Catch The SEACOOS Wave!

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South Atlantic Coastal Ocean Observing System

"We've made the investment needed to venture into the skies, and it has paid off mightily. We've neglected the oceans, and it has cost us dearly. This is the time to do for [the oceans in] the 21st century what our predecessors did for space"

- Sylvia Earle

Why are we interested in observing ocean waves?

- Safe and efficient shipping requires an understanding of waves
  - 95% of U.S. foreign trade passes through ports and harbors
  - 50% of all materials shipped through U.S. waters are hazardous
- Coastal states earn 85% of all U.S. tourism revenues.
  - Surfing, fishing, boating, swimming safety and pleasure requires knowledge of waves
- Safe extraction: 25% of U.S. natural gas production and about 17% of U.S. oil production come from the Outer Continental Shelf

How Does This Information Help?

Safe Marine Operations

Commercial Transportations
Search and Rescue Operations
National Security

Mitigating Natural Hazards

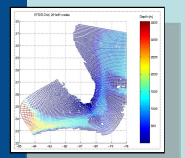
Coastal Storm Preparedness
Coastal Erosion Prevention
Flooding

Living Marine Resources

Commercial Fishing
Endangered Species
Aquaculture

Scientific Contributions

Baselines
New Discoveries
Detect Changes



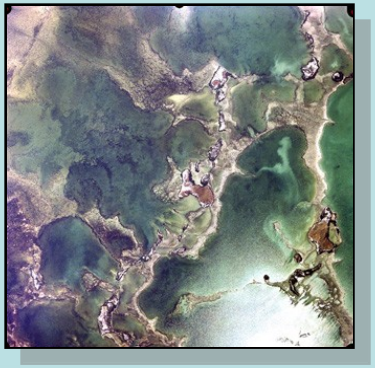
What Other Parameters Does Ocean Observing Monitor?

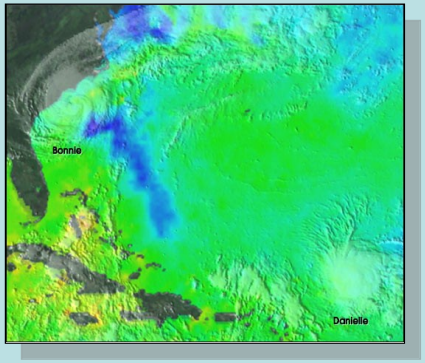
Physical Ocean Conditions

Atmospheric Conditions

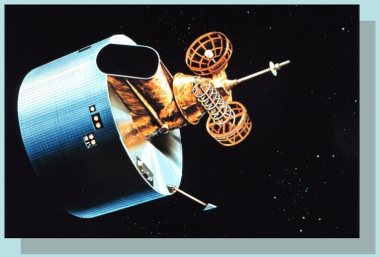
Biological and Ecological Conditions

- Temperature
- Wind
- Currents
- Water Levels
- Salinity Fields
- Pressure
- Fog
- Nutrients
- Contaminants
- Benthic Habitat
- Chlorophyll





SECOORA wave observations use many instruments



“What’s In the Field ?”

- in situ moored and drifting sensing systems offshore and in currents
- coastal and offshore instrumented installations, such as platforms and towers
- remote sensing from satellites and aircraft
- shore-based remote sensing with radar CODAR

Every ocean observing system depends upon the actual equipment in the field.

Why use waves in the Classroom?

Ocean Observing wave data and images provide real time information, graphing, predictions and analysis. These apply to science standards in earth sciences, physical sciences, physics, marine sciences

Water Waves are fun to surf, but they can be dangerous in nor'easters, hurricanes and tsunamis.

COSEE and SEACOOS--Wave Lessons and Poster!

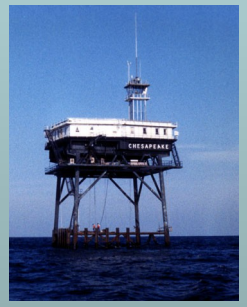
Get the Poster and lessons: secoora.org
Find out about your COSEE: COSEE.NET

Use archived wave information in your classroom

- **Predict** maximum wave size resulting from sustained winds (duration) over large distances (fetch).
- **Investigate** hurricane waves, generated by hurricane winds in the SE, which depend on the size of the storm (fetch for the winds) and how fast the hurricane is moving (duration over a given fetch).
- **Compare and analyze** wave heights at South East Atlantic shorelines. Investigate the differences.

