Virtual Field Trip to Upper Texas Coast

Physical Geology GEOL1303 Spring 2022 Extra Credit Assignment

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Professor's Name: Professor Murphy

Class Time: 10.00-11.30 AM(Mon-Wed)

Academic Honesty (Signature Required)

The Virtual Field Trip to Upper Texas Coast is to be completed by yourself; you should not work with a partner or group. Do not search for answers on the internet because 1) it is cheating; 2) answers that are posted are incorrect and we'll know where you got them from and 3) the questions change every semester. Be careful if you watch the videos with closed captioning because the spelling of geologic terms is often incorrect or misinterpreted by the captioning software, so you may end up with a wrong answer. If you are unfamiliar with a word or geologic concept, it is okay to look it up online or and find the correct spelling and definition. If you need help, physical geology teaching assistants staff the Geoscience Learning Center team in Fleming 136.

By submitting this work, I, Dosbol Aliev attest that I have not violated the UH AcademicHonesty code. I completed this assignment by myself and did not copy any portion of my answers fromanother student, a website, or any other source. In addition, I will not upload any of my answers to anyelectronic media such as Course Hero, SnapChat, Chegg, etc.

Assignment Submission

Save your completed written assignment as "yourlastname_firstname_VFTUpperTXcoast". Email your file to eas.uh.physical.geology@gmail.com. You will not get a confirmation that it has been received.

Teaching Assistants will begin grading submissions after the deadline in early December 2021. You will receive an email from a TA when your assignment is graded. If your assignment requires resubmission, you will have 48 hours to do so.

How the virtual field trip works.

There is an interactive field trip with a map of locations for each stop you will visit. First, you need to watch the introductory video by clicking on the red video icon located near University of Houston. Then, you should click on each stop (green circle). This will take you to an immersive 360 panorama. Use your

mouse to explore the entire area. Within the 360 panorama, pay attention to icons that will take you to either videos and/or panoramas. Use the navigation bar at the bottom to come back to the map and move to other stops. The stop order is:

Stop UH	Welcome to the Coast Virtual Field Trip and Methods in the field
Stop 1	Brazos river
Stop 2	Modern Brazos river delta
Stop 3	Paleo Brazos river delta
Stop 4	Galveston State Park Beach and Bay side
Stop 5	Galveston Seawall
Stop 6	Galveston NE end

Welcome to the Coast Virtual Field Trip and Methods in the field

When a geologist goes on a field trip or does their field research, they take notes and make sketches of what they see and try to interpret these rocks (outcrops). So, to do this field trip you will be asked to take notes on what you see using both the videos and 360^{o} images. The first step at every outcrop is to identify if you are looking at igneous, metamorphic or sedimentary rocks. Then, describe features of the rocks and possibly sketch them. After describing the rocks, you need to describe any deformation that has occurred. The general process for writing rock descriptions is to start off with a general description (color, grain size, texture, etc.), followed by identification of the minerals within the rock (the mineral assemblage), the name of the rock (deduced from the assemblage) and then finally your interpretation on how and where it was formed. If you need help describing rocks, your text has many figures that are helpful. We've noted many of the figures for each stop. All figures referred to are from Earth, 12th Edition by Tarbuck, Lutgens, and Tasa. All answers should be written as full sentences and not one or two words. Most of the Google Earth imagery is done in 2018 except as noted.

EXERCISE 1

In the Google earth image of the Texas coast (Figure 1) identify the different coastal elements, listed below. Use Figure 2 with the definitions below. Mark these on the image.

1. Coast
2. Bay
3. Nearshore
4. Offshore

Figure 1. Google Earth image (2018) showing the Texas coast for exercise 1.

