CE En 114 Lab Exercises

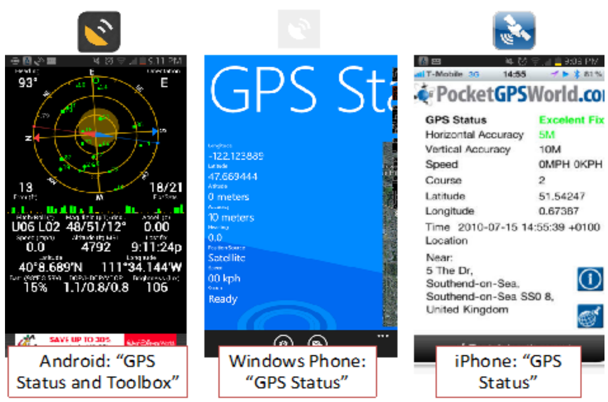
Lab #8 – Using GPS Data in ArcMap

Introduction

At the beginning of the semester, we collected spatial data using surveying equipment. That process is limited in the distance we can reasonably measure. It takes a lot of time to measure large distances with surveying equipment and maintain. Some advantages to GPS are that we can quickly collet spatial information for anywhere in the world and GPS devices are widely available. A GPS will give you Latitude and Longitude coordinates that can be converted to match any projection system. Points surveyed through GPS can be uploaded, visualized, and eventually analyzed as spatial data in a GIS such as ArcMAP. In this lab, you will use and collect GPS data around campus.

Part 1 (Collect & Import Data)

1. Form groups of 3. Each member needs either a handheld GPS unit or a cell phone with a GPS and an appropriate GPS reader app.



Android: "GPS Status and Toolbox" | Windows Phone: "GPS Status" | iPhone: "GPS Status"

2. Go to 10 of the following places and collect the Latitude and Longitude information using your phone/GPS. For the sake of accuracy, and adventure, do NOT pick two points right next to each other (such as the Tau Beta Pi monument and the sundial). Each team member needs to collect Lat/Long data at each location you visit.

    1) JSB_Joseph- Statue of Joseph in the JSB grove area
    2) Tree_Of_Life- Tree of Life statue in front of the JSB
    3) Pit_Of_Despair- Bottom floor lobby of the Testing Center
    4) BroMaeser- Statue in front of the Maeser building
    5) TheBigPi- Tau Beta Pi statue in front of the Clyde
    6) Sundial- Sundial in front of the Clyde
    7) TA_Lab- By the door to the TA Lab.
    8) Pendulum- Pendulum in the ESC entrance
    9) Buried_Treasure- Underneath the X in the glass above the entrance to the library (on the stairs going down to Periodicals)

10) Pool_Party- JFSB fountain
11) Bikes- Highest rated bike rack on campus, south of the Talmage
12) BroBrigham- Brigham Young statue south of the ASB
13) Busted- Bust in the 4th floor entrance to the TNRB
14) MOArt- Entrance to the MOA
15) Winner- Victory Bell south of the Marriott Center
16) Hinckley- Grass area behind the Hinckley building
17) Cosmo- The Cosmo statue inside the Bookstore by the bank

3. Each team member should record all of their lat/long data points. Find the average Latitude and Longitude value measured by each team member. Use every digit you get from the phone/GPS. Using an online converter, convert your lat/long data points to XY coordinates. Each team member should also convert their own data so that each has a list of coordinates for the points they measured and the team has a list of coordinates of their averages.

   http://www.rcn.montana.edu/resources/converter.aspx (You're converting from DMS or Decimal Degrees to Standard UTM, Zone 12N).