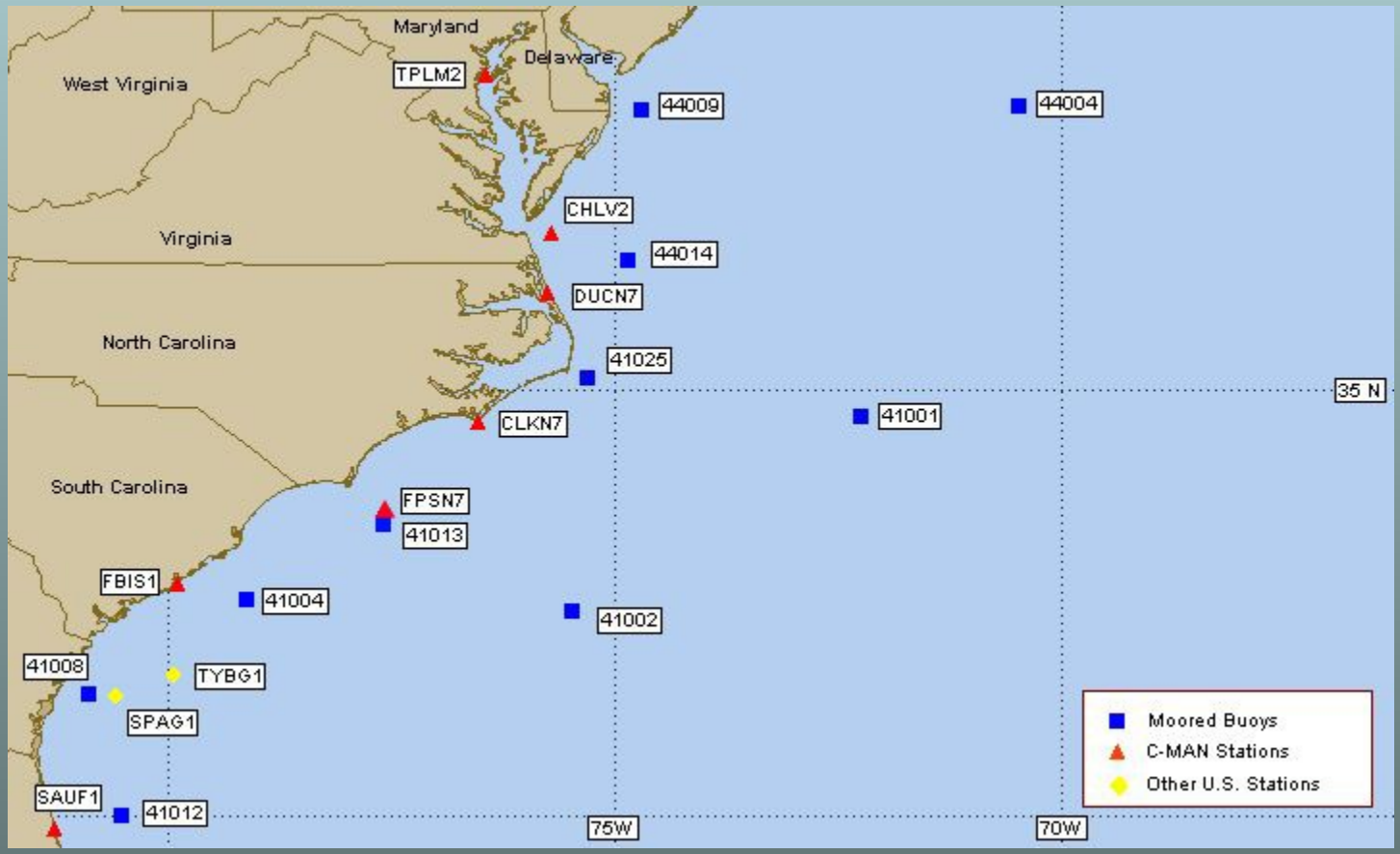
How and where are Waves measured?

