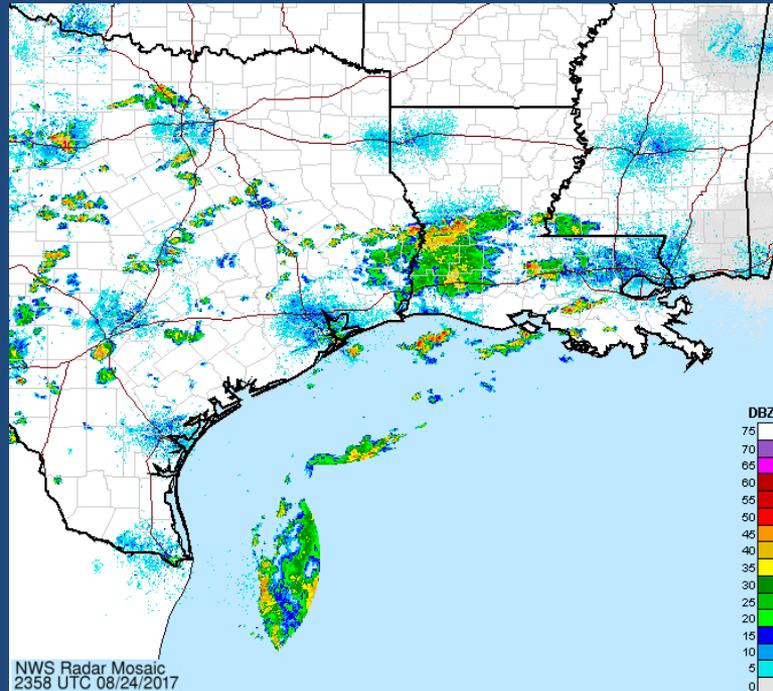
Source: National Weather Service Post Tropical Cyclone Reports (Incomplete and unrepresentative data have been removed from this analysis. Non 10-m winds have been modified to a 10-m value.)

Water Hazards: Rainfall and Storm Surge Flooding



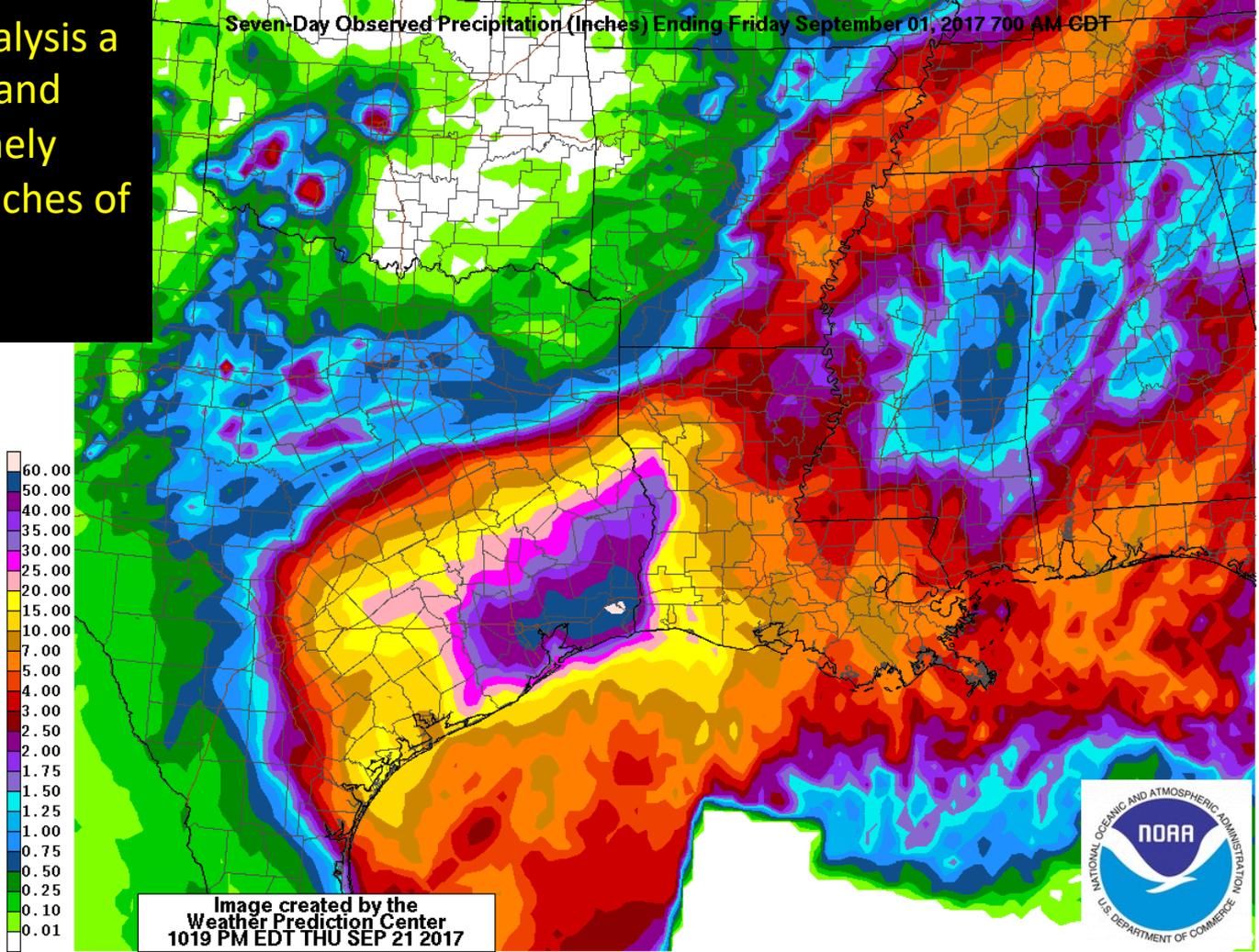
Harvey's Slow Looping Track

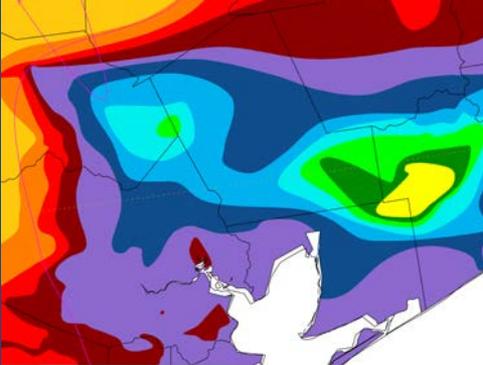
Harvey made landfall near Rockport, TX as a cat 4 major hurricane then slowed down and “weakened” (wind speed), was “downgraded” to a tropical storm; slow moving hurricanes, tropical storms, depressions are notorious for producing extreme rainfall, flooding. Spiral bands produced the most intense rain.



