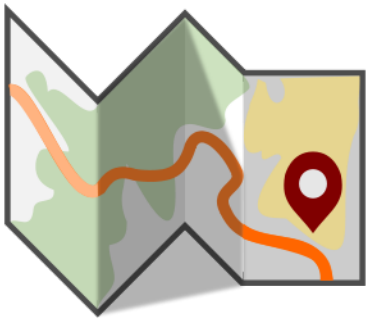
Writing Python Scripts for Processing Framework (QGIS3)

QGIS Tutorials and Tips



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Writing Python Scripts for Processing Framework (QGIS3)

One can write standalone pyqgis scripts that can be run via the Python Console in QGIS. With a few tweaks, you can make your standalone scripts run via the Processing Framework. This has several advantages. First, taking user input and writing output files is far easier because Processing Framework offers standardized user interface for these. Second, having your script in the Processing Toolbox also allows it to be part of any Processing Model or be run as a Batch job with multiple inputs. This tutorial will show how to write a custom python script that can be part of the Processing Framework in QGIS.

> ***Note***
>
> The Processing API was completely overhauled in QGIS3. Please refer to this guide for best practices and tips.

Overview of the task

Our script will perform a dissolve operation based on a field chosen by the user. It will also sum up values of another field for the dissolved features. In the example, we will dissolve a world shapefile based on a `CONTINENT` attribute and sum up `POP_EST` field to calculate total population in the dissolved region.

Get the data

We will use the Admin 0 - Countries dataset from Natural Earth.

Download the Admin 0 - countries shapefile..

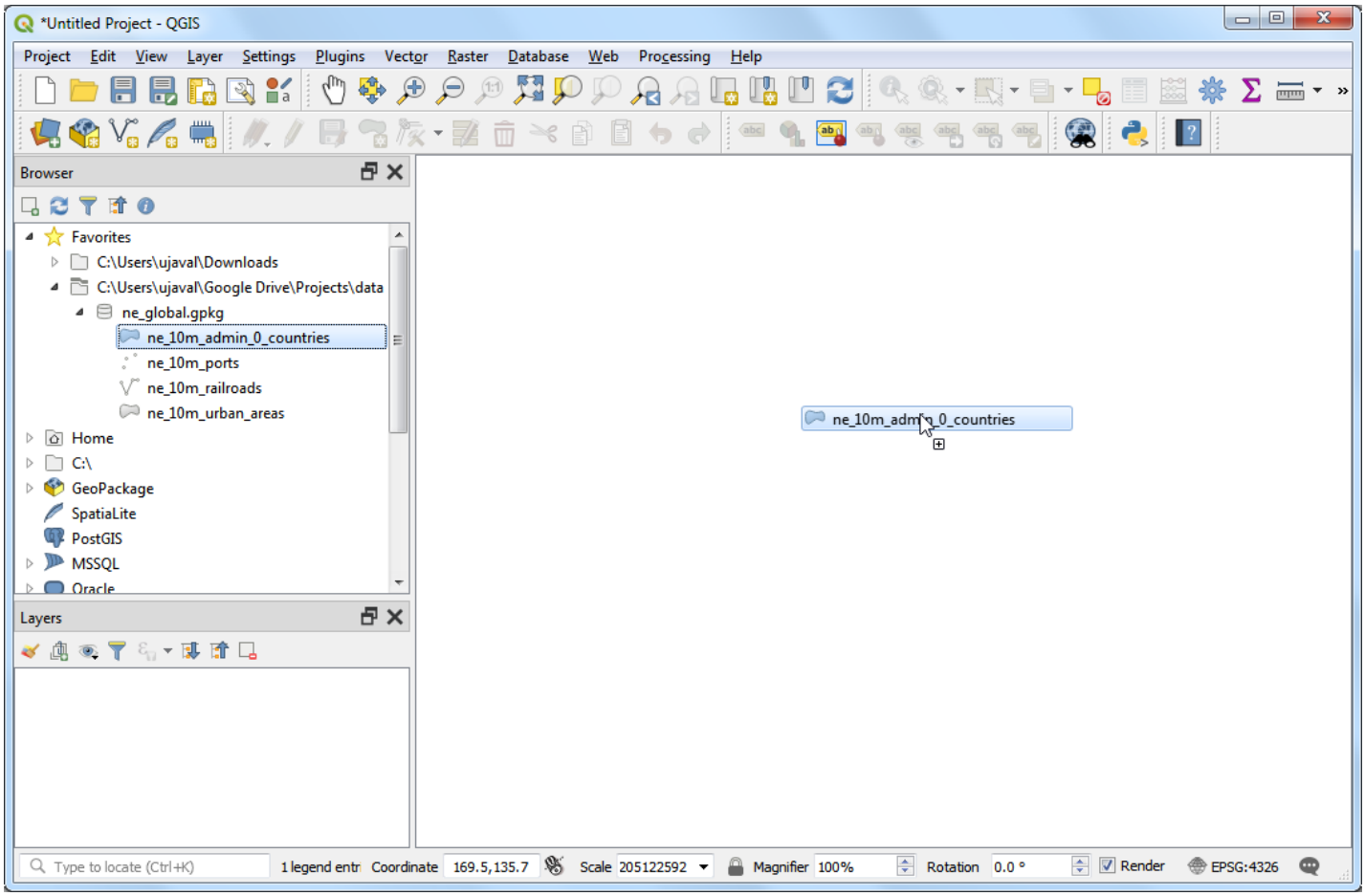
Data Source [NATURALEARTH]

For convenience, you may directly download a geopackage containing the above layer from below:

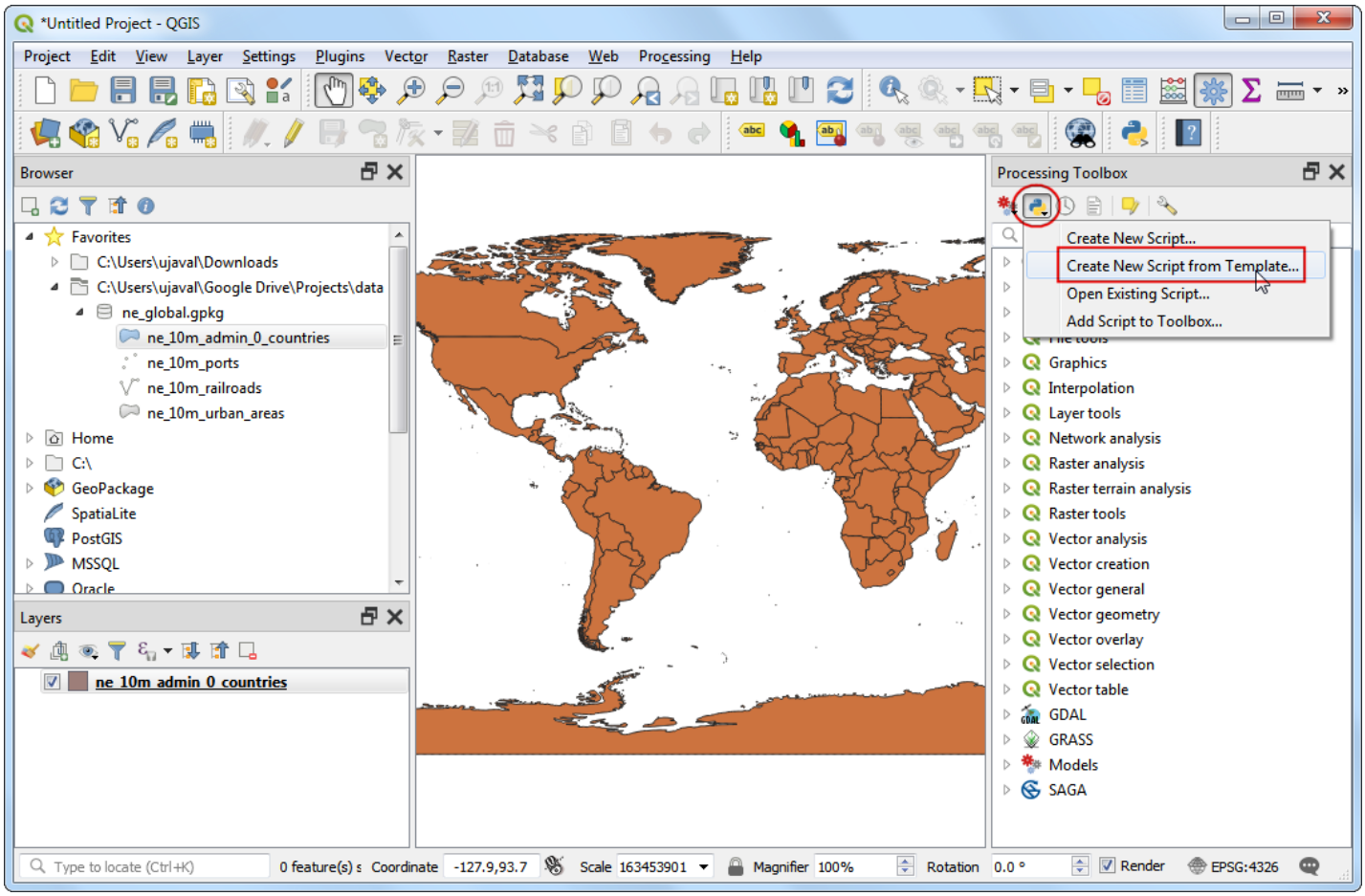
ne_global.gpkg

Procedure

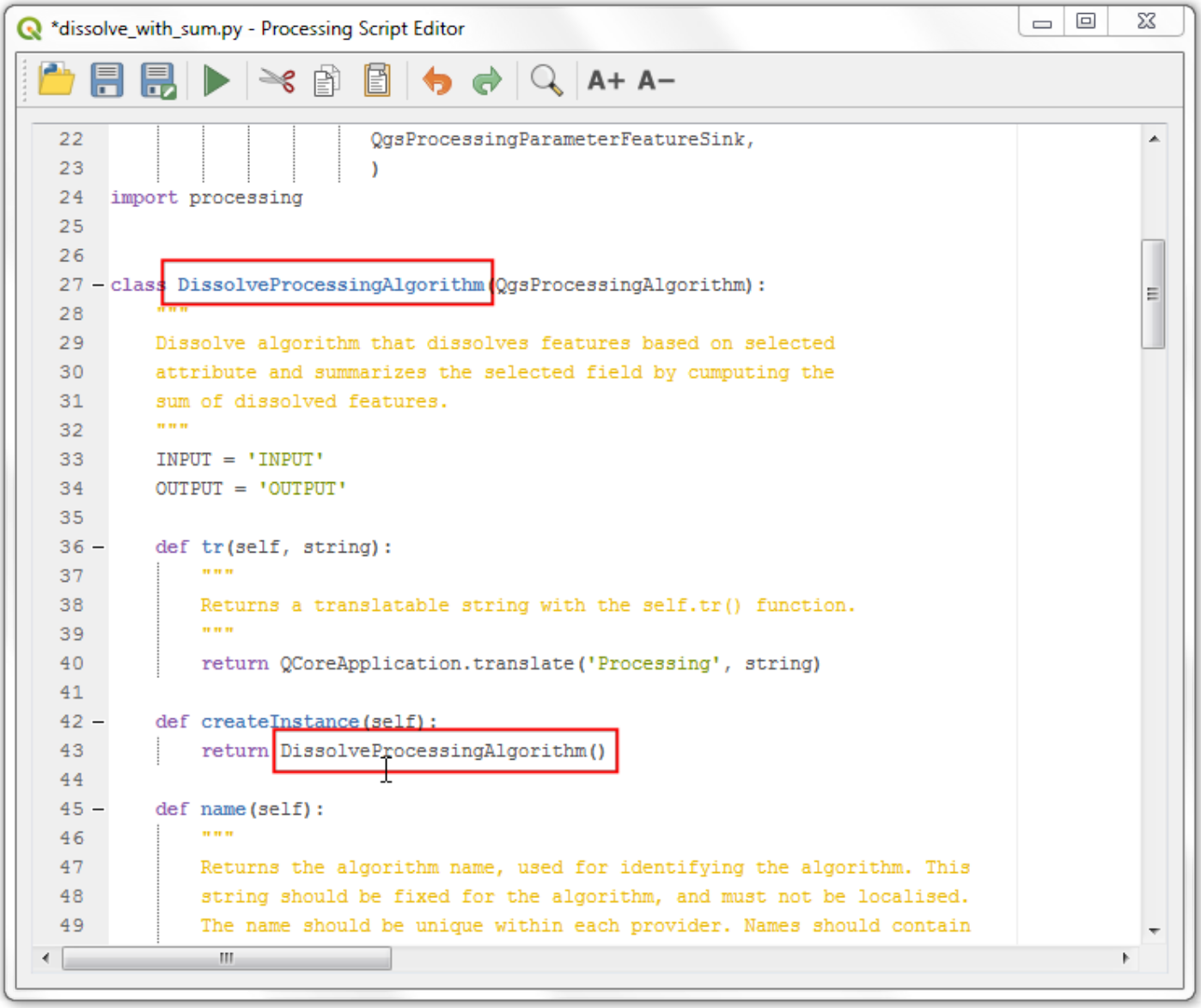
1. In the QGIS Browser Panel, locate the directory where you saved your downloaded data. Expand the `zip` or the `gpkg` entry and select the `ne_10m_admin_0_countries` layer. Drag the layer to the canvas.



