

Points in Polygon Analysis

QGIS Tutorials and Tips

Ujaval Gandhi ujaval@spatialthoughts.com

Points in Polygon Analysis

The power of GIS lies in analysing multiple data sources together. Often the answer you are seeking lies in many different layers and you need to do some analysis to extract and compile this information. One such type of analysis is Points-in-Polygon. When you have a polygon layer and a point layer – and want to know how many or which of the points fall within the bounds of each polygon, you can use this method of analysis.

Overview of the task

Given the locations of all known significant earthquakes, we will try to find out which country has had the highest number of earthquakes.

Get the data

We will use NOAA's National Geophysical Data Center's [Significant Earthquake Database](#) as our layer representing all major earthquakes. Download the [tab-delimited earthquake data](#).

Natural Earth has [Admin 0 – Countries](#) dataset. Download the [countries](#)

Data Sources: [NGDC] [NATURALEARTH]

Procedure

1. Open Layer › Add Delimited Text Layer and browse to the downloaded *signif.txt* file.



2. Since this is a tab-delimited file, choose Tab as the File format. The X field and Y field would be auto-populated. Click OK.

Note

You may see some error messages as QGIS tries to import the file. These are valid errors and some rows from the file will not be imported. You can ignore the errors for the purpose of this tutorial.

Create a Layer from a Delimited Text File

File Name:

Layer name: Encoding:

File format: ☐ CSV (comma separated values) ☒ Custom delimiters ☐ Regular expression delimiter

☐ Comma
 ☒ Tab
 ☐ Space
 ☐ Colon
 ☐ Semicolon

Other delimiters: Quote: Escape:

Record options: Number of header lines to discard: ☒ First record has field names

Field options: ☐ Trim fields ☐ Discard empty fields ☐ Decimal separator is comma

Geometry definition: ☒ Point coordinates ☐ Well known text (WKT) ☐ No geometry (attribute only table)

☒ X field: Y field: ☐ DMS coordinates

Layer settings: ☒ Use spatial index ☐ Use subset index ☐ Watch file

| | I_D | FLAG_TSUNAMI | YEAR | MONTH | DAY | HOUR | MINUTE | SECOND | FOCAL_DEPTH | EQ_MAG_MW | EQ_MAG |
|---|-----|--------------|-------|-------|-----|------|--------|--------|-------------|-----------|--------|
| 1 | 1 | | -2150 | | | | | | | | |
| 2 | 2 | Tsu | -2000 | | | | | | | | |
| 3 | 3 | | -2000 | | | | | | 18 | | 7.1 |
| 4 | 8 | | -1566 | | | | | | | | |
| 5 | 11 | | -1450 | | | | | | | | |

3. As the earthquake dataset has Latitude/Longitude coordinates, choose WGS 84 EPSG:4326 as the CRS in the Coordinate Reference System Selector dialog.



4. The earthquake point layer would now be loaded and displayed in QGIS. Let's also open the Countries layer. Go to Layer > Add Vector Layer. Browse to the downloaded *ne_10m_admin_0_countries.zip* file and click Open. Select the *ne_10m_admin_0_countries.shp* as the layer in the Select layers to add... dialog.



5. Click on Vector › Analysis Tools › Point in Polygon



6. In the pop-up window, select the polygon layer and point layer respectively. Name the output layer as *earthquake_per_coutry.shp* and Click OK.

Note

Be patient after clicking OK, QGIS may take upto 10 minutes to calculate the results.

7. When asked whether you want to add the layer to TOC, click Yes.



8. You will see a new layer is added to the table of content. Open the attribute table by right-clicking on the layer and selecting Open Attribute Table.



9. In the attribute table, you will notice a new field named *PNTCNT*. This is the count of number of points from the earthquakes layer that fall within each polygon.

Attribute table - earthquakes_per_country :: Features total: 255, filtered: 255, selected: 0

