a. Introduction.

This project wants us to analyze the land surface parameters at different scales and evaluate different methodological choices for terrain and hydrological analyses. Task 5 need us to prepare the data for the following tasks, helping us remember how to project current layer into another layer at the needed projected coordinate system. Also, extract by mask tool is required to let us focus on one small area. Task 6 is to analyze the terrain. There are several new tools I need to use, so I took a glance at the description of the tools first before I used them in the project. Hillshade, Slope, Aspect are three tools to analyze terrain. Next tasks are bounded with each other and task with small number is the prerequisite for the bigger one. Task 7 is to create a streamflow layer. This task can give us a view of how water flows from high to low and the tool called Flow accumulation can calculate the number of pixels that flow into a given pixel, which is the mechanism of how we obtain the direction of rivers. Task 8 needs us to change the color of layers where we can differentiate streams and lands clearly. It’s a little bit difficult to estimate the optimal cutoffs for each DEM and I have tried many times to find a balance between having too more red zones on the layer and clearly showing the river. Task 9 is to calculate the amount of land that drains into the Browns Canyon Creek. With the formula in the instruction, I solved this task quickly but still spent a lot of time on locating the pixels (use the wrong layer many times). Task 10 wants us to draw the watershed which requires several steps to edit a point and use the Watershed tool to draw the outline. Task 11 and 12 is to create a map and make a comparison between layers at different scales.

b. Study area.

The study area is a rectangle located in the San Fernando Valley section of Los Angeles (Figure b1). The package of this project includes rater data of this study area at 3 different scales. This area is larger than the Brown Canyon Wash and forms a watershed of the Los Angeles River and Browns Canyon Wash. All of the tasks are based on the streams which flows in this area especially the intersections.

Figure b1. Study area

c. Data table.

1) This dataset contains many folders and we need to use the usgs_ned_13（1）_n35w119_gridfloat.flt. The number 13（1）in the name represents the scale used in the raster layer.
2) Browns_BoundingBox_USGS_DEM_1m is a DEM at 1m which we used a lot in this project. BrownsCanyonWash_BoundingRect shows the boundary of the study area. USGS_Watershed_BrownsCanyonWash helps us locate and make a comparison between the streams we identified. Based on these data, we create other layers and data using tools provided by ArcGIS pro.
3) This dataset is provided by the USC Spatial Institute and we used it as student

d. Methods..

1) Task 5: prepare data

   I used Project Raster tool to project the data into NAD 1983 UTM Zone 11 N, which focuses on the North America. Secondly, I used Extract by Mask tool to constrain the projected layer into a smaller one which is the same as the boundary.
2) Task 6: analyze the terrain

   This task contains three parts. Firstly, when I was using the Hillshade tool to create shaded relief, I changed the z-factor to see if there were some changes and the outcomes changed. Z-factor made the shade more stereoscopic. After finishing these tasks, I changed the symbology of the outcomes in the end. It looked better when we use contrasting colors.
3) Task 7: analyze the streamflow

   I followed the instructions to create the layers. I chose the default algorithms D8 to run the Flow Direction tool.
4) Task 8: change the symbology

   Changing the symbology was difficult for me because I used wrong layer (the original one not the Flow Accumulation one) and found however I changed the value, I couldn’t get an image of rivers. After asking my classmate for help, I started to find an optimal cutoff for each layer. Because if the upper value of yellow becomes bigger, there are fewer red zones appearing on the map. The raster layer at 1 m was hard to distinguish the red river because it’s to vague. I used the original raster data USA Detailed Streams to help me to adjust parameters.
5) Task 9: access the amount of land

   I followed the formula mentioned in the task. It’ easy for me to change the unit because we only need to multiply it. But I still spend time on locating the pixels because when I used a wrong layer, I couldn’t zoom it into a pixeled size.

