

Storm Surge, Katrina and Super Cats

Presented to the Midwestern Actuarial Forum

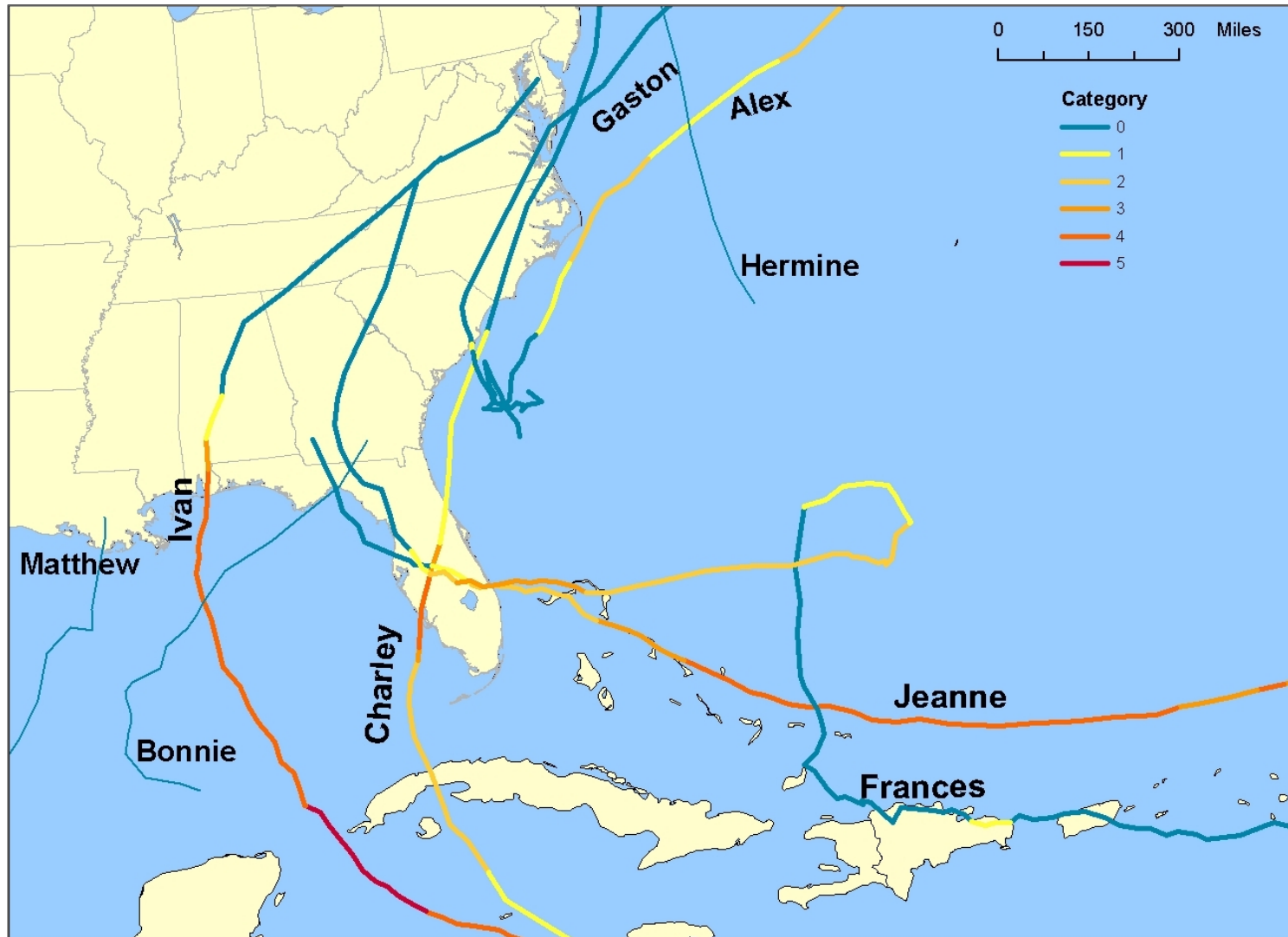
September 20, 2007

Josh Ellingson, CCRA

Bringing Science to the Art of Underwriting™



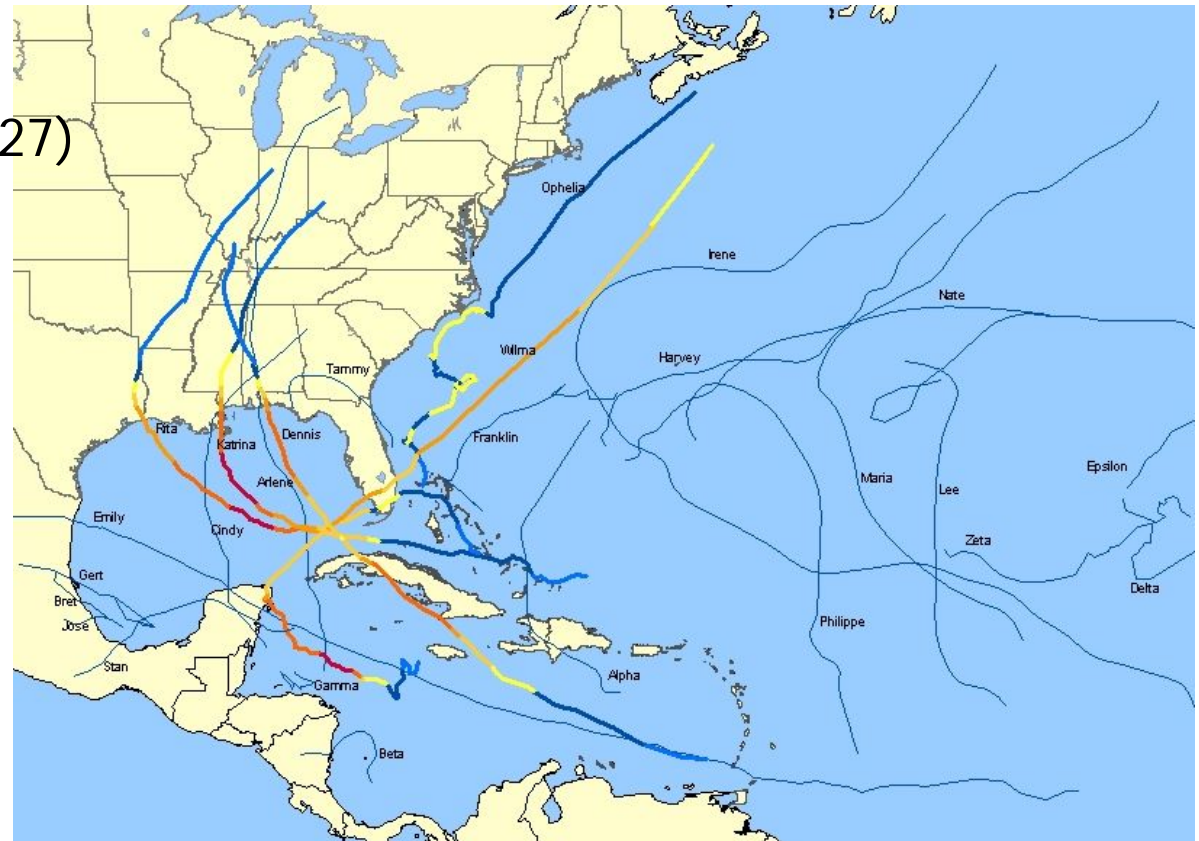
2004 Atlantic Hurricane Season in Review



2005 Atlantic Hurricane Season in Review

■ Record:

- # Named storms (27)
- # Hurricanes (15)
- # Category 5 hurricanes (4)
- # U.S. landfalling hurricanes (5)
- \$ Insured losses



