Regents Earth Science

Hurricane Tracking Lab

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Name ________________

Period ______

Companion Websites: http://weather.unisys.com/hurricane/index.html
http://www.atwc.org
http://www.bedford.k12.ny.us/flhs/science/hurricane1.html

INTRODUCTION:

Hurricanes begin as tropical depressions (low pressure systems) just north of the equator west of Africa. As energy laden warm, moist (mT) air rises up from the sea surface into the low, condensing water vapor releases heat and the low deepens. As air spirals in to "fill" the low, wind speeds around the low increase. Meteorologists often measure wind speed in *knots*, rather than miles per hour (see note below). When the wind speeds reach 35 knots, the low becomes a tropical storm, and at 64 knots, a hurricane. (For more info, look up the Saffir-Simpson Scale at one of the companion websites).

The location and path of a hurricane is important to mariners and aviators when it is over water, and to people living on islands and coastlines in the hurricane's path.

Planetary winds are important in steering a hurricane in its westward trip across the Atlantic tropics toward the Caribbean Sea, the Gulf of Mexico, and the east coast of the United States.

In this lab, you'll plot the path of the hurricanes that occur during the current Atlantic hurricane season in an effort to learn where hurricanes get their energy, where they go, and why.

NOTE: A knot is 1 *nautical mile per hour*. Nautical miles are used at sea and are equal to 1 minute of latitude (1/60th of a degree). A nautical mile is a little longer than the 5280' *statute mile* we use on land, so 1 knot is a little faster than 1 mile per hour.

TERMS TO KNOW:

The following terms are important for you to understand before you begin this lab. Use your textbook, the reference tables, an atlas, and/or any other resources you need to write definitions of the following terms:

PLANETARY WINDS / PREVAILING WINDS ______________________________

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AIR MASS ______________________________

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The code letters describing air masses, and what they mean:

mT ______________________________

mP ______________________________

cT ______________________________

cP ______________________________

AIR PRESSURE ______________________________

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MILLIBARS (mb) ______________________________

____

Greenwich Mean Time (GMT) or ZULU or UNIVERSAL TIME: ______________________________

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(See http://www.bedford.k12.ny.us/flhs/science/labs/zulutime.html for more info about timekeeping.)

PROCEDURE

YOU'LL NEED:

- This lab
- Current hurricane data (get it at http://www.bedford.k12.ny.us/flhs/science/tropicalseason.html or one of the Companion Websites)
- 2005 Hurricane Emily tracking data (see sites above)
- 2005 Hurricane Tracking Chart and Hurricane Emily tracking chart
- Graph paper
- A sharp pencil

1. Using a pencil, plot the position of the first storm of the current tropical season on the accompanying map. It is not necessary to plot more that one point for each day, though the data tables list several. Next to each point, very lightly label the advisory number.

2. Connect the plotted points with a smooth line that approximates the path of the center of the storm and label that line with the name of the storm.

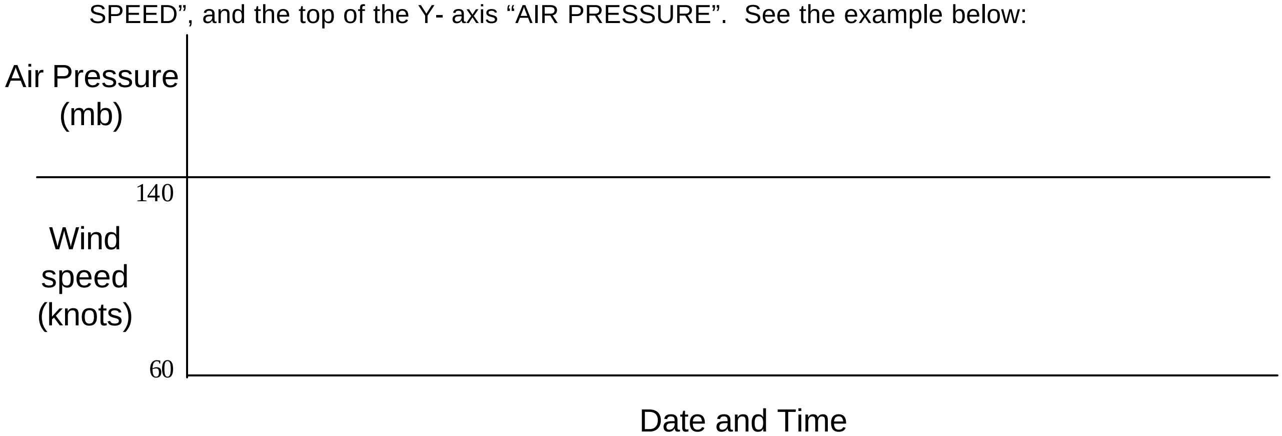
3. As the current Atlantic hurricane season progresses, do the same for all the hurricanes that occur. Get their daily positions at http://www.bedford.k12.ny.us/flhs/science/tropicalseason.html or http://weather.unisys.com/hurricane/