6) Task 10: draw the watershed

When I was doing this task, I returned to the exercise 4b to help me remember how I did to create a new feature layer. However, I found the tool mentioned in the instruction has a wrong name and we should use the Create Feature Class. I firstly created a point on the original layer and then import them as different layer but still inside of this boundary. And then I used the Watershed tool to draw the watershed zone. I removed the created layer several times because I miscreated points on the layer so the created layer has multiple values which were totally wrong.

7) Task 11: compare results

I compare the results with the provided 10 M layer, and I found the 30M is similar to this but 1 M is smaller than these two. I think the difference was resulted by the upper value I changed in previous task. Maybe it’s hard for it to draw a big zone if the river in 1 M is quite vague.

8) Task 12: create a finished map

I created a new map and dragged the layers I needed into this new map. I change the map frame, the legend and the scale bar to get a finished map.

e. Results.

1) Task 5: prepare data

I used the tool and the new DEM was now in NAD 1983 UTM Zone 11N and oppend its propertires to see if it worked (Figure e1). And now we can concentrated in this zone (same big as the bounding box) (Figure e2).

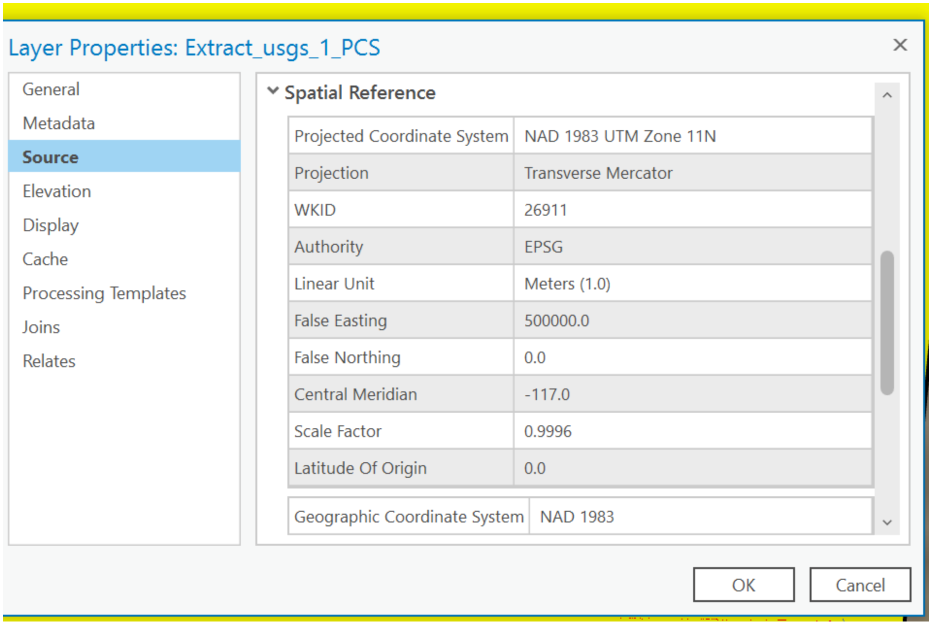

Figure e1 the PCS of the extracted DEM

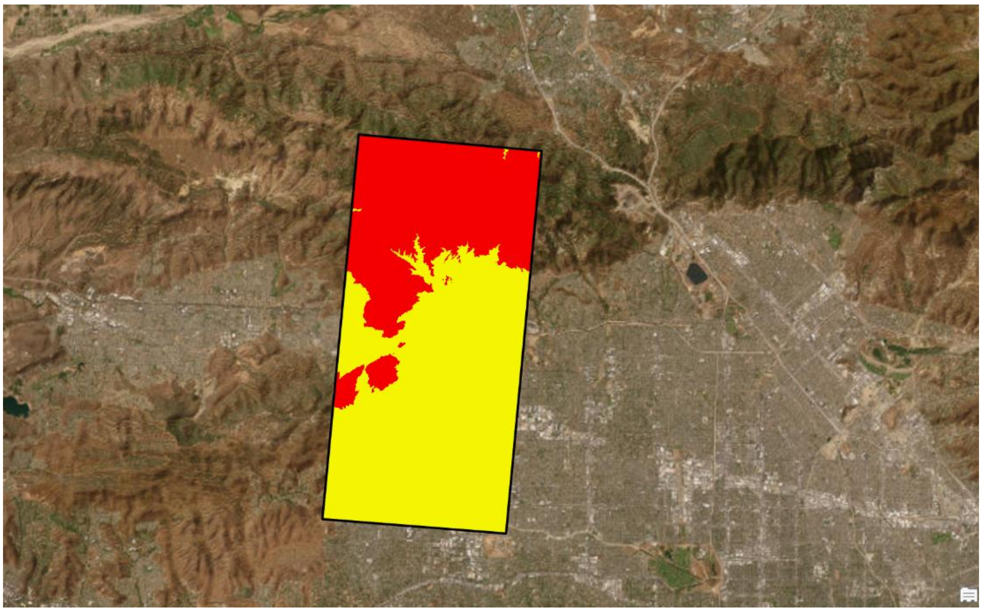

Figure e2 the bounding box

2) Task 6: analyze the terrain

Hillshade:

After using the tools I obtained to hill shades at different scale (Figure e3 and Figure e4). We can see the Hill shade at 30 M is not clear as the 1 M one. The smaller scale makes the shade more apparent and the lines are sharper. Hillshading gives us the lighting effect on the map based on the elevation variations of the mountains and hills. It seems like we are observing the lunar surface!

