Latitude, Longitude and Map Projections

Introduction

Latitude and longitude is one of the ways we can locate anything, anywhere on earth. This coordinate system divides the planet with imaginary parallels of latitude and meridians of longitude. Latitude and longitude are measured in degrees either going north or south of the Equator (0^o latitude) or going east or west of the Prime Meridian (0^o longitude).

Objective

This exercise will focus on some of things you have learnt about latitude and longitude. You will look at latitude and longitude from a global perspective while learning the location of some of the more significant lines of latitude and longitude.

Before you begin…

1. **Start ArcVoyager**. (If you are not sure how to do this, ask your teacher.)
2. The ArcVoyager Guide will appear. Scroll down and click on the link called **Creating New Worlds: Turn Me Loose**.
3. Click on **Creating New Worlds: Start-up Project**.
4. In the new dialogue box *click* on the **magnifying glass**  to start the project. A blank ArcVoyager project will appear behind this window.
5. *Click* on the  in the top right hand corner of the window to close the ArcVoyager Guide. (You can always bring this window back by going to the Help menu and choosing ArcVoyager Guide.)

1. You need to add some maps to your view. Click on the **Add Theme** button . In the dialog box that appears, go to the **"c:\lat_long"** directory. From the list of files that appears in the left hand side of the box, hold down the **SHIFT** key and select the following files and then click on **OK**.

   country.shp
   grid30.shp
   geogrid.shp

2. You will see the names of these themes appear in the **Table of Contents** (the gray area to the left of the map window). Turn on the visibility of all the themes by placing a check mark the gray box to the left of the theme.

3. The themes will now appear in your **View**. You need to change the order that the themes are drawn in (ArcVoyager draws themes from bottom to top). To do this, click and hold you cursor on the theme name, drag the theme up or down in the **Table of Contents** and then release the mouse button. Do this until the themes appear in the following order: (1) geogrid.shp (2) country.shp (3) grid30.shp.

Part A – Latitude and Longitude

4. You are going to label some of the features on the map that are related to latitude and longitude. To do this, make the **"geogrid.shp"** theme the active theme by clicking once on the theme name, it will

appear raised up in the **Table of Contents**. (By making a theme active, you are telling ArcVoyager that this is theme you want to work with right now.)

5. With the **"geogrid.shp"** theme active, click on the **Text tool** . Label the lines of latitude and longitude listed here. To do this click on the line you wish to label. When the **Text Properties** dialog box appears, type in the name of the line and then click on **OK**. Do this for each of the lines listed here.

   Equator
   Prime Meridian
   Tropic of Cancer
   Antarctic Circle
   Tropic of Capricorn
   Arctic Circle
   North Pole
   International Date Line

6. If you look in the top right hand corner of your screen, you will notice that as you move your cursor over the map in your view, the latitude and longitude values appear here.

   Move your mouse along the Equator. What happens to the latitude and longitude as you move along this line? _____

   Move your cursor up and down the Prime Meridian. What happens to latitude and longitude here? _____

7. From the **Edit** menu, choose **Select All Graphics** and then hit the **Delete** key on your keyboard.

Part B – Great Circle Route

8. Let's take a look at the Great Circle Route. Click and hold the **Draw Point** tool . From the drop down list, select the **Draw Line tool**. Start at the bottom of Ontario in Canada (Latitude = 40, Longitude = -82 approximately) ***NOTE:** Remember, Longitude is the top number and Latitude is the bottom number.***. Click and hold your mouse. Drag a line to just inside of Russia (Latitude = 50, Longitude = 30) and then let go of your mouse. (Don't forget you can see the latitude and longitude in the upper right hand corner of your screen!!)

9. Let's change the color of the line so that it is more distinct. Click on your **Pointer tool**  and click on the line you just drew. Handles should appear around the line. Go to the **Window menu** and choose **Show Symbol Window**. This will bring up the **Line Palette**. Change the **Width** of the line to **2**. Click on the **Paintbrush icon**  to bring up the **Color Palette**. Change the line color to **green**. Close the Color Palette.

