

Evacuate!

Overview

Students will plot the pathways of storms in the Atlantic Ocean and the Gulf of Mexico (GOM) to predict whether drilling and production facilities in the GOM will need to be evacuated.



Source: NOAA

Background

After hurricanes Katrina and Rita, the U.S. government agency Minerals Management Service (MMS) and oil companies recognized the need to update the "Hurricane Operations Plan." This plan, which is filed by each operator, outlines their evacuation methods, measures for 'shutting in' the oil and gas production, and start-up procedures for post-storm recovery. The most important priority is that there is no injury or loss of life. A typical plan resembles the one shown on page 54.

Levels

Grades 5 - 8

Concepts

Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-5.

Next Generation Science Standards

Skills

Classification, Gathering Information, Interpreting Data, Predicting, Graphing

Objectives

Students will use latitude and longitude coordinates to determine the pathways of storms heading toward the Gulf of Mexico and the Atlantic Ocean. They will use charts to categorize the storms and determine the storms' stages. The students will predict whether drilling rigs and platforms need to be shut in.

Materials

- Evacuate the Rig Student Page
- Atlantic Basin Hurricane Tracking Chart
- Storm Coordinates page
- Hurricane Categories and Stages of Hurricane Development tables
- Liquid bluing (found in soap section of grocery store)
- Colored pencils
- Atlantic Hurricane Tracking Chart
- Answer Key

Time Considerations

Preparation: 10 minutes

Activity: 90 minutes

Evacuate!

In 2010, the MMS was dissolved, and a temporary agency was established: The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). In late 2011, this agency was also dissolved and split into three new agencies. The functions of the Bureau of Ocean Energy Management (BOEM) includes leasing, plan administration, environmental studies, economic analysis, and the renewable energy program. The functions of the Bureau of Safety and Environmental Enforcement (BSEE) encompass all field operations, including permitting and research, inspections, offshore

regulatory programs, oil spill responses, and training and environmental compliance.

The next priorities of the BSEE are to protect the nation's supply of oil and gas from production and transportation disruption and to protect the environment from oil spills. All wells in the Outer Continental Shelf (OCS) are equipped with downhole safety valves that shut off the flow of oil in the event of an emergency. These valves are closed when a hurricane is forecast, and they remain closed until the BSEE gives the go-ahead for re-opening. (The third agency, ONRR, is discussed in the "Offshore Lease Sale" activity within this curriculum.)

During the height of Hurricane Katrina, 95% of oil production and 83% of gas production in the OCS was shut in. Offshore operations maintained a record of no loss of life and no significant environmental damage from wells on the OCS. The BSEE and the oil industry will continue to refine their plans to minimally disrupt oil and gas production in the GOM, while protecting marine environments and the safety of personnel.

Since 1953, the National Hurricane Center has created lists for naming tropical storms in the Atlantic. An international committee of the World Meteorological Organization now maintains and updates the lists. The original name lists featured only women's names. In 1979, men's names were introduced, and they now alternate with the women's names. Six lists are used in rotation. Thus, the list from 2010 will be used again in 2016.

The lists only change if a storm is so deadly or costly that the future use of its name for a different storm would be insensitive.

Hurricane Operations Plan

Upon notification that a hurricane is entering the Gulf of Mexico:

- 1.** All non-essential personnel are removed to shore by ship or helicopter. Personnel with shut-in responsibilities remain on the drilling rig or production platform.
- 2.** To prevent spills should the platform be damaged, valves 'shut' in the oil and gas flow until it can be safely restarted.
- 3.** All remaining personnel are evacuated before the storm hits.
- 4.** Operators report shut-in statistics to BSEE.
- 5.** After the storm passes, operators return to inspect for damage both above and under water.
- 6.** Repairs are conducted out both above and under water.
- 7.** Divers or Remotely Operated Vehicles (ROVs) must conduct or complete inspection of pipelines. A check for flow, leaks, or other damage is also required.
- 8.** After the repairs are completed, operators and lessees provide their initial start-up plans to BSEE, who will review them for safety concerns.
- 9.** Operators provide updated status reports each month as the start-up process continues.
- 10.** When the inspections and repairs are completed and environmental safety is assured, the start-up process is finished and production resumes.