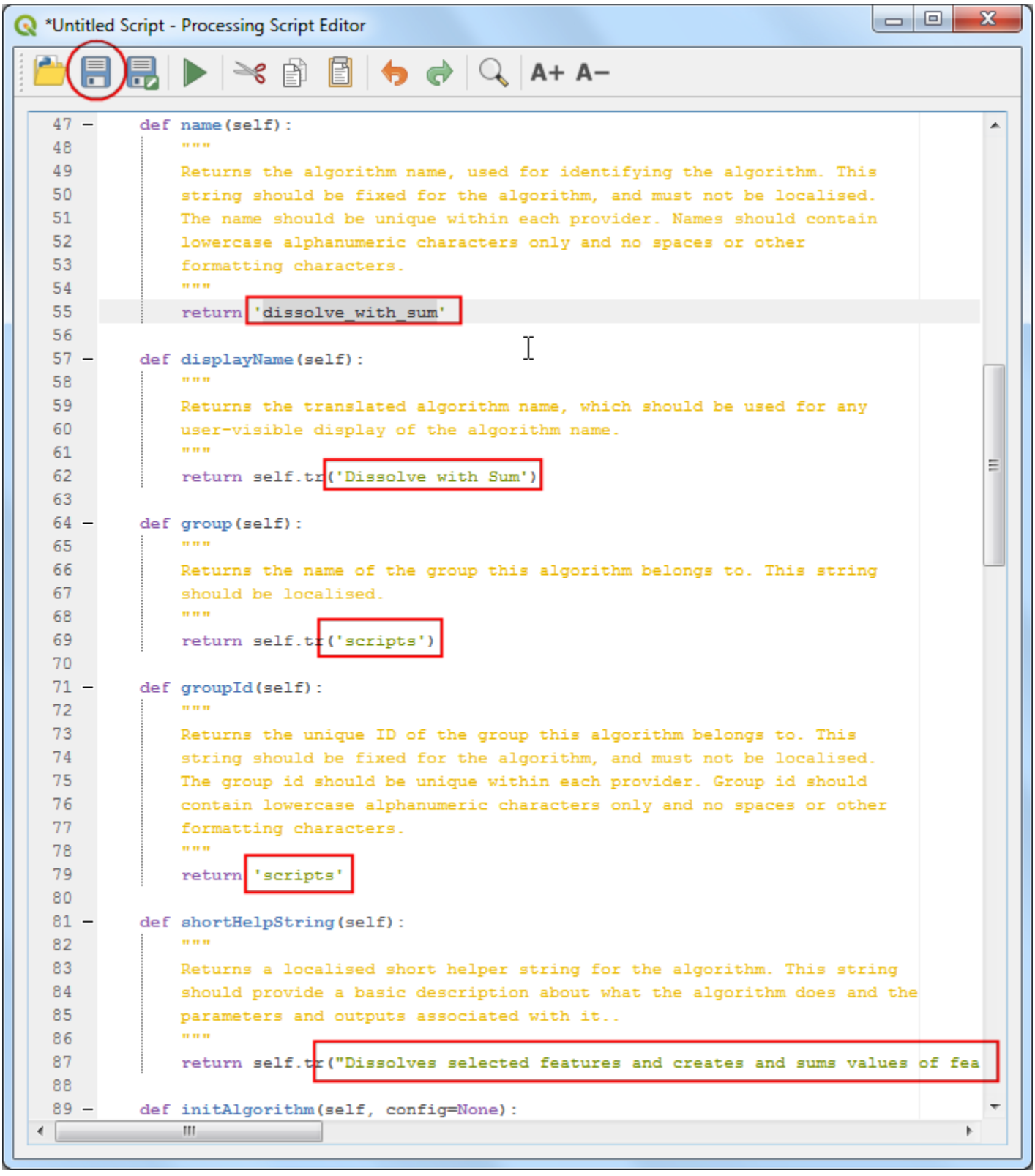
2. Go to Processing ▸ Toolbox. Click the Scripts button in the toolbar and select Create New Script from Template.



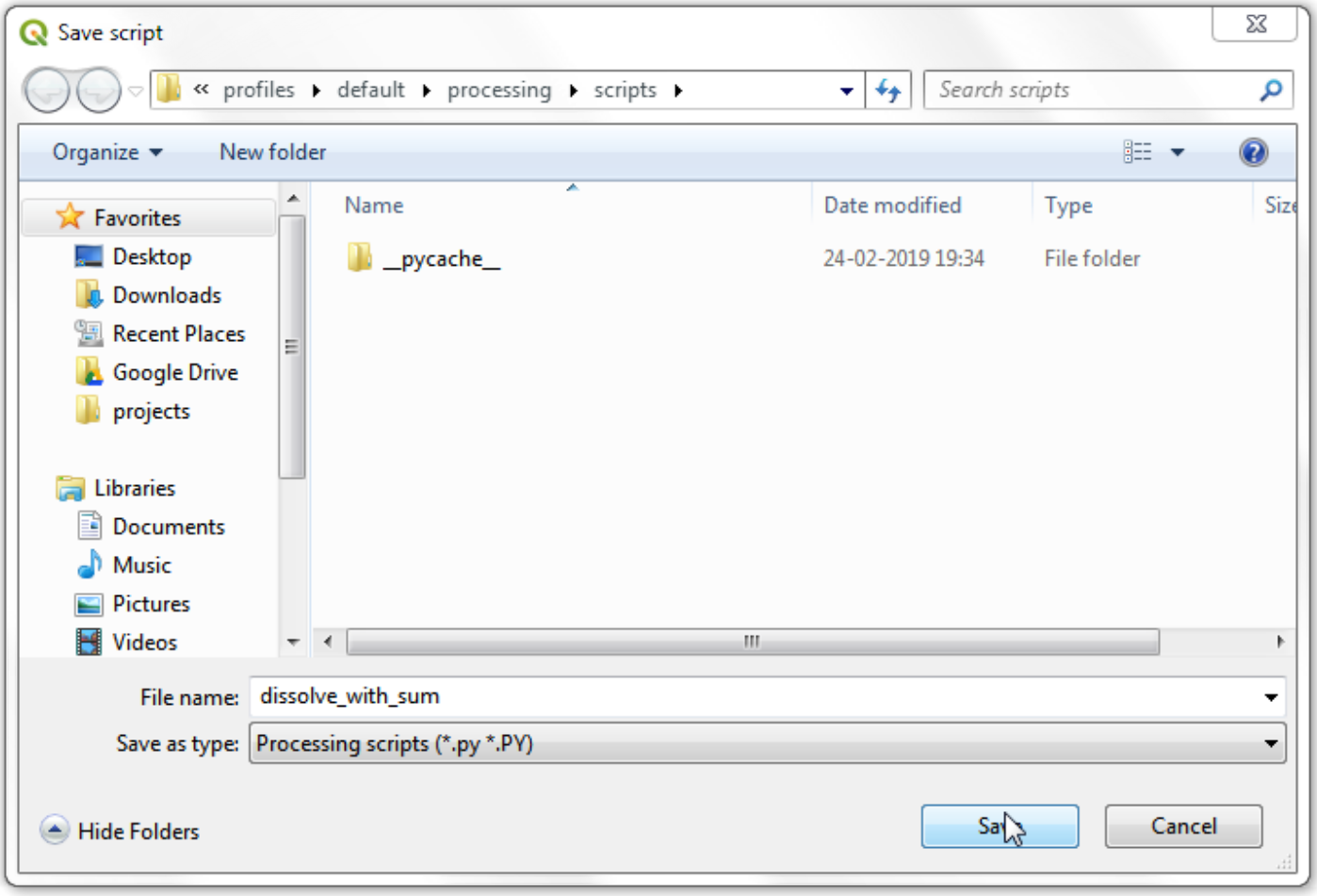
3. The template contains all the boilerplate code that is required for the Processing Framework to recognize it as a Processing script, and manage inputs/outputs. Let's start customizing the example template to our needs. First change the class name from `ExampleProcessingAlgorithm` to `DissolveProcessingAlgorithm`. This name also needs to be updated in the `createInstance` method. Add a docstring to the class that explains what the algorithm does.



4. As you scroll down, you will see methods that assign name, group, description etc. to the script. Change the return values for *name* method to be `dissolve_with_sum`, *displayName* method to `Dissolve with Sum`, *group* method and *groupId* method to `scripts`. Change the return value of *shortHelpString* method to a description that will appear to the user. Click the Save button.