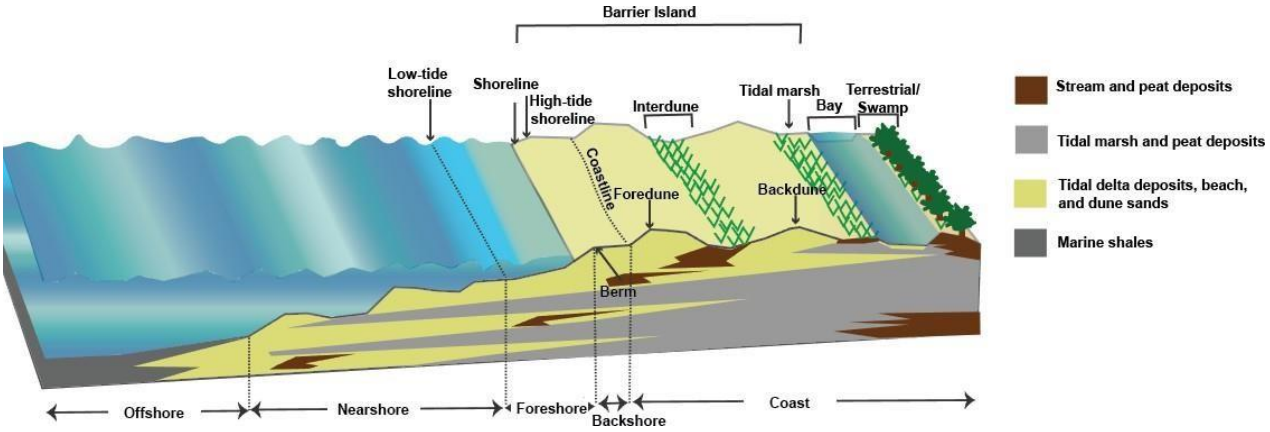

Figure 2. Coastal elements and facies.

BACKDUNE	It is the dune area behind the foredunes, after the trough. The backdune is usually forested and provides shade to its inhabitants. The backdune provides cool temperatures and moist soil adequate for many plants and animals.
BACKSHORE	Zone that is dry under normal conditions, it is characterized by present of berms and it has no vegetation. The backshore is only exposed to waves under extreme events with high tide and storm surge.
BERM	Terrace of a beach that has formed in the backshore, above the water level at high tide. Berms are commonly found on beaches that have fairly coarse sand and are the result of the deposition of material by low-energy waves.

COAST	It is the strip of land that extends from the coastline landward to the first major change in the terrain features, which are not influenced by the coastal processes.
DUNE	Ridges of loose, wind-blown sand (fine to medium) forming on the backshore.
FOREDUNE	It is the dune area directly behind the beach. The sand dunes are usually covered by grass, that help stabilize the sand.
INTERDUNE	It is the depressed area between the foredune and the backdune. The trough often fills with groundwater causing interdunal ponds where many organisms survive in this more stable habitat.
NEARSHORE	Extents seaward from the low water line beyond the breaker zone; it defines the area influenced by the nearshore currents.
OFFSHORE	Extents seaward from the nearshore zone.
SHORELINE	The line that marks the contact between land and sea. It migrates up and sown as the tide rises and falls.
COASTLINE	The coast's seaward edge. The landward limit of the effect of the highest storm waves on the shore.
TIDAL MARSH	It is a type of wet land regularly inundated by the tidal action. It is located in the back part of the barrier Island.
SWAMP	It is a type of wetland characterized by low, generally saturated land covered intermittently or permanently with shallow bodies of water. It can be covered by either aquatic vegetation or vegetation that tolerates periodical inundation. The water of a swamp may be fresh water or salt water.

STOP 1. BRAZOS RIVER

After watching the video with Dr. Wellner discussing the Brazos River, answer the following questions.

1. What type of river is the Brazos River?

Brazos River is a meandering river channel

2. On which side of the Brazos River does a deposition of sediments occur?

So, they are standing in Point Bar. In Point Bar Deposition occurred

3. Describe the water in the Brazos River and explain why it has a distinctive color.

Brazos River's color is brownish red color because it has a very high suspended load.

4. When this video was recorded, was the Brazos River below or above flood stage?

   As the professor said that it is three feet below flood stage, so it was below flood stage.

5. Describe the suspended sediment load in the Brazos River?

So, Fine-grain particles that travel in suspension and remain in the water column are referred to as suspended loads.

6. On which side of the Brazos River does deposition of sediment occur?

   So, they are standing in Point Bar. In Point Bar Deposition occurred

EXERCISE 2.

Figure 3. Photo of a trench in the Brazos River

1. Look at the picture of the trench dug into the river bar (Figure 3), and describe the sedimentary structures present in the trench.

Looking at this image, we can tell that its color is yellow and black and identified as fine-grained.