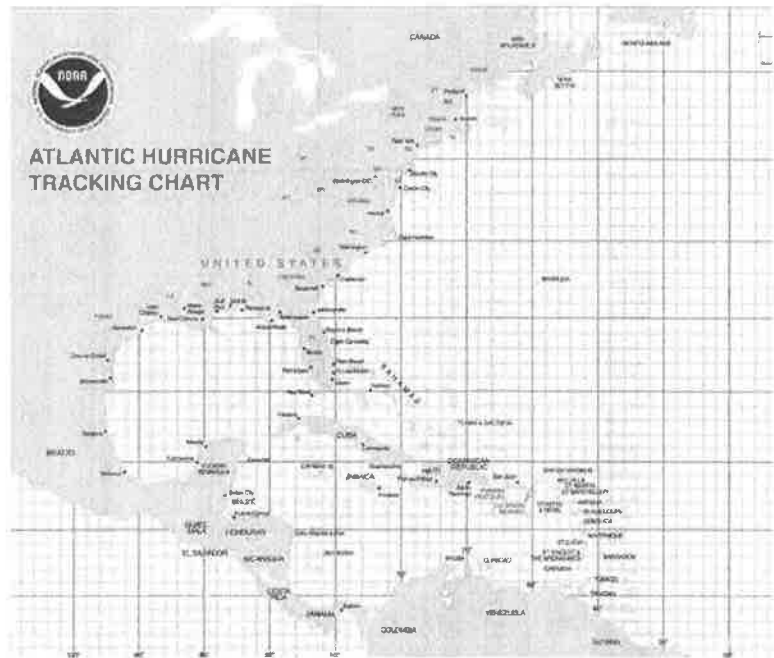
MMS Ocean Science, Volume 4 Issue 2, April/May/June 2007

Getting Ready

1. Make copies of the Hurricane Categories and Stages of Hurricane Development tables, the Storm Coordinates page, and the Evacuate the Rig? Student Page - one per student.
2. Download one copy per student of NOAA's Atlantic Hurricane Tracking Chart from the following website: http://www.nhc.noaa.gov/AT_Track_chart2.pdf and make copies.
3. Review the terms 'latitude' and 'longitude.'
4. Use the tables to review hurricane categories and stages of development.

Procedure

1. Distribute copies of the Hurricane Categories and the Stages of Hurricane Development tables and the Storm Coordinates page, which lists the various storms.
2. Give each student a copy of the Atlantic Hurricane Tracking Chart and an Evacuate the Rig? Student Page.
3. Using the chart with coordinates, have students plot and label each storm.
4. Have students complete the Student Page using all of the charts. Use a different color for each storm. Connect the dots. Label the start and end dates. Create a legend with the storm name, month, and year.
5. Have students determine the stage and category of the storm once it hits land and record this information on the chart.
6. Have students determine in what state or country landfall was made for each storm and record this information on the chart.



AT_Track_chart2

Source: http://www.nhc.noaa.gov/AT_Track_chart2.pdf

7. After they have plotted the pathways of the storms, have students predict whether the drilling rigs and production platforms in the GOM had to be evacuated. Record this information on the chart.

Map Discussion

1. What determines the category of a hurricane?
2. To what agency do operating companies report to get clearance to continue production?
3. When a hurricane enters the Gulf of Mexico, what is the first action step?
4. What is the most important priority of the operators on the drilling rigs and production platforms?

