Storm Surge:
Myths, Misconceptions, and Facts

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LA Department of Natural Resources
Local Coastal Programs Quarterly Meeting
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Image Courtesy of NOAA
LA Cooperative Extension Service

- 2005 - Hurricane Rita
- Congressional Disaster Program for Sugarcane Producers to be implemented by USDA
- LSU AgCenter named to develop data related to area of damage due to storm surge inundation
FINAL HWM FOR PROJECT AREA

LEGEND
AGENCY HWM
- AgCenter
- FEMA/URS
- FEMA Pine / Baush
- LSU Hurricane Center
- Private Engineer
- USGS - Gage Study
- USGS - Gages
Hurricane Rita Storm Surge

LEGEND
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY

Rita
Sept. 2005

CITIES:
- Cameron
- Calcasieu
- Jeff Davis
- Acadia
- St Martin
- Iberville
- Assumption
- Ascension
- St James
- St John
- Saint Tammany
- Livingston
- Plaquemines
- Saint Bernard

FLOOD AREA:
- Vermilion
- St Mary
- Terrebonne
- Lafourche

PARISH BNDRY:
- Cameron
- Calcasieu
- Vermilion
- St Mary
- Terrebonne
- St Bernard
- Saint Tammany
- Livingston
- Plaquemines
- Saint Bernard
An education and outreach program to inform the public about hurricane storm surge, and the vulnerability of coastal communities to its impact
Factors Impacting Storm Surge

• **Coastal Factors**
  - Elevation
  - Proximity to Coastline
  - Bathymetry
  - Slope of coast
  - Roughness of coast
  - Natural or man made barriers

• **Storm Factors**
  - Intensity of storm
  - Wind speed
  - Atmospheric pressure
  - Radius of maximum winds
  - Forward speed
  - Track of the storm
Lake Pontchartrain Area
Hypothetical Storm

Speed: 7 mph (Rita 11 mph)
Intensity: 128 mph (Rita 128)
Size: Slightly Smaller than Rita
Terrebonne – Lafourche Region
Hypothetical Storm

Speed: 13 mph (Rita 11 mph)
Intensity: 128mph (Rita 128)
Size: Same as Rita

Surge Elevation (Ft)
- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8

6 - 7
5 - 6
4 - 5
3 - 4
2 - 3
1 - 2
0 - 1
Vermilion – Iberia Region

Hypothetical Storm

- Speed: 7 mph (Rita 11 mph)
- Intensity: 111 mph (Rita 128)
- Size: Same as Rita
Goal: An Informed (and Safer) Public

- Understand how storm surge is predicted and the limitations of those predictions
- Understand how to interpret surge
- Understand that surge estimates do not include waves, and flooding estimates do not include inland rainfall
- Understand its destructive potential
- Realize the potential extent of its impact - how far inland it can go
LA Cooperative Extension Service

- Land Grant – LSU AgCenter
  - Agriculture & Forestry Revenue Loss Estimates

- Sea Grant – LA Sea Grant Program
  - Aquaculture and Commercial Fisheries and Infrastructure Losses
3. Estimating: Surge Damage Curves

- USACE Max
- Dealers
- Vessels
- Processors
- USACE Min

Maximum Surge Height (Feet)
Mapping the Ike Storm Surge

Ike Advisory 46 ADCIRC Max Surge Elevations

ADCIRC Model Surge Elevation (Ft)

- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1

ADCIRC storm surge model data provided by:
LSU Coastal Emergency and Risks Assessment
LSU CLEAR
UNC Institute of Marine Sciences
Notre Dame Computational Hydraulics Laboratory
Mapping the Ike Storm Surge

Legend
- Red Cross: Sea Grant Extent and Elevations Points
- Green Star: Sea Grant Validation Points
- Green Square: Sea Grant Elevation Points
- Green Diamond: Gauges - NWS Brazzell
- White Circle: Terrebonne Lafourche Gauges
- Orange Circle: USGS Storm Surge Sensors
- Purple Diamond: Calcasieu Parish Engineering
- Orange Triangle: FEMA LA Draft HWM
Louisiana Tropical Cyclones: 2001 - 2010

