

Natural Disasters

Lecture 10_b Ch 11 – Hurricanes

Text Source Today:
Chapter 11

11.2: Ch. 11 – Hurricanes

- **Notable Atlantic Hurricane Seasons:**

<http://weather.unisys.com/hurricane/>

- **Least Active Season: 1983**, four tropical storms (three hurricanes). *El Nino* suppressed?
 - **Most Active Season: 2005**, when 28 tropical storms (15 hurricanes) were documented, including tropical storm “**Zeta**” on New Year’s Day **2006**. This season also was the first to see three **Category 5** hurricanes (Katrina, Rita, Wilma) and to need **Greek letter** names!
 - **In 2004**, tropical storm Bonnie and four (4) hurricanes (Charley, Frances, Ivan, Jeanne) made landfall in **Florida**!
 - **In 2007**, two **Category 5** hurricanes (Dean, Felix) made landfall in Mexico.
- ♦ **The Evacuation Dilemma:** Population growth is **far faster** than the building of new roads and bridges. As many as **50 million people** live along the Atlantic and Gulf coasts. Some large cities take up to **72 hours** to evacuate, but hurricane **landfall** forecasts are not that accurate 3 days in advance. It has been said that the cost of evacuation is “**\$1 million per mile** of coastline!” While likely not that pricey, it is still expensive. People do not tolerate “**false alarms!**”
- ♦ If ever caught in a situation where you are near a coastline (or worse, on an island) and cannot evacuate in time, you must seek “**vertical evacuation.**” Go inside the strongest shelter available and go **high enough inside** to withstand the flooding by the storm surge.

- **Hurricane Mitigation:** 1) better building codes; 2) land-use planning; and, 3) coastal development restrictions.

♦♦ Most buildings destroyed in a hurricane begin with **the roof being torn off**. Roofs need to be strengthened to pass the wind energy from the roof down through the walls to the ground. Overhanging eaves need to be eliminated or strengthened to better withstand **uplift** in high winds. Hurricane straps can be installed where the roof meets the walls. And, higher grade **roofing** materials need to be used.

- Hurricane winds create lots of **wind-borne debris**, that break windows and pierce entry and garage doors. All exterior glass and sliding-glass doors need to be made of shatter-proof glass or be protected by **hurricane shutters**. Otherwise, **plywood** should be nailed over all windows and sliding-glass doors.

- Stow or secure all outdoor items, such as patio furniture, trash cans, barbecues, awnings, potted plants and toys.

- **Land-use** planning can prevent lots of damage. For example, in low-lying coastal areas, create parks, farm fields, golf courses, nature preserves and other uses where **flooding** will not create disasters. Zone the **high** ground for homes and buildings.

- A **building boom** is underway along the Atlantic Ocean and Gulf of Mexico shorelines. Thousands of expensive new homes and condos are waiting for the inevitable **destruction by a hurricane!** FEMA estimates that in the next 60 years, **25%** of houses within **150 m (500 ft)** of the shoreline will fall into the water unless mitigating actions are taken!

- National Hurricane Center (NHC): <http://www.nhc.noaa.gov>

♦ **Galveston, 1900, “Isaac’s Storm”:**

in the late afternoon on 8 September, the **deadliest natural disaster in U.S. history** struck Galveston Island, a low-lying, sandy barrier beach. At the time, it was the wealthiest city in

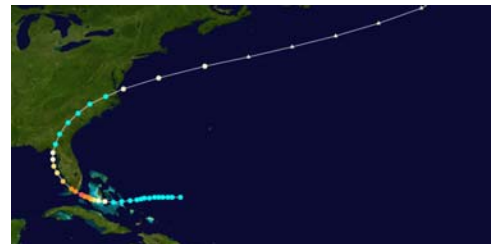
Texas, with about 38,000 residents. The **Category 4** hurricane arrived at high tide and combined with the storm surge to flood the highest point on the island to a depth of 0.3 m (1 foot), with battering, wind-blown (210 km/hr; 130 mph) waves on top!



• The next morning, after the hurricane, half the buildings were destroyed, most of the remainder damaged. There was no water, no electricity, no medical supplies, the boats were wrecked and bridges down. About **8,000** people had died. (A seawall was built, but another hurricane in 1915 claimed **275** lives.)

• **Other Notable U.S. and Worldwide Hurricanes:**

♦ **“The Labor Day Hurricane”** in **1935** reached **Category 5** status, crossed the FL Keys and then came up the east coast, killing **408** people.



♦ **Hurricane “Camille”** in **1969** reached **Category 5** status, slammed into the Gulf Coast at Pass Christian, MS, with a 7.3 m (24 ft) high storm surge, leaving **256** dead.

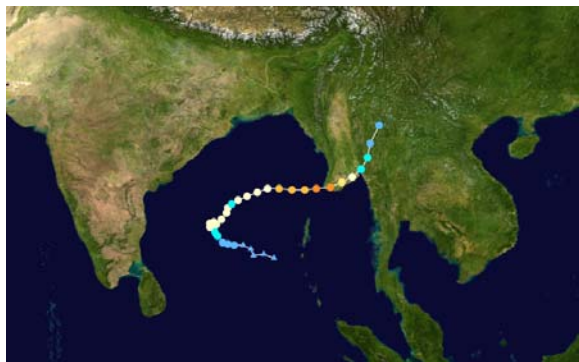
♦ Hurricane “**Andrew**” in **1992**, was recently re-classified a **Category 5** hurricane, crossed south-FL before slamming into southern LA. The damage in FL looked more “tornado-like” due to the storm’s compact size.