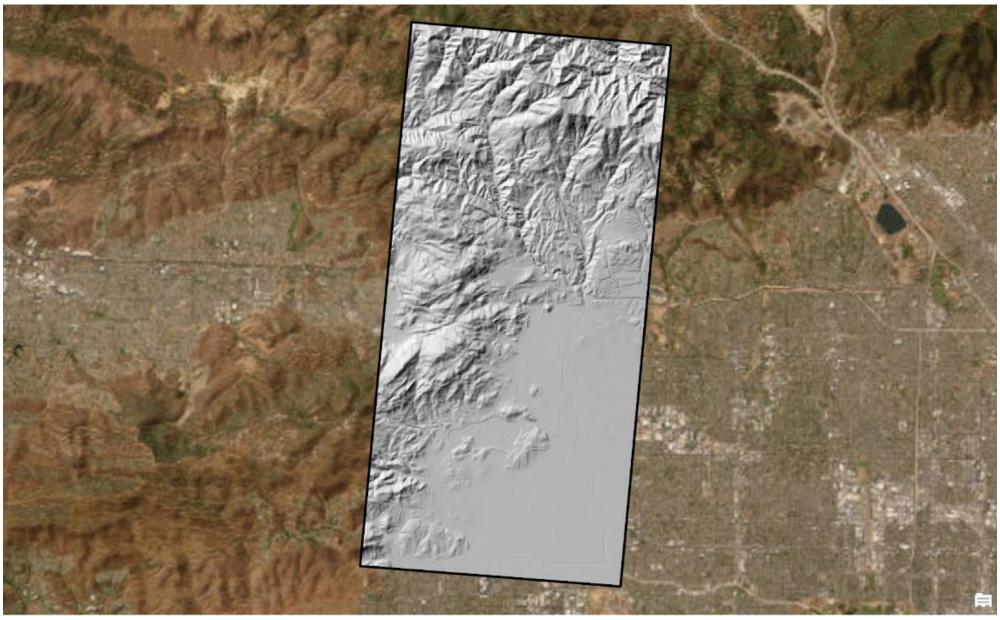

Figure e3 Hillshade of extracted 30 m DEM

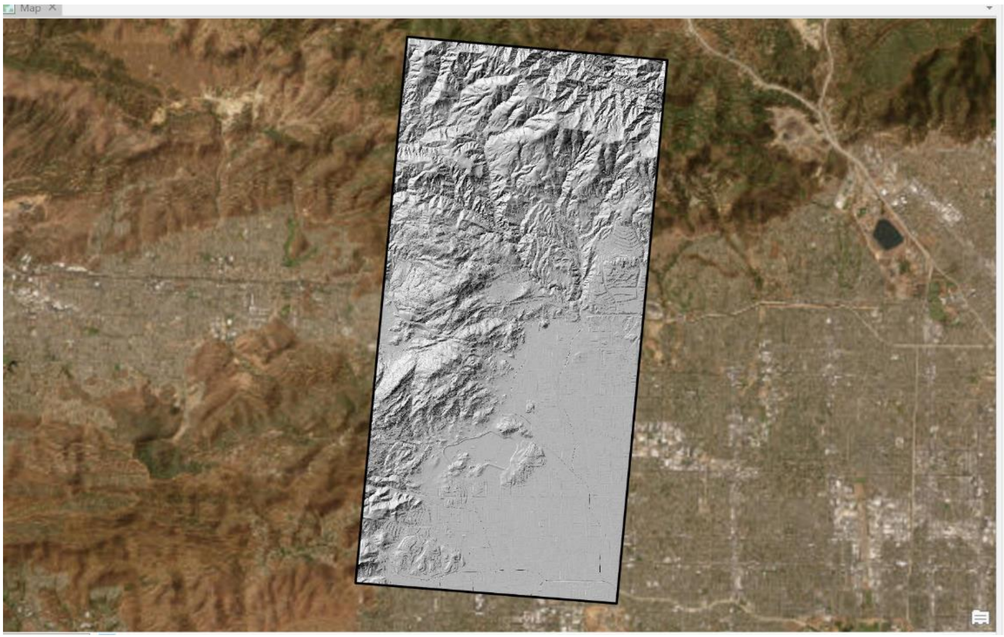

Figure e4 Hillshade of Extracted 1 m DEM

Using the slope tool I obtained this two figures below which clearly showed the slope of this area (Figure e5 and e6). This tool identifies the steepness ate different cell of a raster layer. In the map, the darker areas are more steep but the shallow area ares more smooth. It’s an another way of showing the variation of the elevation and how the terrain changes.

Figure e5 Slope of Extracted 30 m DEM

Figure e6 Slope of extracted 1 m DEM

The aspect tool I used below gave me two figures (Figure e7 and e8), which showed the direction the downhill slope faces. After I looked the description of the tool in ArcGIS, I found the values are measured clockwise in degrees from 0 to 360.