Sources:
NOAA / National Hurricane Center
NOAA / Atlantic Oceanographic and Meteorological Laboratory

Jay Grymes
LSU AgCenter Climatologist
& WAFB-TV Chief Meteorologist
The Louisiana Coast
A Vulnerable Area for Storm Surge
The Louisiana Coast
A Vulnerable Area for Storm Surge
The Louisiana Coast
A Vulnerable Area for Storm Surge

LEGEND
- CITIES
- PRIMARY ROAD
- FLOOD AREA
- PARISH BNDRY

Hurricane Gustav
Ike
The Louisiana Coast
A Vulnerable Area for Storm Surge
The Louisiana Coast
A Vulnerable Area for Storm Surge

Storm Surge Record: 24.6 ft

Camille 1969
The Louisiana Coast
A Vulnerable Area for Storm Surge

LEGEND
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY

Betsy 1965
Hurricane Betsy Storm Surge

LEGEND
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY

Betsy 1965
Hurricane Carla Storm Surge

Carla 1961
Texas Landfall
Hurricane Flossy Storm Surge

Flossy 1956

LEGEND
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY
August 1940 Hurricane Storm Surge
August 1915 Hurricane Storm Surge

Hurricane of August 1915
Texas Landfall
Sept. 1915 Hurricane Storm Surge

**LEGEND**
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY
All Atlantic Basin Tropical Systems
National Hurricane Center 1850 - 2008
12 of the last 14 years have been “above-average”!!
Atlantic Multidecadal Oscillation (AMO)
1900 - 2006

"Warmer-than-Normal"

"Cooler-than-Normal"

Jay Grymes
LSU AgCenter Climatologist & WAFB-TV Chief Meteorologist
The Louisiana Coast
Population and Demographics

1970 Total Population 1.69 Million
2000 Total Population 2.02 Million

% less than 50 years of age in 2000
74.4%
It is essential that the citizens of coastal LA understand the facts and potential impacts of hurricane storm surge!
Storm surge flooding from hurricanes causes significant damage and 90% of the deaths associated with a hurricane landfall.

Storm surge holds the greatest potential for loss of life during a hurricane.

http://hurricanetrack.com/surge.html
Hurricane Storm Surge Damage
Cameron Parish

Storm Surge Destruction of Home
East of Creole on Hwy 1143
Hurricane Storm Surge Damage  
Rita - Cameron Parish  

Images courtesy of Kevin Savoie  

Storm Surge Destruction of Home  
East of Creole on Hwy 1143
Images courtesy of Kevin Savoie
Bolivar Peninsula - Before Ike
Bolivar Peninsula - After Ike
Ike Storm Surge Destruction

Bolivar Peninsula, Texas
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

• “Gates at Chef Pass and the Rigolets will protect us from storm surge”
INLAND LAKE STORM SURGE

Lake Pontchartrain
Louisiana

Lake Okeechobee
Florida
INLAND LAKE STORM SURGE

Lake Pontchartrain
Louisiana
630 Square Miles

Lake Okeechobee
Florida
730 Square Miles
Great Miami Hurricane of 1926 - strong winds drove water over the 6-foot (2 m) mud dike that circled the lake at the time, causing approximately 300 casualties.
San Felipe – Okeechobee Hurricane
1928 - lake surge of 6 to 9 ft. topped the dike around the lake and inundated the surrounding areas, causing approximately 2000 casualties.
Fort Lauderdale Hurricane 1947 - a lake surge of **20 feet** was reported at the south end of the lake. Unlike in the 1928 Okeechobee Hurricane, the previously improved and enlarged dike held, and a much larger catastrophe was averted.
Hurricane Ike Storm Surge Elevations
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “I’m outside the flood zone!”
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

“The local water gauge levels show the water is beginning to drop, we should be able to go home now.”
When Does the Storm Surge Arrive?

