Practical No.: 8

A) Nearest neighbor analysis.

Given the locations of all known significant earthquakes places, we need to find out the nearest populated place for each location where the earthquake happened.

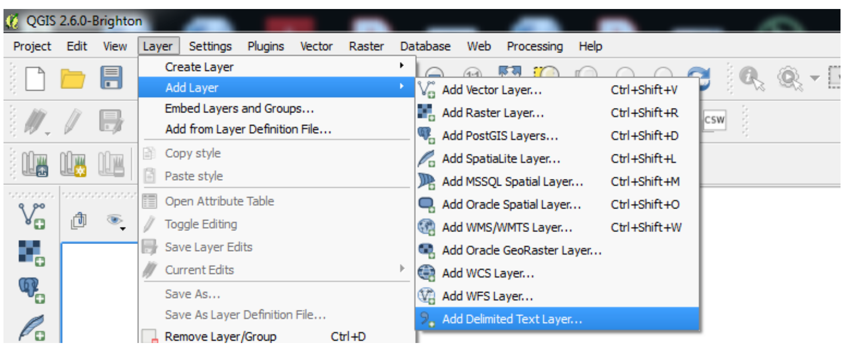
Required dataset:

ne_10m_populated_places_simple
signif.txt

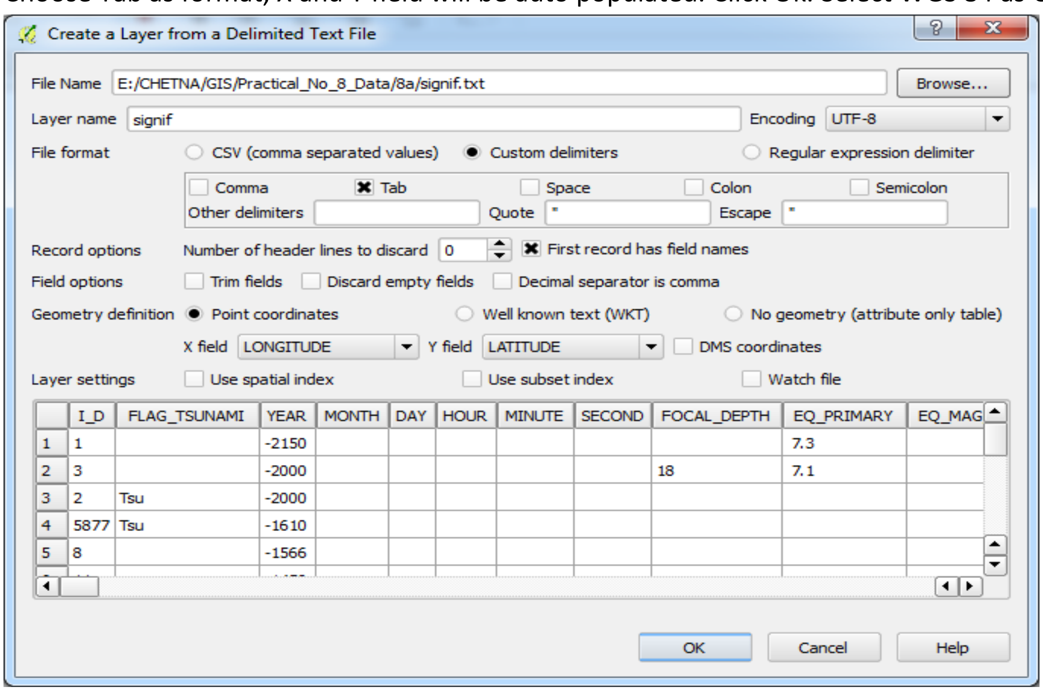
Required plugin:

MMQGIS

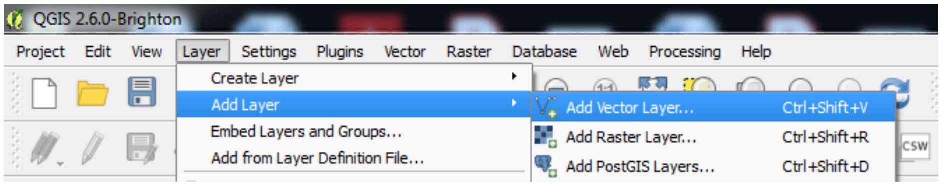
1. Add delimited text layer “signif.txt”

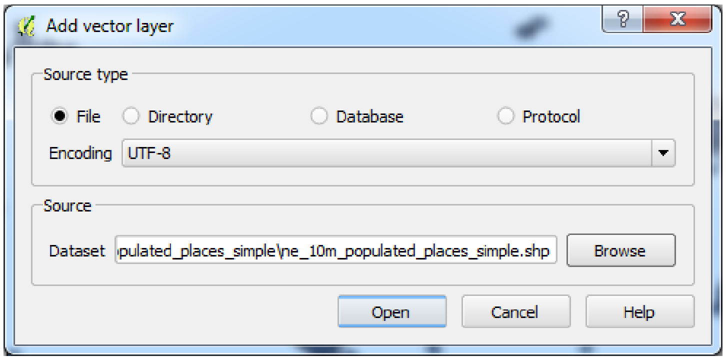


2. Choose Tab as format, X and Y field will be auto populated. Click Ok. Select WGS 84 as CRS.

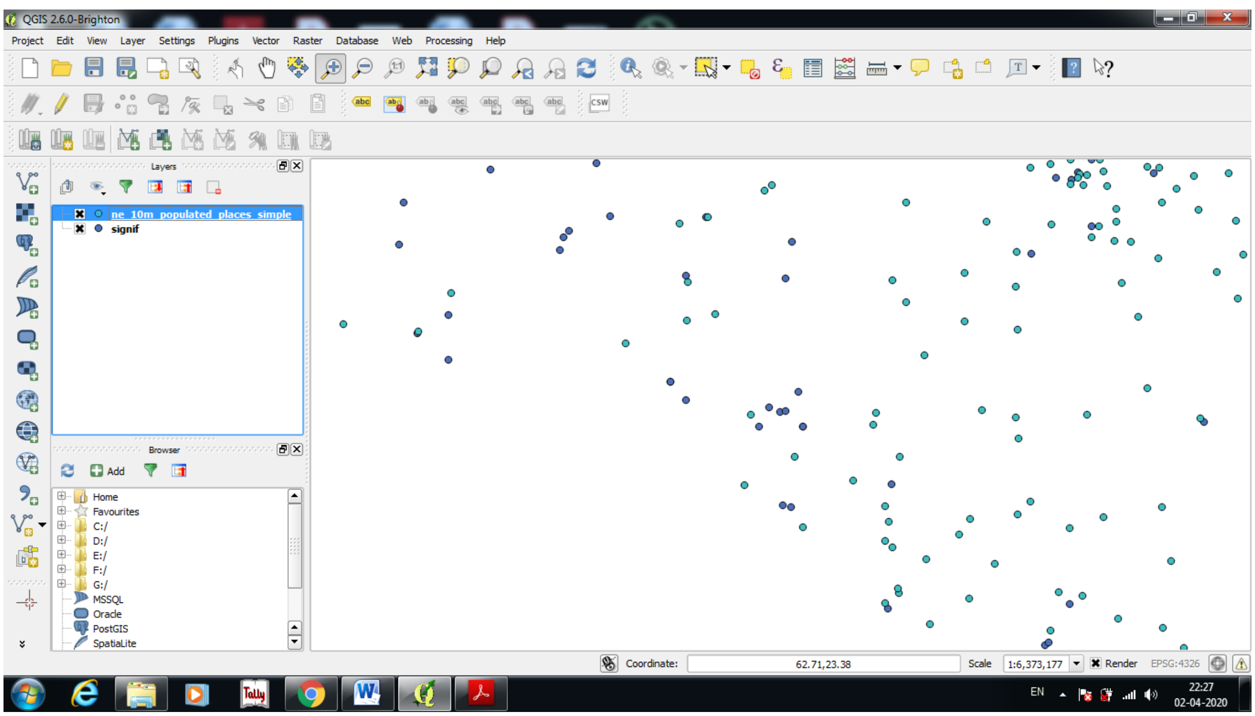


3. Now add vector layer “ne_10m_populated_places_simple.shp”

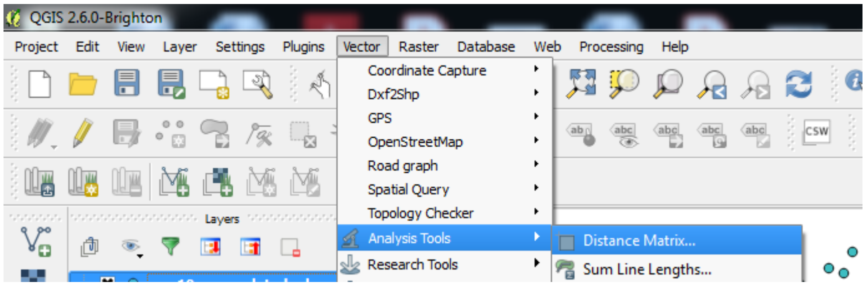




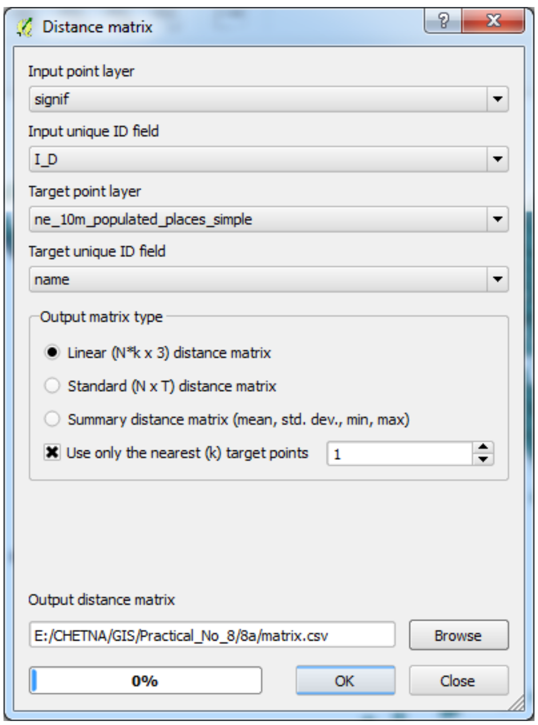
4. Zoom and observe both the layer carefully. Each purple and blue point represents location of significant earthquake and populated places respectively. We need to find out nearest point from populated places layer for each of the point in earthquake layer.



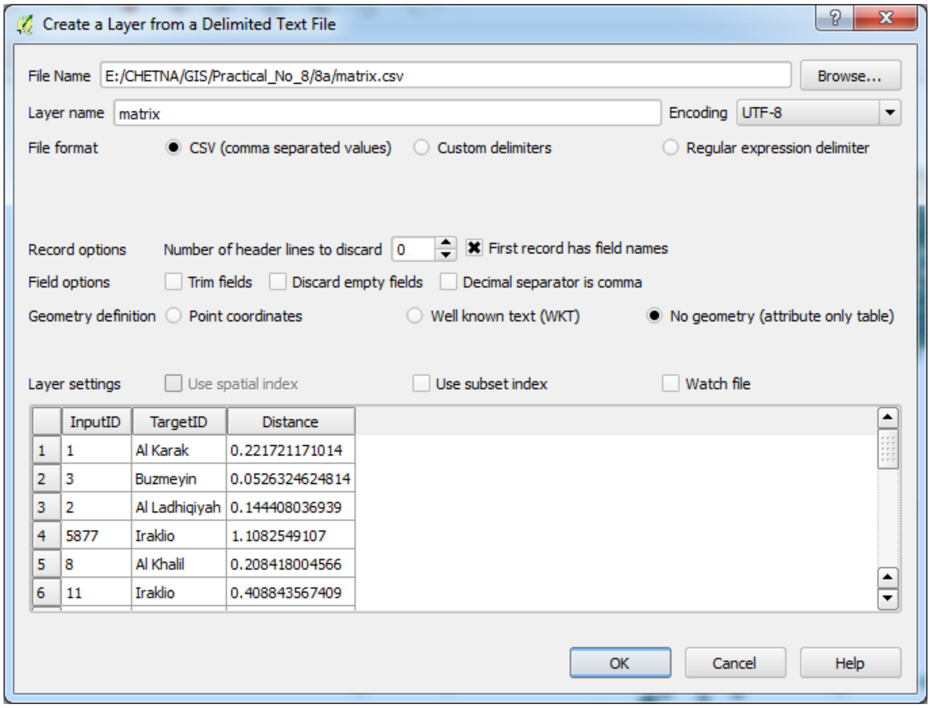
5. Go to vector → analysis tools → distance matrix.



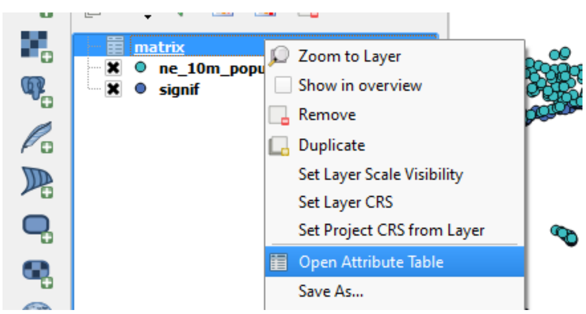
6. On next screen select signif layer as input layer and ne_10m_populated_places_simple as target layer. We need to select a unique field from each of these layers which is how our results will be displayed. Select name as target unique ID field. Here, we are looking to get only 1 nearest point so we will check Use only the nearest(k) target point, and enter 1. Specify location for output file and give name of output file as “matrix.csv”, click on ok. After processing click on close.



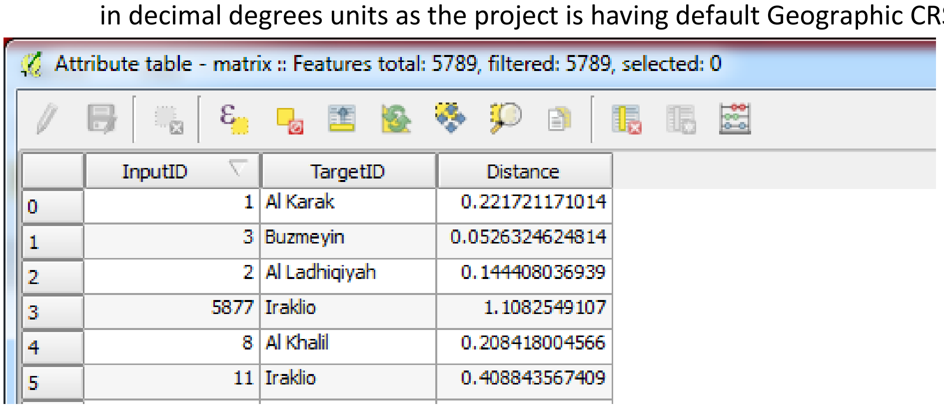
7. Add this file as delimited text layer.
8. On next screen, since the file created just now is csv file contains only text therefore select No geometry as geometry definition. And click on Ok.



