"Crossborder investigation"

How to deal with different projections in one map and do geo-calculations ... Or how I found out how Swiss bridges compare to German bridges.

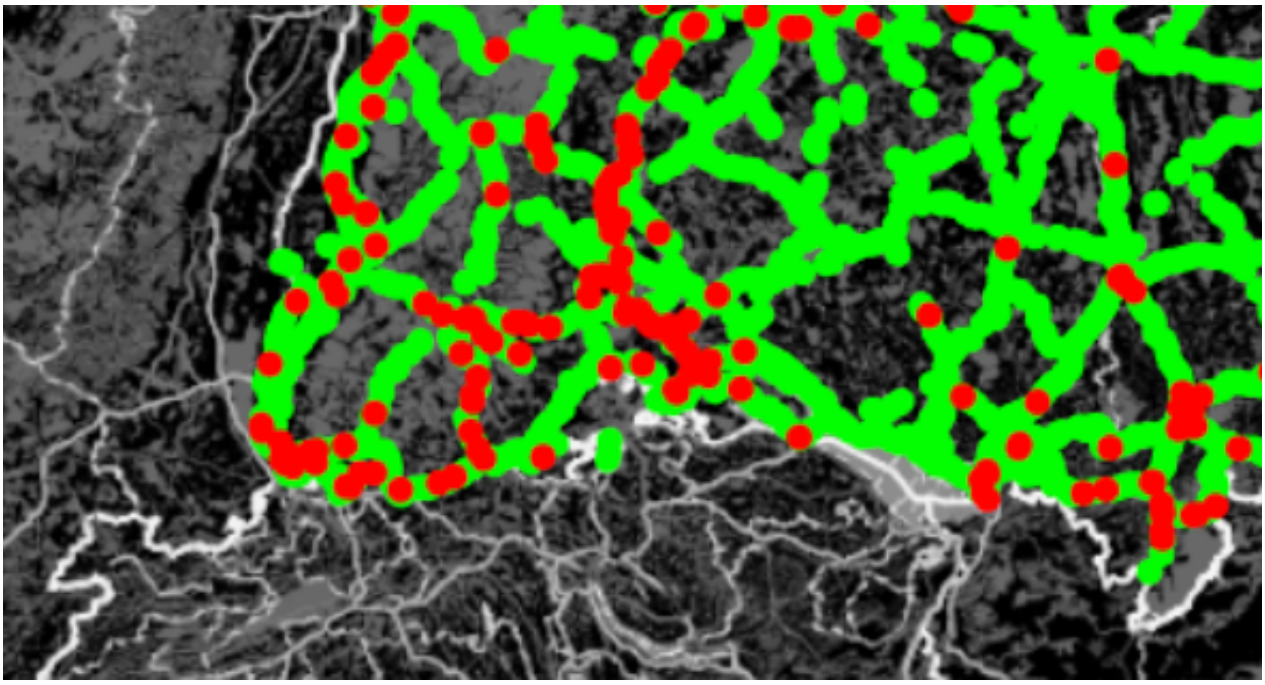
Preface: So, how did all this start?

We got the hint that a lot of German bridges close to the Swiss-German border are in a bad condition.

Hint:

> Die Brücken an der Rheingrenze sind ein tiefroter Gefahrenbereich.
>
> Die Politik ist sich offenbar nicht bewusst, dass hier das Leben der Grenzgänger und der Einkaufstouristen systematisch aufs Spiel gesetzt wird.

With a link to:



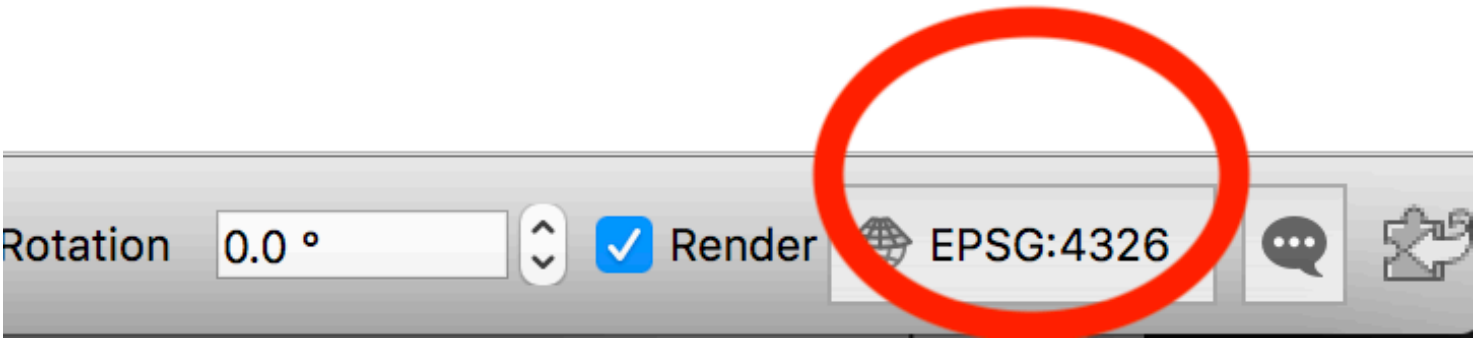
We then took the data from the official German authority for roads and bridges and also, we got from Swiss

Astra the data for Swiss bridges.

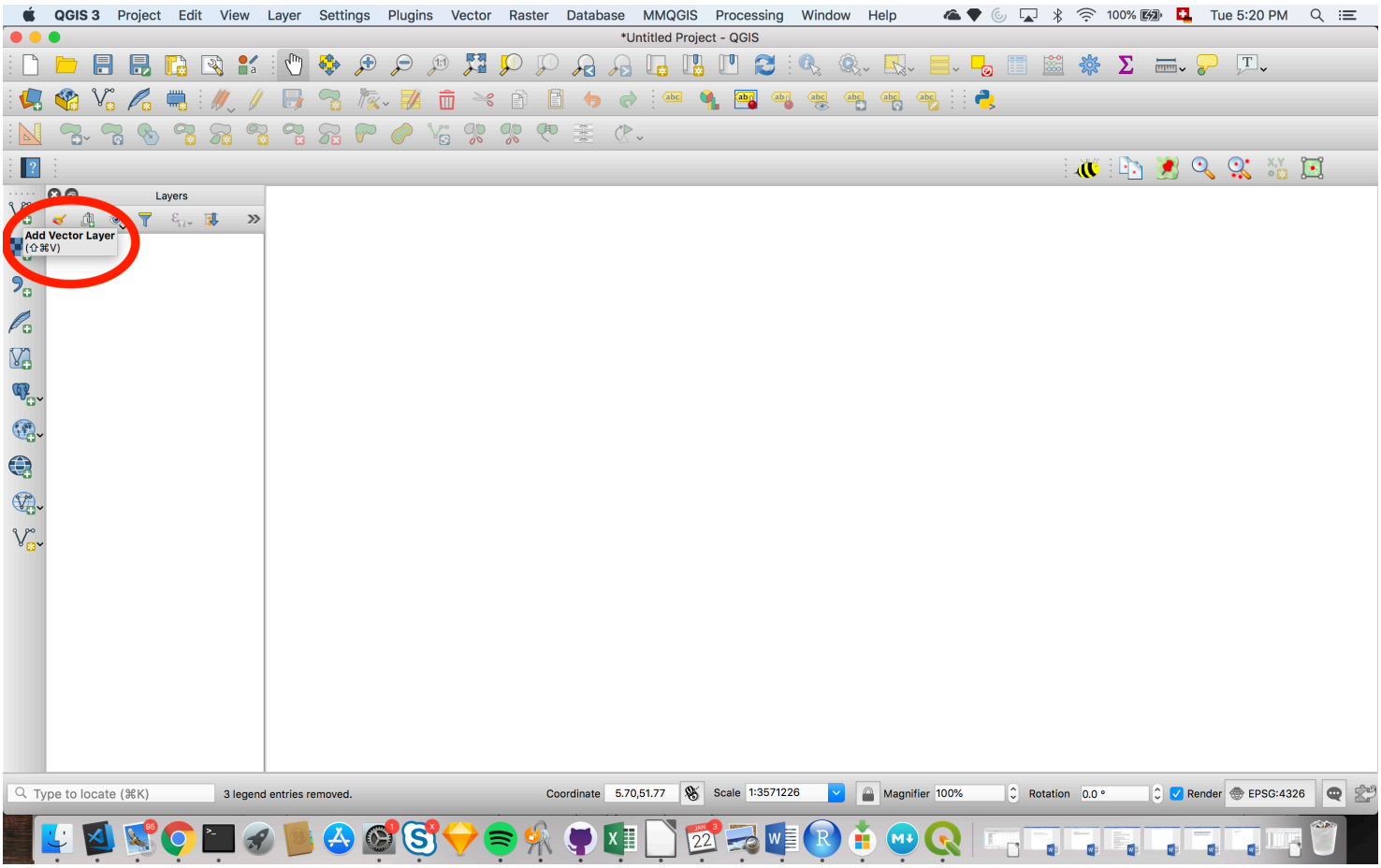
Then we wanted to bring the bridges all on a map in Qgis.

Part 1) Mapping two CSVs with different projections

First set the project CRS (Coordinate Reference System)



Then load shapes for countries from something like naturalearth.


QGIS 3 Project Edit View Layer Settings Plugins Vector Raster Database MMQGIS Processing Window Help
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Add Vector Layer
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Type to locate (⌘K)
3 legend entries removed.
Coordinate 5.70,51.77
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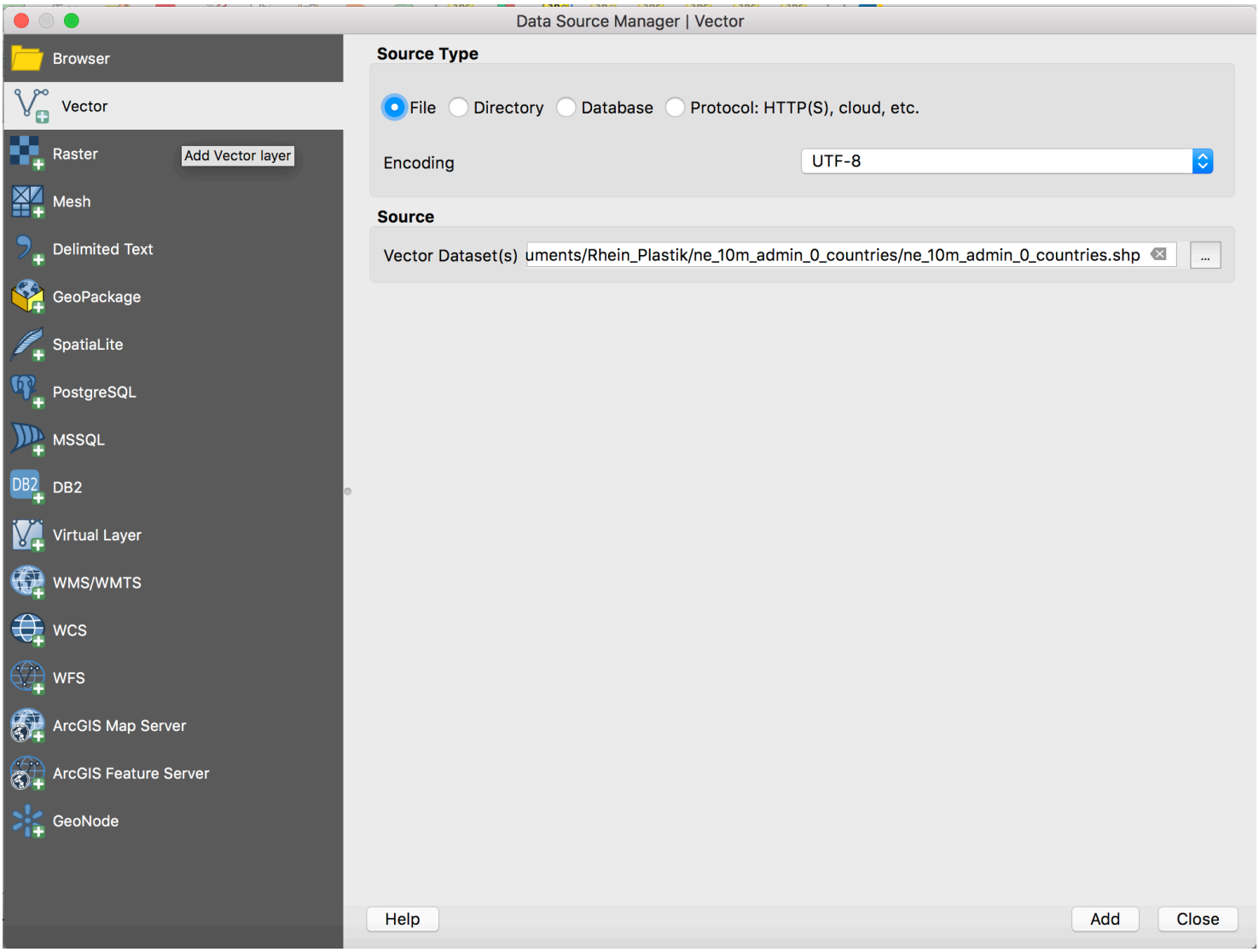
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ArcGIS Feature Server
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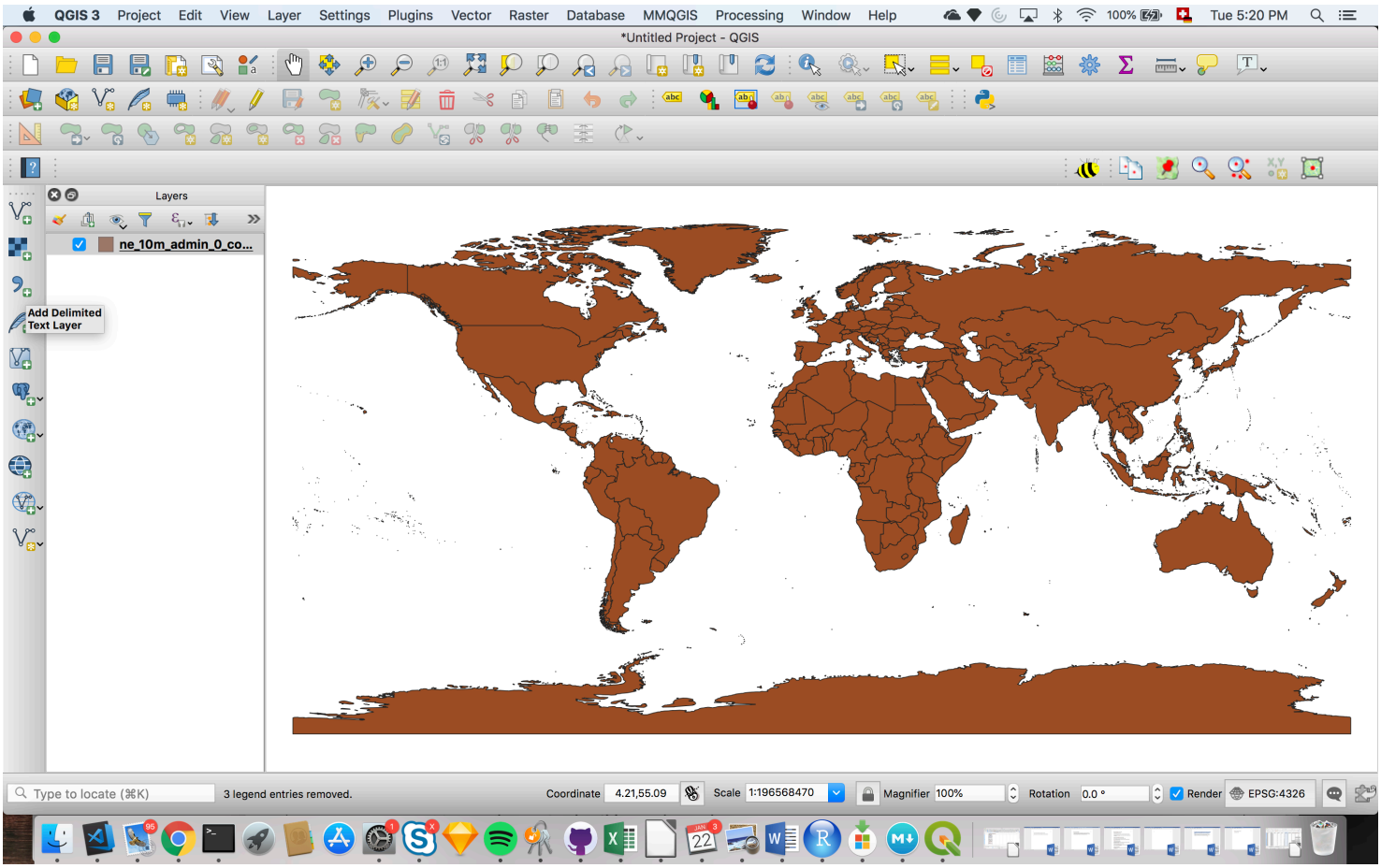
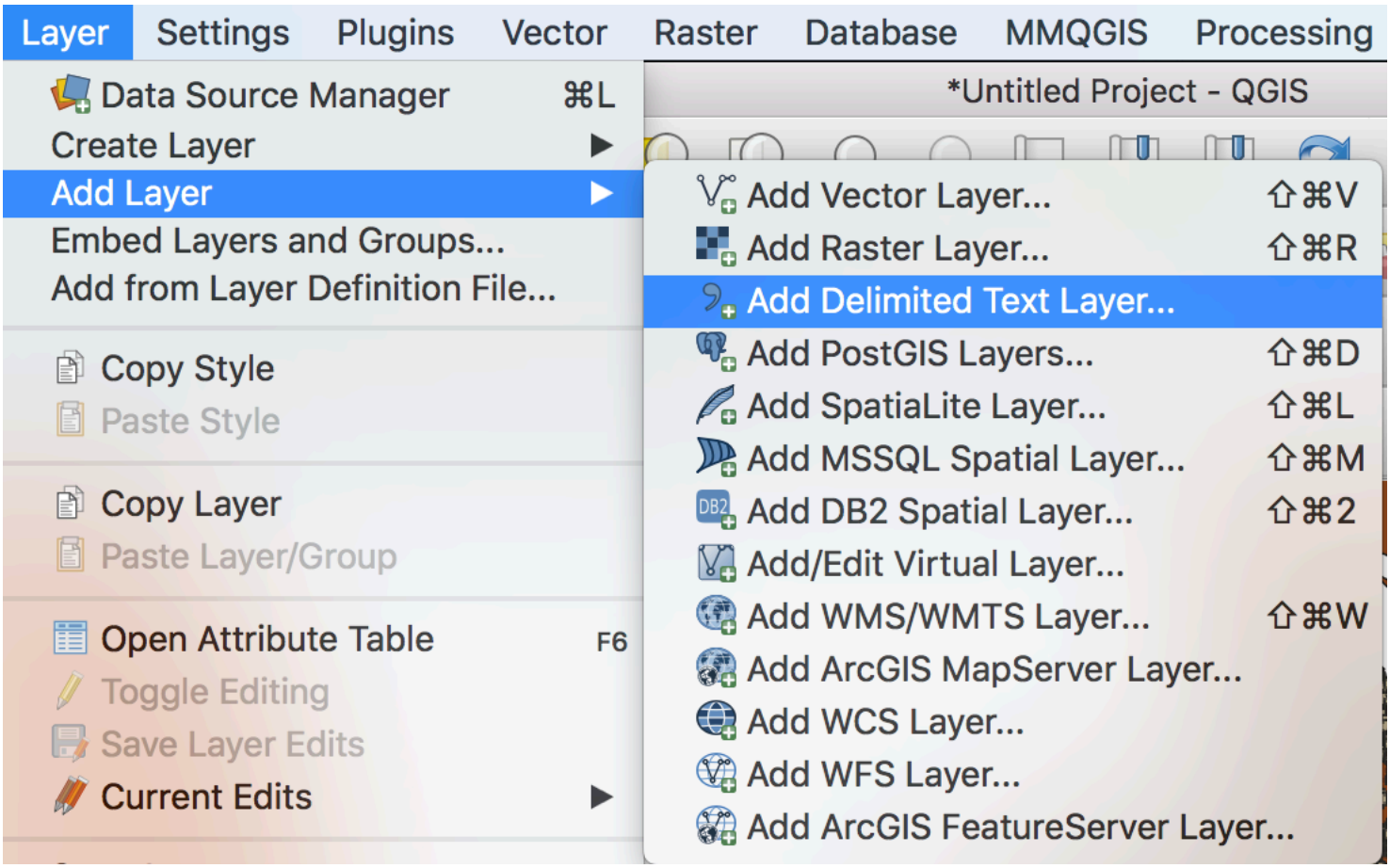
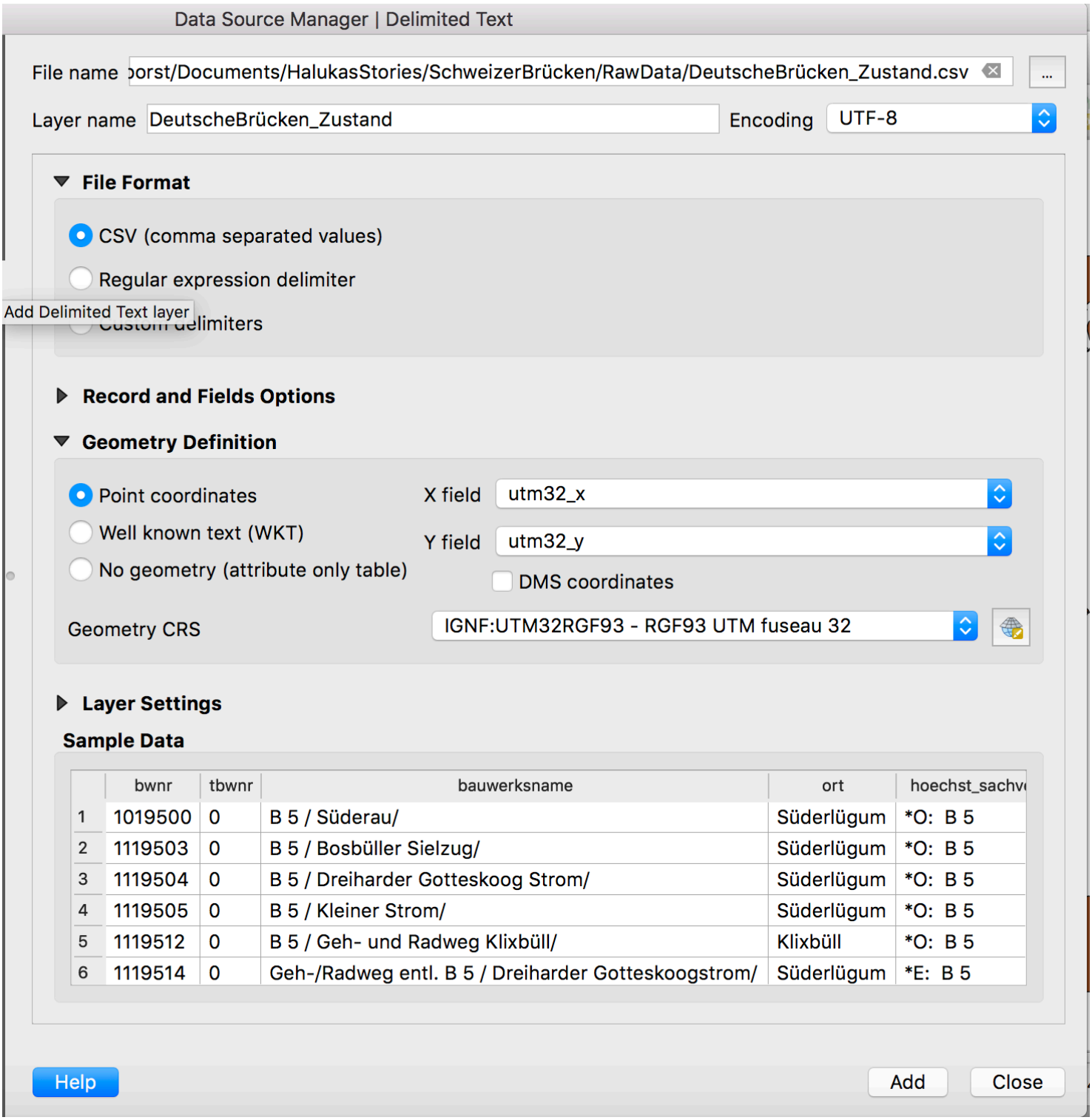


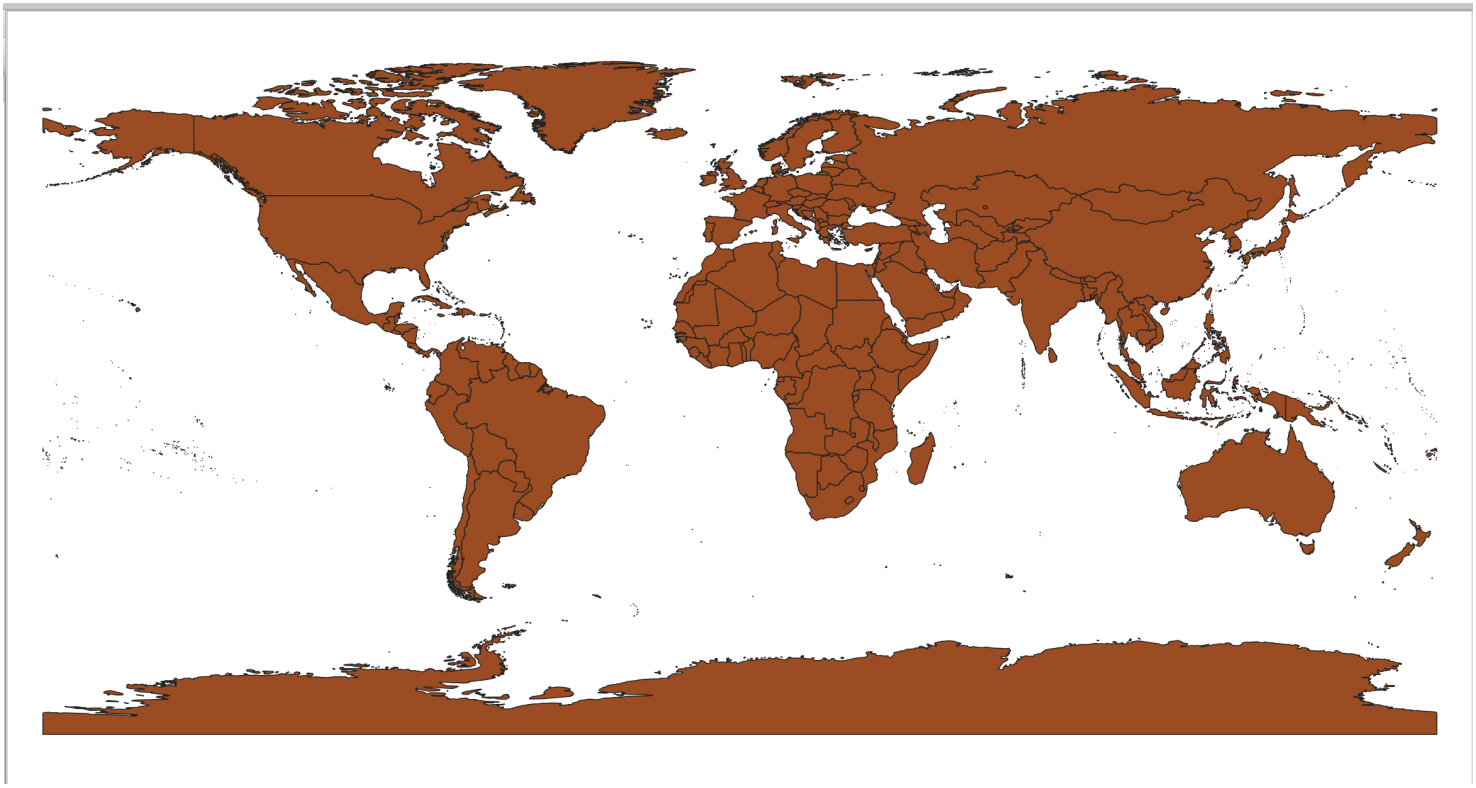
Next, we load the dataset for Germany as a csv