5. Answer/Do the following:

A. Using the data from hurricane Emily, a strong 2005 hurricane that hit the Yucatan peninsula of Mexico, do the following:

1-On the Hurricane Emily tracking chart, note that advisory 22 and advisory 37A are already plotted and labeled. Plot and label the advisories 24, 26, 28, 29A, 30, 32, 34, 35A, and 36 on the map.

2- Use graph paper or a spreadsheet to construct a line graph of wind speed and air pressure over time. You need not plot every point. Rather, start at Advisory 22, and plot each advisory nearest 15Z and 09Z from there on. It would make sense to make a mark on the data table next to each point you plan to plot. Label the "DATE and TIME" on the X- axis (horizontal) of your graph. Label the bottom of the Y-axis "WIND SPEED", and the top of the Y- axis "AIR PRESSURE". See the example below:



B. Determine a reasonable scale on each axis to cover the values in the data table. For instance, the wind speeds range from 65 to 130 knots. Therefore your graph should probably start at 60 knots and go up to 140 knots, as shown above. Be sure to put a title on your graph.

C. Make a statement about the general relationship between wind speed and air pressure in the space below.

D. Notice the data recorded while Emily was over land. What happened to the wind speed during that time?

E. Read the introduction to this lab again, and explain *WHY* EMILY'S winds slowed down while over land.

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F. What happened to the wind speed during 7/19 and 7/20?______________________ *WHY?* ________________

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G. Notice the scale of nautical miles on your Emily map. Determine the average speed (in knots) of the storm system (not the wind's speed in the storm) between advisory 22 and advisory 26. *EXPLAIN* how you found that speed. (Speed or rate = distance/time)

SPEED =______________ How I figured it: ____

____

____

____

H. What was the average speed in knots of Emily between advisory 30 and advisory 37A? ___________________

I. Refer to your 2005 Hurricane Tracking Chart. At approximately what latitude did Dennis, Irene, and Katrina veer to the east?_____________Refer to your reference table chart of the planetary winds. Is the change of direction of those storms compatible with the information on the chart?_____________

J. Use your pencil to very lightly copy Irene's path onto the planetary wind diagram in your reference tables.

K. From what you can tell, is warm, moist, and stormy air associated with ***high pressure*** or ***low pressure*** air? (circle one)

L. Notice that Emily kept veering to the north (her right) as the northeasterly winds of the tropics drove her east across the Atlantic. This occurs due to an interesting effect of the Earth's rotation. Look up and describe the CORIOLIS EFFECT. ____

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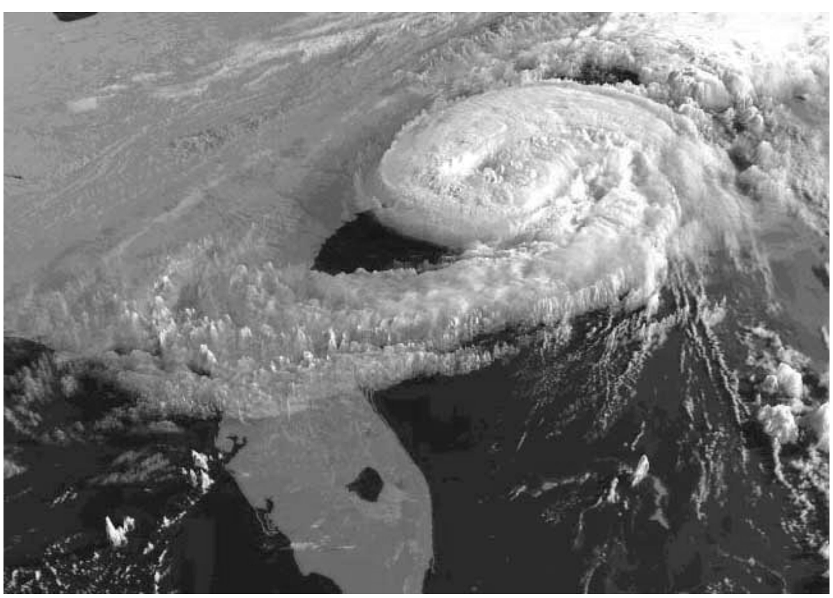
M. The image below shows Bonnie approaching the east coast of the US. Describe the motion of the air around the center of the storm as completely as you can.