Dennis, Emily, Rita, Wilma – and Katrina

The 2004 & 2005 Hurricane Seasons in Context



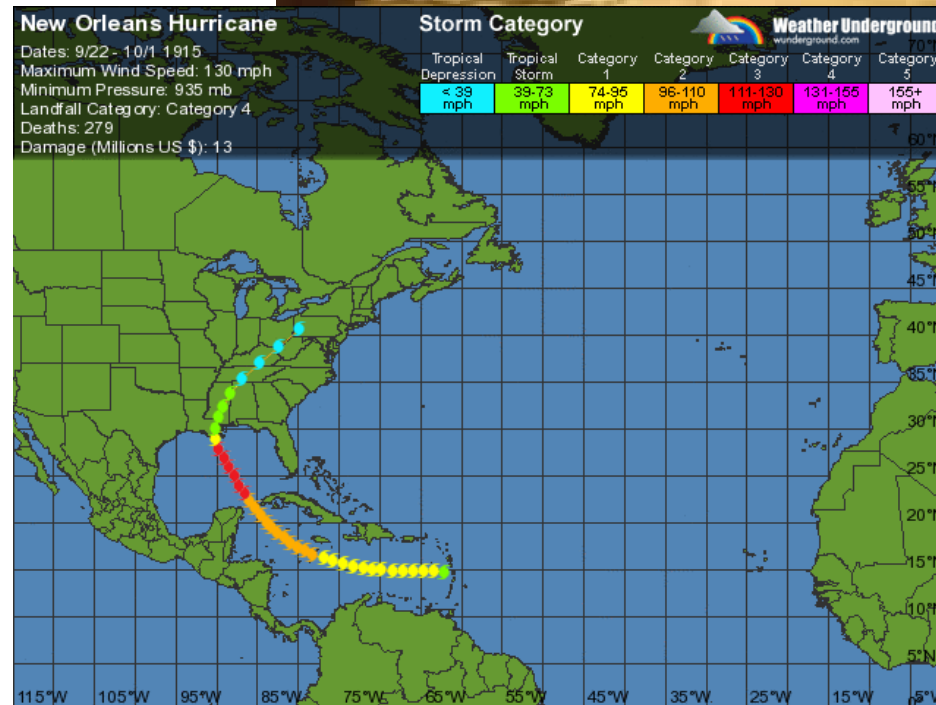
	Average	2004	2005	2005 Multiplier
Named Storms	11	15	★ 27	x2.5
Hurricanes	6	9	★ 15	x2.5
Cat 3-5	2	6	7	x3.5
Cat 5	0.4	1	3	x7.5
US Hurricanes	1.5	6	★ 5	x3.3
US Cat 3-5	0.6	3	4	x6.5
Insured Loss (onshore)	\$7Bn	\$24Bn	★ \$55Bn+	x8

★ Record

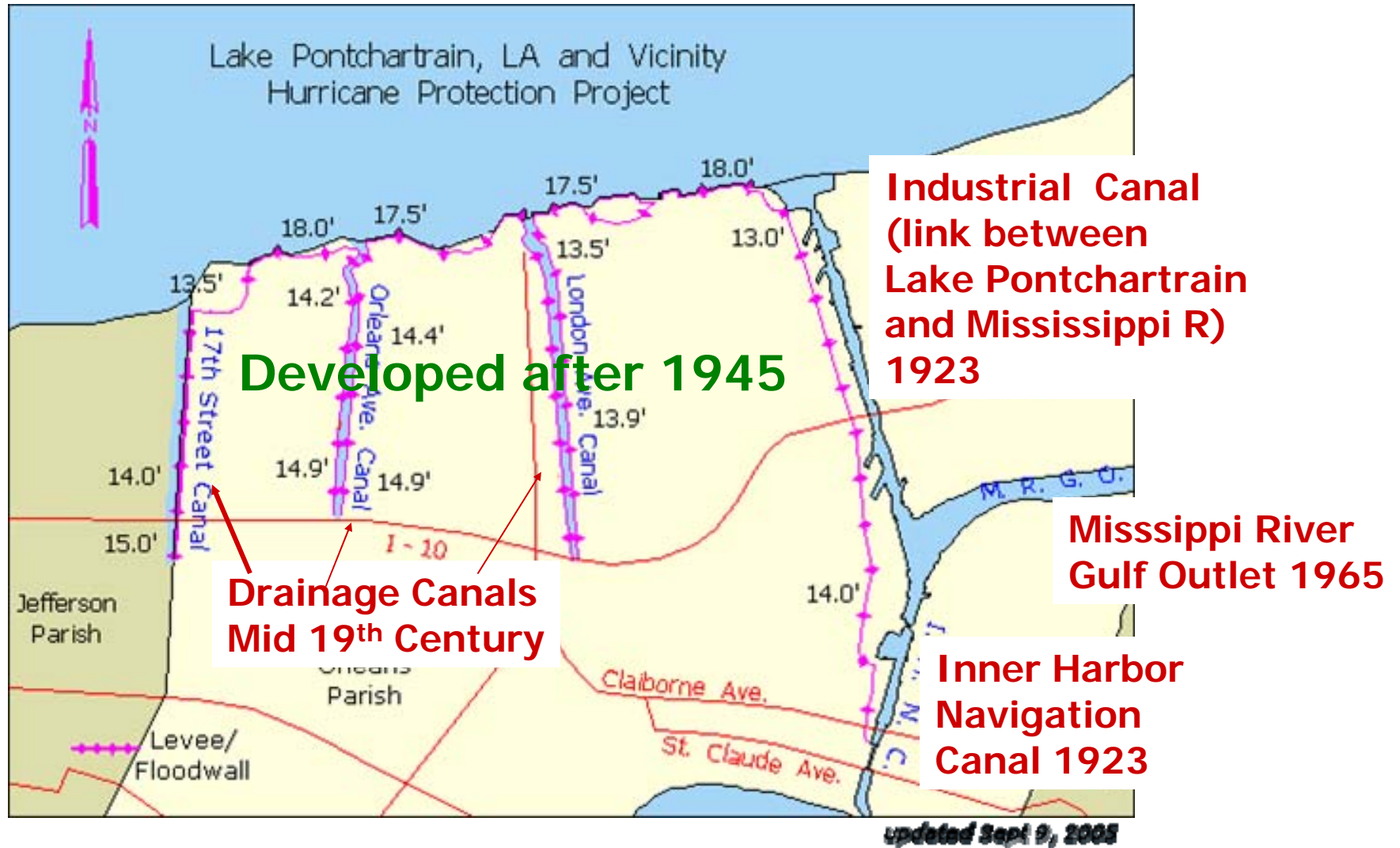
History of New Orleans Storm Surge

1915 Hurricane

- Cat 4
- 279 Deaths

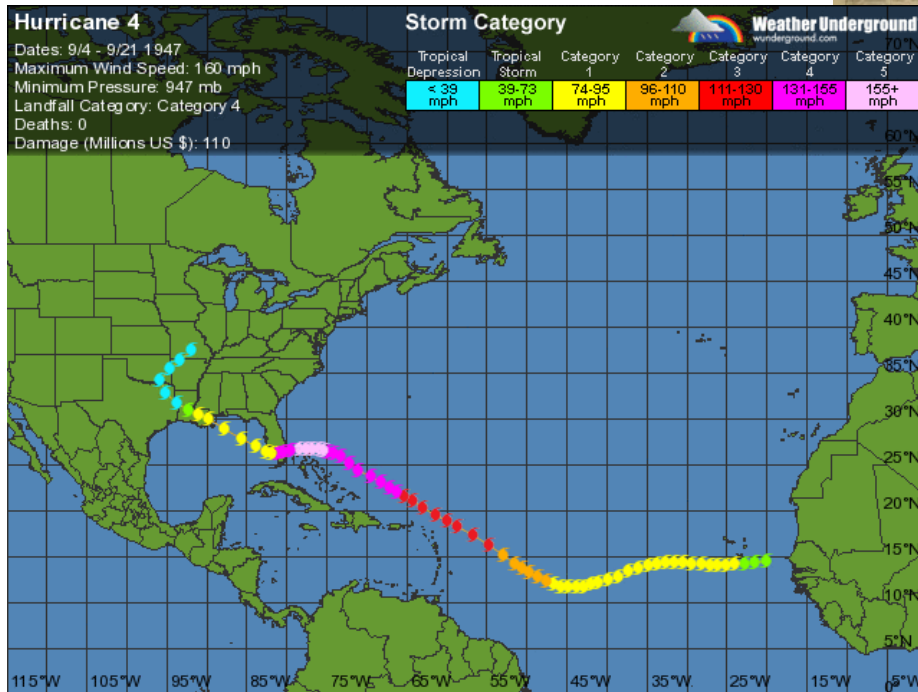
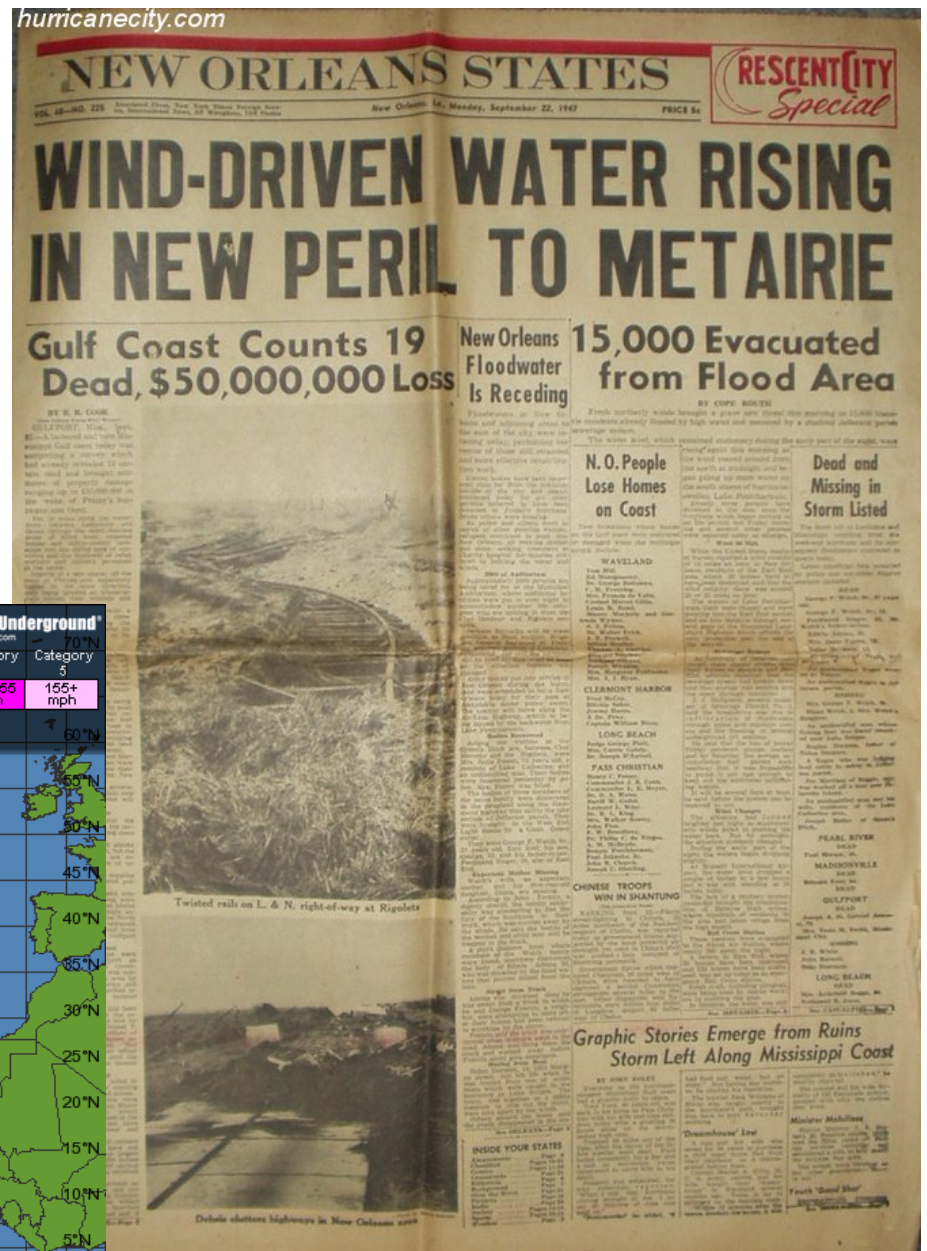


