

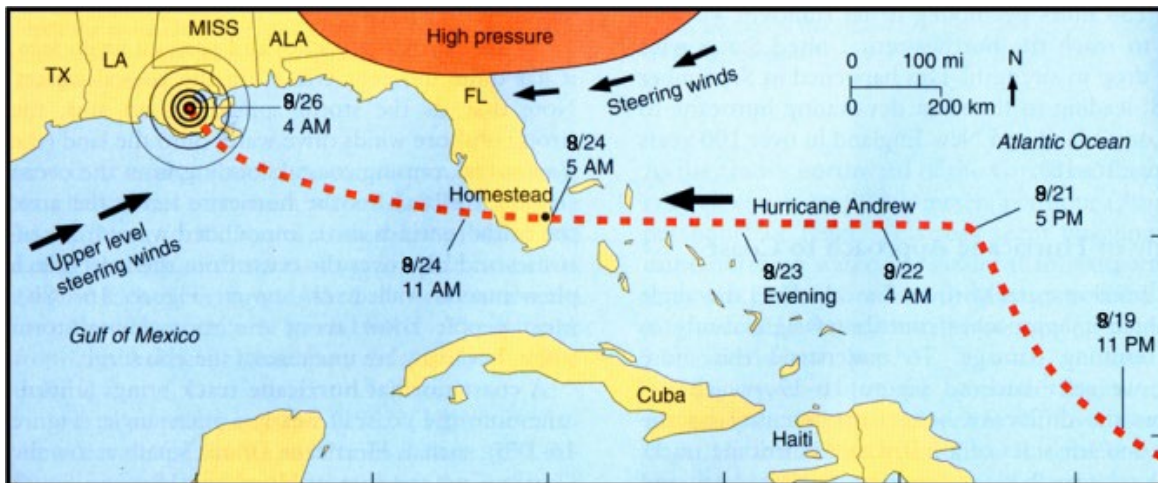
LECTURE #19: Hurricane Case Studies

Date: 31 March 2025

Hurricane Andrew (1992)

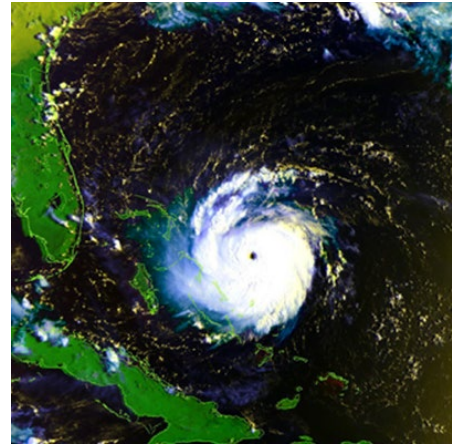
I. Chronology:

- 8/16/92
 - convection focuses
 - spiral clouds develop
 - transitions to tropical depression
- 8/17/92
 - wind shear diminishes
 - Tropical Storm "Andrew" is named
- 8/18/92 - 8/20/92
 - sporadic convection
 - low surface winds and not much strengthening
- 8/21/92
 - wind shear decreases (*promotes storm strengthening*)
 - high pressure area develops over the southern U.S.
 - producing steering winds that turn Andrew westward

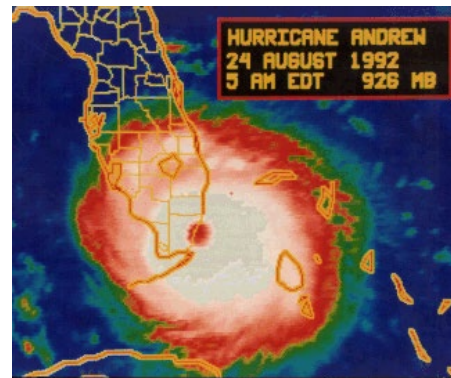


- 8/22/92
 - Andrew reaches hurricane strength
 - high pressure region continues to steer Andrew due west
 - hurricane warning issued for Bahamas