National Data Buoy Center (http://www.ndbc.noaa.gov/)



Towers

Buoys

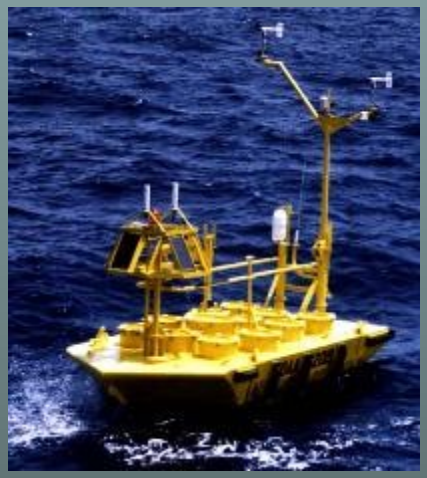


Buoys have instruments to measure vertical motion--rise and fall.
Towers have a high resolution, submerged , pressure sensors.

Instrumented Buoys

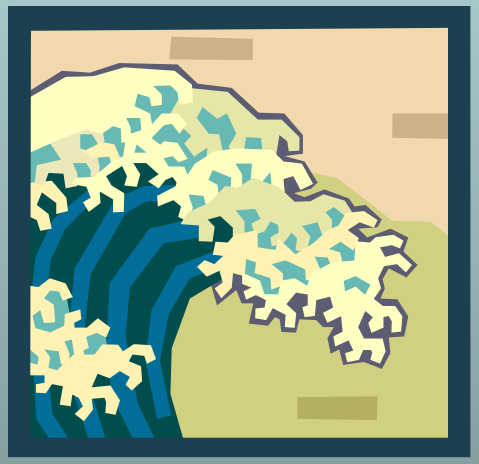
Diamond Shoals Buoy
8 nautical miles
off Cape Hatteras, NC

Gray's Reef Buoy
40 nautical miles off Savannah, GA



Cape Canaveral Buoy
120 Nautical miles off Florida

Fact to Know: Wave Data on most graphs is "Significant Wave Height"



Wave height is the distance between the crest and the trough.

Instruments are programmed to provide significant wave height.

- Definition: Significant wave height is the average height of 1/3 of the highest waves.
- Significant wave height does not identify the largest waves in a storm.

Using Data in a Lesson

Idea: Follow a Hurricane Event to compare wind speed and wave height.

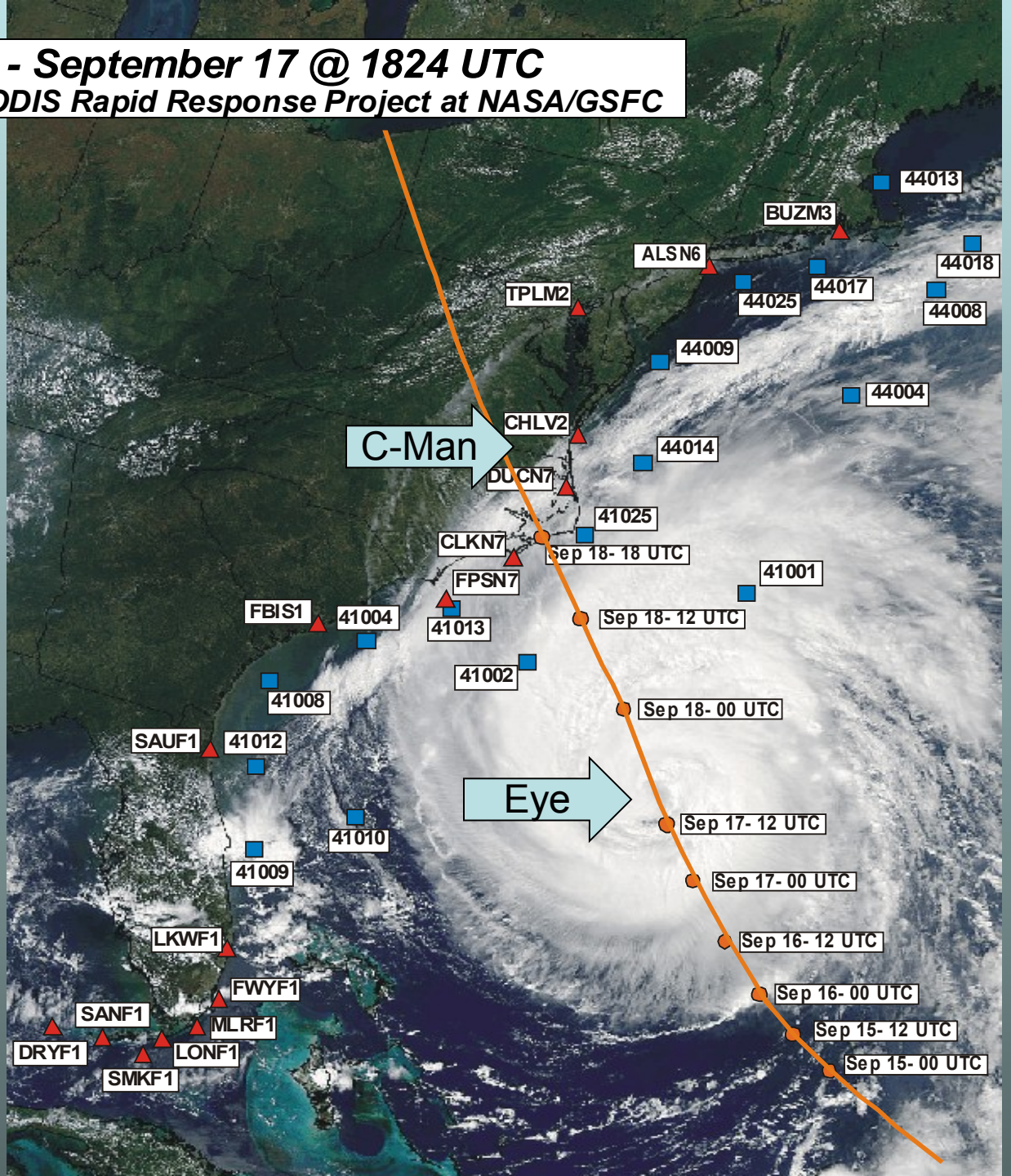
Sample 1: Hurricane Isabel, September 2003, off South Atlantic Bight