2. How are these sedimentary structures created?

The density of the minerals causes these sedimentary formations to form as the lighter particles pile on top of the denser minerals, and the further they travel, the more well-rounded they become.

3. In which part of the river could these structures form? Hint: use Figure 4.

As we all know, we normally have deposition at Point Bar, thus we should observe this structure in Point Bar and the portion of the river where this may occur is at a meandering point.

Figure 4. Important morphologic features of a meandering river system. Simplified block diagram of Walker and Cant (1984)

EXERCISE 3 DON'T UNDERSTAND HOW TO DO IT

The purpose of this exercise is to locate the NOAA water level station in google maps and get water levels. Follow the steps below:

1. In the link below look for the LAT and Lon of the Brazos River near Rosharon station.
   http://water.weather.gov/ahps2/hydrograph.php?wfo=HGX&gage=ROST2

LAT LON How far north of the equator is this water level gauge. Use your latitude and remember that 1° latitude is ~111 km.

2. Check water levels for the Brazos River near Rosharon station in the link below and report today's water level:
   http://water.weather.gov/ahps2/hydrograph.php?wfo=HGX&gage=ROST2

Date: May 12, 2022, Time: 3.00 CDT Water level (ft): 8.72 ft Is it rising or falling?

3. How does the level of the river that you observe today compare with that when the video was recorded?

STOP 2 & 3. MODERN AND PALEO BRAZOS RIVER DELTA

1. What type of coastal deposit feature was discovered by Dr. Sisson in the current mouth of Brazos River? What is it called?

Dr. Sisson found a sandbar in the present place of the Brazos River as a coastal deposit feature. It is referred to as the lunate bar.

2. How has Hurricane Harvey affected the beach?

Hurricanes have a significant impact on the beach in terms of storm surges. Storm surges near the shore. wreak havoc on the beach and other coastal formations such as marshy woodlands

EXERCISE 4. THE FORMATION AND EROSION OF RIVER DELTAS: THE PALEO AND MODERN BRAZOS DELTA

a) Using the images below in Figures 5 and 6, describe the evolution of the old and the new Brazos River delta through time.