Record Rainfall; This analysis a combination of gauges and radar estimates; extremely large area of 30 to 60 inches of rain! 60.58 inches near Nederland, TX

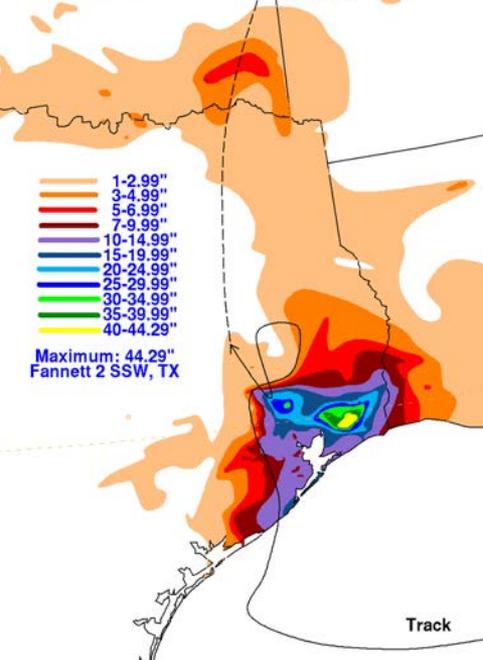
Seven-Day Observed Precipitation (Inches) Ending Friday September 01, 2017 7:00 AM CDT





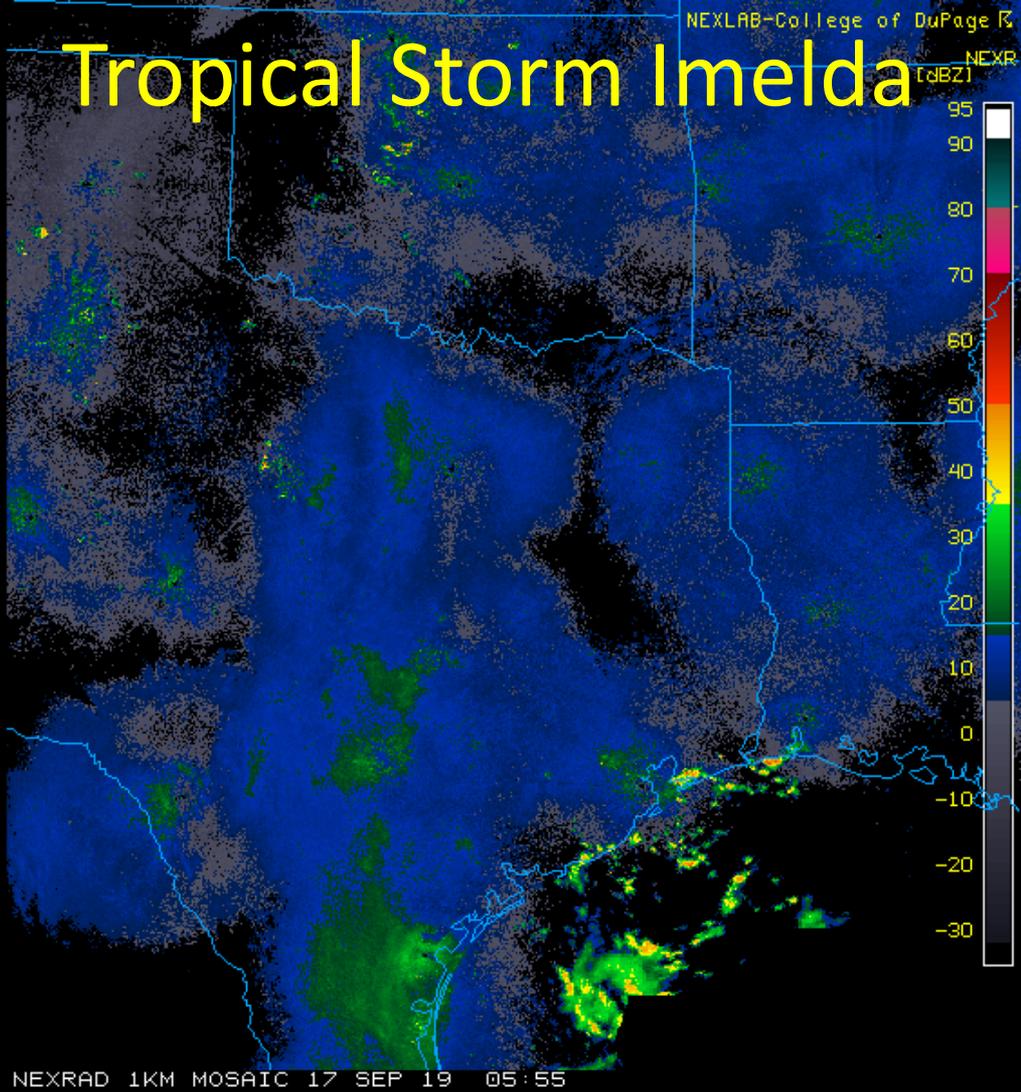
Tropical Storm Imelda
September 16-20, 2019
3593 sites

Track of mid-level remnant

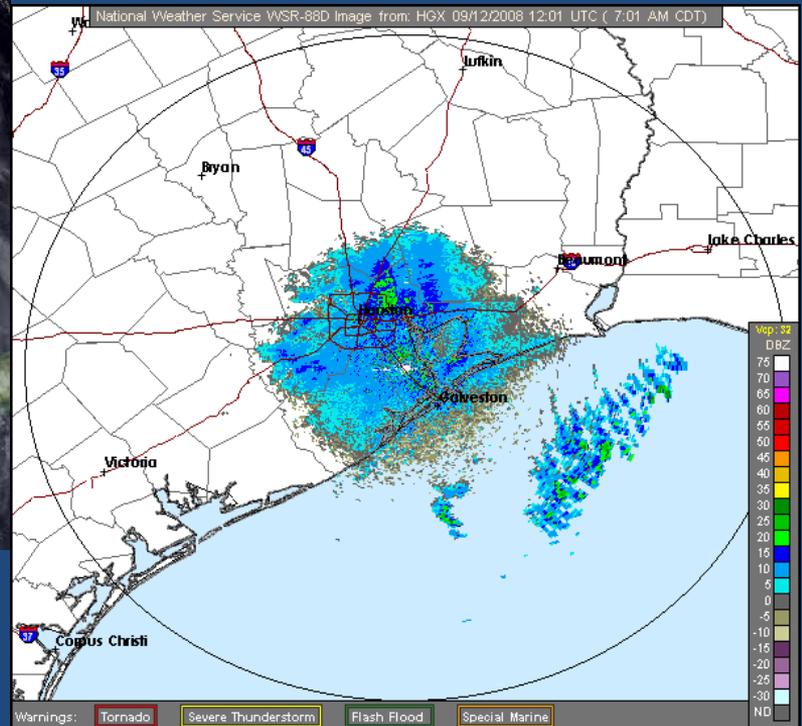


Track

Tropical Storm Imelda



Hurricane Ike, 2008



Houston Chronicle

Storm Surge Flooding

Hurricane Ike: SE TX Coast

Storm Surge/ Coastal Flooding

For storms like Ike, Carla, 1900 storm, water rises well before arrival of winds. Don't wait too long to leave!