Sample 2: Hurricanes Isadore, Lili and Hannah, Lili, September 2002, off west coast of Florida

Hurricane Isabel - September 17 @ 1824 UTC

Image courtesy of MODIS Rapid Response Project at NASA/GSFC

Episodic Events, such as hurricanes, provide examples of wave changes



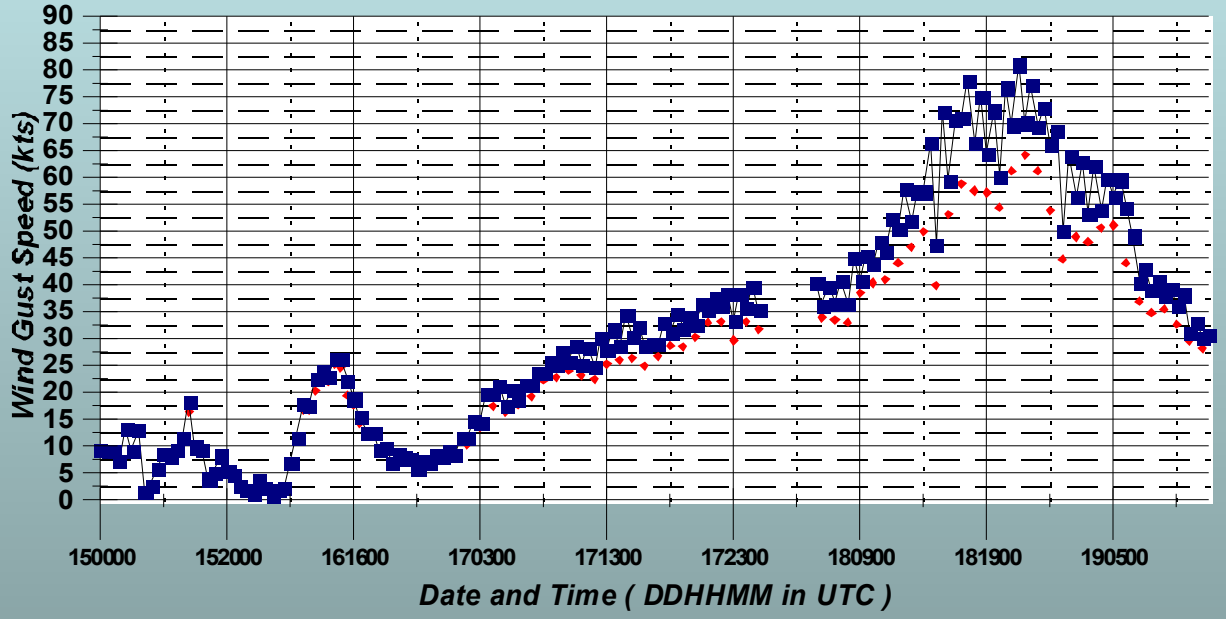
Symbols

C-Man Platforms

Moored Buoys

Eye of Storm

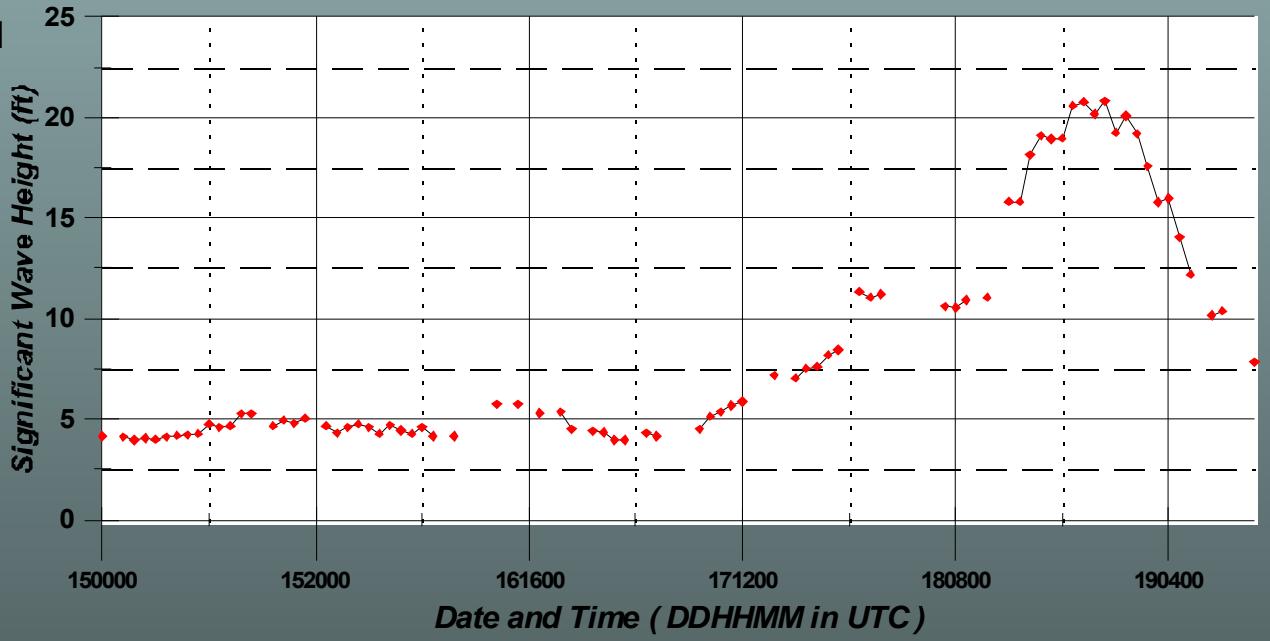
Hurricane Isabel-CHLV2 C-Man Station
September 15-19, 2003



Blue line = 5 second peak wind gust speed
Red line = 2 minute average wind speed.

Student Inquiry: What is the relationship between wave height and wind speed?