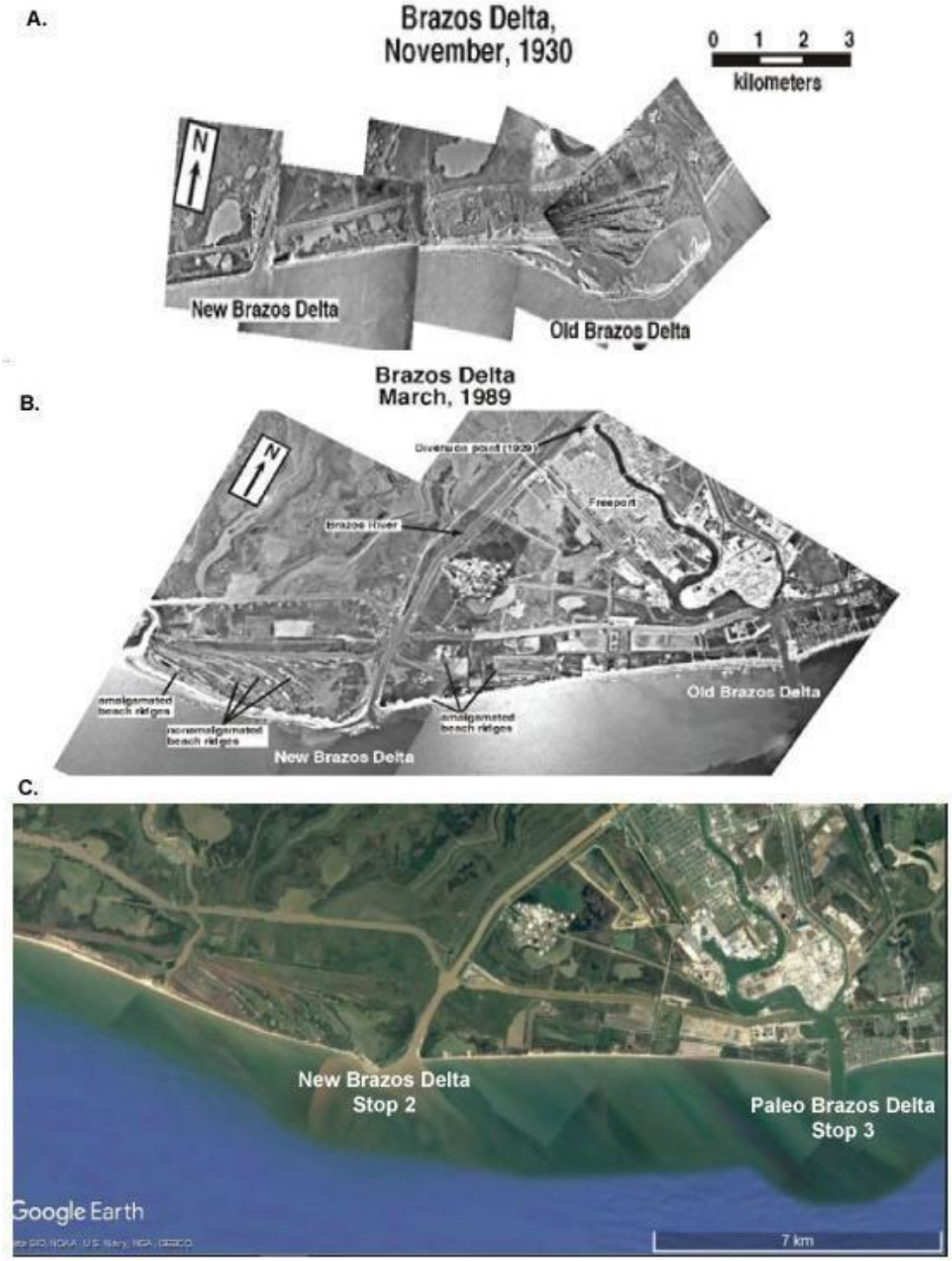

Figure 5. Time photos evolution Brazos river old and new deltas. Photos A and B from Rodriguez, A., et al., 2000. Photo C from Google Earth in 2018.

A) We can see how the Delta has changed over time. The old beach is one, while the new beach is the other. The avulsion of the river causes this. The river's course usually varies throughout time. A delta is formed when a river flows into the ocean and meets it. The Brazos River's path has varied

throughout time, resulting in two forms of delta development.

Figure 6. Brazos river new delta from Google Earth 2021.

Stop 3 Paleo Brazos river delta

True or False:

The waterway is tidal at stop 3. True

In the Gulf Coast, there is a very narrow continental shelf. So, the tidal forces are very large here.

Particularly in the summers, the breezes are always onshore. True

The high and low tides occur always at 2:00 am and 11:00 pm, respectively

False

The sand flux is similar during summertime and wintertime. False

The tidal range is sometimes only about a foot and the tidal frequency is as regular as elsewhere False

EXERCISE 5. TEXAS COAST GRAIN SIZES

Sediments from the Texas coast have been analyzed for grain size, using a laser particle analyzer, at the UH sedimentology lab. Using the grain size results in figure 13:

a) What is the mean of the grain size value for the Paleo Brazos River Delta, is the sample well sorted? The mean for Paleo Brazos River is between 100 and 300 um, and it is nearly well sorted. As we can see, it is well-sorted since it is mean in very fine and fine sand.

b) What is the mean of the grain size value for the Modern Brazos River Delta, is the sample well sorted? The mean for Modern River Delta is between 125-275 um, and it is not well sorted.
As we can see, it has a part in medium and coarse sand

c) What is the mean of the grain size value for the Galveston State Park- Beach, is the sample well sorted? The mean for Galveston State – Beach is between 100-200 um, and it is also not well sorted. As we can see, it has a part in medium sand

d) Locate the samples on a map, what can you interpret from the different grain size results along the Texas coast.

When we compare it to other deltas, the Modern Brazos Delta contains coarser grains.