Evacuate the Rig? Student Page

	Storm	Year	Hurricane Stage	Hurricane Category	Final Landfall Location Country/State	Evacuate Yes/No
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

Answer Key

	Storm	Year	Hurricane Stage	Hurricane Category	Final Landfall Location Country/ State	Evacuate Yes/No
1.	Isadore	2002	Hurricane	2	Mexico	Yes
2.	Henri	2003	Tropical Depression	NA	Florida	Yes
3.	Earl	2004	Tropical Storm	NA	NA	No
4.	Katrina	2005	Hurricane	3	Louisiana	Yes
5.	Beryl	2006	Tropical Storm	NA	Massachusetts	No
6.	Karen	2007	Tropical Storm	NA	NA	No
7.	Ike	2008	Hurricane	2	Texas	Yes
8.	Erika	2009	Tropical Storm	NA	Puerto Rico	No

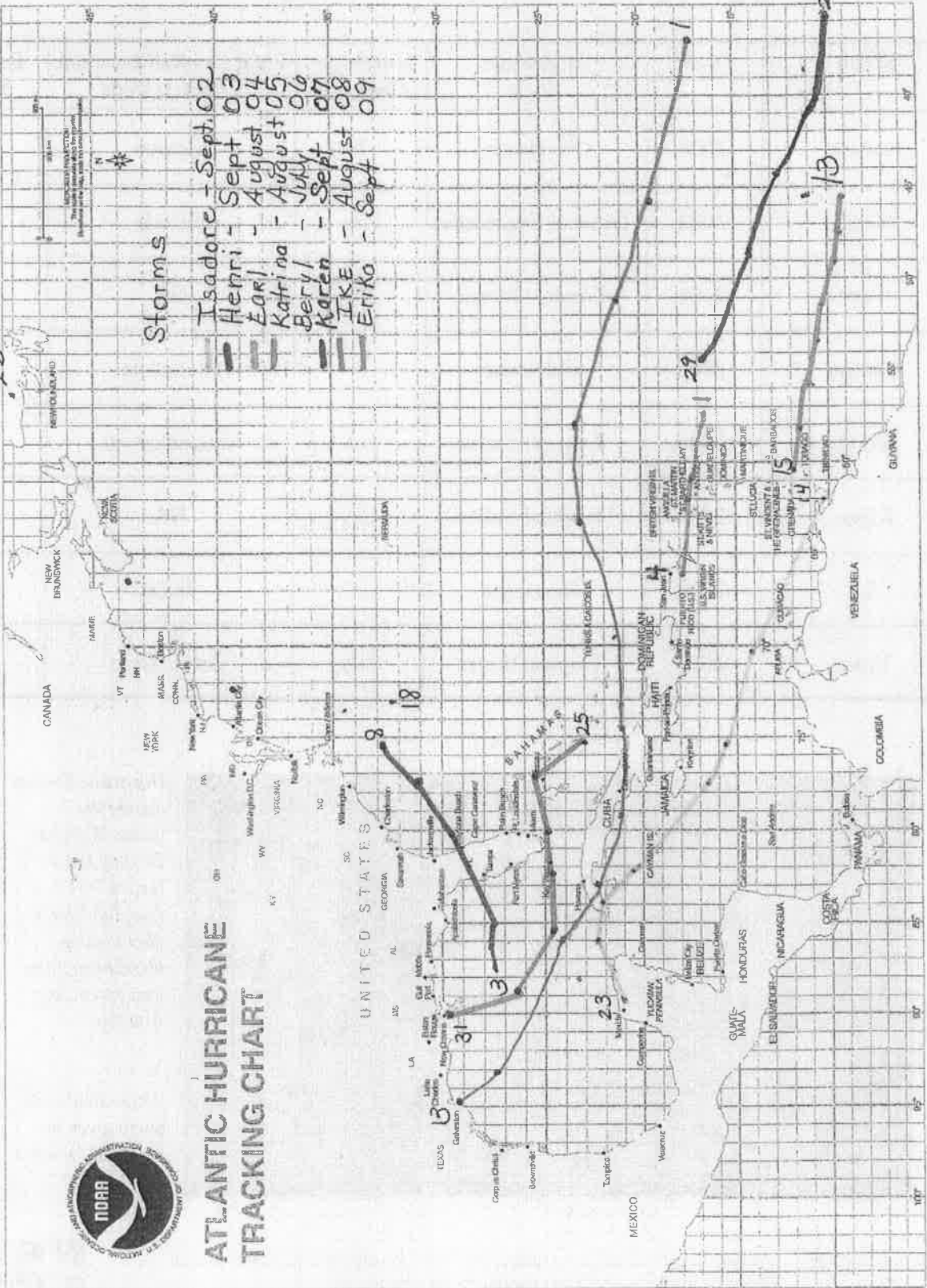


Hurricane Katrina caused the Ocean Warwick Drilling Rig to 'beach' on Dauphin Island after drifting 66 nautical miles from its drilling location.