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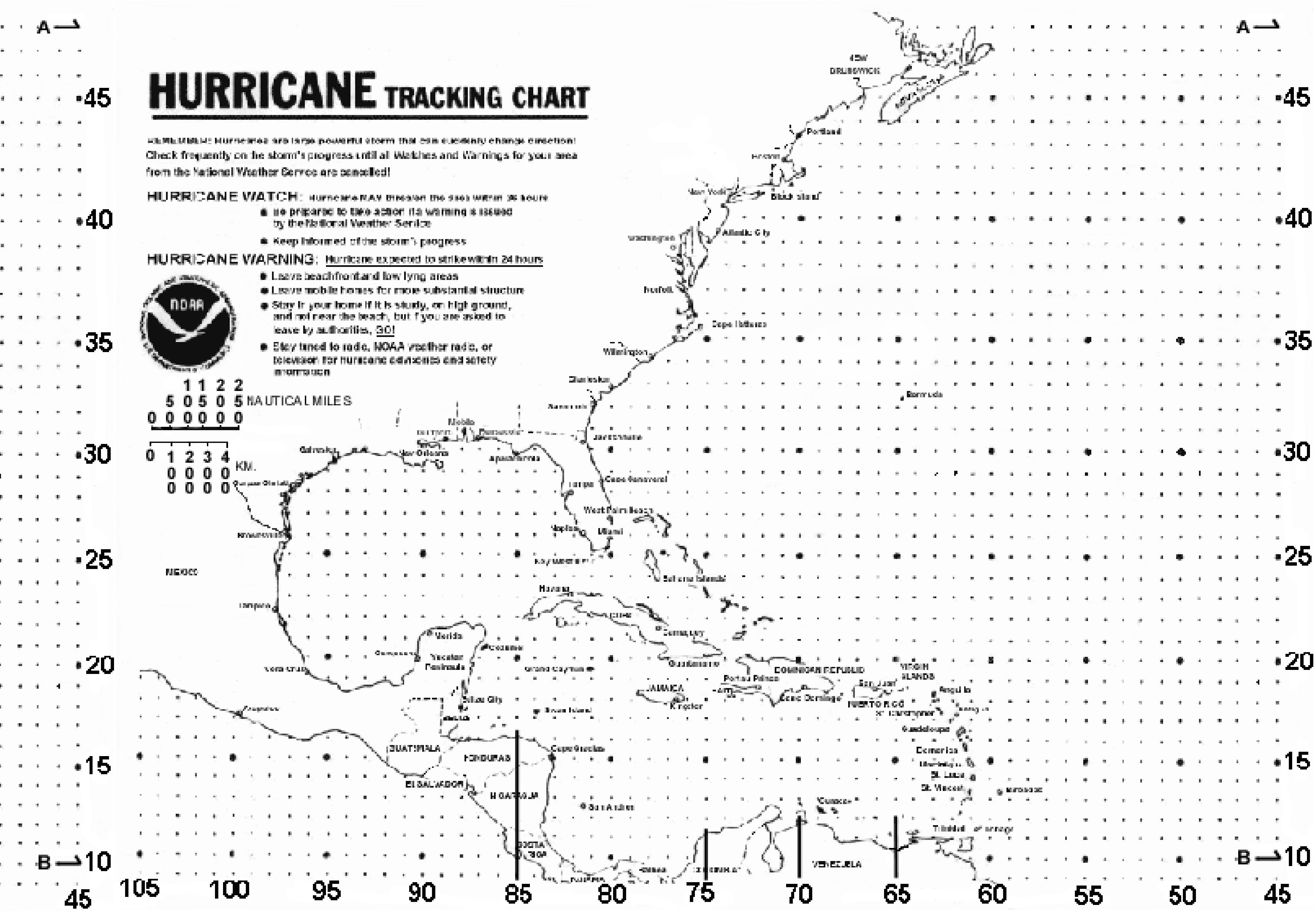
WHAT TO HAND IN:

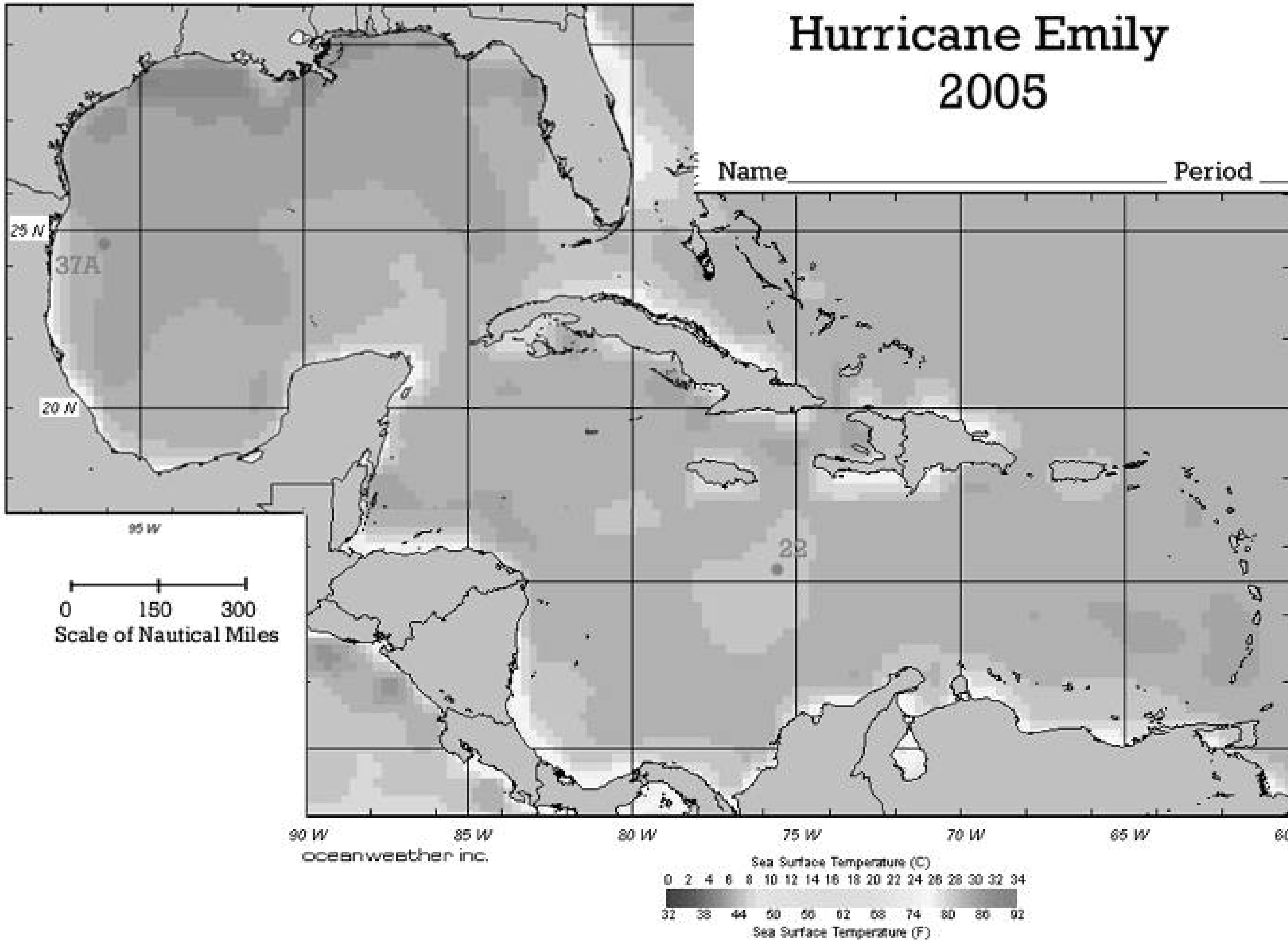
- These 3 pages
- 2 Maps
- 1 Graph



HURRICANE TRACKING CHART
REMEMBER! Hurricanes are large powerful storms that can suddenly change direction!
Check frequently on the storm's progress until all Watches and Warnings for your area from the National Weather Service are cancelled!
HURRICANE WATCH: Hurricane MAY threaten the area within 36 hours
• Be prepared to take action if a warning is issued by the National Weather Service
• Keep informed of the storm's progress
HURRICANE WARNING: Hurricane expected to strike within 24 hours
• Leave beachfront and low lying areas
• Leave mobile homes for more substantial structure
• Stay in your home if it is sturdy, on high ground, and not near the beach, but if you are asked to leave by authorities, GO!
• Stay tuned to radio, NOAA weather radio, or television for hurricane advisories and safety information
NOAA
0 50 100 150 200 250 NAUTICAL MILES
0 100 200 300 400 KM.
A
B
45 40 35 30 25 20 15 10
105 100 95 90 85 80 75 70 65 60 55 50 45
NEW BRUNSWICK
Portland
Boston
New York
Block Island
Atlantic City
Washington
Norfolk
Cape Hatteras
Wilmington
Charleston
Savannah
Jacksonville
Bermuda
Mobile
Pensacola
New Orleans
Apalachicola
Galveston
Tampa
Cape Canaveral
West Palm Beach
Naples
Miami
Key West
MEXICO
Tampico
Bahama Islands
Havana
Merida
Cozumel
Yucatan Peninsula
Guantanamo
Grand Cayman
Port au Prince
DOMINICAN REPUBLIC
San Juan
VIRGIN ISLANDS
JAMAICA
Kingston
Santo Domingo
PUERTO RICO
Anguilla
Belize City
Swan Island
Guadeloupe
GUATEMALA
HONDURAS
Cape Gracias
Dominica
St. Lucia