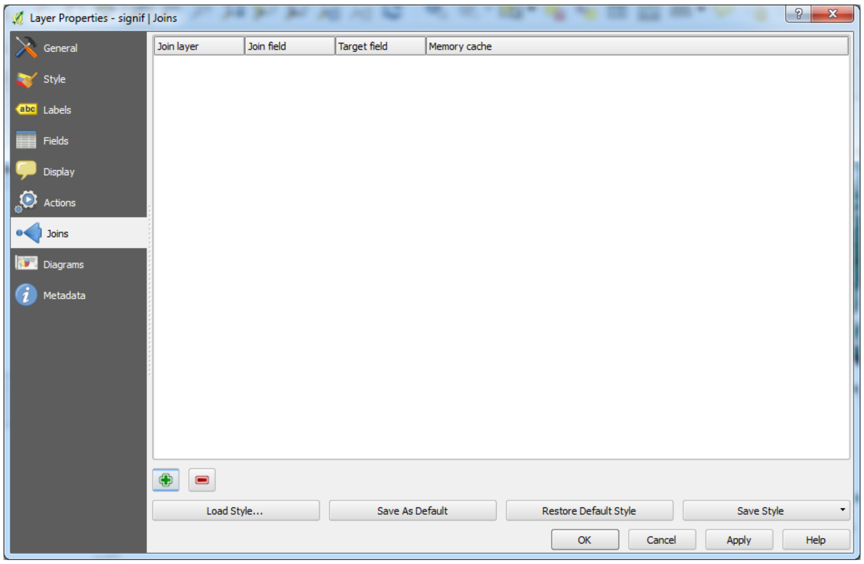
9. This file is loaded as table. Right click on this layer in layer pane and click on open attribute tables.



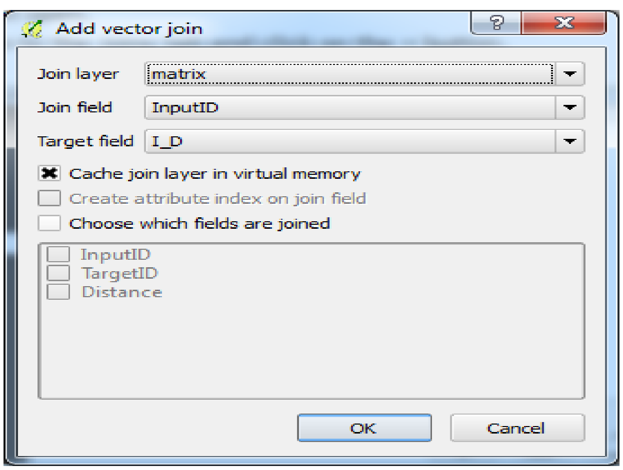
10. The InputID field contains the field name from the Earthquake layer and The TargetID field contains the name of the feature from the Populated Places layer that was the closest to the earthquake point. The Distance field is the distance between the 2 points. (distance is calculated in decimal degrees units as the project is having default Geographic CRS).



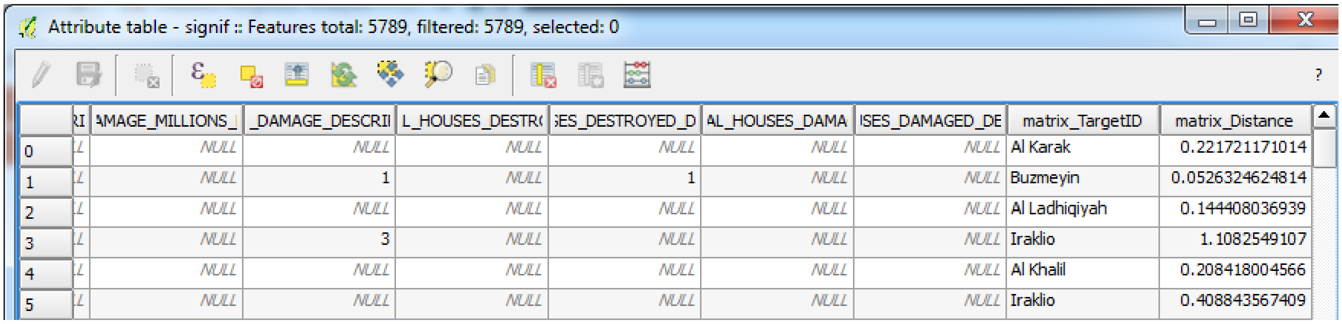
11. This table would be sufficient. However, we can also integrate this result in our original Earthquake layer using a “Table Join”. Double click on Earthquake layer, Properties window will get open.
12. Go to the Joins tab and click on the + button.



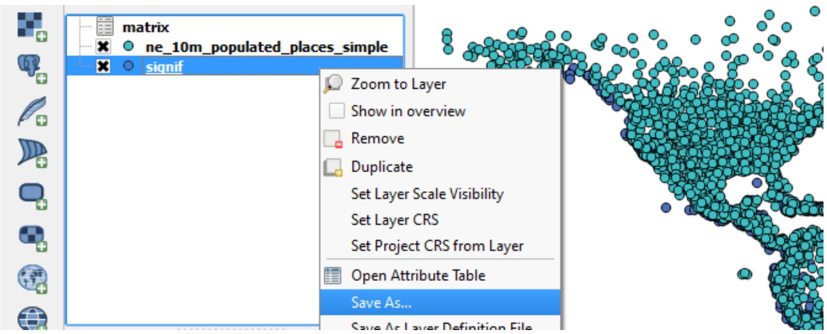
13. Select matrix as the Join layer and InputID (matrix) as the Join field. The Target field would be I_D (signif). Click on OK. Join will appear in property window, now click on Ok.



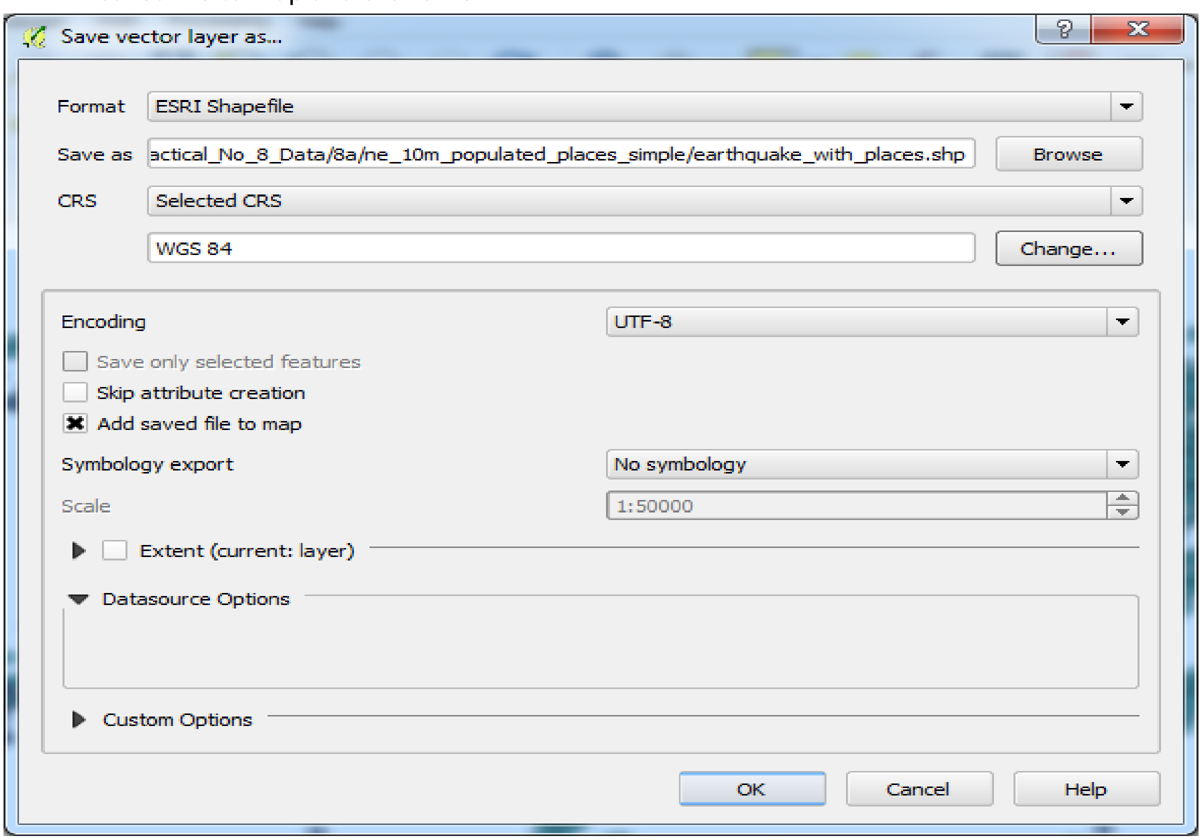
14. Now right click on signif and click on open attribute table.
15. We will see that for every Earthquake feature, we now have an attribute which is the nearest neighbor (closest populated place) and the distance to the nearest neighbor.



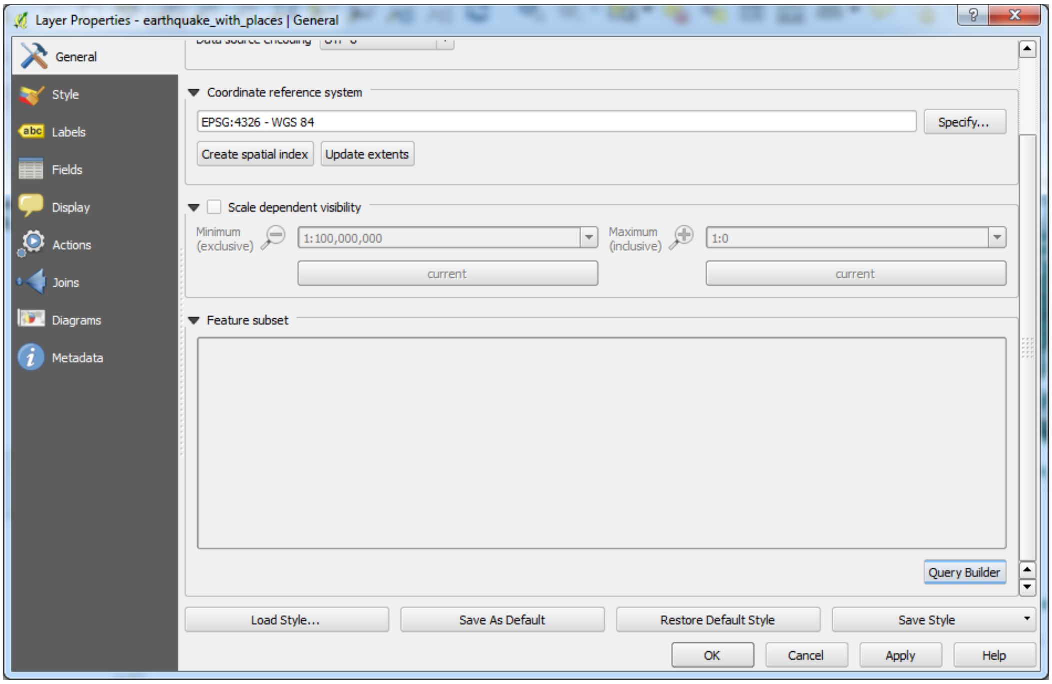
16. Now to visualize these results. First, we need to make the table join permanent by saving it to a new layer. Right-click the signif layer and select Save As....



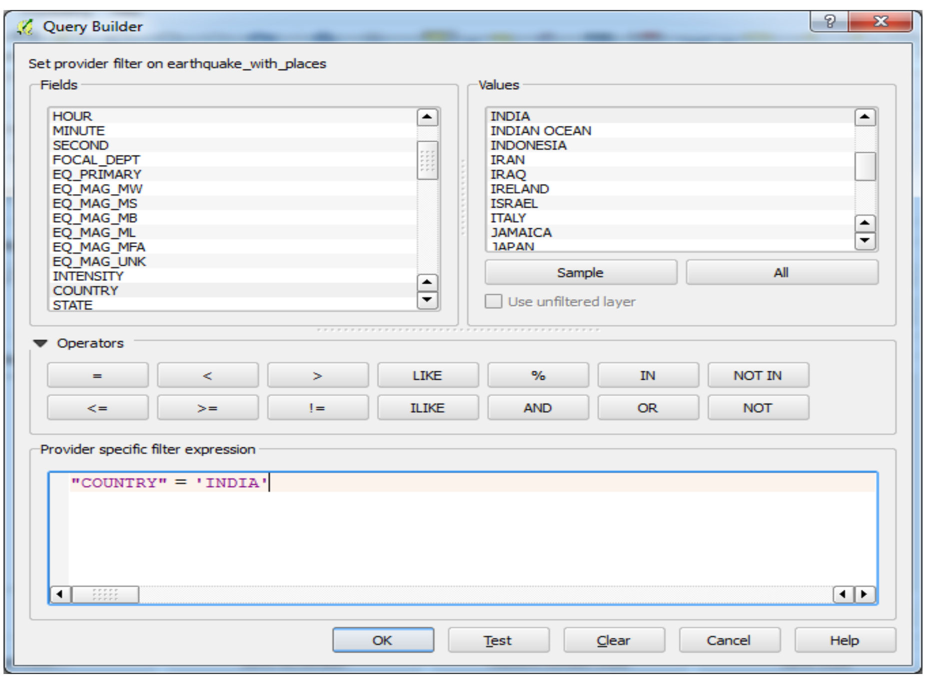
17. Select format as ESRI Shapefile, select location and give name as “earthquake_with_places.shp” for this file. Click on change button to select CRS and select WGS 84, click on Ok. Check add saved file to map and click on Ok.