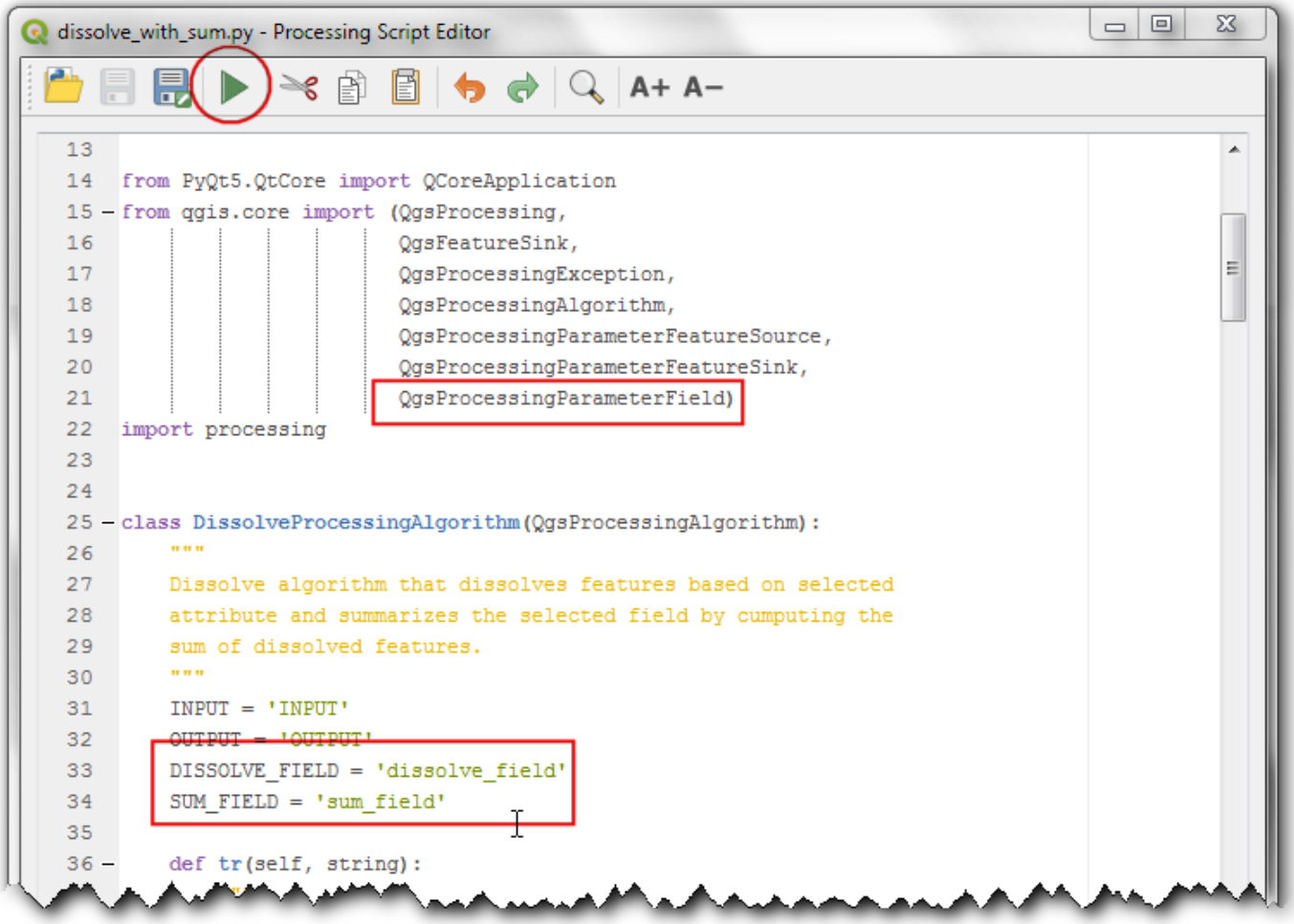


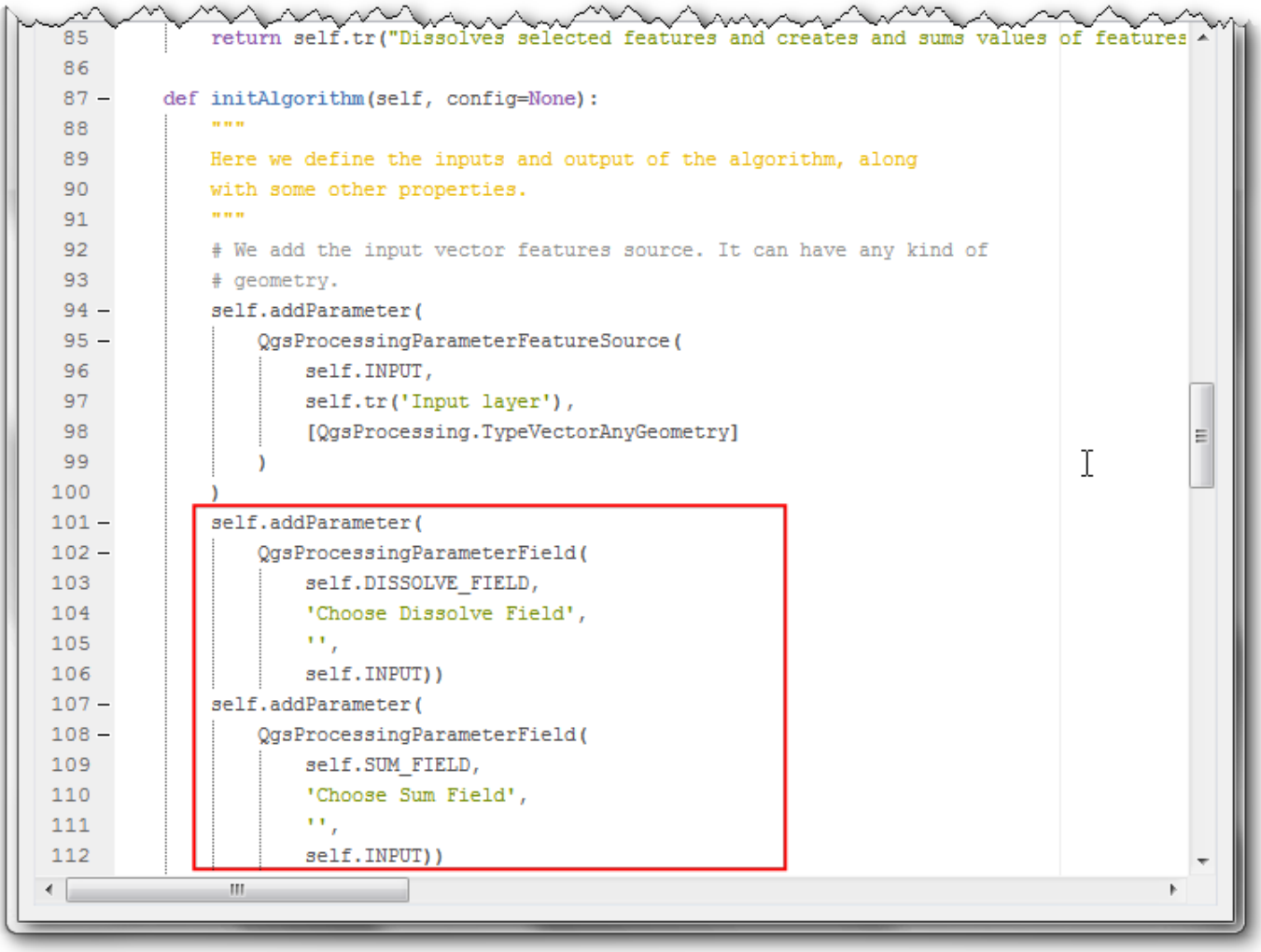
5. Name the script `dissolve_with_sum` and save it at the default location under profiles ▸ default ▸ processing ▸ scripts folder.



6. Now we will define the inputs for the script. The template already contains a definition of an `INPUT` Vector Layer and a `OUTPUT` layer. We will add 2 new inputs which allows the user to select a `DISSOLVE_FIELD` and a `SUM_FIELD`. Add a new import at the top and the following code in the `initAlgorithm` method. Click the Run button to preview the changes.

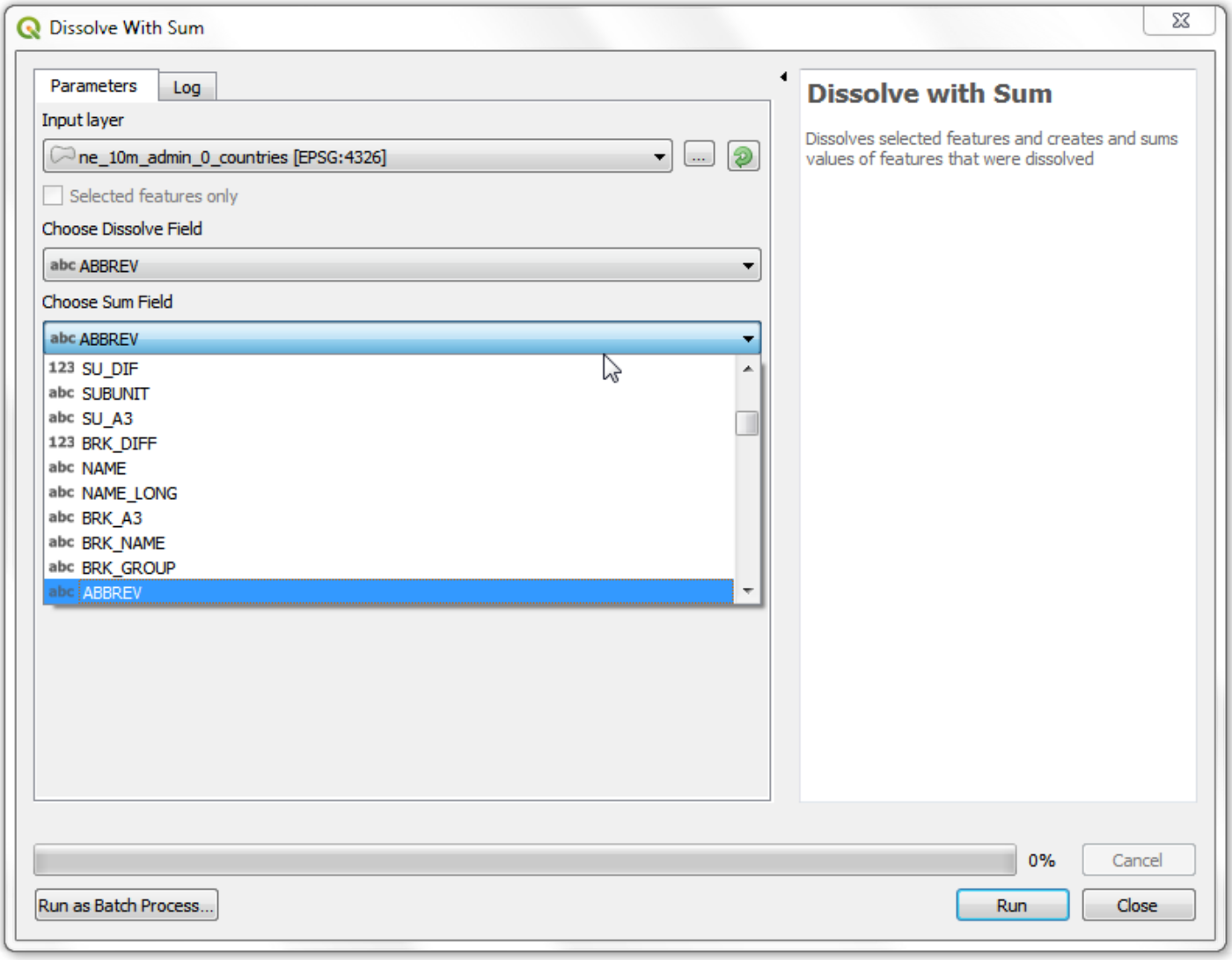
```
from qgis.core import QgsProcessingParameterField

self.addParameter(
        QgsProcessingParameterField(
                self.DISSOLVE_FIELD,
                'Choose Dissolve Field',
                '',
                self.INPUT))

self.addParameter(
        QgsProcessingParameterField(
                self.SUM_FIELD,
                'Choose Sum Field',
                '',
                self.INPUT))
```


dissolve_with_sum.py - Processing Script Editor
A+ A−
13
14 from PyQt5.QtCore import QCoreApplication
15 from qgis.core import (QgsProcessing,
16 QgsFeatureSink,
17 QgsProcessingException,
18 QgsProcessingAlgorithm,
19 QgsProcessingParameterFeatureSource,
20 QgsProcessingParameterFeatureSink,
21 QgsProcessingParameterField)
22 import processing
23
24
25 class DissolveProcessingAlgorithm(QgsProcessingAlgorithm):
26 """
27 Dissolve algorithm that dissolves features based on selected
28 attribute and summarizes the selected field by cumputing the
29 sum of dissolved features.
30 """
31 INPUT = 'INPUT'
32 OUTPUT = 'OUTPUT'
33 DISSOLVE_FIELD = 'dissolve_field'
34 SUM_FIELD = 'sum_field'
35
36 def tr(self, string):



```
85          return self.tr("Dissolves selected features and creates and sums values of features
86
87      def initAlgorithm(self, config=None):
88          """
89          Here we define the inputs and output of the algorithm, along
90          with some other properties.
91          """
92          # We add the input vector features source. It can have any kind of
93          # geometry.
94          self.addParameter(
95              QgsProcessingParameterFeatureSource(
96                  self.INPUT,
97                  self.tr('Input layer'),
98                  [QgsProcessing.TypeVectorAnyGeometry]
99              )
100         )
101         self.addParameter(
102             QgsProcessingParameterField(
103                 self.DISSOLVE_FIELD,
104                 'Choose Dissolve Field',
105                 '',
106                 self.INPUT))
107         self.addParameter(
108             QgsProcessingParameterField(
109                 self.SUM_FIELD,
110                 'Choose Sum Field',
111                 '',
112                 self.INPUT))
```

