An Analysis of Historical Storm Surge Activity along the U.S. Gulf Coast

October 16, 2012

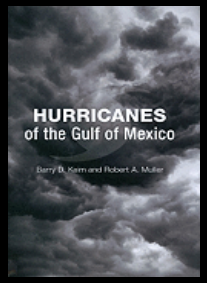
Southern Climate Impacts Planning Program

SURGEDAT

- Tropical cyclone-generated storm surges
- Time period: 1880-2011 (132 years)
- Surge height: ≥ 1.22 meters (4 feet)
- Research area: U.S. Gulf Coast

SURGEDAT utilized 67 sources of surge data (U.S. Gulf Coast)

Federal Government: 28



Books and Academic Publications: 23

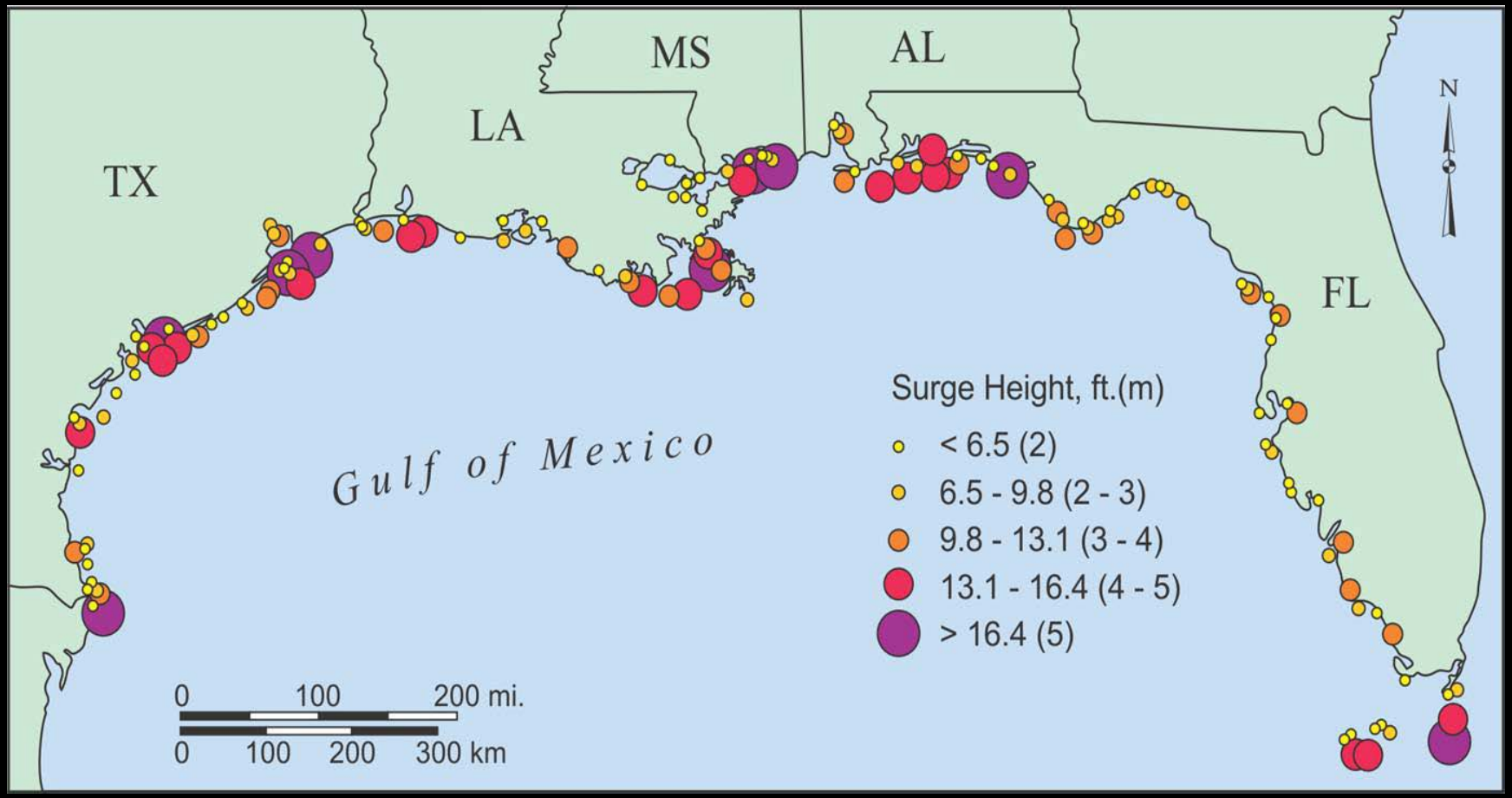
Historic newspapers: 16 titles

3,120 pages of newspaper read

Top 5 Highest Surges along the U.S. Gulf Coast

Rank	Height (m)	Height (ft)	Year	Storm Name	Location of Peak Surge
1	8.47	27.8	2005	Katrina	Pass Christian, MS
2	7.50	24.6	1969	Camille	Pass Christian, MS
3	6.10	20.0	1900	“Galveston”	Galveston, TX
4	6.10	20.0	1935	“Labor Day”	Long Key, FL
5	5.64	18.5	1961	Carla	Port Lavaca, TX

Map of Surge Activity along the U.S. Gulf Coast



Calculating Return Periods

Statistical Distributions:

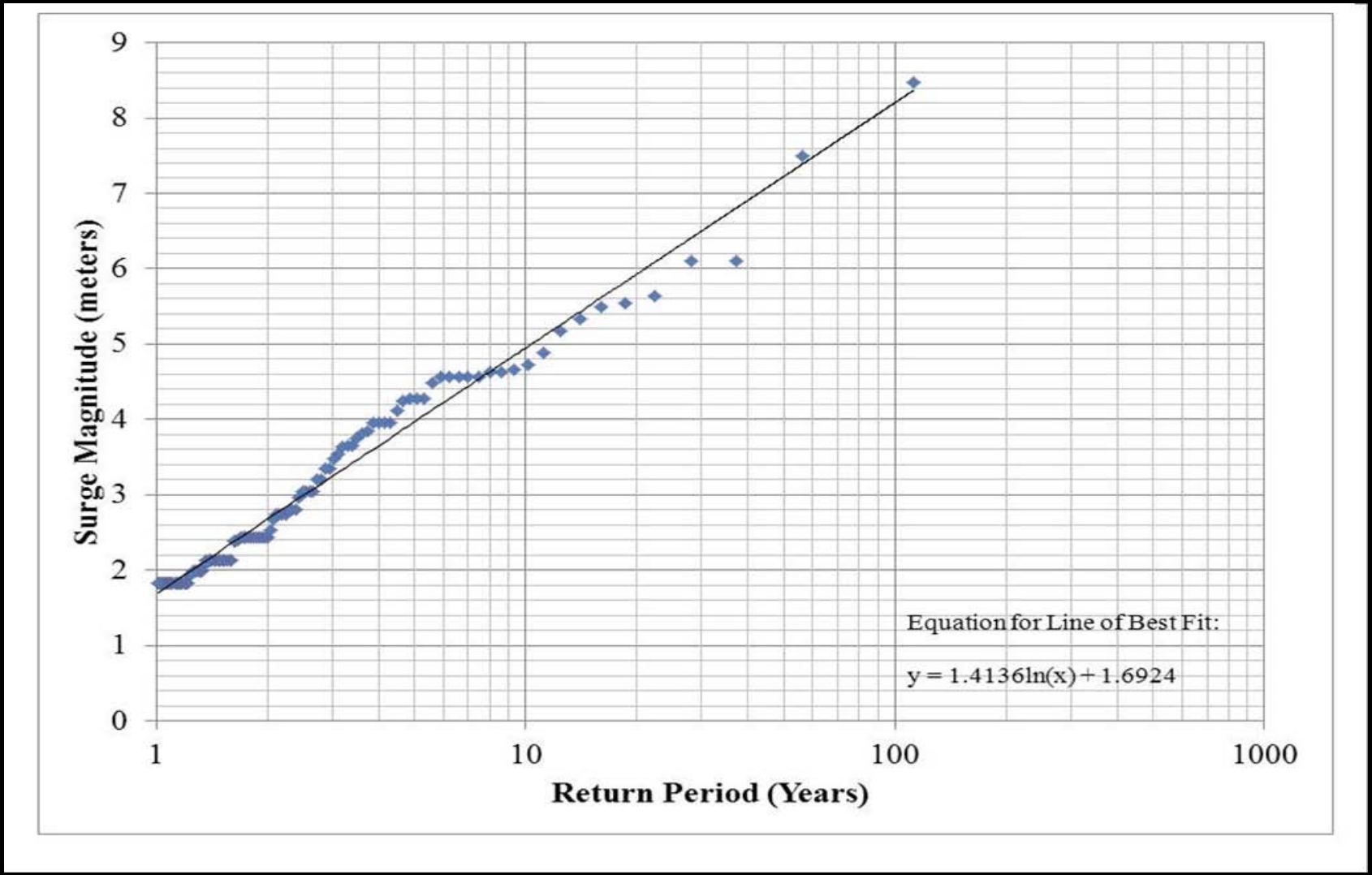
- Gumbel Distribution
  - Widely used since Technical Paper 40 (Hershfield 1961)
- Beta-P Distribution
  - Best fit for heavy rainfall events in Northeast (Wilks 1993); (Wilks and Cember 1993)
- Pareto Distribution
  - Model hydrological extremes over truncation level
    - (Hoskin and Wallis 1987)

Calculating Return Periods

Linear Regressions:

- Huff-Angel linear regression method
  - Log-log method
  - Estimated quantile values in the Midwest
- Southern Regional Climate Center (SRCC) linear regression method
  - Log-linear method
  - Estimated quantile values in south-central states

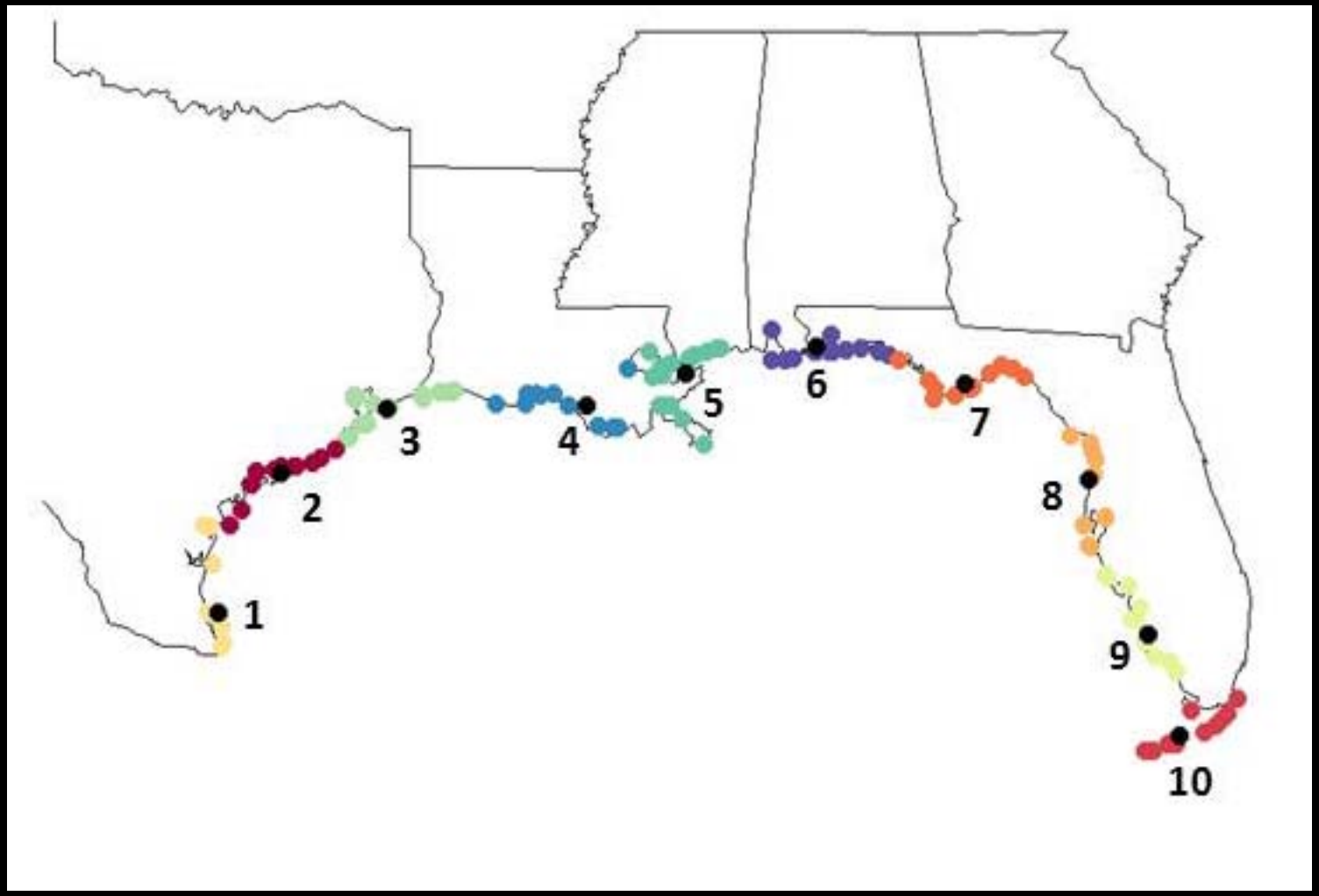
SRCC linear regression for Gulf Coast storm surges