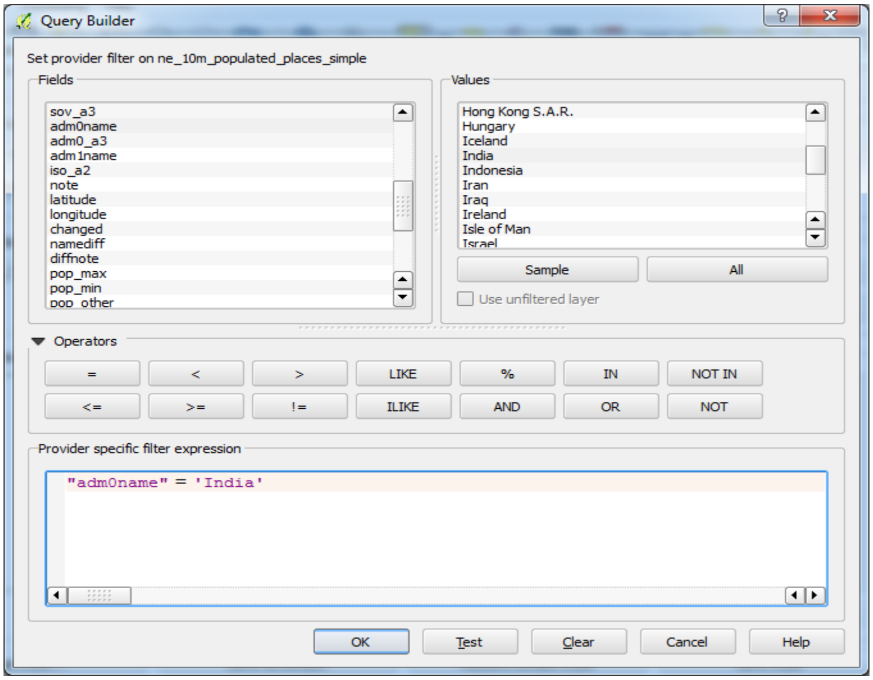
18. Now we can uncheck original signif layer as we are not going to use it further.
19. Double click on earthquake_with_places layer to open property window.
20. Select general tab and scroll down and click on query builder button.



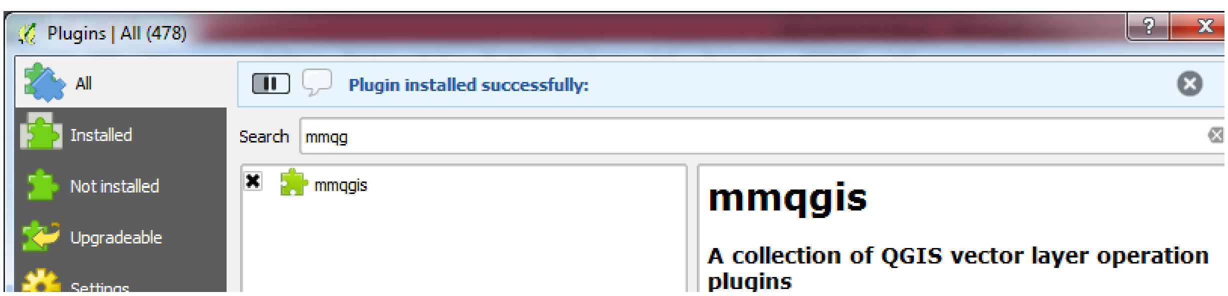
21. For this tutorial, we will visualize the earthquakes and their nearest populated places for India. Enter the following expression in the Query Builder dialog box.

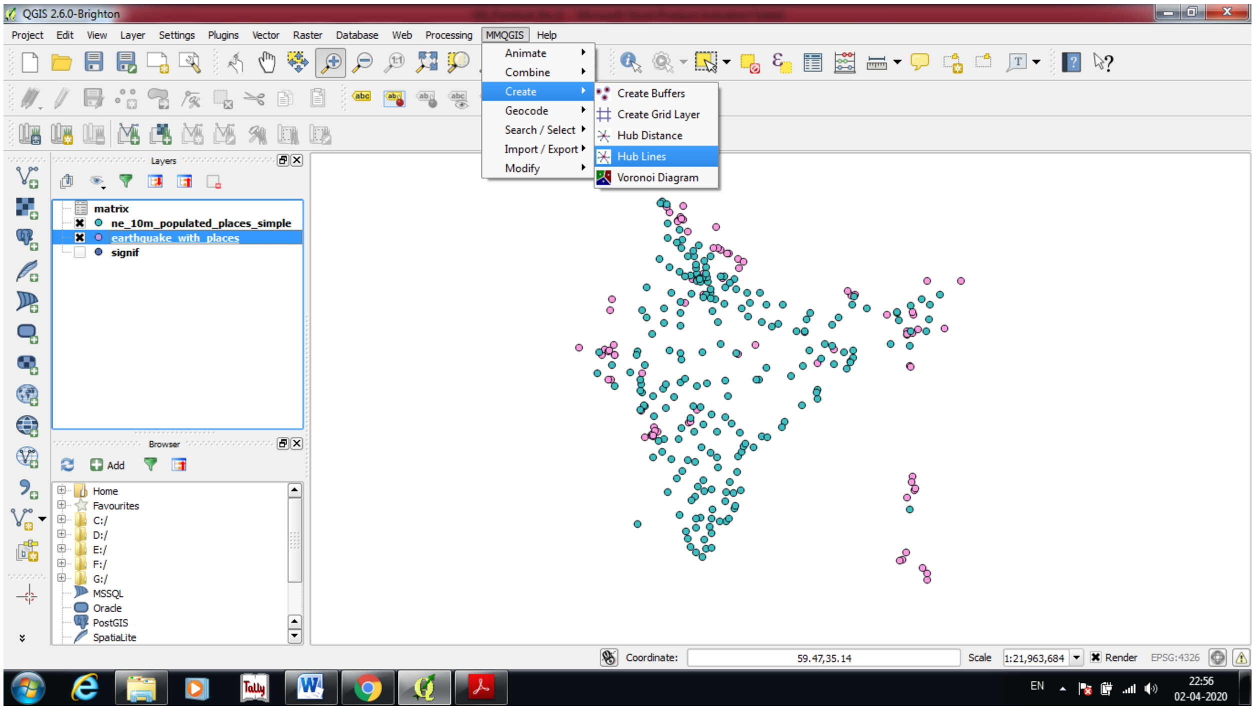


22. We will see that only the points falling within India will be visible in the canvas. Let's do the same for the populated places layer. Double click on the ne_10m_populated_places_simple layer to open property window.
23. Open query builder dialog box and enter the following expression. And click on Ok on property window.

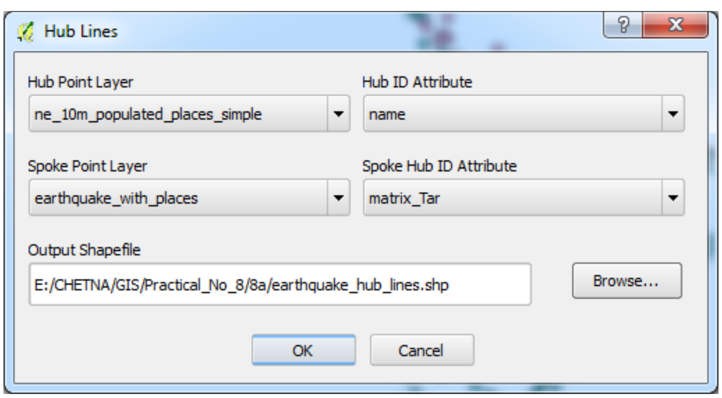


24. Now we are ready to create our visualization, but we will require a plugin "MMQGIS". So, we need to make sure that the plugin is installed. Go to MMQGIS → Create → Hub Lines.

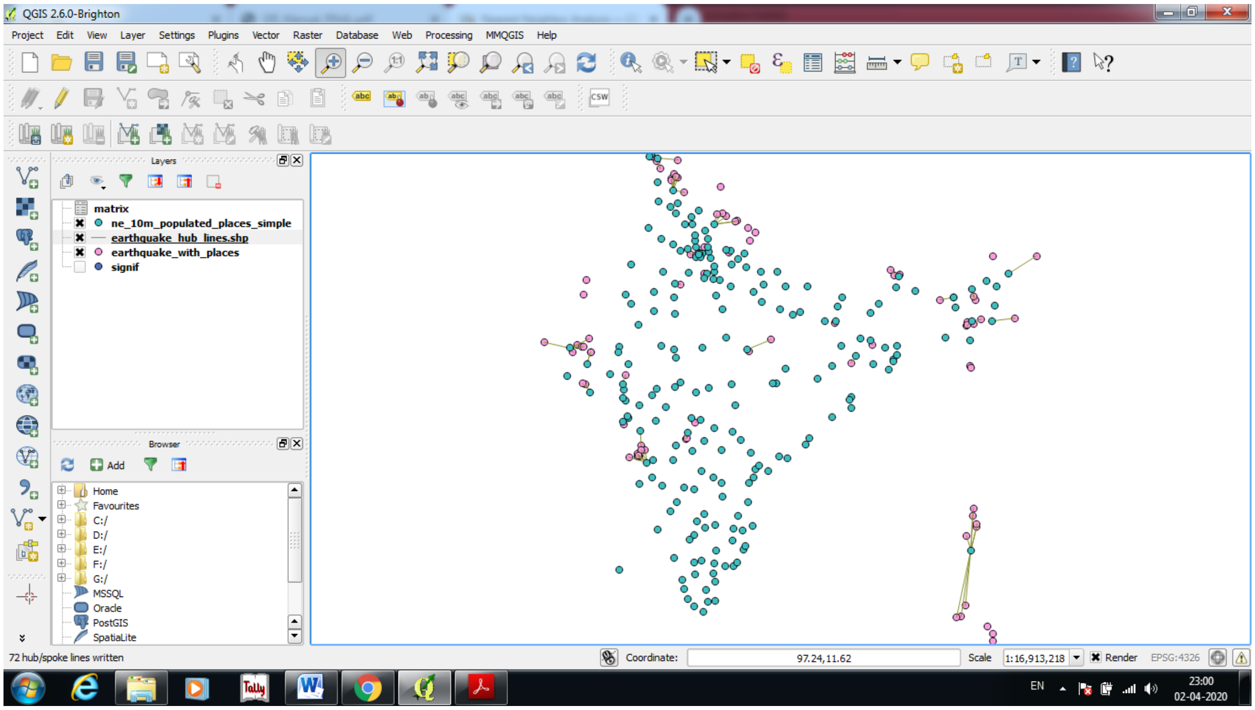




25. Select ne_10m_populated_places_simple as the Hub Point Layer and name as the Hub ID Attribute. Similarly, select earthquake_with_places as the Spoke Point Layer and matrix_Tar as the Spoke Hub ID Attribute. The hub lines algorithm will go through each of earthquake points and create a line that will join it to the populated place which matches the attribute we have specified. Click Browse and name the Output Shapefile as earthquake_hub_lines.shp and Click on OK to start the processing.



26. It may take few minutes. Once the processing is done, we will see the earthquake_hub_lines layer loaded in QGIS. We can see that each earthquake point now has a line that connects it to the nearest populated place.


QGIS 2.6.0-Brighton
Project Edit View Layer Settings Plugins Vector Raster Database Web Processing MMQGIS Help
Layers
matrix
ne_10m_populated_places_simple
earthquake_hub_lines.shp
earthquake_with_places
signif
Browser
Add
Home
Favourites
C:/
D:/
E:/
F:/
G:/
MSSQL
Oracle
PostGIS
SpatiaLite
72 hub/spoke lines written
Coordinate:
97.24,11.62
Scale
1:16,913,218
Render
EPSG:4326
EN
23:00
02-04-2020

B) Sampling Raster data using Points or Polygons

A raster grid of maximum temperature in the US is given, we need to extract the temperature at all urban areas and also we will calculate the average temperature for each county in the US.

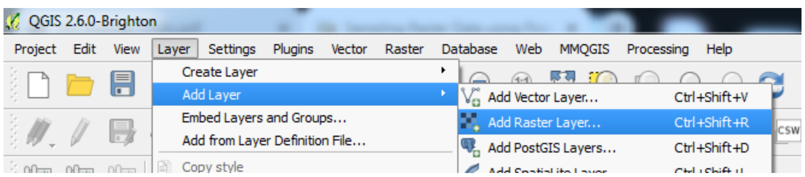
Required dataset:

us.tmax_nohads_ll_20140525_float.tif
2013_Gaz_ua_national.zip
tl_2013_us_county.zip

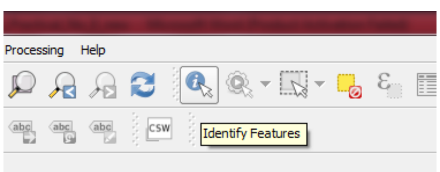
Required Plugin:

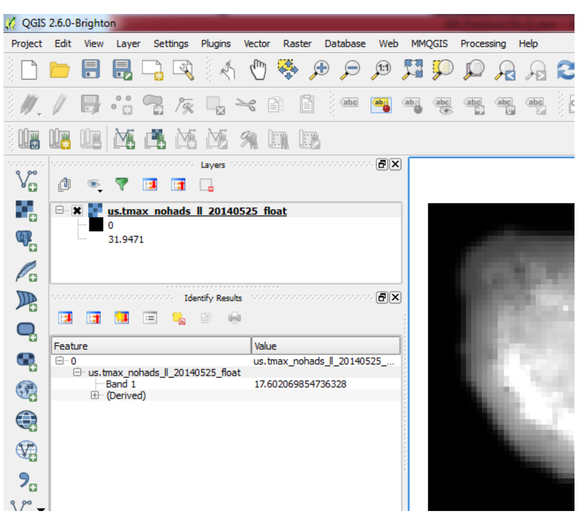
Point sampling tool

1. Add raster layer "us.tmax_nohads_ll_20140525_float.tif".

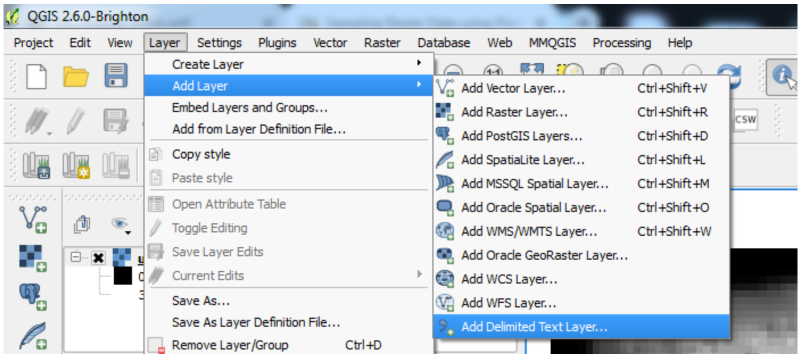


2. Click on identify feature tool and then click anywhere on the image, we will see the temperature value at that location as value or band 1 in left pane or in the canvas area.