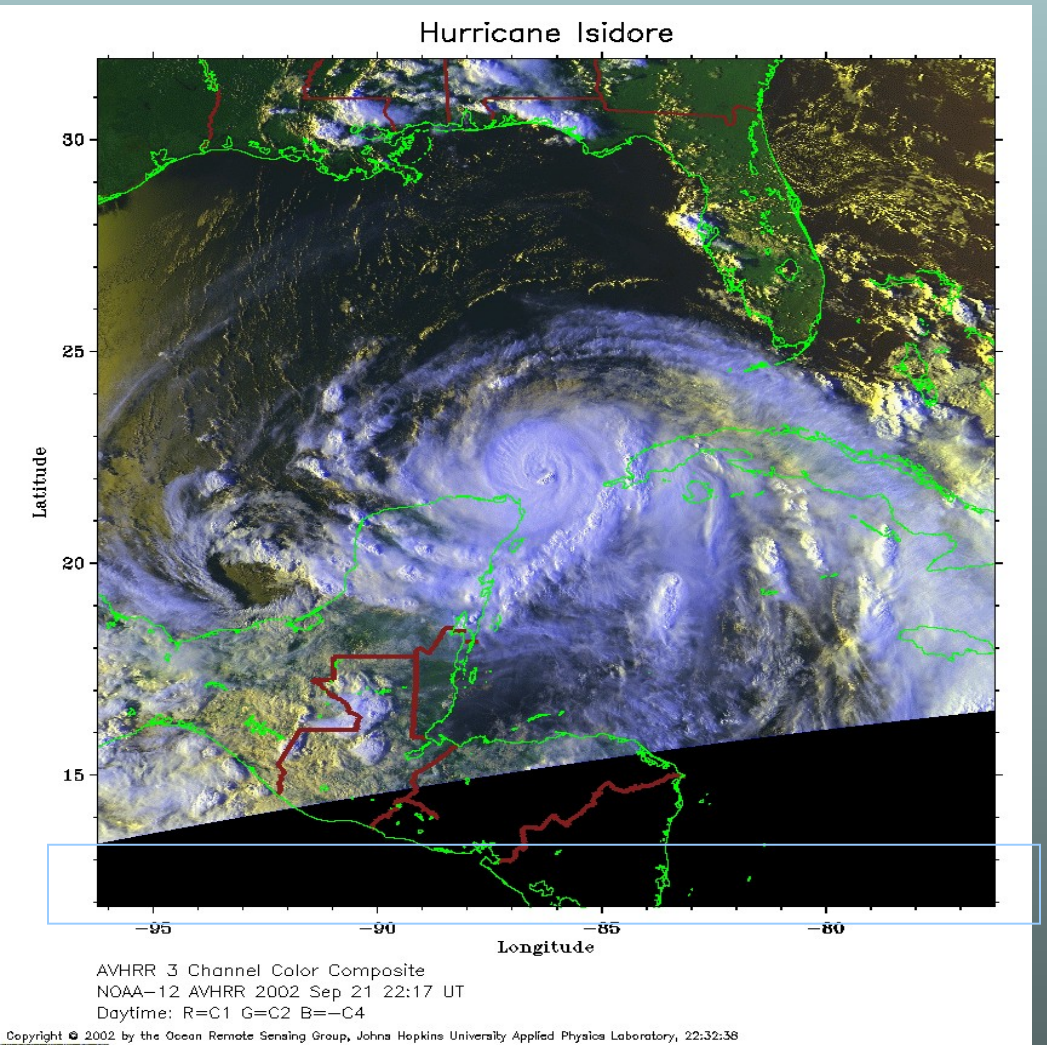
Hurricane Isabel- CHLV2 C-Man Station
September 15 - 19, 2003