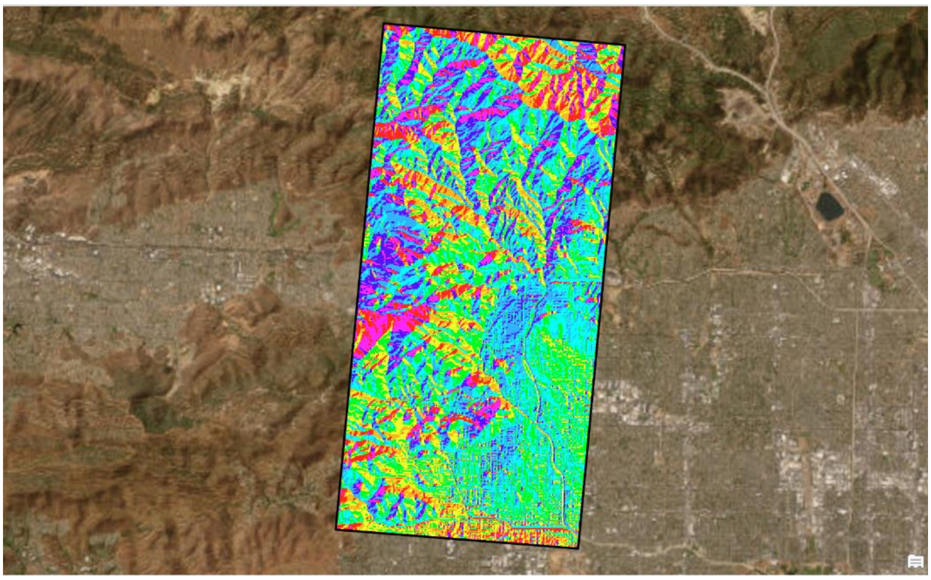

Figure e7 Aspect of extracted 30 m DEM

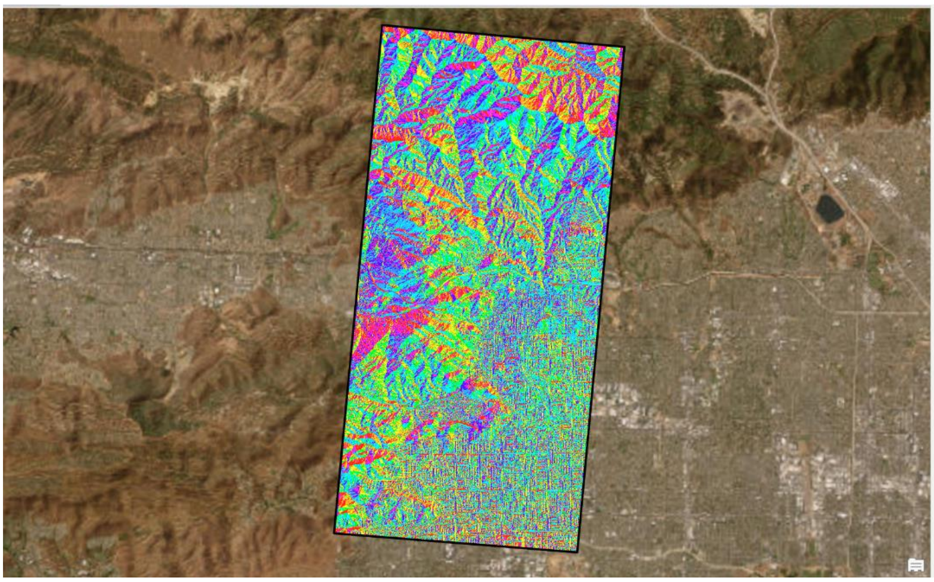

Figure e8 Aspect of Extracted 1 m DEM

3) Task 7: analyze the streamflow

   We can see how the rivers flow in this area. The lighter area represents how the rivers intersects and its tributaries. The river origins at the foot of the mountain and floods into flat area which forms canyons valleys. The map at scale 30 looks more clear (Figure e9 and e10).

Figure e9 Flow accumulation of 30M DEM

Figure e10 Flow accumulation of 1M DEM

4) Task 8: change the symbology

I adjusted the upper of the yellow zone to get a clear red river on each map. No matter how I made changes, the intersection was still far from the real location. If I lower the upper value of yellow, it will wrongly count streets as river which can be showed in a map as straight lines (Figure e11 and e12).