4. For each list of coordinates, make a table that exactly duplicates this format in Excel.

Location Name	X	Y
MOA	4452354	98413264
…	…	…

5. Each team member should also copy their table of values to the class google sheet under the tab called GPS activity. (link available on learningsuite) We will use this data for a class demonstration.
6. Save this table as a csv comma delimited file. In previous labs, we only included the coordinates. If you include additional columns of information, ArcMap will include them as attribute information. This will save you the work of editing the attribute table manually for each point.
7. Open a new project in ArcMap and add this file using the Add XY data tool. Remember to select "NAD 1983 UTM Zone 12N."
8. Add a World Imagery Basemap.
9. In the Table of Contents, right click your new layer and select Zoom to Layer. Change the symbol to be more easily visible. If the data is not in the correct place, check to be sure the x and y data were imported correctly and you are in the correct projection/coordinate system.
10. Convert your .csv layer to a shape file. Csv files cannot be fully utilized by ArcMap but can be converted into a shapefile which can be. Right click the .csv layer, select Data, then Export Data. Save as a shapefile in the same location as other files for this lab. A message box will appear asking if you want to add the exported data to the map as a layer. Select Yes to pull the shapefile into the project as a new layer.
11. Ensure the new layer is displaying the csv data correctly on the map. If there are errors, check the attribute table to see the x and y column values. If everything is correct, delete the .csv layer.

Part 2 (Creating a Map)

Export a map showing the points you created with labels, basemaps, titles, and all the other cartographic elements required. The following is an instructional guide to remind you how to do each portion in case you have forgotten.

1. In the bottom left corner, select Layout view.
2. Using the Insert menu (top toolbar) and the layout toolbar that appears when you open this view, add all the necessary components to the map. Refer to the rubric for requirements. Leave space for an inset map.
3. Create an inset map. Select Insert > Data Frame. A new box will appear in the layout view. You can switch between editing this data layer and the first by clicking on the one you want to edit while in layout view then switching to data view.
4. Select your new data layer and switch to data view. For this assignment, the purpose of the inset map is to provide context to the location of these data points compared to the rest of the country. Add a basemap layer to this data frame that will be most helpful in showing the location of your data points (i.e. not necessarily just imagery).
5. From the Catalog on the right, add your GPS Data layer to the new data frame. Zoom out far enough that you can see where the data is compared to the rest of the country.
6. Return to the layout view. Make sure the map is legible and organized. If you need to change either of the maps, select that map in the layout view then switch to data view and make your changes.
7. Export your map. You may either go to File>Print or File>Export Map. Choose PDF. Check to be sure the PDF looks how you want it to then submit it on Learning Suite.

Part 3 (Reverse Surveying/Geocaching)

The goal of this section is to use GPS coordinates to find a place on campus. Go to the following location and take a picture of your group at that place. These are either statues or large grates on the ground. Now go to the exact spot your GPS reads these coordinates and estimate the error between this given measurement and your experimentally collected measurement (this should be a linear distance eg I was approximately 5 ft away). Write a short conclusion where you give your estimated error for each of these points and discuss why there might be error. You should reference the types of error discussed in the readings and lecture.

40^{0} 14.876′ N 111^{0} 38.925′ W (a statue)

40^{0} 14.89074′ N, 111^{0} 38.985′ W (a statue)

40^{0} 14.82876′ N, 111^{0} 39.05124′ W (a vent in the ground)

40^{0} 14.93838′ N, 111^{0} 38.91192′ W (a drain cover)

40^{0} 14.98362′ N, 111^{0} 38.95578′ W (center of a walkway)

Deliverables

<table>
<tr><th>Item</th><th>Points</th></tr>
<tr><td>Conclusion describing
What you learned
Reporting the error in the geocaching measurements
Explaining possible error associated with the GPS. Do not speculate, use the sources of error discussed <u>by name</u> in chp 5 of the textbook and the lecture slides. Human error should not be present because we gave you specific instructions about where you should go and how to take measurements.
This should take several paragraphs.</td><td>10</td></tr>
<tr><td>Pictures of your crew at the geocaching locations</td><td>5</td></tr>
<tr><td>Make a full-page map showing the locations of the GPS points.
Map Title: 1 point
Neat Line: 1 point
North Arrow: 1 point
Scale Bar: 1 point
Text box with author names, date, map projection: 1 point
All points are marked with a clear, well-defined color/icon: 2 points
Inset map clear enough to show context: 2 points
Background map is visible: 2 points
Zoomed to an appropriate scale for viewing all points: 2 points
All text is legible on printed map: 2 points</td><td>15</td></tr>
</table>