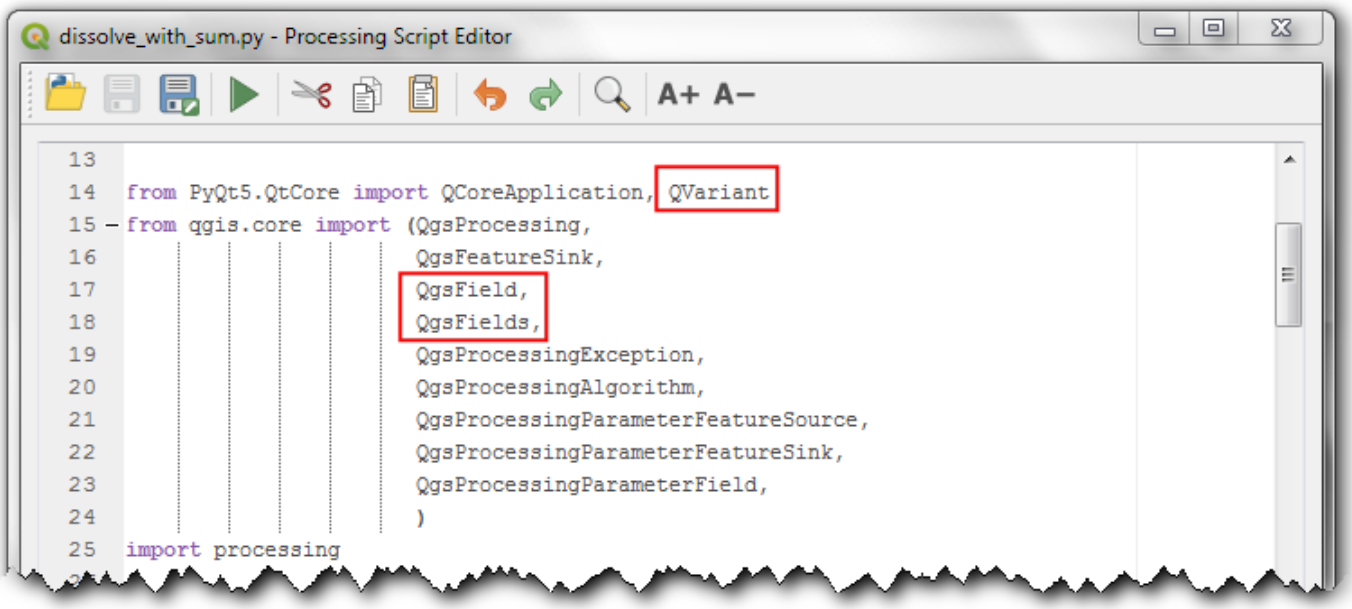
7. You will see a Dissolve with Sum dialog with our newly defined inputs. Select the `ne_10m_admin_0_countries` layer as Input layer`. As both Dissolve Field and Sum Fields are filtered based on the input layer, they will be pre-populated with existing fields from the input layer. Click the Close button.

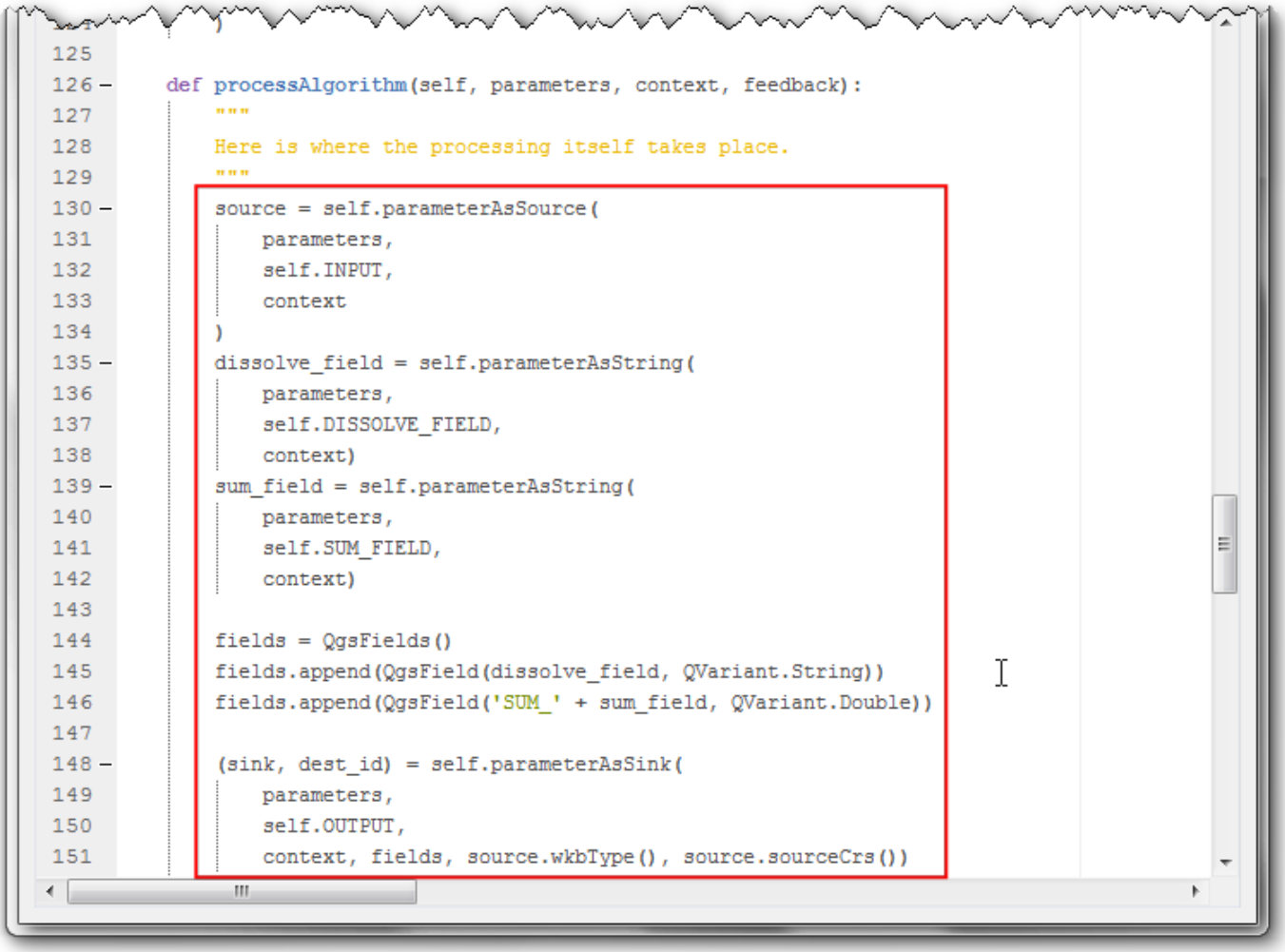


8. Now we define our custom logic for processing data in the `processAlgorithm` method. This method gets passed a dictionary called `parameters`. It contains the inputs that the user has selected. There are helper methods that allow you to take these inputs and create appropriate objects. We first get our inputs using `parameterAsSource` and `parameterAsString` methods. Next we want to create a feature sink where we will write the output. QGIS3 has a new class called `QgsFeatureSink` which is the preferred way to create objects that can accept new features. The output needs only 2 fields - one for the value of dissolved field and another for the sum of the selected field.

```
from PyQt5.QtCore import QVariant
from qgis.core import QgsField, QgsFields

source = self.parameterAsSource(
        parameters,
        self.INPUT,
        context)
dissolve_field = self.parameterAsString(
        parameters,
        self.DISSOLVE_FIELD,
```

```
        context)
sum_field = self.parameterAsString(
        parameters,
        self.SUM_FIELD,
        context)

fields = QgsFields()
fields.append(QgsField(dissolve_field, QVariant.String))
fields.append(QgsField('SUM_' + sum_field, QVariant.Double))

(sink, dest_id) = self.parameterAsSink(
        parameters,
        self.OUTPUT,
        context, fields, source.wkbType(), source.sourceCrs())
```

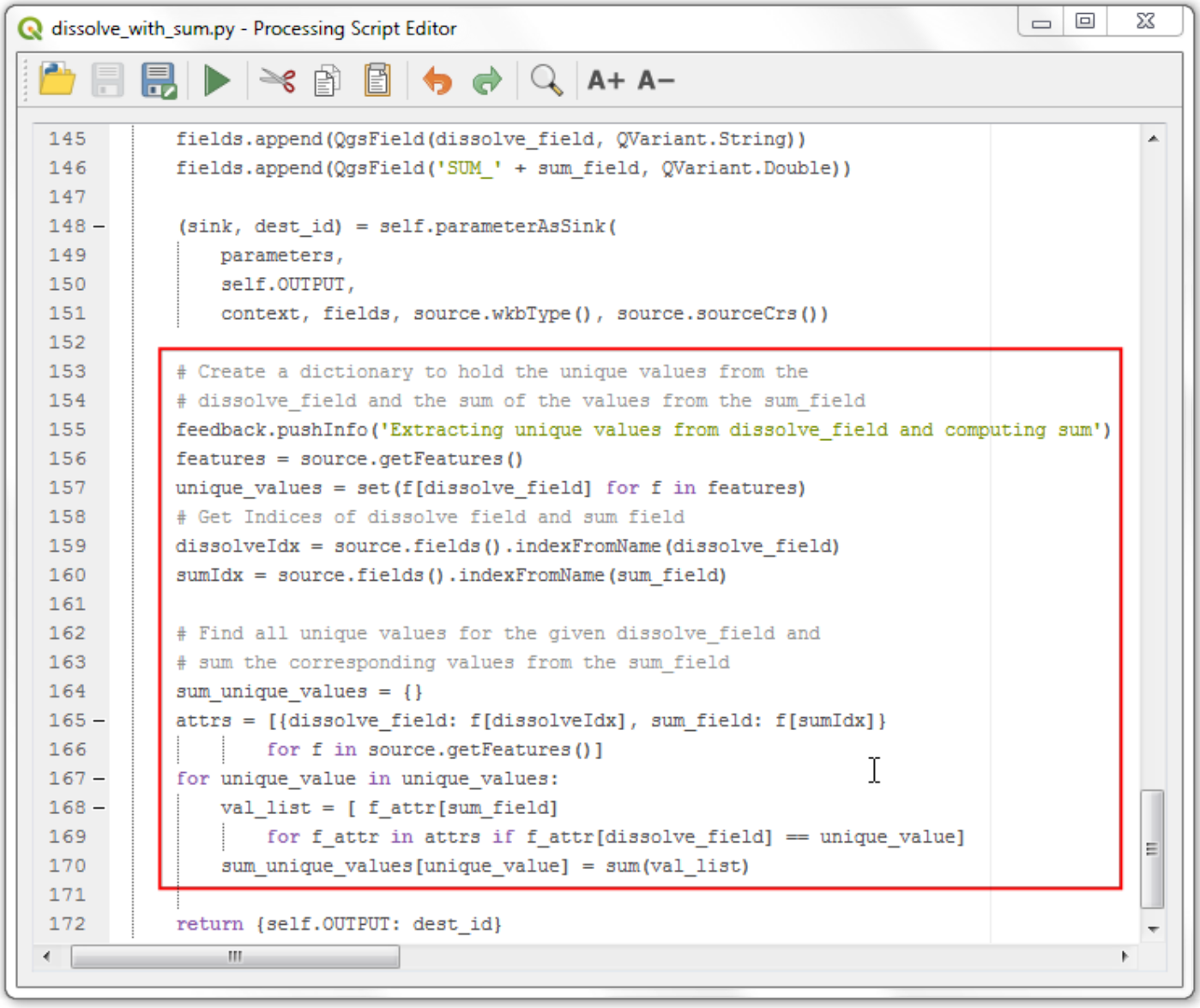




```
125
126 -   def processAlgorithm(self, parameters, context, feedback):
127         """
128         Here is where the processing itself takes place.
129         """
130 -       source = self.parameterAsSource(
131             parameters,
132             self.INPUT,
133             context
134         )
135 -       dissolve_field = self.parameterAsString(
136             parameters,
137             self.DISSOLVE_FIELD,
138             context)
139 -       sum_field = self.parameterAsString(
140             parameters,
141             self.SUM_FIELD,
142             context)
143
144         fields = QgsFields()
145         fields.append(QgsField(dissolve_field, QVariant.String))
146         fields.append(QgsField('SUM_' + sum_field, QVariant.Double))
147
148 -       (sink, dest_id) = self.parameterAsSink(
149             parameters,
150             self.OUTPUT,
151             context, fields, source.wkbType(), source.sourceCrs())
```