New Orleans Canals



1947 Hurricane

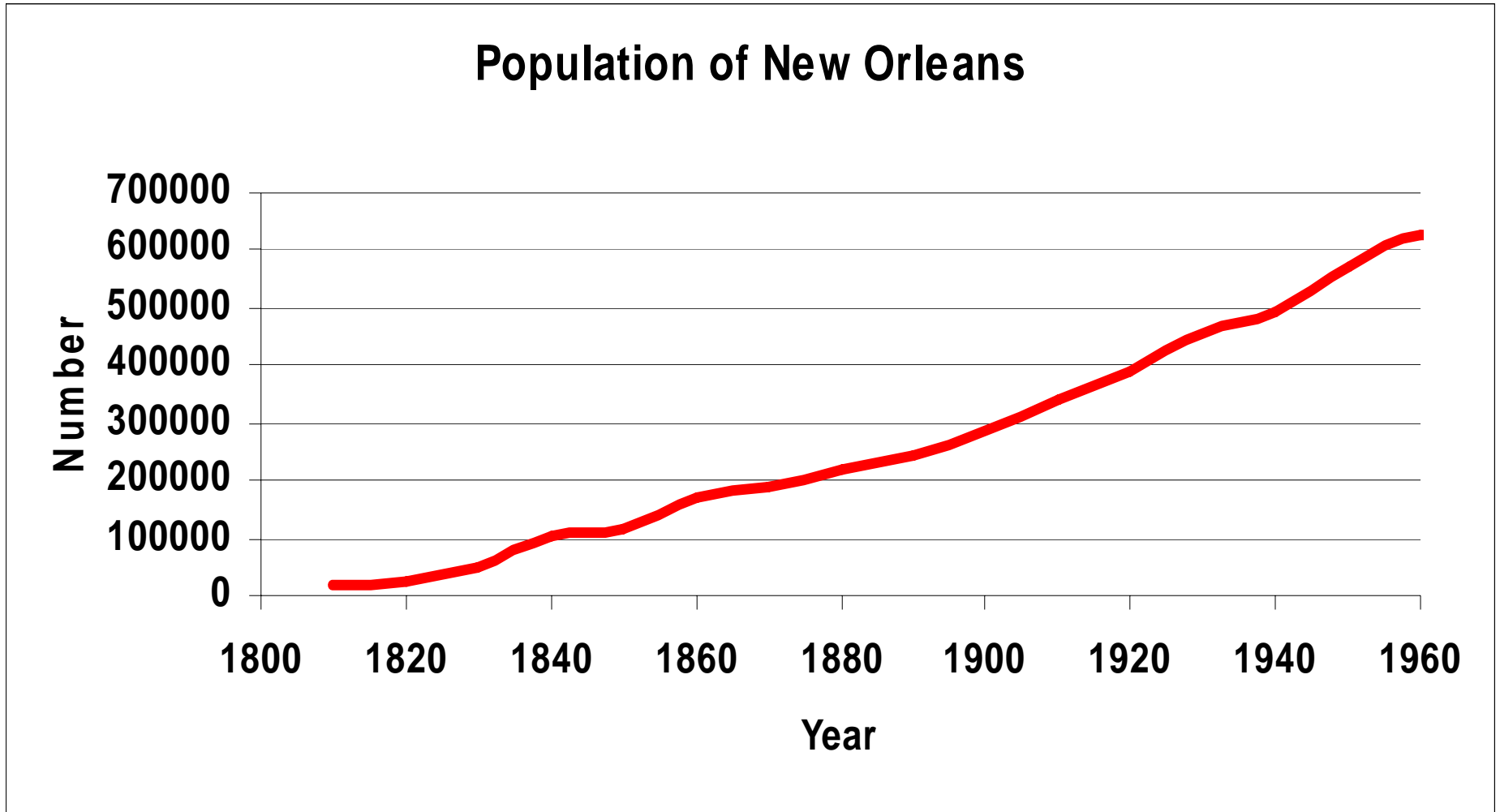
- Cat 3 directly over the City
- 0 Deaths