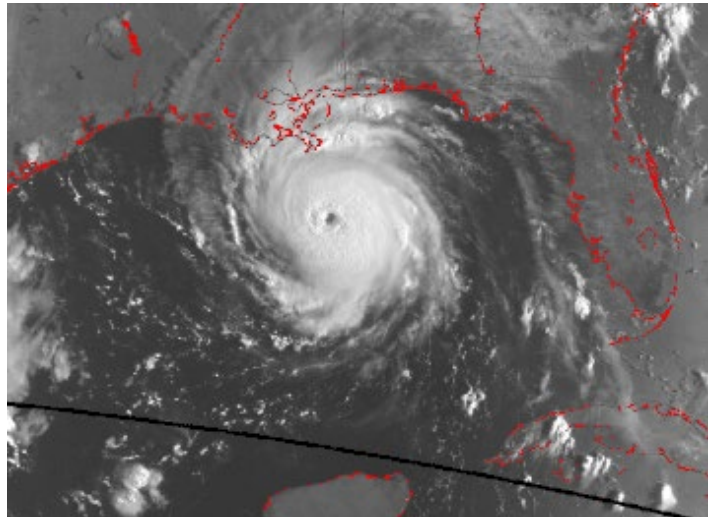
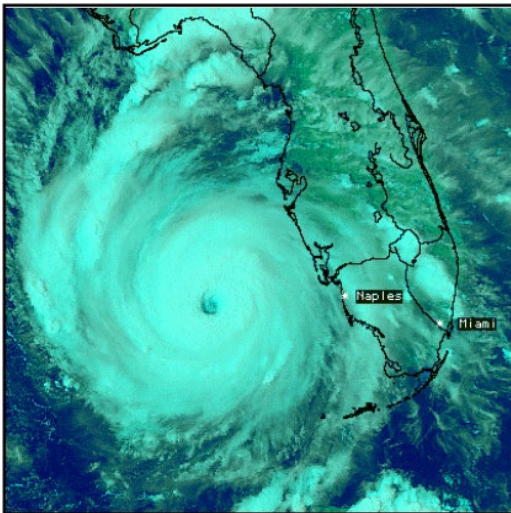
- 8/23/92
 - Andrew reaches peak intensity
 - classified as borderline Category 4-5
 - passes over Bahamas and weakens slightly
 - storm surges 16-23 ft.
 - hurricane warning issued for Eastern Florida
 - expectation of further strengthening with the warm water of the Gulf Stream



- 8/24/92
 - Andrew regains strength over Straits of Florida
 - eye-wall convection strengthens
 - landfall at Homestead, Florida
 - sustained winds 145 mph
 - gusts up to 175 mph
 - maximum storm surge of 16.9 ft.
 - Category 5 at landfall



- resurgence
 - Andrew passes over Southern Florida in about 4 hours
 - maximum storm surge in SW Florida 7 ft
 - storm weakens slightly, but intensifies again over the Gulf of Mexico



- Louisiana landfall (8/26/92)
 - steering winds turn Andrew back to the northwest
 - storm hits the Louisiana coast with Category 3 intensity
 - storm surge reached 8 ft
 - rainfall in Hammond, Louisiana totals 11.92 inches

II. Costs

- Andrew was the costliest disaster in US history (*until Hurricane Katrina*)
 - real estate development along the Florida coast in the 70s and 80s put lives and dollars at risk
 - **total damage = \$27 billion**
 - 26 deaths directly attributable to Andrew
- structural damage
 - 25,524 homes destroyed
 - 101,241 damaged
 - most devastated regions corresponded to the track of the eyewall
 - “mini-swirls” confirmed to happen
- surge damage
 - most deaths associated with the storm surge and strong waves
 - responsible for erosion and damage caused by floating debris
 - severely damaged Florida’s artificial reef system
 - moving nearly 1000 tons of concrete 700 ft. across the seafloor
 - losses to boats alone were estimated at \$½ billion
- “Hurricane Hotel”
 - Holiday Inn in Dade County
 - sustained the greatest amount of structural damage
 - withstood two impacts from the hurricane’s eyewall
 - every window was destroyed
 - the steel-reinforced structure kept the building intact
- airborne debris
 - debris propelled at high speeds by the hurricane’s winds are a major cause of damage
 - numerous examples post Andrew