9. Now we will ready the input features and create a dictionary to hold the unique values from the dissolve_field and the sum of the values from the sum_field. Note the use of `feedback.pushInfo()` method to communicate the status with the user.

```
feedback.pushInfo('Extracting unique values from dissolve_field and computing sum')

features = source.getFeatures()
unique_values = set(f[dissolve_field] for f in features)

# Get Indices of dissolve field and sum field
dissolveIdx = source.fields().indexFromName(dissolve_field)
sumIdx = source.fields().indexFromName(sum_field)

# Find all unique values for the given dissolve_field and
# sum the corresponding values from the sum_field
sum_unique_values = {}
attrs = [{dissolve_field: f[dissolveIdx], sum_field: f[sumIdx]} for f in source.getFeatures()]
for unique_value in unique_values:
        val_list = [ f_attr[sum_field] for f_attr in attrs if f_attr[dissolve_field] == unique
        sum_unique_values[unique_value] = sum(val_list)
```



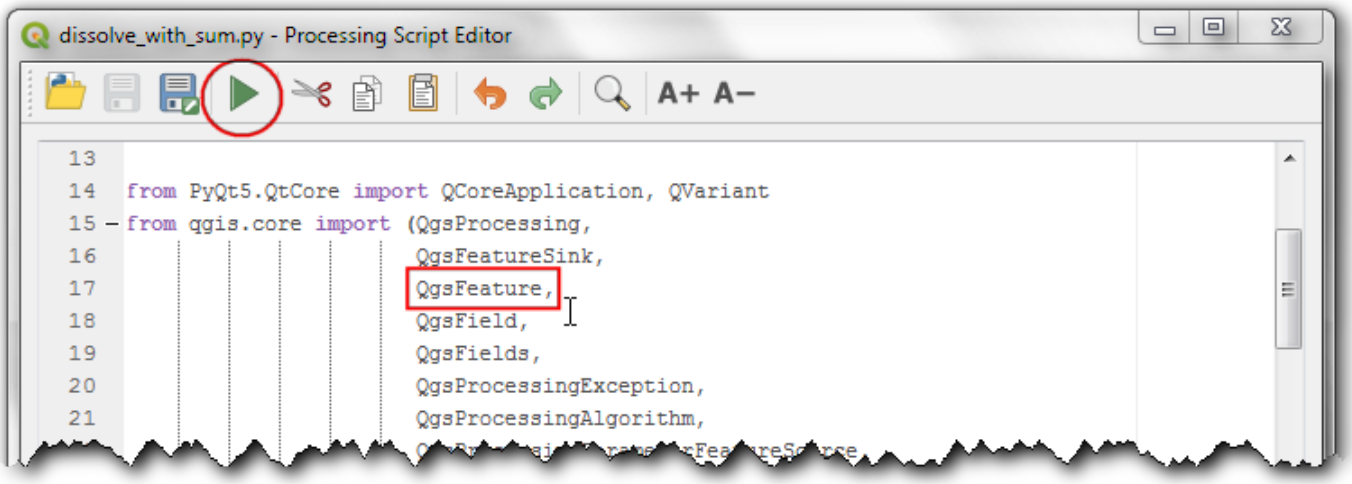
10. Next, we will call the built-in processing algorithm `native:dissolve` on the input layer to generate the dissolved geometries. Once we have the dissolved geometries, we iterate through the output of the dissolve algorithm and create new features to be added to the output. At the end we return the `dest_id` FeatureSink as the output. Now the script is ready. Click the Run button.

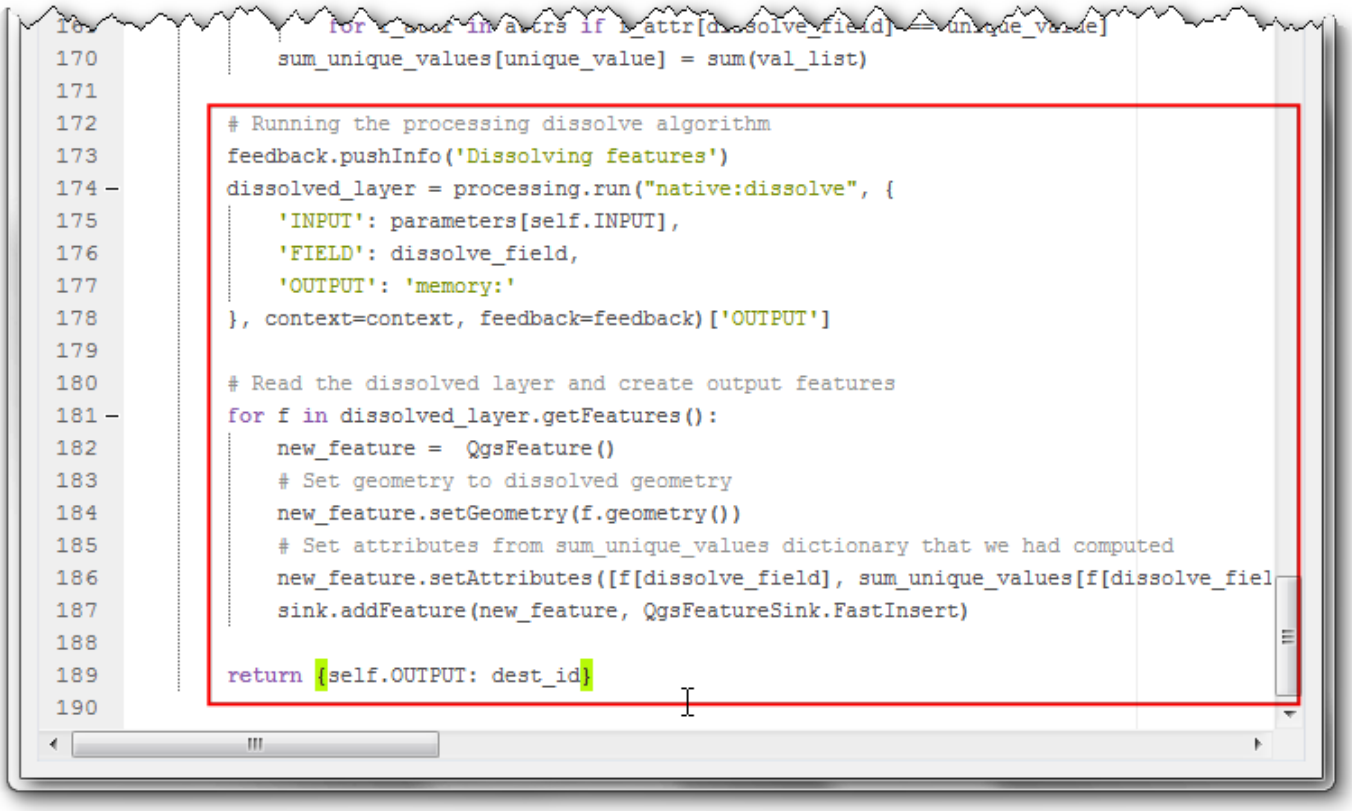
Note

Notice the use of `parameters[self.INPUT]` to fetch the input layer from the parameters dictionary directly without defining it as a source. As we are passing the input object to the algorithm without doing anything with it, it's not necessary to define it as a source.

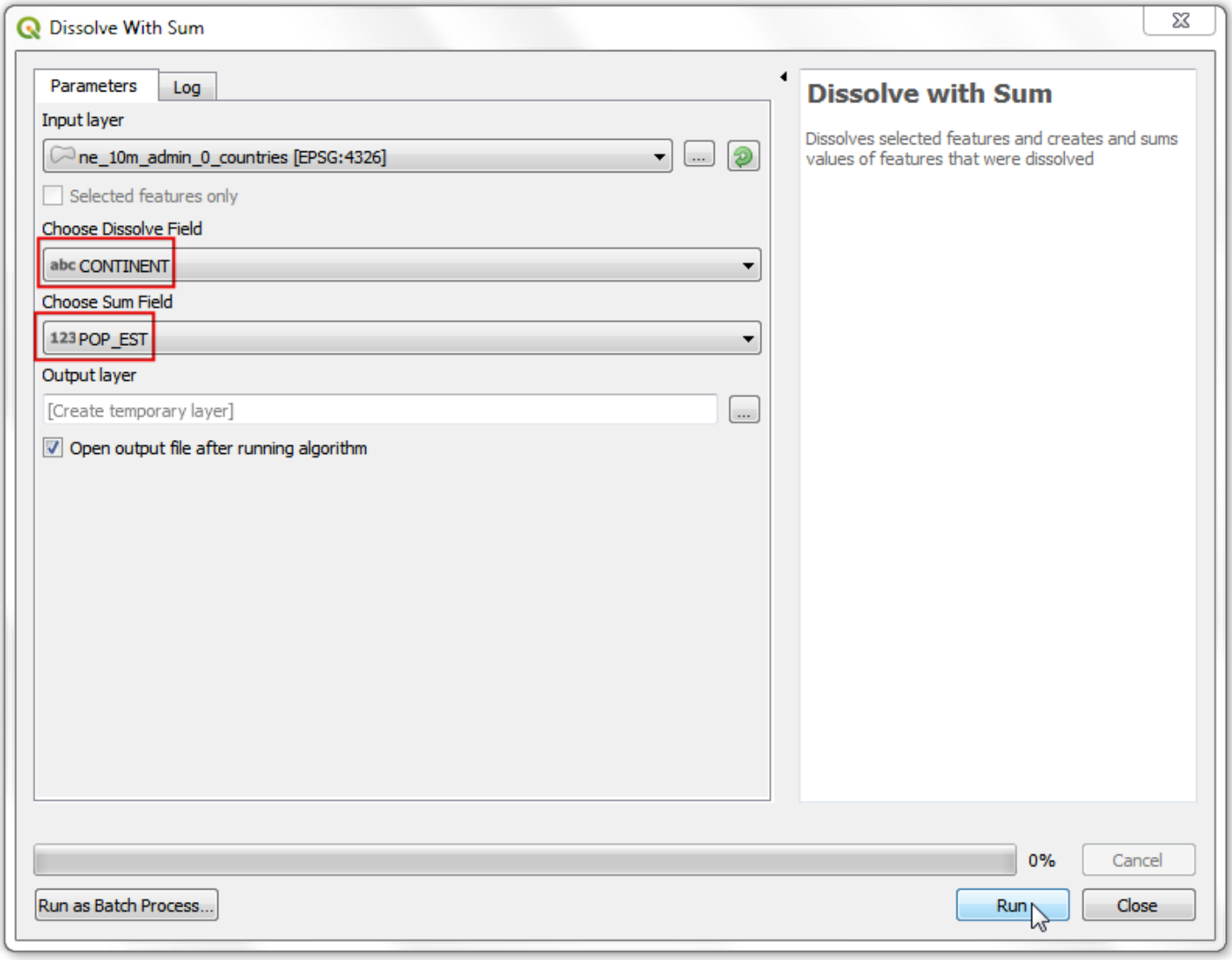
```
from qgis.core import QgsFeature
```

```
# Running the processing dissolve algorithm
feedback.pushInfo('Dissolving features')
dissolved_layer = processing.run("native:dissolve", {
        'INPUT': parameters[self.INPUT],
        'FIELD': dissolve_field,
        'OUTPUT': 'memory:'
        }, context=context, feedback=feedback)['OUTPUT']

# Read the dissolved layer and create output features
for f in dissolved_layer.getFeatures():
        new_feature =  QgsFeature()
        # Set geometry to dissolved geometry
        new_feature.setGeometry(f.geometry())
        # Set attributes from sum_unique_values dictionary that we had computed
        new_feature.setAttributes([f[dissolve_field], sum_unique_values[f[dissolve_field]]])
        sink.addFeature(new_feature, QgsFeatureSink.FastInsert)

return {self.OUTPUT: dest_id}
```