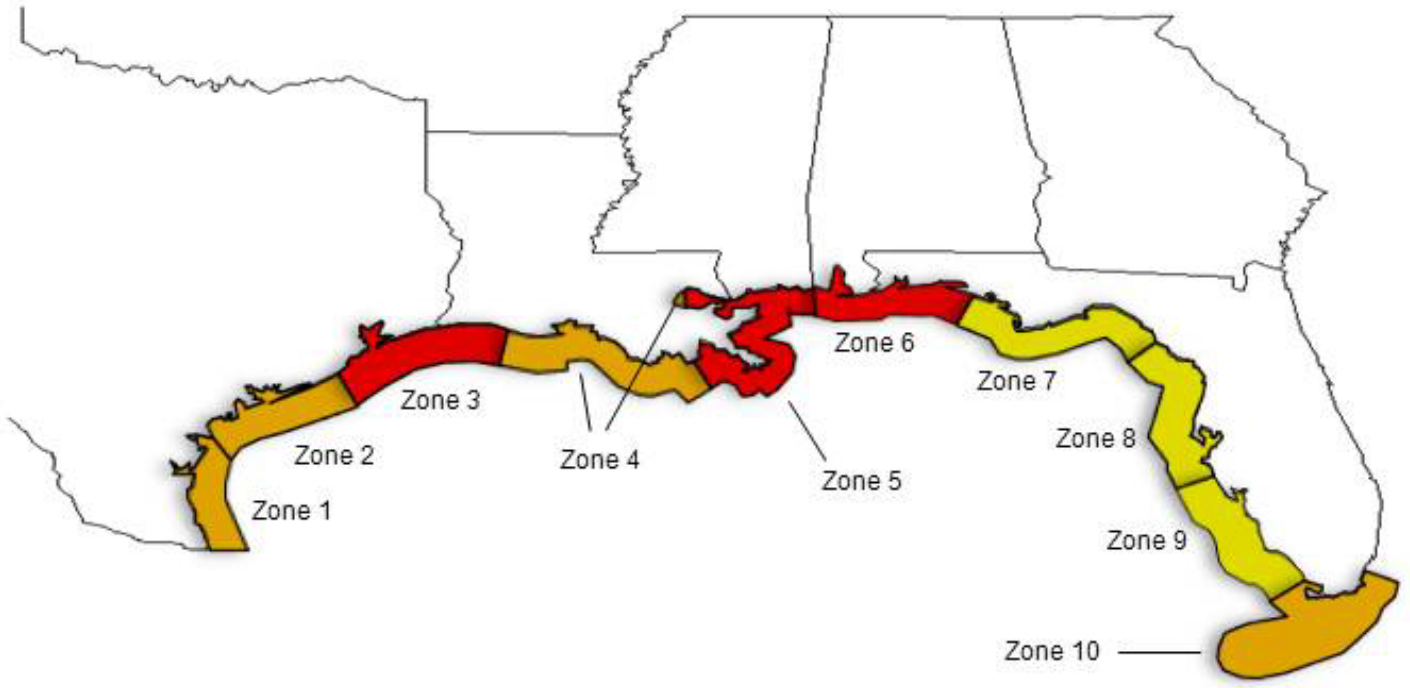
Storm Surge Quantiles for U.S. Gulf Coast

Return Period (years)	SRCC Surge Level (meters)	SRCC Surge Level (feet)
100	8.20	26.90
50	7.22	23.69
25	6.24	20.47
10	4.95	16.24
5	3.97	13.02
2	2.67	8.76

