

Natural Hazards - Geology 209

HURRICANES

Due Date: **April, 16th**

Name _____

Hurricane Mapping and Hazard Analysis

This exercise examines typical hazards associated with hurricane landfalls in the southeastern US, and also gives you practice using latitude and longitude coordinates on maps.

Find attached the Hurricane Tracking Map. Remember that the horizontal axis (**longitude**) coordinates are given in degrees E or W of Greenwich in the UK. Moving to the left on this map takes one farther west, away from Greenwich, so longitude ($^{\circ}$ W) coordinates increase to the left. **Latitude** (on vertical axis) is simpler: 0 is the Equator and moving poleward takes one to higher latitude values ($^{\circ}$ N), to a maximum of 90° , which is the pole.

1. Plot by hand the following hurricane coordinates for Hurricane Arlosity on the map. The coordinates refer to the position of the center (or eye) of the hurricane. Next to each point, write the day of the month, and the time (hrs) if there is more than one location per day. Write small and neatly. The maximum sustained wind speeds and storm center velocities are in miles per hour (mph); the wind speeds are relative to the storm center.

Track of Hurricane Arlosity

| Date | Time | Lat $^{\circ}$ N, Lon $^{\circ}$ W | Max Sustained Winds (mph) | Storm Center Speed (mph) |
|----------|------|------------------------------------|---------------------------|--------------------------|
| Sept. 6 | 1200 | 13.6 45.8 | 66 | 17 |
| Sept. 7 | 1200 | 15.2 52.9 | 74 | 15 |
| Sept. 8 | 1200 | 16.8 59.5 | 76 | 15 |
| Sept. 9 | 1200 | 19.1 64.7 | 77 | 16 |
| Sept. 10 | 1200 | 21.2 68.1 | 88 | 10 |
| Sept. 11 | 0600 | 21.2 70.0 | 110 | 15 |
| Sept. 11 | 1800 | 21.2 74.0 | 128 | 15 |
| Sept. 12 | 0600 | 22.0 78.0 | 135 | 18 |
| Sept. 12 | 1800 | 23.0 80.0 | 144 | 18 |
| Sept. 13 | 0600 | 24.0 84.0 | 155 | 18 |
| Sept. 13 | 1800 | 25.0 86.0 | 160 | 15 |
| Sept 13 | 2100 | 26.0 87.0 | 166 | 20 |
| Sept.14 | 0300 | 28.0 89.0 | 166 | 20 |
| Sept. 14 | 0600 | 28.5 88.0 | 167 | 18 |
| Sept 14 | 1200 | 28.5 84.0 | 165 | 20 |
| Sept. 14 | 1800 | 28.5 83.0 | 155 | 15 |
| Sept. 15 | 0100 | 28.5 81.5 | 125 | 15 |
| Sept 15 | 1000 | 30.0 80.0 | 120 | 15 |
| Sept. 15 | 1800 | 33.0 79.0 | 125 | 25 |
| Sept 16 | 0600 | 34.0 78.0 | 125 | 25 |
| Sept. 16 | 1200 | 35.0 77.0 | 105 | 30 |
| Sept. 16 | 2100 | 37.0 76.0 | 100 | 35 |
| Sept. 17 | 0000 | 38.0 75.0 | 95 | 38 |
| Sept. 17 | 1800 | 39.0 73.0 | 65 | 35 |

After you have plotted all of the points on the map, connect the points with lines using the following color codes:

| | |
|---|--------|
| Tropical Storm (not yet a Category 1 hurricane) : | Blue |
| Category 1 or 2 Hurricane: | Green |
| Category 3 Hurricane: | Yellow |
| Category 4 Hurricane: | Orange |
| Category 5 Hurricane: | Red |

Additional information needed for the above color-coding and to answer some of the following questions is contained in your textbook on page 389 (Table 14-1).

2. New Orleans is located at 30° N, 90° W. What might the National Hurricane Center have been saying about New Orleans after the report of the hurricane's location on Sept. 14 at 0300 hours?
3. What was the likely height of the storm surge at Tampa Florida on the afternoon of Sept 14?
4. What were the maximum sustained winds at Tampa Florida during the evening of Sept 14?
5. What were the maximum sustained winds on the Florida Gulf Coast at 29.5° N during the evening of Sept 14?
6. As the Hurricane crossed Florida between Tampa and Orlando it lost intensity. Give two reasons that may explain why this occurred.
7. What might the weather have been like in Disney World (Orlando, Florida, 28.5°N, 81.5°W) at **exactly** 1:00 AM (0100 hrs) on Sept. 15?
8. What would have been the approximate storm surge at Wilmington, North Carolina just before the storm hit there? If the tidal range in Wilmington was 9 feet on that day and the storm made landfall at the time of low tide, about how high above mean sea level would the surge level have been?
9. Use figure 14-5 in your book - What area in the United States has the highest probability of getting hit by a hurricane in any given year, and what is the probability of such a hit?

Visit the Tropical Weather page (<http://www.wunderground.com/tropical/>) on the Weather Underground website to answer the following questions:

10. What is the sea surface temperature (<http://www.osdpd.noaa.gov/PSB/EPS/SST/contour.html>) at 30°N, 70°W (between Bahamas and Bermuda in Atlantic) and at 30°N, 120°W (off northern Baja, Mexico)? How does this observation help explain lack of problematic hurricanes in southern California?
11. Scroll down to **Hurricane Archive** (<http://www.wunderground.com/hurricane/hurrarchive.asp>) and look at the last three years of hurricane tracks. In the last 3 years, how many storms have hit the area you identified in question 9 as having the maximum strike probability in the US? How does this influence the area's strike probability forecast based on the most recent 30 years of data?

12. Of the top ten deadliest Hurricanes in the U.S. since 1900, how many have occurred in the last 40 years?
13. Of the top ten Hurricanes that have caused the most damage (\$\$) in the U.S. since 1900, how many have occurred in the last 40 years?
14. Use the list of Costliest Hurricanes to answer questions 14 – 16. Clicking on a name shows the track of each storm. Compare the tracks of Hurricanes Agnes and Betsy. Both caused ~ \$ 7.5 billion in damages.
 - a. What time of year did Agnes occur? How does this relate to its strength compared with the time of year for Betsy?
 - b. Comparing the tracks of Agnes and Betsy, which do you think had the more damaging coastal storm surge?
 - c. Given Agnes' track, and her relatively weak storm status, what kind of hurricane hazard do you think contributed to her costly damage?
15. Tropical Storm Allison was also a weak, early season storm, yet she caused 40 deaths (more than Hurricane Andrew) and \$5 billion in damages. What was the dominant hazard?
16. Check the track of Hurricane Andrew (second costliest hurricane in US history). Andrew was not associated with major coastal erosion by waves in the Miami area. Looking at the track map, can you explain why large waves were not such a problem for south Florida during Hurricane Andrew?
17. Compare the tracks of Hurricanes Donna (1960) and Gloria (1985).
 - a. What was the approximate storm surge in the Florida Keys due to Hurricane Donna?
 - b. On the Donna track map, locate the small triangle of coast jutting out from the North Carolina coast at 34.5°N, 76°W. This is Cape Lookout (just south of Cape Hatteras). How did the relative wind directions compare between Donna and Gloria as each storm made its closest approach to Cape Lookout?
 - c. Which storm caused a larger storm surge at Cape Lookout?
 - d. Which storm created higher winds in New York City?

HURRICANE TRACKING CHART

REMEMBER: Hurricanes are large powerful storm 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 PA 77020