Storm Surge Continues to Rise after Landfall
Vermilion Parish
Delcambre on Hwy 14

Salinity 7ppt
Hurricane Ike

Time of highest storm surge

Monday

6 pm
5 am
2 am
2 am
8 am
11 pm
9 pm
Hurricane Lili 2002

Intracoastal Waterway near Vermilion Lock

Landfall: 8 am
First storm surge peak: 11 am
Second storm surge peak: 4 pm

If winds stay onshore after landfall, there can be a second storm surge maximum hours after landfall.
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

• “We have levees to protect us.”
The Louisiana Coast
A Vulnerable Area for Storm Surge
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

• “It’s making landfall far to the west.”
Hurricane Ike Storm Surge

Ike

Sept. 2008
Hurricane Carla Storm Surge

Carla
1961
Texas Landfall

LEGEND
- CITIES
- PRIMARY ROADS
- FLOOD AREA
- PARISH BNDRY
“It’s making landfall far to the west.”

ARE YOU SURE??  What about predicted track error??

Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion
The Good News:
“Forecast error has been cut in half over the past 20 years.”
The Not-So-Good News: “Forecast error still ‘averages’ about 50 miles as little as 24 hours before landfall.”
Ike Predicted Track – NHC Advisory #29
Ike Predicted Track – NHC Advisory #30
Ike Predicted Track – NHC Advisory #31
Ike Predicted Track – NHC Advisory #33
Ike Predicted Track – NHC Advisory #35
Ike Predicted Track – NHC Advisory #36
Ike Predicted Track – NHC Advisory #37
Ike Predicted Track – NHC Advisory #38
Ike Predicted Track – NHC Advisory #39
Ike Predicted Track – NHC Advisory #42
Ike Predicted Track – NHC Advisory #43
Ike Predicted Track – Range

230 Miles
Ike Actual Track – Range
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “Storm surge can’t come this far inland.”
Lynwood Plantation Subdivision – 12 Miles from Bay
38 Miles
Hurricane Ike

Cameron vs. Lake Charles Water Levels

Datum is NGVD

Time is LST

8 to 10 Hours
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “Storm surge can’t come this far inland.”

As measured from where???
COASTAL LAND LOSS (1932 – 2000)

Source: USGS
J. Barras
COASTAL LAND LOSS (1932 – 2050)

Source: USGS
J. Barras
NOAA's Sea Levels Online

http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml
Relative Sea-Level Rise Components

Increasing Sea Level Elevation
Increasing Sea Level Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation
Relative Sea-Level Rise Components

- Increasing Sea Level Elevation
- Decreasing Land Surface Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation + Decreasing Land Surface Elevation
Relative Sea-Level Rise Components

Increasing Sea Level Elevation

+ 

Decreasing Land Surface Elevation
NOAA’s Sea Levels Online

Grand Isle 3.03 ft. / 100 yrs.

http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml
Eugene Island
3.17 ft. / 100 yrs.

http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml
Mean Sea Level Trend
8761724 Grand Isle, Louisiana

Grand Isle, LA 9.24 +/- 0.59 mm/yr

The mean sea level trend is 9.24 millimeters/year with a 95% confidence interval of +/- 0.59 mm/yr based on monthly mean sea level data from 1947 to 2006 which is equivalent to a change of 3.03 feet in 100 years.

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by CO-OPS. The calculated trends for all stations are available as a table in millimeters/year or a table in feet/century (0.3 meters = 1 foot).

