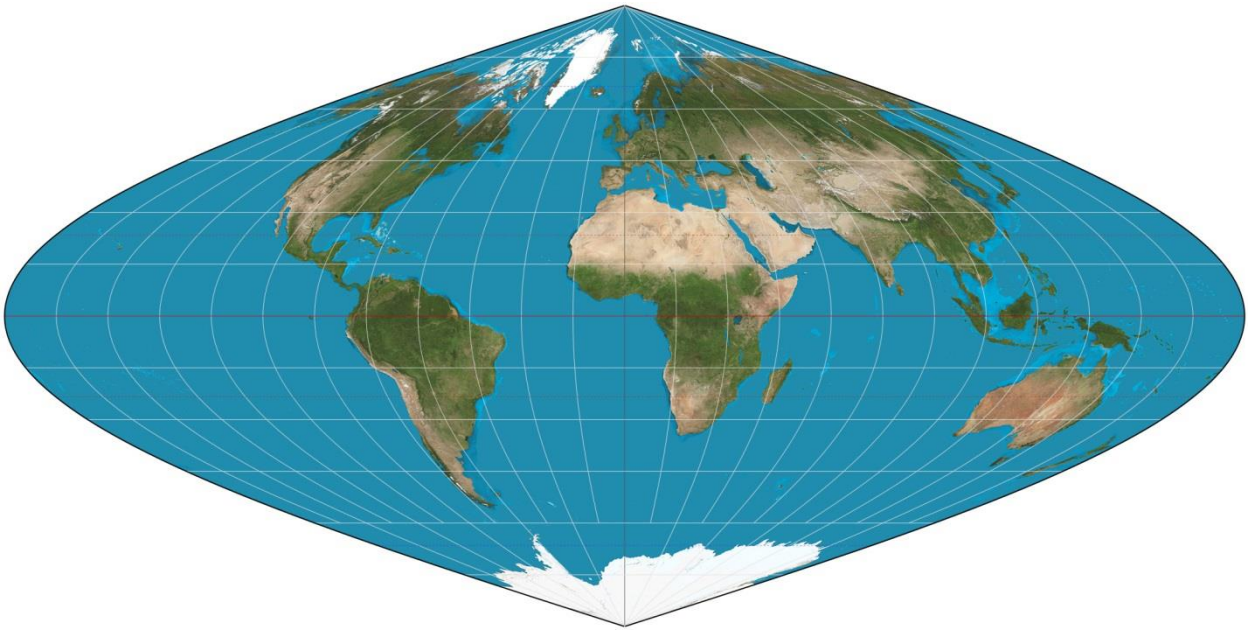
Sinusoidal Projection



Overview

In this exercise you will calculate values for a sinusoidal projection that you produce.

Concepts

The location of a point (x, y) in a sinusoidal equal area projection is calculated for this exercise in two steps. First, the longitude value is transformed to east–west values (x) by multiplying the longitude value times the radius and times the cosine of the latitude. Multiplying the longitude values by a cosine of latitude creates the gradually increasing distortion of areas further away from the equator. The north–south values (y) of the projection are calculated through a linear relationship between the radius and the latitude. Second, you will scale the calculated x and y values to fit a map on a piece of paper by determining a scale ratio that transforms the radius of the sphere (6,371 km).

Exercise Steps and Questions

Preparation

In this exercise you will be calculating a projection of a graticule. You will have to do the calculations and show that you have done them, but you can work with other people to check your answers and

determine the process. Before the calculating part of this exercise, let's look at the fundamental problems of projecting a spherical object on a plane.

Part 1: Angle measurement: degrees and radians

In Part 2 of this exercise, you will need to make the calculations in radians. Radians are one of three ways to measure angles. They are mainly used for engineering and science. We won't spend much time getting into the mathematics of angular measures. For this exercise, you only need to understand the relationship between degree and radian measures of angles.

Part 2: Construct a sinusoidal projection of a graticule

STEP 1: CALCULATE THE PROJECTION

Use the table below for recording the results of your calculations. The rows indicating latitude are on the left and the columns indicating longitude are on the top. You will be calculating the sinusoidal projection for latitudes 0°, 30°, 60°, and 90°, and for longitudes 0°, 30°, 60°, 90°, 120°, 150°, and 180°. Your results will be in kilometers, or, for an idealized projection surface, about 10,000 km in length and height. The equations you will use are:

$$x = \text{radius} \cdot \text{longitude} \cdot \text{cosine (latitude)}$$

$$y = \text{radius} \cdot \text{latitude}$$

Where: radius = 6,371 km.

Remember: convert all angle measures from degrees to radians.

Table of projected values (Step 1)

Latitude	Longitude						
	0°	30°	60°	90°	120°	150°	180°
0°	0,0						
30°							
60°							
90°							

STEP 2: SCALE THE X, Y VALUES AND THEN GRAPH THEM

The x, y values calculated in Step 1 are in kilometers; therefore they are certainly too large to fit on a piece of paper. As with creating any other map, the values need to converted to map units by determining a ratio that fits the x, y values on an ***A3*** sheet of paper. Scale can be determined by putting the ground values and map values in the same units, here cm, and calculating the ratio between the shortest ground value distance and the longest map value distance.

Determine this value and fill it in here:

Scale factor: _____

With the scale factor, convert your original projected values to map units. Use the table below for those calculations.

Table of Projected Values (Step 2)

Latitude	Longitude						
	0°	30°	60°	90°	120°	150°	180°
0°	0,0						
30°							
60°							
90°							

Using a ruler, graph each coordinate pair on the x and y axis on a separate piece of paper. The graph should look like the northeastern quadrant of a sinusoidal projection (***which should occupy the whole A3 paper***). When this is completed, label the axis with tick marks that indicate the corresponding degree value from 0° to 90° latitude and 0° to 180° longitude. This is a map projected to a sinusoidal projection.

Questions

1. The sinusoidal projection is an example of an equal area projection. What are the major differences between this type of projection and conformal projections?
2. Why do the x values lack two-dimensional scaling at 0° longitude in the sinusoidal projection?
3. What are the major differences between the Mercator and sinusoidal projections? How big is a pole in each projection?
4. Cebu City is located at 10.2833° N (Lat), 123.9000° E (Long). What is the x, y coordinates in the sinusoidal projection?