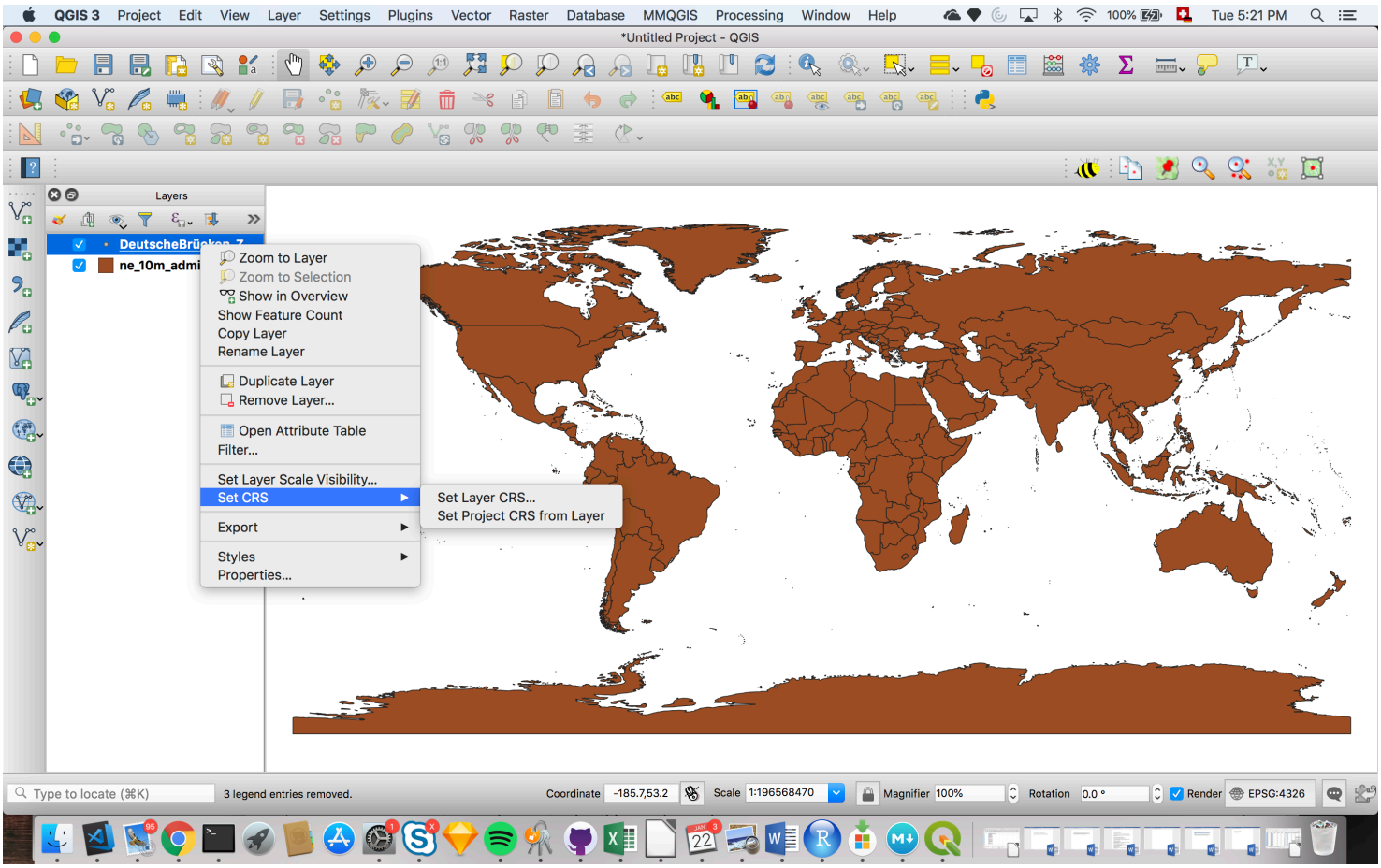
And set the layer CRS as UTM fuseau 32 and also tell QGIS what x and y coordinates are



However, sometimes the loaded layer does not show up right away



We can fix this by setting the CRS of the layer once more in the left menu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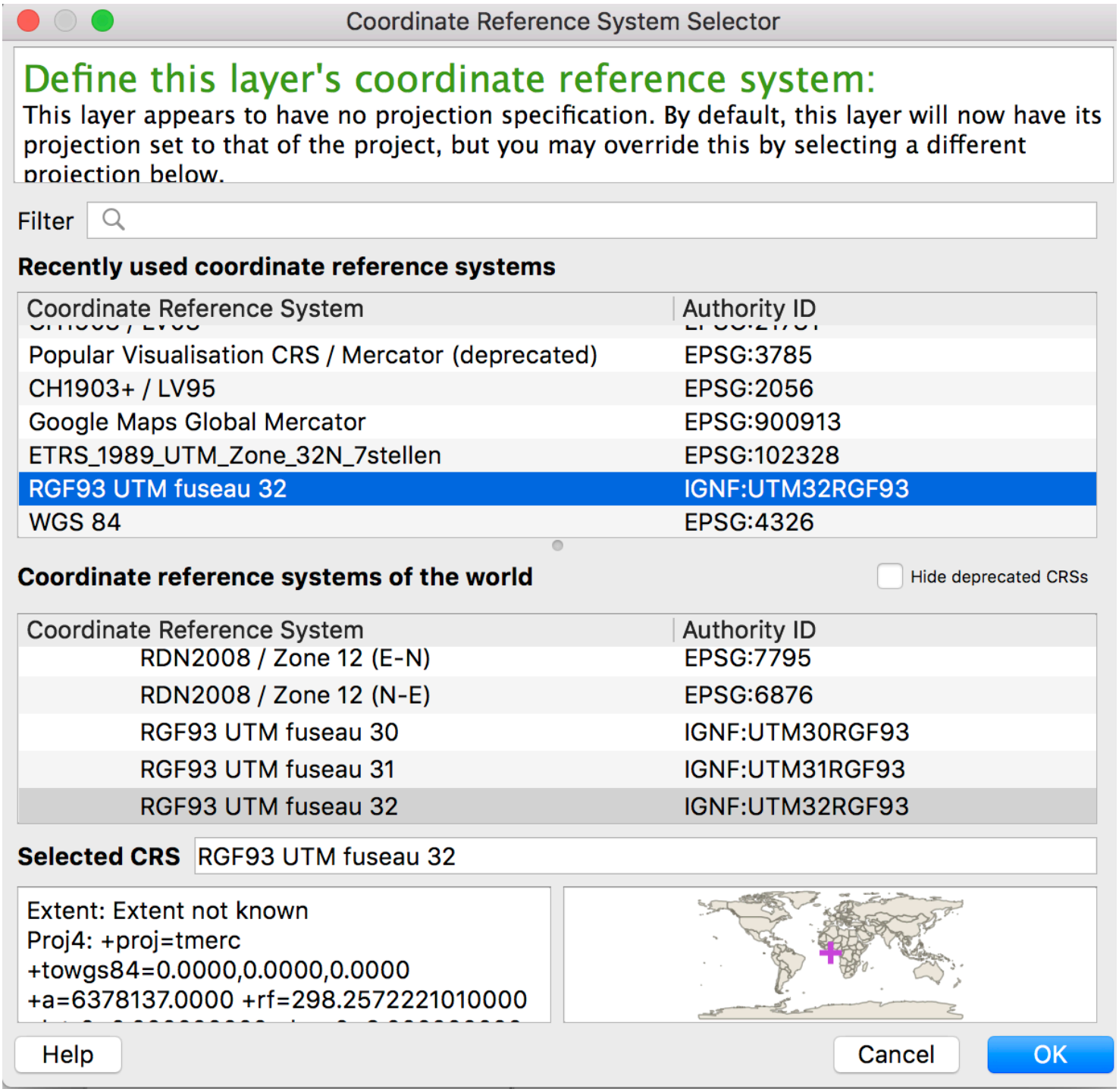
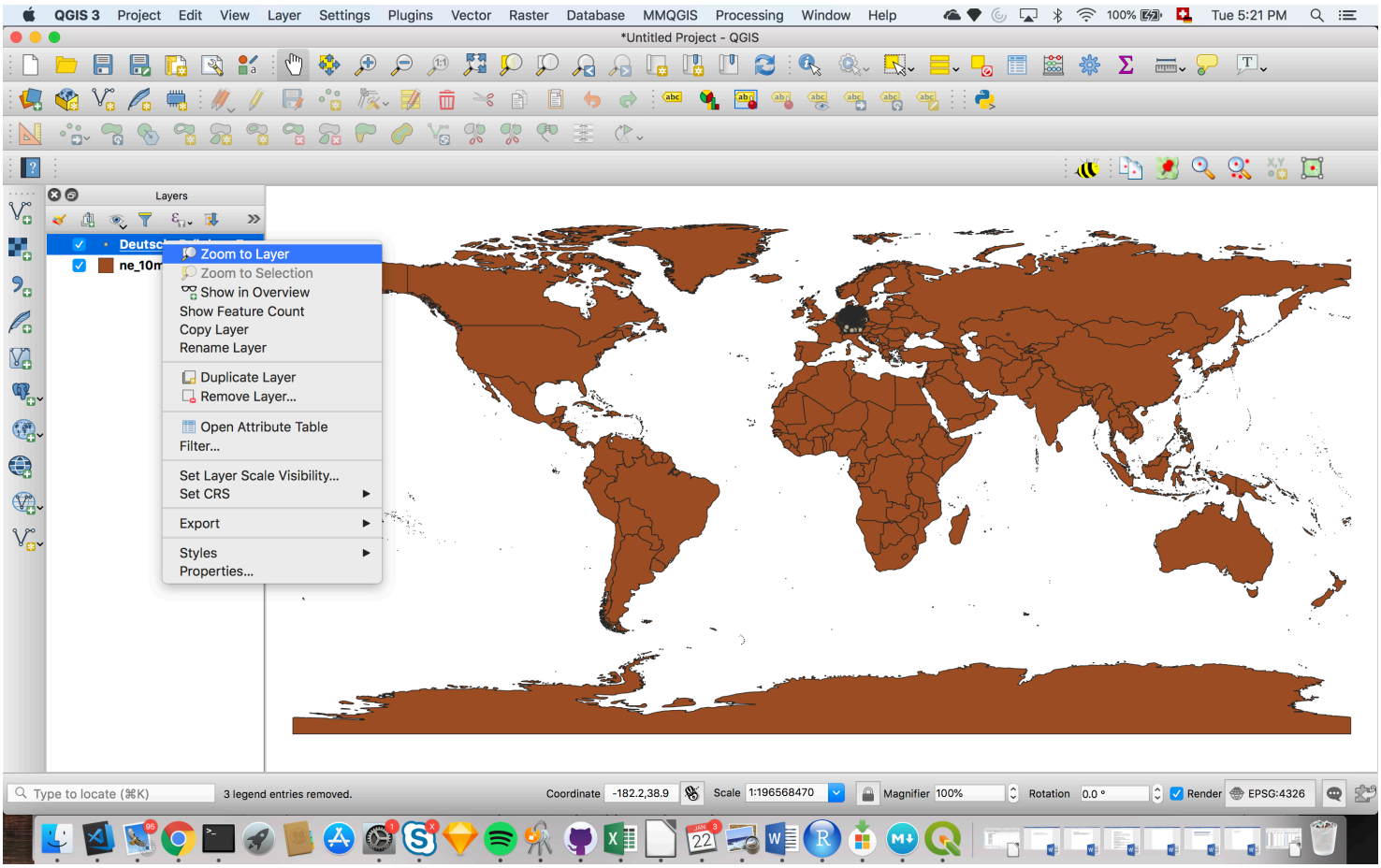
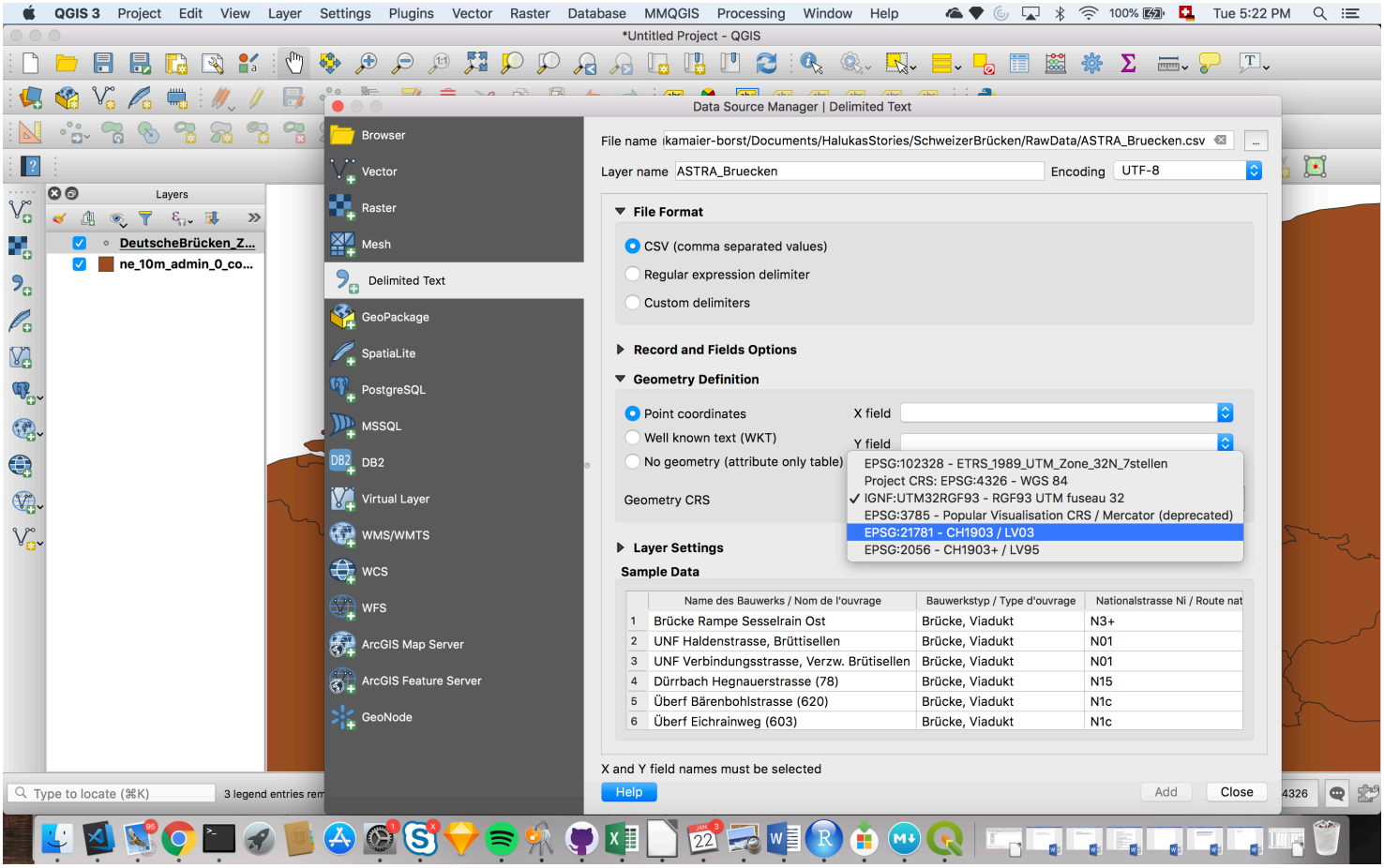


Now, the points show up and we zoom to the points with "Zoom to Layer"



Next, we do the exact same thing for the data for Switzerland. Import csv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WFS
ArcGIS Map Server
ArcGIS Feature Server
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File name kamaier-borst/Documents/HalukasStories/SchweizerBrücken/RawData/ASTRA_Bruecken.csv
Layer name ASTRA_Bruecken
Encoding UTF-8
File Format
CSV (comma separated values)
Regular expression delimiter
Custom delimiters
Record and Fields Options
Geometry Definition
Point coordinates
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No geometry (attribute only table)
X field
Y field
Geometry CRS
EPSG:102328 - ETRS_1989_UTM_Zone_32N_7stellen
Project CRS: EPSG:4326 - WGS 84
IGNF:UTM32RGF93 - RGF93 UTM fuseau 32
EPSG:3785 - Popular Visualisation CRS / Mercator (deprecated)
EPSG:21781 - CH1903 / LV03
EPSG:2056 - CH1903+ / LV95
Layer Settings
Sample Data
Name des Bauwerks / Nom de l'ouvrage
Bauwerkstyp / Type d'ouvrage
Nationalstrasse Ni / Route nat
1 Brücke Rampe Sesselrain Ost Brücke, Viadukt N3+
2 UNF Haldenstrasse, Brüttisellen Brücke, Viadukt N01
3 UNF Verbindungsstrasse, Verzw. Brütisellen Brücke, Viadukt N01
4 Dürrbach Hegnauerstrasse (78) Brücke, Viadukt N15
5 Überf Bärenbohlstrasse (620) Brücke, Viadukt N1c
6 Überf Eichrainweg (603) Brücke, Viadukt N1c
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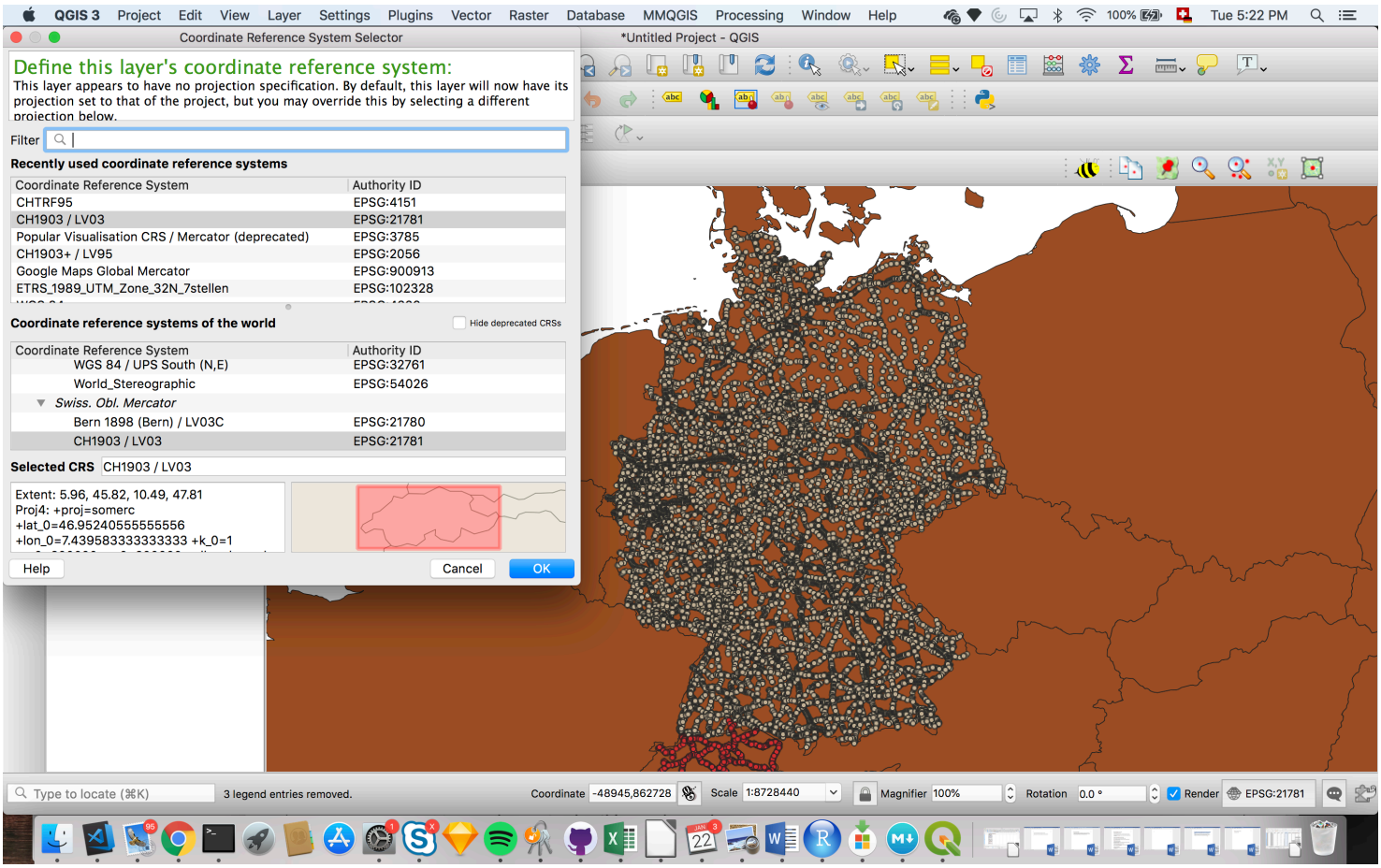
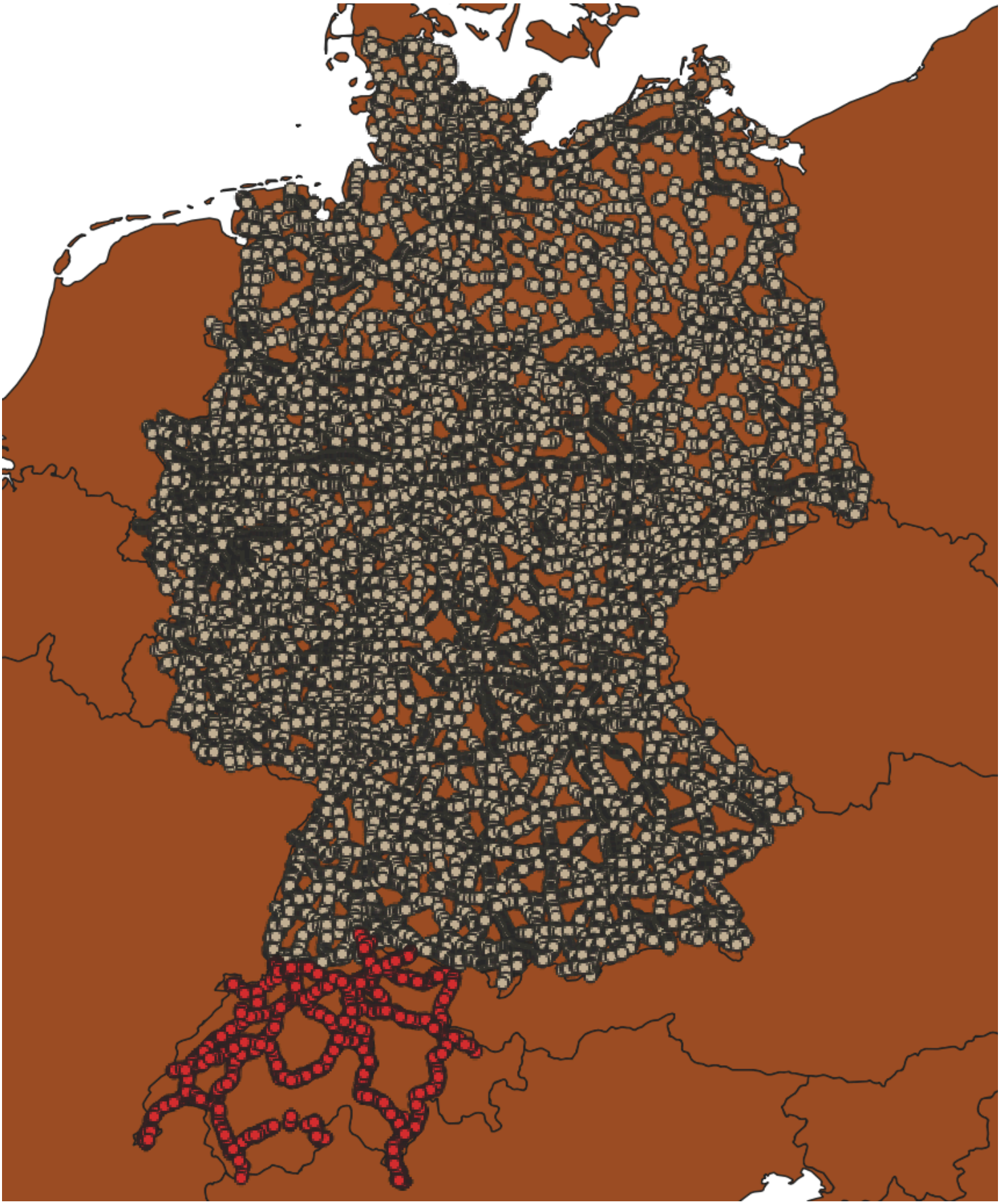
Set the CRS

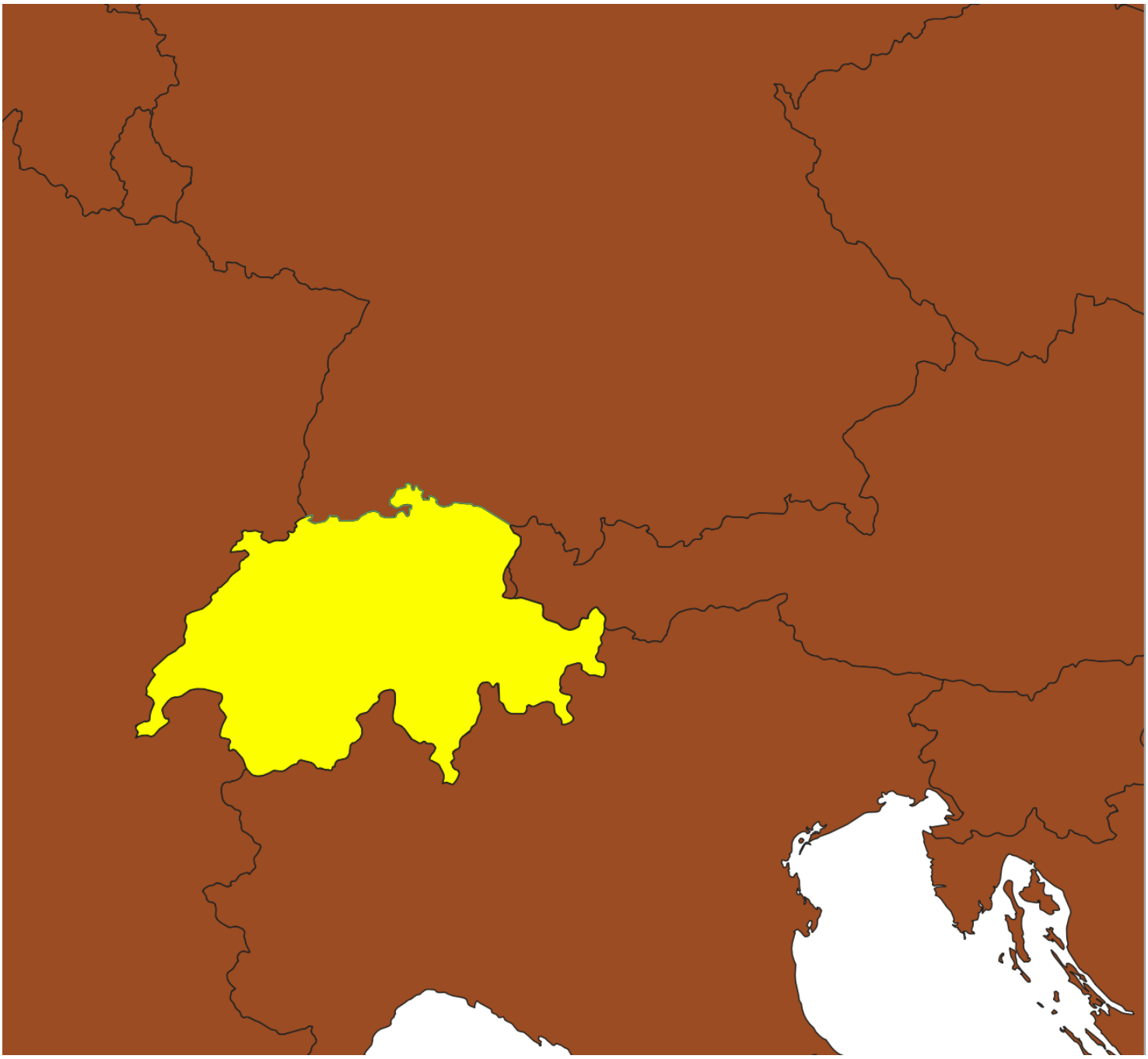


And then we should have both on the map.