If present, solid vertical lines indicate times of any major earthquakes in the vicinity of the station and dashed vertical lines bracket any periods of questionable data.

http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml
ELEVATION – COASTAL LA. IS LOW

LIDAR SURFACE ELEVATION

Elevation - Feet

- < 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16
- 16 - 18
- 18 - 20
- 20 - 40
- 40 - 68
- WATER

©
POTENTIAL IMPACTS OF SEA LEVEL RISE

Inundation to 2.0 ft. Elevation
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

“IT was 50 years since Audrey; it won’t happen again for another 50 years.” Southwest LA after Rita.
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “It’s only a Category 2!!!”
- “We will evacuate tomorrow morning, there is still plenty of time.”

Bolivar Peninsula, Texas, before Ike
Saffir – Simpson Scale

- Relates wind speeds to the potential for damage on land
- Designed to measure potential wind damage to man-made structures

- Category 1 – Winds 74 to 95 mph
- Category 2 – Winds 96 to 110 mph
- Category 3 – Winds 111 to 130 mph
- Category 4 – Winds 131 to 155 mph
- Category 5 – Winds exceed 155 mph
Saffir – Simpson Scale

Potential Surge

- Category 1 – 4 – 5 ft
- Category 2 – 6 – 8 ft
- Category 3 – 9 – 12 ft
- Category 4 – 13 – 18 ft
- Category 5 – >18 ft

Charley - Category 4  Surge 6 – 9 ft
Katrina - Category 3  Surge 27+ ft
Ike - Category 2  Surge 15 – 20 ft
Saffir – Simpson Scale

- For 2009, the National Hurricane center will be using a “new” version of the the Saffir-Simpson Hurricane Scale
- It will be called the Saffir-Simpson Hurricane WIND Scale
  - Will assess only wind speed
  - All information related to storm surge and flooding will be removed
HURRICANE IKE ADVISORY NUMBER 42
NWS TPC/NATIONAL HURRICANE CENTER, MIAMI, FL
10 AM CDT THUR SEPT 11 2008
(Ike made landfall SEPT 13, 2008 2:00 AM)

COASTAL STORM SURGE FLOODING OF UP TO 20 FEET ABOVE NORMAL TIDE LEVELS...LOCALLY UP TO 20 FEET AT HEAD OF BAYS AND NEARBY RIVERS...WITH LARGE AND DANGEROUS BATTERING WAVES...CAN BE EXPECTED NEAR AND TO THE EAST OF WHERE THE CENTER MAKES LANDFALL.
THE SURGE EXTENDS A GREATER THAN USUAL DISTANCE FROM THE CENTER DUE TO THE LARGE SIZE OF THE CYCLONE. WATER LEVELS HAVE ALREADY INCREASED TO 9 TO 12 FEET ABOVE NORMAL ALONG MUCH OF THE NORTHWESTERN GULF COAST.
Communicating the threat from Ike was not so easy

- It’s **just** a Category 2
- It’s making landfall well to the west
- It’s just weather propaganda

Led to strongly worded warnings:

“Hurricane Ike has the potential to produce a storm surge similar to a Category 4 storm!”
Communicating the threat from Ike was not so easy

- It's just a Category 2
- It's making landfall well to the west
- It's just weather propaganda

Led to strongly worded warnings:

“Neighborhoods that are affected by the storm surge ... and possibly entire coastal communities ... will be inundated during the period of peak storm tide.”
Communicating the threat from Ike was not so easy

- It's just a Category 2
- It’s making landfall well to the west
- It’s just weather propaganda

Led to strongly worded warnings:

"Persons not heeding evacuation orders in single-family, one- or two-story homes may face certain death. ... Widespread and devastating personal property damage is likely."
Communicating the threat from Ike was not so easy

• It's just a Category 2
• It's making landfall well to the west
• It's just weather propaganda

Led to strongly worded warnings:

In other words,

“LEAVE or DIE”
Ike - Friday morning 9/12/2008: Bolivar - It's too late!
While higher wind speeds create the potential for higher storm surges, there **IS NOT** an ideal relationship between storm category and storm surge.