Two of eight hurricanes near Florida in 2002

September 18, 2002

Hurricane Isidore



September 30, 2002

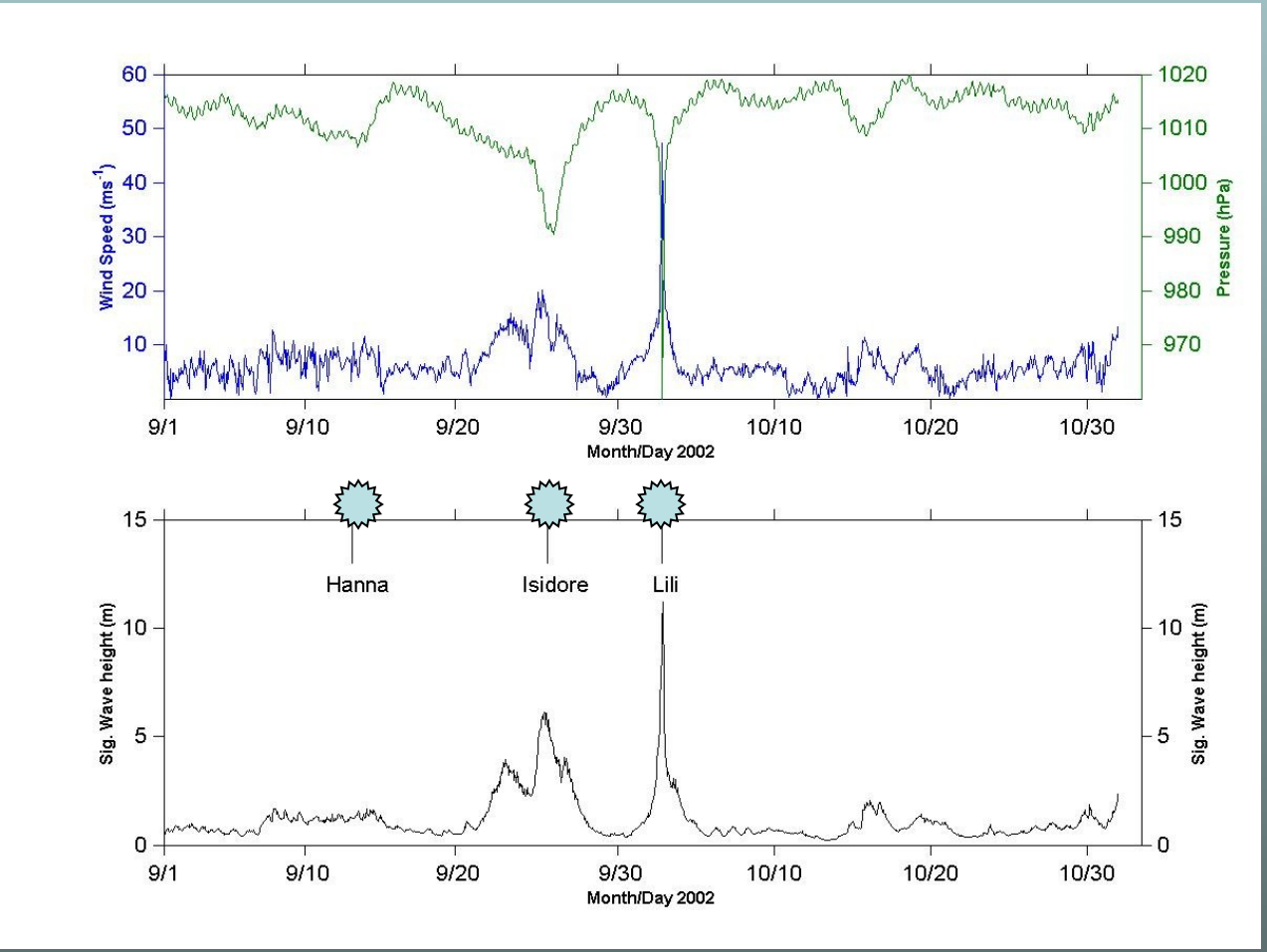
Hurricane Lili

Hurricanes: Hanna (9-14-02)
Isidore (9-18-02)
Lili (9-30-02)