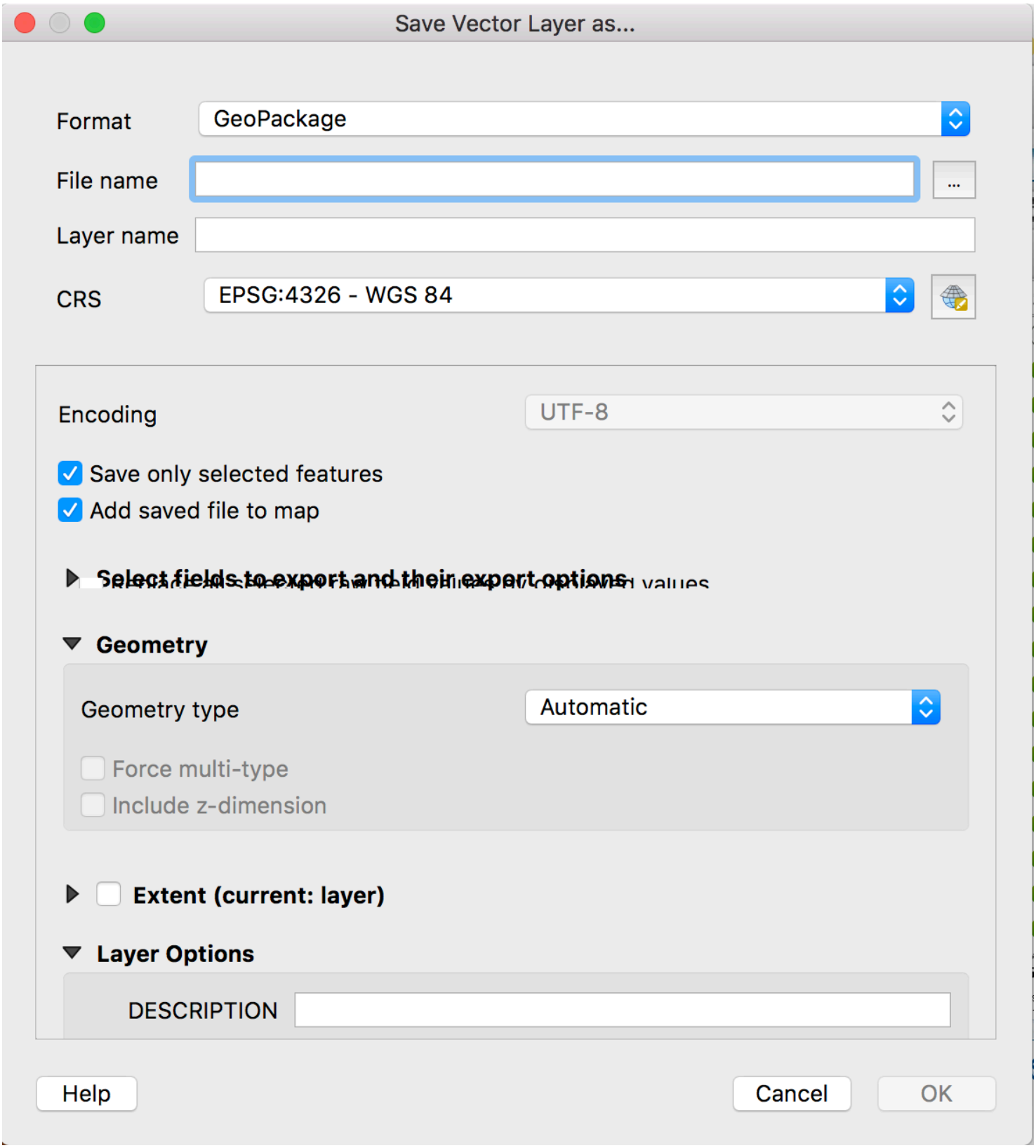


Step 2) Isolating the German-Swiss border

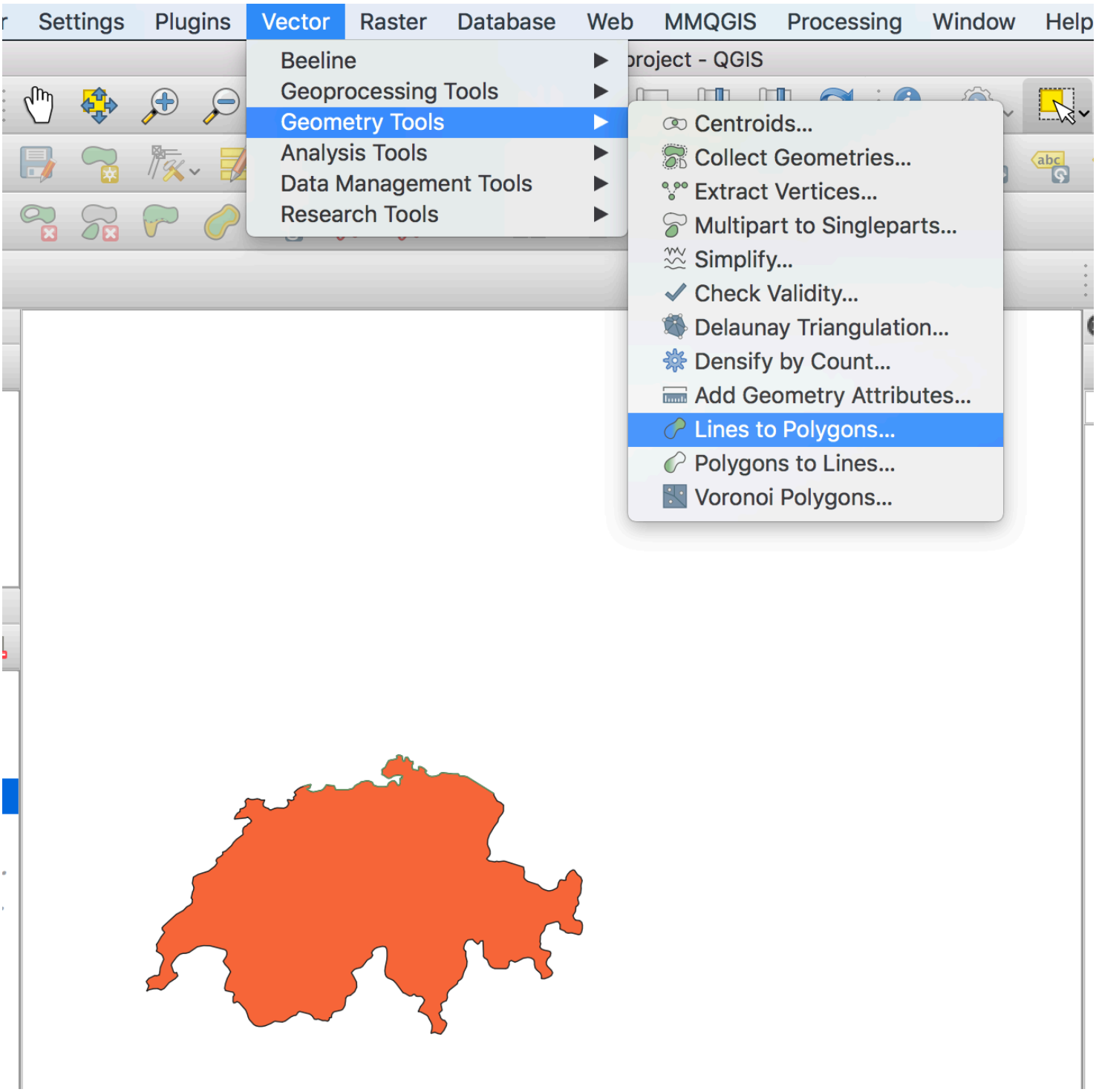
Now we want to define the German-Swiss border. We unselect the layers with the bridges shown as dots and then select the polygon of Switzerland.



And we save this single polygon as one particular layer. Note that the tickbox "save only selected features" is used.



Next, we take this polygon and turn it into lines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Analysis Tools
Data Management Tools
Research Tools
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Polygons to Lines...
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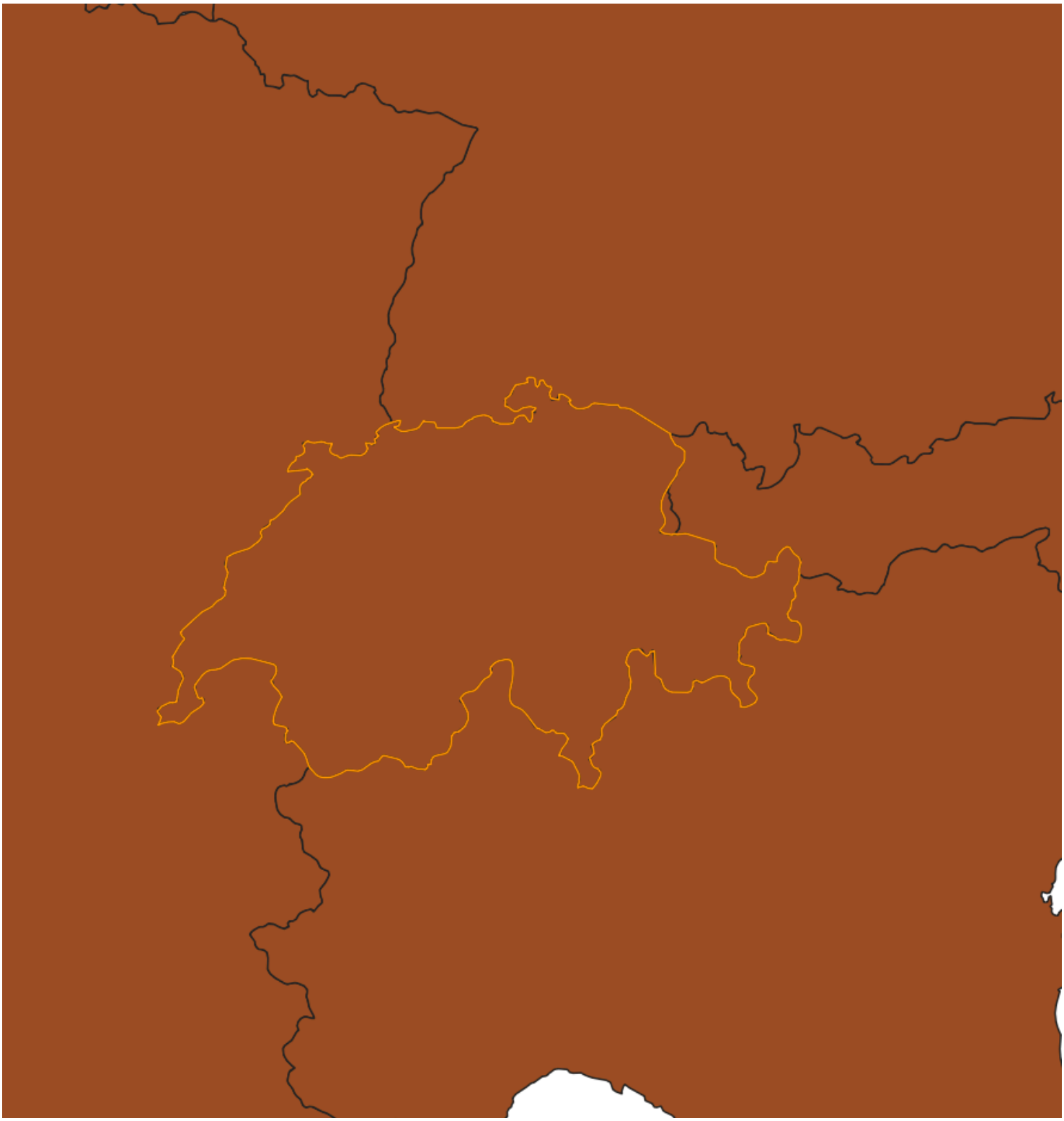
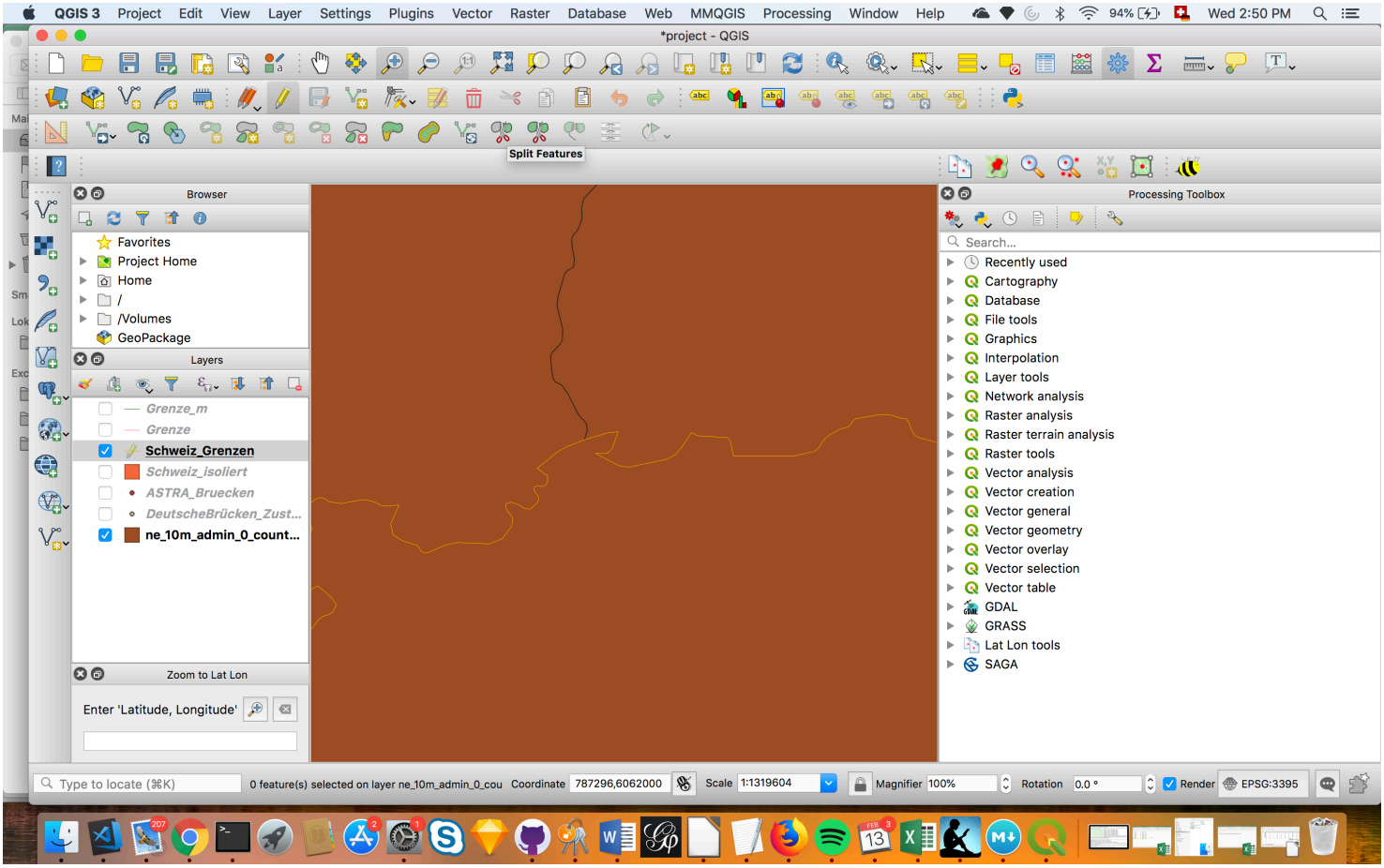
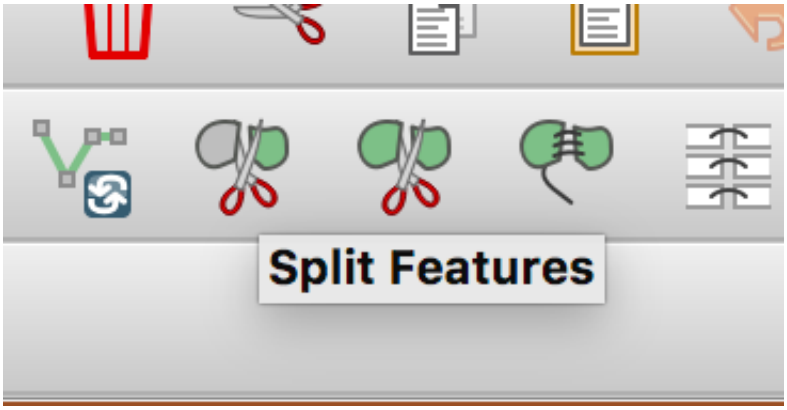


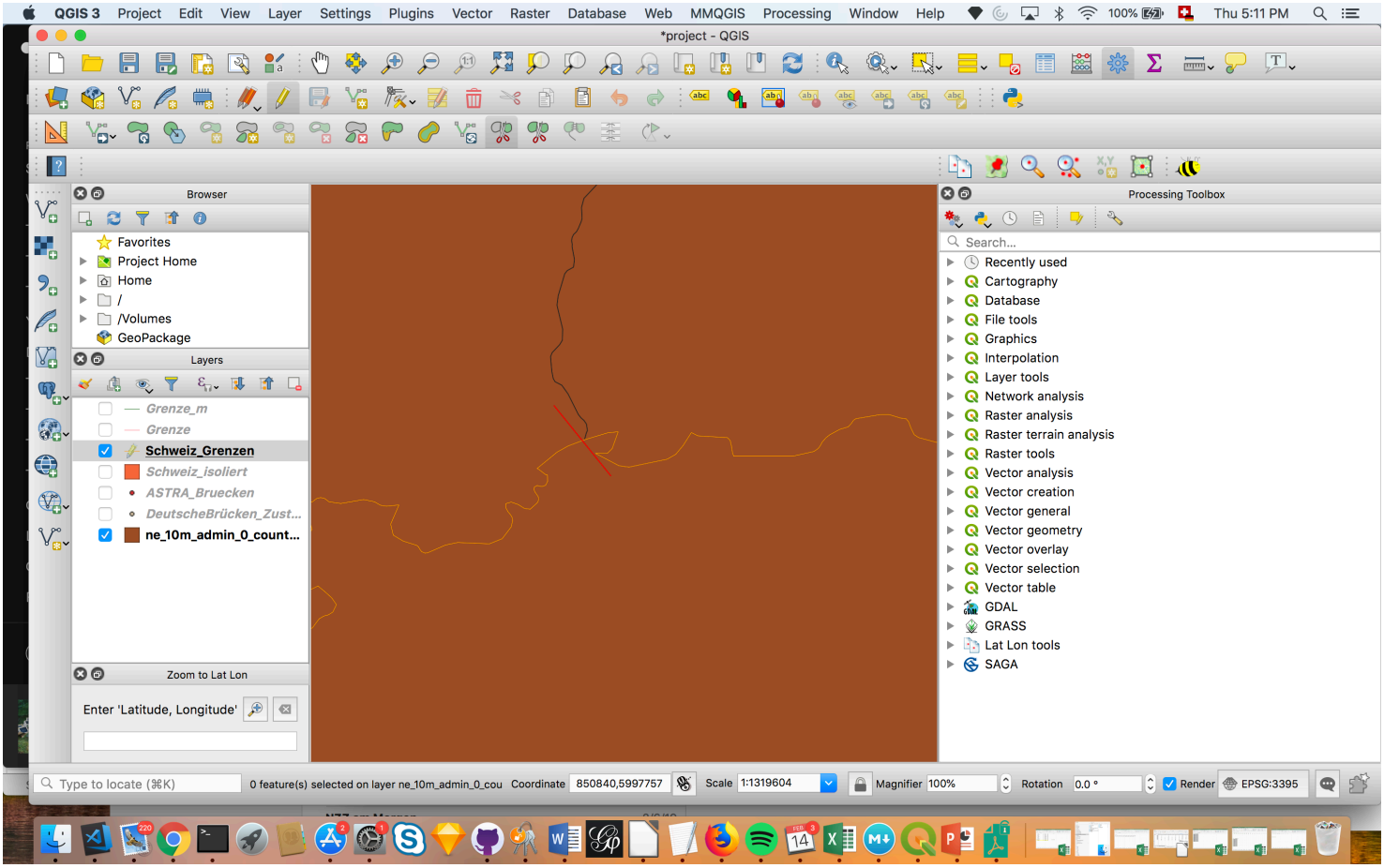
And zoom to the parts where the border begins and ends.