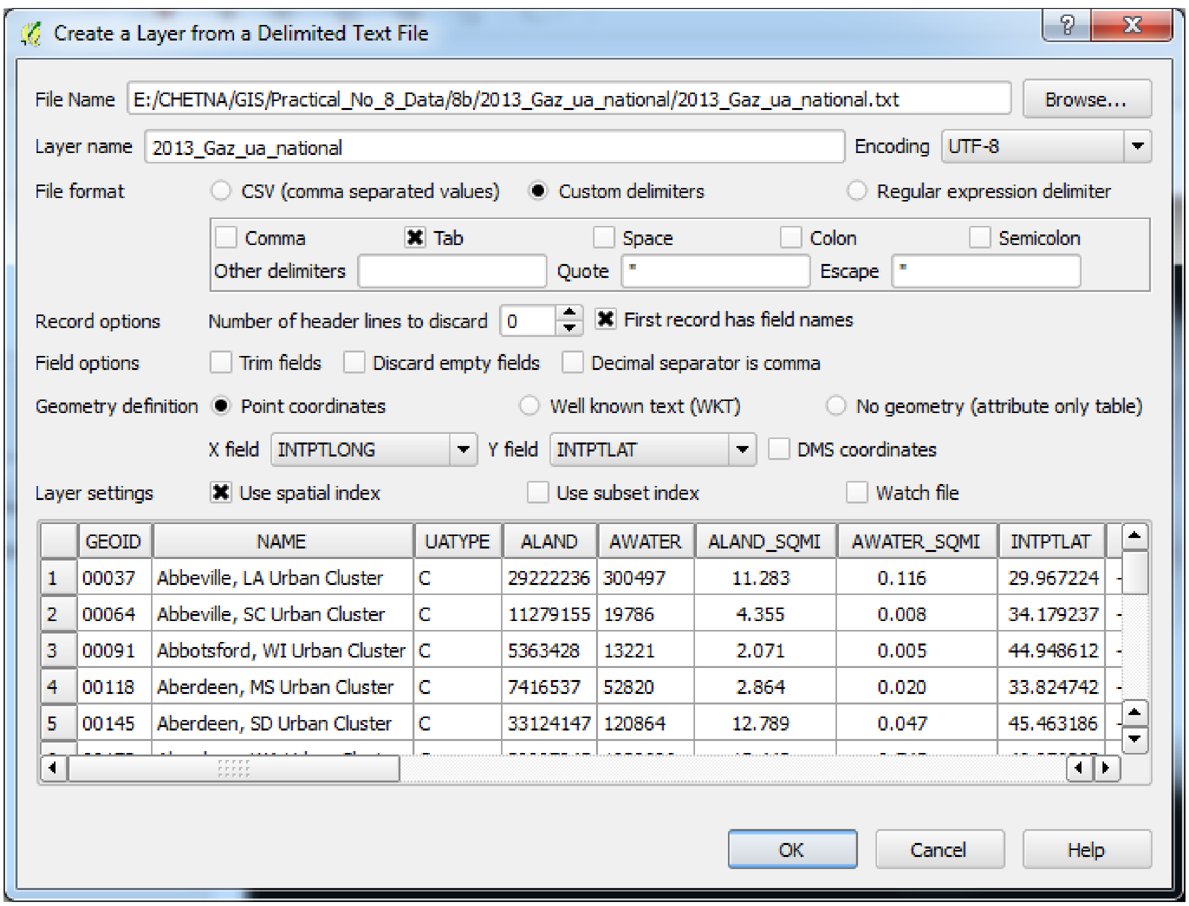


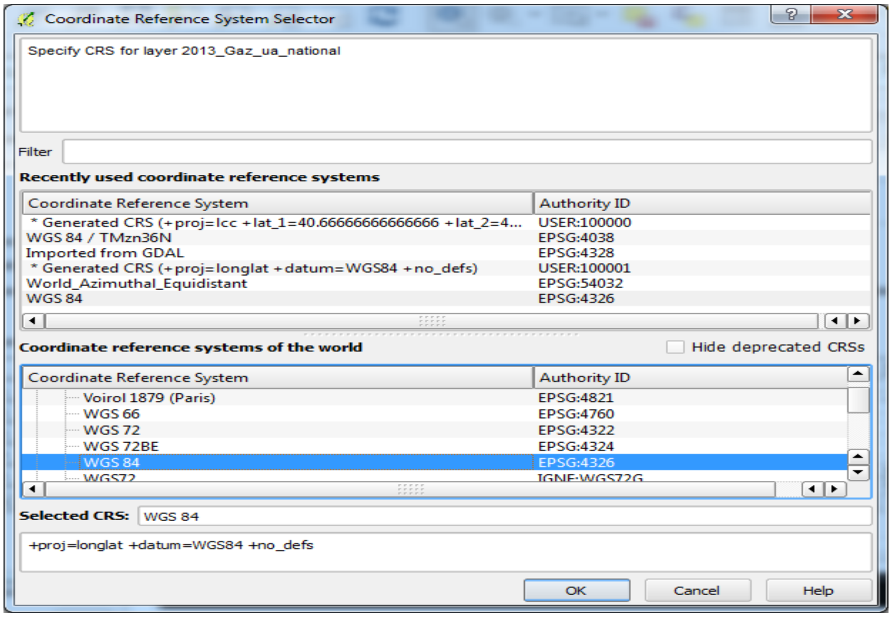


3. Add delimited text layer “2013_Gaz_ua_national.txt” which is present in 2013_Gaz_ua_national folder.

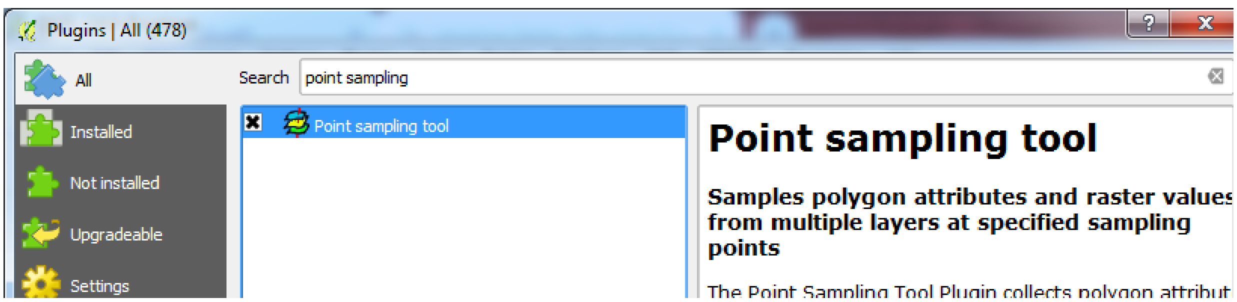


4. On next window click on browse button and select 2013_Gaz_ua_national.txt file, select tab under custom delimiters, the point coordinates are in Latitude and Longitude, so select INTPTLONG as X field and INTPTLAT as Y field. Also check the Use spatial index box and then click on OK. Then select CRS as WGS 84.

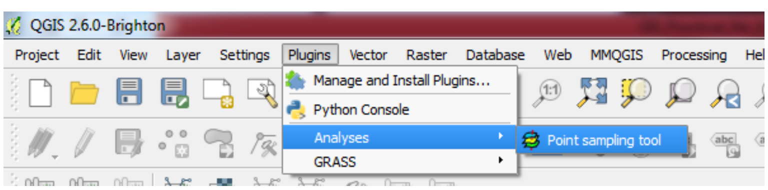




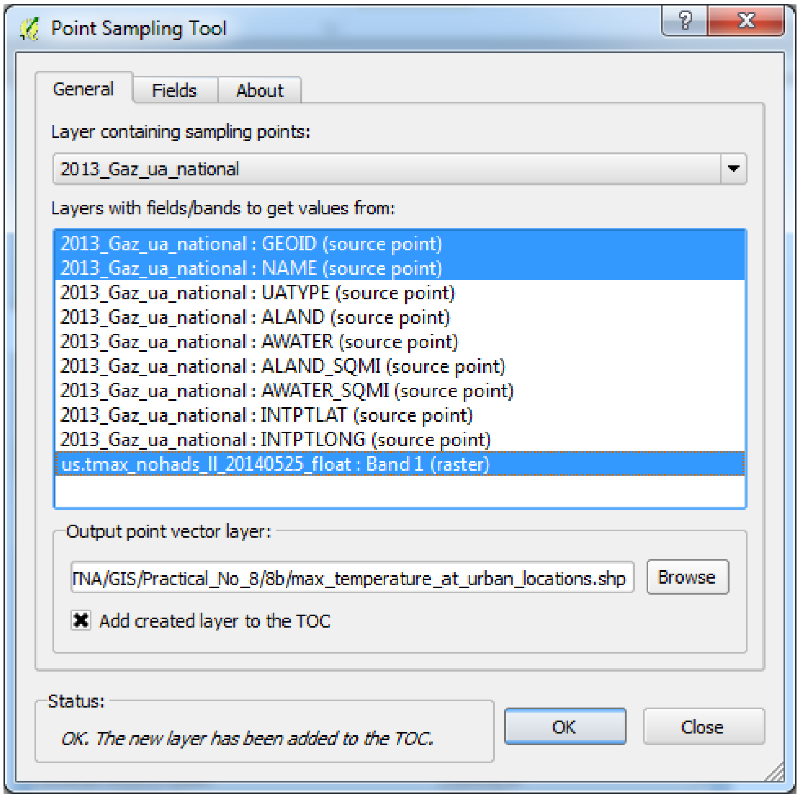
5. Now we are ready to extract temperature value from raster layer, but before moving further we need to install “Point sampling tool” plugin if it is not installed.

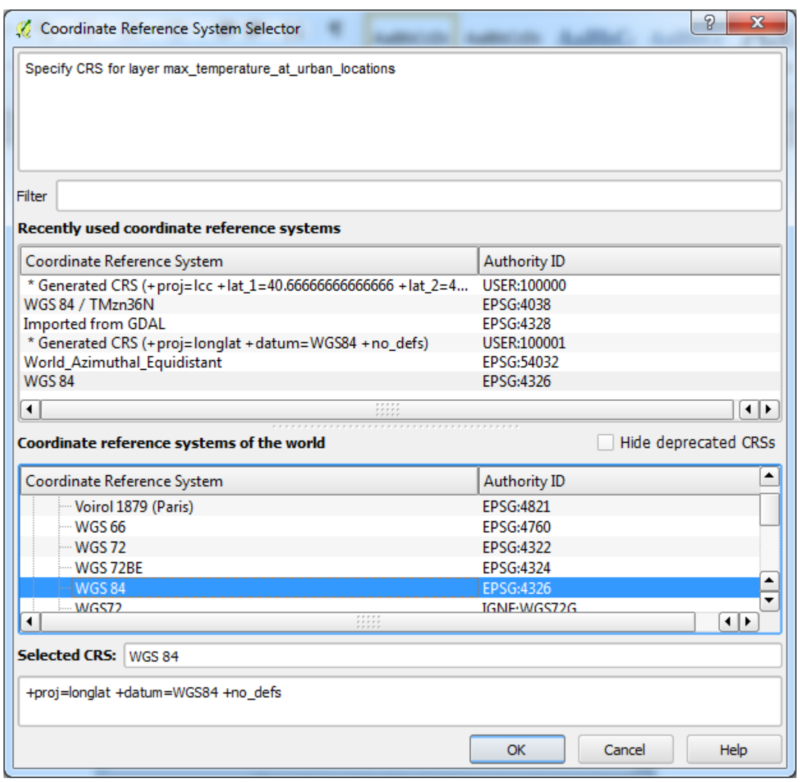


6. Click on plugin → analysis → point sampling tool.

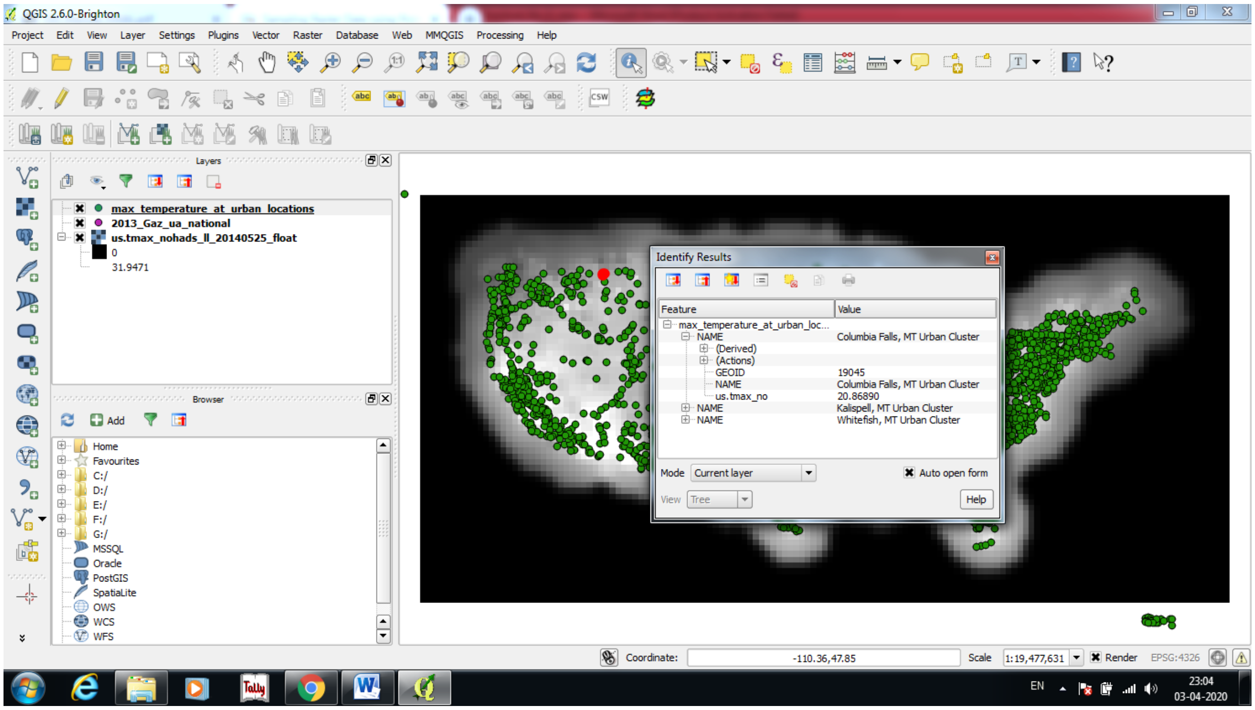


7. In point sampling dialog box, select 2013_Gaz_ua_national as layer containing sampling point, here we need to select fields from input layer that we want in our output layer. Select GEOID and NAME fields. We can sample values from multiple band but here we have only one band so select us.tmax_nohads_ll_20140525_float: band 1. Set location and give name for output vector layer as max_temperature_at_urban_locations.shp, then click on Ok button. Once the process is completed click on close button. Also select WGS 84 as CRS on next screen.