Compare the wind speed vs wave heights

SPEED

WAVE HEIGHT



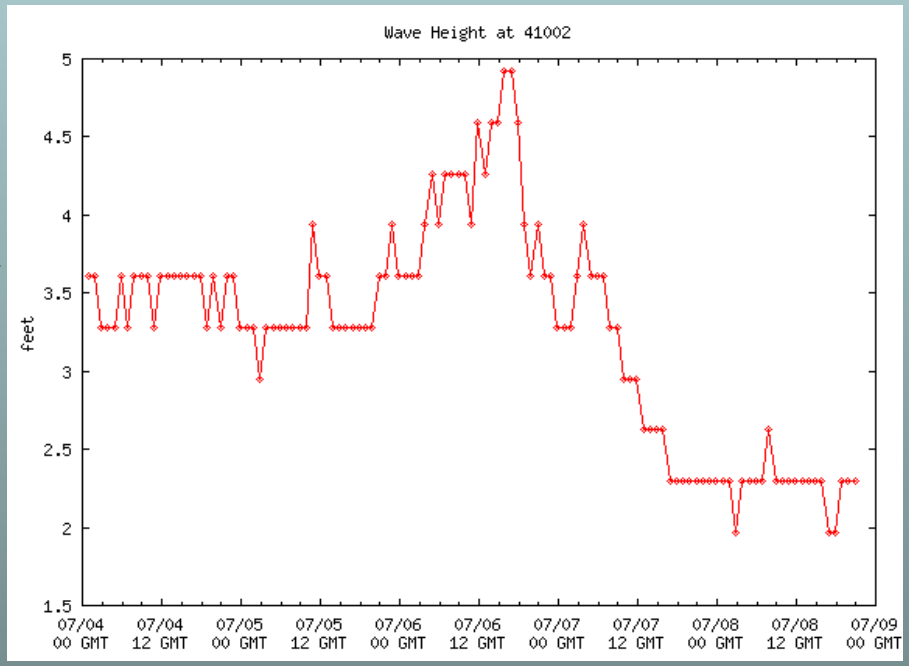
Idea: Find current wave data

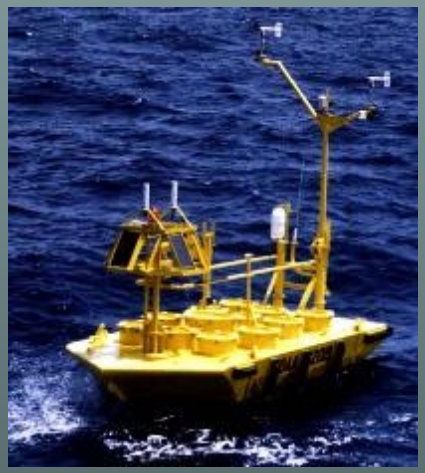
1. Use a 5 day graph from the National Data Buoy Center