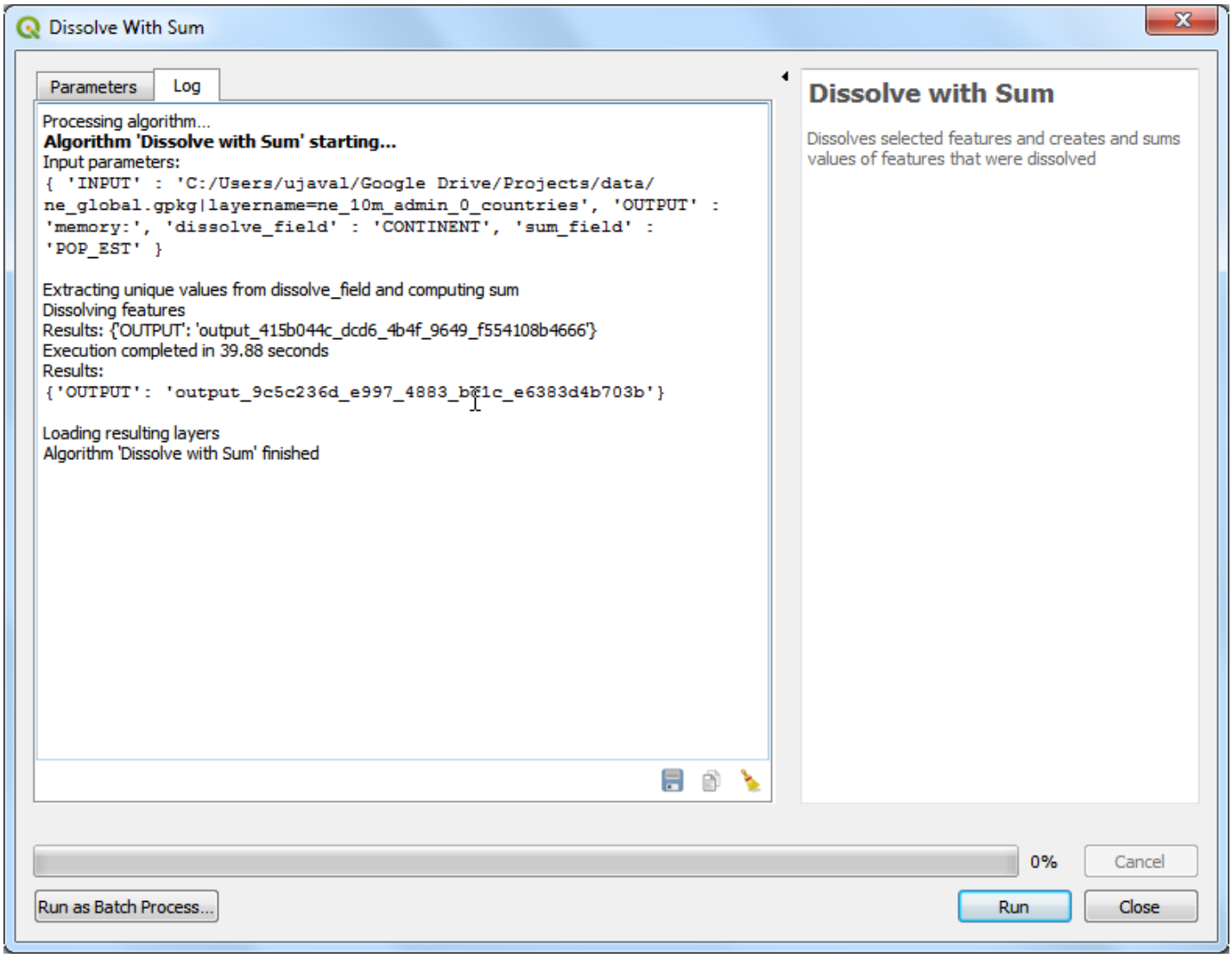




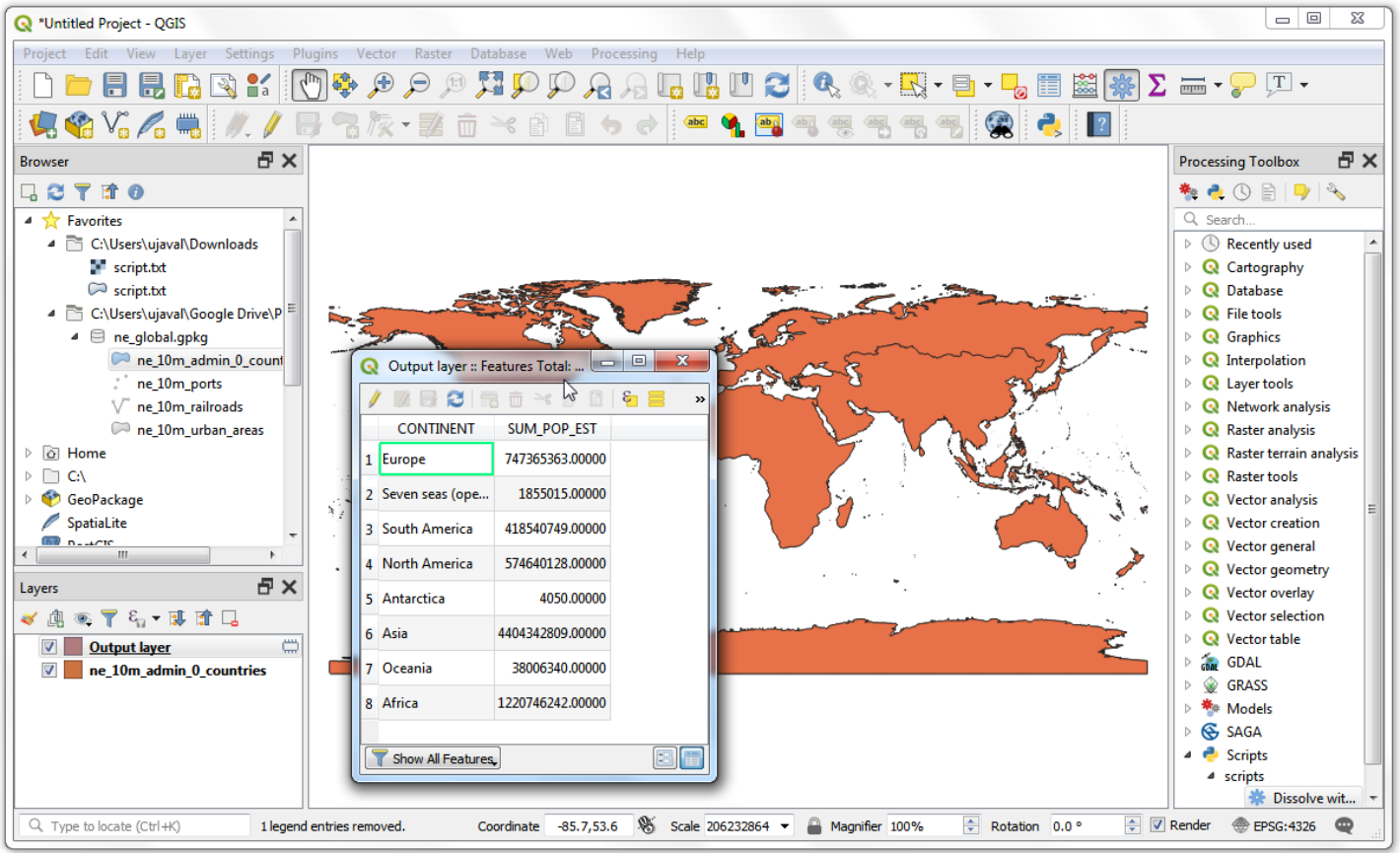
11. In the Dissolve with Sum, dialog, select `ne_10m_admin_0_countries` as the Input layer, `CONTINENT` as the Dissolve field and `POP_EST` as the Sum field. Click Run.



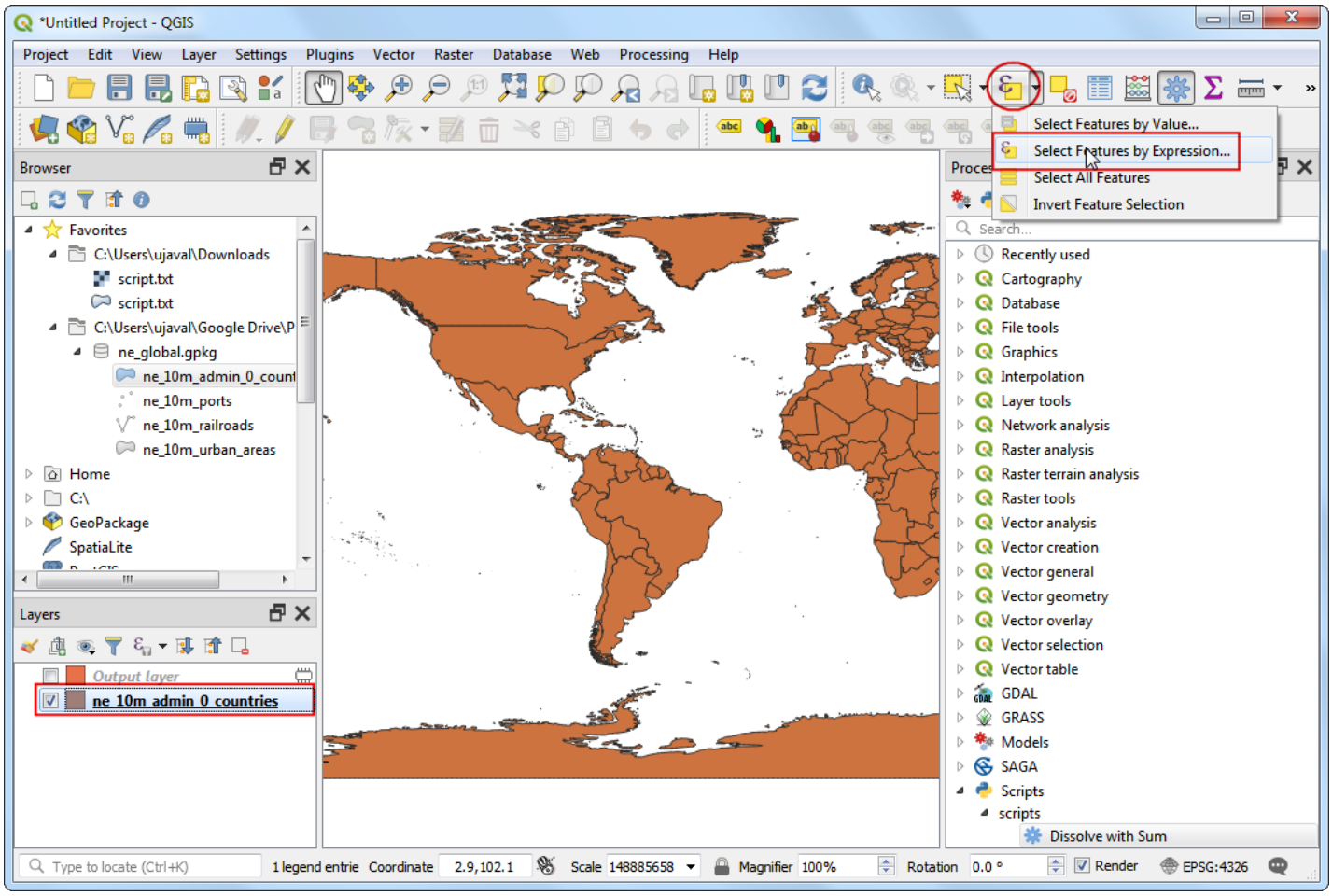
12. Once the processing is finished, click the Close button and switch to the main QGIS window.