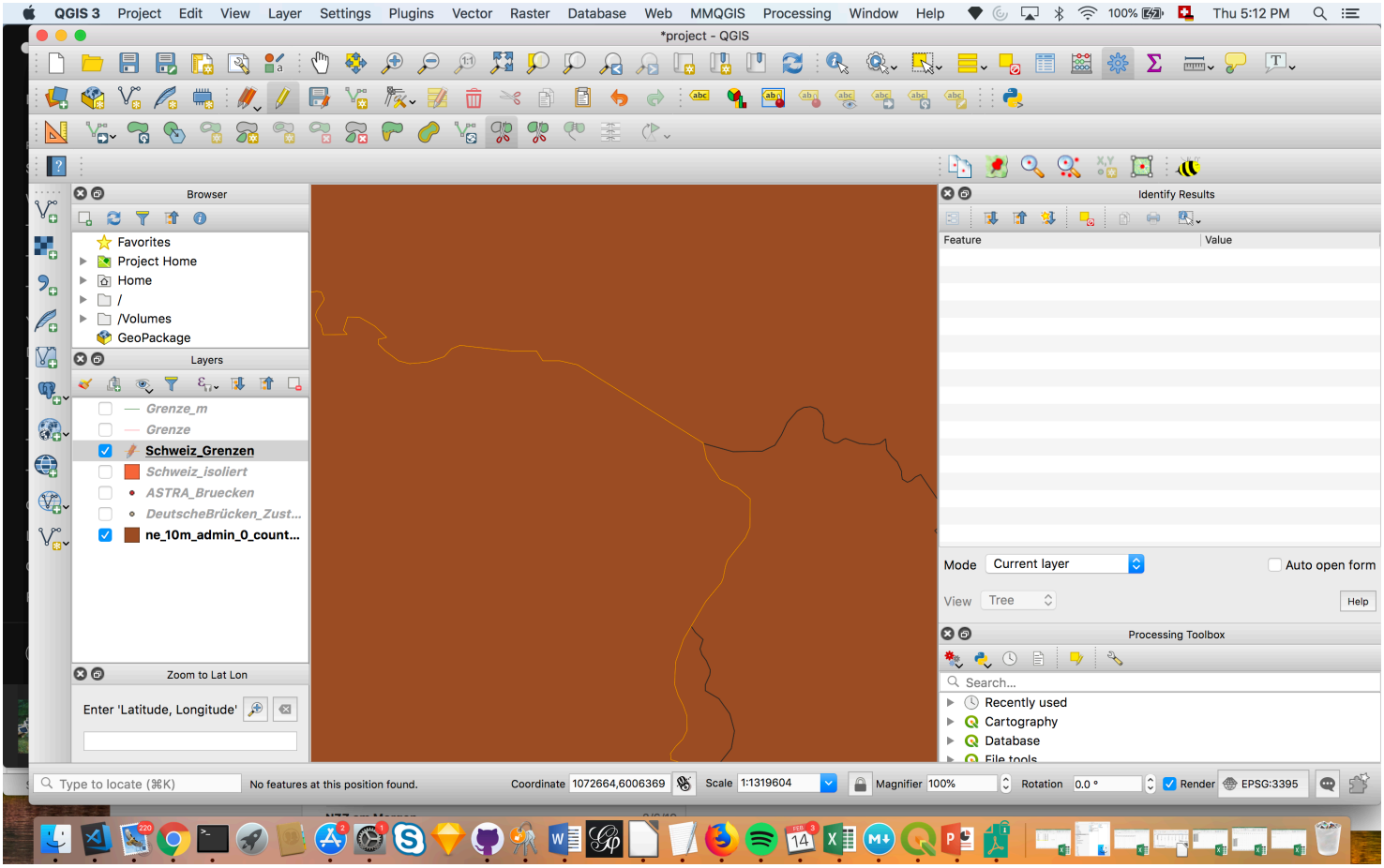
We then select this lines of the polygon and select the split_features option



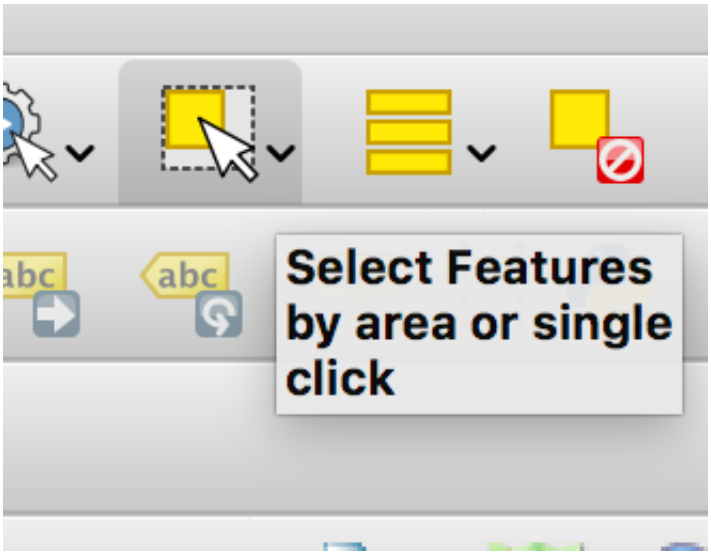
We draw a red line across the border where it changes from German-Swiss to French-Swiss. First we click left at one end and then click left at the other of the border. By clicking right, we save this split.



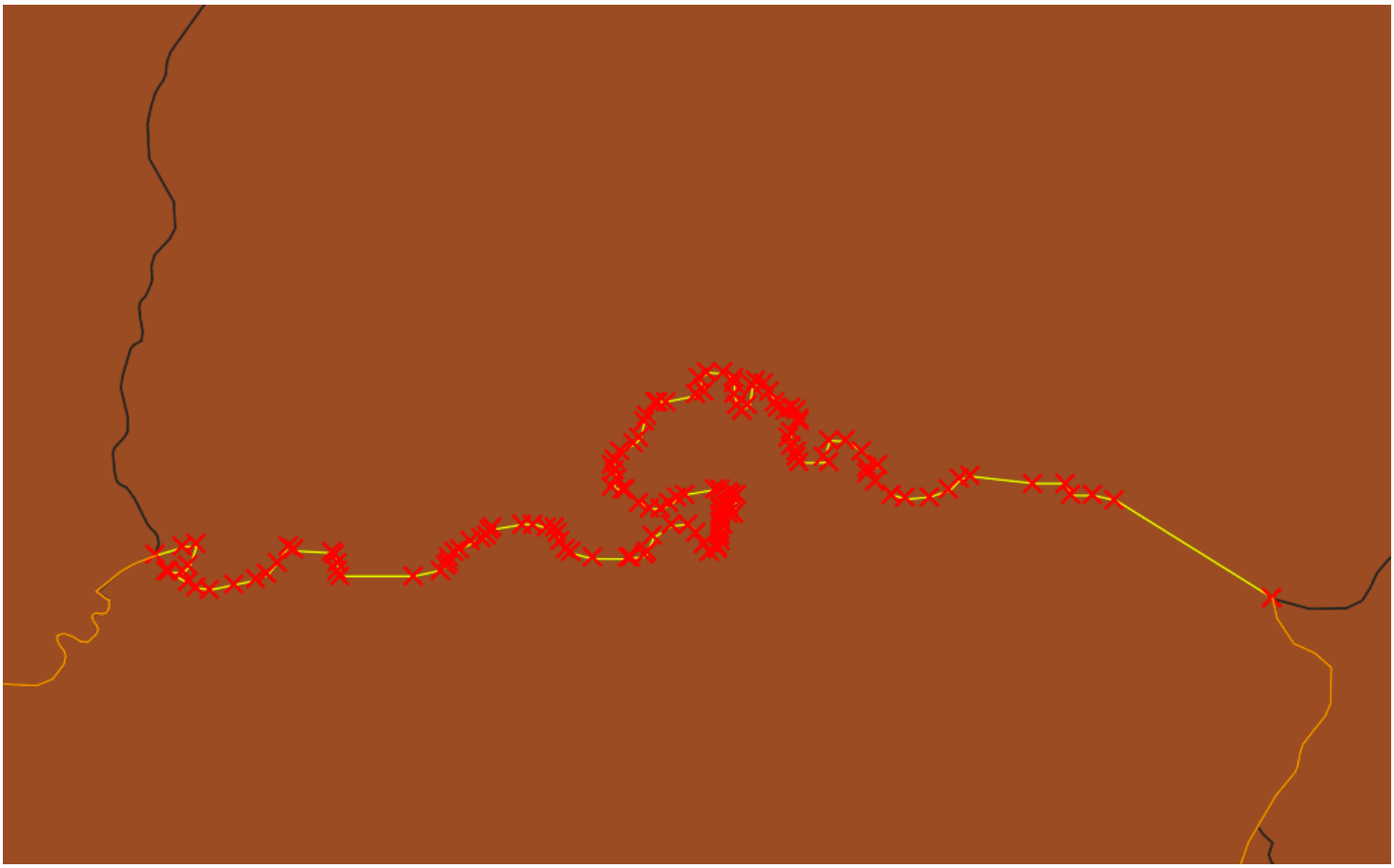
We do the exact same thing once more at the other end of the German-Swiss border.



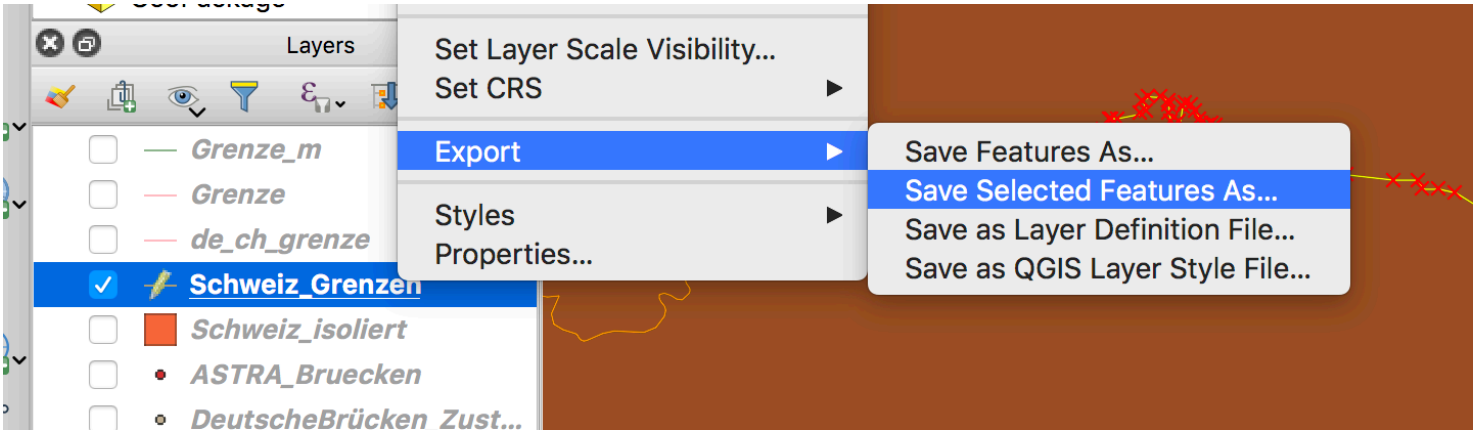
Sometimes this ends up in having this particular feature being split in two border parts. We can merge them by select features and clicking right on both of them one after another.



Then we should have selected the whole border.



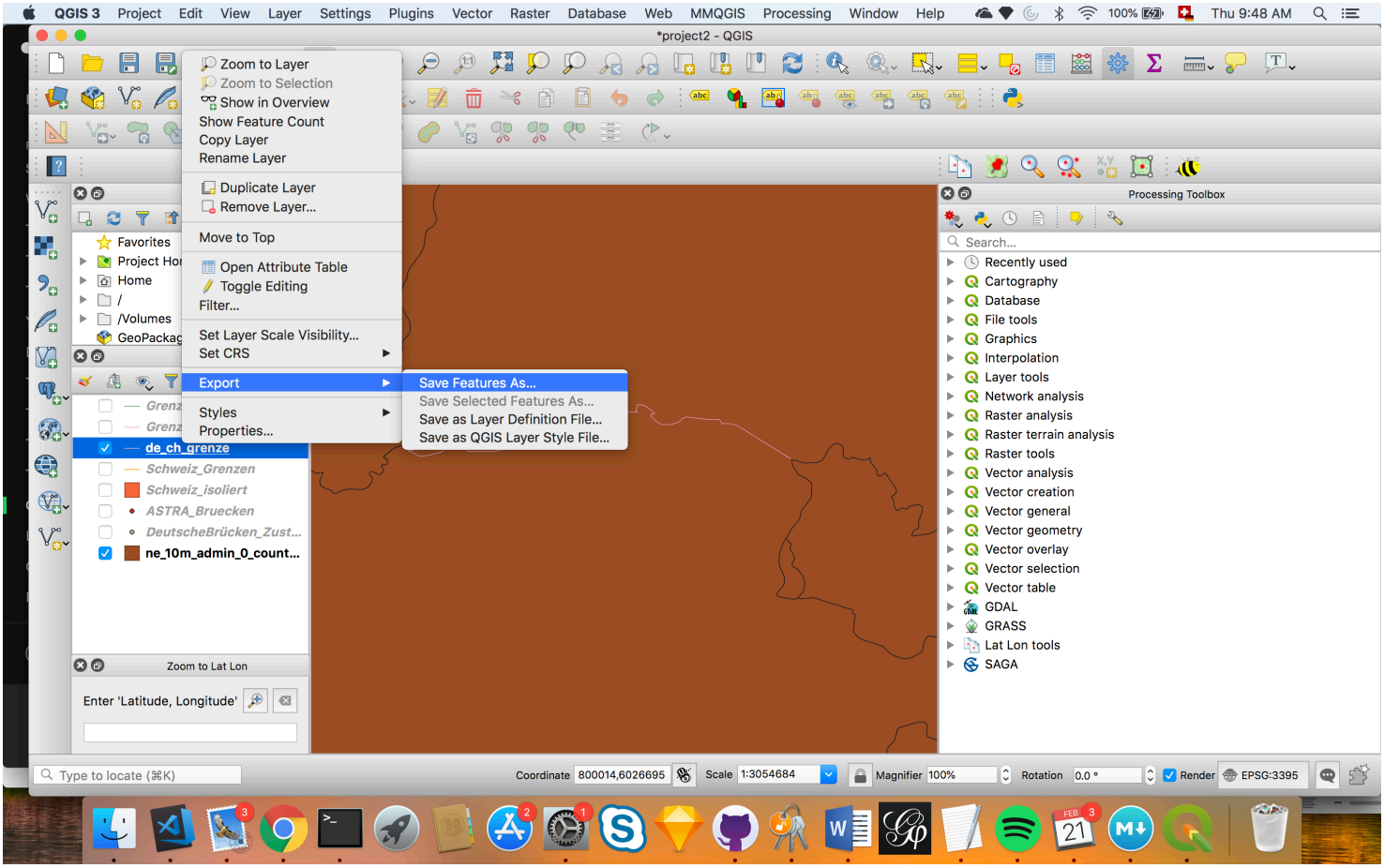
And we can save it as the German-Swiss border here.



So that we have one feature only consisting of the border.

Step 3) Creating the border region and count how many bridges are in there and how many of them are in a bad state

We turn the isolated border into a file with the right projection.


QGIS 3 Project Edit View Layer Settings Plugins Vector Raster Database Web MMQGIS Processing Window Help
Thu 9:48 AM
*project2 - QGIS
Zoom to Layer
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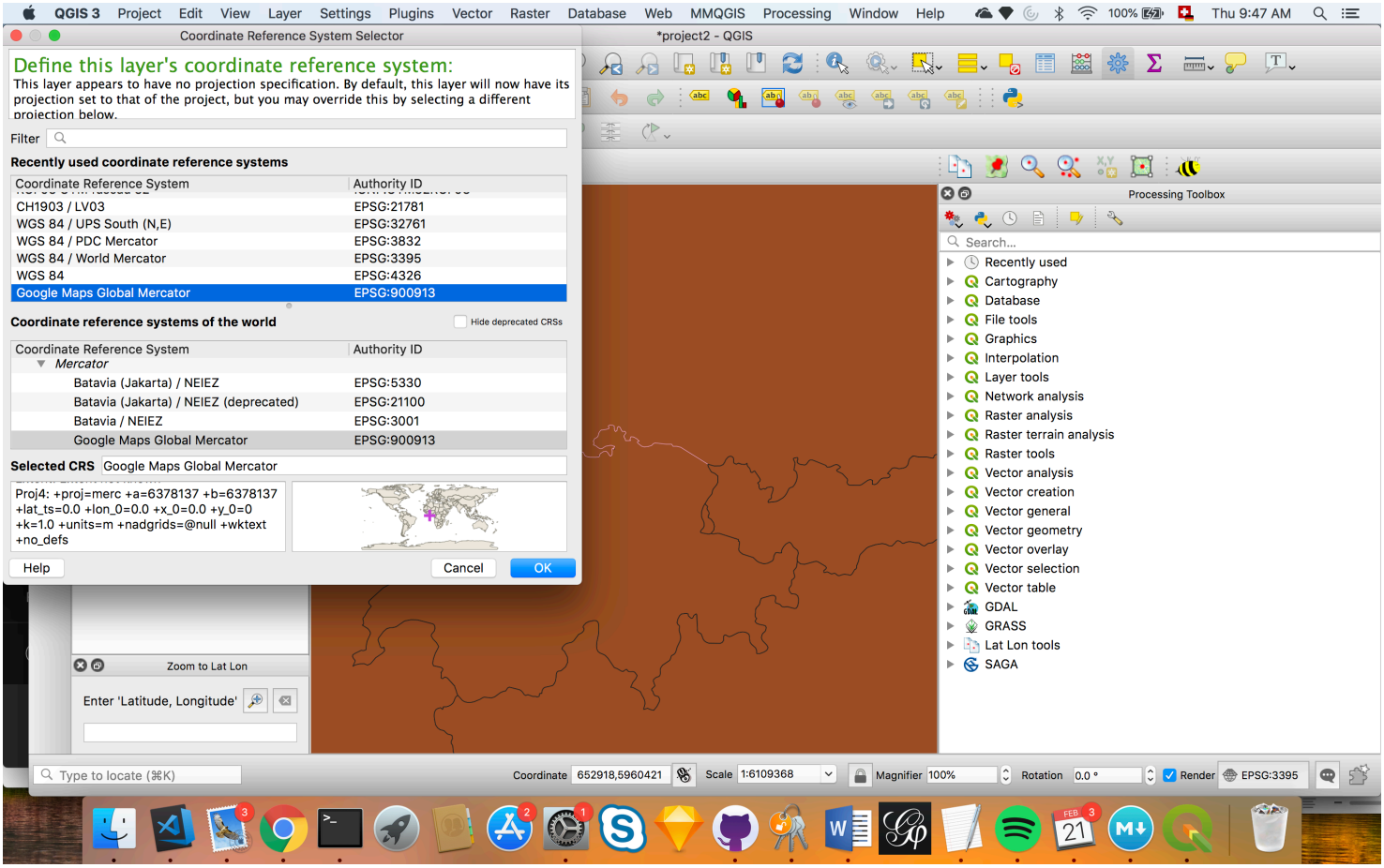
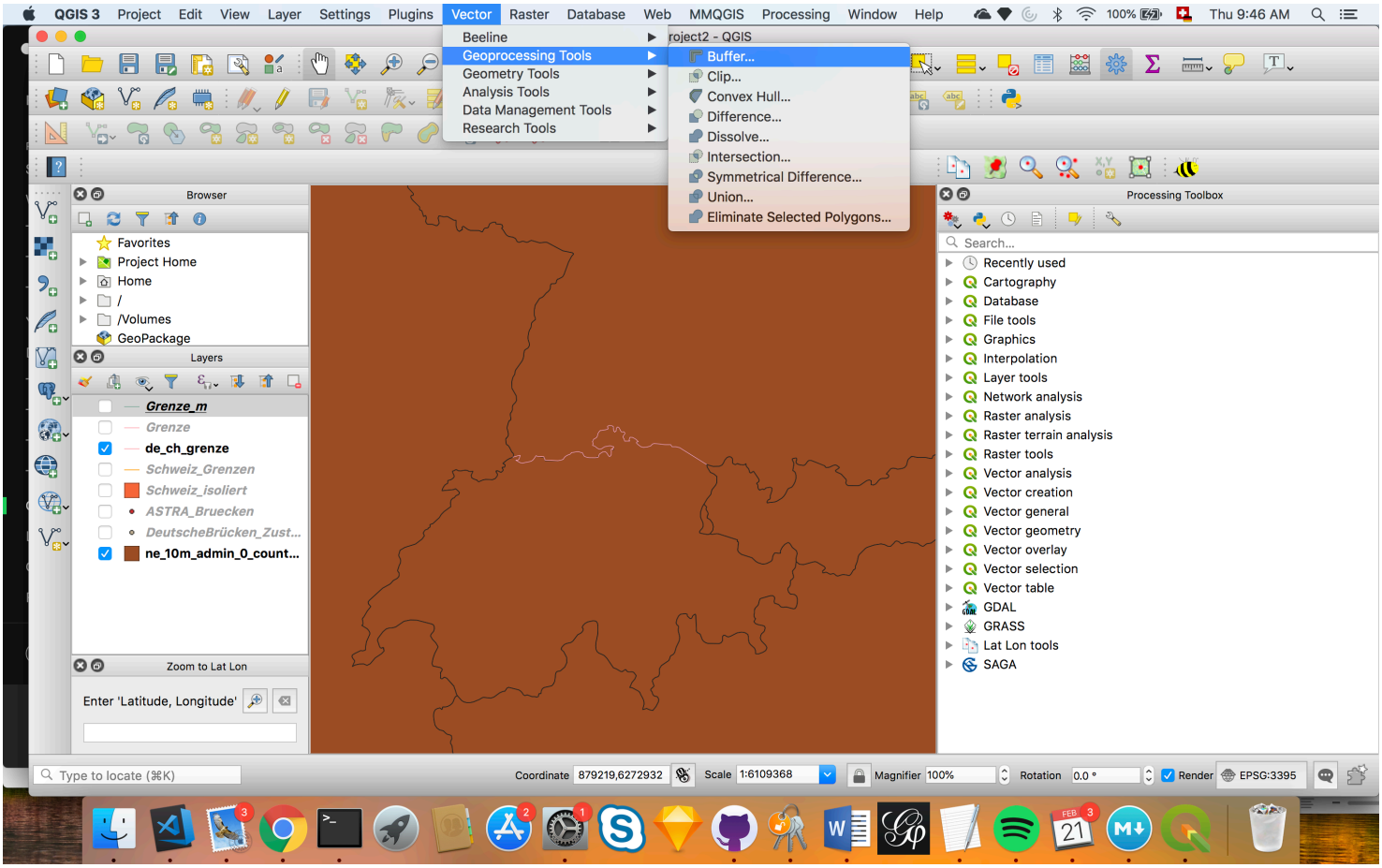