AP Photo/David J. Phillip

Hurricane Ike: Bolivar Peninsula Devastation

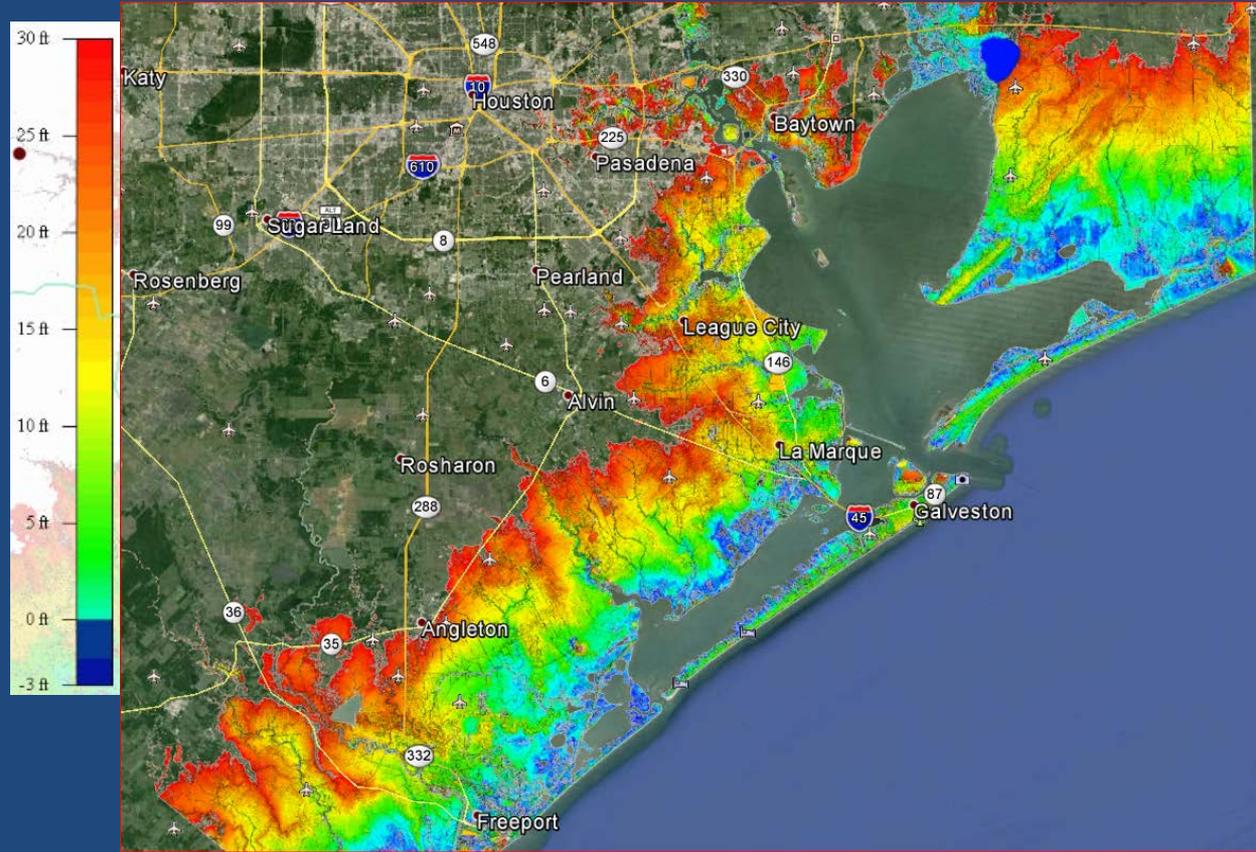


Image from www.hawkeyemedia.com/bolivar/

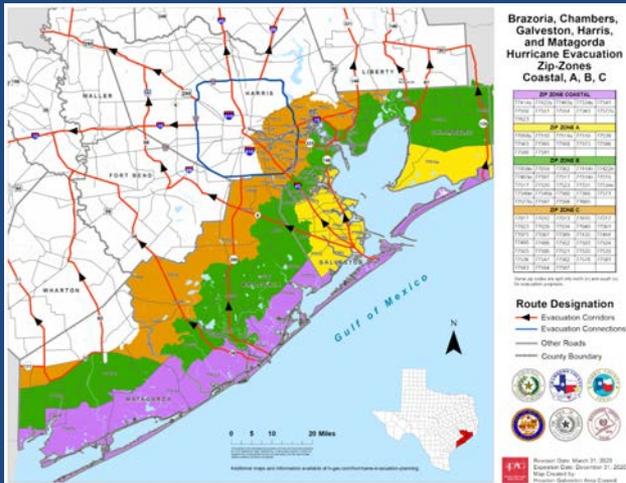
Storm Surge Risk Depends on Ground Elevation

Know your storm surge risk. If Storm Tide greater than ground elevation, you can be flooded.

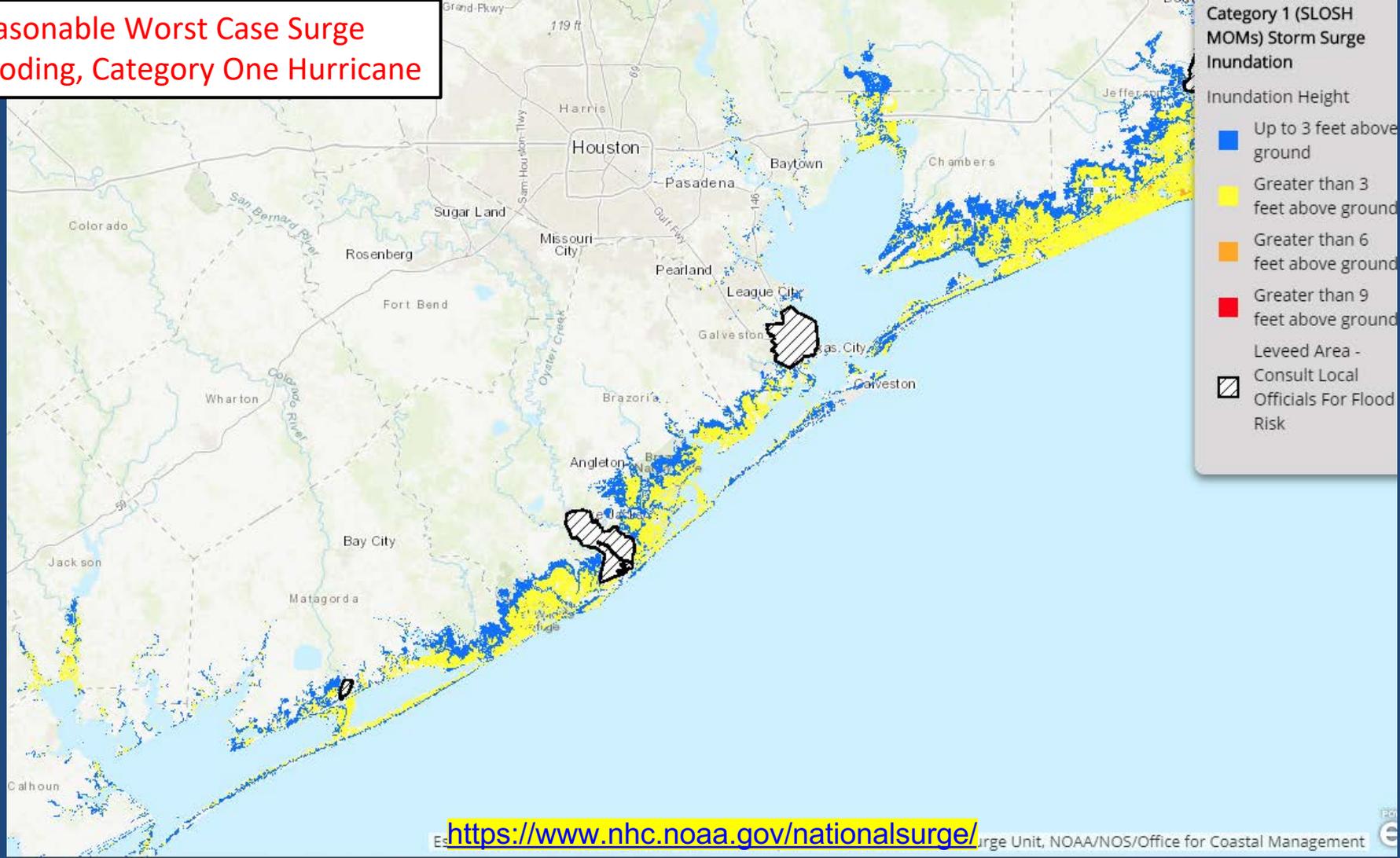
Note similarities to evacuation zone map which are based mostly on storm surge risk.