K-Means Method of Spatial Clustering

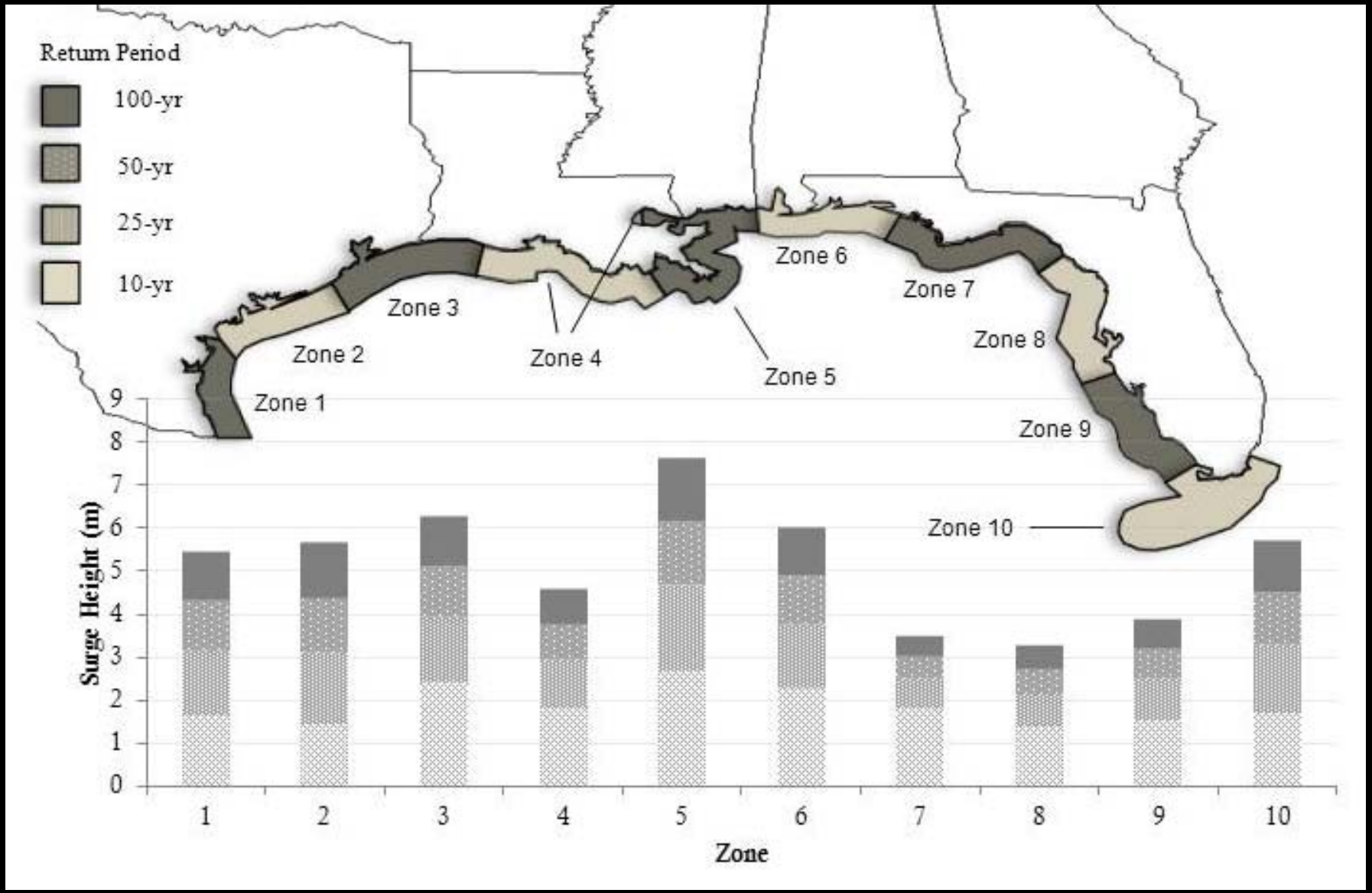


100-Year Storm Surge Levels



Zone #	1	2	3	4	5	6	7	8	9	10
Height (m)	5.51	5.69	6.30	4.63	7.67	6.06	3.55	3.33	3.94	5.77

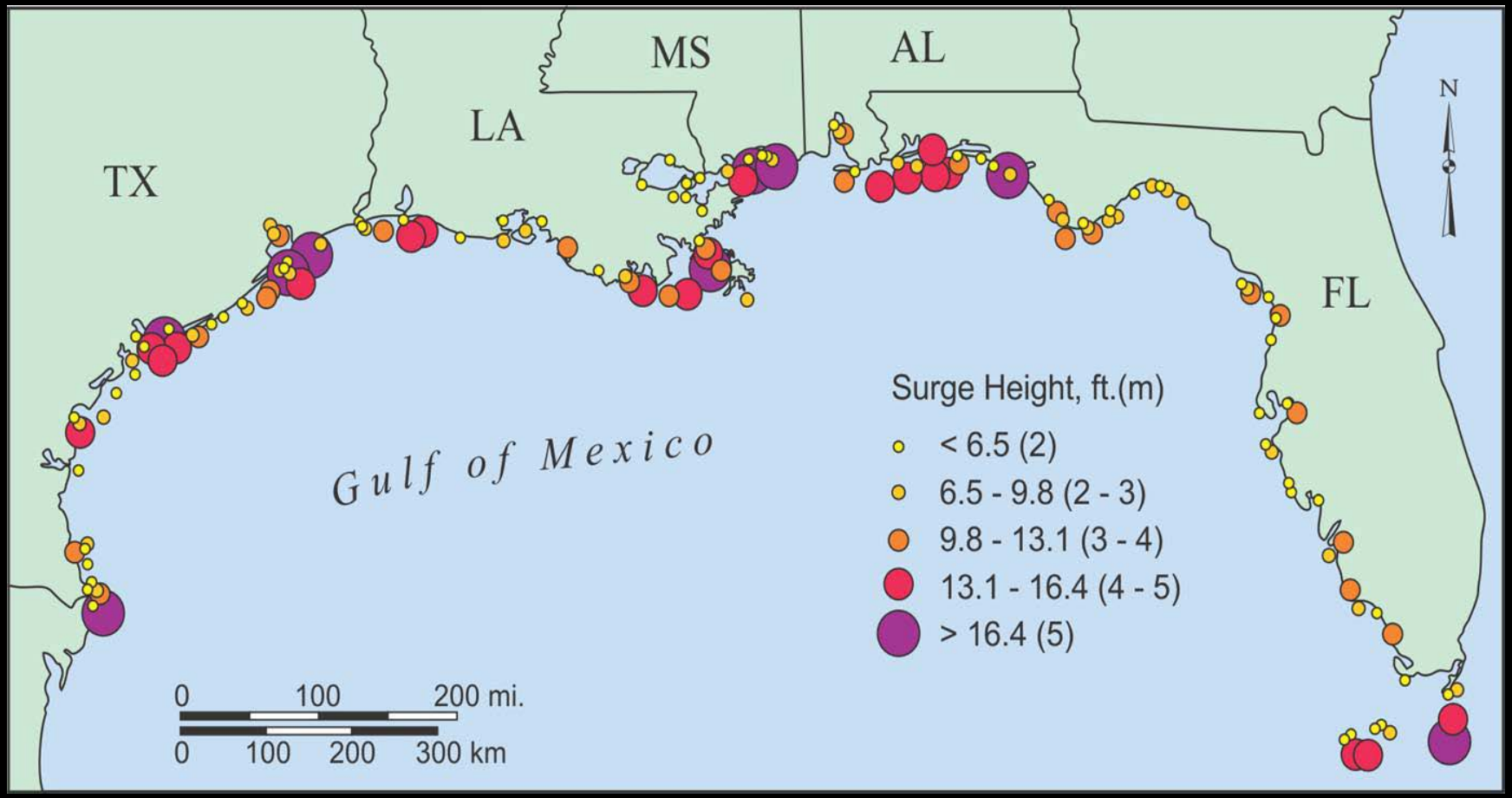
Surge Color Code	< 4 meters	4-6 meters	> 6 meters


