gis-mit-jupyter

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0.1 FOSSGIS 2026

1 Kollaboratives GIS mit Jupyter Notebooks und JupyterGIS

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2 Sourcepole

- Web-GIS
  - QGIS Webclient (QWC)
  - qgiscloud.com
  - BBOX (T-rex) Vector Tile Server
- QGIS
  - 4 C++ Core Entwickler
  - QGIS Server, Drucken, Plugins, …
  - QGIS Enterprise Support
- Weitere OSGeo Projekte
  - Beiträge zu OGR/GDAL, PostGIS, MapServer, Openlayers, …
- Javascript, Python, C++ & Rust

3 Jupyter Notebooks

- "Jupyter" = Julia, Python und R
- Kann Code, Text und Graphen oder Diagramme enthalten
- Jupyter Lab: Webanwendung zur Erstellung von Jupyter-Notebook-Dokumenten
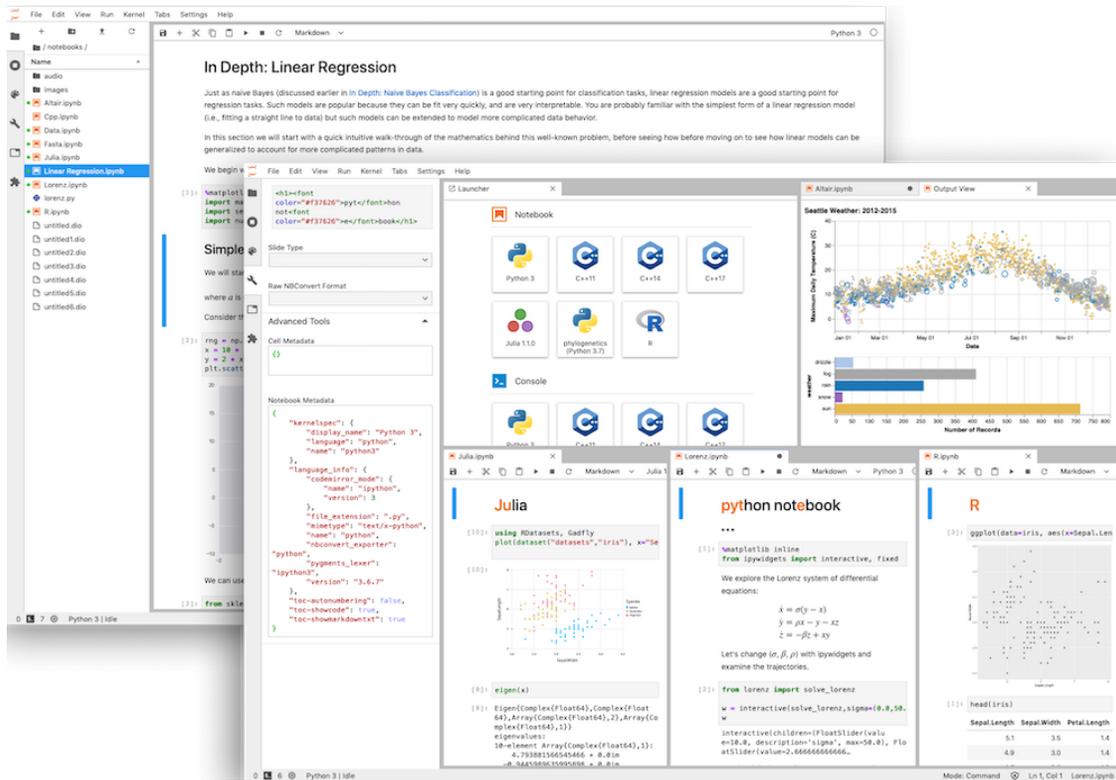
4 Jupyter Lab mit Python

```python
[1]: print("Hello Jupyter")
```

```
Hello Jupyter
```

```python
[5]: a = 2
```

```python
[6]: a
```

```
[6]: 2
```

```python
[7]: a+1
```

```
[7]: 3
```