13. You will see the dissolved output layer with one feature for every continent and the total population summed from the individual countries belonging to that continent.

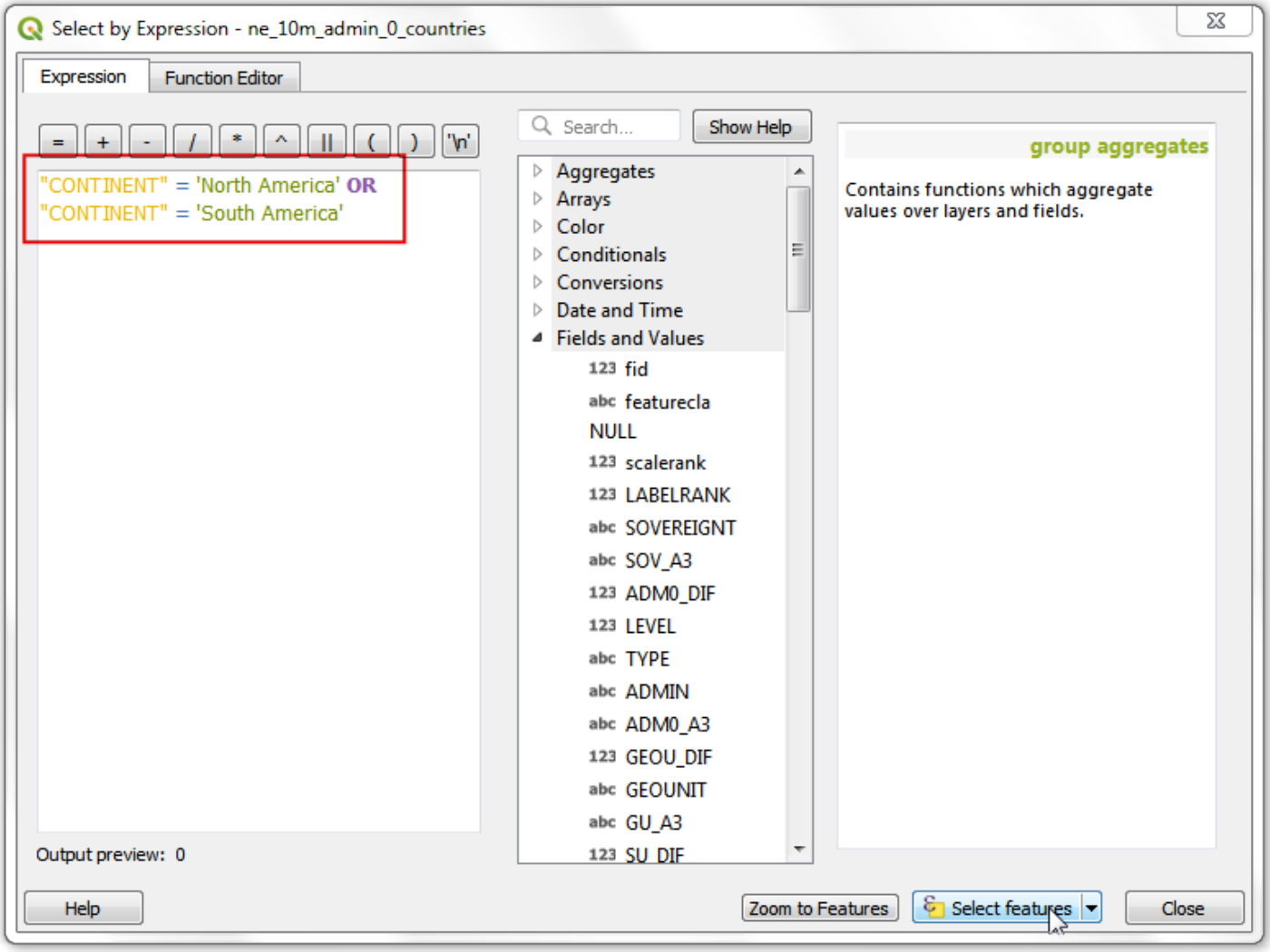


14. One another advantage of writing processing script is that the methods within the Processing Framework are aware of layer selection and automatically filter your inputs to use only the selected features. This happens because we are defining our input as a `QgsProcessingParameterFeatureSource`. A feature source allows use of ANY object which contains vector features, not just a vector layer, so when there are selected features in your layer and ask Processing to use selected features, the input is passed on to your script as a `QgsProcessingFeatureSource` object containing selected features and not the full vector layer. Here's a quick demonstration of this functionality. Let's say we want to dissolve only certain continents. Let's create a selection using Select feature by Expression tool.

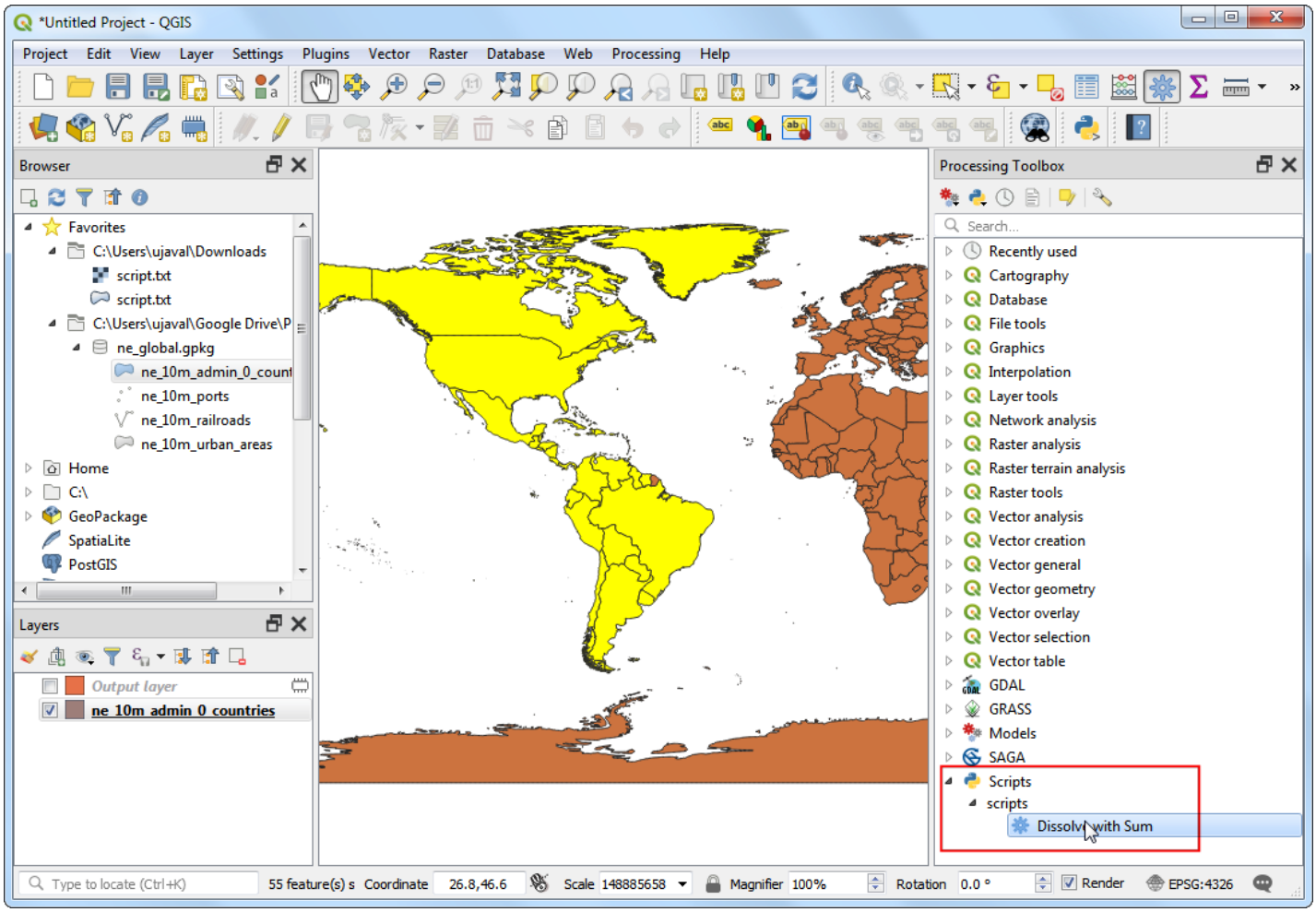


15. Enter the following expression to select features from North and South America and click Select.

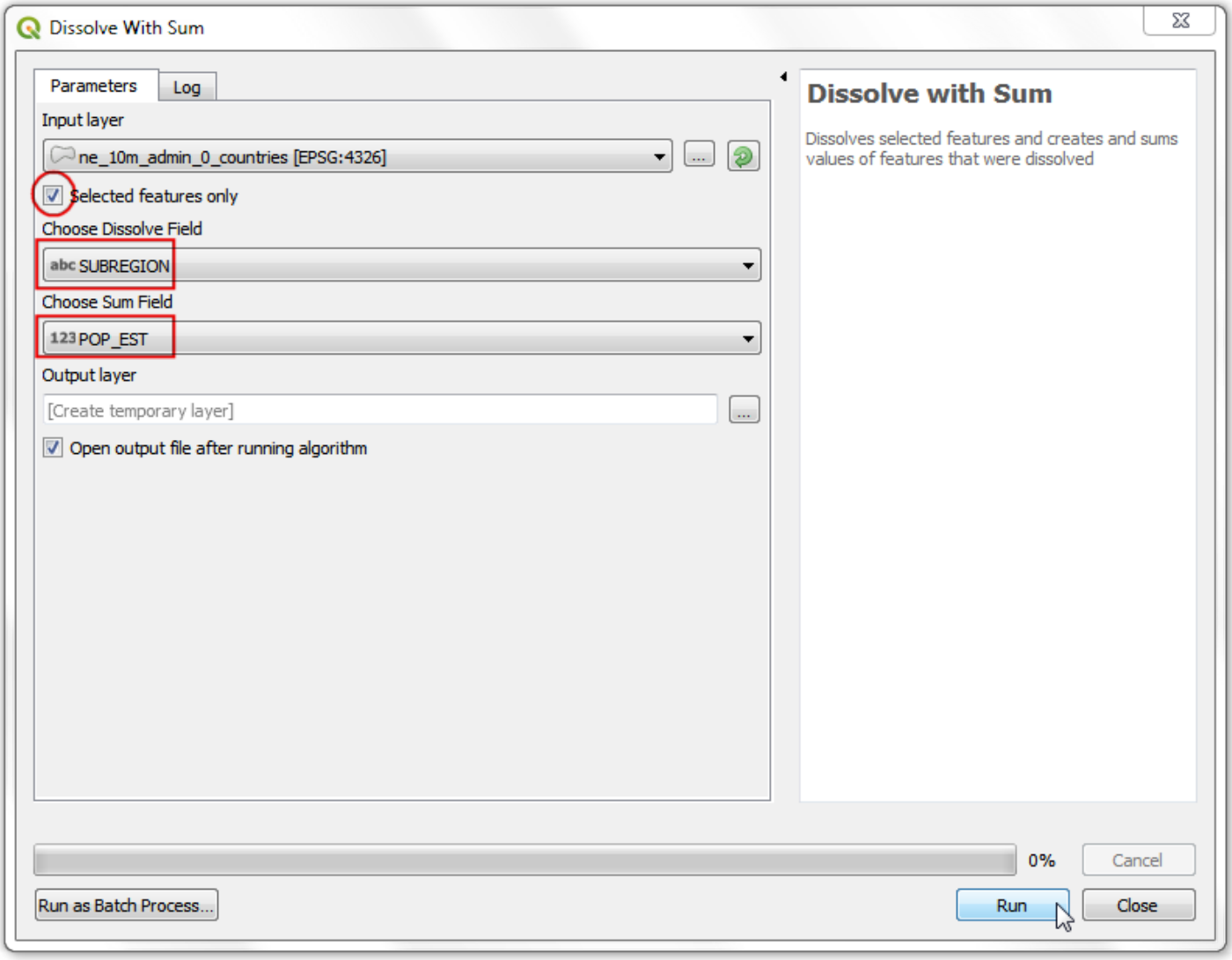
```
"CONTINENT" = 'North America' OR "CONTINENT" = 'South America'
```