Lake Pontchartrain Flood Defences

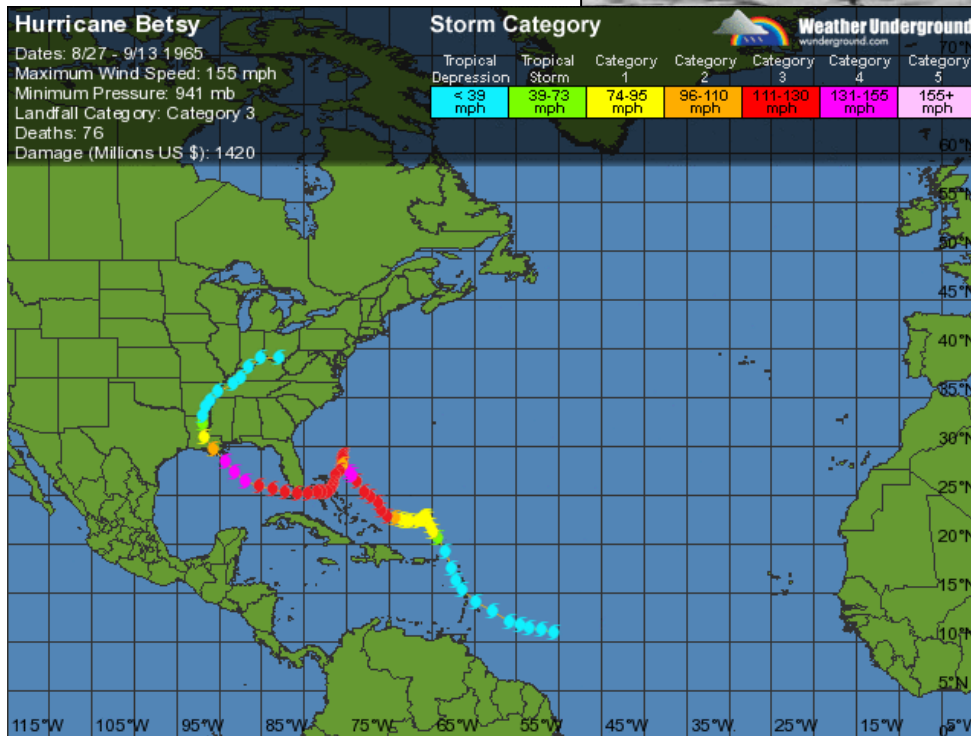


The Historical Expansion Of The Crescent City

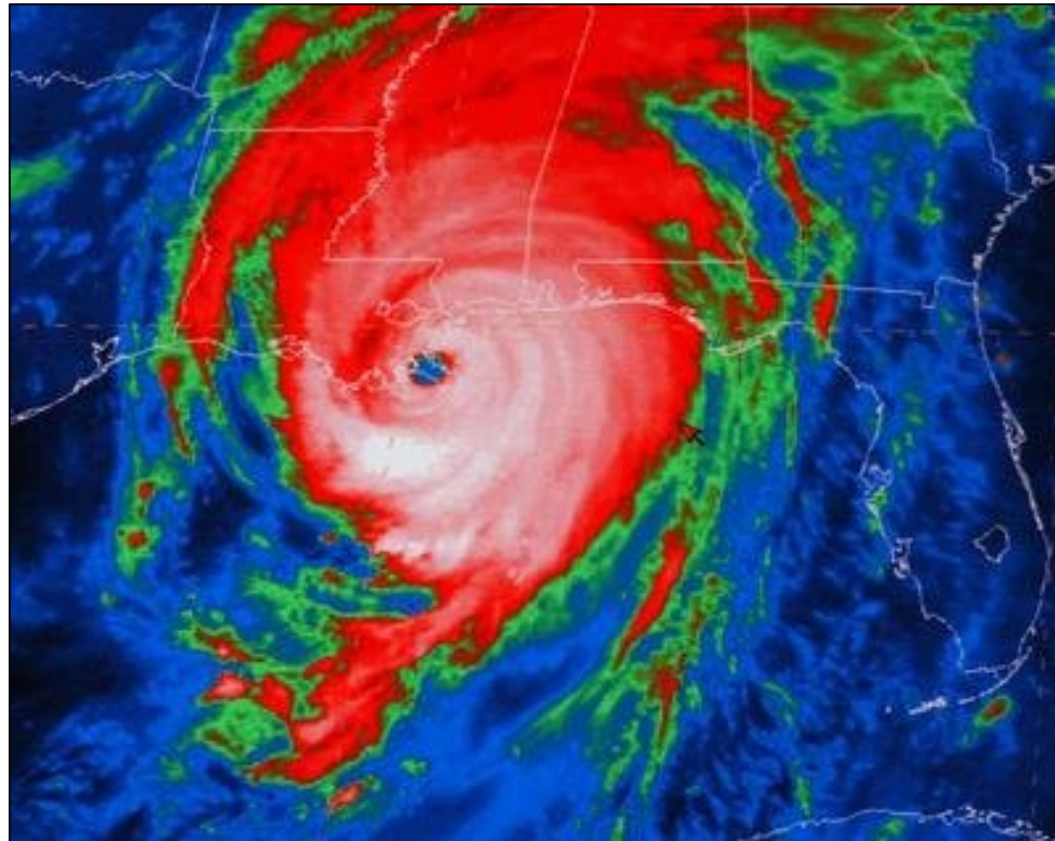


1965 Hurricane Betsy

- Cat 3 Hurricane
- 12 foot storm surge
- 60,000 homeless



Katrina



The Element of Surprise?

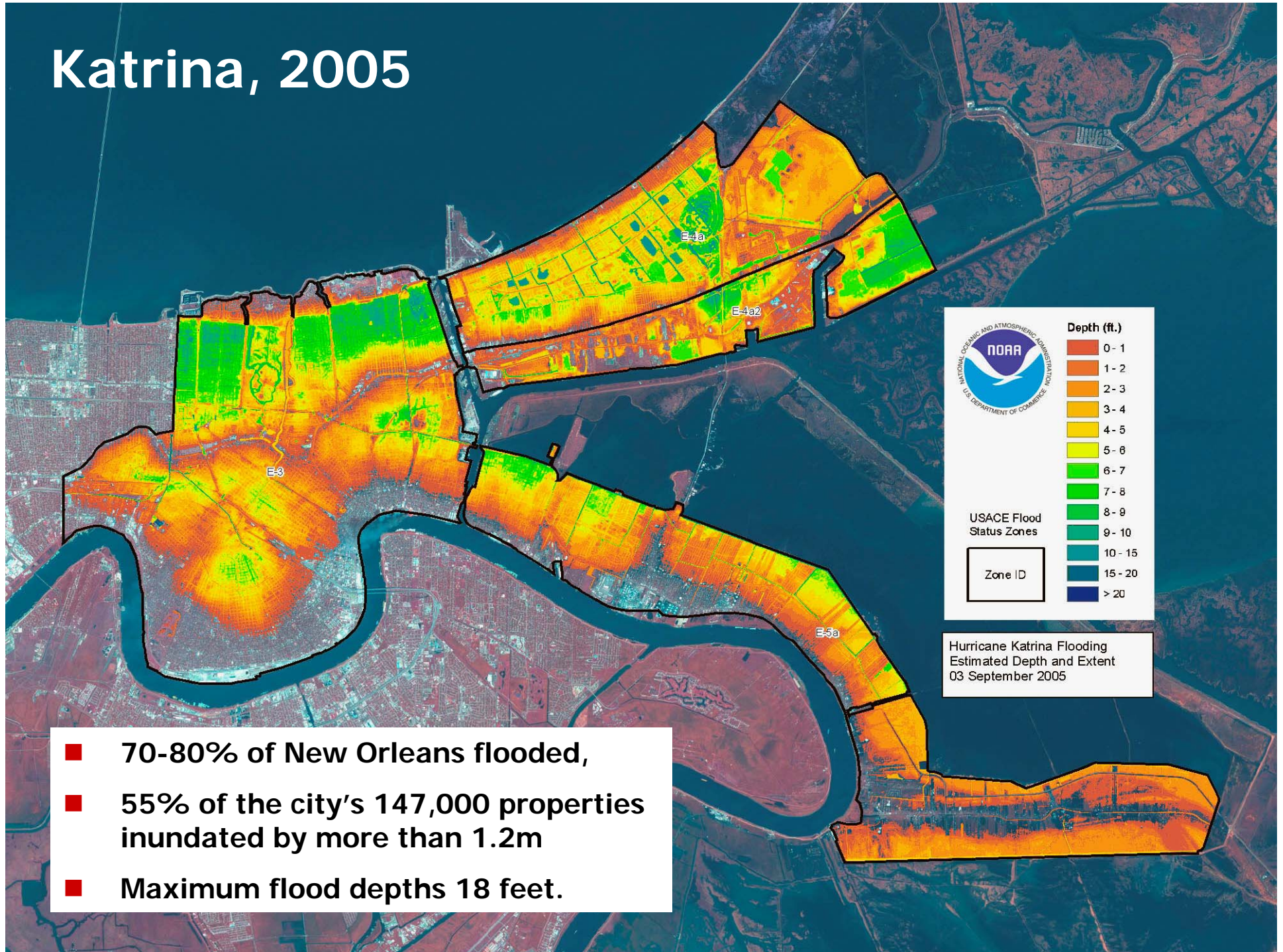


No attempt had been made to teach people what happened in Betsy

Why Was the South Louisiana Death Toll in Katrina (1,292+) 15 Times that of 1965 Betsy (81)

- After Betsy highlighted the differentials of flood risk, many people moved out and the lowermost districts became increasingly poor
- Flooding in Katrina up to 5 feet deeper than Betsy and many more houses flooded (x7)
- In 2005 only one shelter in the City – the Superdome - with 45,000 person-days of food
 - Multiple Shelters in public buildings on higher ground in 1965 outfitted with cots and stockpiled with 700,000 person-days of food