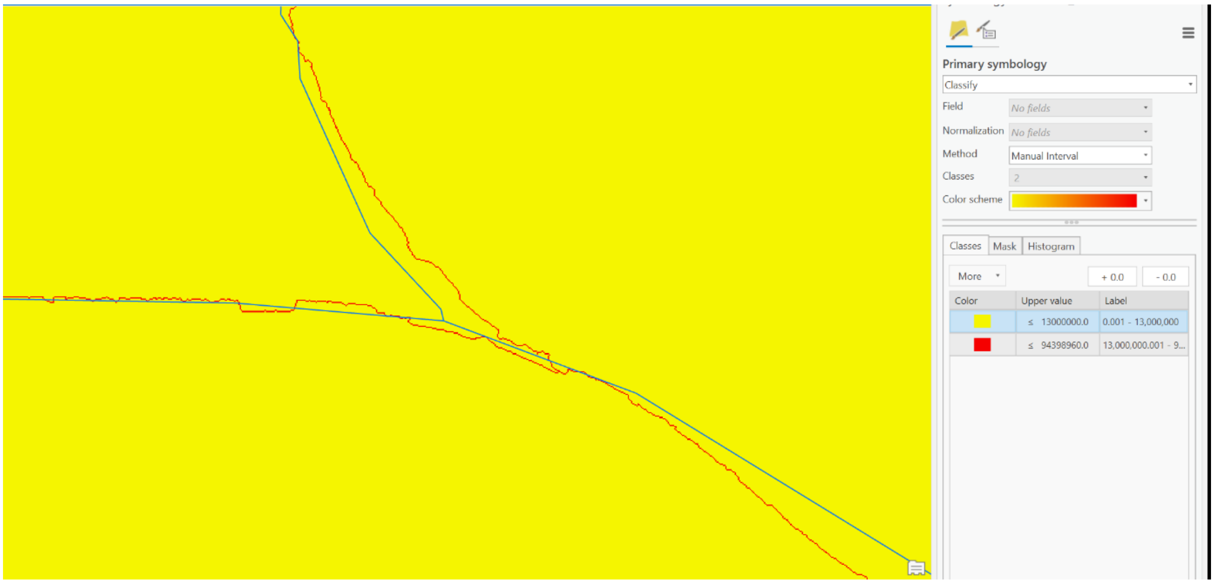

Figure e11 rivers at 1M

Figure e12 rivers at 30 M

5) Task 9: access the amount of land

Here is the pixel I located in the map (Figure e13). And the answer is (69697 * 900) / 1000000, which equals to 62.7273 km^2.

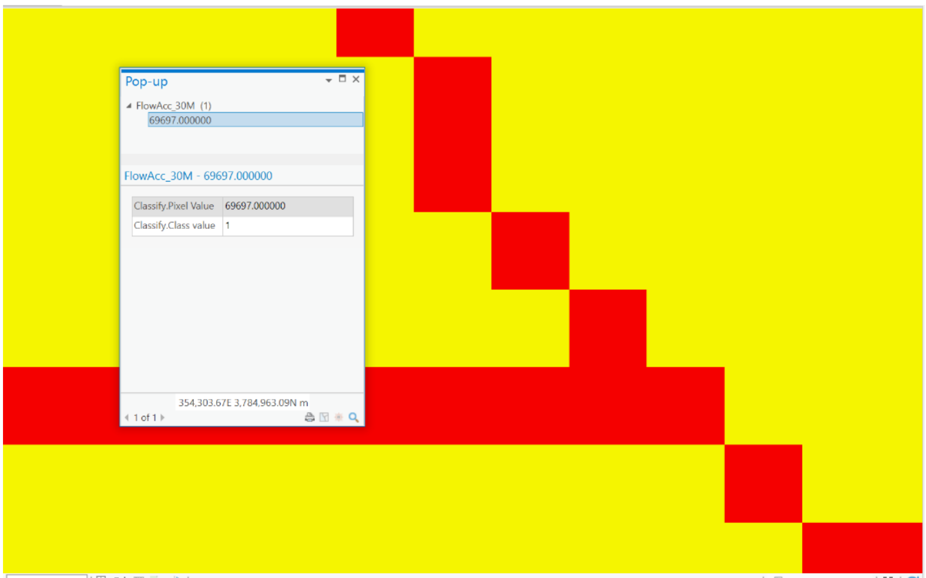

Figure e13 the pixel of the intersection in the flow accumulation at 30 M

6) Task 10: draw the watershed

I have never imagined the watershed can be displayed as a zone (I just thought it should be a line or a ridge of the mountain). The watersheds are as below (Figure e14 and e15).