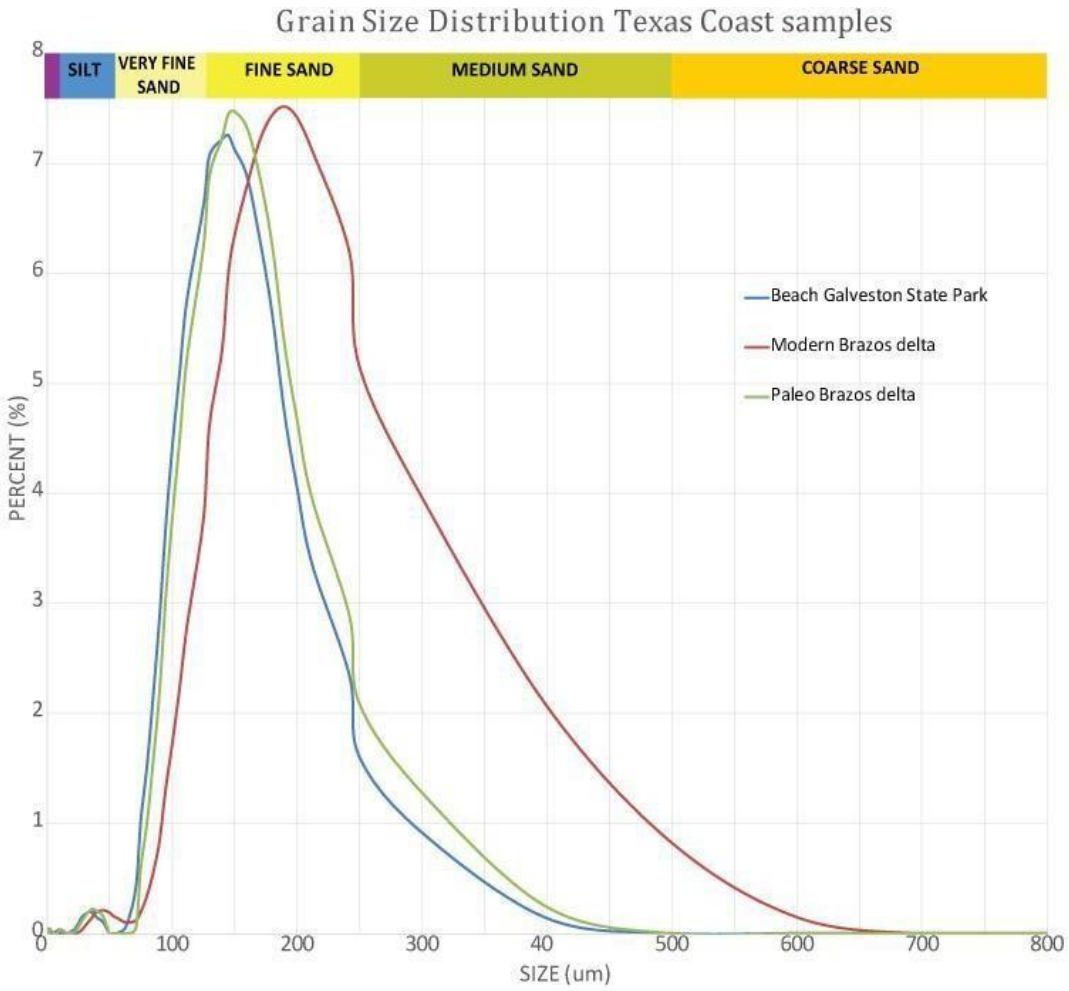

Figure 7. Grain size results from samples in Galveston.

STOP 4. GALVESTON STATE PARK

1. Describe the differences between the sediments observed between the beaches and the back bay?

   The sand on the beach is predominantly formed of a lighter substance, such as quartz, but the sand on the rear bay appears to be considerably darker.

Very shallow profile

2. Why is the marine vegetation that grows in the backbay is important in the CO_2 cycle and climate change?

   The flora that develops in the backbay is vital in the CO2 cycle because it sequesters carbon dioxide and traps it.

3. What is the typical direction of sand movement caused by the currents in the beach?

   The normal direction of sand movement induced by beach currents is following the longshore current.

4. Describe the difference in the color of the water at this stop with that at the Brazos River. Why is the water on the beach not blue?

   It is not blue Because there is a lot of suspended clay.

5. How many miles the beach would have been 10,000 years ago in the location of Stop 4?

Professor said 39 miles from the beach would have been 10,000 years ago.

EXERCISE 6: UNDERSTANDING WAVE RIPPLES AND THE LONGSHORE DRIFT CURRENT

a) Using the picture below (Figure 8), answer the following questions:
How do you think these ripples are being form?