**WHY?** Many other factors are involved.
Factors Impacting Storm Surge

- Storm Factors
  - Intensity of storm
  - Wind speed
  - Radius of maximum winds - SIZE
  - Atmospheric pressure
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “This (house, building) survived Camille, it will survive anything.” Mississippi Gulf Coast resident prior to Katrina

  - Camille Syndrome - “It looks like Hurricane Camille killed more people in 2005 than it did in 1969.” (Attributed to Jim Holt of Biloxi, quoted in the Biloxi Sun Herald.)
Camille 1969
HFW : 60 mi.
TSFW: 180 mi.

Gustav 2008
HFW : 70 mi.
TSFW: 220 mi.

Ike 2008
HFW : 120 mi.
TSFW: 275 mi.

Betsy 1965
HFW : 85 mi.
TSFW: 205 mi.

Carla 1961
HFW : 125 mi.
TSFW: 300 mi.

Ike 2008
HFW : 40 mi.
TSFW: 130 mi.

HFW : 105 mi.
TSFW: 230 mi.

Gustav 2008
HFW : 70 mi.
TSFW: 220 mi.

Camille 1969
HFW : 60 mi.
TSFW: 180 mi.

HFW : 70 mi.
TSFW: 160 mi.
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

- “We didn’t flood for Gustav, why should we worry about Ike?”
- “We didn’t flood for Andrew, why should we worry about ???”

- **Storm Factors**
  - Forward speed
  - Track of the storm
How does this impact storm surge?

- Fast moving storms cause high surges along open coast and lower surges in sheltered bays and estuaries.
- Slow moving storms usually result in greater flooding inside bays and estuaries, with smaller values along the open coast.
- The longer the wind blows over water toward land, the greater the potential for flooding.
GULF + 0 hrs.

**Gustav**
- HFW: 70 mi.
- TSWF: 175 mi.
- Max Winds: 140 mph
- In Wind Field: 0 hr.

**Ike**
- HFW: 35 mi.
- TSWF: 175 mi.
- Max Winds: 80 mph
- In Wind Field: 0 hr.
GULF + 6 hrs.

**Gustav**
- HFW: 50 mi.
- TSWF: 200 mi.
- Max Winds: 125 mph
- In Wind Field: 0 hr.

**Ike**
- HFW: 35 mi.
- TSWF: 175 mi.
- Max Winds: 85 mph
- In Wind Field: 0 hr.
GULF + 12 hrs.

**Gustav**

- HFW: 50 mi.
- TSWF: 200 mi.
- Max Winds: 120 mph
- In Wind Field: 0 hr.

**Ike**

- HFW: 80 mi.
- TSWF: 205 mi.
- Max Winds: 90 mph
- In Wind Field: 0 hr.
GULF + 18 hrs.

**Gustav**
- HFW: 65 mi.
- TSWF: 220 mi.
- Max Winds: 115 mph
- In Wind Field: 0 hr.

**Ike**
- HFW: 90 mi.
- TSWF: 205 mi.
- Max Winds: 100 mph
- In Wind Field: 0 hr.
GULF + 24 hrs.

Gustav

HFW 70 mi.
TSFW 220 mi.
Max Winds 115 mph
In Wind Field 6 hr.

Ike

HFW 115 mi.
TSFW 230 mi.
Max Winds 100 mph
In Wind Field 0 hr.
GULF + 30 hrs.

Gustav

HFW  70 mi.
TSFW 230 mi.
Max Winds 115 mph
In Wind Field 12 hr.

Ike

HFW  115 mi.
TSFW 255 mi.
Max Winds 100 mph
In Wind Field 0 hr.
GULF + 36 hrs.

**Gustav**
- HFW: 70 mi.
- TSWF: 200 mi.
- Max Winds: 110 mph
- In Wind Field: 18 hr.

**Ike**
- HFW: 115 mi.
- TSWF: 275 mi.
- Max Winds: 100 mph
- In Wind Field: 0 hr.
GULF + 42 hrs.

Gustav

HFW  35 mi.
TSFW  200 mi.
Max Winds  80 mph
In Wind Field  24 hr.