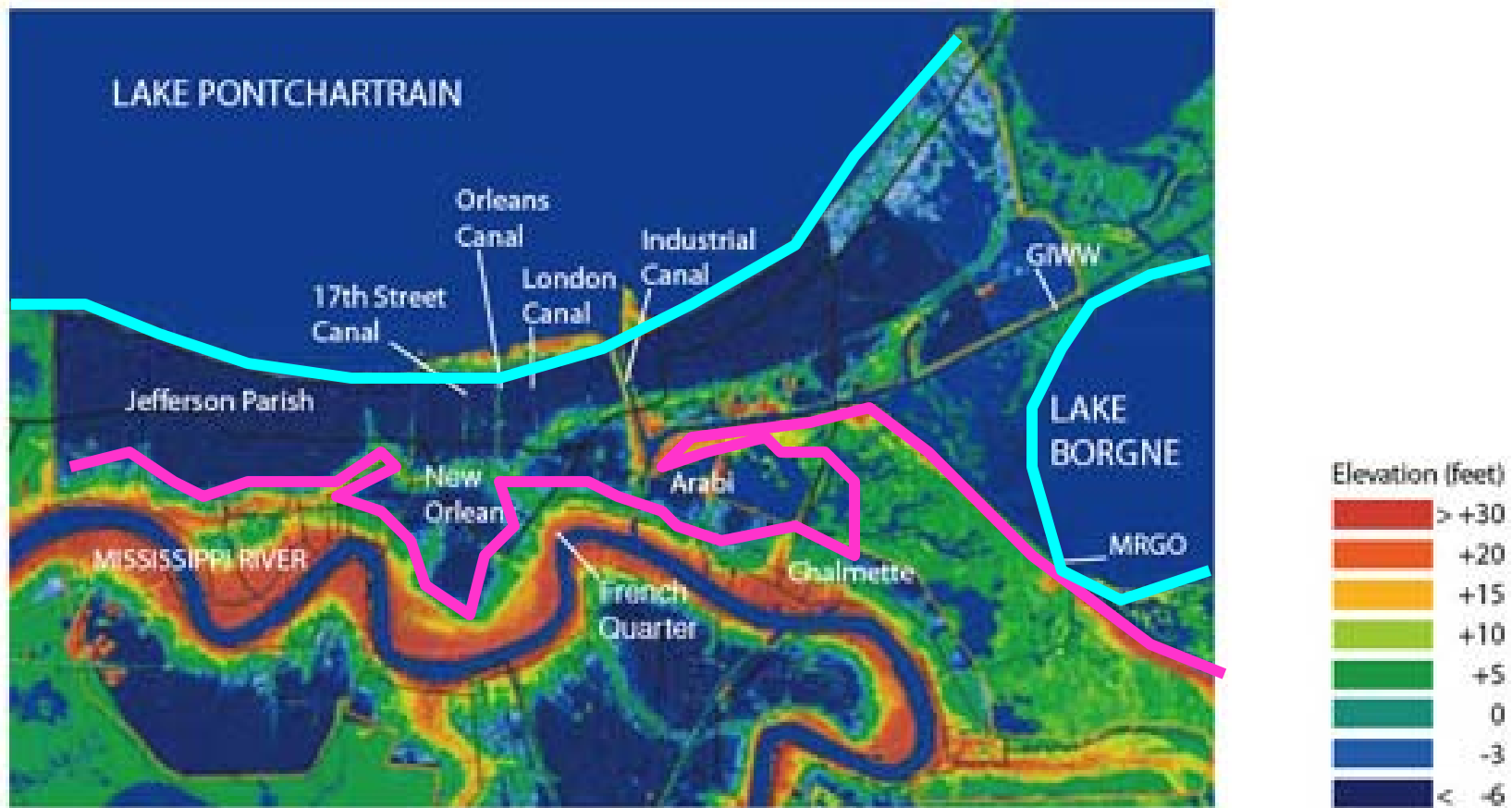
Katrina, 2005



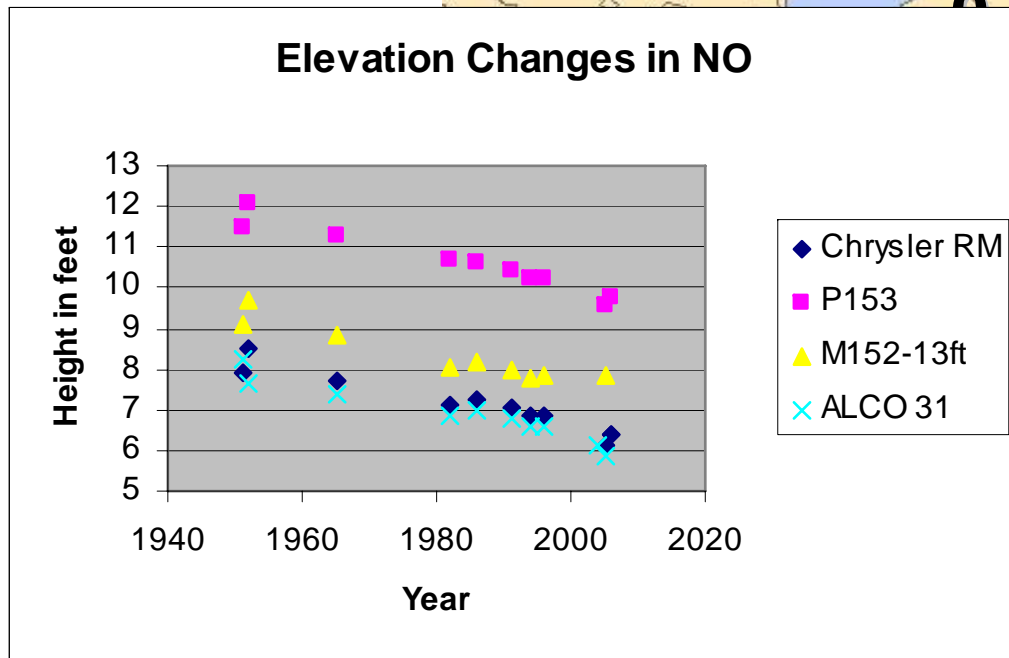
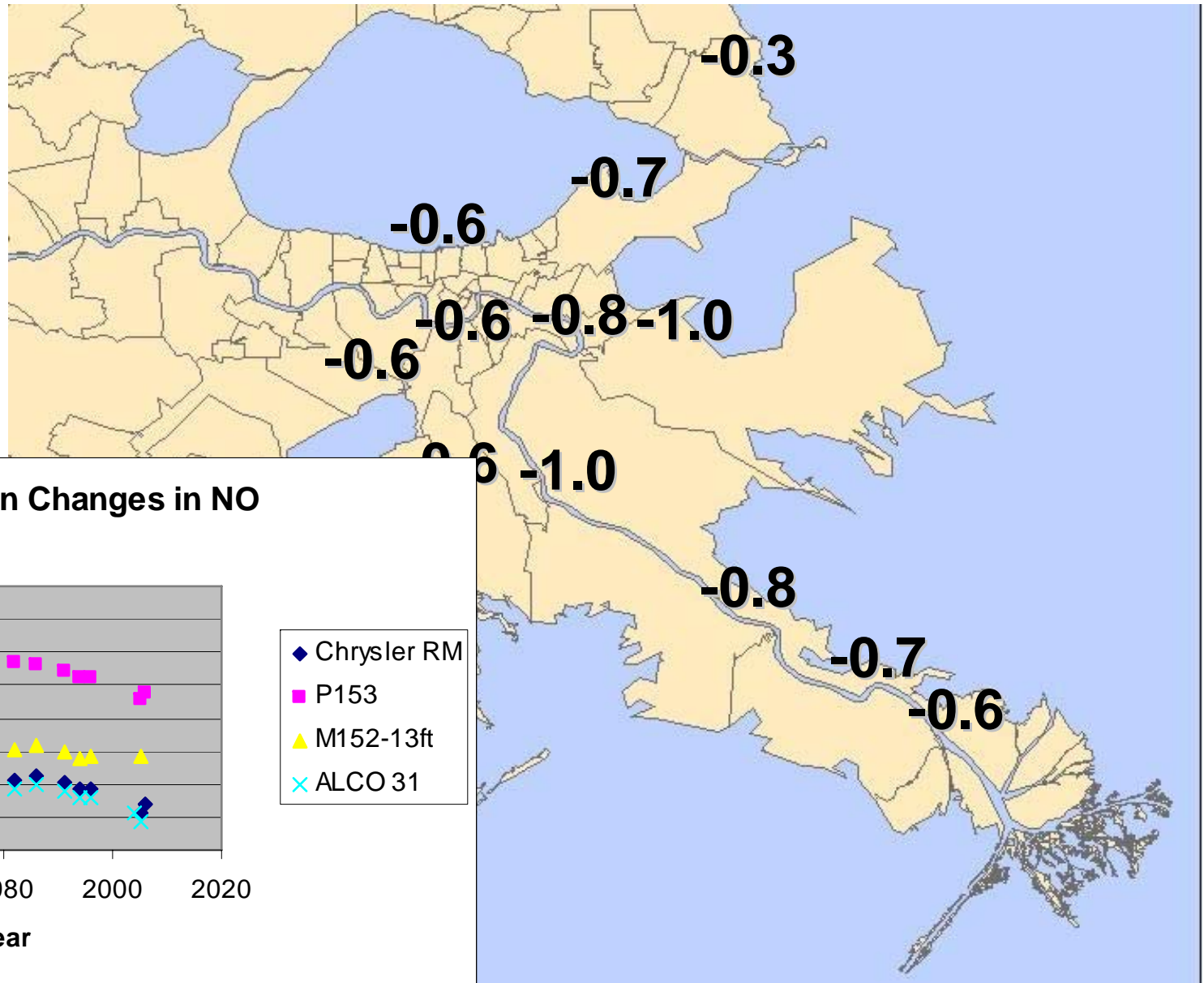
- 70-80% of New Orleans flooded,
- 55% of the city's 147,000 properties inundated by more than 1.2m
- Maximum flood depths 18 feet.