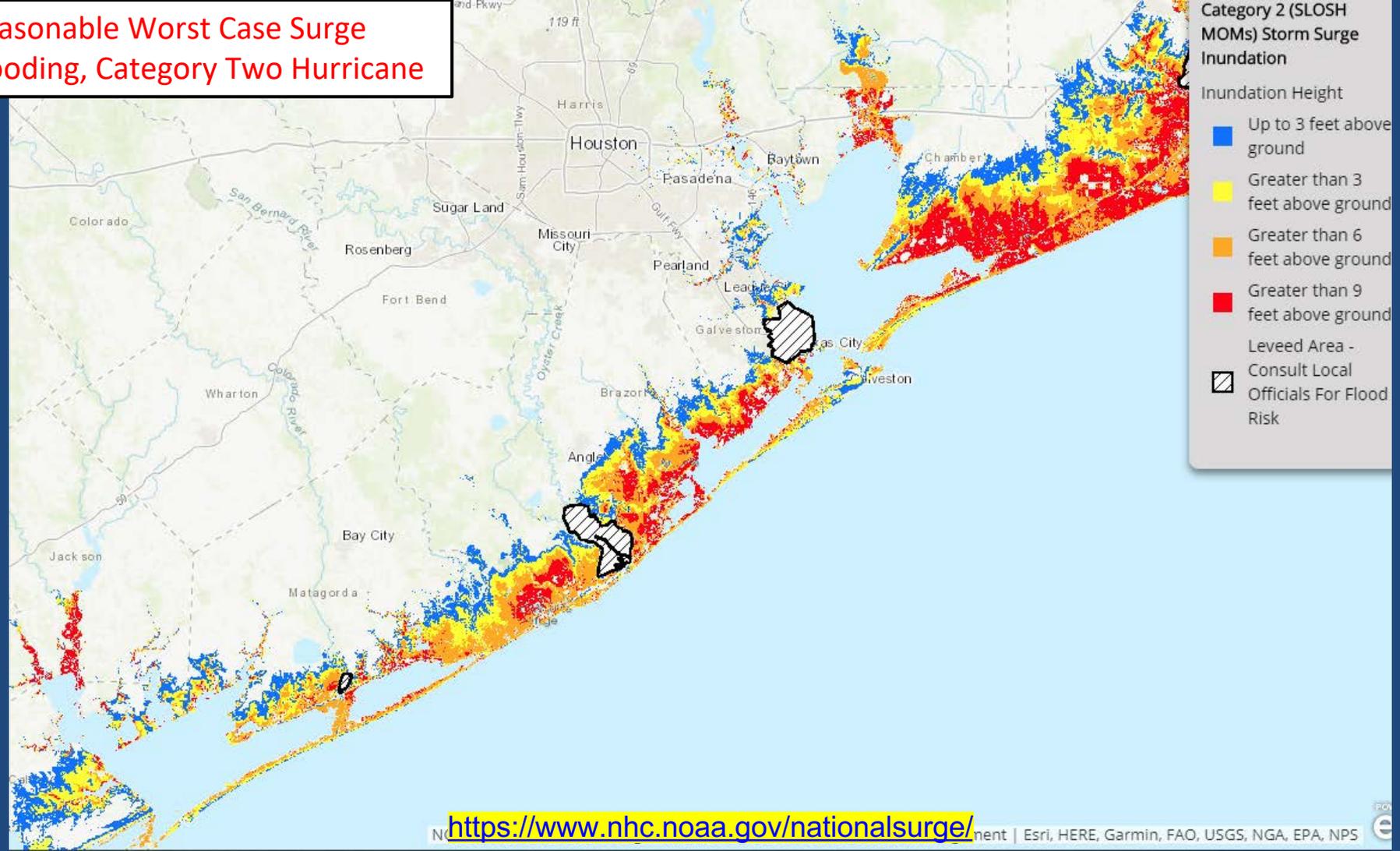
Land elevation above mean sea level. From lidar data.



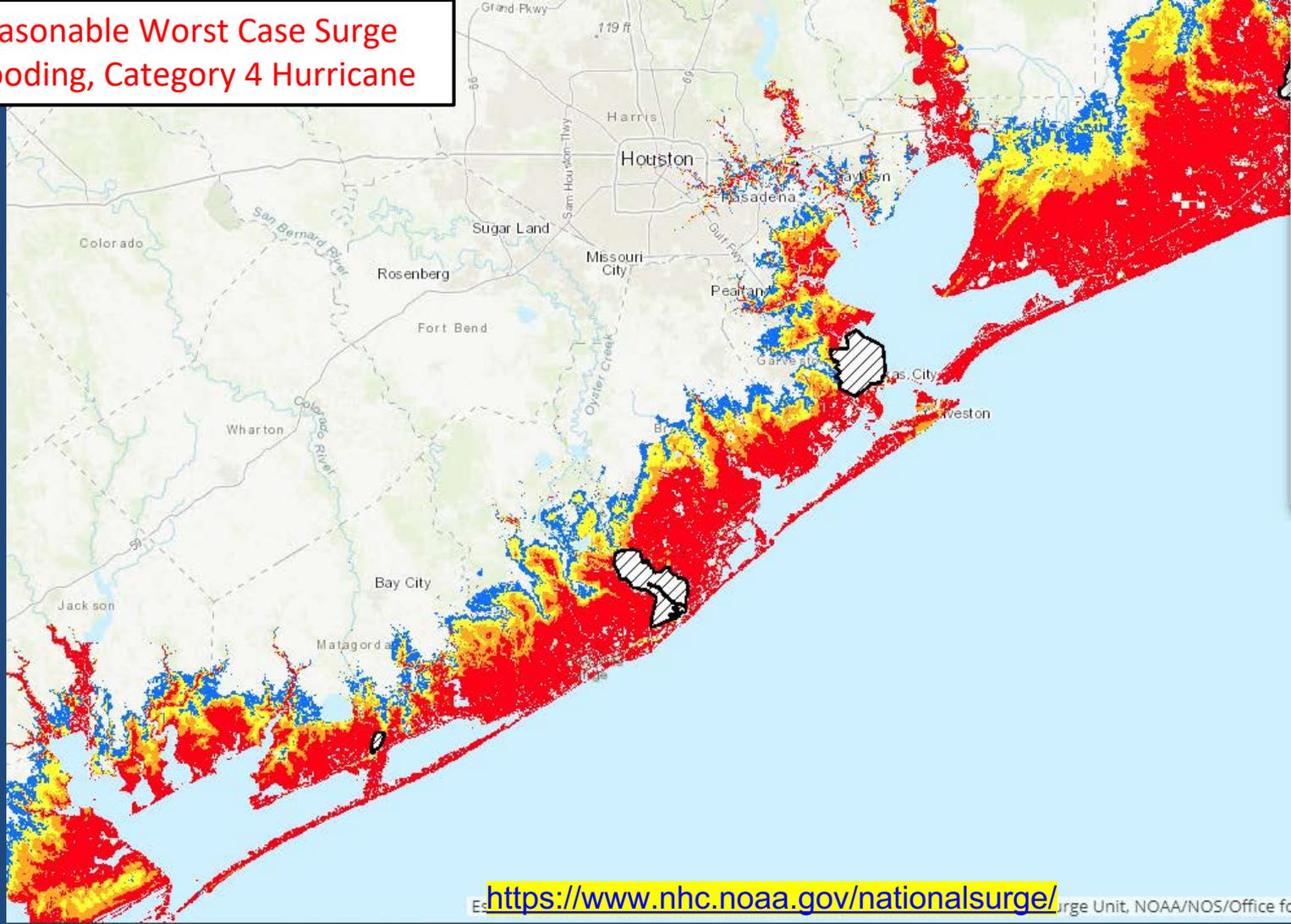
Reasonable Worst Case Surge Flooding, Category One Hurricane