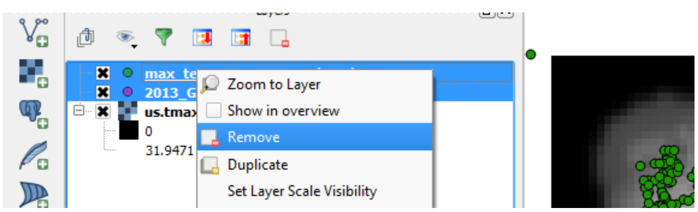




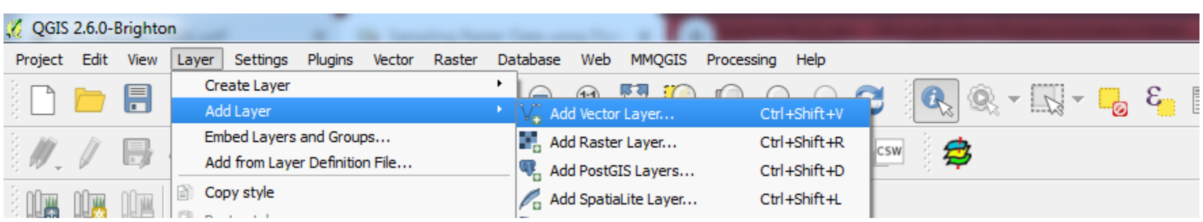
8. New layer is loaded in QGIS, now again we can click on identify tool and click on any point on layer to see the values associated with it.

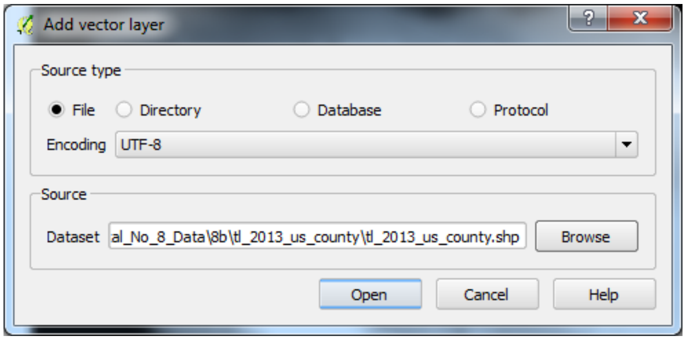


9. First part of analysis is over, now we can remove unnecessary layers from qgis. Right click on max_temperature_at_urban_locations in layer pane and select remove, similarly remove 2013_Gaz_ua_national layer.

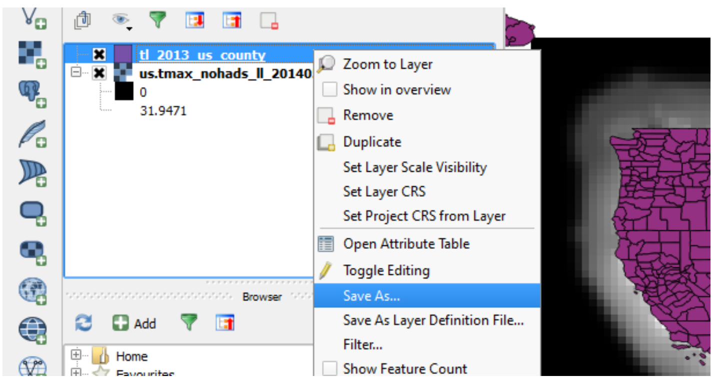


10. Now add vector layer “tl_2013_us_county.shp”.

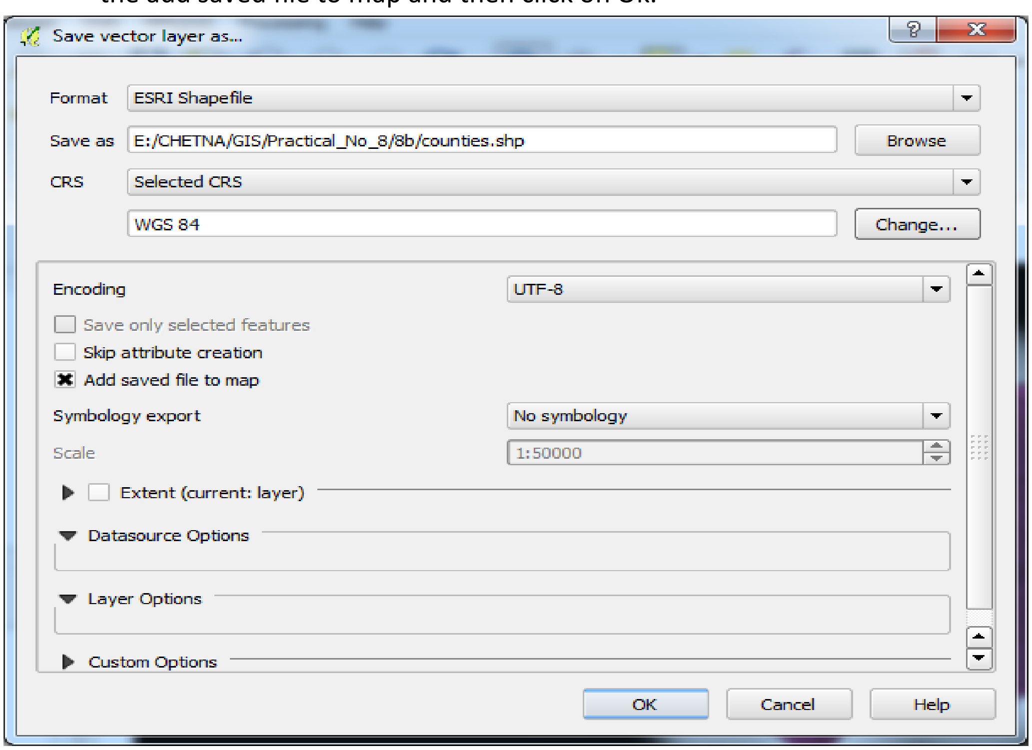




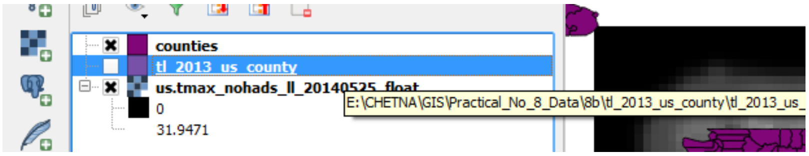
11. The above layer is added in QGIS, but it is in EPSG: 4269 projection (we can check in property window) which doesn't match with the raster layer, so we will reproject this layer to EPSG: 4326. Right click on this layer and select Save as…



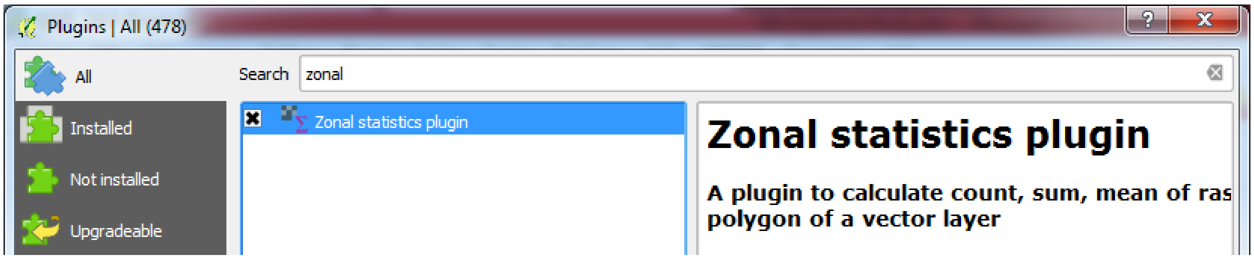
12. In save as dialog box select format as ESRI Shapefile, set location for output file and give name of output file as counties.shp. Click on Change button to set the CRS and select WGS 84, check the add saved file to map and then click on Ok.



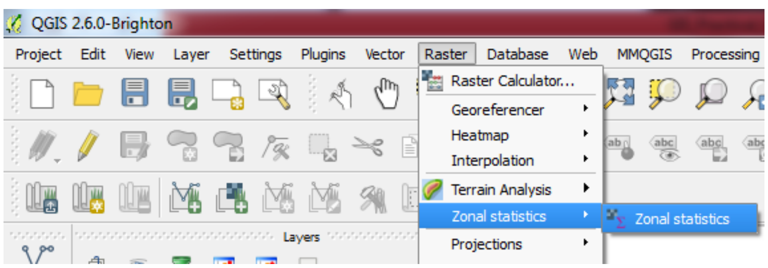
13. Uncheck the original layer from layer pane now.



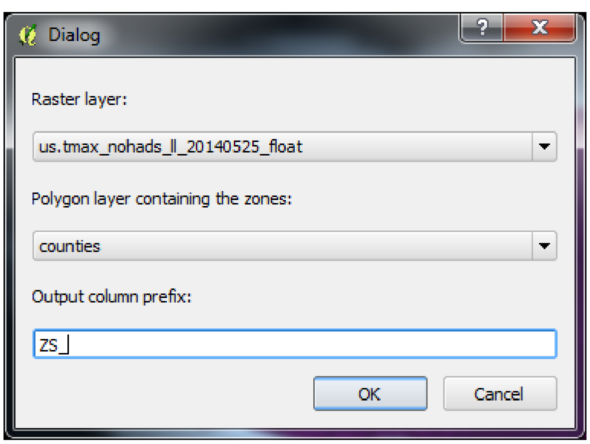
14. Install “Zonal statistics plugins” if it is not installed.

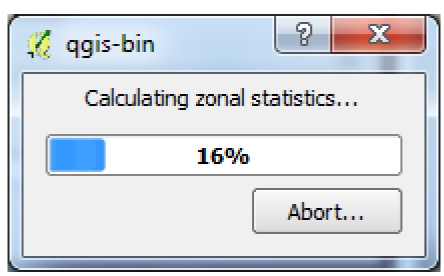


15. Click on raster → zonal statistics → zonal statistics.



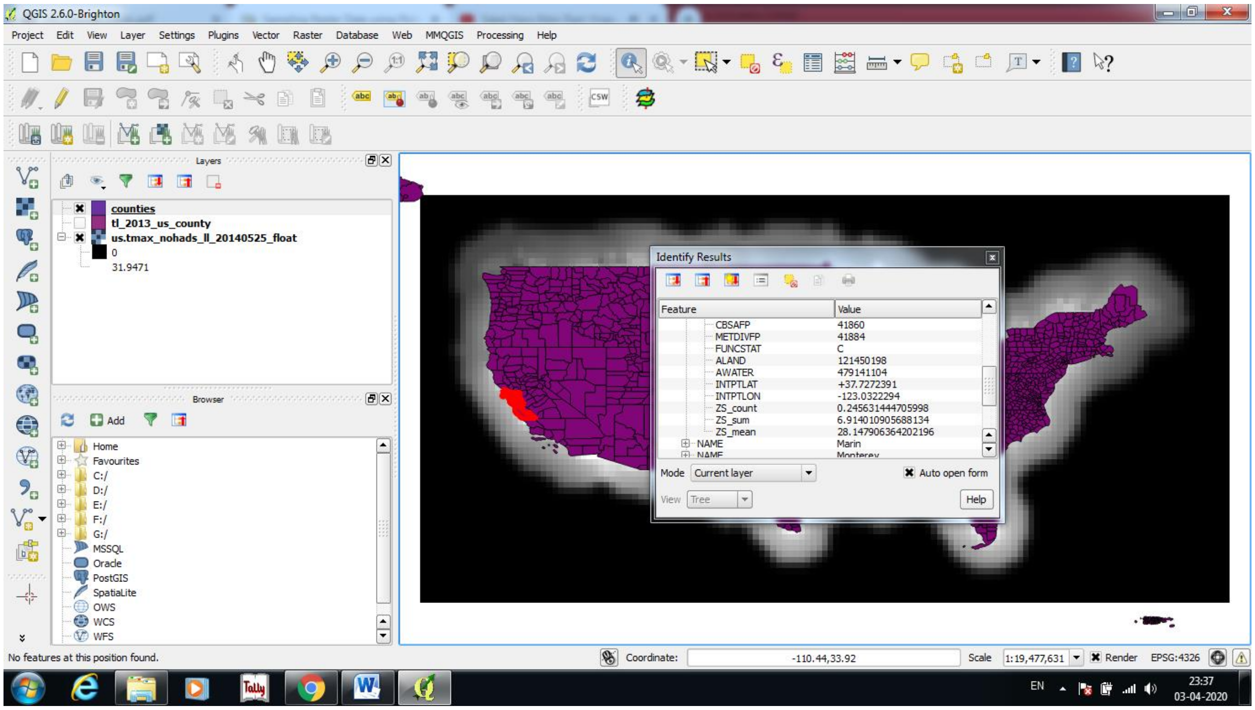
16. Select us.tmax_nohads_ll_20140525_float as raster layer and counties as polygon layer containing the zones. Enter ZS_ as the output column prefix. Click on Ok. It may take some time.