Return Period
100-yr
50-yr
25-yr
10-yr
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
Surge Height (m)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
8
9
10
Zone

Super SURGEDAT – Summer 2012

- All high water marks
- All historic storms
- More than 6,000 obs for U.S. Atlantic Basin

Original SURGEDAT

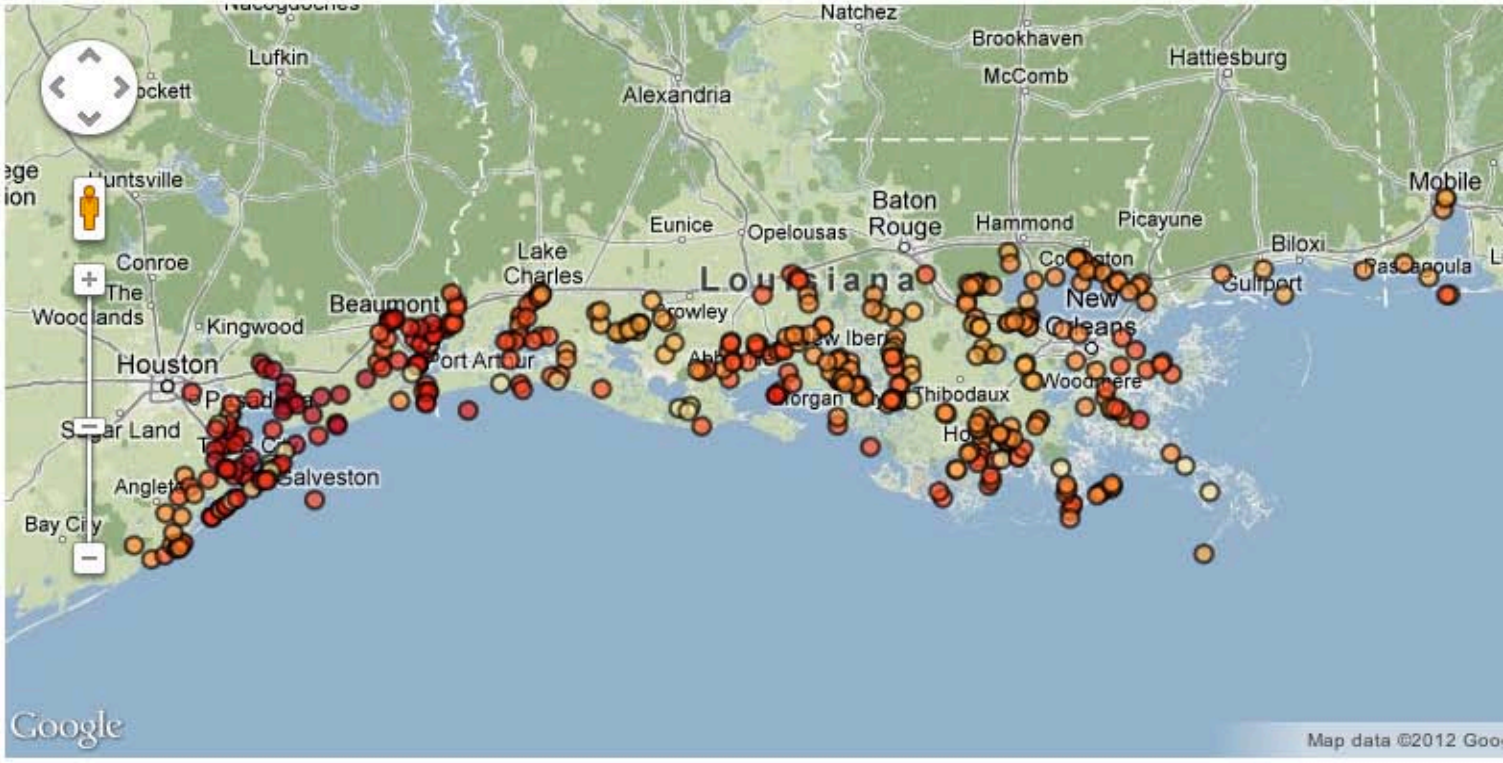


Search By Storm Name & Year

Ike

2008

Search By Location



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Storm Name	Year	Storm Tide(ft)	Storm Tide(m)	Surge(ft)	Surge(m)	Location	Basin	State
Ike	2008	6.6	2.01168				U.S. Gulf Coast	TX
Ike	2008	6.9	2.10312				U.S. Gulf Coast	TX
Ike	2008	8.8	2.68224				U.S. Gulf Coast	TX
Ike	2008	5.1	1.55448				U.S. Gulf Coast	TX
Ike	2008	5.3	1.61544				U.S. Gulf Coast	TX
Ike	2008	5.5	1.6764				U.S. Gulf Coast	TX
Ike	2008	7.2	2.19456				U.S. Gulf Coast	TX
Ike	2008	6.6	2.01168				U.S. Gulf Coast	TX
Ike	2008	7.3	2.22504				U.S. Gulf Coast	TX
Ike	2008	7.7	2.34696				U.S. Gulf Coast	TX