5 Scientific computing mit Dataframes

5.1 Pandas

```python
[8]: import pandas as pd
```

```python
[9]: df = pd.DataFrame(
        {
            "Name": [
```

```
            "Braund, Mr. Owen Harris",
            "Allen, Mr. William Henry",
            "Bonnell, Miss Elizabeth",
        ],
        "Age": [22, 35, 58],
        "Sex": ["male", "male", "female"],
    }
)

df
```

[9]:
```
                    Name  Age     Sex
0      Braund, Mr. Owen Harris   22    male
1      Allen, Mr. William Henry   35    male
2      Bonnell, Miss Elizabeth   58  female
```

[11]:
```python
# single column -> Series
df["Age"]
```

[11]:
```
0    22
1    35
2    58
Name: Age, dtype: int64
```

[12]:
```python
df["Age"].max()
```

[12]: np.int64(58)

[13]:
```python
df.describe()
```

[13]:
```
              Age
count    3.000000
mean    38.333333
std     18.230012
min     22.000000
25%     28.500000
50%     35.000000
75%     46.500000
max     58.000000
```

5.2 Diagramme
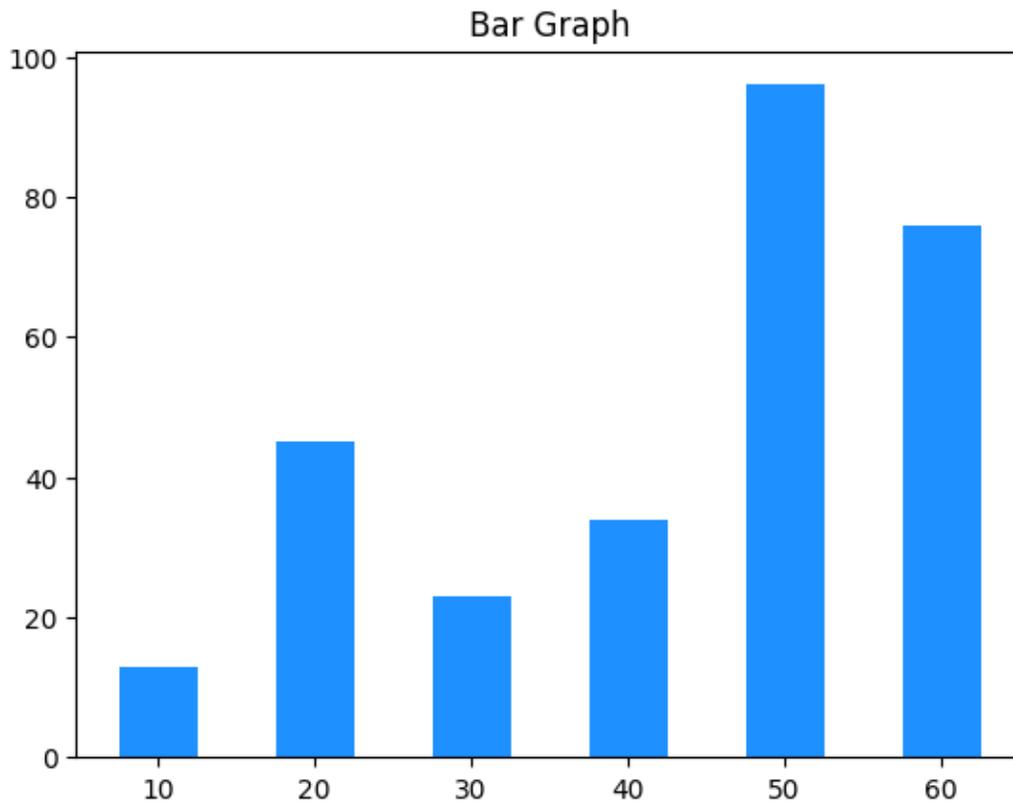
[7]:
```python
import matplotlib.pyplot as plt
```

[8]:
```python
x = [10, 20, 30, 40, 50, 60]
y = [13, 45, 23, 34, 96, 76]
plt.title('Bar Graph')
plt.bar(x, y, color='dodgerblue', width=5)
```

```
plt.show()
```