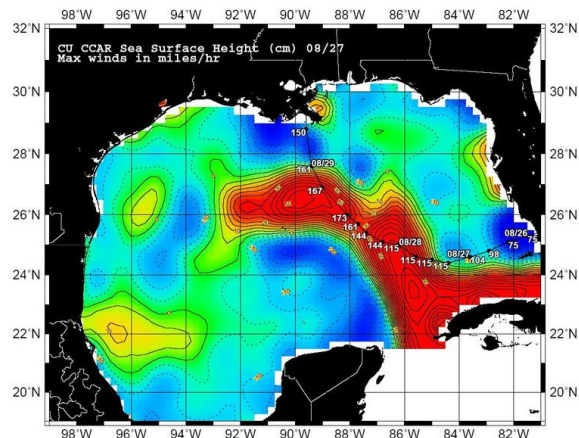
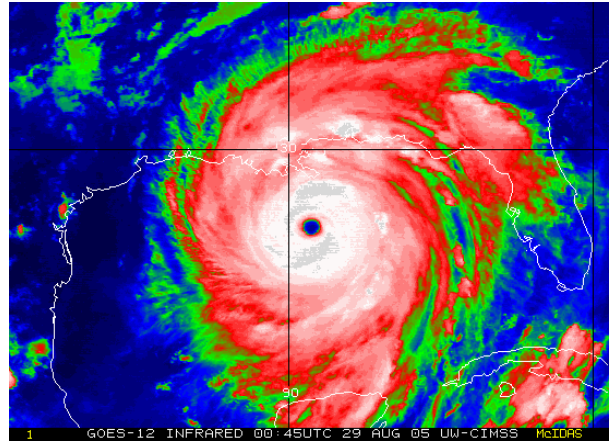
III. Post-Assessment

- although the damage was extensive, it could have been much worse
- if Andrew landed a little north, it would have struck downtown Miami and Ft. Lauderdale
- Andrew also passed far enough from New Orleans to cause little damage there

Hurricane Katrina (2004)

I. Background

- statistics
 - formed: August 23, 2005
 - dissipated: August 31, 2005
 - highest winds: 175 mph (280 km/h) sustained
 - lowest pressure: 902 mbar
 - fatalities 1833
 - damages: \$190 billion (2002 USD)
 - costliest Atlantic hurricane in history
- affected areas
 - Bahamas, South Florida, Cuba, Louisiana, Mississippi, Alabama, Florida Panhandle, and most of eastern North America
 - the costliest and one of the deadliest hurricanes in American history
 - the eleventh named storm, fifth hurricane, third major hurricane, and second Category 5 hurricane of the 2005 Atlantic hurricane season
 - the sixth-strongest Atlantic hurricane ever recorded
- timeline: formed as Tropical Depression #12 southeastern Bahamas at 5:00 PM EDT on August 23, 2005
 - upgraded to Tropical Storm Katrina on the morning of August 24
 - hurricane only two hours before it made landfall around on August 25
 - between Hallandale Beach and Aventura, Florida
 - August 26
 - regained hurricane status about one hour after entering the Gulf of Mexico
 - rapidly intensified during its first 24 hours after entering the Gulf
 - due in part to the storm's movement over the warm sea surface temperatures of the Loop Current
 - August 27: the storm reached Category 3
 - August 28: attained Category 5 status
 - peak reached 6 hours later
 - with maximum sustained winds of 175 mph (280 km/h)
 - a minimum central pressure of 902 mbar
 - then weakened because of the cooler waters near the coast

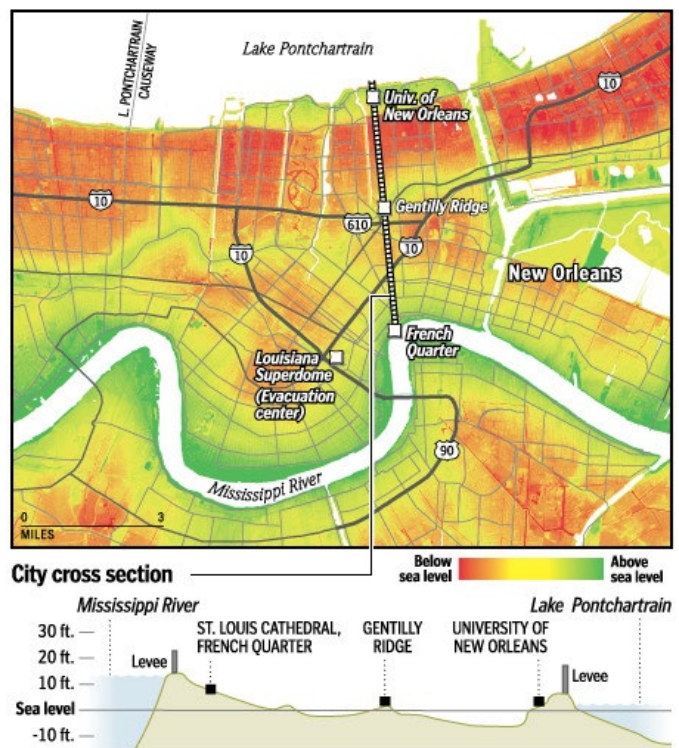


click on the map for the video file

- made its second landfall at 6:10 AM CDT on August 29 as a Category 3
 - near Buras-Triumph, Louisiana
- made its third landfall near the Louisiana/Mississippi border
 - 120 mph sustained winds
 - record storm surges (> 20 ft) along the entire MS and AL coastlines
- lost hurricane strength more than 150 mi inland, near Jackson, Mississippi
- downgraded further to a tropical depression near Clarksville, Tennessee