Reasonable Worst Case Surge Flooding, Category Two Hurricane



Reasonable Worst Case Surge Flooding, Category 4 Hurricane



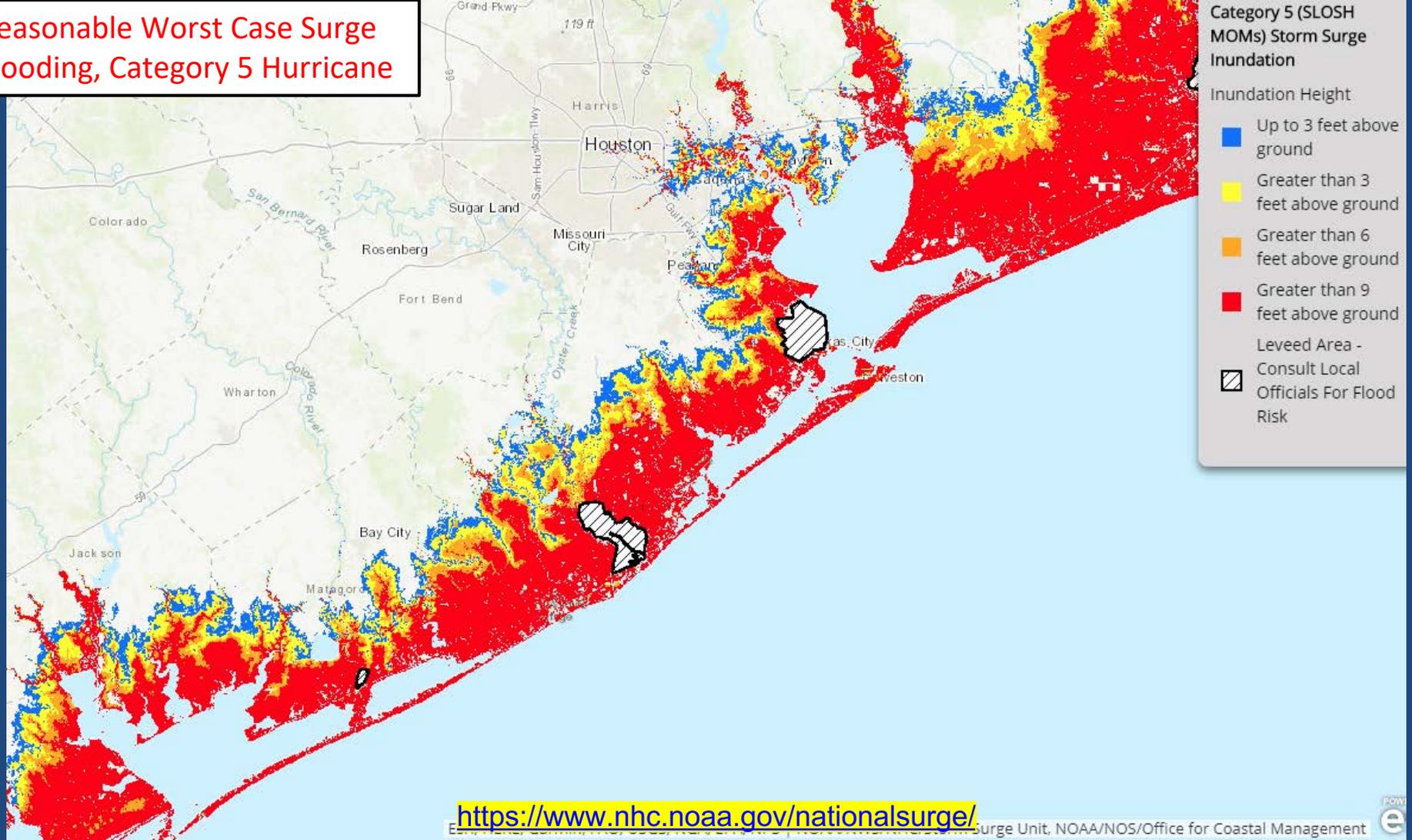
Category 4 (SLOSH MOMs) Storm Surge Inundation

Inundation Height

- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

Leveed Area - Consult Local Officials For Flood Risk

Reasonable Worst Case Surge Flooding, Category 5 Hurricane



<https://www.nhc.noaa.gov/nationalsurge/>



Stay Informed! Keep Track of What is Going on in Tropics

- Useful websites
 - [Hurricanes.gov](https://www.hurricanes.gov)
 - [Weather.gov/houston](https://www.weather.gov/houston)
 - Local EMC pages and social media

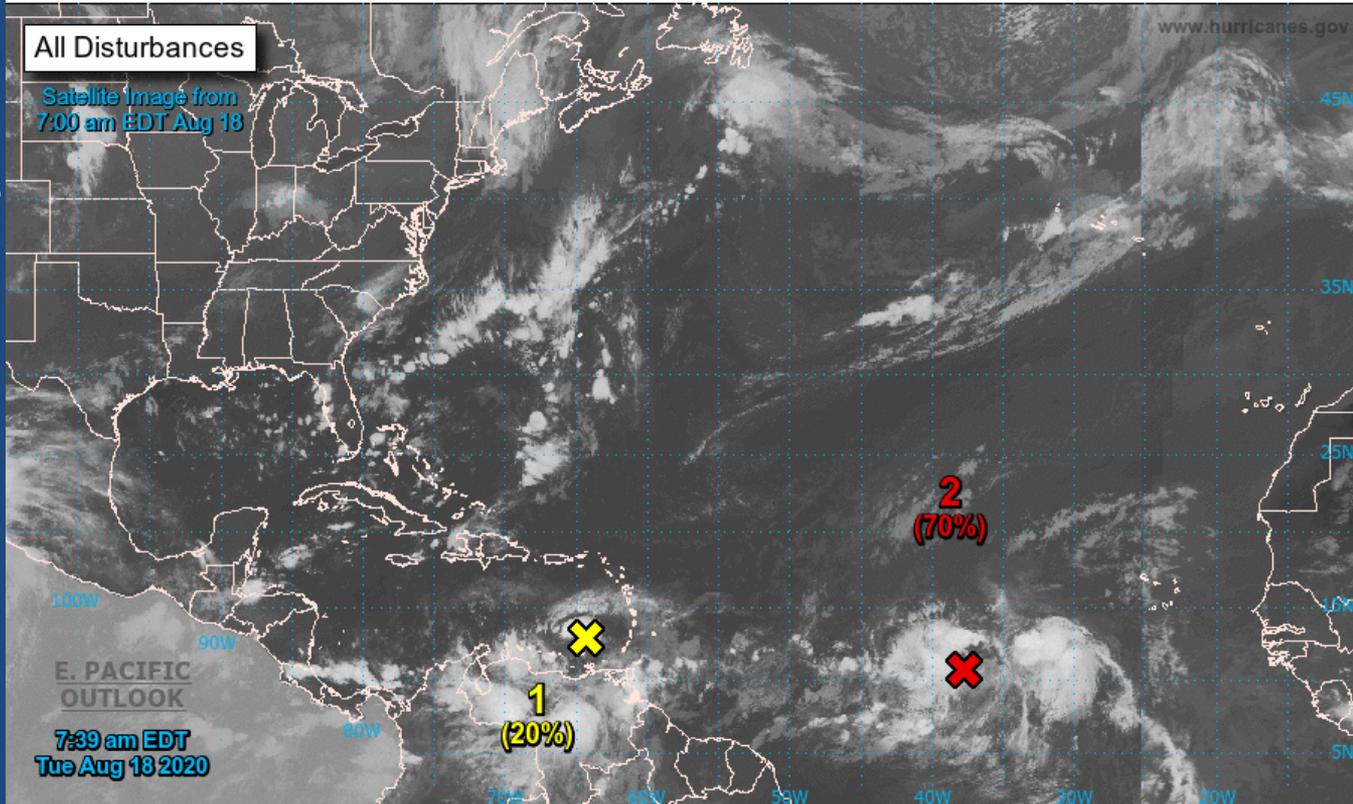
Tropical Weather Outlook: 2-day

Describes the chance a disturbance will develop into a tropical depression or tropical storm in the next 48 hours