New Orleans Shoreline Shift

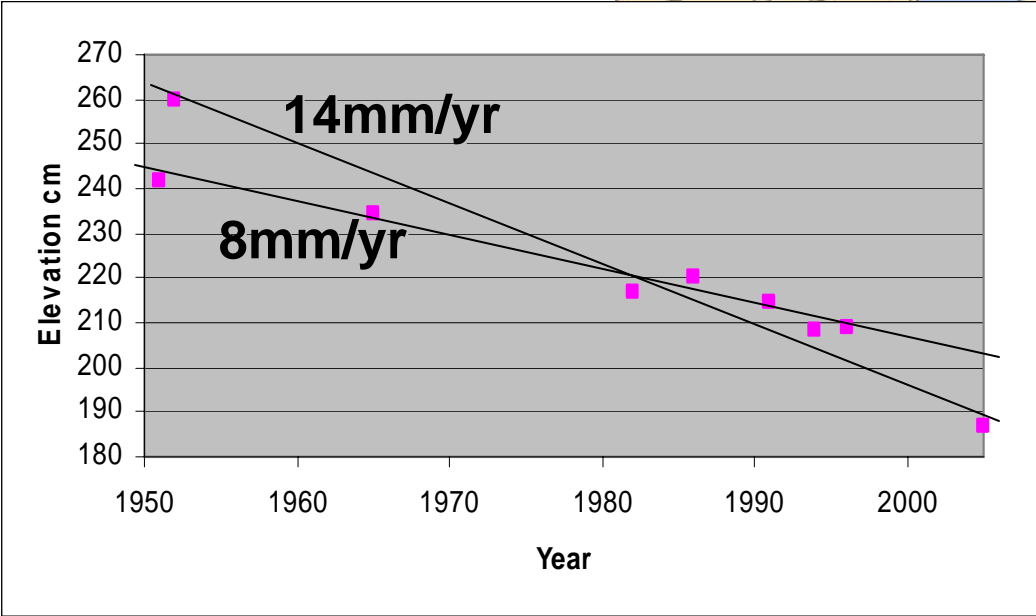
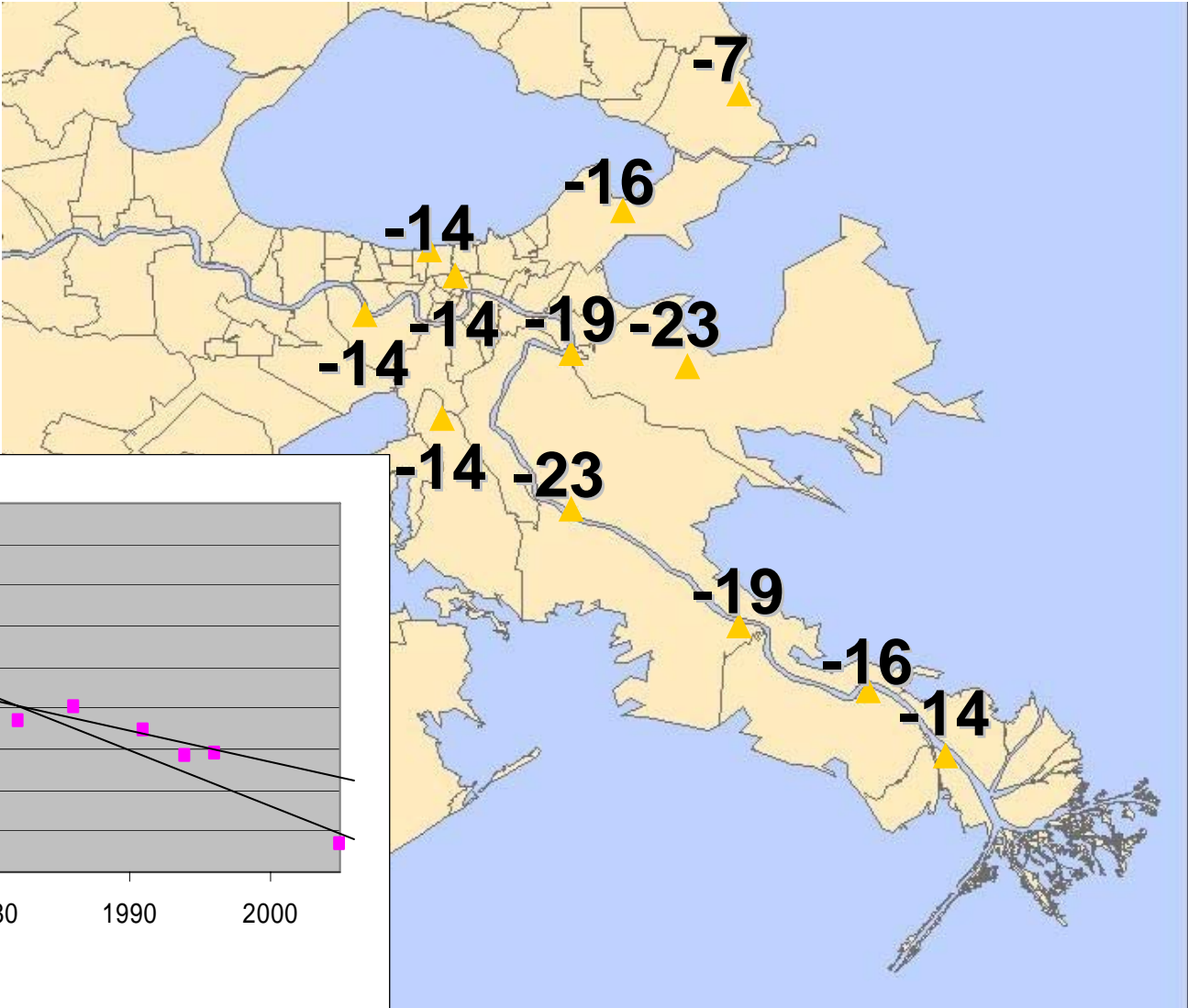
Natural shoreline: 1850  2005 



Land-level Changes 1991-2004 in Feet



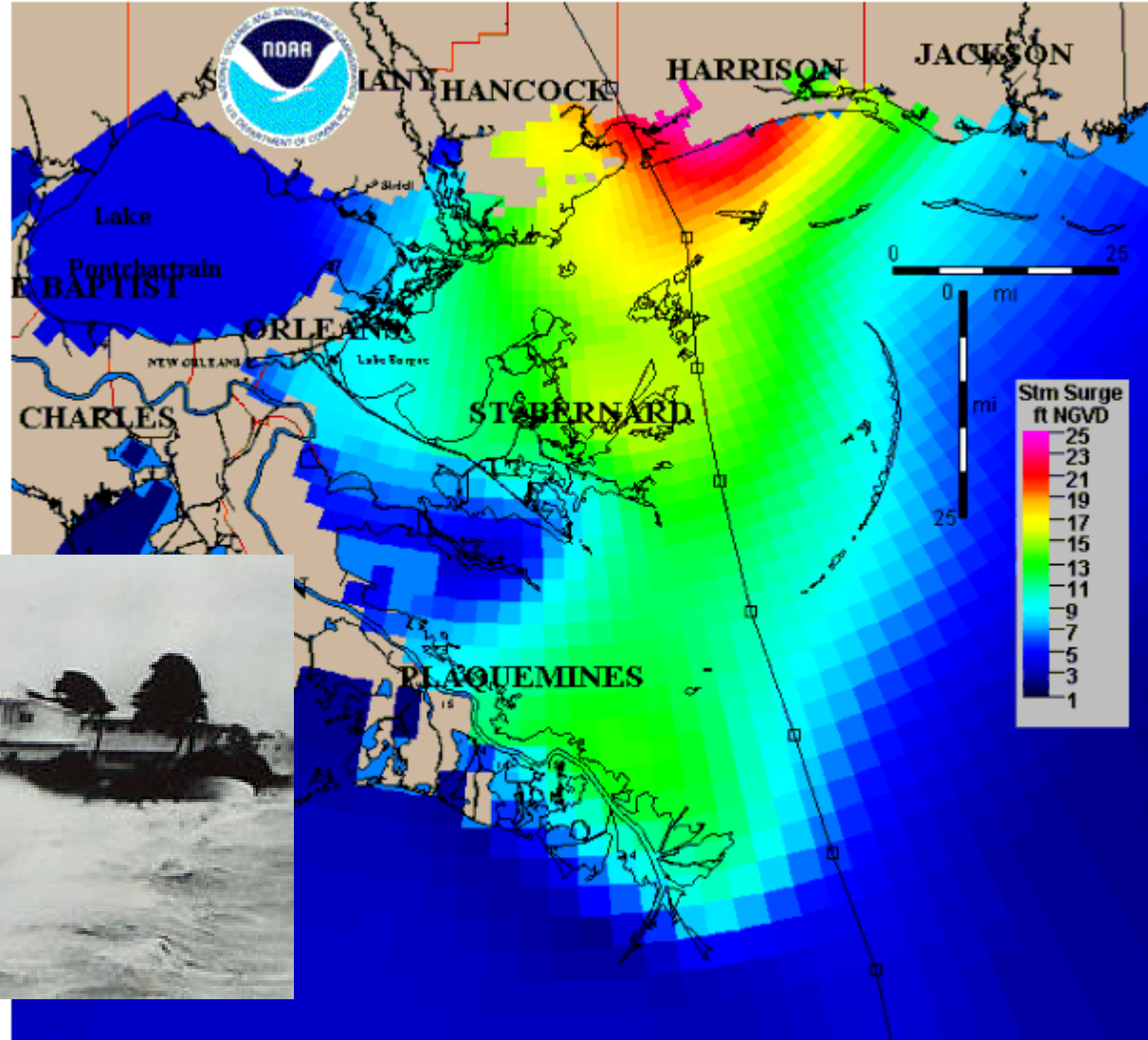
Implied Annual Subsidence mm/yr



Camille and Katrina

1969 Hurricane Camille (Cat 5)

(Wilson Shaffer, National Weather Service/NOAA)