| | REGION_WB | NAME_LEN | LONG_LEN | ABBREV_LEN | TINY | HOMEPART | PNTCNT |
|----|--------------------|----------|----------|------------|--------|----------|--------------------|
| 0 | Latin America ... | 5.00 | 5.00 | 5.00 | 4.00 | -99.00 | 0.000000000000... |
| 1 | South Asia | 11.00 | 11.00 | 4.00 | -99.00 | 1.00 | 57.000000000000... |
| 2 | Sub-Saharan Af... | 6.00 | 6.00 | 4.00 | -99.00 | 1.00 | 0.000000000000... |
| 3 | Latin America ... | 8.00 | 8.00 | 4.00 | -99.00 | -99.00 | 0.000000000000... |
| 4 | Europe & Centr... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 44.000000000000... |
| 5 | Europe & Centr... | 5.00 | 13.00 | 5.00 | 5.00 | -99.00 | 0.000000000000... |
| 6 | Europe & Centr... | 7.00 | 7.00 | 4.00 | 5.00 | 1.00 | 0.000000000000... |
| 7 | Middle East & ... | 20.00 | 20.00 | 6.00 | -99.00 | 1.00 | 0.000000000000... |
| 8 | Latin America ... | 9.00 | 9.00 | 4.00 | -99.00 | 1.00 | 20.000000000000... |
| 9 | Europe & Centr... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 14.000000000000... |
| 10 | East Asia & Pac... | 14.00 | 14.00 | 9.00 | 3.00 | -99.00 | 0.000000000000... |
| 11 | Antarctica | 10.00 | 10.00 | 4.00 | -99.00 | 1.00 | 0.000000000000... |
| 12 | East Asia & Pac... | 23.00 | 27.00 | 7.00 | -99.00 | -99.00 | 0.000000000000... |
| 13 | Sub-Saharan Af... | 22.00 | 35.00 | 10.00 | 2.00 | -99.00 | 0.000000000000... |
| 14 | Latin America ... | 17.00 | 19.00 | 6.00 | 4.00 | 1.00 | 0.000000000000... |
| 15 | East Asia & Pac... | 9.00 | 9.00 | 4.00 | -99.00 | 1.00 | 9.000000000000... |
| 16 | Europe & Centr... | 7.00 | 7.00 | 5.00 | -99.00 | 1.00 | 4.000000000000... |
| 17 | Europe & Centr... | 10.00 | 10.00 | 4.00 | -99.00 | 1.00 | 15.000000000000... |
| 18 | Sub-Saharan Af... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 1.000000000000... |
| 19 | Europe & Centr... | 7.00 | 7.00 | 5.00 | -99.00 | 1.00 | 2.000000000000... |
| 20 | Sub-Saharan Af... | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 1.000000000000... |
| 21 | Sub-Saharan Af... | 12.00 | 12.00 | 4.00 | -99.00 | 1.00 | 0.000000000000... |

Show All Features

10. To get our answer, we can simply sort the table by *PNTCNT* field and the country with highest count will be our answer. Click 2-times on the *PNTCNT* column to get it sorted in descending order. Click on the first row to select it and close the Attribute Table.

Attribute table - earthquakes_per_country :: Features total: 255, filtered: 255, selected: 1

| | REGION_WB | NAME_LEN | LONG_LEN | ABBREV_LEN | TINY | HOMEPART | PNTCNT |
|-----|--------------------|----------|----------|------------|--------|----------|-------------------|
| 42 | East Asia & Pac... | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 540.0000000000... |
| 108 | Middle East & ... | 4.00 | 4.00 | 4.00 | -99.00 | 1.00 | 345.0000000000... |
| 112 | Europe & Centr... | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 263.0000000000... |
| 230 | Europe & Centr... | 6.00 | 6.00 | 4.00 | -99.00 | 1.00 | 259.0000000000... |
| 146 | Latin America ... | 6.00 | 6.00 | 4.00 | -99.00 | 1.00 | 157.0000000000... |
| 238 | North America | 13.00 | 13.00 | 6.00 | -99.00 | 1.00 | 152.0000000000... |
| 102 | East Asia & Pac... | 9.00 | 9.00 | 5.00 | -99.00 | 1.00 | 129.0000000000... |
| 90 | Europe & Centr... | 6.00 | 6.00 | 6.00 | -99.00 | 1.00 | 119.0000000000... |
| 41 | Latin America ... | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 111.0000000000... |
| 177 | Latin America ... | 4.00 | 4.00 | 4.00 | -99.00 | 1.00 | 110.0000000000... |
| 179 | East Asia & Pac... | 11.00 | 11.00 | 5.00 | -99.00 | 1.00 | 101.0000000000... |
| 116 | East Asia & Pac... | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 87.0000000000... |
| 104 | South Asia | 5.00 | 5.00 | 5.00 | -99.00 | 1.00 | 70.0000000000... |
| 50 | Latin America ... | 8.00 | 8.00 | 4.00 | -99.00 | 1.00 | 64.0000000000... |
| 1 | South Asia | 11.00 | 11.00 | 4.00 | -99.00 | 1.00 | 57.0000000000... |
| 67 | Latin America ... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 52.0000000000... |
| 232 | East Asia & Pac... | 6.00 | 6.00 | 6.00 | -99.00 | 1.00 | 46.0000000000... |
| 4 | Europe & Centr... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 44.0000000000... |
| 174 | South Asia | 8.00 | 8.00 | 4.00 | -99.00 | 1.00 | 42.0000000000... |
| 66 | Middle East & ... | 7.00 | 7.00 | 4.00 | -99.00 | 1.00 | 40.0000000000... |
| 77 | Europe & Centr... | 6.00 | 6.00 | 3.00 | -99.00 | 1.00 | 38.0000000000... |
| 242 | Latin America | 9.00 | 9.00 | 4.00 | -99.00 | 1.00 | 38.0000000000... |

Show All Features

- Back in the main QGIS window, you will see one feature highlighted in yellow. This is the feature linked to the selected row in the attribute table which had the highest number of points. Select the Identify tool and click on that polygon. You can see that the country with the highest number of Significant earthquakes is China.



We determined from the simple analysis of 2 datasets that China has had the highest number of major earthquakes. You may refine this analysis further by taking into consideration the population as well as the size of the country and determine which is the most adversely affected country by major earthquakes.