“X” marks current center position (estimated)
Percent likelihood is given
There is also a mouseover text discussion for more details



Two-Day Graphical Tropical Weather Outlook National Hurricane Center Miami, Florida



hurricanes.gov

Current Disturbances and Two-Day Cyclone Formation Chance: < 40% 40-60% > 60%
Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane
 Post-Tropical Cyclone or Remnants

Tropical Weather Outlook: 5-day

Describes the chance a disturbance will develop into a tropical depression or tropical storm in the next 5 days

“X” marks current center position (estimated)

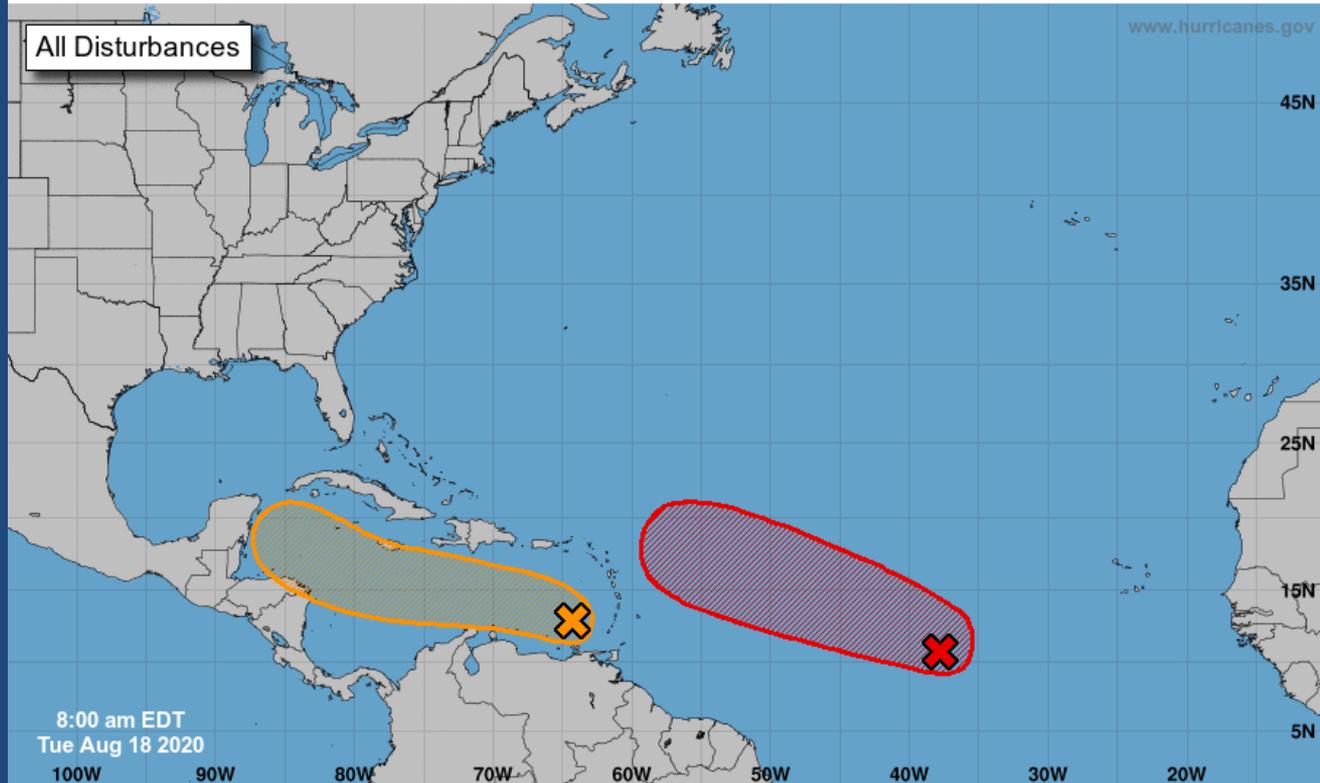
Hatched area is the zone where that development could occur

There is also a mouseover text discussion for more details and to get the percentage chance



Five-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



Current Disturbances and Five-Day Cyclone Formation Chance: < 40% 40-60% > 60%

Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane

Post-Tropical Cyclone or Remnants

BE READY FOR HURRICANE SEASON



Before the 2020 hurricane season, there are **actions you can take to be ready.**

**TODAY
YOU CAN:**



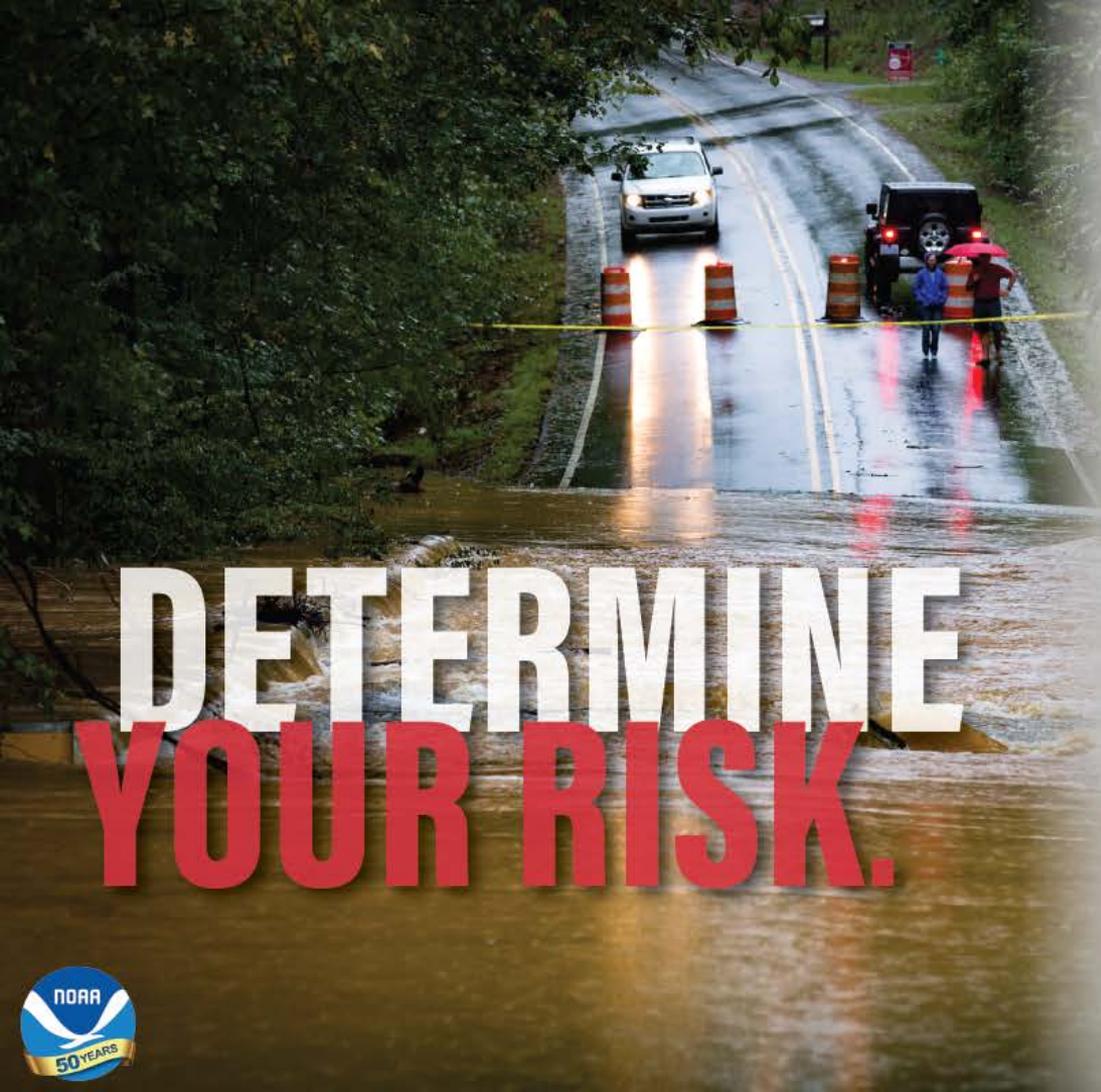
Make a list of supplies for your hurricane kit. Check to see what you already have. Restock during the next several weeks.