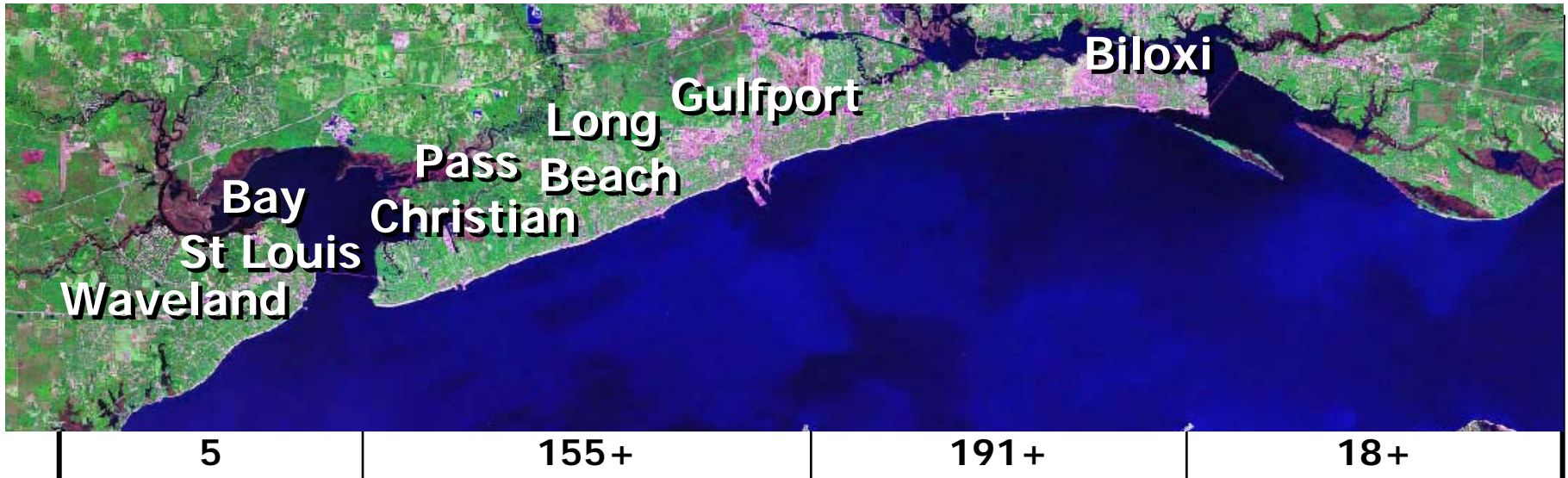
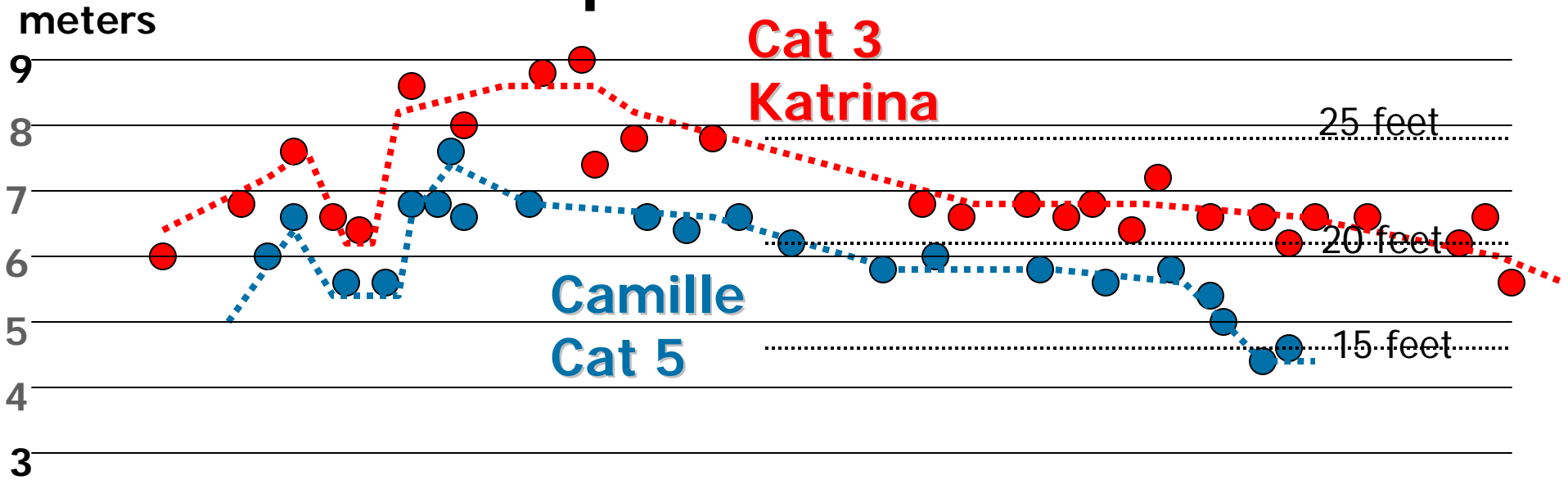


Camille's Envelope of High Water From SLOSH Model

Katrina Storm Surge (ADCIRC Model)



Is the Saffir Simpson Scale Good Science?