2. Select your buoy and dates

2. Sample of wave data July 4-9, 2004

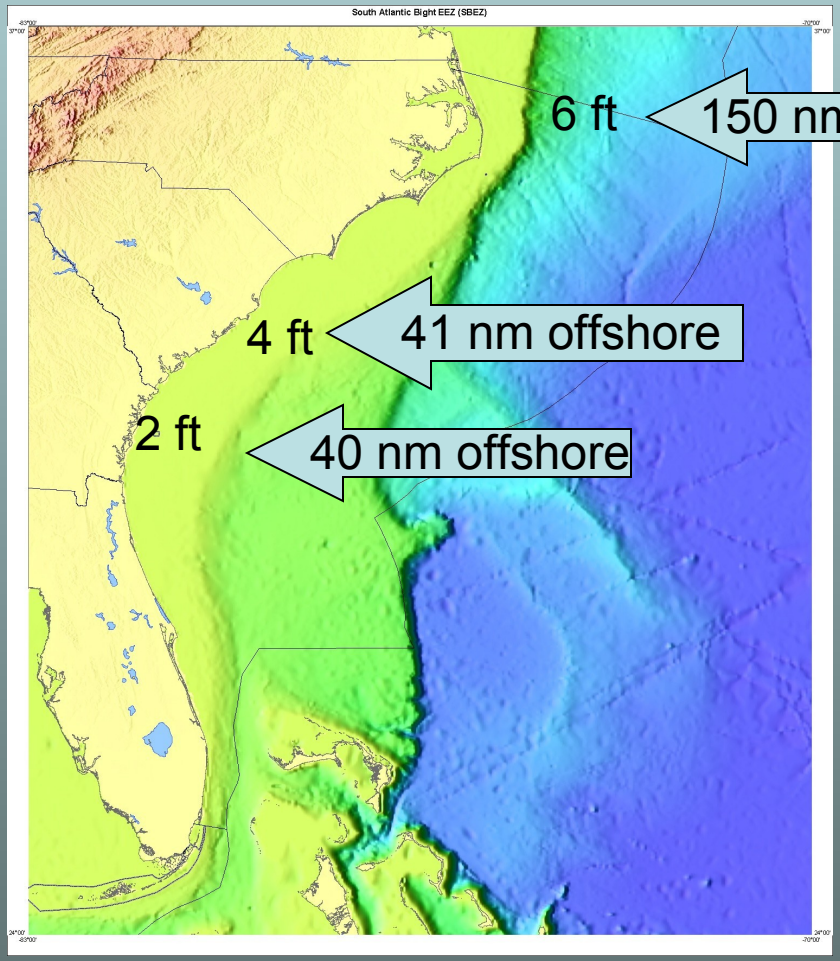
3. Compare to winds





Buoy 4102
250 nautical miles off Charleston, SC

Idea: Compare Average Wave Heights in the South Atlantic Bight



Increasing width of the Continental shelf Increases bottom friction of Waves—so what happens?

Check NBDC under historical wave data to compare heights.

Web References:
Wave Conditions and Classroom Lessons

USING REAL TIME WAVE DATA

- The National Data Buoy Center. You can select location and buoys to find real time wave height: http://www.ndbc.noaa.gov/

- US graphic of daily waves and weather for sailors: http://www.intellicast.com/Sail/World/UnitedStates/WaveHeights/

- To learn about wave measurements from the National Data Buoy Center: http://www.ndbc.noaa.gov/wavecalc.shtml
- East Coast Surf Waves: http://www.surfinfo.com/html/fnmoc.html
- NOAA's Wave Watch III: http://polar.wwb.noaa.gov/waves/

LESSONS

- National Geographic Activity on Interactive Waves: http://www.nationalgeographic.com/xpeditions/lessons/07/g35/wavesheigh
- http://www.thecoolroom.org/swimmers/swim_help_waves.htm