Ike

HFW  115 mi.
TSFW  275 mi.
Max Winds  100 mph
In Wind Field  6 hr.
GULF + 48 hrs.

Gustav

HFW
TSFW               115 mi.
Max Winds       60 mph
In Wind Field  30 hr.

Ike

HFW               115 mi.
TSFW               265 mi.
Max Winds       100 mph
In Wind Field  12 hr.
GULF + 54 hrs.

Gustav

HFW
TSFW
Max Winds
In Wind Field  35 hr.

Ike

HFW  120 mi.
TSFW  275 mi.
Max Winds  105 mph
In Wind Field  18 hr.
GULF + 60 hrs.

Gustav

HFW

TSFW

Max Winds

In Wind Field  30 hr.

Ike

HFW  120 mi.

TSFW  275 mi.

Max Winds  105 mph

In Wind Field  24 hr.
GULF + 66 hrs.

Gustav

HFW

TSFW

Max Winds

In Wind Field 30 hr.

Ike

HFW 120 mi.

TSFW 275 mi.

Max Winds 105 mph

In Wind Field 30 hr.
GULF + 72 hrs.

**Gustav**

- HFW
- TSWF
- Max Winds
- In Wind Field: 30 hr.

**Ike**

- HFW: 120 mi.
- TSWF: 275 mi.
- Max Winds: 110 mph
- In Wind Field: 36 hr.
GULF + 78 hrs.

**Gustav**

- HFW
- TSWF
- Max Winds
- In Wind Field: 30 hr.

**Ike**

- HFW: 125 mi.
- TSWF: 260 mi.
- Max Winds: 110 mph
- In Wind Field: 42 hr.
GULF + 84 hrs.

Gustav

HFW
TSFW
Max Winds
In Wind Field 30 hr.

Ike

HFW 45 mi.
TSFW 230 mi.
Max Winds 80 mph
In Wind Field 50 hr.
GUSTAV

Cuba to Landfall: 630 mi.
Time over Gulf: 36 hrs.
Average Speed: 17.5 mph
HFW Radius: 70 mi.
TSFW Radius: 230 mi.
Wind Speed: 110 mph
Coast in wind field: 30 hr

IKE

Cuba to Landfall: 850 mi.
Time over Gulf: 82 hrs.
Average Speed: 10 mph
HFW Radius: 125 mi.
TSFW Radius: 260 mi.
Wind Speed: 110 mph
Coast in wind field: 62+ hr
**GUSTAV**

- Cuba to Landfall: 630 mi.
- Time over Gulf: 36 hrs.
- Average Speed: 17.5 mph
- HFW Radius: 70 mi.
- TSFW Radius: 220 mi.
- Wind Speed: 110 mph

**RITA**

- Cuba to Landfall: 912 mi.
- Time over Gulf: 87 hrs.
- Average Speed: 10.5 mph
- HFW Radius: 85 mi.
- TSFW Radius: 205 mi.
- Wind Speed: 128 mph
**ANDREW - 1992**
- Gulf to Landfall: 692 mi.
- Time over Gulf: 42 hrs.
- Average Speed: 16.5 mph
- HFW Radius: 70 mi.
- TSWFW Radius: 175 mi.

**KATRINA - 2005**
- Gulf to Landfall: 747 mi.
- Time over Gulf: 84 hrs.
- Average Speed: 8.9 mph
- HFW Radius: 105 mi.
- TSWFW Radius: 230 mi.
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

• “Katrina was an anomaly.”
  - “Rita was an anomaly.”
  - “Ike was an anomaly?”
  - “Betsy was an anomaly?”
  - “Carla was an anomaly?”
  - “The hurricane of August 1915 was an anomaly?”
Storm Surge Myths, Misconceptions, Misunderstanding, and Confusion