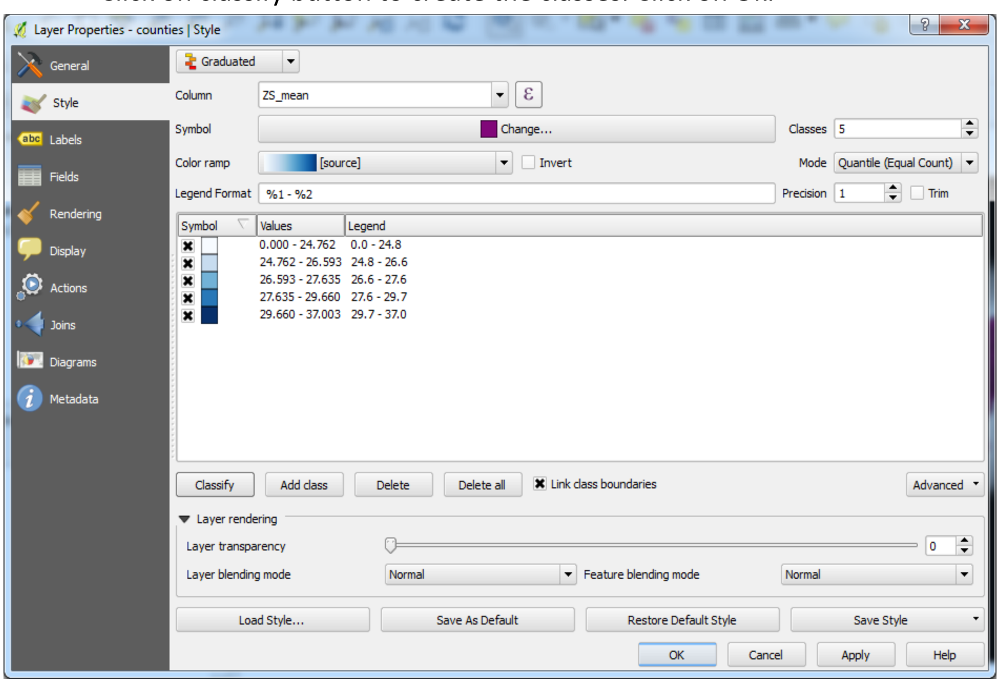


17. Once the processing is completed, select counties layer from layer pane and select identify tool and click on any county polygon. We can see three new attributes as ZS_count, ZS_mean and

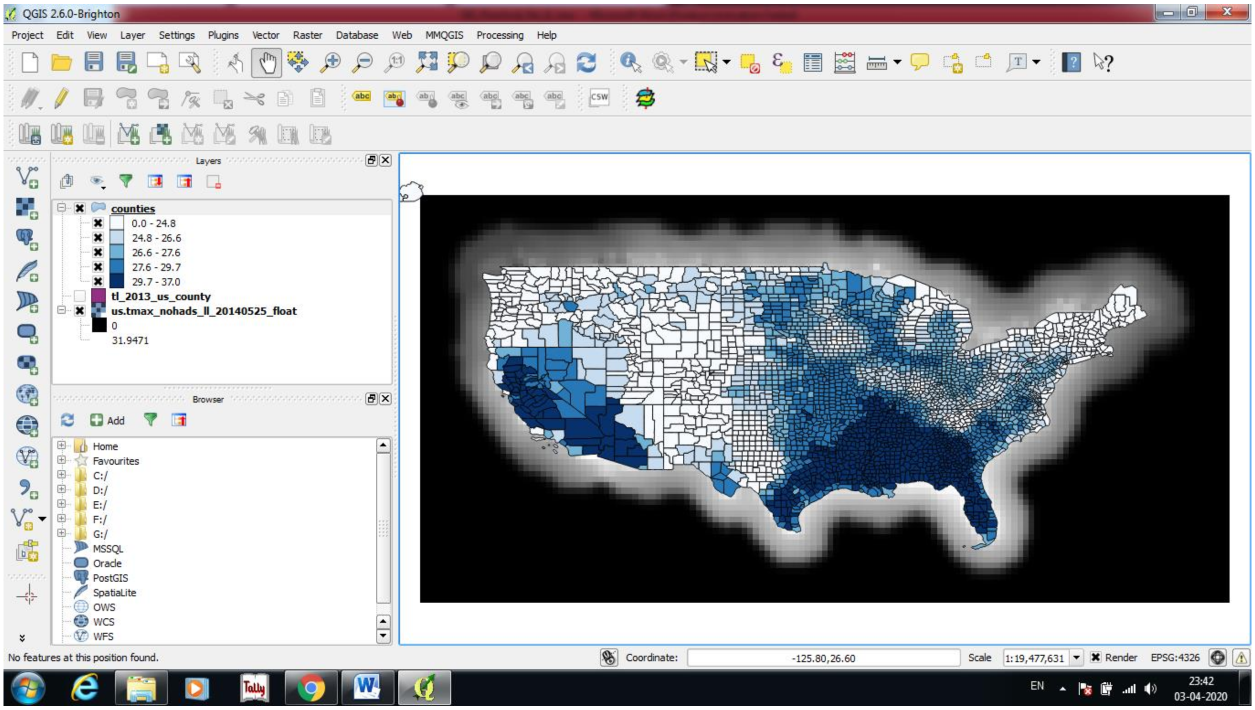
ZS_sum. These attributes contain count of raster pixels, mean of raster pixel values and sum of raster pixel values respectively. We are going to use ZS_mean.



18. Let's change the style of this layer to create temperature map. Double click on counties layer from layer pane to open its property window.
19. Click on style tab. Select graduated style and ZS_mean column. Select color ramp and mode. Click on classify button to create the classes. Click on Ok.



20. We will see the county polygons styled using average maximum temperature extracted from the raster grid.



C) Interpolating point data

We will take field depth measurements for a Lake Arlington in Texas and then create an elevation relief map and contours from these measurements.

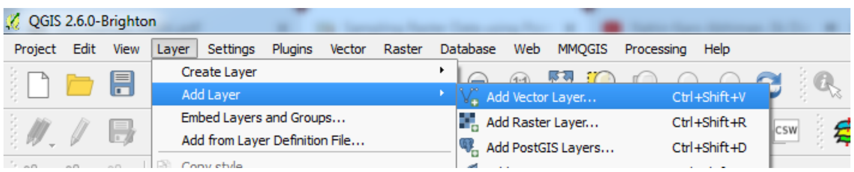
Required dataset:

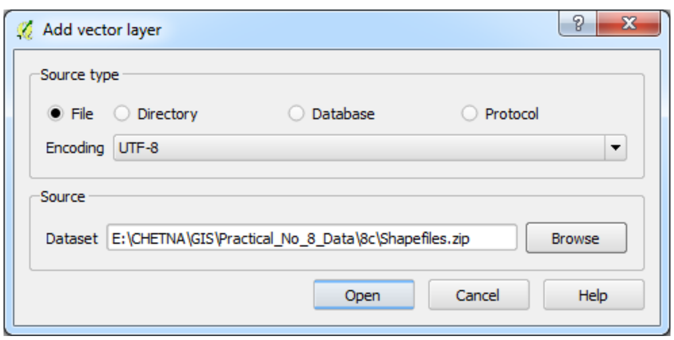
2007-12 survey shapefiles for Lake Arlington i.e. Shapefiles.zip

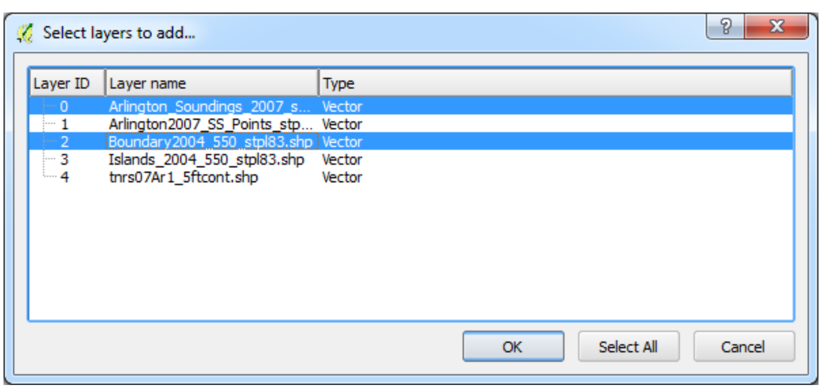
Required plugin:

Interpolation plugin

1. Add two vector layers "Arlington_soundings_2007_stpl83.shp" and "Boundary2004_550_stpl83.shp" (using shift key we can select both the layers at once).

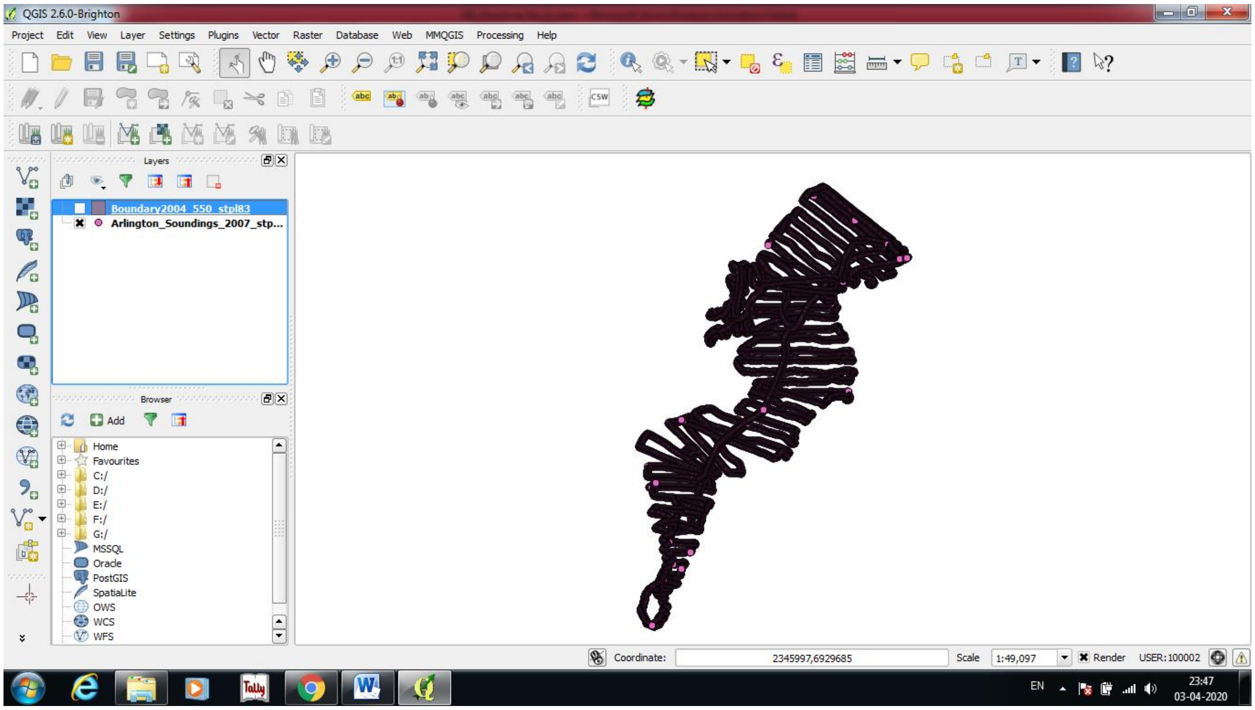




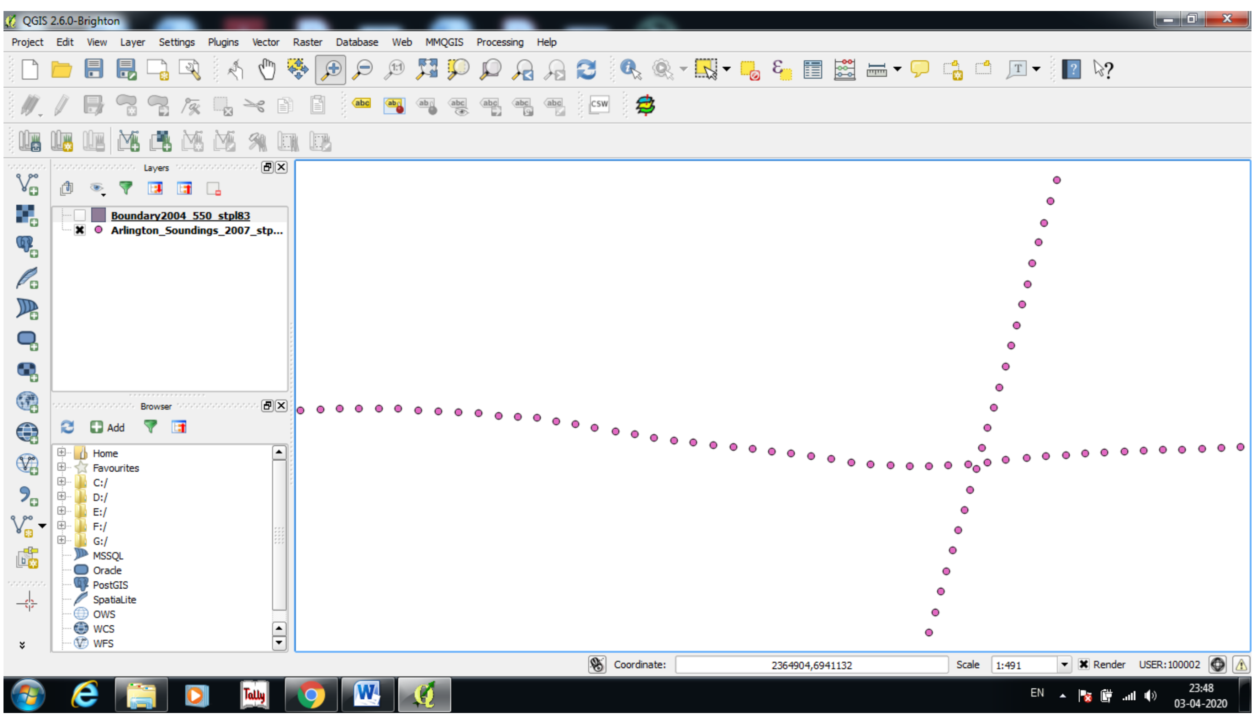


2. Both the layers are loaded in QGIS. Boundary2004_550_stpl83 represents boundary of lake, uncheck this layer from layer pane.

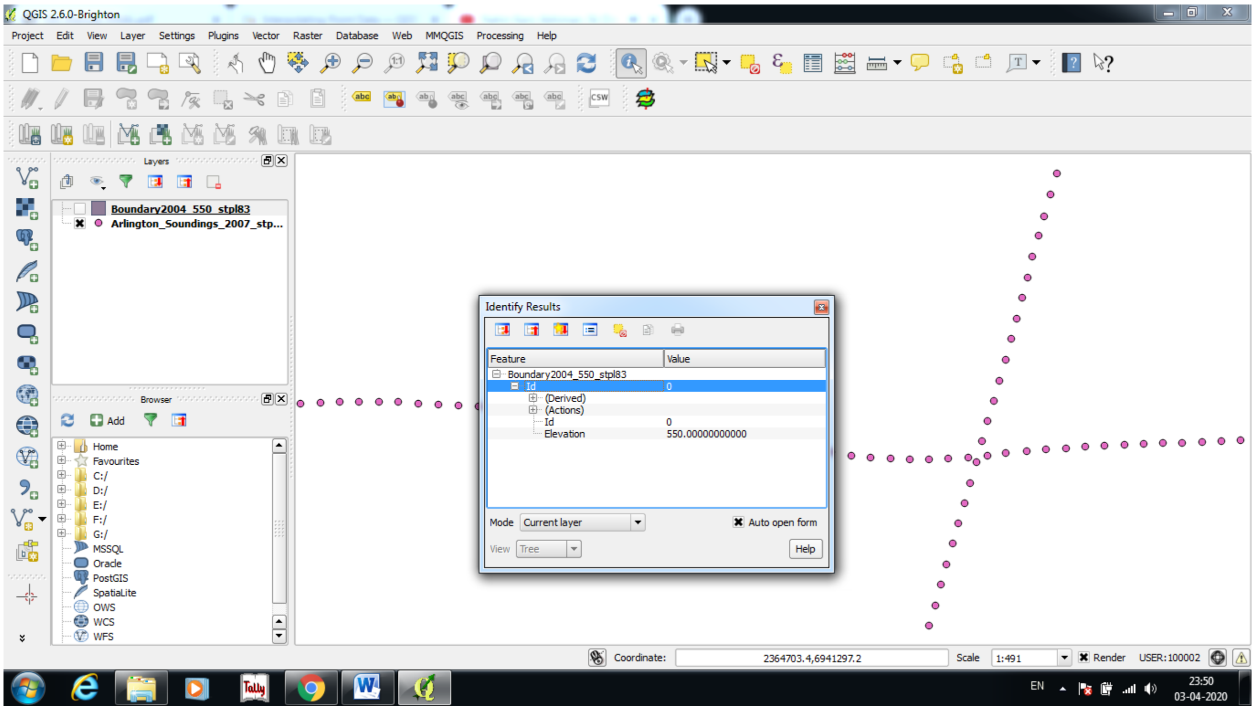
3. Now we can see the other layer. Here data looks like lines but they are actually series of points that are very close.