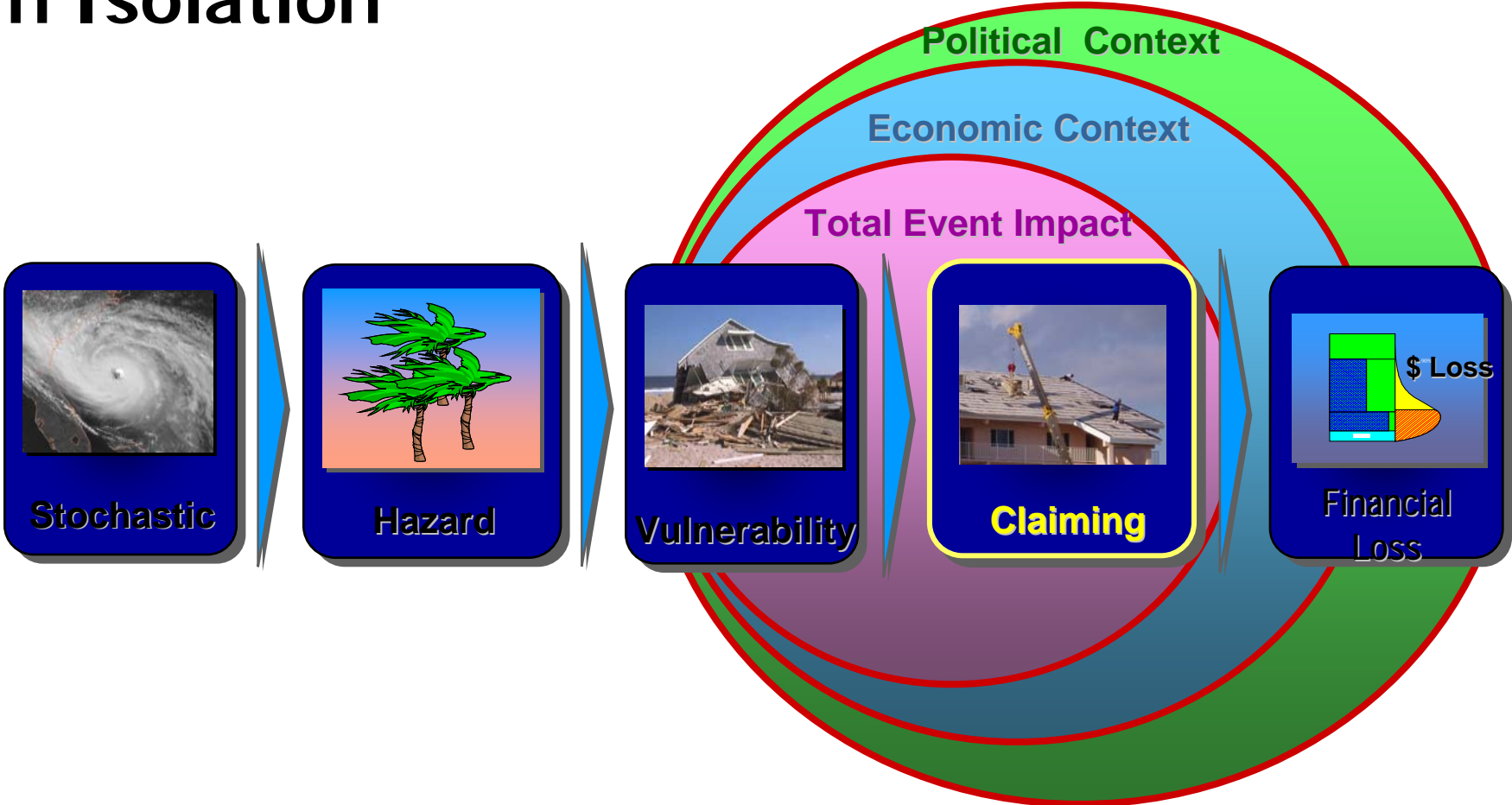


Failings of the Saffir Simpson Scale

- 235 people died (drowned) in Mississippi in Katrina
 - Cat 5 Camille considered a ‘worst case storm’
 - People remained in houses outside any FEMA defined flood zone
- The science has yet to catch up with reality!
 - Storm size and surge inertia both need to be considered in linking hurricane windfield and surge height
- Most critical for the most extreme storms
 - How high would the Katrina surge have been if the hurricane had been Cat 5 at landfall?

Lessons for Super Cat Modeling

In Major Catastrophes Losses Do Not Occur In Isolation



What is a Super Cat?

- Secondary consequences of the event start to become a major proportion of the loss
 - At the extreme the secondary consequence can become larger than the original event
- Characterized by:
 - Containment failures
 - Widespread long term evacuation
 - Systemic macroeconomic impacts
 - eg. Hotels/stores staying closed because there are no customers

Blue Tarp City: New Orleans November 2005

A visual signal of the extent and scale of damage



Secondary Consequences

Meraux (St. Bernard Parish) covered in 672,000 gallons of crude oil (from ruptured storage tank)



(Photos: David J. Phillip / Pool-AP)

Evacuation Leads To Secondary Consequences



Law and Order Containment Failures



The Core Components of Loss Amplification

■ Economic Demand Surge

- Inflation in costs as a result of the excess of demand over supply in the market for both labor and materials

■ Repair Cost Delay Inflation

- Time dependent damage escalation caused by delays in making repairs

■ Claims Inflation

- Relaxation of insurers procedures for policing claims to resist exaggeration and fraud

■ Coverage Expansion

- Expansion of insurance terms & coverages - often as a result of political pressure

Repair Cost Delay in Katrina

Water Penetration + Evacuation = Major Claims Cost Escalation



Roof damage and air conditioner ducts torn open, lets rain penetrate through 1 ft duct



Evacuation left water penetration unattended for two weeks in summer heat and humidity

Claims Inflation



Coverage Expansion



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2005 Hurricane Response



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State Farm® pays additional \$29.8 million in Katrina

Mississippi Commissioner of Insurance George Dale announced **August 13** that State Farm Insurance Company, who agreed to voluntarily re-evaluate Hurricane Katrina slab cases in April, has paid more than \$29.8 million additional dollars in claims payments since the re-evaluation process began. [More...](#)

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State Farm settles 103 Katrina cases in Mississippi

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By Michael Kunzelman, Associated Press

NEW ORLEANS — State Farm Insurance Cos. has settled with 103 policyholders in Mississippi who challenged the company's refusal to cover damage to their homes from Hurricane Katrina, a lawyer for the homeowners said Monday.

Terms of the settlement are confidential, said attorney Chip Merlin, whose law firm represents all 103 policyholders who are part of the agreement.

The deal proves that "small individuals can stand up to large insurance companies and still have a resolution that's acceptable to them," Merlin said.

Forty-seven of the 103 policyholders involved in the pact had filed lawsuits against the Bloomington, Ill.-based insurer; the rest had hired Merlin's law firm to represent them but hadn't filed suit yet.

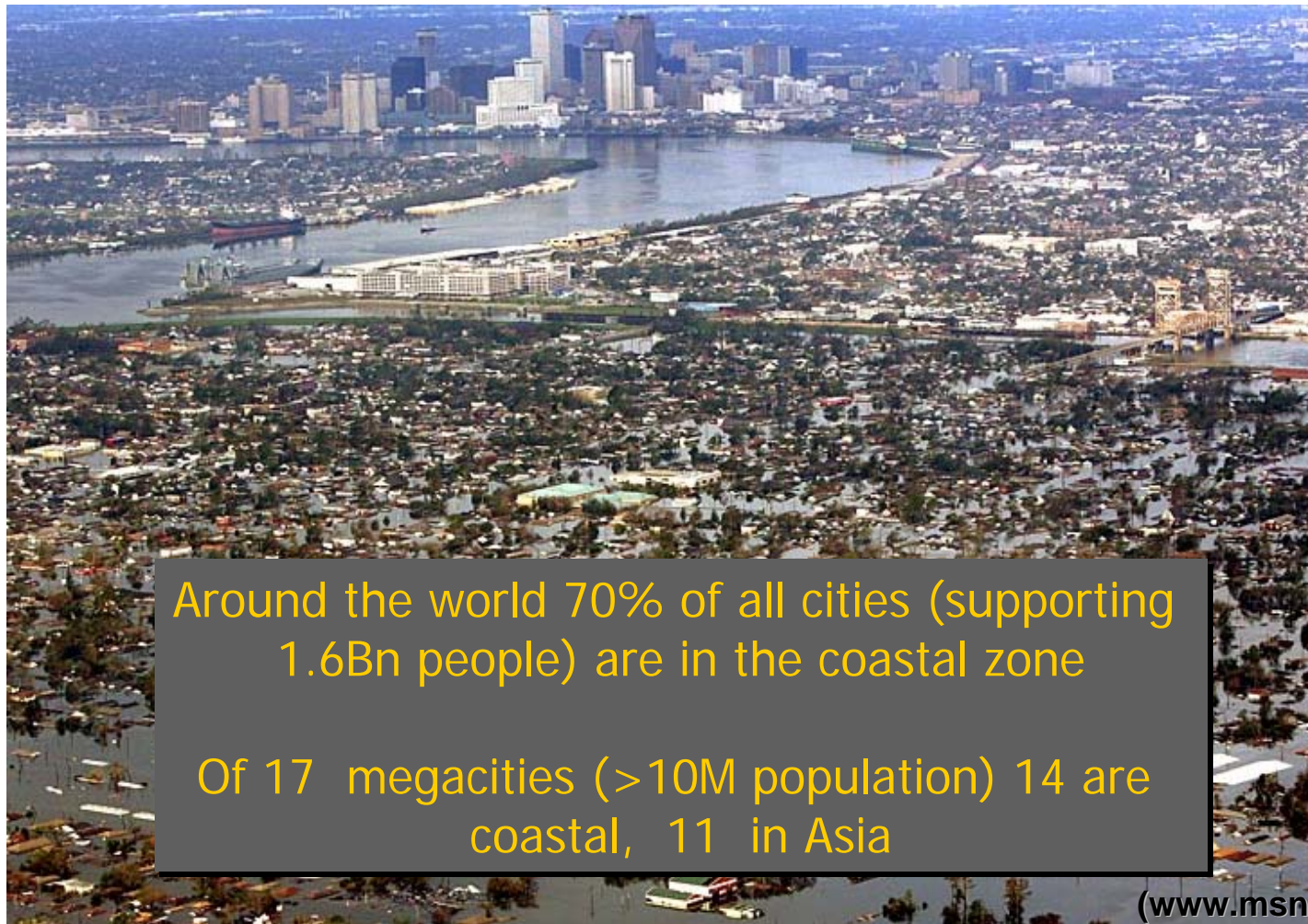
"We're pleased with this settlement in that it spares our customers and our organization from time-consuming and expensive litigation," said State Farm spokesman Phil Supple.

The 1906 San Francisco Earthquake & Fire – Loss Amplification & Super Cat elements

- Secondary fire consequence much larger than original earthquake \$ damage
- Massive coverage expansion
 - Fire Damage Exclusion



The Flooding of New Orleans Was a Geologically Determined Disaster – With a Climate Change Twist



Around the world 70% of all cities (supporting 1.6Bn people) are in the coastal zone

Of 17 megacities (>10M population) 14 are coastal, 11 in Asia

(www.msnbc.msn.com)