Then we create a buffer around this border of 50 kilometres which is 50 000 metres.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Thu 9:46 AM
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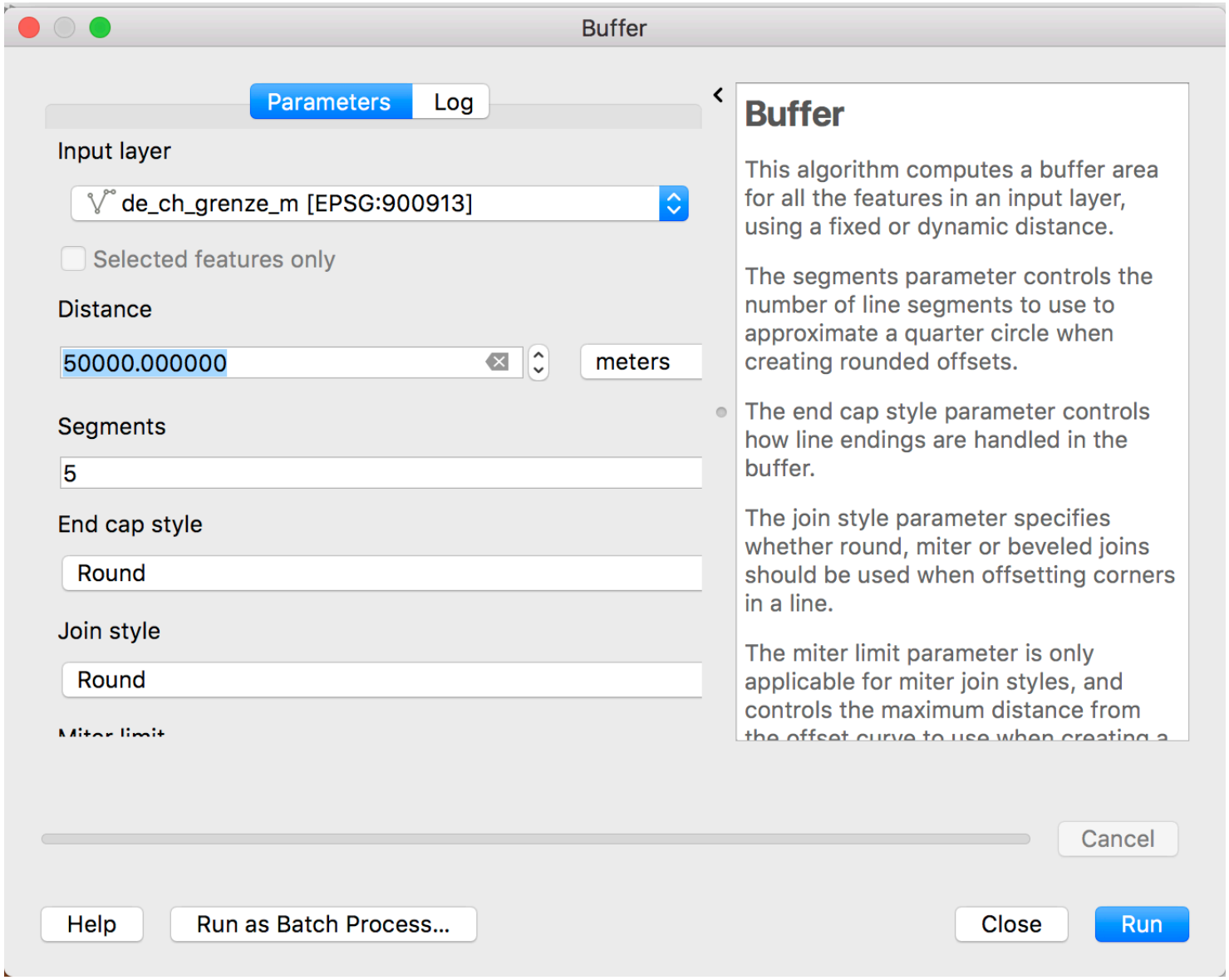
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This algorithm computes a buffer area for all the features in an input layer, using a fixed or dynamic distance.
The segments parameter controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.
The end cap style parameter controls how line endings are handled in the buffer.
The join style parameter specifies whether round, miter or beveled joins should be used when offsetting corners in a line.
The miter limit parameter is only applicable for miter join styles, and controls the maximum distance from
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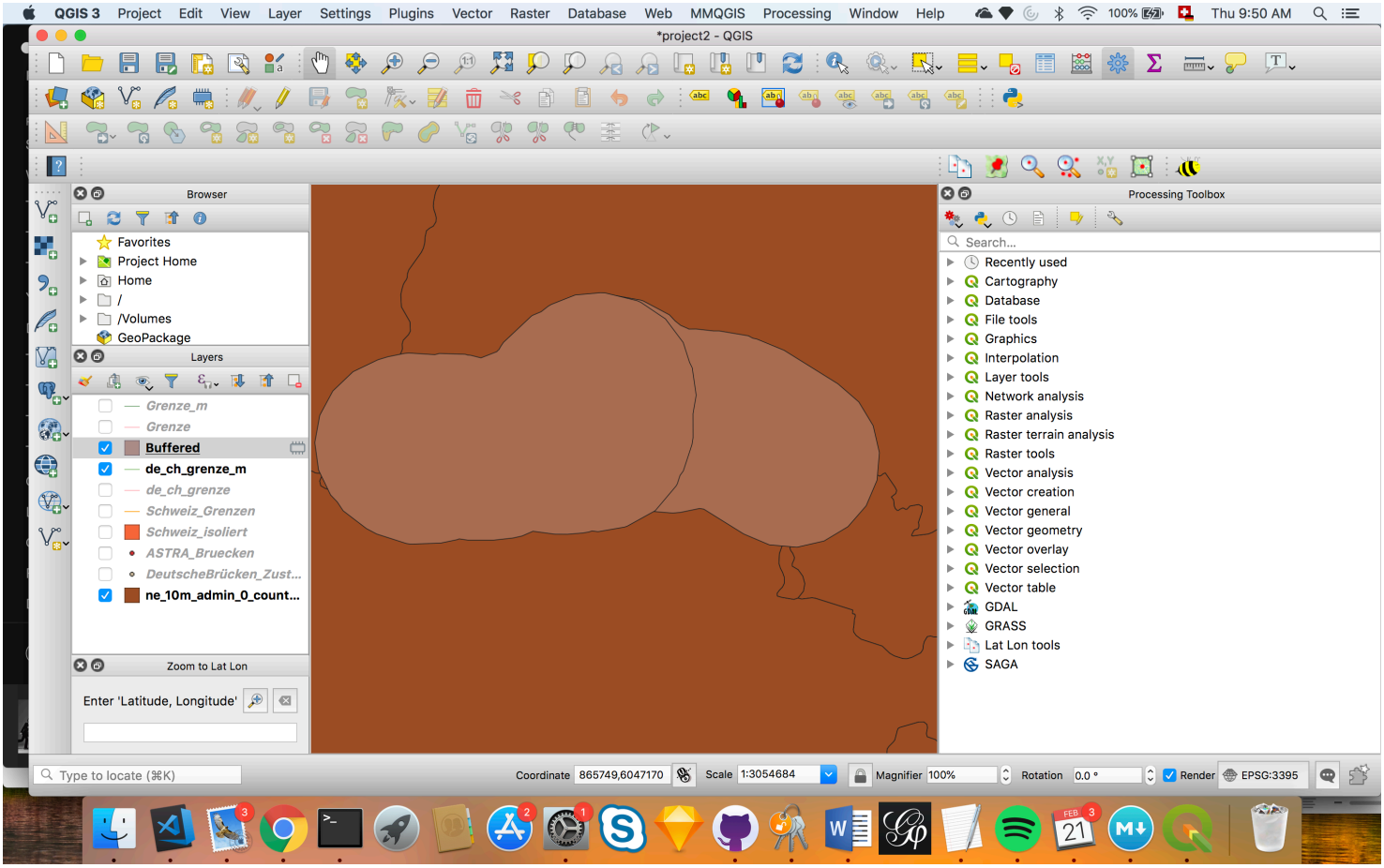
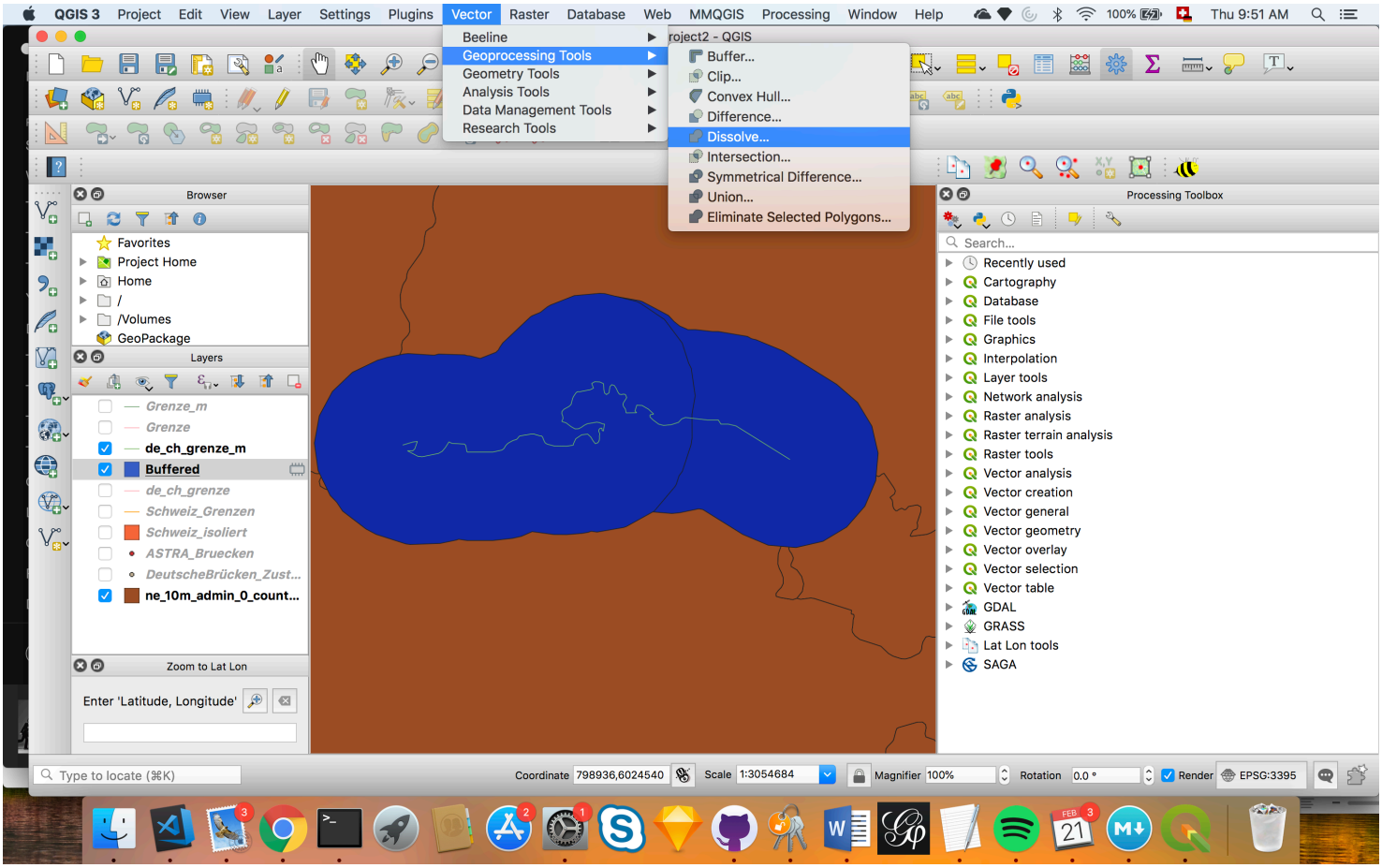


As you can see, we have some weird artefacts due to certain parts of the border creating overlapping buffers. We fix this by dissolving.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Thu 9:51 AM
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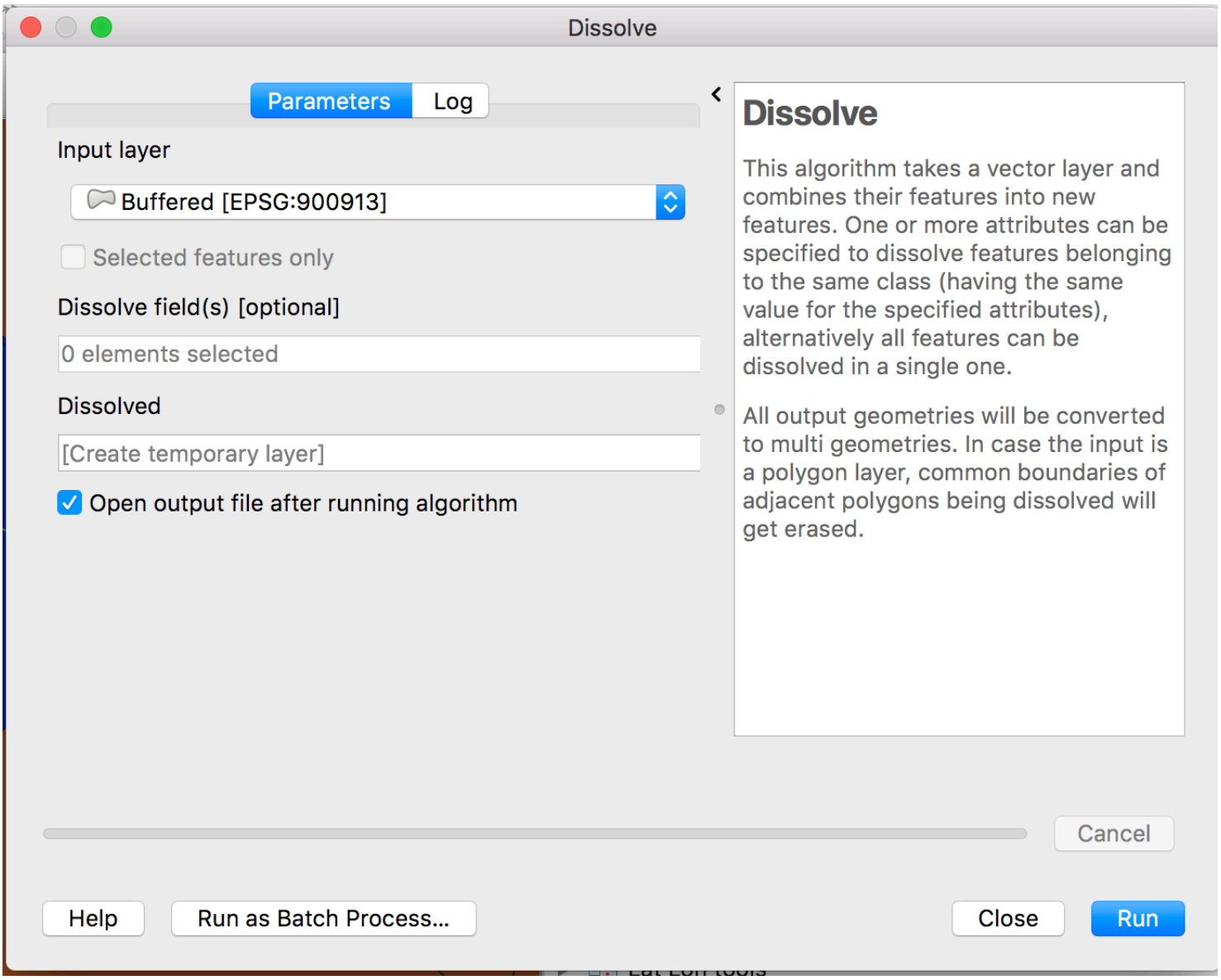
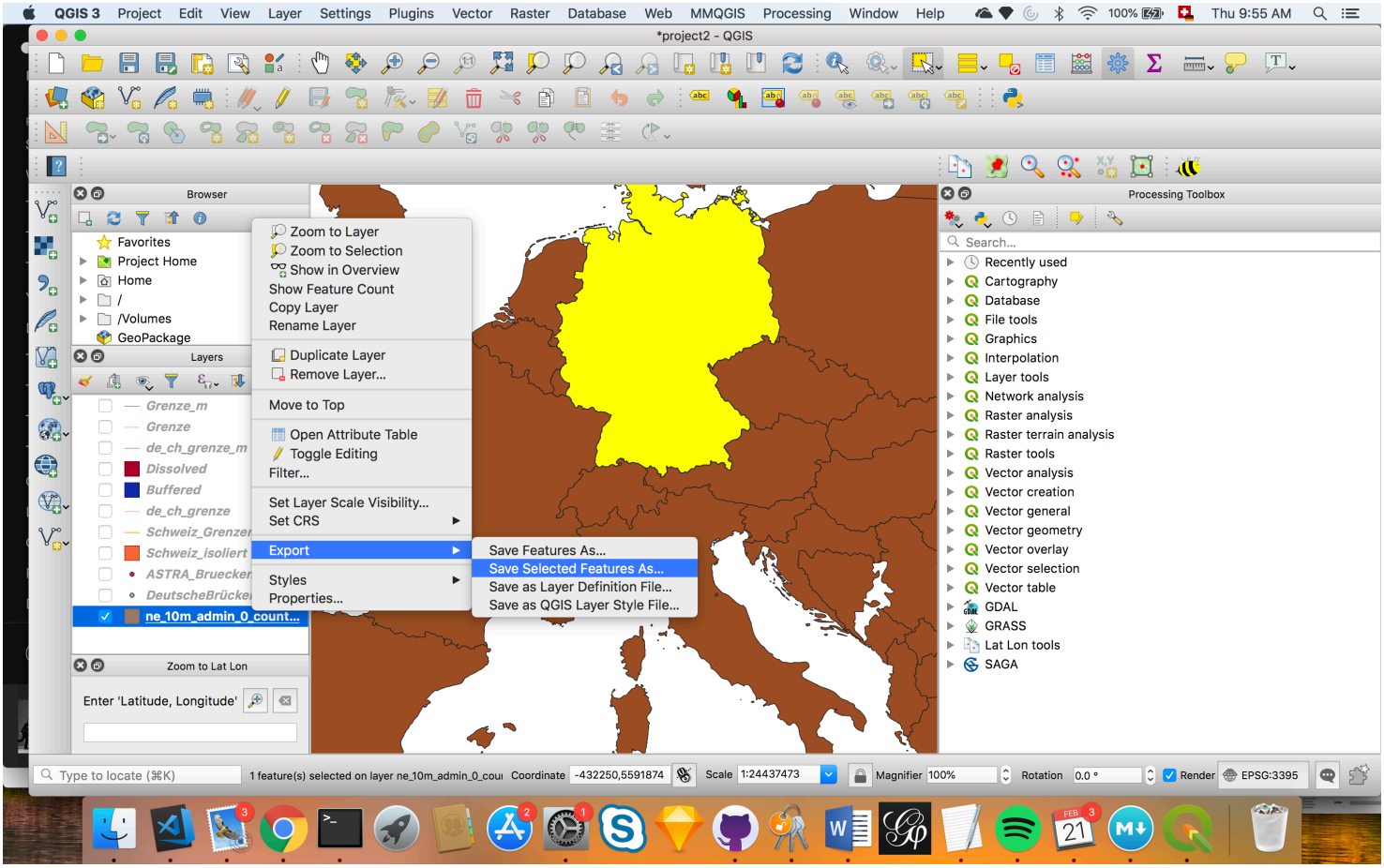


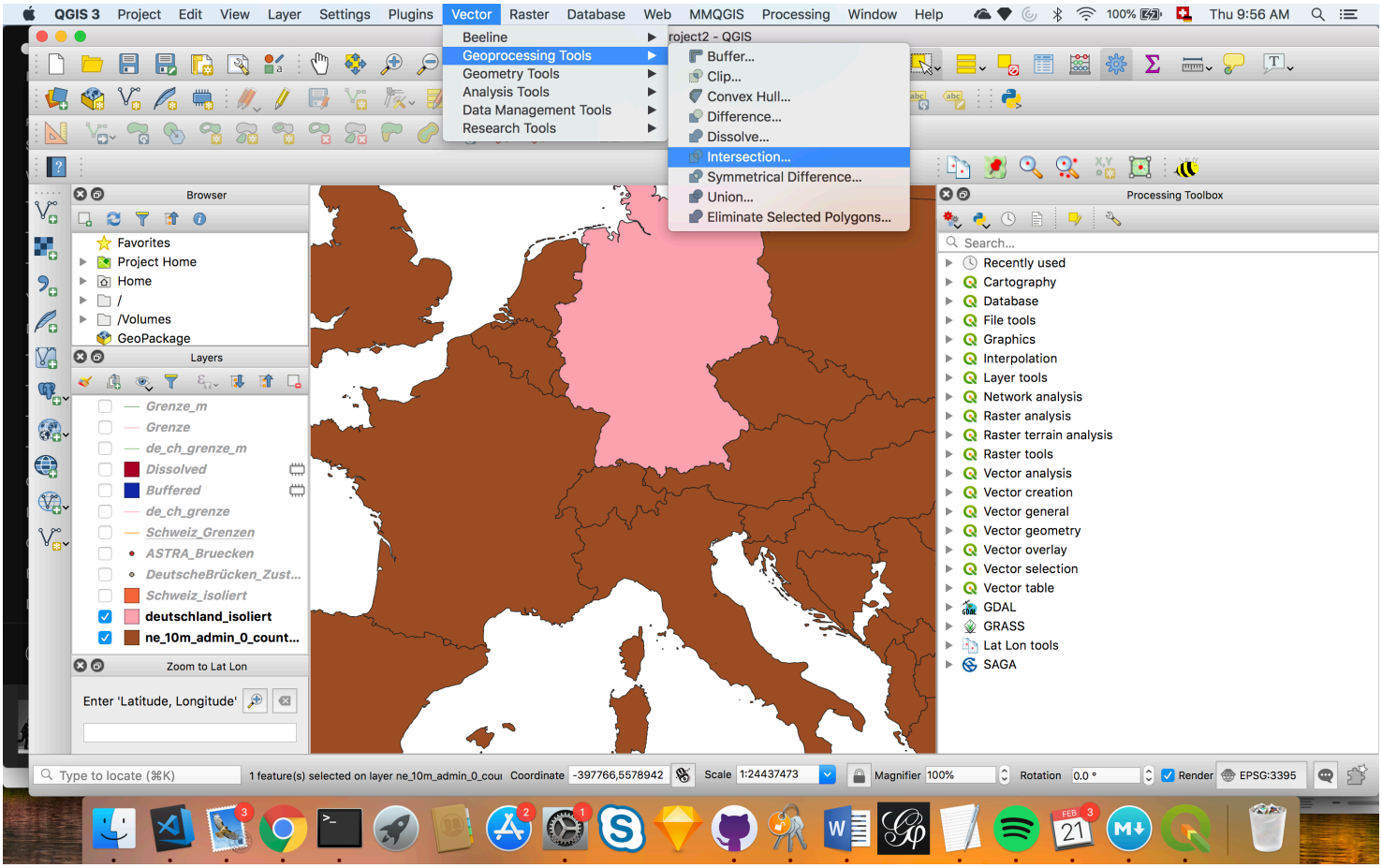
In case the new buffer is hiding the original border, just drag the layer with the border above the dissolved buffer.

Next we want to adjust this rather oddly shaped blob so that it dpes not overlap into France, Liechtenstein and the Lake Constance.

For this, we have to isolate the shape of Germany in the same way we did it for Switzerland. Select the shape of Germany and save it in the projection that we use for the whole project.



Next, we use the tool intersection and let QGIS get the overlap between our buffer and the shape of Switzerland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Thu 9:56 AM
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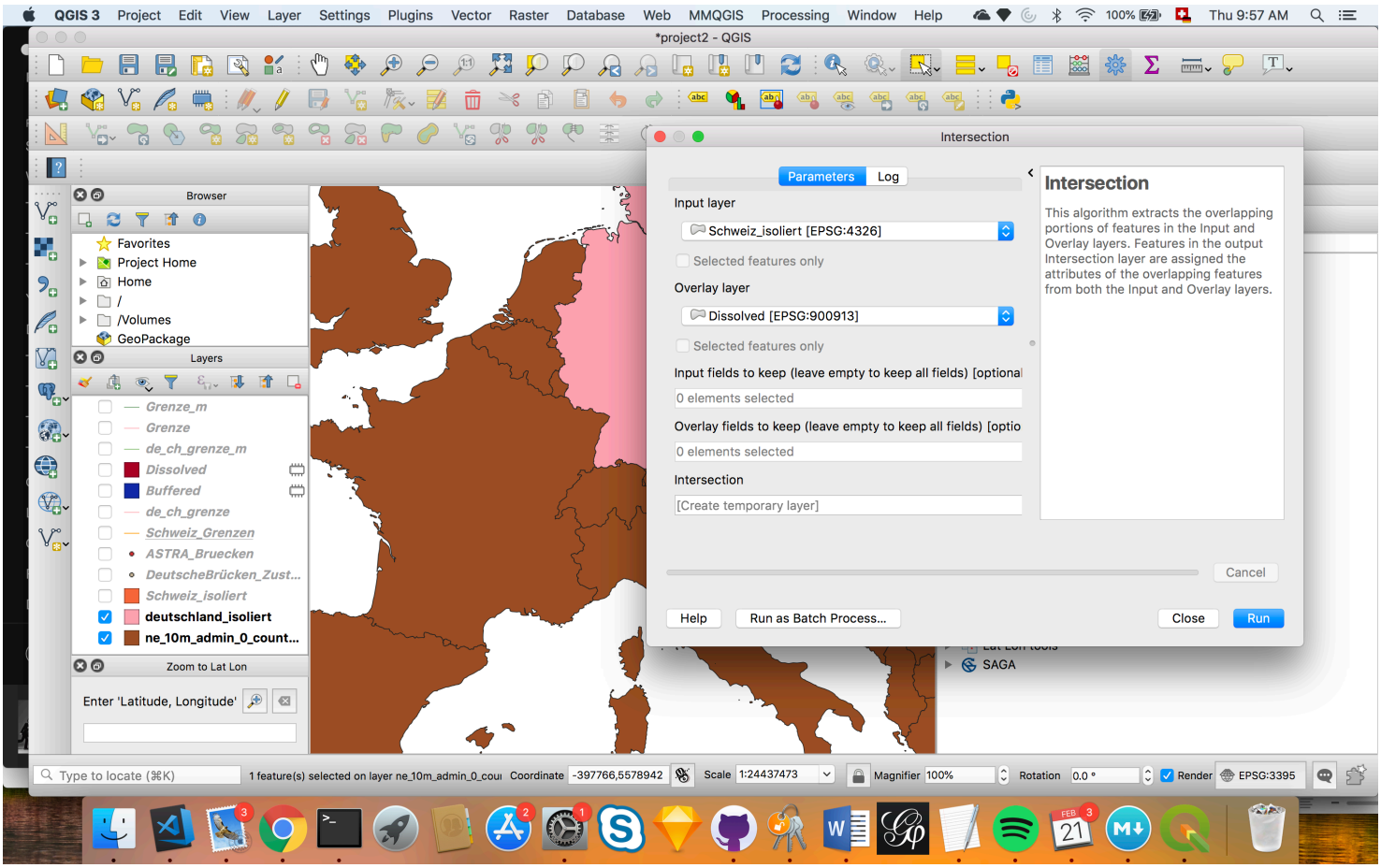
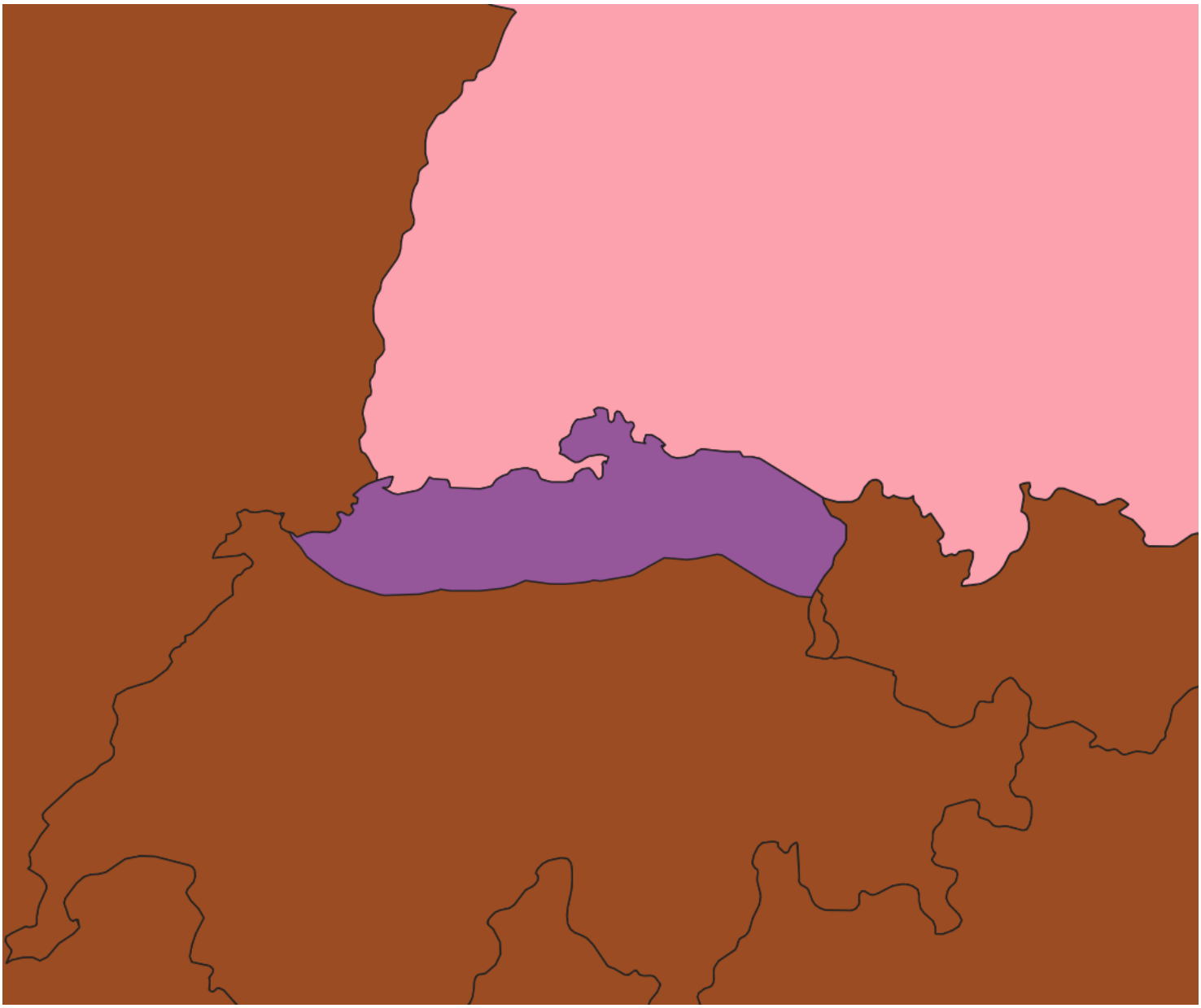
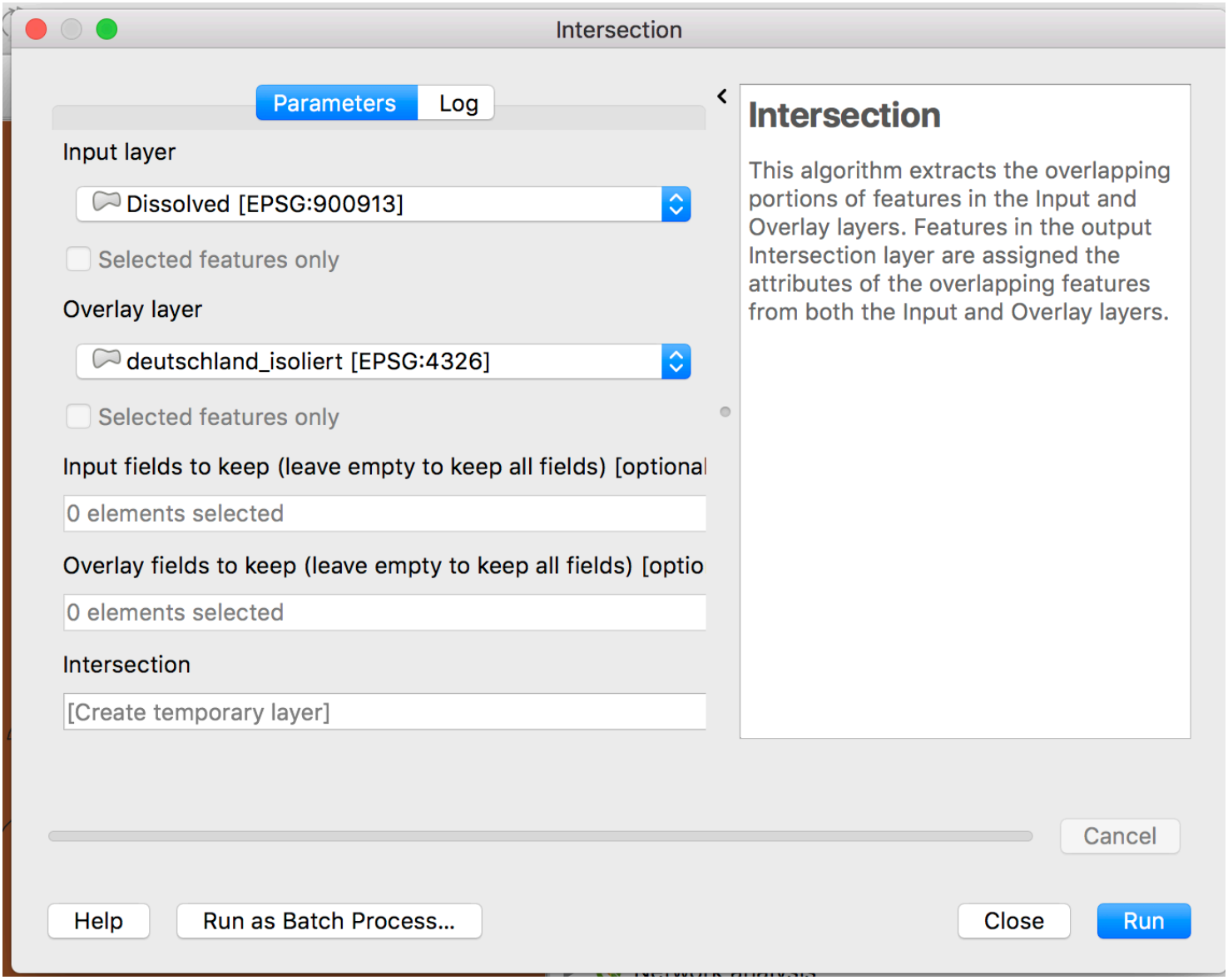
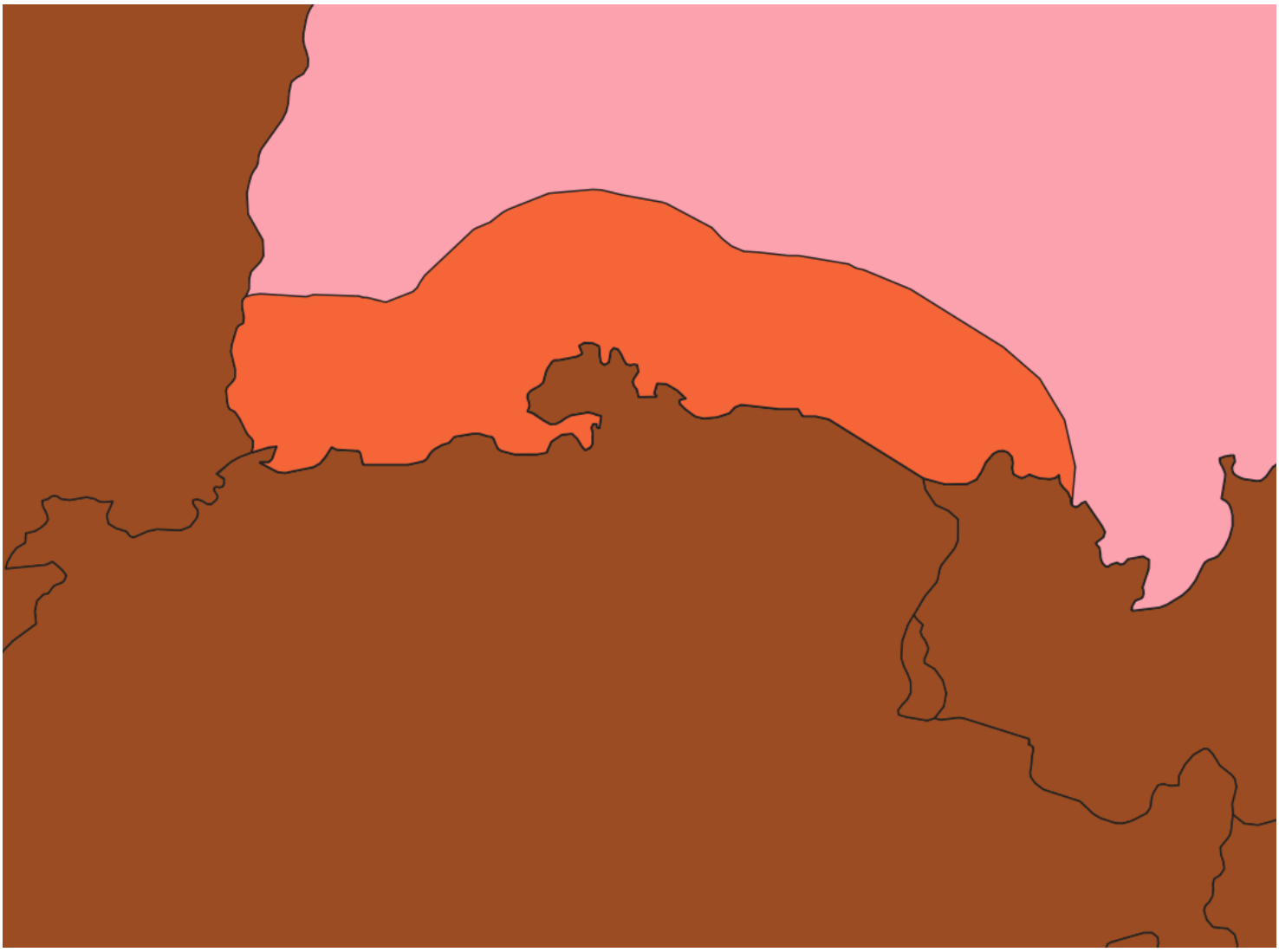
Schweiz_Grenzen
ASTRA_Bruecken
DeutscheBrücken_Zust...
Schweiz_isoliert
deutschland_isoliert
ne_10m_admin_0_count...
Zoom to Lat Lon
Enter 'Latitude, Longitude'
Processing Toolbox
Search...
Recently used
Cartography
Database
File tools
Graphics
Interpolation
Layer tools
Network analysis
Raster analysis
Raster terrain analysis
Raster tools
Vector analysis
Vector creation
Vector general
Vector geometry
Vector overlay
Vector selection
Vector table
GDAL
GRASS
Lat Lon tools
SAGA
Type to locate (⌘K)
1 feature(s) selected on layer ne_10m_admin_0_cou
Coordinate
-397766,5578942
Scale
1:24437473
Magnifier
100%
Rotation
0.0 °
Render
EPSG:3395