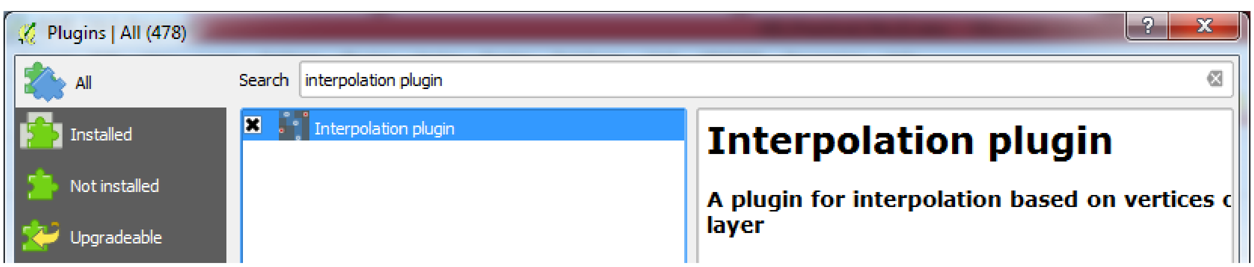
4. Zoom in the layer so that we can see points representing readings taken by Depth Sounder at the location recorded by DGPS equipment.



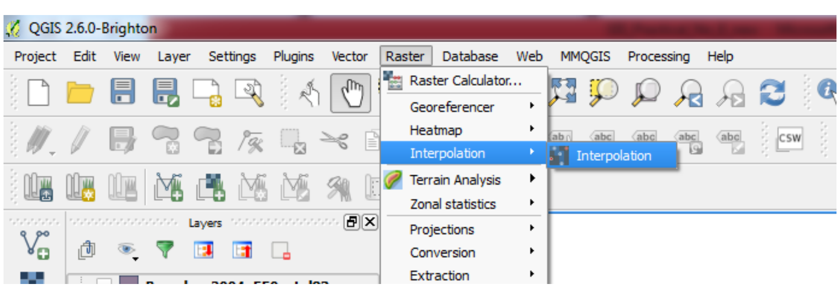
5. Select the Identify tool and click on any point. We will see the Identify Results panel on the left with the attribute value of the point. Here, the ELEVATION attribute contains the depth of the lake at the location. Our task is to create a depth profile and elevation contours, we will use this value as input for the interpolation.



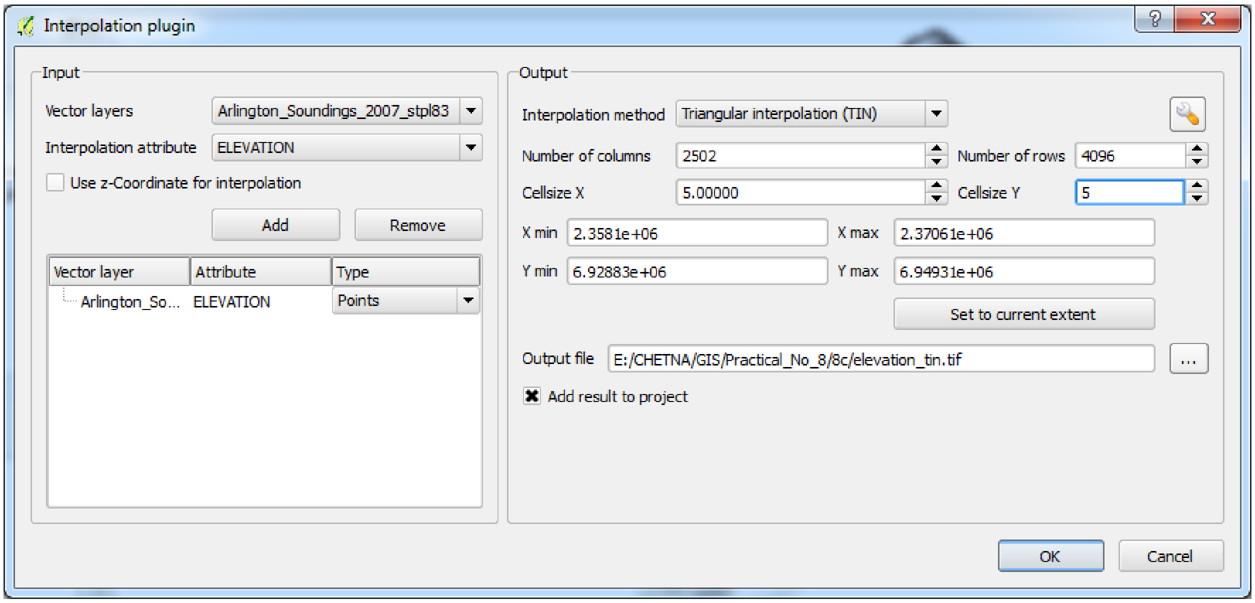
6. Make sure that “Interpolation plugin” is installed and enabled.



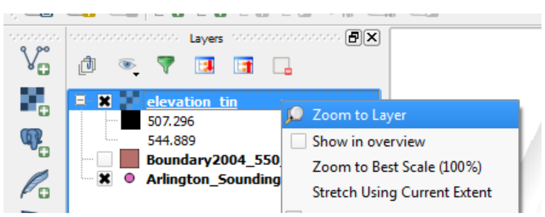
7. Click on raster → interpolation → interpolation.



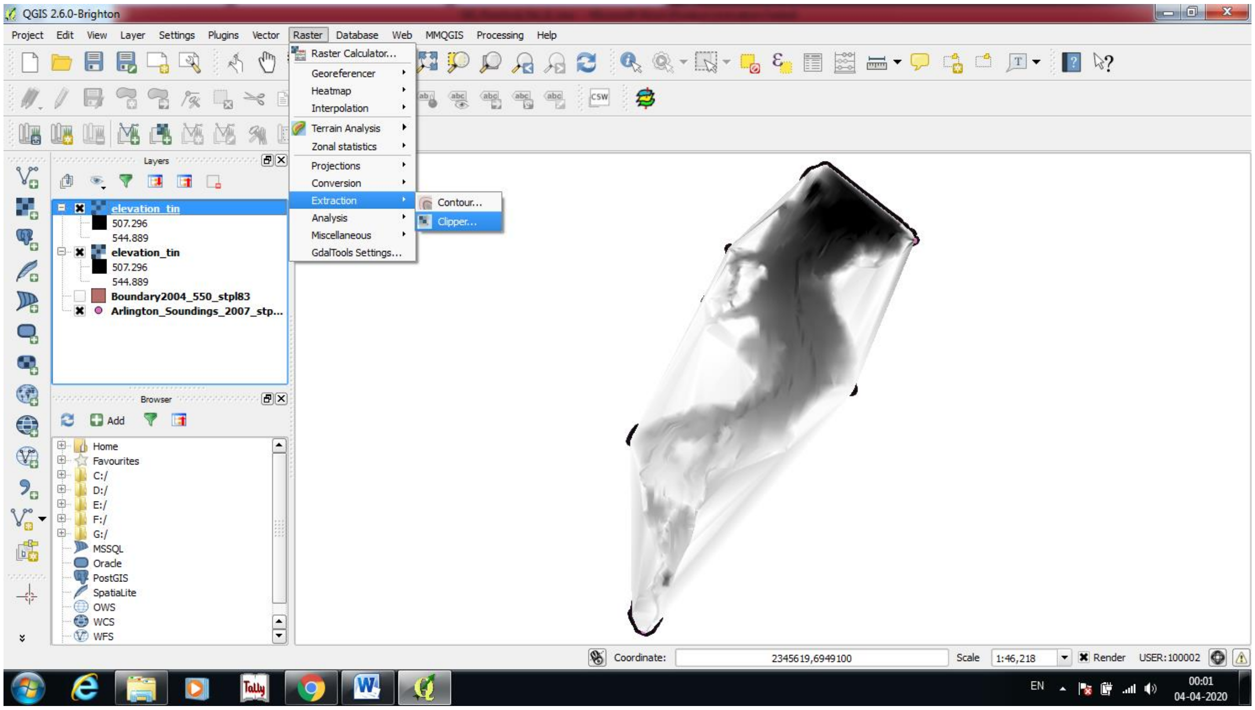
8. In interpolation dialog box, select Arlington_soundings_2007_stpl83 as vector layer in input panel, Chose ELEVATION as interpolation attribute, then click on Add button. Change the Cellsize X and Cellsize Y to 5. This is the size of each pixel in the output grid. Since our source data is in a projected CRS with Feet-US as units, therefore based on our selection, the grid size will be 5 feet. Click on the ... button next to the Output file and name the output file as elevation_tin.tif. Check add result to project. Click on Ok (QGIS interpolation supports Triagulated Irregular Network (TIN) and Inverse Distance Weighting (IDW) methods for interpolation).



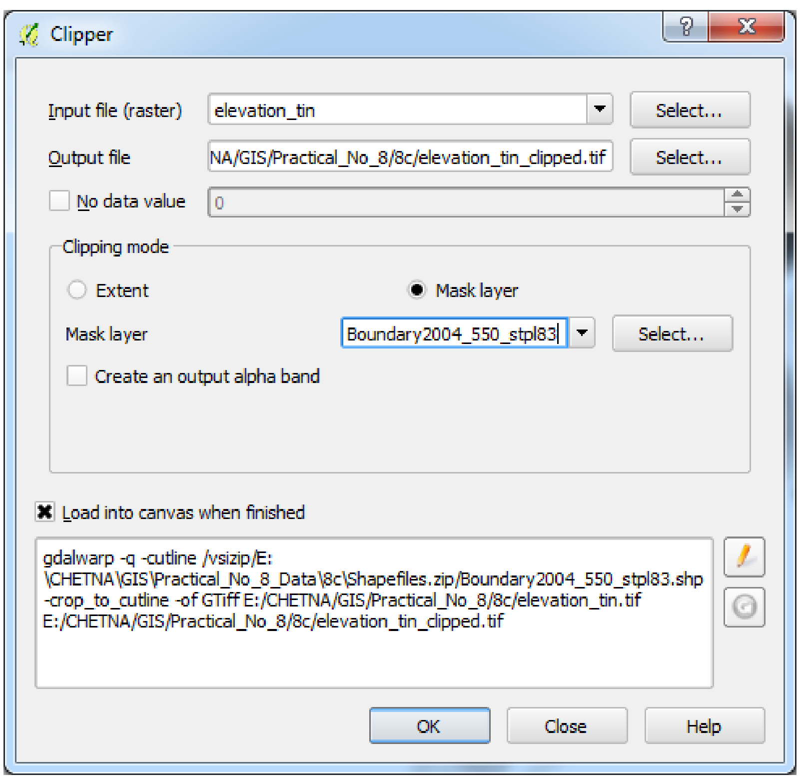
9. Now elevation_tin layer is added, if it is not completely visible right click on it and select Zoom to layer.



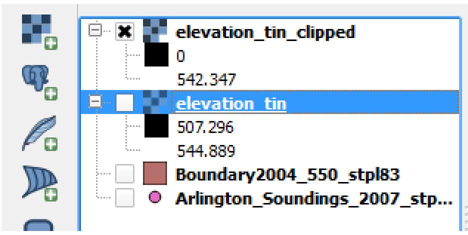
10. Now we will see the full extent of the created surface. Interpolation does not give accurate results outside the collection area. So let's clip the resulting surface with the lake boundary. Click on raster → extraction → clipper.



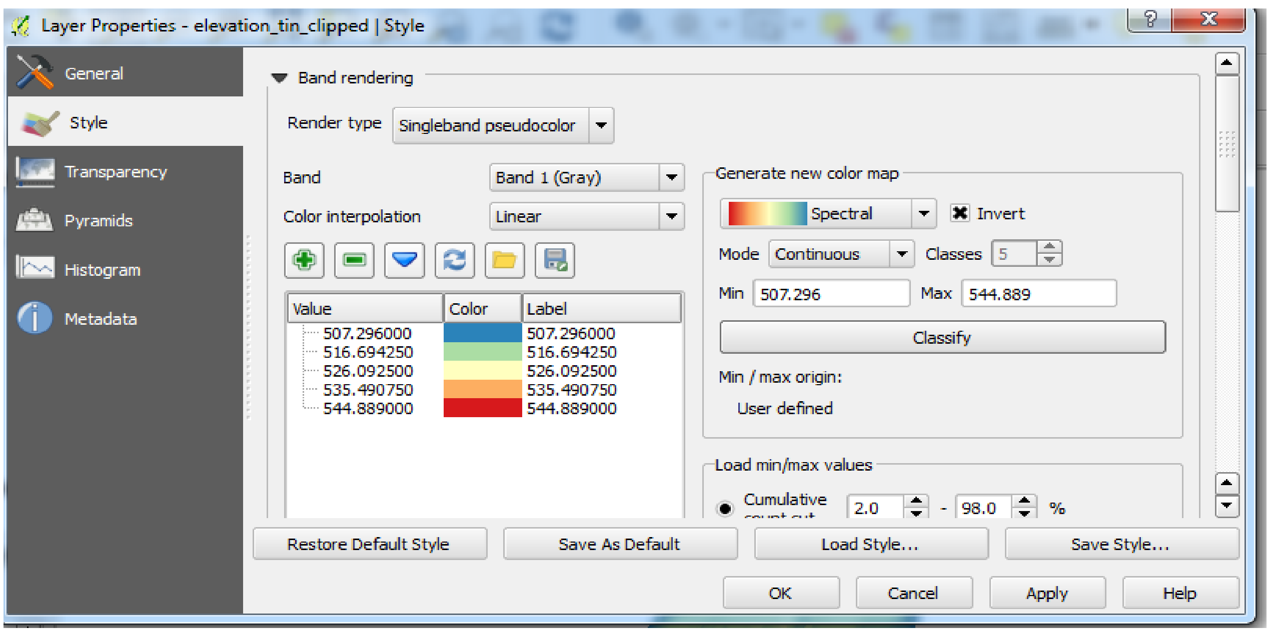
11. Select elevation_tin as input file (raster). Give name of output file as elevation_tin_clipped.tif, select mask layer as clipping mode and select Boundary2004_550_stpl83 as mask layer. Make sure that load into canvas when finished is checked. Then click on Ok.