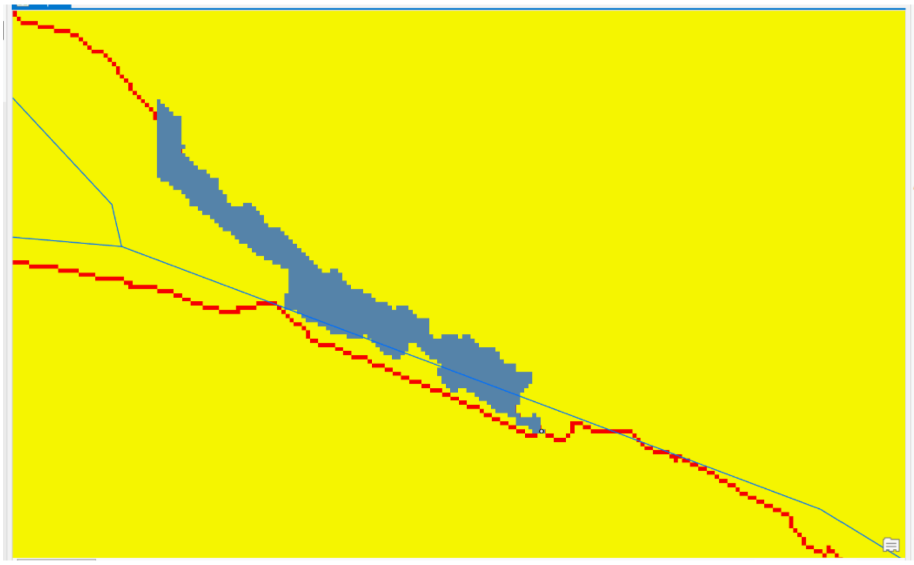

Figure e14 watershed at 1 M

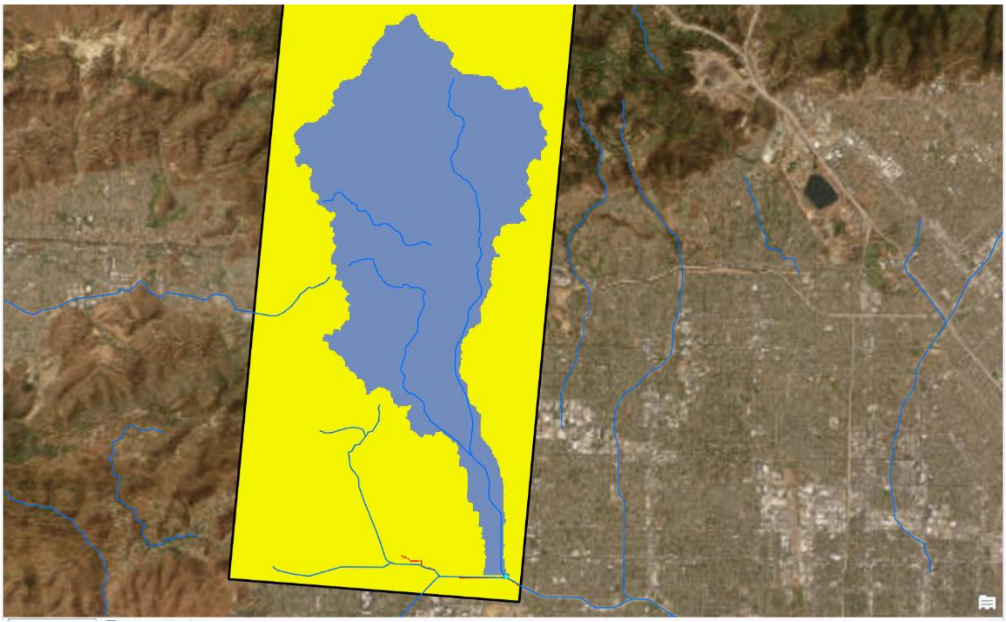

Figure e15 watershed at 30 M

7) Task 11: compare results

   I compare the results with the provided 10 M layer, and I found the 30M is similar to this but 1 M is smaller than these two. I think the difference was resulted by the upper value I changed in previous task. Maybe it’s hard for it to draw a big zone if the river in 1 M is quite vague.