10. Go to the **View menu**, and choose **Change Distance Units**. Select **Kilometers** and click on **OK**.

11. Click on the **Measure tool** . Click once at the start of the line and then double click at the end of the line. The distance will appear at the bottom left of your screen (look at the Length).

    Record the distance here _____

12. Go to the **View** menu and choose **Properties**. Click on **Projection**. In the new dialog box, change the **Type** to **The World From Space**. Click on **OK**. Click on **OK** again.

    What has happened to the shape of your green line?

    _____

13. Once again, select the **Draw Line tool** . Start at the same point again. Click and hold your mouse, drag the line to the end point and release.

14. From the **Window menu**, choose **Show Symbol Window**. Change the Width of the line to **2**. Click on the **Paintbrush icon**  to bring up the **Color Palette**. Change the color of the line to blue. Close the Color Palette.

15. Click on the **Measure tool** . Click once at the start of the line and then double click at the end of the line. The distance will appear at the bottom left of your screen (look at the Length).

    Record the distance here _____

    Why is the distance shorter with the blue line?

    _____

    _____

16. From the **View menu**, choose **Properties** again. Change the **Type** to **Geographic**. Click on **OK**. Click on **OK** again. You will see your projection change again. Click on the **Zoom to Full Extent** button to see the entire map in your view.

    What has happened to the shape of the blue line?

    _____

    What are some conclusions you can make about the Great Circle Route?

    _____

    _____

Part C – Map Projections

17. From the **Edit menu**, choose **Select All Graphics**. Hit the **DELETE** key on your keyboard.

18. From the **View menu**, choose **Change Map Projection**. Select **Mercator** and click on **OK**.

NOTE: When you change your map projection to something other than Geographic, the latitude and longitude of your cursor are not longer displayed in the top right hand corner of your screen. To view the latitude and longitude, click on the Show Longitude, Latitude tool and then click anywhere on your map. The latitude and longitude will appear in the bottom left hand corner of your screen now.

    What has happened to the shape of the countries?

    _____

    _____

19. Try changing the projection to **Robinson** and **Sinusoidal** also.

    Which projection do you think is the best?

_____
_____

20. Finally, change the map projection to **Orthographic (World From Space).**

    What are the advantages to this projection? What are the disadvantages?
    _____
    _____
    _____

21. Click on the **Pan East**  or **Pan West**  button until your map is centered on North and South America.

    What happens to the shape of the lines of latitude as you move east or west?
    _____
    _____

22. Click on the **Pan North**  or **Pan South**  button until you see the either the entire **North Pole** or **South Pole** in your view.

    What happens to the shape of the lines of longitude as you move towards the poles?
    _____
    _____

Let's print your map…

23. From the **View menu**, choose **Layout**. In the **Template Manager** that appears, choose **Landscape** and click on **OK**. You have now created a printable version of your map with a scale bar, a title, a north arrow and a legend. However, some things need to be changed.

24. Double click on the **title** of the map (**View1**). In the **Text Properties** dialog box, change the title to something that reflects more what you are showing here (What? Where? When?) and then click on **OK**. Now, double click on the **scale bar**. In the **Scale Bar Properties** dialog box that appears, change the units to **Kilometers** and click on **OK**.

HINT!! To change the size of the text, click on the **Pointer tool**  and then click once on the text. You can use the handles that appear and your **Pointer tool**  to resize and move the text to your liking.

25. Click on the **Text tool**  and then click on the bottom right hand corner of the layout. When the **Text Properties** dialog box appears, type in your name and then click on **OK**.

26. You are now ready to print your map. Go to the **File** menu and choose **Print** (remember to change the orientation of the paper in your Printer Properties to Landscape) and hand it in to your teacher…

27. Once you have printed, go the **File** menu and choose **Exit** to close the program.

Extension exercise: The Flat Earth Society believes that the earth is not round. What do you think? Visit the Flat Earth Society (or becoming a member!) by visiting their web page at **http://www.alaska.net/~clund/e_djublonskopf/Flatearthsociety.htm**