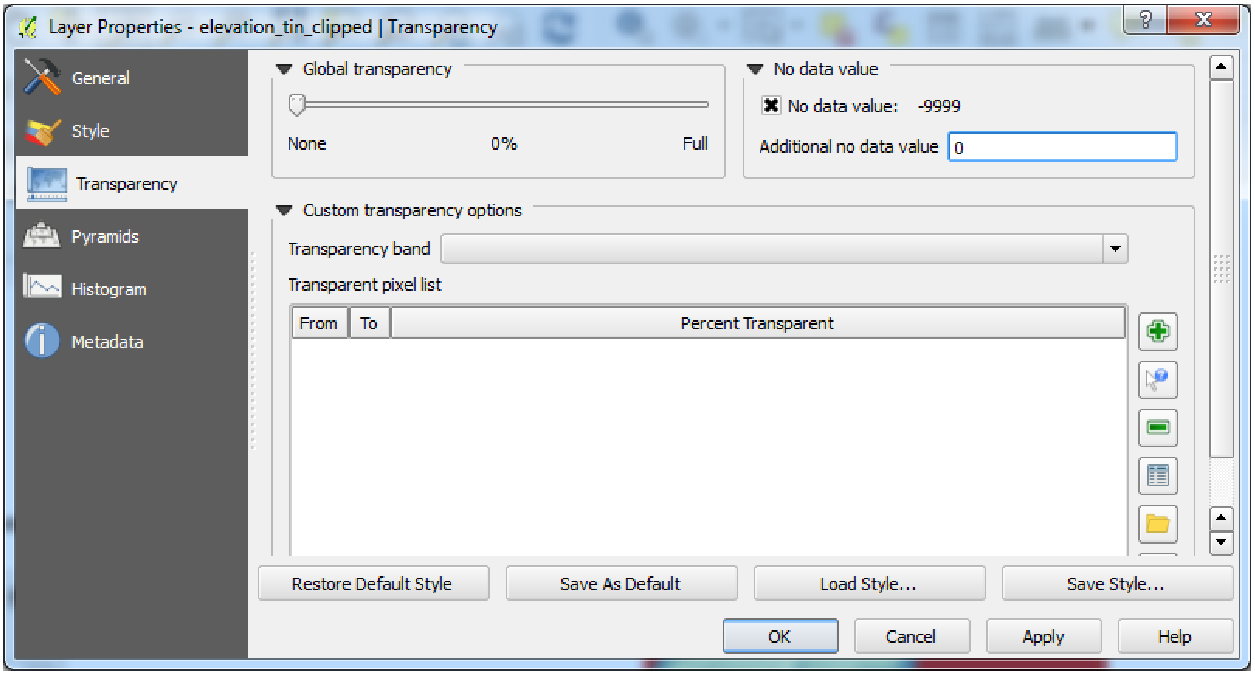
12. A new raster elevation_tin_clipped will be loaded in QGIS. We will now change style of this layer to show the difference in elevations. Click on + sign against elevation_tin layer in layer pane, now we can note the min and max elevation values. Double click on elevation_tin_clipped layer to open property window.



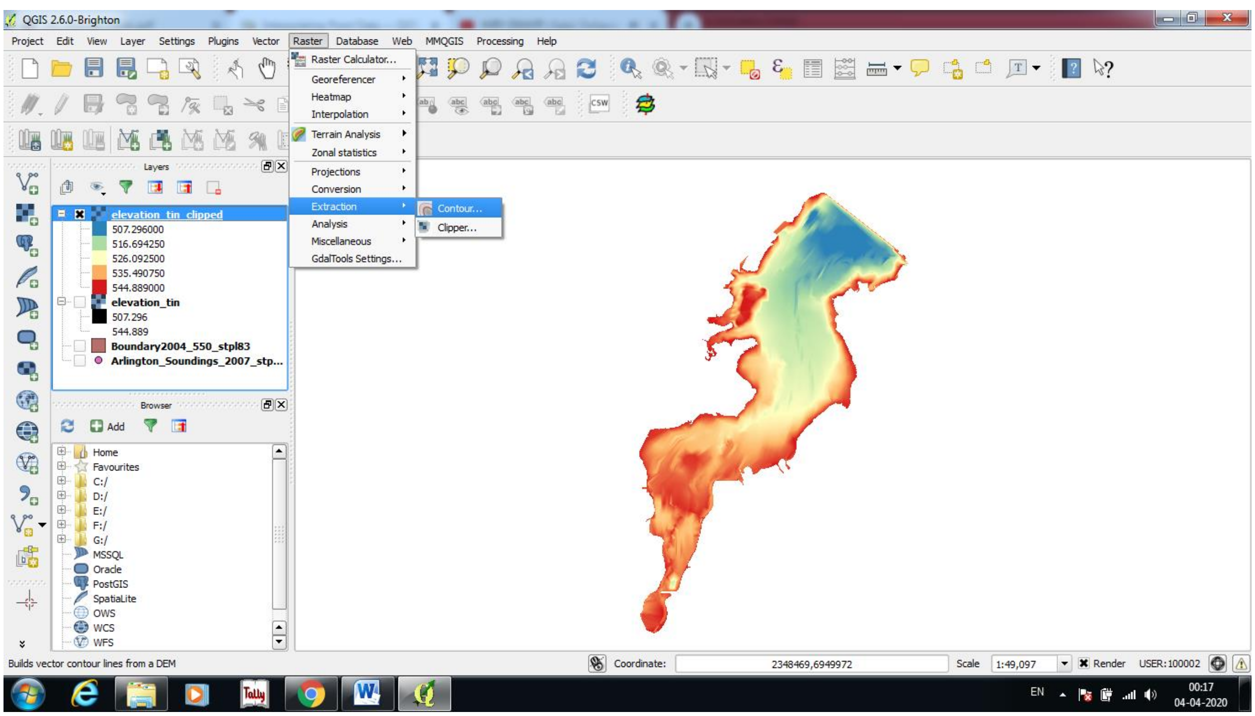
13. Click on the Style tab. Select Render type as Singleband pseudocolor. In the Generate new color map panel, select Spectral as color ramp and enter min and max values. Since we want to create a depth-map as opposed to a height-map, check the Invert box. This will assign blues to deep areas and reds to shallow areas. Click on Classify button.



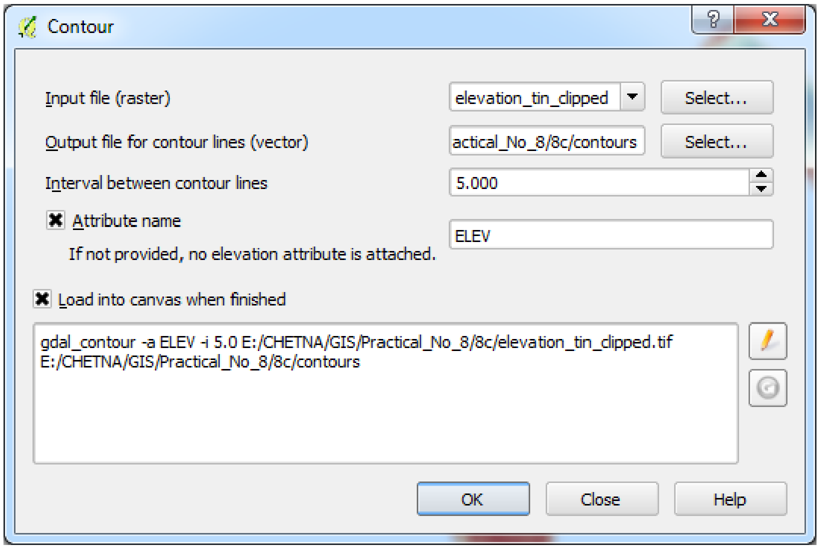
14. Click on Transparency tab. We want to remove the black-pixels or unknown pixels from our output, so enter 0 as the Additional no data value. Click on Ok.



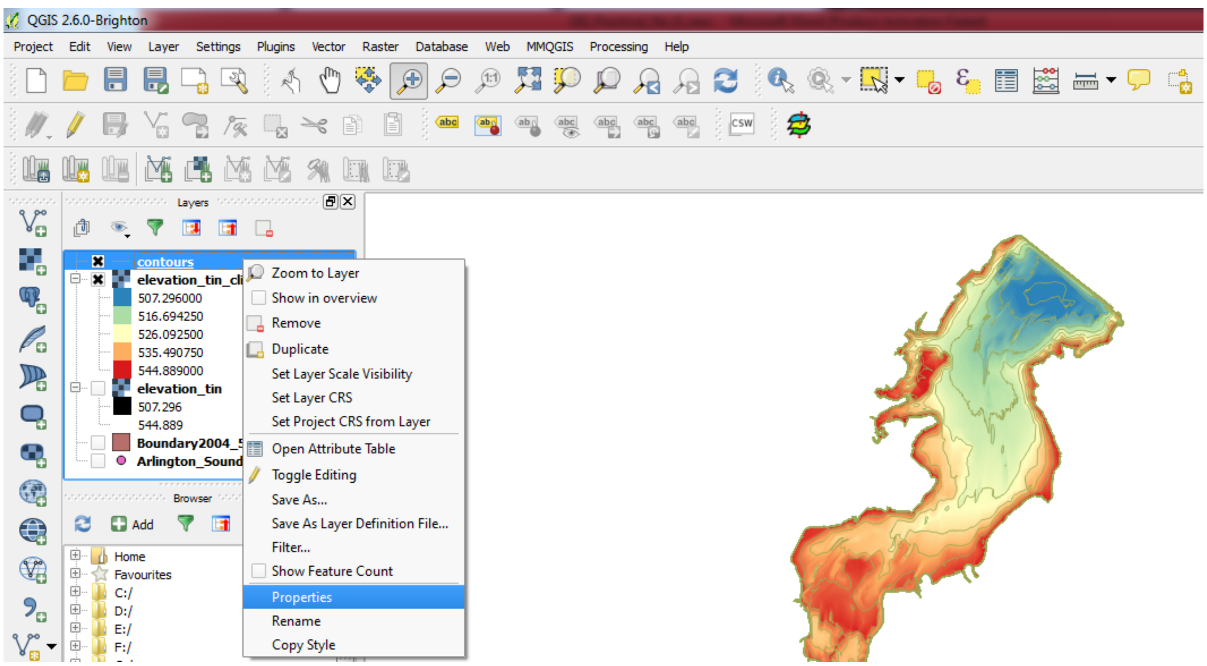
15. Now we have an elevation relief map for the lake generated from the individual depth readings. Let's generate contours now. Click on raster → extraction → contours.



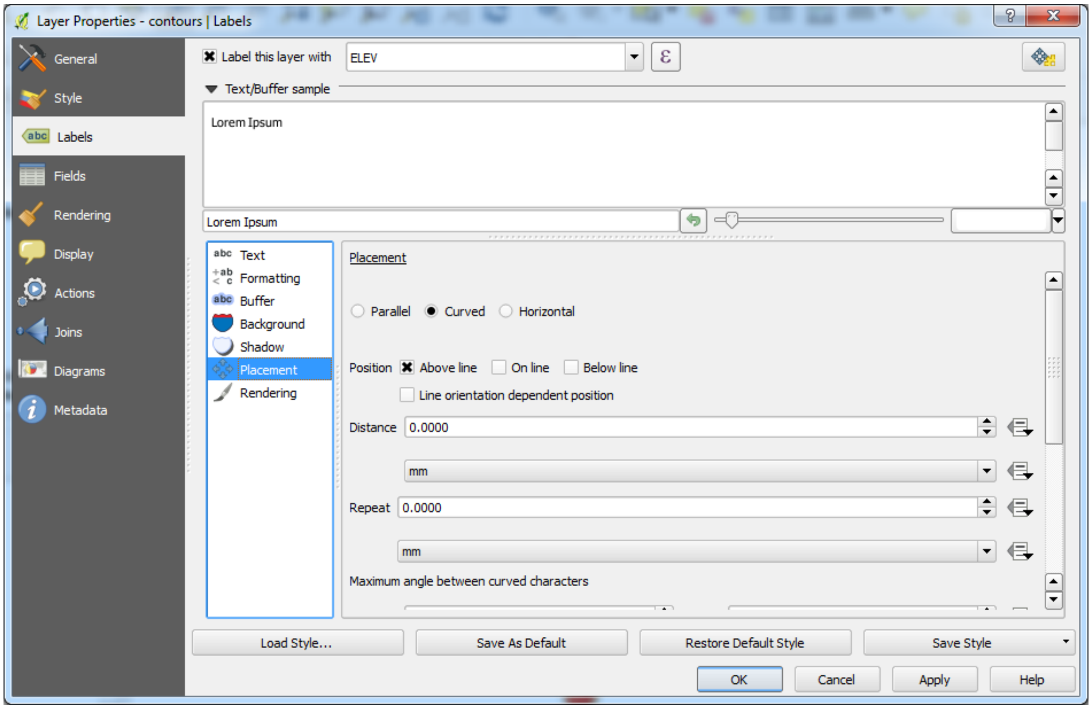
16. In the Contour dialog box, enter contours as the Output file for contour lines. We will generate contour lines at 5 feet intervals, so enter 5.00 as the Interval between contour lines. Check the Attribute name box. Make sure that load into canvas when finished. Click on Ok.



17. The contour lines will be loaded as contours layer once the processing is finished. Double click on this layer to open property window or right click on contours and select properties.



18. Click on Labels tab. Check the Label this layer with box and select ELEV as the field. Select Curved as the Placement type and click on Ok.



19. We will see that each contour line will be appropriately labeled with the elevation along with the line.