8) Task 12: create a finished map

   Here is the map which contains every map I create during the process and is located at the bounding box. I found difficulties in making a layout and I understand I need more time to finish the Exercise in Chapter 10.

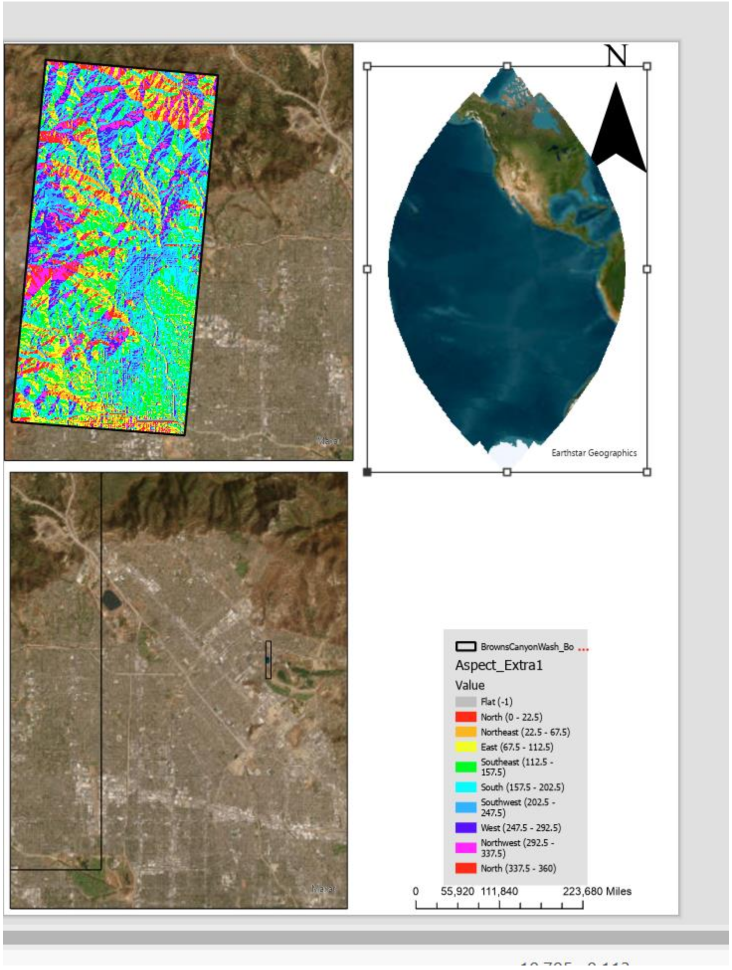

Figure e16 the output map

f. Discussion. Critical assessment of your results.

I think I did a great job of this project but still need time to practice more especially in making a true map. The 30M works well for every task in this project because it's big enough for us to clearly see how the map changes in hydrologic analyses. The modifiable area unit problem occurs when we use different scale. For example, the watersheds I draw are different between each other. The layer at small scale has a small watershed (I don't know if I did something wrong during the practice) but the 30 M has a large watershed. It should be similar to each other but finally they appeared differently. That was how the scale effect changes outcomes. When we examine a phenomenon at a finer resolution than the relevant scale, the noise introduced in the covariates generates an error in variables bias, which is carried throughout the different levels of aggregation (Avelino et al.,2016). This article indicates we observe increasing bias in the more precise variable (finer scale) and I think that might be the reason why my outcome is too unique.

Reference

1. Avelino AFT, Baylis K, Honey-Rosés J. Goldilocks and the raster grid: Selecting scale when evaluating conservation programs. PloS one. 2016;11(12):e0167945-e0167945. doi:10.1371/journal.pone.0167945