This was originally designed by Jordan Adams during her time as a PhD student at Tulane University.

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GiST Workflow / Notes for lecture

Note, if you don’t have Google Earth already, it is free. Download from here:

<https://www.google.com/earth/versions/>

**Before the session:**

1. Google Earth Set-Up
   * Upload new dataset to all computers (including front computer!)
   * Make sure all the points are “unchecked” in GoogleEarth
   * Change to feet instead of meters. Tools -> Options
   * Check “Borders and Labels” in the Layers file.

**During the session:**

* **Introduction**

All volunteers state their names, current occupation or grade, and a sentence or two about how they got into the sciences.

* **How do we describe the surface of the earth?**

We often state the elevation of the earth’s surface, with reference to a constant value, so locally we talk about how high above sea level we are. We can makes maps of the earth’s surface elevation, or topography.

For slides of the U.S.: Places where you see white are mountains. Notice that in Louisiana everything is all one color – black – which means elevations are all the same, that is it is flat. And the elevations are low, that is we live very close to sea level. 4421 m is 2.7 miles! The map that we see is actually a whole bunch of squares, but there are so many that you can’t see them when we are zoomed out. When we zoom in, we can start to see the square. Each square has one value that represents the elevation of the earth’s surface in that square.

* **What is geomorphology?**

**Geomorphology** is a subfield of geology, or the study of the earth. Geomorphology is the branch of geology that focuses on the origins, characteristics and development of landforms on the earth’s surface.

* **How do we use satellite imagery?**

To study these landforms, geomorphologists use a variety of tools. Often, geomorphology work is conducted using a variety of methods, like field work, lab experiments, computer modeling and satellite imagery. Most geomorphologists use some combination of these methods. Today we will be just looking at remotely sensed imagery, made available by Google in their software GoogleEarth.

* **What are landforms? How are they made?**

The different puzzle pieces are ”plates” on the surface of the earth. The entire surface of the earth – land and ocean – is part of different plates. The plates move around. So motion can be towards each other, away from each other, or sideways. As plates crash together they make mountains. Moving plates also separate areas, causes earthquakes, makes new sea floor…

Lots of photos of different landforms and how they are shaped/made. Also a mars image. You can explore Mars on Google Earth. (Hit the button in the toolbar that looks like Saturn. That will allow you to change to Mars or the Moon or the Sky.)

* **Section 1: How to use GoogleEarth**

Before we get started, we just want to review a few of the main tools in GoogleEarth.

1. When we click the name “Lake Pontchartrain”, it will take us to the pinned location.
2. The zoom in/zoom out bar is on the right (**PowerPoint**). If the mouse has a scrolling wheel, you can use that as well. If you get lost, click the “Lake Pontchartrain” pin in the content folder again.
3. Now zoom in until you can see both lanes of the Causeway. Zoom out until you can see both Point A and Point B again. If you get stuck, you can always click the “Lake Pontchartrain” pin again.
4. Now we are going to try out the ruler tool. (**PowerPoint**). It is located on the top toolbar. Once you have it open, click Point A and draw a line to Point B to measure the distance between the points. (~24 miles). “X” out the ruler box to close the ruler tool.
5. Finally, we are going to use the compass tool (**PowerPoint**). The “N” is the north direction. If you click on the N and hold it, you can spin it around to change the direction of the Google Earth image.
6. Using the compass tool, flip the image you see so that Point B is on the top of the screen and Point A is on the bottom.
7. Once you have that, let go of the “N”. Now, click that “N” and it should return to Point A at the top and Point B at the bottom.
8. We are now done with our Google Earth tools and we use Google Earth to explore a variety of landforms.