5.3 Interaktive Notebooks

```python
[9]:  # Plot Funktion
      import numpy as np

      def interactive_plot(amplitude, frequency):
          x = np.linspace(0, 2 * np.pi, 1000)
          y = amplitude * np.sin(frequency * x)
          plt.figure(figsize=(8, 4))
          plt.plot(x, y)
          plt.title('Interactive Sine Wave')
          plt.grid(True)
          plt.show()
```
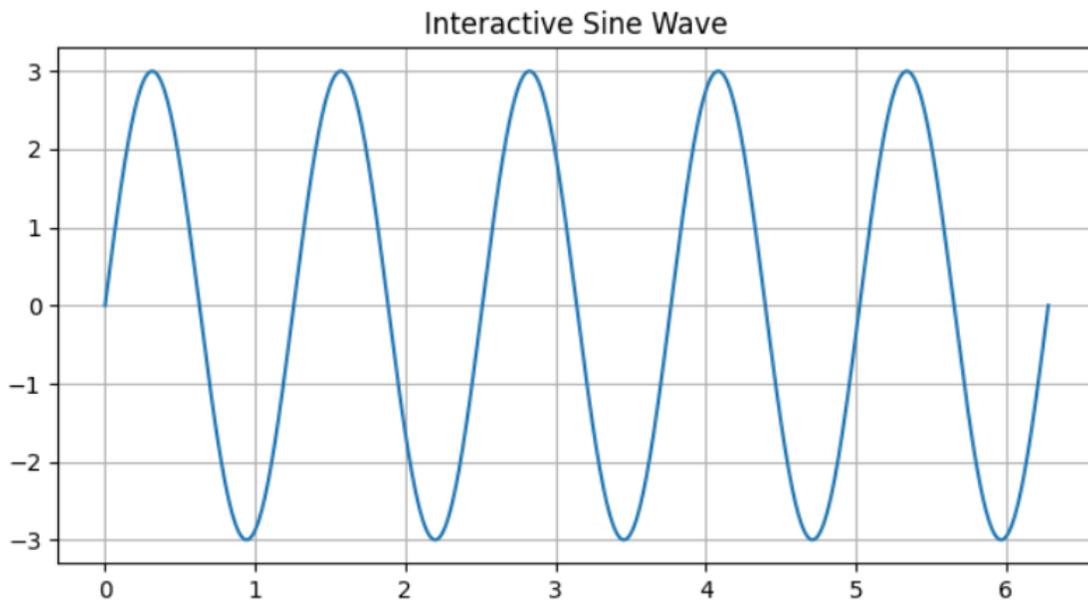
```python
[10]: # Interact Funktion
      from ipywidgets import interact

      interact(interactive_plot, amplitude=(1, 5, 0.1), frequency=(1, 10, 0.1))
```

```
interactive(children=(FloatSlider(value=3.0, description='amplitude', max=5.0,␣
 ↪min=1.0), FloatSlider(value=5.0…
```

[10]: `<function __main__.interactive_plot(amplitude, frequency)>`

5.4   GeoPandas

Erweitert Pandas um Geometrie-Typen und geographische Funktionen.

[19]:
```python
import geopandas
```

[20]:
```python
# Beispieldatensatz laden
from geodatasets import get_path

path_to_data = get_path("nybb")
gdf = geopandas.read_file(path_to_data)

gdf
```

[20]:
```
   BoroCode       BoroName    Shape_Leng      Shape_Area  \
0         5  Staten Island  330470.010332   1.623820e+09
1         4         Queens  896344.047763   3.045213e+09
2         3       Brooklyn  741080.523166   1.937479e+09
3         1      Manhattan  359299.096471   6.364715e+08
4         2          Bronx  464392.991824   1.186925e+09
```

```
                                    geometry
0  MULTIPOLYGON (((970217.022 145643.332, 970227…
1  MULTIPOLYGON (((1029606.077 156073.814, 102957…
2  MULTIPOLYGON (((1021176.479 151374.797, 102100…
3  MULTIPOLYGON (((981219.056 188655.316, 980940…
4  MULTIPOLYGON (((1012821.806 229228.265, 101278…
```