St. Vincent
EL SALVADOR
NICARAGUA
San Andres
Curacao
Trinidad
COSTA RICA
VENEZUELA

Hurricane Emily
2005

Name______________________________ Period _____



Emily Data for questions A through H

22	15.6	-75.8	07/16/09Z	120	950	HURRICANE-4
22A	15.9	-76.5	07/16/12Z	120	947	HURRICANE-4
23	16.2	-77.3	07/16/15Z	125	943	HURRICANE-4
23A	16.4	-78	07/16/18Z	135	937	HURRICANE-4
24	16.8	-78.8	07/16/21Z	135	937	HURRICANE-4
24A	17.1	-79.5	07/17/00Z	135	929	HURRICANE-4
25	17.5	-80.3	07/17/03Z	135	930	HURRICANE-4
25A	17.7	-81.2	07/17/06Z	130	943	HURRICANE-4
26	18	-82	07/17/09Z	130	938	HURRICANE-4
26A	18.3	-82.8	07/17/12Z	130	938	HURRICANE-4
27	18.6	-83.6	07/17/15Z	130	946	HURRICANE-4
27A	19	-84.4	07/17/18Z	130	948	HURRICANE-4
28	19.4	-85.2	07/17/21Z	125	948	HURRICANE-4
28A	19.6	-85.9	07/18/00Z	115	951	HURRICANE-4
29	19.9	-86.5	07/18/03Z	115	955	HURRICANE-4
29A	20.3	-87.3	07/18/06Z	115	955	HURRICANE-4
30	20.6	-88	07/18/09Z	95	962	HURRICANE-2
30A	21.2	-88.9	07/18/12Z	85	975	HURRICANE-2
31	21.8	-89.6	07/18/15Z	85	975	HURRICANE-2
31A	22	-90.3	07/18/18Z	65	984	HURRICANE-1
32	22.3	-91	07/18/21Z	65	983	HURRICANE-1
32A	22.6	-91.5	07/19/00Z	65	982	HURRICANE-1
33	22.9	-92.1	07/19/03Z	80	983	HURRICANE-1
33A	23.2	-92.9	07/19/06Z	80	984	HURRICANE-1
34	23.5	-93.5	07/19/09Z	80	980	HURRICANE-1
34A	23.7	-94	07/19/12Z	80	977	HURRICANE-1
35	23.9	-94.5	07/19/15Z	80	972	HURRICANE-1
35A	24	-94.8	07/19/15Z	80	970	HURRICANE-1
35B	24.1	-95.2	07/19/19Z	85	959	HURRICANE-2
36	24.3	-95.6	07/19/21Z	85	956	HURRICANE-2
37	24.5	-96	07/19/23Z	110	945	HURRICANE-3
37A	24.4	-96.1	07/20/01Z	110	948	HURRICANE-3