Organize important documents and confirm coverage with your insurance agency.



Determine if you live in a hurricane evacuation zone. Make a plan of action with multiple options.



DETERMINE YOUR RISK.

Determine Your Risk

Hurricanes bring many hazards to U.S. coastlines and inland areas, including storm surge along the coast, inland flooding due to heavy rainfall, tornadoes, strong wind, rip currents and large waves.



Storm Surge



Rip Currents



Inland Flooding



Tornadoes



Strong Wind

While preparing for hurricane season, follow the latest health guidelines from the CDC and your local officials.



DEVELOP AN EVACUATION PLAN.

Develop an Evacuation Plan

Find out today if you live in a hurricane evacuation zone and determine who issues evacuation orders for your area. Plan for multiple options on where you would go and how you would get there. Leave immediately if ordered to evacuate and be sure to plan for your pets.



Find out if you live in an evacuation zone



Plan your route out



Follow evacuation orders

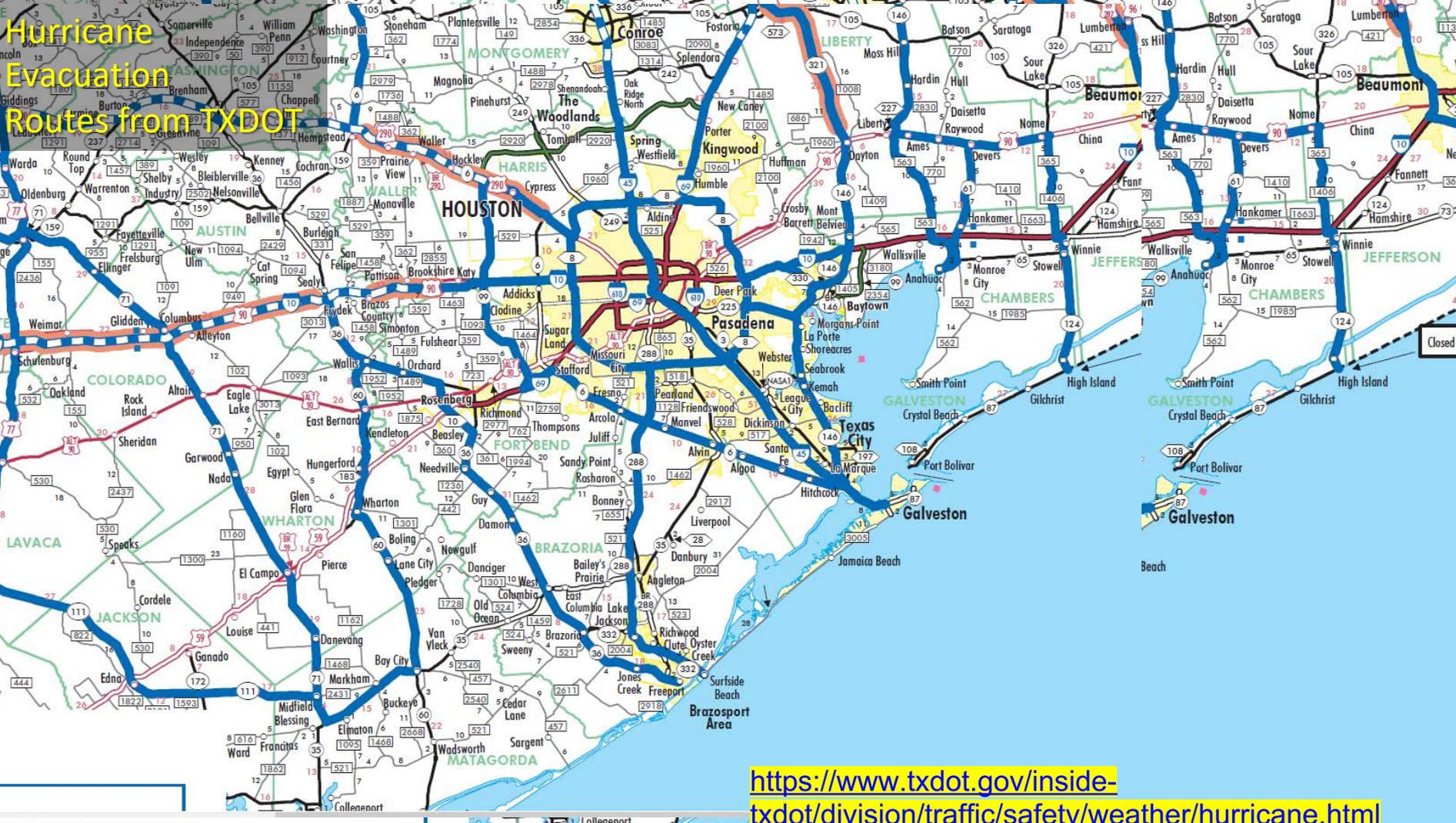


Plan for your pets

While preparing for hurricane season, follow the latest health guidelines from the CDC and your local officials.



Hurricane Evacuation Routes from TXDOT



<https://www.txdot.gov/inside-txdot/division/traffic/safety/weather/hurricane.html>

ASSEMBLE DISASTER SUPPLIES.

Assemble Disaster Supplies

Make a list of items to replenish your hurricane supplies and begin to assemble them before hurricane season begins. Have enough food and water for each person for at least three days. Be sure to fill your prescriptions and have medicine on hand. Radios, batteries and phone chargers are also must-haves. Gas up your vehicle and have extra cash on hand.



Food/Water



Medicine



Batteries, Radio,
Chargers



Gas Up



Cash on Hand

While preparing for hurricane season, follow the latest health guidelines from the CDC and your local officials.

- 
- Emergency Preparedness
Checklist
- Flashlight
 - Batteries
 - Water Bottle



Emergency Supplies List

- 3-day supply of non-perishable food (dried fruit, canned tuna fish, peanut butter, etc.)
- Can opener
- Paper plates, plastic cups and utensils, paper towels
- Moist towelettes, garbage bags and plastic ties for personal sanitation
- Water – at least a gallon per person, per day for drinking and hygiene
- First aid kit
- Prescription medication and glasses
- Sleeping bag or warm blanket for everyone in your family
- Change of clothes to last for at least 3 days, including sturdy shoes; consider the weather where you live
- Matches in a waterproof container
- Toothbrush, toothpaste, soap and other personal items
- Feminine hygiene supplies
- Fire extinguisher
- Wrench or pliers to turn off utilities
- Dust mask, and plastic sheeting and duct tape, to help filter contaminated air
- Battery-powered or hand-cranked radio and extra batteries
- Flashlights and extra batteries
- Cell phone with charger, extra battery and solar charger
- Whistle to signal for help
- Household chlorine bleach and medicine dropper (when diluted nine parts water to one part bleach, bleach can be used as a disinfectant. Or in an emergency, you can use it to treat water by using 16 drops of regular household liquid bleach per gallon of water. Do not use scented, color safe or bleaches with added cleaners.)
- Local maps
- Cash or traveler's checks
- Emergency reference material such as first aid book or information from www.ready.gov
- Important family documents such as copies of insurance policies, ID, and bank records in a waterproof, portable container
- Pet supplies
- Infant formula and diapers
- Paper and pencil
- Books, games or puzzles (let your kids pick these out themselves!)
- Your child's favorite stuffed animal or security blanket
- Pet food and extra water for your pet

Don't forget to think about infants, elderly, pets, or any family members with special needs!

