#### Earth 103 Module 2

#### Lab 2: Hurricanes

In this lab, we will observe the tracks of the largest storms of the last century, and learn about the impacts of those storms on land.

The goals of the lab are:

1. To determine the main causes of damage from storms including wind, rainfall and flooding, and storm surge.
2. To observe the relationship between storm intensity and warming.

#### Files to Download:

1. [Hurricane Tracks](file://localhost/earth103/sites/www.e-education.psu.edu.earth103/files/module02/Hurricane%2520Tracks.kmz)
2. [Temperature Anomaly](file://localhost/earth103/sites/www.e-education.psu.edu.earth103/files/module02/Temperature%2520Anomalies.kmz)

#### Instructions

There are two Google Earth maps to load, the first, [Hurricane Tracks kmz file](file://localhost/earth103/sites/www.e-education.psu.edu.earth103/files/module02/Hurricane%2520Tracks.kmz), shows tracks of storms from 1900 to 2017. The second, [Temperature Anomaly kmz file](file://localhost/earth103/sites/www.e-education.psu.edu.earth103/files/module02/Temperature%2520Anomalies.kmz), shows average August temperatures for each year calculated relative to the average temperature between 1900 and 1910. You can switch back and forth between maps. Both maps have sliders at the top left of your screen that allow you to look at storms as well as temperature over time. The storm tracks have points that show the wind speed and pressure at different stages in its development. We definitely recommend that you don’t try to look at the storms all at once or you will see a maze of lines. Please make sure that the slider at top left has the relevant range of dates on it, otherwise, you will not be able to view tracks for the desired storm. Also, there are a few storms including Betsy whose names do not show unless you zoom in close. Note also we break up the 2000-2010 and 2010-2017 decades.

As in the lab for Module 1, we begin with some practice questions that you can take in the Lab 2 practice submission in Canvas, where you will receive the answers to the questions. Once you feel good about these questions, move on to the graded assignment, also in Canvas. If you have any questions about the practice questions, please let us know. Remember you only get one attempt at the graded assignment.

#### Practice Questions

**Part A.** In the first part of the lab we look at the tracks of hurricanes. You will need to look for the storm names. Load the name of the storm once you have found it and click on a point to find the wind speed and pressure. For certain storms, we will include the storm surge as well as the precipitation in areas near the landfall. You will also need to observe the elevation of areas close to the coast and look at historical imagery to determine the impact of the storm on coastal communities.

1. What was the wind speed of Hurricane Gilbert just before US landfall (click on the point closest to land)?
2. What was the strongest storm in the 1960s at US landfall based on wind speed?
3. Observe the storm surge of Hurricane Rita at Gueydan, LA (10 feet) and from the elevation, which is the closest to the extent of inland flooding? (Make sure terrain is switched on to read elevations and run cursor over the map to see how elevation changes around the location of interest).

A. About half of the town would be flooded
B. None of the town would be flooded
C. All of the town would be flooded

1. What is the percentage of rainfall from Hurricane Georges near landfall compared to the average annual rainfall of southern Alabama (60 inches)? Please give your answer as a percentage.
2. Here we are going to look at historical imagery to answer questions about the impact of storms on urban areas and the landscape. We will look at the 2005 Hurricane Katrina and its impact on Gulfport Mississippi. Enter “Gulfport” in the search box and fly to an elevation between 2000 and 4000 feet above the city. Turn on the historical imagery (clock at top left) and go back and forth between the July 2005 and August 29, 2005 (right after the storm) photos using the slider. You will need to click the + button on the slider to get that scale of time change. Answer the following questions:
	1. What is the yellow material in the streets and parking lots very close to the coast after the storm?
	2. What is missing from the marina after the storm after the storm? We are looking for single words so your answers can be one word?
	3. Look at the parking lot across the four-lane road from the harbor area, what are the white boxes (look at both photos)?
	4. Does it look like the neighborhoods a block away from the four-lane road are inhabited? Yes or No

**Part B.** In the second part of the lab, we will observe the change in temperatures of the Atlantic Ocean over the last century that is related to the generation of more powerful hurricanes. Load and turn on the temperature anomaly kmz. By pressing the year buttons on the left you can observe the temperature anomalies in August every five years (from 1910 to 2000) and annually from (2000 to 2017) relative to the average temperature from 1900 to 1910 file.

Center the map over the Atlantic Ocean so you can see Africa as well as North America including the Gulf of Mexico. As we have learned, the warmer the temperature the more energy to fuel hurricanes as well as the ability to hold more moisture.

1. Which is the warmest year in the central Atlantic Ocean between 1910 and 1950?
2. Which of the following is a year that the Gulf of Mexico had the highest potential to fuel strong storms based on temperature?

A. 1965
B. 1975
C. 1985
D. 1995
E. 2005

1. Which year would temperatures in the Atlantic have been favorable for hurricane development?
A. 1960
B. 2017
C. 1990
D. 2000
E. 2007
2. What is the general trend for temperature change between 1900 and 2017?
A. Warming
B. Cooling
C. Stayed consistent
3. Which decade would have been slow for hurricane generation in the Atlantic based on temperatures?
A. 2000-2010
B. 1990-2000
C. 1970-1980