Figure 8. Wave ripples at the Galveston State Park beach.

When water meets sediments, it starts to move in the direction of the water flow, forming an alternate ridge and furrow formations in the sediments. Because of the wave's forward and backward motions, both the stoss and lee sides of the ripple get rounded, and the waves become bipolar and generate herringbone cross-stratification.

b) he longshore drift is the movement of material along a coast by waves that approach at an angle to the shore but recede directly away from it. In what direction are the waves approaching the shore in Figure 7? what is the longshore drift direction in the Texas coast? Hint: Use what you learn about longshore drift currents at the stop 3.

Figure 9. Same as figure 8 with direction of wind shown by arrow.

The wave is nearing the coast from the southeast. Waves from the southeast are battering the shoreline. Longshore drift is flowing in a northeasterly direction.

STOP 5. GALVESTON SEAWALL

EXERCISE 7: HOW FAST IS THE BEACH BEING ERODED?

In this exercise, you will quantify how fast is the beach being eroded. Using the time pictures below (Figure 10) calculate the beach retreat rate between different years at the seawall and the average retreat rate at the seawall. Note the road on the top of the 1954 aerial photo (marked with a red dot in each image). You can use this to estimate the distance to the beach in 1954 and 1974 and subsequent years. For example, measure the distance from the red dot to the shoreline and use the scale bar on the photo. With this measurement, the beach is ~260 m from the red dot in 1954. You need to calculate the distance to the beach from the red dot at each time. Your measurements can be used to calculate either erosion or growth of the beach through time by simply dividing the difference in distance to the beach by the number of years between each image.