If a big storm is coming...

- ✓ Fill your car with gas
- ✓ Fill plastic bags with water and place them in the freezer
- ✓ Get extra cash out of the bank
- ✓ Fill prescriptions

CDC also recommends cloth face coverings, hand sanitizer, bar or liquid soap be added to your kit to help prevent the spread of viruses including coronavirus and the flu.

From <https://www.ready.gov/kit>

GET AN INSURANCE CHECKUP.

Get an Insurance Checkup

Check in with your insurance agency well before hurricane season. Remember that flood insurance must be obtained separately. Prepare your home and vehicles according to your policy. Know where your insurance documents are located and take them with you if you evacuate. Visit [floodsmart.gov](https://www.floodsmart.gov) for more information.



Check with
your agent



Keep your
documents
with you



For more info:
[floodsmart.gov](https://www.floodsmart.gov)



Consider
flood insurance



Know your
policy

While preparing for hurricane season, follow the latest health guidelines from the CDC and your local officials.



Hurricane Isabel Storm Surge Damages Jamestown Archeological Collection

ISABEL'S LESSONS APPLIED TO COLLECTION

SEPTEMBER 18, 2005 | JAMES CITY

Long after the hurricane inundated Jamestown Island's archaeological collection, the damage still makes waves.

Two years after Hurricane Isabel sent brackish floodwaters streaming across historic Jamestown Island, the National Park Service has released a report that cites "inadequate preparation" as a chief cause of \$6.2 million in damage to one of the nation's most important archaeological collections.



<https://www.dailypress.com/news/dp-xpm-20050918-2005-09-18-0509180018-story.html>

Saving Collections, Caribbean Museums

In the immediate aftermath of the storms, as people reeled from the loss of life and personal property, there was already significant concern about the endangered cultural infrastructure of the Caribbean. The damage to the museums represented a significant problem for the islanders, both psychologically and economically. Caribbean cultural heritage sites are not only safe keepers of the islanders' history and identity – they also contribute to the tourist economy on which most of these islands survive.



<https://culturalpropertynews.org/crisis-intervention-curbs-hurricane-devastation-at-caribbean-museums/>

General Takeaways for Collections

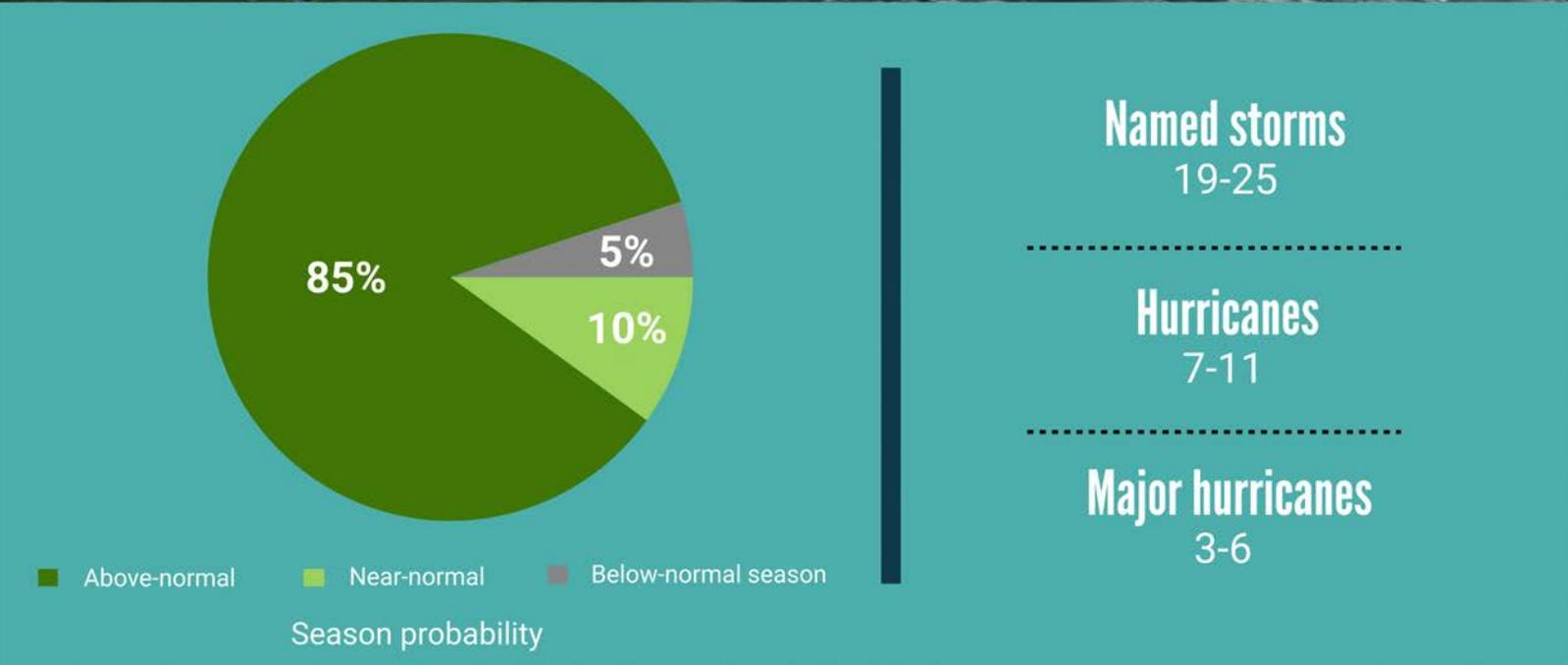
- Understand the risks, vulnerabilities to wind, surge, flooding where collections are stored.
- Try mitigation measures to limit the risk (store in more sturdy structures, higher off the ground, outside surge, flood zones, etc)

Extremely active season possible! If over 21 named storms, Greek alphabet is used



2020 Atlantic Hurricane Season Outlook

AUGUST 6 UPDATE



- 2020 Atlantic Names
- Arthur
- Bertha
- Cristobal
- Dolly
- Edouard
- Fay
- Gonzalo
- Hanna
- Isaias
- Josephine
- Kyle
- Laura
- Marco
- Nana
- Omar
- Paulette
- Rene
- Sally
- Teddy
- Vicky
- Wilfred

Be prepared: Visit hurricanes.gov and follow @NWS and @NHC_Atlantic on Twitter.

August 6, 2020

Follow Trusted Sources

On web, social media follow trusted sources of information including local office of emergency management

Find your local NWS Twitter and Facebook pages:
@NWSHouston, weather.gov/houston

NHC forecast information for Atlantic storms can be found on Twitter at: @NHC_Atlantic, hurricanes.gov

Dan.Reilly@noaa.gov

HOUSTON/GALVESTON
National Weather Service



HURRICANE & SEVERE
WEATHER GUIDE



Hurricane Harvey. Photo credit: NOAA.



Tornado. Photo credit: NOAA.



Flooding of Cypress Creek at Hardy Toll Road.
Hurricane Harvey. Photo credit: HGFCF.



Tornado damage, Onalaska, April 2020.

<https://www.weather.gov/media/hgx/HurricaneGuide2020.pdf>