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Ike

2008

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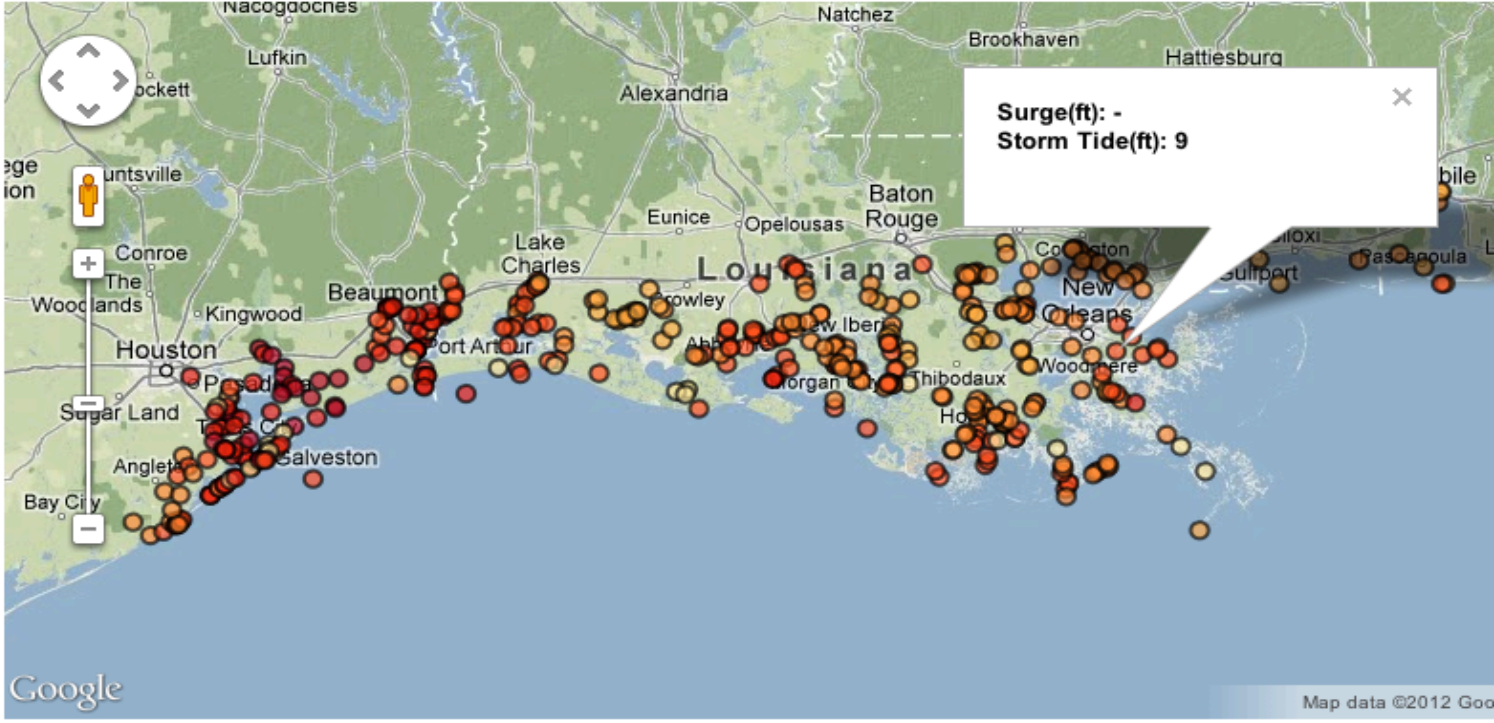