* **Section 2: Geomorphic Landforms**
  + 1. Rivers
* Click “**A**” to takes us to a portion of the Mississippi River on the border between Arkansas and Mississippi.
* This is called a **meandering river**, which is a river that moves (or meanders) back and forth, curving across a landscape.
* (**Q**): Can you identify old meander bends in the landscape where the river no longer flows?
* (**Q**): Why does the border between Mississippi and Louisiana not follow the Mississippi River exactly?
* Click “**B**” to take us to a portion of the Donjek River in Canada.
* (**Q)**: What is the big difference between this river and the Mississippi?
* This is different because it is a **braided river**. The biggest difference between the MS River and the Donjek River is that the MS River only has one main channel. **Braided rivers** have a network of small channels flowing in the same direction which make up the whole river system. Why is it so different? There is a lot more sediment – or the rocks that a river carries, in braided rivers. The Mississippi has smaller sediment, and Braided rivers usually have bigger sediment and more of it. Part of this is because this braided river is in a cold place.
* **C** is the Grand Canyon. This big hole in the ground, or valley, was cut by the Colorado River, over about 10 million years, but that number is debated. You can see a profile of the valley by clicking on the green line and choose “Show Elevation Profile”.
* **D** is Niagara Falls. The falls are made by the Niagara River. They formed after the last major glaciation, about 10,000 years ago. They are now engineered to not move, but in their natural state they moved upstream about 3 ft / year. Now we have lots of infrastructure around the falls, so we don’t want them to move.
  + 1. Volcanoes
* Now we are going to visit some volcanoes.
* If we click point “**E**”, we will travel to small cinder cone volcanoes in Hawaii.
* (**F**) Right now, the most active volcano in Hawaii is Kilauea. It has been active since 1983. It was recently very active (last year, 2018) and people lost their homes.
* (**Q**): Where are some other big volcanoes?
* Let’s go to a very famous volcano in the United States. Type “Mount St. Helens” in the search bar.
* If you zoom in, you can see the large **caldera**, which is a common volcanic feature formed by collapsing land after a volcanic eruption.
  + 1. Glaciers
* (**Q**): Do you think we have glaciers anywhere in the United States? **(A):** Glacier National Park, Alaska: the Wallypogs
* Only 1% of the glaciers exist outside of the polar regions.
* **G** is a glacial landform. This is Yosemite valley. You don’t seen any glaciers here today, but there were glaciers at one time that carved this landscape. Glaciers make “U-shaped valleys”.
  + 1. Mountains
* Some of the most recognizable landforms are mountains!
* **Mountains** are really large landforms that have really high elevations, and are often peaked at the top.
* (**Q**): Where in the United States can we see mountains? **(A):** Rocky Mountains, Appalachian Mountains
* Now, we can click on “**H**” to travel to the largest mountain in the world – Mount Everest!
* Mount Everest sits at the border of Nepal and China, and at the peak sits 5.5 miles above sea level. That’s like driving from Tulane to Metairie!
* Annual temperatures at the peak of Mount Everest range from -40 to 5 degrees Fahrenheit.
* If you zoom in and around Mount Everest, you’ll see large ice flows. These are glaciers!
* **I** is the South American Andes. There are glaciers here too. Mountains are high, and it is cold in high places, so glaciers can survive there.
  + 1. Landslides
  + Now we will look at landslides. Click “**J**” to travel to Washington State.
  + A **landslide** is a sliding mass of earth or rock down a steep slope.
  + You can see at the top of the landslide a steep scarp where the landside started.
  + Panning down, you can see where the landslide dammed the river.
  + (**Q**): What factors can cause a landslide? (**A**): gravity is the biggest, water helps too.
* **Section 3: Changing Earth**
* In this section we will look at changes through time and also look “below” the plants.
* In the toolbar, click the button that looks like a clock with an arrow above it. “Show historical imagery”. You can move the slider on here to see older images.
* **K** shows land loss in coastal Louisiana. Scroll all the was back to 1984. Slowly move the slider to the right. Make sure the images have time to load. How does the coast line change? How do the lakes change? How do the areas around infrastructure change? Note that you can always identify roads and infrastructure because it is very straight. For example, areas west and east of Golden Meadow.
* **L** shows land building. Here you can see two deltas form. (You might need to zoom in a bit.) Scroll back to 1985 and slowly move forward in time. You can see two new deltas being made. These are not controlled the way the Mississippi River is, but in its natural state the MS River would be doing this too, but likely in a different place from the current “bird’s foot”.
* **M** is the Ouachita Mountains in Arkansas. These mountains are very old, probably about 300 million years old. The earth was folded like an accordion and the mountains were formed. Beneath all the trees are layered rocks. If you click on 3DEPElevation, and wait a second for it to load, you will see what is called a “hillshade”. This is just an image that brightens some areas and darkens others, like we would see from sun-lit areas and shade. It’s a way for us to “see 3D”. The cool thing about this is that the vegetation is removed. Zoom in a bit and move around. You can see layers in the rocks that you couldn’t see with the regular image. You can also see gullies, or small valleys that were not visible with the vegetation. You can turn this on and off to compare what you see when you do and do not have trees.
* **N** is deforestation in the Brazillian Rainforest. Zoom back to 1987. You can already see many lines of deforestation. Scroll forward in time and the destruction spreads.
* **O** is a reservoir, or man-made lake, in South Africa. This lake is a water source for people in Cape Town and also farmers in the area. Zoom out so you see Cape Town and get your bearings. Click back on **O**. Now scroll back to 2009 and slowly move forward in time. The lake dries up in this area. Last year Cape Town was worried that they would run out of water from this reservoir. They initiated very drastic water rationing, or limiting people’s access to water. They never ran out of water. But droughts, like the one that caused the decrease in water in the reservoir, will likely get worse with climate change. Also, the biggest use of water is not people at home, but for agriculture.
* Click on **“Collapse of the Larsen B Ice Shelf”:** Once you get here, uncheck the box next to “Collapse of the Larsen B Ice Shelf” and then recheck it. This should update your time scroller. In the time scroll window, you should be a button that looks like a clock with an arrow pointing to the right. Hit that. You will see the collapse of the Ice shelf in early 2002. The students can measure it to see how big it is.