- New Orleans, LA
 - computer models
 - city of New Orleans had a strike probability of 29% by August 28
 - considered a potential catastrophe
 - because 80% of the New Orleans metro area is below sea level along Lake Pontchartrain
 - levees separating Lake Pontchartrain from New Orleans were breached by the surge
 - ultimately flooding roughly 80% of the city
 - many areas of neighboring parishes



- death toll:

<u>State</u>	<u>Deaths</u>	<u>State</u>	<u>Deaths</u>
Alabama	2	Mississippi	238
Florida	14	Ohio	2
Georgia	2	Unknown	53
Kentucky	1		
Louisiana	986-1577	Total	1245-1836

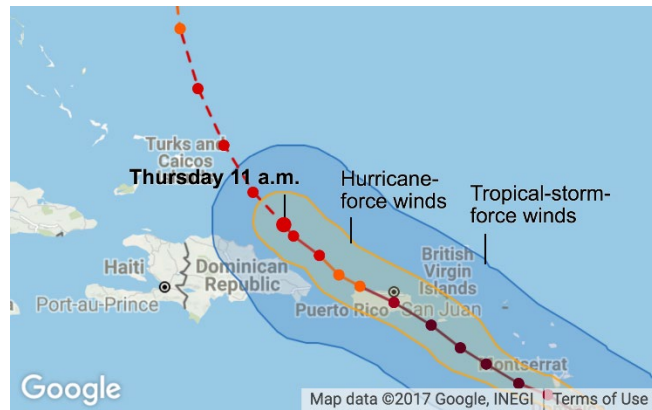
- aftermath
 - **why was this storm one of the worst natural disasters in U.S. history?**
 - waited too long?
 - 10:00 AM on August 28, shortly after Katrina was upgraded to a Category 5 storm, New Orleans mayor Ray Nagin ordered the first ever mandatory evacuation of the city
 - many citizens did not listen (*or could not leave*)
 - slow response time?
 - Homeland Security Secretary Michael Chertoff designated Michael Brown (head of FEMA) as the primary federal official to lead the deployment and coordination of all federal response resources
 - he was recalled 8 days later
 - later, leaked video footage and transcripts of top-level briefings during the week before the storm indicate that federal officials did inform Bush and Chertoff of the danger of levee breaches
 - within days of Katrina's landfall, public debate arose about local, state, and federal governments' role in the preparations for and response to the storm
 - President Bush, Michael Brown, Mayor Ray Nagin, Governor Kathleen Blanco all received blame



Hurricane Maria (2017) - brief

I. Notable Fact/Figures:

- worst storm in 80 years to hit PR
 - reached cat 5 (Dominica)
 - Cat 4 at PR
 - political will to help/help faster?? Debatable



- by 11/3/17: 50% of roads back open
- NYC shelters were still full after a significant period of time
 - US citizens as refugees (ramifications for voting, etc.)
 - 1.2 million still no electric (Jan)
 - March 5: 16% still without power

II. Other Notable Fact/Figures:

- \$94B in damage / only \$5B from US gov't so far
- Irma hit 2 weeks before (major storm)
 - already damage
- death toll??
 - 112 dead official / > 3000 (now)
 - mayor of Corozal, PR confirmed higher death toll
- 9/16/17 – named (tropical storm)
- 9/18/17 – cat 5
- 10/3/17 – died out

Statistics Progress in Puerto Rico

Hurricane Maria Update

Signs of Recovery	Cell Service	61%	96%	96%	98.5%
	Potable water	69%	90.63%	86%	98.82%
	Patients cared for in hospitals by federal workforce	6,100	35,777	38,037	38,037
	Open ATMs	1,047	1,300	1,586	1,586
	Generators	148	645	933	708
	Gas Stations	78%	85%	84.3%	88%
	Power Generation	21%	49%	65.4%	80.3%
	Installation of Blue Roof	439	11,196	23,455	55,692
		30 DAYS	60 DAYS	90 DAYS	120 DAYS
		Numbers of days after Maria made landfall			