[21]:
```python
# Index setzen
gdf = gdf.set_index("BoroName")
```

[22]:
```python
# Berechnung der Fläche
gdf["area"] = gdf.area
gdf
```

[22]:
```
               BoroCode      Shape_Leng      Shape_Area  \
BoroName
Staten Island         5  330470.010332   1.623820e+09
Queens                4  896344.047763   3.045213e+09
Brooklyn              3  741080.523166   1.937479e+09
Manhattan             1  359299.096471   6.364715e+08
Bronx                 2  464392.991824   1.186925e+09


                                                  geometry          area
BoroName
Staten Island  MULTIPOLYGON (((970217.022 145643.332, 970227…   1.623822e+09
Queens         MULTIPOLYGON (((1029606.077 156073.814, 102957…   3.045214e+09
Brooklyn       MULTIPOLYGON (((1021176.479 151374.797, 102100…   1.937478e+09
Manhattan      MULTIPOLYGON (((981219.056 188655.316, 980940…   6.364712e+08
Bronx          MULTIPOLYGON (((1012821.806 229228.265, 101278…   1.186926e+09
```

[23]:
```python
# Plot der Geometrie
gdf.plot("area", legend=True)
```
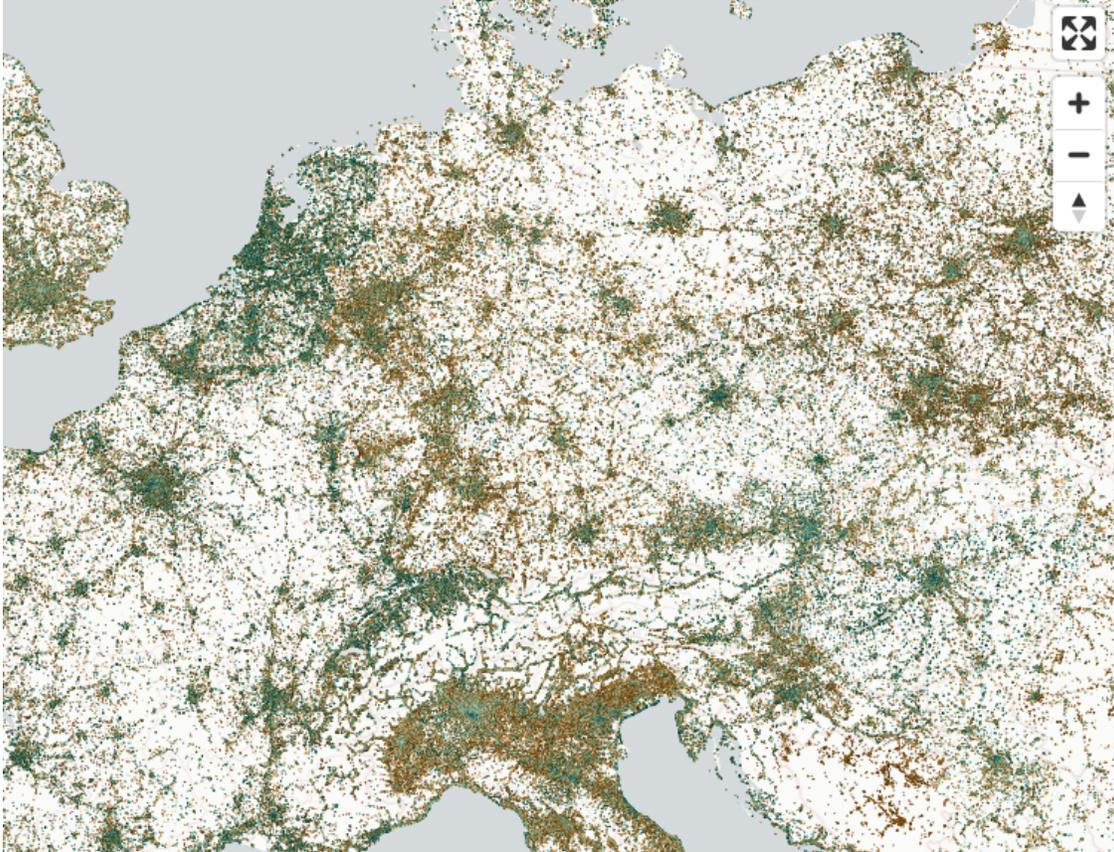
[23]: <Axes: >
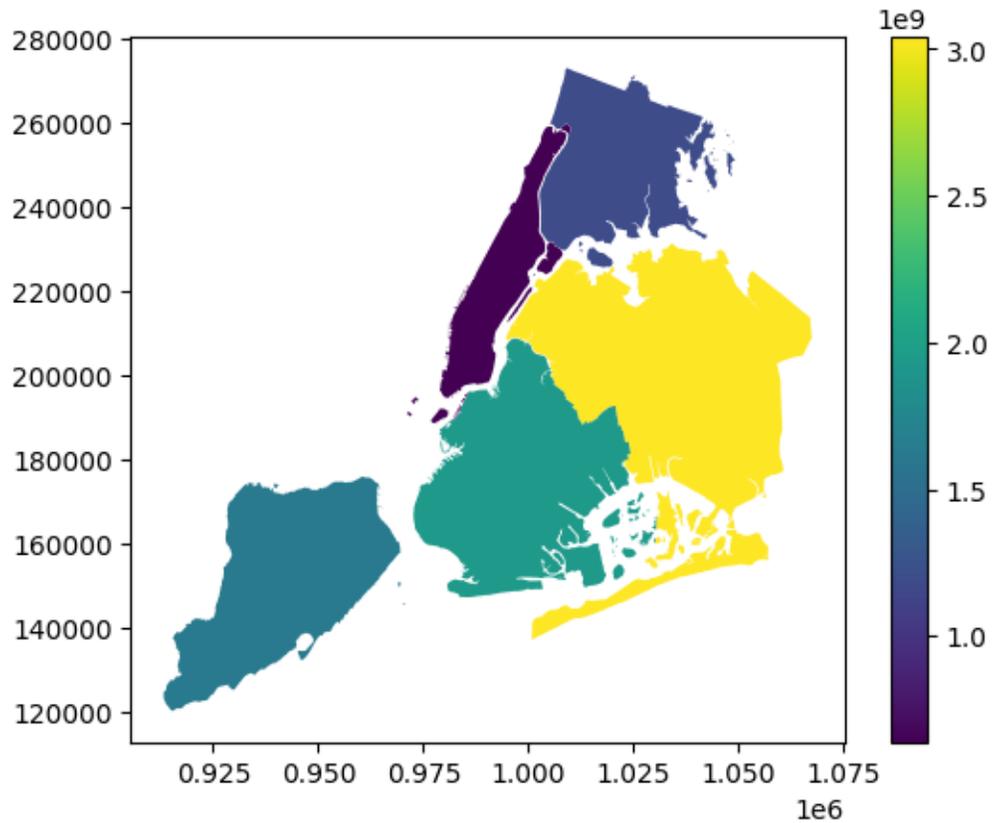
5.5 Bibliotheken

- Datenverarbeitung
  - Dask, Polars, ...
- Machine Learning
  - scikit-learn, ...
- Geo
  - MovingPandas, ...
- Tabellen
  - ITables, ...
- Kartenviewer
  - Folium, geemap, Lonboard, ...

5.5.1 Lonboard

Kartenviewer für grosse Datenmengen.

-> Demo

5.6   JupyterGIS

Kollaboratives GIS in JupyterLab

https://jupytergis.readthedocs.io/ | https://geojupyter.org/

- Gleichzeites Arbeiten mehrerer User am selben GIS-Projekt
- Grundlegende Unterstützung für den Import und Export von QGIS-Projektdateien.
- Python-API und Integration in kollaborative Jupyter-Notebook-Workflows.