• “The models are wrong!”
• “It can’t happen here!”
COASTAL STORM SURGE FLOODING OF 15 FEET ABOVE NORMAL TIDE LEVELS...LOCALLY UP TO 20 FEET AT HEAD OF BAYS AND NEARBY RIVERS...WITH LARGE AND DANGEROUS BATTERING WAVES...CAN BE EXPECTED NEAR AND TO THE EAST OF WHERE THE CENTER MAKES LANDFALL. TIDES ARE CURRENTLY RUNNING ABOUT 2 FEET ABOVE NORMAL ALONG THE LOUISIANA COAST.
Ike ADCIRC Model Surge Inundation

Ike Actual Surge Inundation

©
RITA IBERIA / ST MARY TRACK

ADCIRC PREDICTED STORM SURGE ELEVATIONS

Surge Elevation (Ft)
- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1

ADCIRC storm surge model data provided by:
Dr. Hassan Mashriqui
LSU AgCenter / LA Sea Grant
Simulation – Rita Landfall in East Cote Blanche Bay
KEEPING THINGS IN PERSPECTIVE
More than 100 Claifornians have been killed...
Shocking cold wave drops temps to 40 below zero
“IT CAN’T HAPPEN HERE”
“THANK YOU”

Maurice Wolcott
LSU AgCenter
Louisiana Sea Grant Program

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The representations of potential flood extent and depth were derived from the results of the ADCIRC storm surge model, based on the best data currently available to the LSU AgCenter and LA Sea Grant, and are meant to illustrate the vulnerability of coastal Louisiana to significant storm surge events. The results are estimates, and should not be considered exact, as wave action, rainfall accumulation, and potential localized efforts to prevent flooding will impact localized areas.
Cuba to Landfall: 645 mi.
Time over Gulf: 40 hrs.
Average Speed: 16 mph
HFW Radius: 90 mi.
TSFW Radius: 250 mi.
HURRICANE CAMILLE - 1969

Cuba to Landfall: 575 mi.
Time over Gulf: 48 hrs.
Average Speed: 12 mph
HFW Radius: 60 mi.
TSFW Radius: 180 mi.
Rita – 2005

Gulf to Landfall: 912 mi.
Time over Gulf: 87 hrs.
Average Speed: 10.5 mph
HFW Radius: 85 mi.
TSFW Radius: 205 mi.
Andrew – 1992

Gulf to Landfall: 692 mi.
Time over Gulf: 42 hrs.
Average Speed: 16.5 mph
HFW Radius: 70 mi.
TSFW Radius: 175 mi.
Katrina – 2005

Gulf to Landfall: 747 mi.
Time over Gulf: 84 hrs.
Average Speed: 8.9 mph
HFW Radius: 105 mi.
TSFW Radius: 230 mi.
STORM SURGE is an abnormal rise of water generated by a storm, over and above the predicted normal tide, due to a storm (hurricane/typhoon.)
STORM SURGE is an abnormal rise of water generated by a storm, over and above the predicted normal tide, due to a storm (hurricane/typhoon.)
STORM SURGE is an abnormal rise of water generated by a storm, over and above the predicted normal tide, due to a storm (hurricane/typhoon.)
STORM TIDE is the total water level (elevation) during a storm

= Normal Tide + STORM SURGE + anomaly
High Water Mark Comparison – Audrey vs Rita

A – 7.5 ft
R – 11.7 ft

A – 12.2 ft
R – 13.9 ft

A – 12.4 ft
R – 14.0 ft

A – 13.9 ft
R – 14.2 ft

A – 7.3 ft
R – 10.1 ft

A – 7.0 ft
R – 10.2 ft

A – 10.4 ft
R – 10.4 ft

A – 11.4 ft
R – 11.5 ft
Factors Impacting Storm Surge

• Coastal Factors
  – Elevation

“THE REASON FOR INUNDATION IS ELEVATION!”