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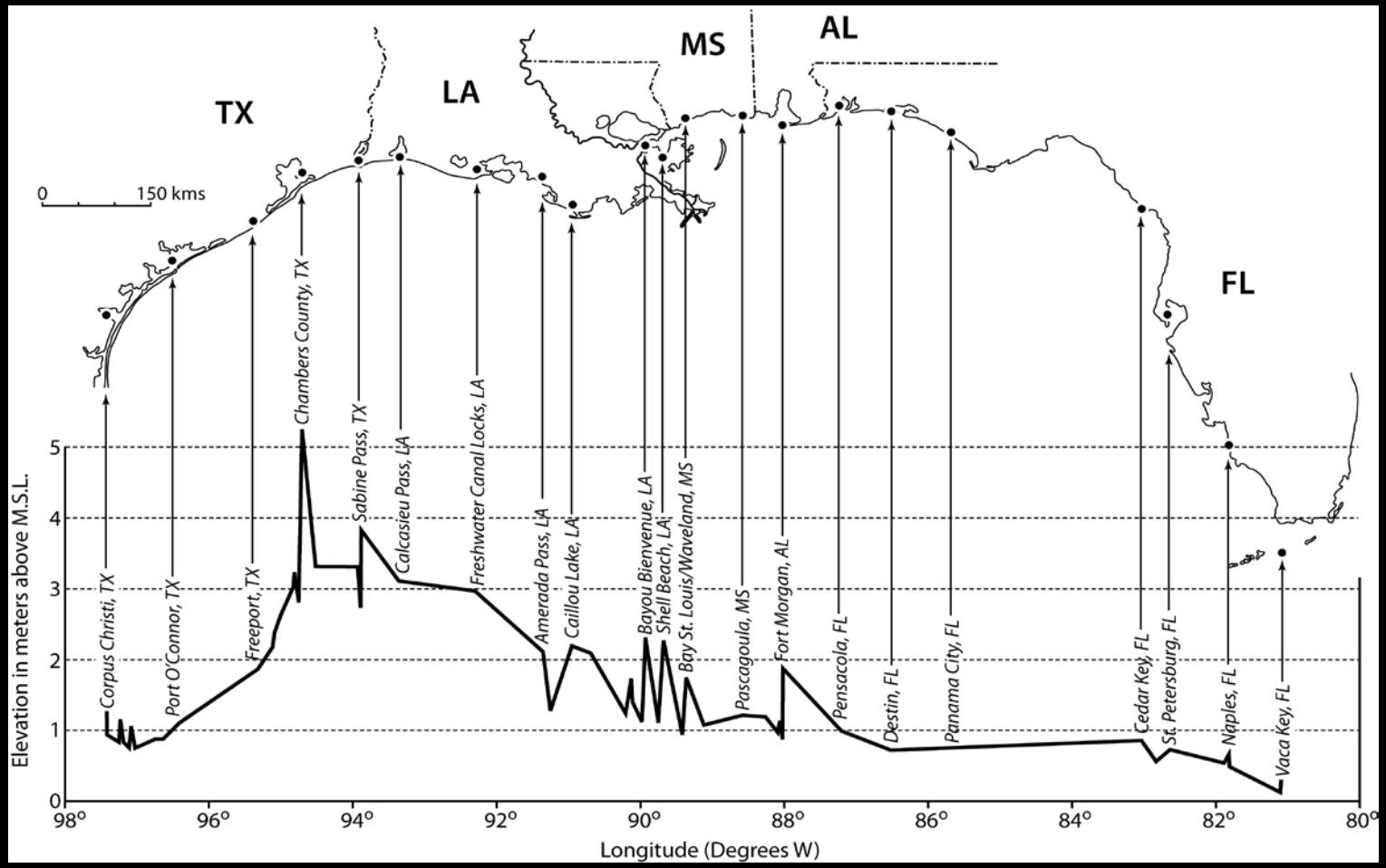
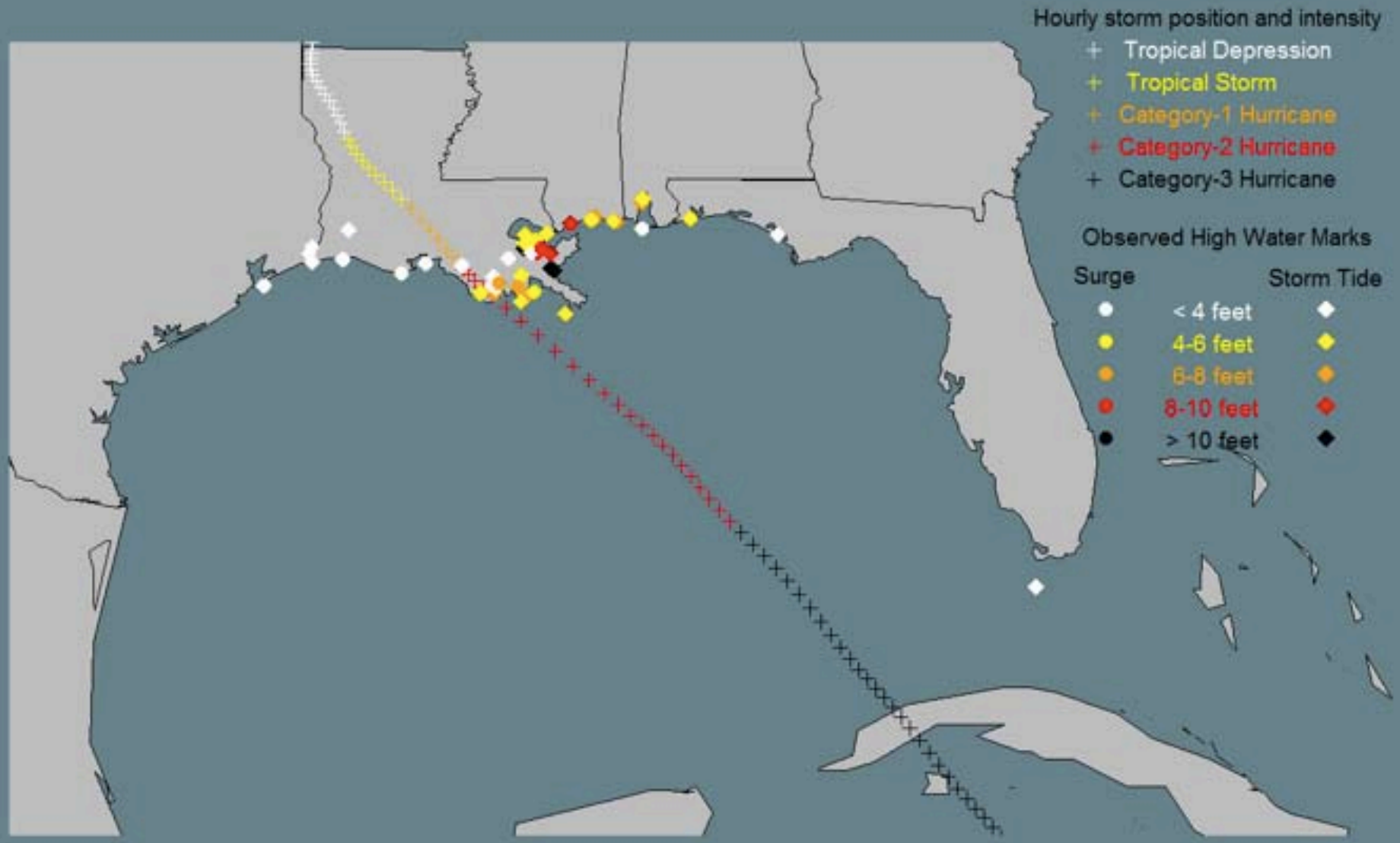
Hurricane Ike Extent of Storm Surge



Hurricane Gustav (2008) wind, position and storm surge/storm tide data



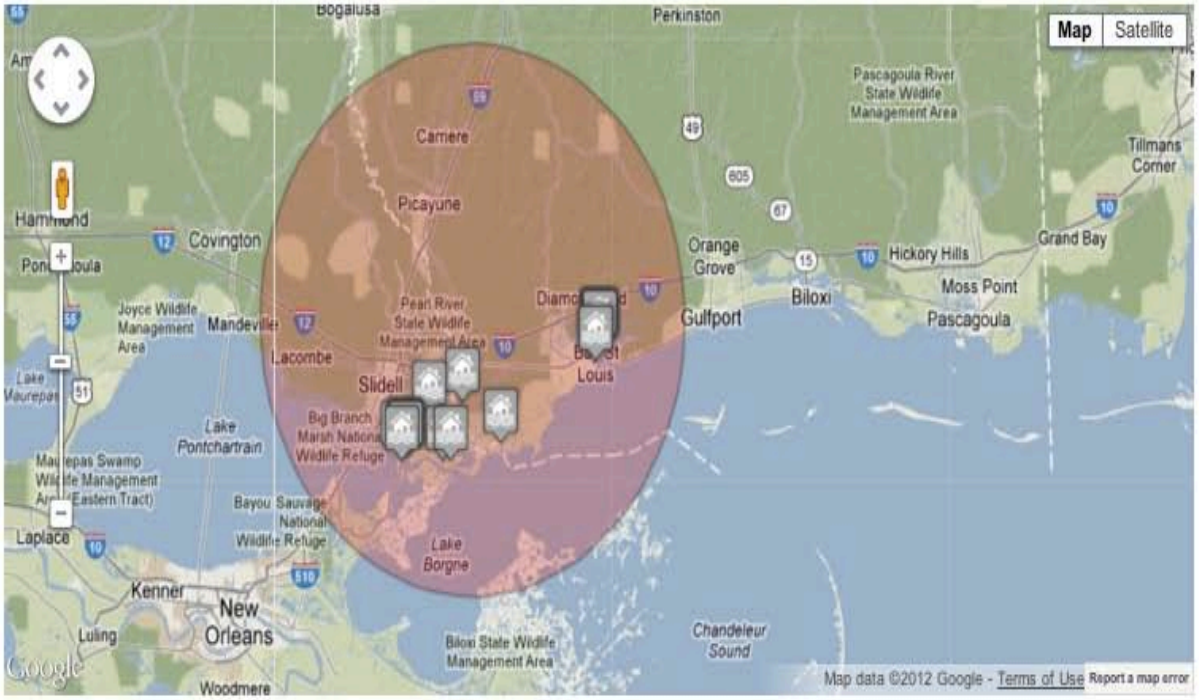
Storm position and intensity data provided by Elsner and Jagger at Florida State Univ