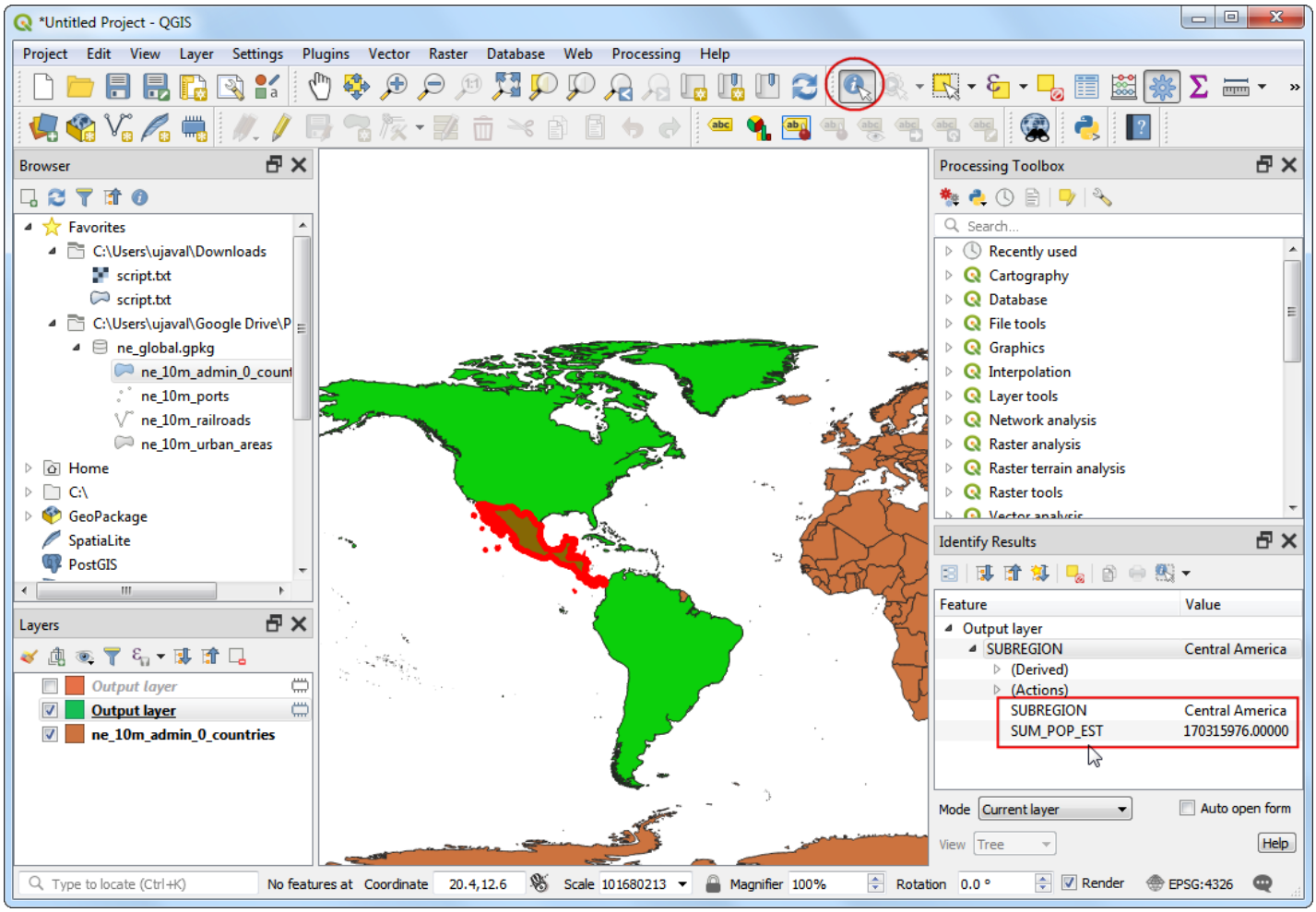
16. You will see the selected features highlighted in yellow. Locate the `dissolve_with_sum` script and double-click it to run it.



17. In the Dissolve with Sum dialog, select the `ne_10m_admin_0_countries` as the Input layer. This time, make sure you check the Selected features only box. Choose `SUBREGION` as the Dissolve field and `POP_EST` as the Sum field.



18. Once the processing finishes, click Close and switch back to the main QGIS window. You will notice a new layer with only the selected features dissolved. Click Identify button and click on a feature to inspect and verify that the script worked correctly.



Below is the complete script for reference. You may modify it to suit your needs.

```
# -*- coding: utf-8 -*-

"""
***************************************************************************
*                                                                         *
*   This program is free software; you can redistribute it and/or modify  *
*   it under the terms of the GNU General Public License as published by  *
*   the Free Software Foundation; either version 2 of the License, or     *
*   (at your option) any later version.                                   *
*                                                                         *
***************************************************************************
"""

from PyQt5.QtCore import QCoreApplication, QVariant
from qgis.core import (QgsProcessing,
                       QgsFeatureSink,
                       QgsFeature,
                       QgsField,
                       QgsFields,
                       QgsProcessingException,
                       QgsProcessingAlgorithm,
                       QgsProcessingParameterFeatureSource,
                       QgsProcessingParameterFeatureSink,
```

```
                       QgsProcessingParameterField,
                       )
import processing


class DissolveProcessingAlgorithm(QgsProcessingAlgorithm):
    """
    Dissolve algorithm that dissolves features based on selected
    attribute and summarizes the selected field by cumputing the
    sum of dissolved features.
    """
    INPUT = 'INPUT'
    OUTPUT = 'OUTPUT'
    DISSOLVE_FIELD = 'dissolve_field'
    SUM_FIELD = 'sum_field'

    def tr(self, string):
        """
        Returns a translatable string with the self.tr() function.
        """
        return QCoreApplication.translate('Processing', string)

    def createInstance(self):
        return DissolveProcessingAlgorithm()

    def name(self):
        """
        Returns the algorithm name, used for identifying the algorithm. This
        string should be fixed for the algorithm, and must not be localised.
        The name should be unique within each provider. Names should contain
        lowercase alphanumeric characters only and no spaces or other
        formatting characters.
        """
        return 'dissolve_with_sum'

    def displayName(self):
        """
        Returns the translated algorithm name, which should be used for any
        user-visible display of the algorithm name.
        """
        return self.tr('Dissolve with Sum')

    def group(self):
        """
        Returns the name of the group this algorithm belongs to. This string
        should be localised.
        """
        return self.tr('scripts')

    def groupId(self):
        """
        Returns the unique ID of the group this algorithm belongs to. This
        string should be fixed for the algorithm, and must not be localised.
        The group id should be unique within each provider. Group id should
        contain lowercase alphanumeric characters only and no spaces or other
        formatting characters.
        """
```

```
        return 'scripts'

    def shortHelpString(self):
        """
        Returns a localised short helper string for the algorithm. This string
        should provide a basic description about what the algorithm does and the
        parameters and outputs associated with it..
        """
        return self.tr("Dissolves selected features and creates and sums values of features th

    def initAlgorithm(self, config=None):
        """
        Here we define the inputs and output of the algorithm, along
        with some other properties.
        """
        # We add the input vector features source. It can have any kind of
        # geometry.
        self.addParameter(
            QgsProcessingParameterFeatureSource(
                self.INPUT,
                self.tr('Input layer'),
                [QgsProcessing.TypeVectorAnyGeometry]
            )
        )
        self.addParameter(
            QgsProcessingParameterField(
                self.DISSOLVE_FIELD,
                'Choose Dissolve Field',
                '',
                self.INPUT))
        self.addParameter(
            QgsProcessingParameterField(
                self.SUM_FIELD,
                'Choose Sum Field',
                '',
                self.INPUT))
        # We add a feature sink in which to store our processed features (this
        # usually takes the form of a newly created vector layer when the
        # algorithm is run in QGIS).
        self.addParameter(
            QgsProcessingParameterFeatureSink(
                self.OUTPUT,
                self.tr('Output layer')
            )
        )

    def processAlgorithm(self, parameters, context, feedback):
        """
        Here is where the processing itself takes place.
        """
        source = self.parameterAsSource(
            parameters,
            self.INPUT,
            context
        )
        dissolve_field = self.parameterAsString(
            parameters,
```

```
        self.DISSOLVE_FIELD,
        context)
    sum_field = self.parameterAsString(
        parameters,
        self.SUM_FIELD,
        context)

    fields = QgsFields()
    fields.append(QgsField(dissolve_field, QVariant.String))
    fields.append(QgsField('SUM_' + sum_field, QVariant.Double))

    (sink, dest_id) = self.parameterAsSink(
        parameters,
        self.OUTPUT,
        context, fields, source.wkbType(), source.sourceCrs())

    # Create a dictionary to hold the unique values from the
    # dissolve_field and the sum of the values from the sum_field
    feedback.pushInfo('Extracting unique values from dissolve_field and computing sum')
    features = source.getFeatures()
    unique_values = set(f[dissolve_field] for f in features)
    # Get Indices of dissolve field and sum field
    dissolveIdx = source.fields().indexFromName(dissolve_field)
    sumIdx = source.fields().indexFromName(sum_field)

    # Find all unique values for the given dissolve_field and
    # sum the corresponding values from the sum_field
    sum_unique_values = {}
    attrs = [{dissolve_field: f[dissolveIdx], sum_field: f[sumIdx]}
            for f in source.getFeatures()]
    for unique_value in unique_values:
        val_list = [ f_attr[sum_field]
            for f_attr in attrs if f_attr[dissolve_field] == unique_value]
        sum_unique_values[unique_value] = sum(val_list)

    # Running the processing dissolve algorithm
    feedback.pushInfo('Dissolving features')
    dissolved_layer = processing.run("native:dissolve", {
        'INPUT': parameters[self.INPUT],
        'FIELD': dissolve_field,
        'OUTPUT': 'memory:'
    }, context=context, feedback=feedback)['OUTPUT']

    # Read the dissolved layer and create output features
    for f in dissolved_layer.getFeatures():
        new_feature =  QgsFeature()
        # Set geometry to dissolved geometry
        new_feature.setGeometry(f.geometry())
        # Set attributes from sum_unique_values dictionary that we had computed
        new_feature.setAttributes([f[dissolve_field], sum_unique_values[f[dissolve_field]]
        sink.addFeature(new_feature, QgsFeatureSink.FastInsert)

    return {self.OUTPUT: dest_id}
```