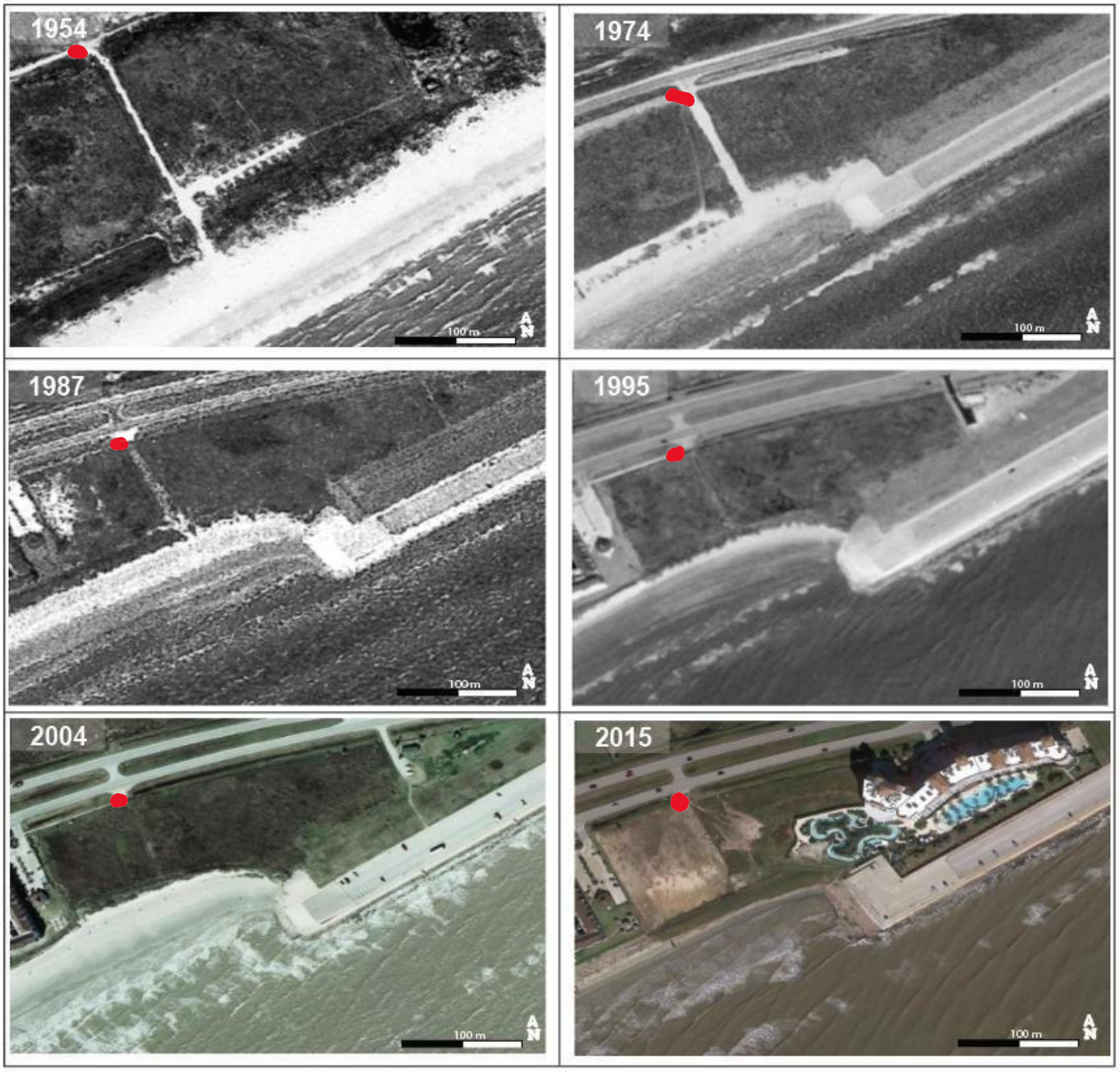

Figure 10. Galveston Seawall through time. Photos from Google Earth.

I don't see ruler to measure these distances. I used my Real Ruler

1. 1954-1974 = m/yr
2. 1974-1987 = m/yr
3. 1987-1995 = m/yr
4. 1995-2004 = m/yr
5. 2004-2015 = m/yr
6. Average beach retreat rate = m/yr

	Difference of Distances	Difference in years	Calculate
1954-1974	260-160=100	20	5.0
1974-1987	160-111.43=48.57	13	3.73
1987-1995	111.43-93=18.43	8	2.30
1995-2004	93-81.7=11.3	9	1.255
2004-2015	81.7-74=7.7	11	0.7
Average	**37.2**	**12.2**	**2.597**

Describe the changes in the beach relative to the seawall through time.

EXERCISE 8: IKE DIKE

The Ike dike has been the focus of continued discussion (figure 11). Much of the recent discussion is about the entrance between the east end of Galveston Island that you saw at Stop 6.

Figure11. Summary proposed features of the Ike dike.

The Ike Dike will be a coastal barrier project of about $26 billion, proposed by Dr. Bill Merrell of Texas A&M University at Galveston, that will protect the Galveston Bay in Texas. The project encompasses three different elements (figure 10): 1. Enhancement to the existing Galveston Seawall, 2. Two floodgates located in Bolivar roads and San Luis Pass, which would protect Galveston, the Bolivar

Peninsula, the Galveston Bay Area, and Houston. 3. Extended barrier across Galveston Island and the Bolivar Peninsula, that will be covered by manmade dunes.

News about the Ike Dike is often in the Houston Chronicle. Recently, some have raised concerns about its effect on Galveston Bay as well as about how the Ike Dike may not protect against all storms especially with climate change. How will this be paid for? Click here for a recent KHOU news report or here for a recent editorial in the Houston Chronicle.

Write a paragraph in which you explain your position on the Ike dike and how should it be paid for, be sure to use the geology concepts learn in class and in this Virtual field trip such as the information you got in Exercise 6, what changes do you think will happen to the beaches? Will all the sand that is accreting to the end of Galveston Island be deposited on the bay side of the new barrier or will it bypass the barrier and be deposited on the beaches? Do you think the proposed funding mechanism is appropriate?

My position about this project Ike Dike, is mostly positive. I believe this project was profoundly learned about any conditions on this beach since it requires more than $26 billion. This barrier will save most homes in these places because the weakness of Galveston Island is to have any storms and waves. As we know, climate change is constantly changing and protecting this place, and we need to take action. To avoid any kind of storm people should be prepared for it because no one knows precisely 100% when the storm will occur. Moreover, if a storm somehow goes through Galveston Island, it can reach Houston as well, so better to prepare for it and build barriers. So. It is an excellent investment since if a storm destroys homes, it will cost more than billions of dollars to repair them. I want to say that distractions can reach 28 billion dollars.