

GEOG 104  
Fall 2017  
Practical Exercise 2: Map Projections

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**Due: Thursday 9/21 at 9:00AM**

7 questions, 20 total points

This exercise will introduce you to two online resources for understanding and manipulating map projections. You will explore and interact with the projections and answer questions relating to their properties, advantages, and differences.

*Part I: Kartograph*

Kartograph is an online mapping framework for creating maps as scalable vector graphics (SVG). It has support for Python and JavaScript implementations, and is primarily intended for simple interactive maps that appear clean and minimalist. The developers specifically target designers and journalists as potential users of the framework. Kartograph has support for 28 different map projections and a demonstration page where you can quickly get a glimpse at the differences between them.

1. Open a web browser and go to:  
<http://kartograph.org/showcase/projections/>
2. Notice that the first projection that pops up is the Orthographic Projection. Take note of the map's appearance.
3. Take a look at the control panel on the bottom. Here, you can adjust the projection and center of the map.



*Question 1. [2pts]*

- a. Change **lon0** to 90 and **lat0** to 90 (in the orthographic projection). What geographic region do you see?
- b. Now, change **lon0** to 0 and **lat0** to 0 (in the orthographic projection). What geographic region is now at the center of the map?

*Question 2. [3pts]*

Change the projection to Mercator and then take a look at Greenland and Antarctica. Do their sizes seem reasonable? Why or why not? How do their sizes here compare to those shown in the Orthographic projection?

4. Take time to explore the other projections and views (Goode Homolosine? Sinusoidal? Hobo-Dyer?).

*Question 3. [3pts]*

If you wanted to make a map to focus on South America, which projection in Kartograph would you pick? Why? Take a screen shot of your selected projection and paste it in your lab writeup. Center this map (as much as possible) on South America. Is this projection cylindrical, conic, azimuthal, or a compromise? Explain why it is a good choice for South America and which properties it preserves (Shape? Area? Distance?).

*Part II: Tissot's Indicatrix*

Tissot's Indicatrix, developed by French mathematician Nicolas Auguste Tissot in 1859, is a tool for visualizing distortion produced by different map projections. It consists of mapping ellipses (which would be perfect circles of the same size on a 3D earth) onto a 2D projected map. The resulting Tissot's Indicatrices (plural of Indicatrix) may be enlarged in some areas, may be farther apart

1. Go to <http://globechalk.com/teaching/projections.html>
2. Click on each of the map projection buttons to open an interactive map with Tissot's Indicatrices in the corresponding projection. Each button should open a separate tab. Keep the tabs open to more conveniently compare projections.
3. As you examine Tissot's Indicatrices, pay attention to how the appearance of the circles changes from the poles to the equator. Do the circles change in size? In shape? How about the distances between them? Do they become larger or smaller?
4. Take a look at the map for the WGS 84 projection. Technically, WGS 84 is NOT a projection; it is a Geographic Coordinate System (GCS). The name of the projection shown in this example as WGS 84 is Plate Carrée. However, projections are often referenced in web mapping by their EPSG code (here = EPSG:4326), which for this is known widely as WGS 84. Compare Tissot's Indicatrices between the WGS 84 Web Mercator and WGS 84/PlateCarrée...

*Question 4. [3pts]*

What differences do you notice between the ellipses for WGS 84 Web Mercator and WGS 84/Plate Carrée? Does the shape of the ellipses change as you move away from the equator and towards the poles? Does the area of the ellipses change as you move towards the poles?

5. Open the Molleweide projection and observe the ellipses. The area of the Tissot's Indicatrices is preserved in this projection (it is equal-area).

*Question 5. [3pts]*

Do you notice other distortion in the Molleweide projection? Is there distortion of shape? Is there distortion of direction? If so, do these distortions become more exaggerated or less exaggerated towards the poles?

6. The examples also include two conic projections: the Lambert Conformal Conic and the USA Contiguous Albers Equal Area Conic. Take a look and observe their similarities.

*Question 6. [3pts]*

Which conic projection preserves shape? How can you tell from the ellipses? Which conic projection preserves area? Again, how can you tell from the ellipses?

7. Open up the Sterographic projection. Observe the area, shape, and distance between the ellipses as you move away from the center.

*Question 7. [3pts]*

What kind of projection is the stereographic projection (i.e. cylindrical, conic, azimuthal)? Why is there so much distortion in the ellipses as you move away from the north pole (hint: point(s) of tangency)? Does this projection preserve distance, shape, or area (or none)?