Having good information about elevation is critical for planning!
Factors Impacting Storm Surge

- Coastal Factors
  - Elevation
  - Proximity to Coastline
  - Bathymetry (Water Depth)
  - Slope of coast
What does this have to do with storm surge?

- A shallow continental shelf will allow a greater surge to inundate coastal communities. Areas with a steeper continental shelf will not see as much surge inundation.
For Louisiana, wide expanses of shallow seabed extend more than 100 miles seaward for much of the coast.
This tends to increase the peak of the storm surge that eventually comes ashore.
Storm Surge Misconceptions, Misunderstanding, and Confusion

- “Gates at Chef Pass and the Rigolets will protect us from storm surge” (Inland Lake Storm Surge)
- “I’m outside the flood zone!”
- “The water is beginning to recede, we should be able to go home now.”
  - (Johnny Boudreaux, “Second Surge” slides)
Storm Surge Misconceptions, Misunderstanding, and Confusion

• “We have levees to protect us.”
• “It’s making landfall far to the west.”
• “Katrina was an anomaly.”
  - “Rita was an anomaly.”
  - “Ike was an anomaly?”
  - “Carla was an anomaly?”
Storm Surge Misconceptions, Misunderstanding, and Confusion

• “This (house, building) survived Camille, it will survive anything.” Mississippi Gulf Coast resident prior to Katrina
• “Storm surge can’t come this far inland.”
Storm Surge Misconceptions, Misunderstanding, and Confusion

- “It’s only a Category 2!!!”
- “It was 50 years since Audrey; it won’t happen again for another 50 years.” Cameron parish after Rita.
- “We will evacuate tomorrow morning, there is still plenty of time.” Bolivar Peninsula, Texas, before Ike.
- “It can’t happen here!”
TWO HYPOTHETICAL RITA ADCIRC MODELS

ADCIRC storm surge model data provided by:
Dr. Hassan Mashriqui
LSU AgCenter / LA Sea Grant
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Dr. Hassan Mashriqui
LSU AgCenter / LA Sea Grant
Hurricane Rita
HURRICANE RITA
ADCIRC MODELED STORM SURGE ELEVATIONS

Surge Elevation (Ft)

- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8

ADCIRC storm surge model data provided by:
Dr. Hassan Mashriqui
LSU AgCenter / LA Sea Grant
HURRICANE GUSTAV

Gustav
Sept. 2008

LEGEND
- CITIES
- PRIMARY ROADS
- PARISH BOUNDARY
HURRICANE GUSTAV
ADCIRC MODELED STORM SURGE ELEVATIONS

Surge Elevation (Ft)

- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1

ADCIRC storm surge model data provided by:
LSU Coastal Emergency and Risks Assessment
LSU CLEAR
UNC Institute of Marine Sciences
Notre Dame Computational Hydraulics Laboratory
HURRICANE IKE
ADCIRC MODELED STORM SURGE ELEVATIONS

Surge Elevation (Ft)

- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1
The Louisiana Coast
A Vulnerable Area for Storm Surge

Major **Storm Surge** Events Impacting LA

Ike, Carla
Texas Landfall
HURRICANE RITA

ADCIRC Predicted Storm Surge Elevations

Surge Elevation (Ft)
- >13
- 12 - 13
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1

ADCIRC storm surge model data provided by:
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LSU AgCenter / LA Sea Grant

Rita
Sept. 2005
TWO HYPOTHETICAL RITA ADCIRC MODELS
ADCIRC storm surge model data provided by:
Dr. Hassan Mashriqui
LSU AgCenter / LA Sea Grant
BM set in 1980. Marker ID – 1108 D 1980. 158 ft south of the south shore of Lost Bayou, 118 ft west of the west shore of a small freshwater pond, 46 ft north of the south shore of the island. The bench mark is set 0.21 m (0.7 ft) above ground level, crimped to a stainless steel rod driven 19.5 m (64 ft) to substantial resistance, and encased in a 4-inch PVC pipe, and concrete kickblock.