Permission to use photo given by Diamond Offshore Drilling, Inc.



ATLANTIC HURRICANE TRACKING CHART



Storms

- Isadore - Sept 02
- Henri - Sept 03
- Earl - August 04
- Katrina - August 05
- Beryl - July 06
- Karen - Sept 07
- IKE - August 08
- Erika - Sept 09

Storm Coordinates

Isadore - 2002			
Date Sept.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
14	10	60.5	25
15	10.2	62.4	25
16	14.2	70.5	20
17	15.8	75.3	25
18	16.7	77.7	30
19	19.3	79.3	50
20	20.7	82.3	75
21	22.1	84.3	75
22	22.1	86.5	110
23	21	89.4	100

Henri - 2003			
Date Sept.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
3	27.4	87.7	25
4	27.8	86.3	30
5	27.6	85.8	30
6	29.2	80.4	25
7	31.3	77.9	30
8	32.9	75.3	25

Earl - 2004			
Date Aug.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
13	9.0	45.6	30
14	9.2	47.4	30
14	9.6	49.2	30
14	10.1	51.4	30
14	10.5	53.5	35
15	11.0	55.9	35
15	11.5	58.3	45
15	11.8	60.8	45
15	12.1	62.8	35

Katrina - 2005			
Date Aug.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
25	23.1	75.1	30
26	25.4	76.9	40
27	26.2	79.6	60
28	24.9	82.6	85
29	24.5	85.3	100
30	26.3	88.6	150
31	29.5	89.6	110

Beryl - 2006			
Date July	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
18	32.3	73.3	30
19	34.5	73.7	35
20	39.1	72.5	45
21	43.8	66.3	35
22	48.5	56.5	30

Karen - 2007			
Date Sept.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
25	10	35.9	30
26	10.9	40.4	40
27	12.8	44.6	60
28	14.1	48.8	50
29	16.8	54.2	30

Ike - 2008			
Date Aug.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
1	17.2	34	30
2	19.3	45.8	55
3	21.1	51.9	105
4	23.4	57.7	115
5	23.2	63.4	100
6	21.5	69	115
7	21	74	105
8	21.2	79.1	75
9	22.7	83.3	65
10	24.2	85.8	85
11	25.8	88.9	85
12	27.5	93.2	90
13	29.1	94.6	95

Erika - 2009			
Date Sept.	Latitude (°N)	Longitude (°W)	Wind Speed (kt)
1	16.7	57.3	45
2	16.3	61	35
3	16.3	61.9	35
4	17	66.5	25

Hurricane Categories			
Category	Wind Speed	Effects	Surge
1	74-95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.	4-5 ft
2	96-110 mph	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers, and small craft in unprotected moorings may break their moorings.	6-8 ft
3	111-130 mph	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures damaged by floating debris. Terrain may be flooded well inland.	9-12 ft
4	131-155 mph	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.	13-18 ft
5	155 mph+	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.	18 ft +

Stages of Hurricane Development	
Term	Description
Tropical wave	A low pressure trough of persisting winds that blow from east to west.
Tropical disturbance	An organized area of thunderstorms generally 100-300 miles in diameter. Typically, a tropical disturbance maintains its identity for at least 24 hours and is accompanied by heavy rains and gusty winds.
Tropical depression	An organized area of tropical low pressure in which sustained winds are 38 miles per hour or less.
Tropical storm	A tropical cyclone with maximum sustained winds of 39-73 miles per hour, accompanied by thunderstorms.
Hurricane	A tropical cyclone with maximum sustained winds of at least 74 miles per hour and accompanied by thunderstorms. In the Northern Hemisphere, hurricane winds circulate in a clockwise rotation.