QGIS 3 Project Edit View Layer Settings Plugins Vector Raster Database Web MMQGIS Processing Window Help
*project2 - QGIS
Intersection
Parameters
Log
Input layer
Schweiz_isoliert [EPSG:4326]
Selected features only
Overlay layer
Dissolved [EPSG:900913]
Selected features only
Input fields to keep (leave empty to keep all fields) [optional]
0 elements selected
Overlay fields to keep (leave empty to keep all fields) [optio
0 elements selected
Intersection
[Create temporary layer]
Intersection
This algorithm extracts the overlapping portions of features in the Input and Overlay layers. Features in the output Intersection layer are assigned the attributes of the overlapping features from both the Input and Overlay layers.
Cancel
Help
Run as Batch Process...
Close
Run
Browser
Favorites
Project Home
Home
/
/Volumes
GeoPackage
Layers
Grenze_m
Grenze
de_ch_grenze_m
Dissolved
Buffered
de_ch_grenze
Schweiz_Grenzen
ASTRA_Bruecken
DeutscheBrücken_Zust...
Schweiz_isoliert
deutschland_isoliert
ne_10m_admin_0_count...
Zoom to Lat Lon
Enter 'Latitude, Longitude'
SAGA
Type to locate (⌘K)
1 feature(s) selected on layer ne_10m_admin_0_cou
Coordinate -397766,5578942
Scale 1:24437473
Magnifier 100%
Rotation 0.0 °
Render
EPSG:3395

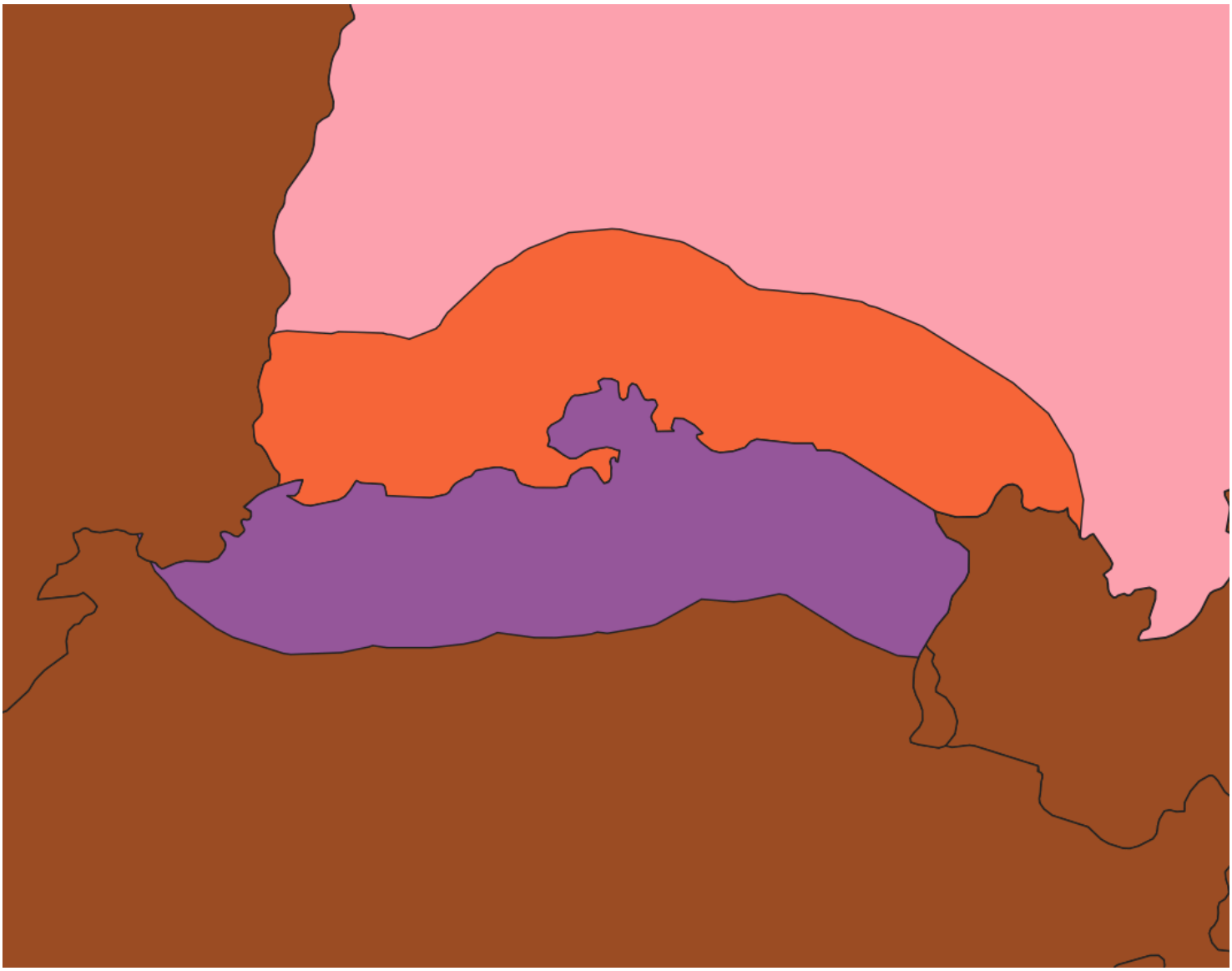


Then we do the same thing for Germany. If there are any problems, as a rule of thumb, it might be because the shapes are in different projections. If so, then export the layers and save them in the right projection.

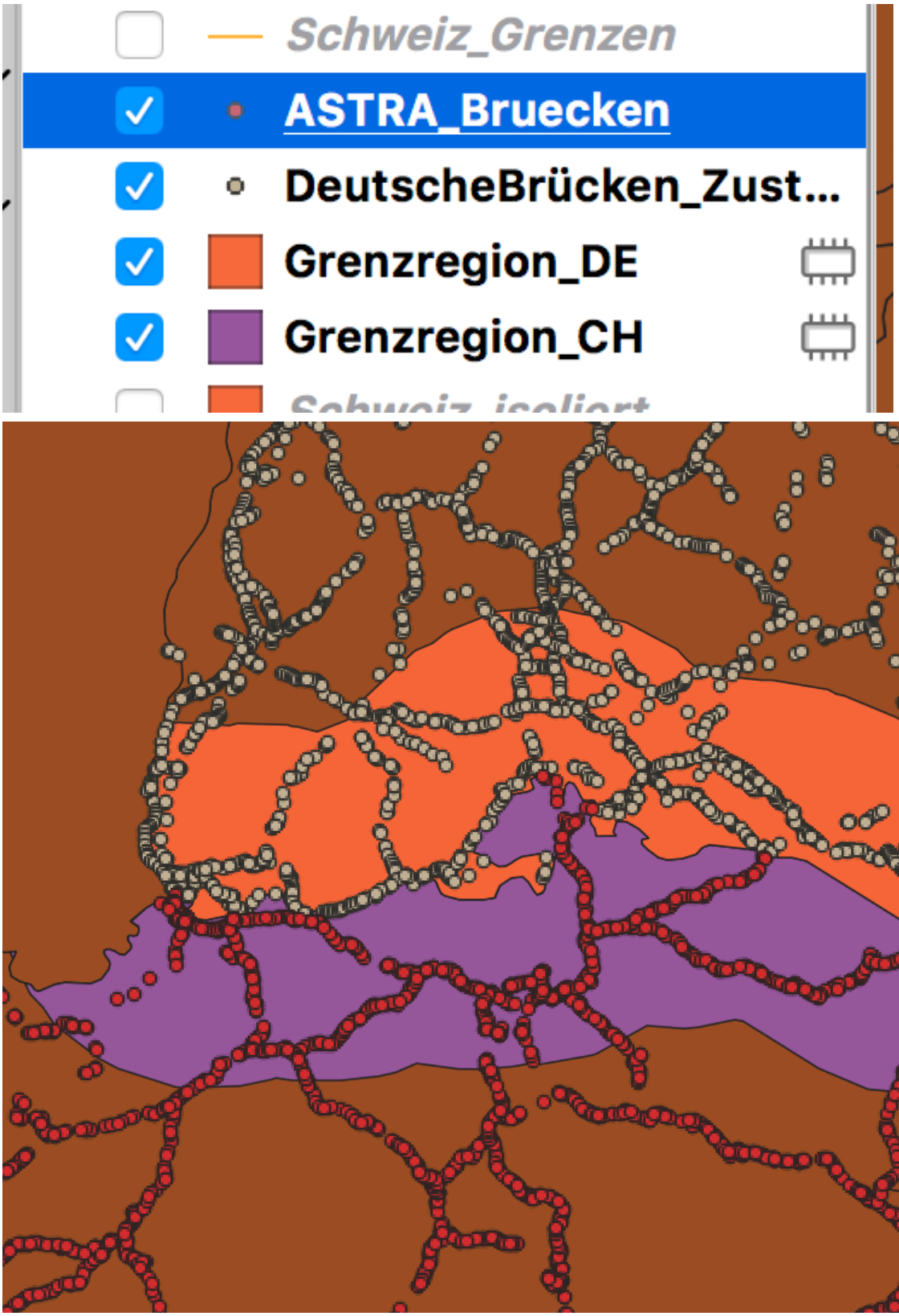

Intersection
Parameters
Log
Input layer
Dissolved [EPSG:900913]
Selected features only
Overlay layer
deutschland_isoliert [EPSG:4326]
Selected features only
Input fields to keep (leave empty to keep all fields) [optional
0 elements selected
Overlay fields to keep (leave empty to keep all fields) [optio
0 elements selected
Intersection
[Create temporary layer]
Intersection
This algorithm extracts the overlapping portions of features in the Input and Overlay layers. Features in the output Intersection layer are assigned the attributes of the overlapping features from both the Input and Overlay layers.
Cancel
Help
Run as Batch Process...
Close
Run



Now, we have the border regions for both countries.

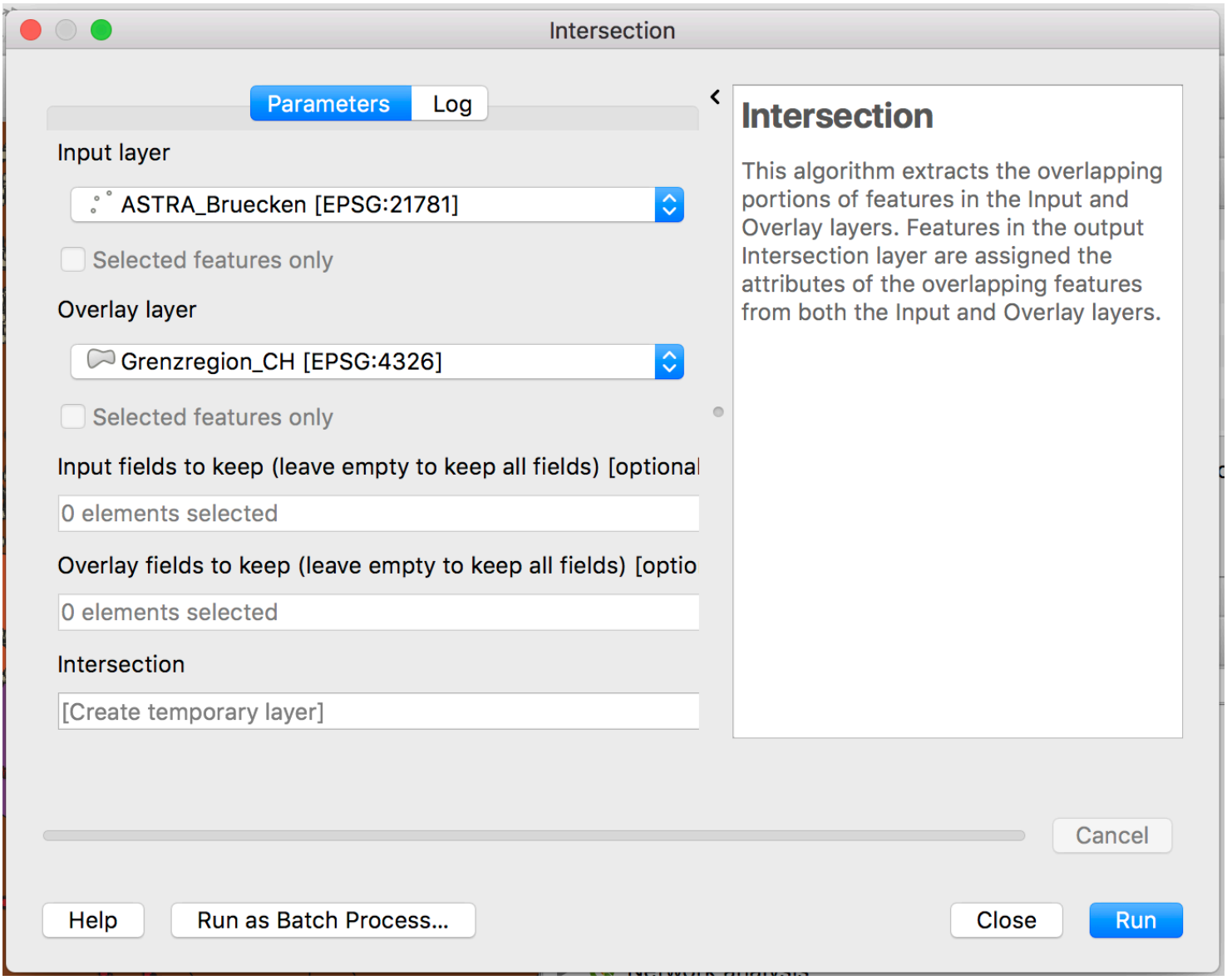


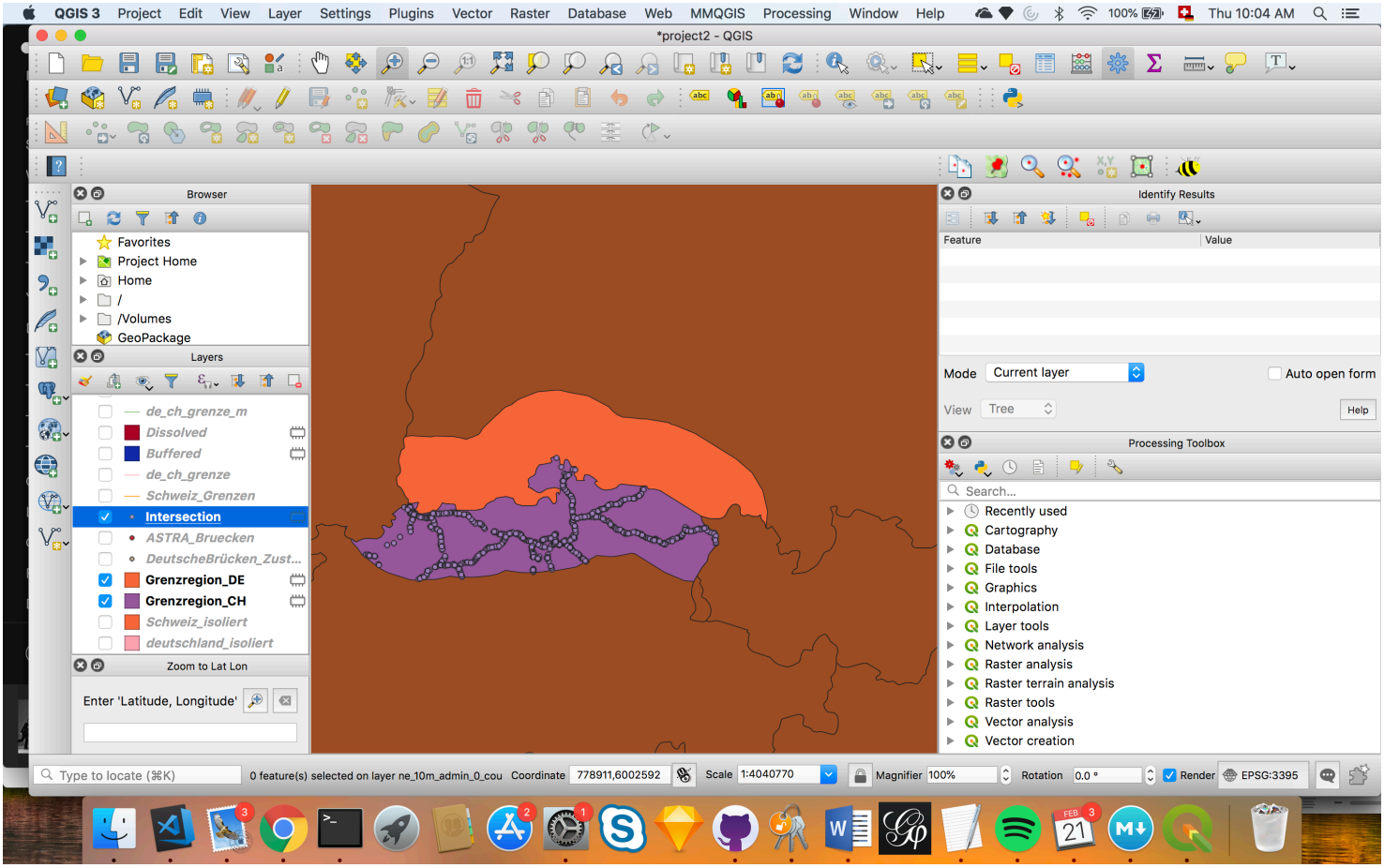
The next step is to filter the bridges that we have for all of Switzerland and Germany down to the ones in this buffer.



Again, we use the "Intersection" tool and this time, we look for the overlap of points and polygons.