5.6.1   Python API

```
[2]: from jupytergis import GISDocument

doc = GISDocument()

doc.add_raster_layer(url="https://tile.openstreetmap.org/{z}/{x}/{y}.png")

doc
```
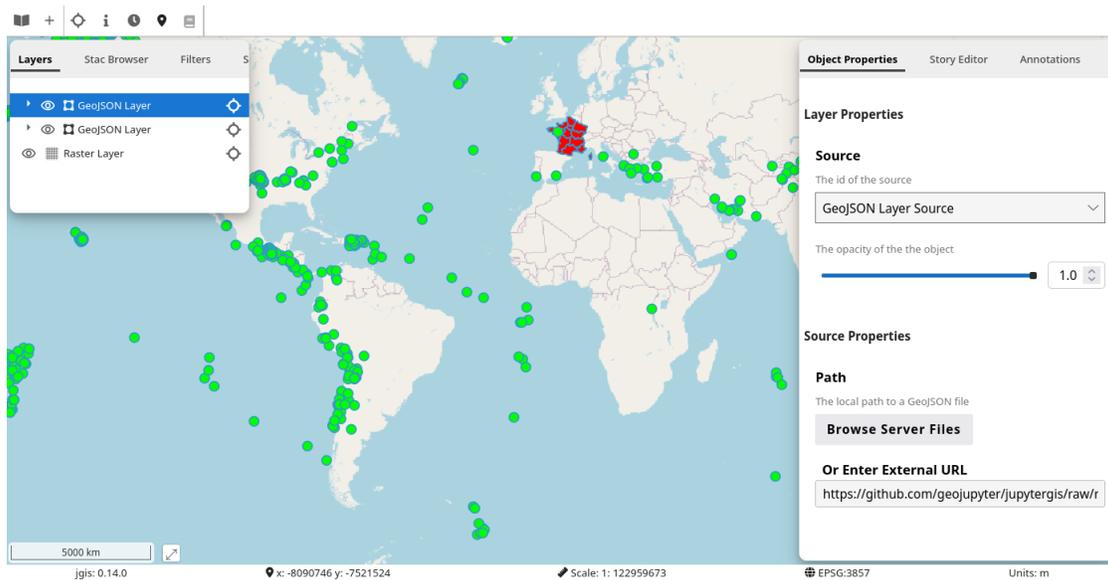
```
[2]: <jupytergis_lab.notebook.gis_document.GISDocument object at 0x7f92b82e46e0>
```

```
[3]: doc.add_geojson_layer(
         path="https://github.com/geojupyter/jupytergis/raw/refs/heads/main/examples/
     ↪data/france_regions.geojson", color_expr={"fill-color": "#FF0000"}
     )
     doc
```
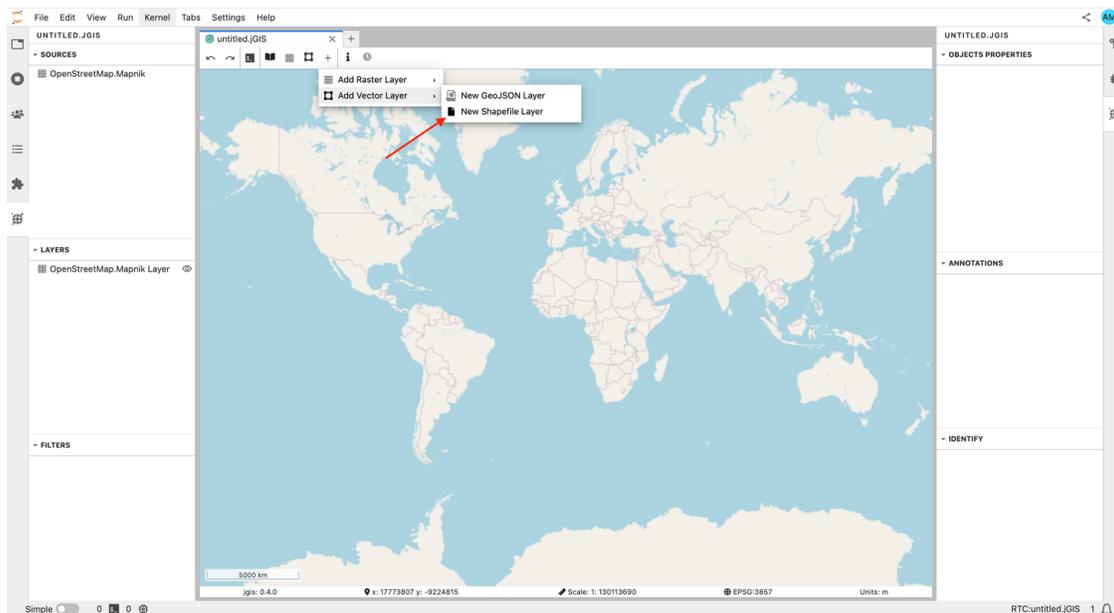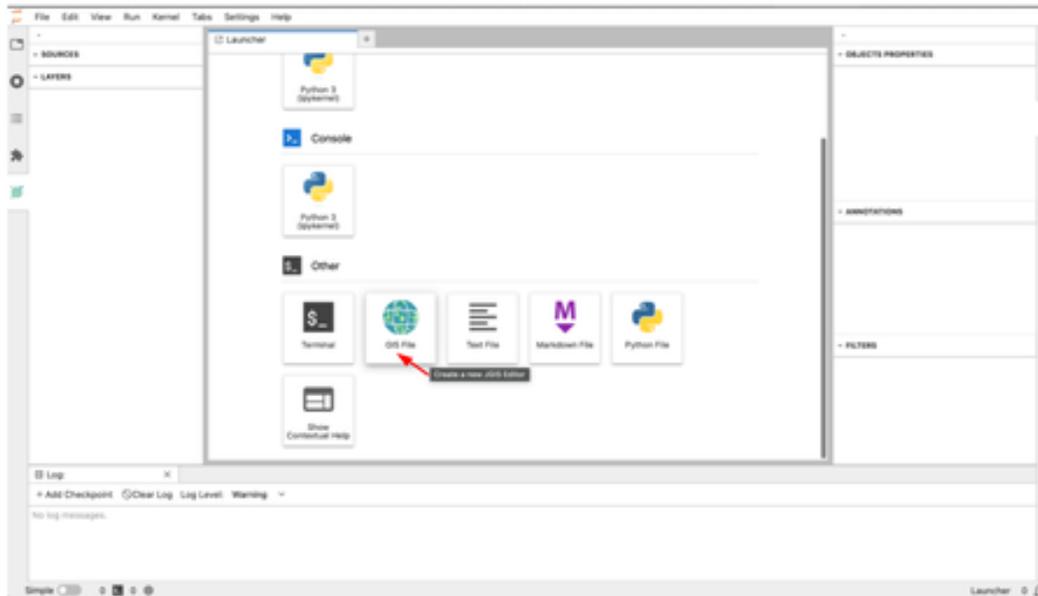
[3]: `<jupytergis_lab.notebook.gis_document.GISDocument object at 0x7f92b82e46e0>`

```
[4]: doc.add_geojson_layer(
         path="https://github.com/geojupyter/jupytergis/raw/refs/heads/main/examples/
     ↪data/eq.geojson", color_expr={"circle-fill-color": "#00FF00"}
     )
     doc
```

[4]: `<jupytergis_lab.notebook.gis_document.GISDocument object at 0x7f92b82e46e0>`

5.6.2 JuypterGIS

5.7 Vorteile von Notebooks

- Reproduzierbarkeit
- Workflows mit Dokumentation
- Datenexploration
- Kollaborationsfähigkeit

5.8   Jupyter Alternativen

- Quarto, …
- Jupyter in QGIS (Plugin: "Notebook")

5.9   Community / Resourcen

- https://pangeo.io/
- https://py.geocompx.org