Career Spotlight:

Meteorologists are scientists who study the atmosphere. They examine the atmosphere's effects on the environment, predict the weather, or investigate climate trends. They use data from satellites, radar, and sensors as well as computer models to make forecasts.

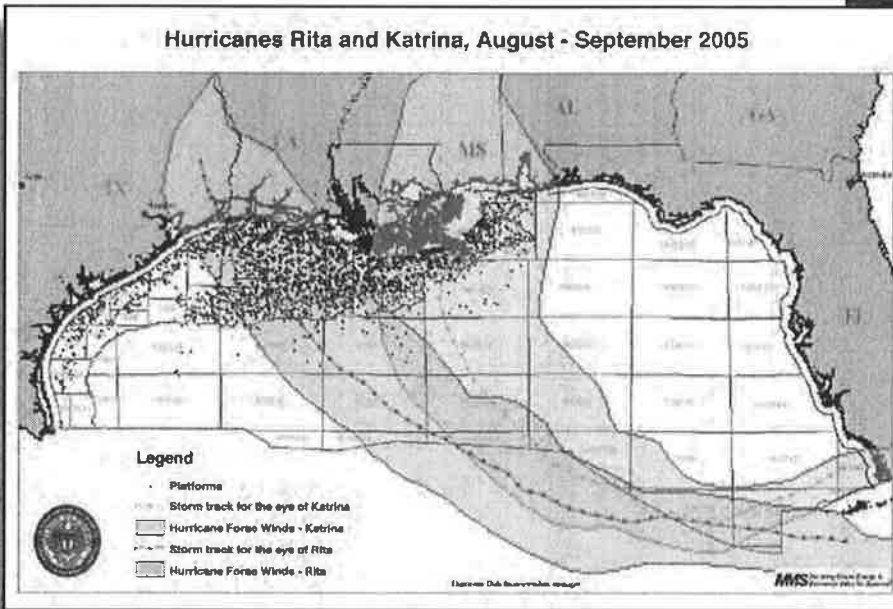
The biggest employer of meteorologists is a government agency, the National Weather Service. Meteorologists use computers and math to interpret weather information, such as temperature, wind speed, and humidity.



Mars Tension-leg Platform



Mars Tension-leg Platform showing damage from Hurricane Katrina (2005)



My Disaster Plan

Basic Emergency Supply Kit

- ___ Water- one gallon person per day (3day supply)
- ___ Food – 3 day supply of non-perishable food
- ___ Flashlight, radio, and extra batteries
- ___ First Aid Kit
- ___ Whistle to signal for help
- ___ Dust mask
- ___ Moist towelettes, garbage bags
- ___ Wrench or pliers to turn off utilities
- ___ Non-electric can opener
- ___ Prescription medication and glasses
- ___ Pet food and extra water
- ___ Charger for phones
- ___ Clean clothes
- ___ Infant formula and diapers

Name: _____

Contact Information – Relative

- 1. Name _____
- Cell No. _____
- Address _____

- 2. Name _____
- Cell No. _____
- Address _____

- 3. Name _____
- Cell No. _____
- Address _____

- 4. Name _____
- Cell No. _____
- Address _____

Emergency Phone Numbers

- 1. Fire Department _____
- 2. Police Department _____
- 3. Ambulance _____
- 4. Dr. _____
- 5. Mom work _____
- 6. Dad work _____
- 7. Grandparents _____
- 8. Insurance agent _____

Shelters

- 1. Name _____
Location _____
- 2. Name _____
Location _____

Location of Documents/ Banking Information

- _____ Insurance Policies
- _____ Wills
- _____ Burial plots
- _____ Bank/accounts/savings

Things to Do Before

- _____ Fill up cars
- _____ Cash a check
- _____ Clean bathtubs and fill with water
- _____ Wash clothes/clean house
- _____ Buy charcoal/matches
- _____ Buy paper goods
- _____ Secure items on lawn
- _____ Tape windows
- _____ Find games