This is how we did it for Switzerland

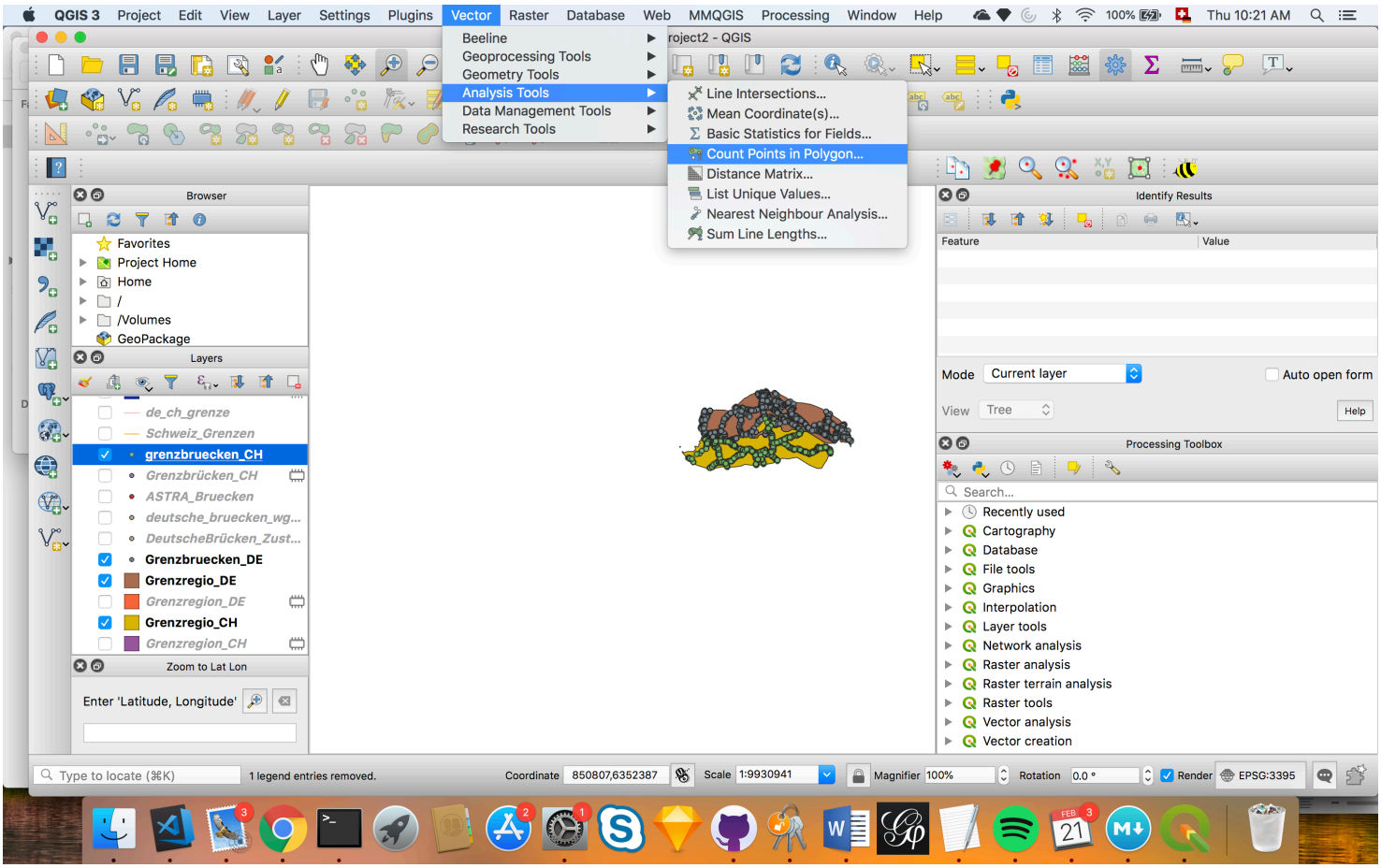




And this is what it looks like for Germany

Again, if there are problems with this step, most likely it is due to different projections of layers. In this case, save the layers in the same projection and then redo this step.

Next, we want to figure out how many points/bridges are in these polygons overall. We do this with the tool "Count Points in Polygon" and first for Germany.


QGIS 3
Project
Edit
View
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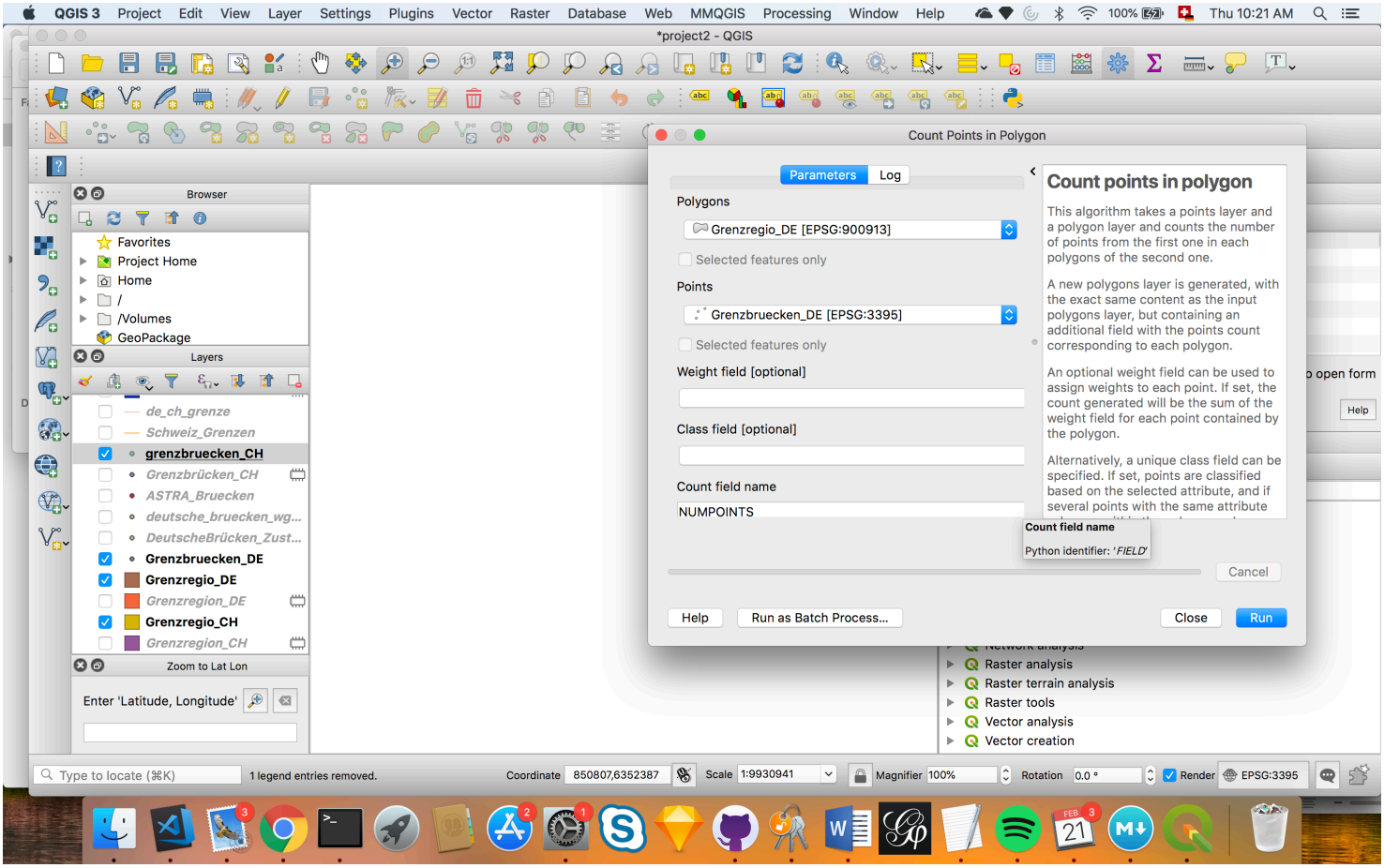
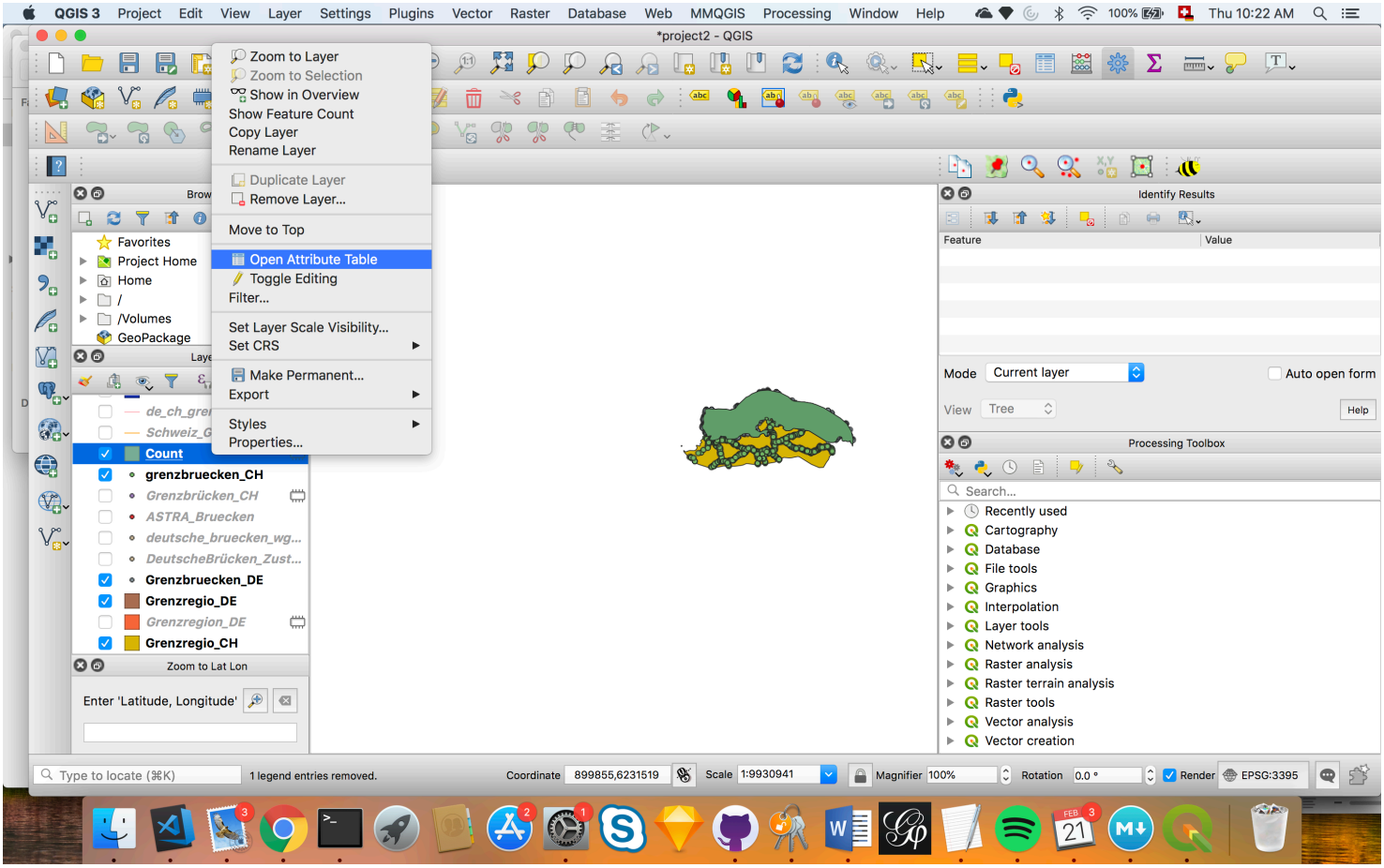
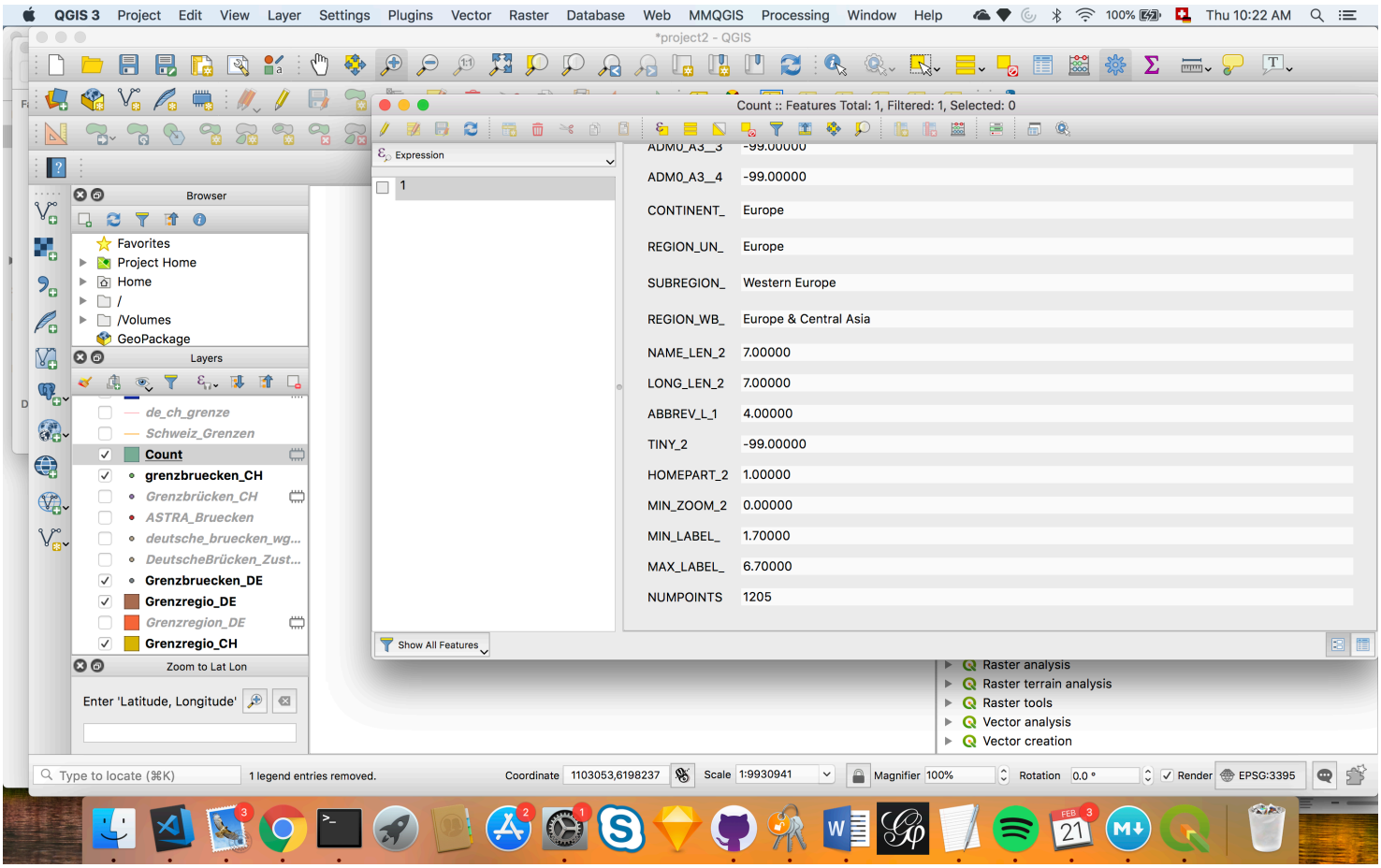
Settings
Plugins
Vector
Raster
Database
Web
MMQGIS
Processing
Window
Help
Thu 10:21 AM
Beeline
Geoprocessing Tools
Geometry Tools
Analysis Tools
Data Management Tools
Research Tools
Line Intersections...
Mean Coordinate(s)...
Basic Statistics for Fields...
Count Points in Polygon...
Distance Matrix...
List Unique Values...
Nearest Neighbour Analysis...
Sum Line Lengths...
Browser
Favorites
Project Home
Home
/
/Volumes
GeoPackage
Layers
de_ch_grenze
Schweiz_Grenzen
grenzbruecken_CH
Grenzbrücken_CH
ASTRA_Bruecken
deutsche_bruecken_wg...
DeutscheBrücken_Zust...
Grenzbruecken_DE
Grenzregio_DE
Grenzregion_DE
Grenzregio_CH
Grenzregion_CH
Zoom to Lat Lon
Enter 'Latitude, Longitude'
Identify Results
Feature
Value
Mode
Current layer
Auto open form
View
Tree
Help
Processing Toolbox
Search...
Recently used
Cartography
Database
File tools
Graphics
Interpolation
Layer tools
Network analysis
Raster analysis
Raster terrain analysis
Raster tools
Vector analysis
Vector creation
Type to locate (⌘K)
1 legend entries removed.
Coordinate
850807,6352387
Scale
1:9930941
Magnifier
100%
Rotation
0.0 °
Render
EPSG:3395

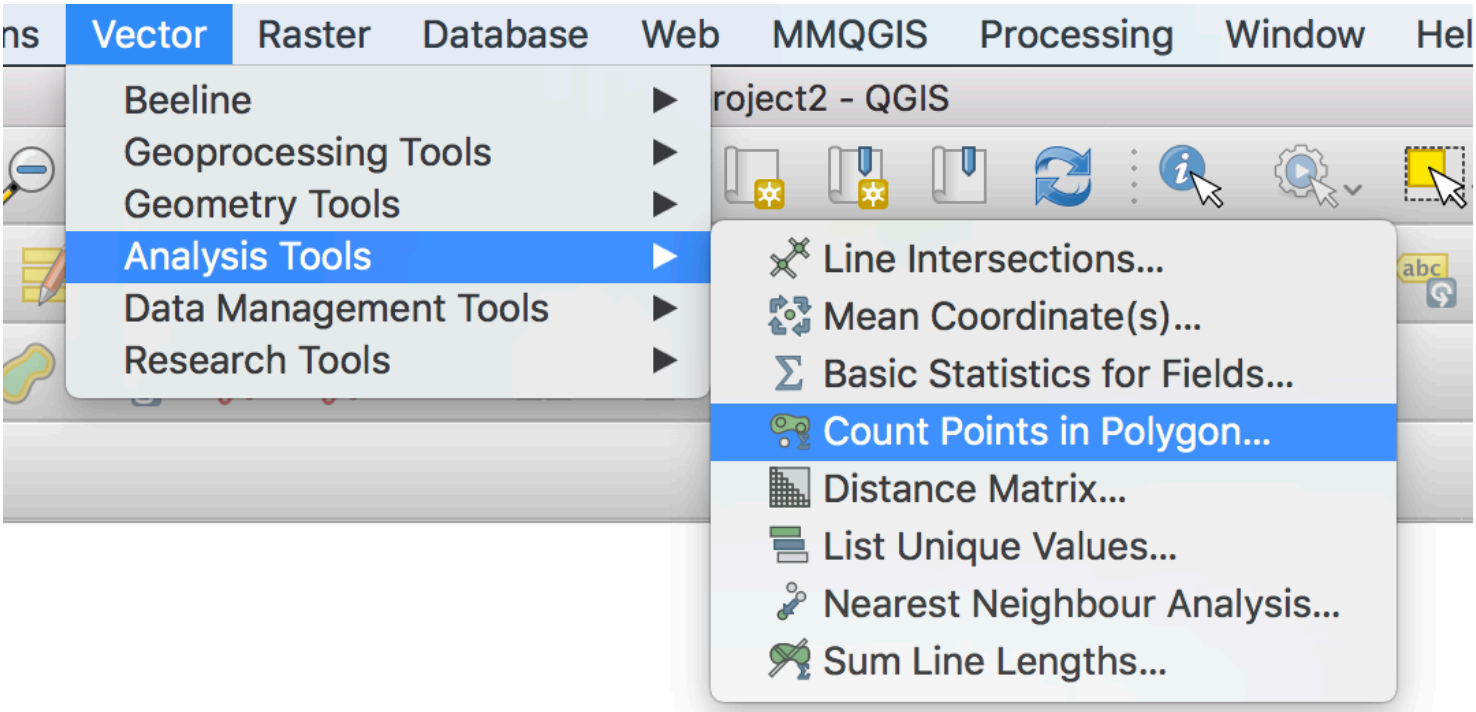


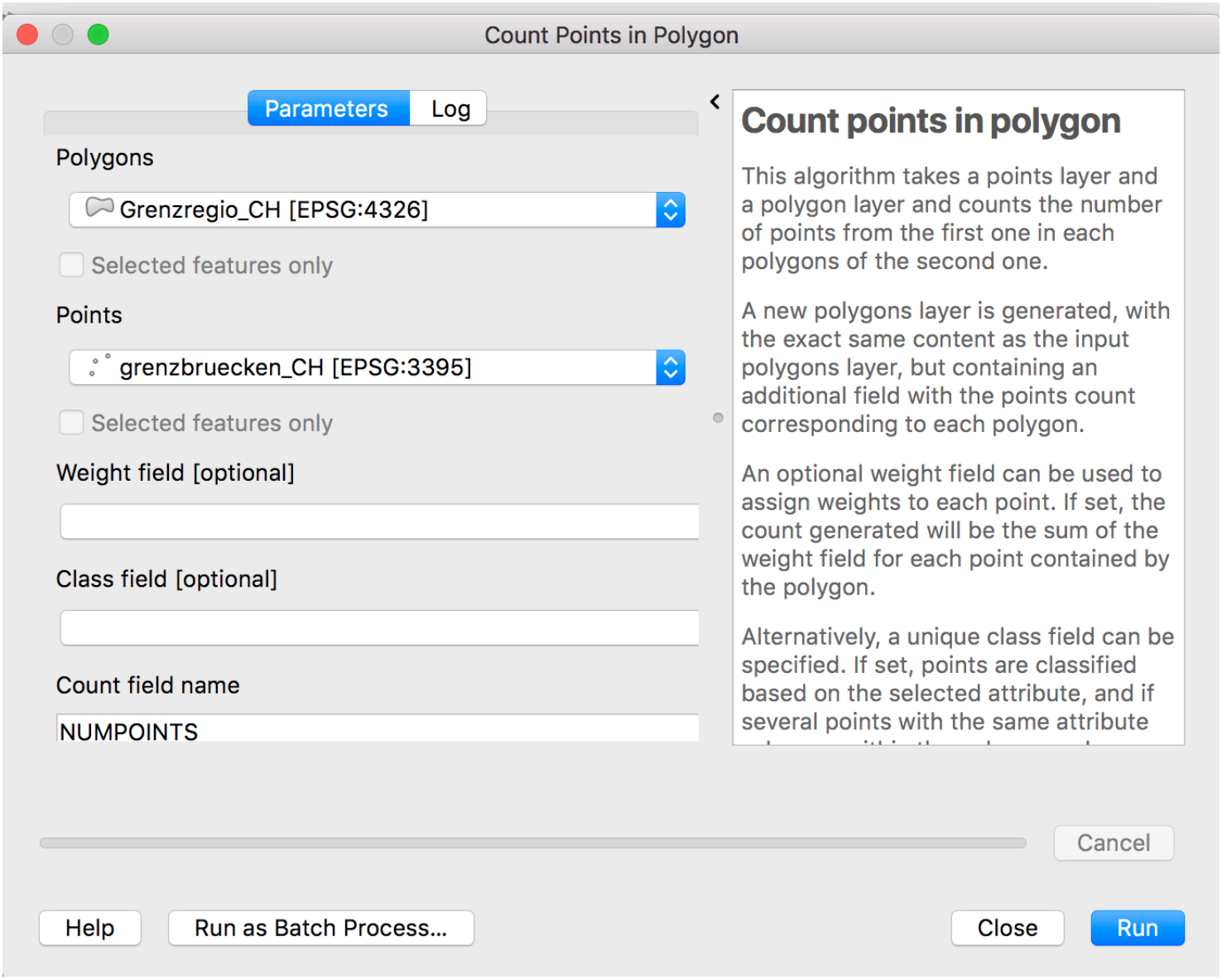
This creates a new layer which has an attribute with the name NUMPOINTS that gives the number of bridges in the border region. For Germany, we end up with 1205.

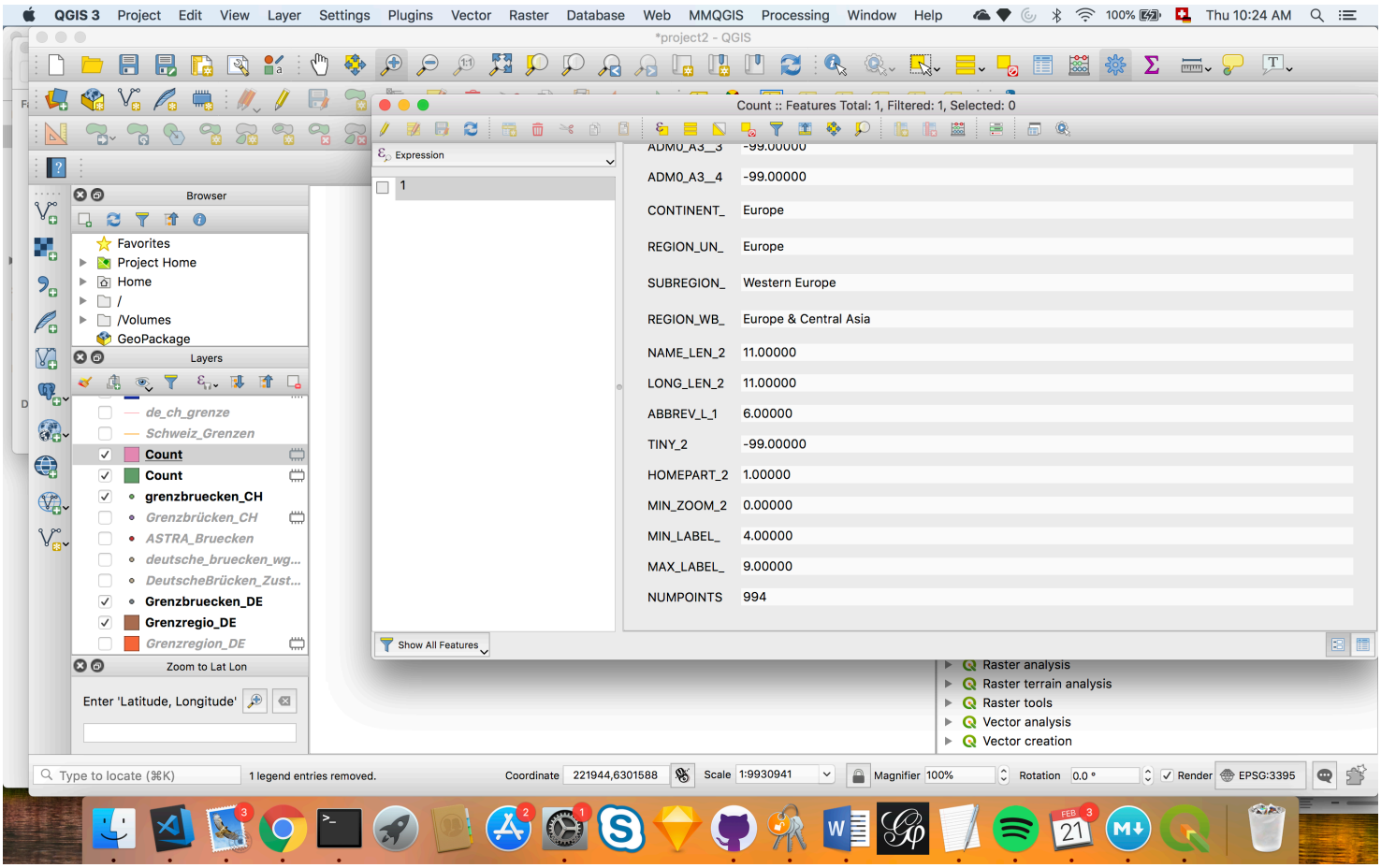

QGIS 3 Project Edit View Layer Settings Plugins Vector Raster Database Web MMQGIS Processing Window Help
*project2 - QGIS
Zoom to Layer
Zoom to Selection
Show in Overview
Show Feature Count
Copy Layer
Rename Layer
Duplicate Layer
Remove Layer...
Move to Top
Open Attribute Table
Toggle Editing
Filter...
Set Layer Scale Visibility...
Set CRS
Make Permanent...
Export
Styles
Properties...
Favorites
Project Home
Home
/
/Volumes
GeoPackage
Count
grenzbruecken_CH
Grenzbrücken_CH
ASTRA_Bruecken
deutsche_bruecken_wg...
DeutscheBrücken_Zust...
Grenzbruecken_DE
Grenzregio_DE
Grenzregion_DE
Grenzregio_CH
Zoom to Lat Lon
Enter 'Latitude, Longitude'
Identify Results
Feature
Value
Mode
Current layer
Auto open form
View
Tree
Help
Processing Toolbox
Search...
Recently used
Cartography
Database
File tools
Graphics
Interpolation
Layer tools
Network analysis
Raster analysis
Raster terrain analysis
Raster tools
Vector analysis
Vector creation
Type to locate (⌘K)
1 legend entries removed.
Coordinate
899855,6231519
Scale
1:9930941
Magnifier
100%
Rotation
0.0 °
Render
EPSG:3395



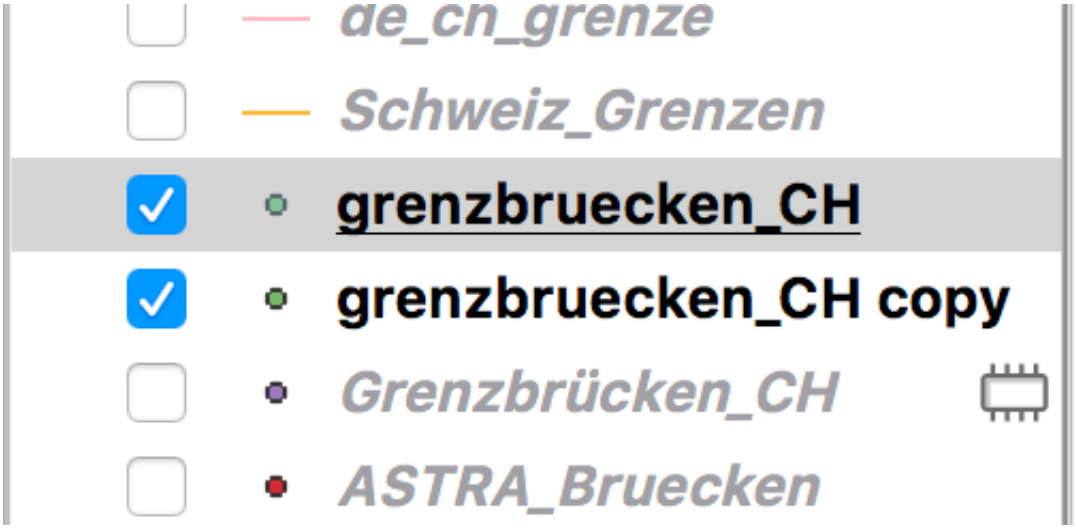
Then we do the exact same thing for Switzerland. Here, we end up with 994.

