GEOG204 Tutorial 4

Map Projections

The objective of this tutorial to learn how to choose the right map projection.

Map Projections are mathematical transformations that allow you to draw geographic objects that in reality exist on the round earth onto a flat piece of paper.

Every map projection deforms the earth because it is impossible to represent the curved surface of the earth onto a flat piece of paper without stretching, skewing, and tearing the curved surface.

Properties of Map Projections:

1. Equivalent or Equal Area Projections
    - Equivalent projections preserve areal relationships
2. Conformal Projections
    - Conformal projections preserve local angles
3. Azimuthal
    - Azimuthal projections preserve directions from the center of the map to any other point
4. Equidistant
    - Equidistant projections preserve distance relationships

Due to the above limitations, *compromise projections* provide a representation of the earth that is not perfectly correct in any way but not badly distorted in any way either.

For this exercise, please put your work in a word document which you should me before you leave.

1. Open QGIS and add the data from World Continents folder
    1. What is the Coordinate System?
        a) Properties >> General Information
        b)
2. Look in the bottom right corner, you will see the current Coordinate Reference System (CRS) EPSG:4326

    1. Note that in most GIS applications the map display window shows the CRS of the first data layer added
    2. Take a screenshot of your map at a scale of 1:80,000,000
3. Change the CRS of the map display to WGS 84 / Pseudo-Mercator
    1. What do you notice about the size of area closer to the north pole?
        a) The Pseudo-Mercator or Web Mercator is a common projected coordinate system designed for web mapping applications. Most of online basemaps are tiled in Web Mercator. However, this projection does not preserve areas, distances, or angles.
    2. Take a screenshot of your map at a scale of 1:80,000,000
        a)

4. Change the CRS of the map display to World Robinson (ESRI:54030)
    a) The Robinson projection is primarily often used for general world maps. Area distortion grows with latitude and does not change with longitude. High latitude areas are exaggerated. Angular distortion is moderate near the center of the map and increases toward the edges. Distortion values are symmetric across the equator and the central meridian.
    b) Take a screenshot of your map at a scale of 1:80,000,000

5. Add the data in the census divisions folder
    1. Zoom in the layer "lcd_000b21a_e"
    2. What do you notice about Canada?
    3. What is the CRS of this layer? Is it different from the one in the map display?
6. Change the CRS of the map display to match the CRS of the lcd_000b21a_e.
    1. Does it provide a better representation of Canada?
        a) The Lambert conformal conic projection provides good directional and shape relationships for mid-latitude regions having a mainly east-to-west extent.
7. Add the Arctic Fox data layer. These data represent partial satellite tracking data of a fox in the arctic.
    1. We need to know distances between points, what projection should we use?
    2.
8. Export the BC data from the "lcd_000b21a_e" shapefile
    1. Reproject the BC data to BC Albers projection
    2. Again, reproject the BC data to NAD83 UTM Zone 10
    3. How different is NAD83 UTM Zone 10 projection from the Lambert conformal projection?

9. For this step the order in which you load the data is really important. We are looking at the so called "Null Island" effect
    1. Start a new project in QGIS
        a) From the Null_Island folder, load the WC_unknown_crs shapefile
            - Look at the bottom right-hand corner and not the CRS
            - Next examine the CRS of the shapefile in Properties >> Information
                - What do you think QGIS is doing?
        b) From the Null_Island folder, load the WC_CRS_54017 shapefile
            - Note that the layers are aligned appropriately
            - What do you think QGIS has done?
    2. Start a new project in QGIS
        a) From the Null_Island folder, load the WC_CRS_54017 shapefile
            - Note the units of measurement and the CRS
            -
        a) From the Null_Island folder, load the WC_unknown_crs shapefile
            - The layers should not be overlayed approprtaely.
            - Can you find the location of the WC_unknown_crs?