Storm surge data provided by SCIPP/SURGEDAT

Search By Storm Name & Year

Search By Location

30.3639
-89.5877
25 miles



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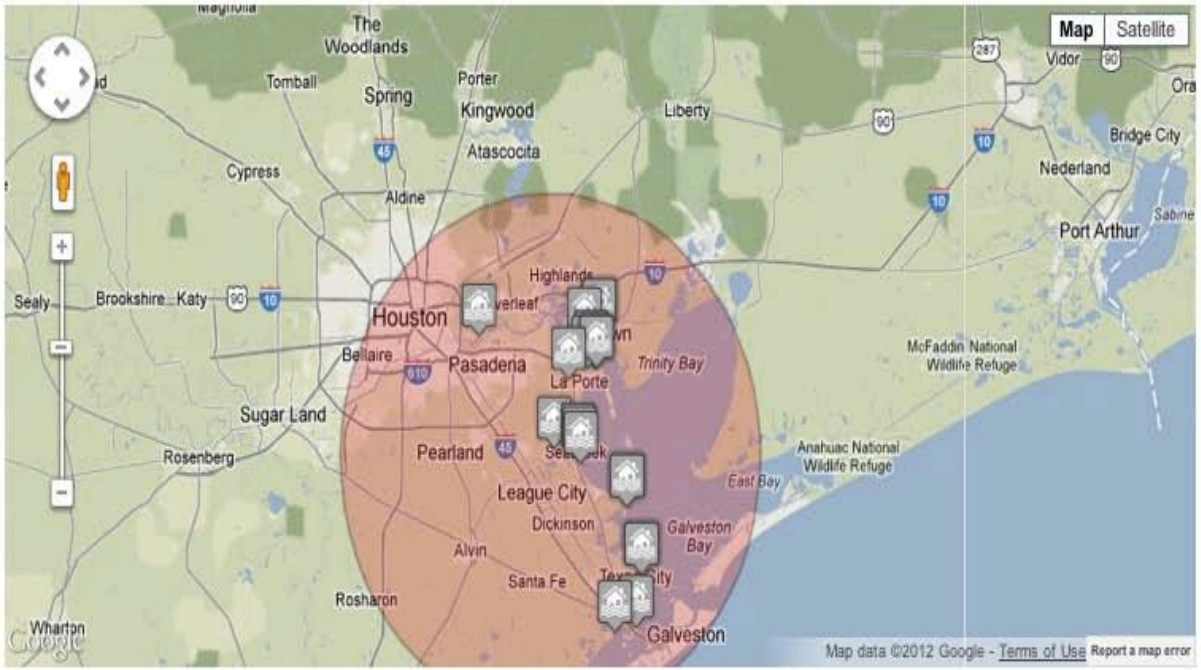
Storm Name	Year	Longitude	Latitude	Storm Tide(ft)	Storm Tide(m)	Surge(ft)	Surge(m)	Location	Basin	State
Georges	1998	-89.3333	30.3053			5.8		Bay St. Louis	U.S. Gulf Coast	MS
Galveston	1915	-89.7274	30.1733	3.2				The Rigolets	U.S. Gulf Coast	LA
Dennis	2005	-89.3250	30.3250	2.11		1.66		Waveland	U.S. Gulf Coast	MS
Bill	2003	-89.3250	30.3250			4.99		Waveland	U.S. Gulf Coast	MS
Babe	1977	-89.7435	30.1737	3.3				Rigolets (Lake Pontchartrain)	U.S. Gulf Coast	LA
New Orleans	1915	-89.5300	30.1914	10.5	3.2			LA/MS border	U.S. Gulf Coast	LA/MS

Search By Storm Name & Year

Search By Location

29.5573
-95.0781
25 miles



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Storm Name	Year	Longitude	Latitude	Storm Tide(ft)	Storm Tide(m)	Surge(ft)	Surge(m)	Location	Basin	State
Frances	1998	-94.9829	29.6812	7.5				Morgans Point	U.S. Gulf Coast	TX
Galveston	1915	-94.8987	29.3044	15.3	4.66			Virginia Point	U.S. Gulf Coast	TX
Delia	1973	-94.9781	29.7335	6.5				Baytown	U.S. Gulf Coast	TX
Claudette	1979	-94.8892	29.3810	3.5				Texas City	U.S. Gulf Coast	TX
Chantal	1989	-95.0161	29.5433	3.8				Kemah	U.S. Gulf Coast	TX
Audrey	1957	-94.8885	29.3826	5.8	1.8				U.S. Gulf Coast	TX
Unnamed	1919	-95.0408	29.6648	8.5	2.59			La Porte	U.S. Gulf Coast	TX

Storm Surge Return Periods (feet)					
	100-year	50-year	25-year	10-year	# of obs
Stennis Space Center	22.59	17.76	12.93	6.54	27
Johnson Space Center	18.79	15.02	11.25	6.27	25

This Research Impacts Many Industries

Fishing/ Seafood

Beaches/ Resorts

Coastal development

Oil and gas industry

Links/ Contact Info

- SCIPP
  - www.southernclimate.org
- SURGEDAT
  - http://surge.srcc.lsu.edu
- Contact info:
  - Hal Needham
  - hneedh1@lsu.edu

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