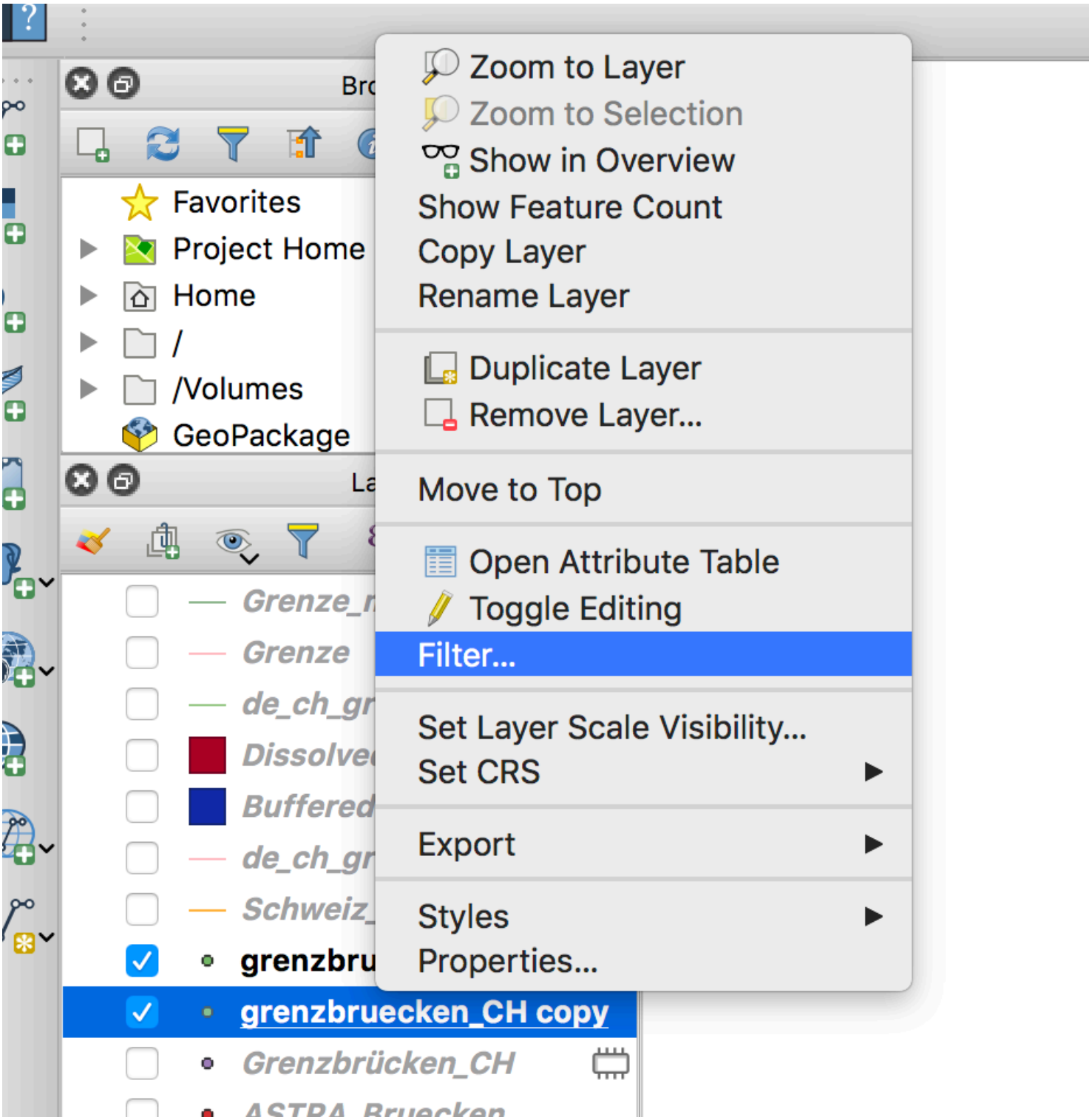



Count Points in Polygon
Parameters
Log
Polygons
Grenzregio_CH [EPSG:4326]
Selected features only
Points
grenzbruecken_CH [EPSG:3395]
Selected features only
Weight field [optional]
Class field [optional]
Count field name
NUMPOINTS
Count points in polygon
This algorithm takes a points layer and a polygon layer and counts the number of points from the first one in each polygons of the second one.
A new polygons layer is generated, with the exact same content as the input polygons layer, but containing an additional field with the points count corresponding to each polygon.
An optional weight field can be used to assign weights to each point. If set, the count generated will be the sum of the weight field for each point contained by the polygon.
Alternatively, a unique class field can be specified. If set, points are classified based on the selected attribute, and if several points with the same attribute
Cancel
Help
Run as Batch Process...
Close
Run

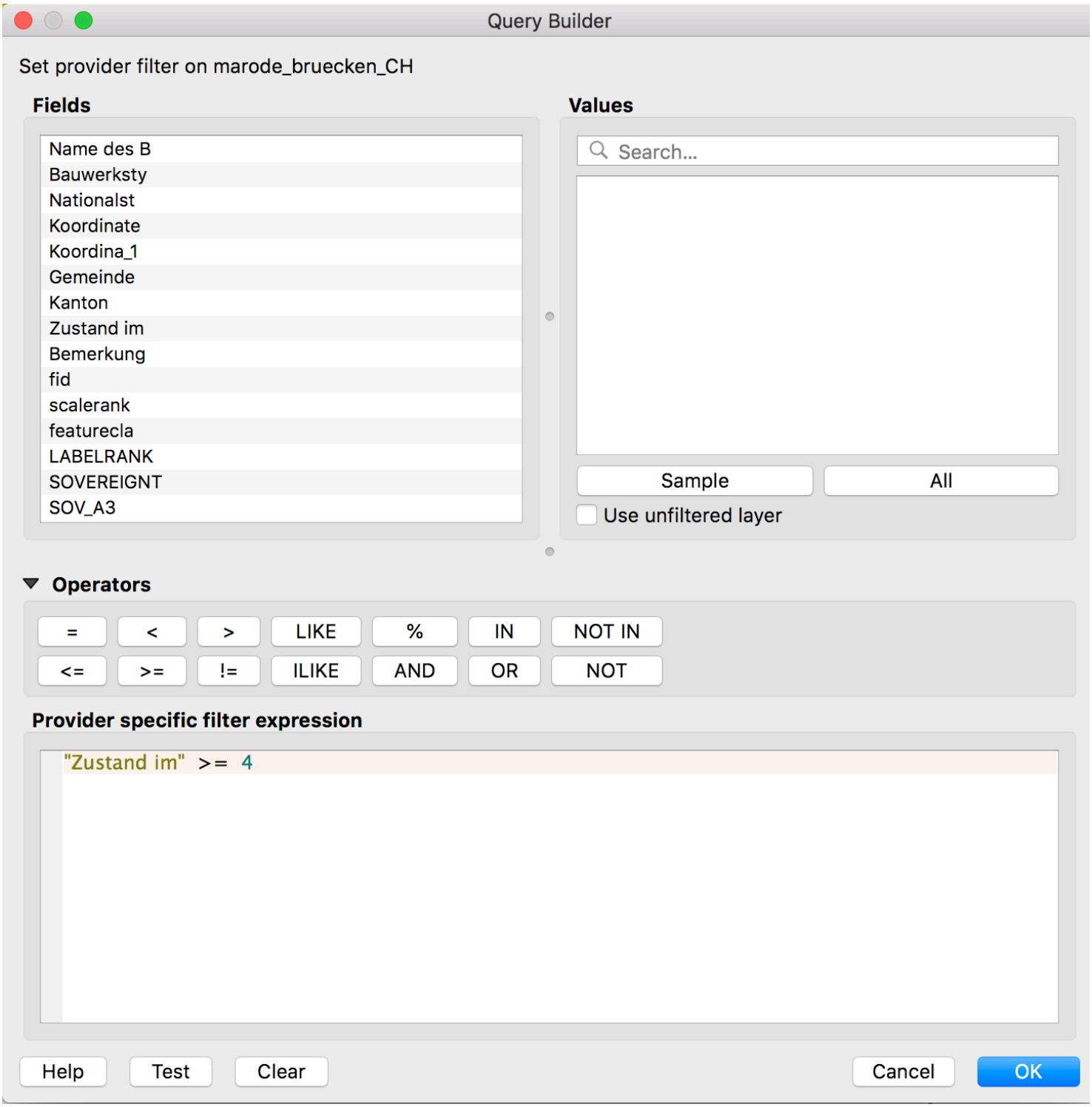


Lastly, we want to know how many of these bridges are in a bad state. We duplicate the layer with the briges in the border region for Switzerland and then use the "Filter" option.

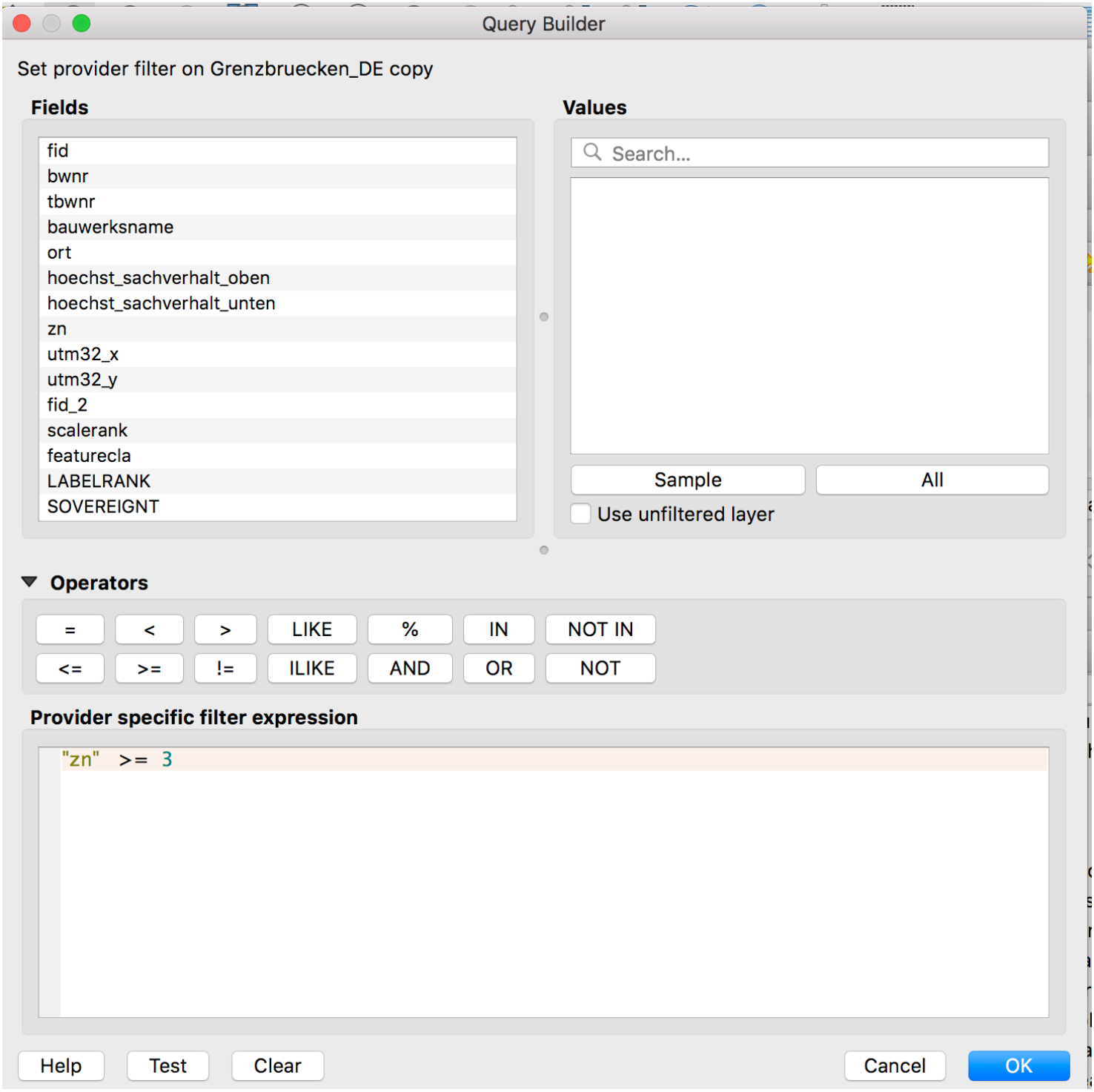




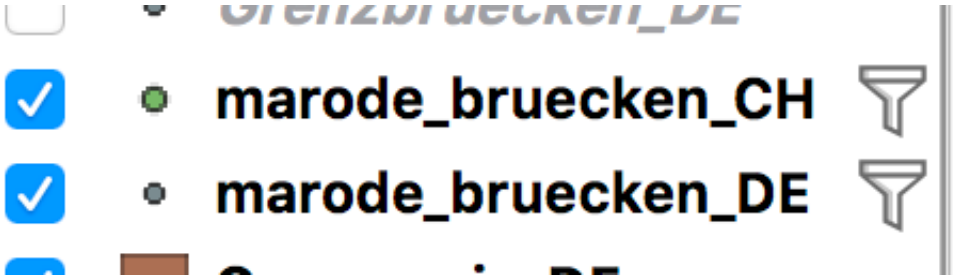
Then we build a query by defining that we only want bridges with a rating of 4 or worse. This is the definition of bridges that Swiss authorities define as "bad" or "alarming".



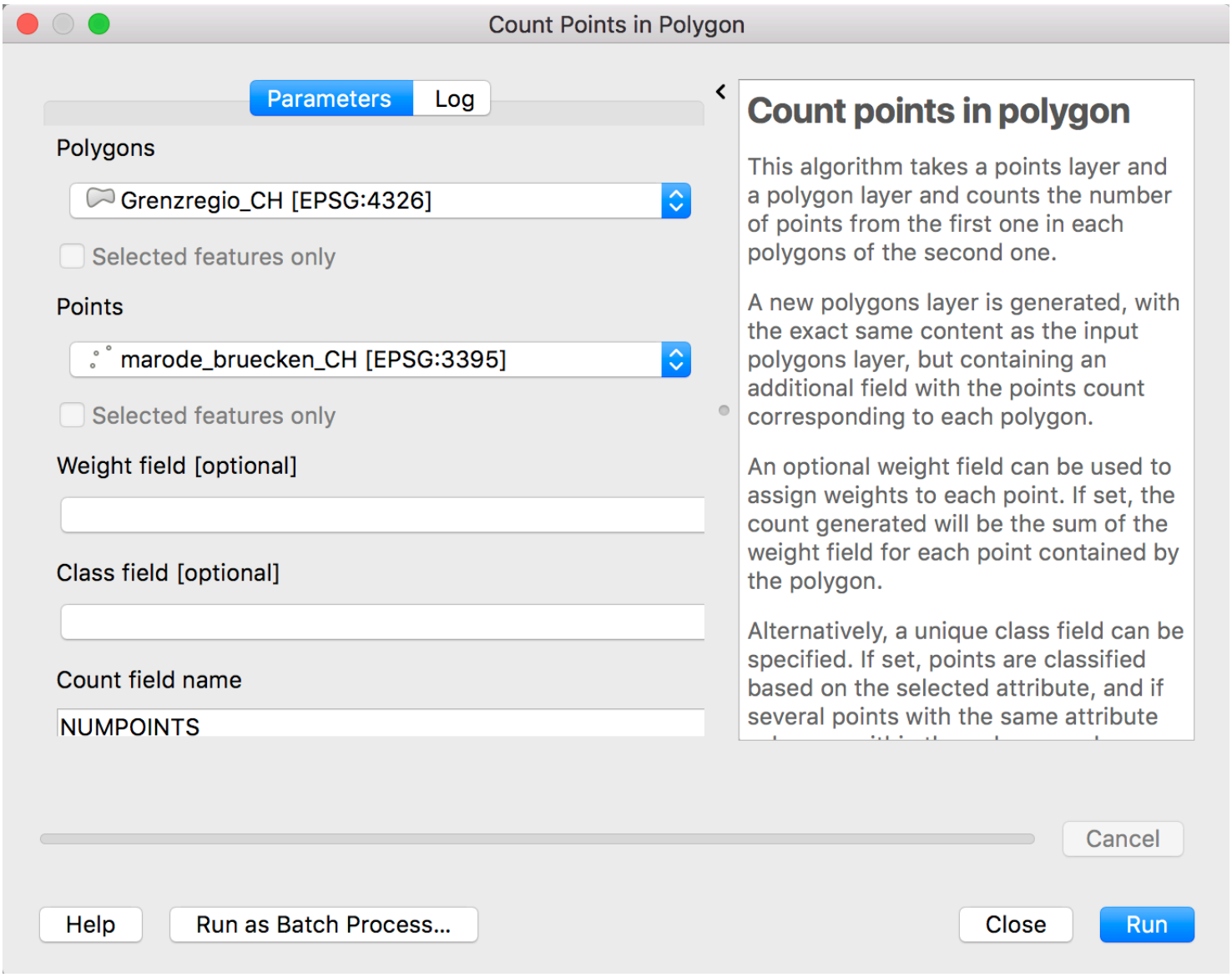
And we do the same for German bridges in the polygons. With the difference that we define 3 or worse as the benchmark, as the German rating system works slightly different.

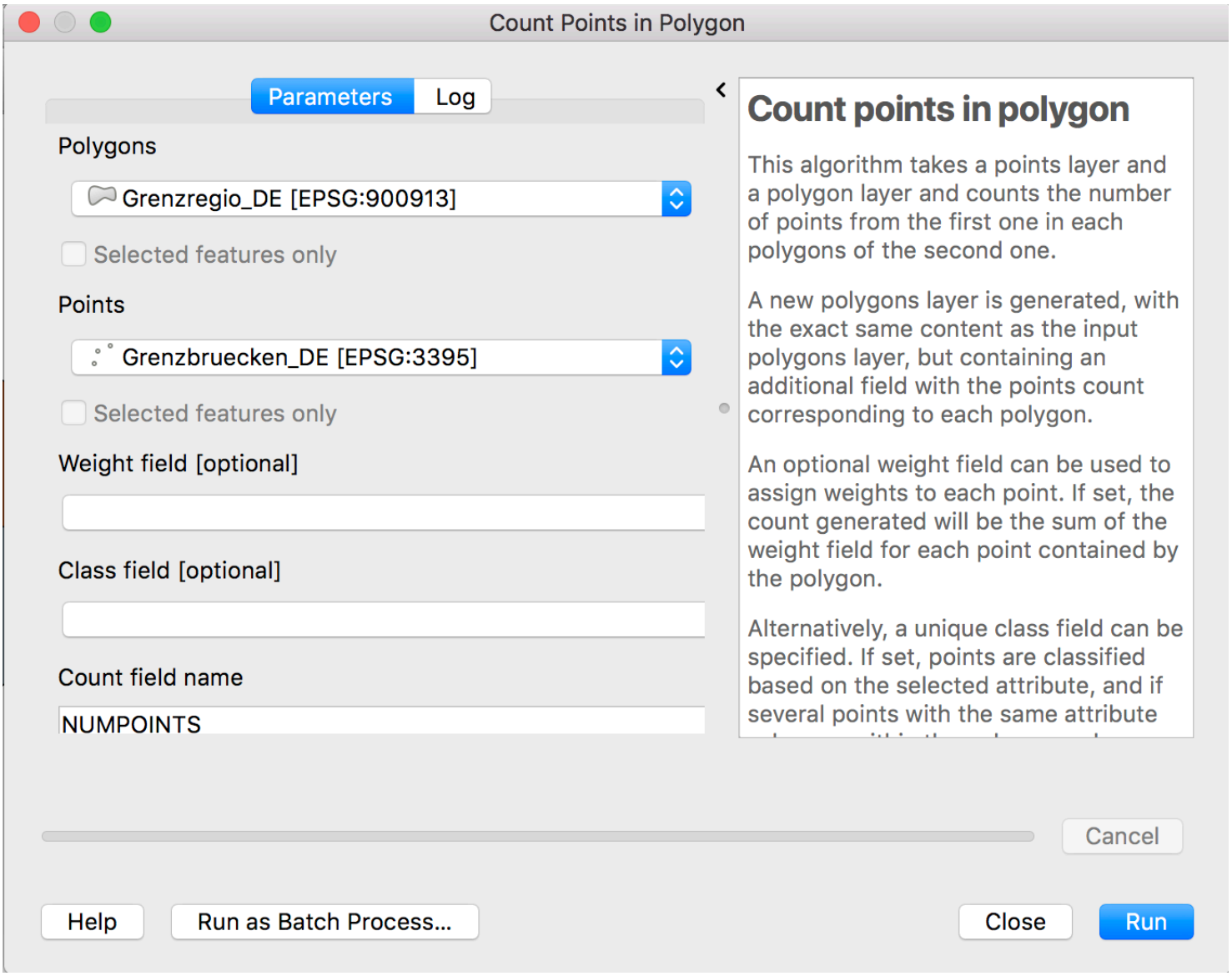


We should now have now two layers with points that are rated as "bad" or "alarming".

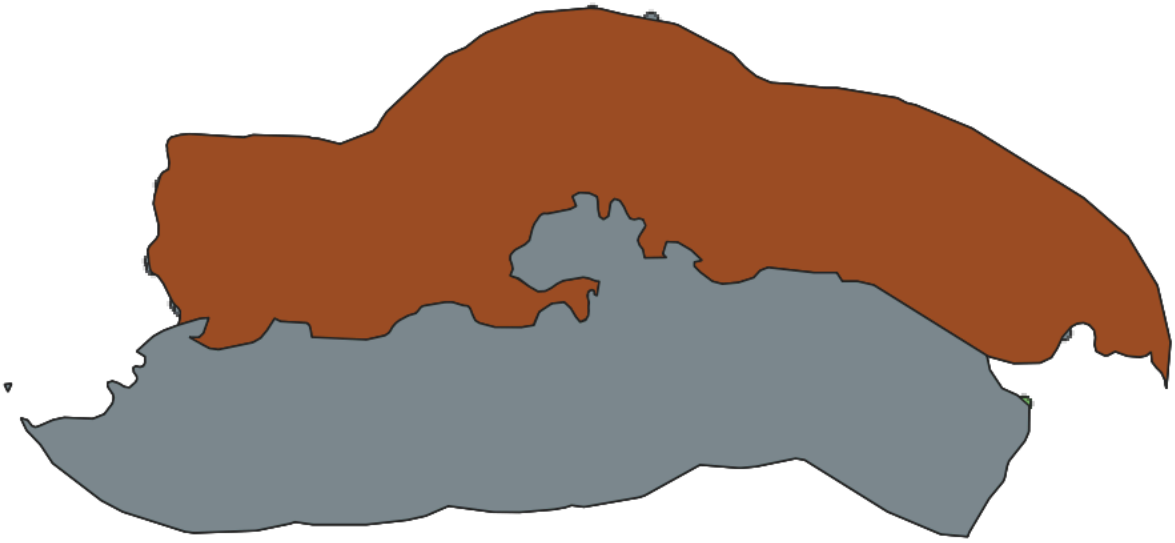


Again, we let QGIS count these points in the polygons.





And check for both count layers the table.



Which brings us to our final result. We have 12 problematic bridges in Switzerland. Out of 994.

MIN_LABEL_	4.00000
MAX_LABEL_	9.00000
NUMPOINTS	12

And 110 in Germany. Out of 1205.

MAX_LABEL_	6.70000
NUMPOINTS	110