“**Andrew**” became the most costliest Atlantic hurricane (\$26.5 billion 1992 USD), killing **65** people.



● Hurricane “**Mitch**” in October **1998** became one of the strongest **Category 5** hurricanes on record in the western Caribbean. The storm stalled off the coast of Honduras pouring up to **5 feet of rain** on

Honduras and Nicaragua for two days! The crater lake atop **Casitas Volcano** filled with water and gave way. The resulting **mudslide (lahar)** buried four villages. In total, it killed over **11,000** people (second only to the “**Great Hurricane**” of **1780** that killed an estimated **22,000** on several Caribbean islands).



● Tropical Cyclone “**Nargis**” on 3 May **2008** made landfall in **Myanmar (Burma)**, forcing a storm surge up to 3 m (10 ft) high well inland. The resulting flooding killed more than **100,000** and left another **50,000**

missing, not to mention 3 million homeless. **The government closed their border and refused international aid.**

● **Japan, Taiwan, China, Guam** and the **Philippines** are “sitting ducks” for typhoons. They are in the path of Earth’s **most active** tropical cyclone “breeding ground.”

◆ **Bangladesh**, the **most vulnerable**

spot on the planet for tropical cyclones, is a densely populated country that sits entirely near sea level, on sediments eroded from the Himalayas. On 12-13 November

1970, during high tide of a full moon, **super tropical cyclone “Bhola”** made landfall, with a storm surge of 7 m (23 ft), killing an estimated **400,000** and many large farm animals.



● On 30 April **1991**, an unnamed tropical cyclone brought a storm surge of 6 m (20 ft) killing **140,000**, while killing a half-million farm animals. About 1 million homes were destroyed, leaving at least 10 million

people homeless! The population of **Bangladesh** is expected to **double** in 30 years!

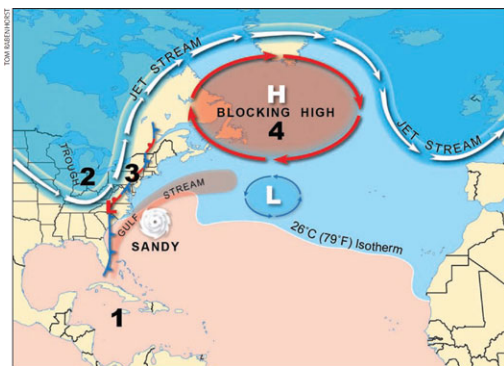
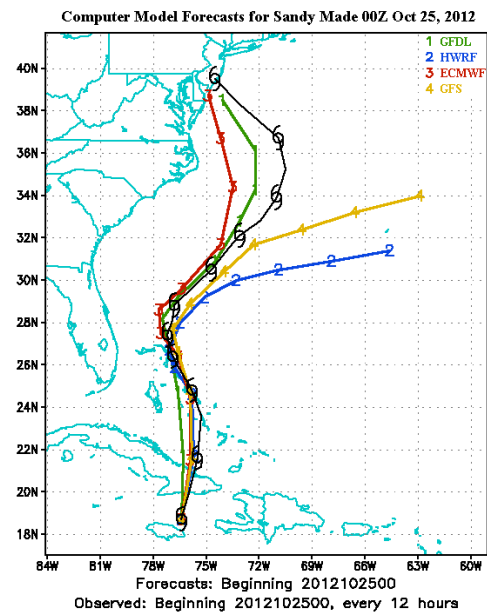
◆ **Hurricane “Katrina”** in **2005**, was “only” a **Category 3** hurricane when it made landfall east of New Orleans, at Gulfport Beach, MS, with a **record 28 foot storm surge!** “**Katrina**” caught New Orleans unprepared and

exposed a seriously flawed emergency response plan. At least **1800** people died in the flooding. “**Katrina**” is still the costliest (\$108 billion 2005 USD) **U.S. natural disaster**.



♦ **“Superstorm Sandy”** was the deadliest (**286** fatalities in 7 countries) and most destructive (\$65 billion 2012 USD) hurricane of the **2012** Atlantic hurricane season. Only **“Katrina”** caused more property damage in U.S. history.

- On 22 October, **“Sandy”** formed over the western Caribbean Sea and was upgraded to a Category 1 hurricane before making first landfall near Kingston, Jamaica.
- On 22 October, the European Centre for Medium-Range Weather Forecasts (**ECMWF**) had correctly predicted the ultimate track of **“Sandy”** nearly **8 days in advance!**
- On 24 October, there was still major disagreement between the computer models on the forecast track of **“Sandy”**, but three days later, all the models finally agreed with the **ECMWF**.



♦ The primary reason for **“Sandy”** making a “left turn” to the northwest to an ultimate landfall near Brigantine, NJ on 29 October, was due to a **blocking high pressure** over the **North Atlantic**. The approach of a typical mid-latitude **upper-level trough (cold core)** and related **arctic cold front** to the west of **“Sandy” (warm core)** to set up the rare conditions for creating a powerful “hybrid” storm. Just before landfall, **“Sandy”** had an extraordinary wind diameter of **1150 miles**.