```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
!pip install lets-plot --quiet
import lets_plot
lets_plot.__version__
```

```
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'4.4.0'
```

```
import numpy as np
import pandas as pd
import geopandas as gpd

from lets_plot import *
from lets_plot import tilesets
LetsPlot.setup_html()
LetsPlot.set(tilesets.NASA_GREYSCALE_SHADED_RELIEF_30M)
```

Volcanoes Coordinates

Volcano coordinates are given in DMS format and should be converted to decimal degrees for plotting on a map.

```
df_volc = pd.read_csv("/content/drive/MyDrive/일본/일본화산/Japan_Volcano.csv", encoding ='utf-8')
df_volc.head(3)
```

	Unnamed: 0	Name	Elevation_meters	Elevation_ft	Coordinates	Last_eruption	Region
0	0	Akaigawa Caldera	725	2379	43.083°N 140.817°E	1.3 Ma BP	Hokkaido
1	1	Mount Atosanupuri	512	1680	43.610°N 144.438°E	1000-200 BP	Hokkaido
2	2	Daisetsuzan Volcanic Group	2290	7513	43.663°N 142.854°E	AD 1739	Hokkaido

다음 단계: df_volc변수로 코드 생성 추천 차트 보기 New interactive sheet

```
def dms_to_decimal(dms_string):
    """
    Convert DMS coordinates to decimal degrees.

    >>> dms_to_decimal("99.539° E")
    99.539

    >>> dms_to_decimal("99.539° W")
    -99.539

    """
    degrees, direction = dms_string.split('° ')
    degrees = float(degrees)

    # Adjusting the sign based on direction
    if direction in ['S', 'W']:
        degrees *= -1

    return degrees
```

```
df_volc = df_volc.dropna(subset=['Coordinates'])

# Split 'Coordinates' DMS str.
lat_lon_dms = df_volc.Coordinates.str.split(' ').apply(lambda lst: lst[1:3])

# Remove BOM symbols (Wufeff) and
# convert DMS strings to decimal degrees.
lat_lon_dd = lat_lon_dms.apply(lambda lst: [dms_to_decimal(v.replace('Wufeff', '')) for v in lst])

# Create a GeoDataframe by adding the 'geometry' column.
latitudes = lat_lon_dd.apply(lambda pair: pair[0])
longitudes = lat_lon_dd.apply(lambda pair: pair[1])

gdf_volc = gpd.GeoDataFrame(df_volc, geometry=gpd.points_from_xy(longitudes, latitudes))
gdf_volc.head(3)
```

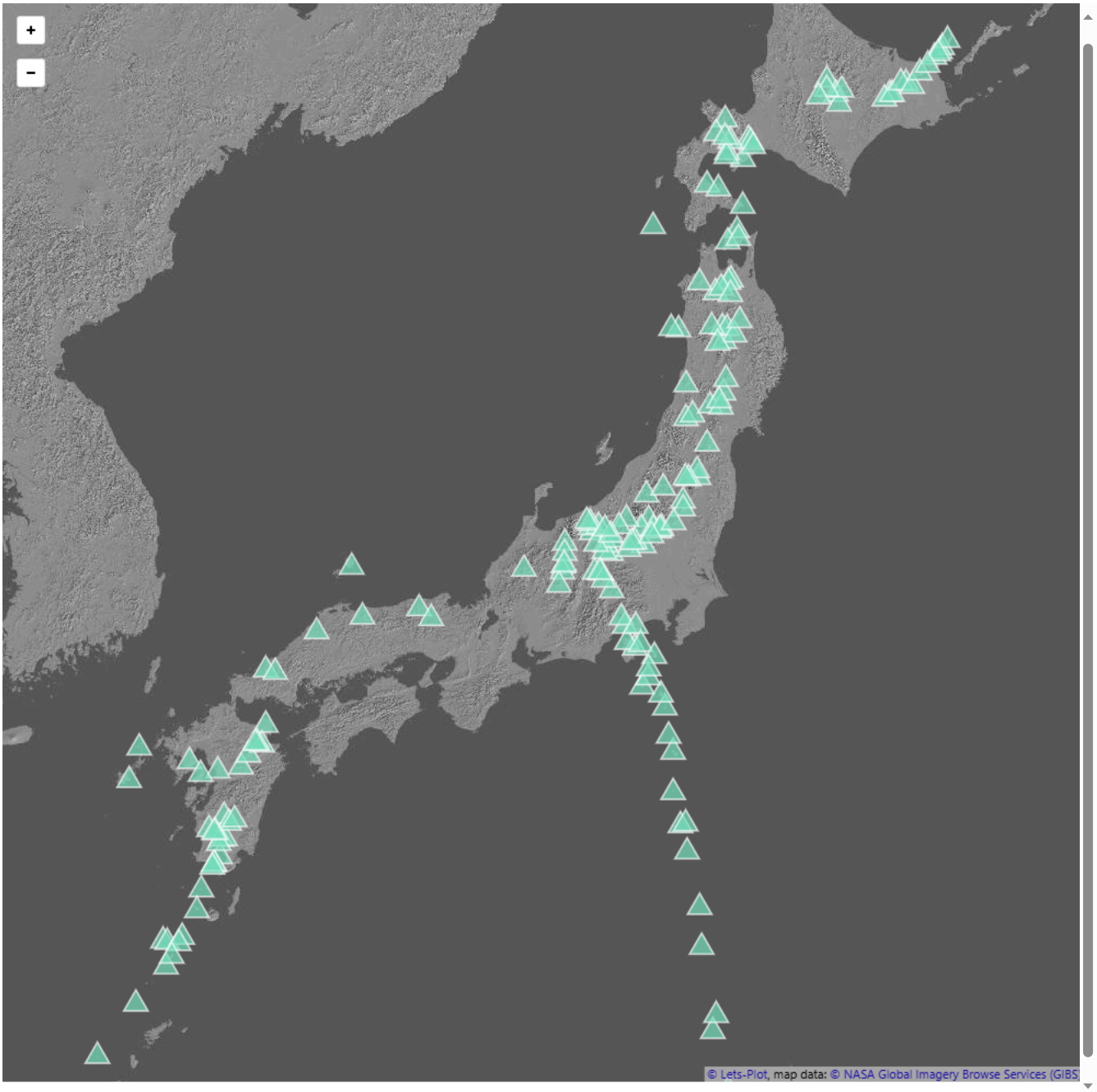
	Unnamed: 0	Name	Elevation_meters	Elevation_ft	Coordinates	Last_eruption	Region	geometry
0	0	Akaigawa Caldera	725	2379	43.083°N 140.817°E	1.3 Ma BP	Hokkaido	POINT (140.81700 43.08300)
1	1	Mount Atosanupuri	512	1680	43.610°N	1000-900 BP	Hokkaido	POINT (144.43800

다음 단계: gdf_volc변수로 코드 생성 | 추천 차트 보기 | New interactive sheet

Volcanoes on Map

```
nice_view_options = dict(
    location = [129.450953, 30.151413, 144.875758, 42.515155],
    zoom = 6
)


(ggplot() + geom_livemap(**nice_view_options, const_size_zoomin=2) +
 geom_point(data=gdf_volc,
            tooltips=layer_tooltips(["Region", "Last_eruption"])
                .title("@Name")
                .line("Elevation | @Elevation_meters(m)/@Elevation_ft(ft)"),
            fill='#75DFBD', color='white', shape=24, size=8, alpha=.7) +
 ggsize(1000, 1000)
)
```



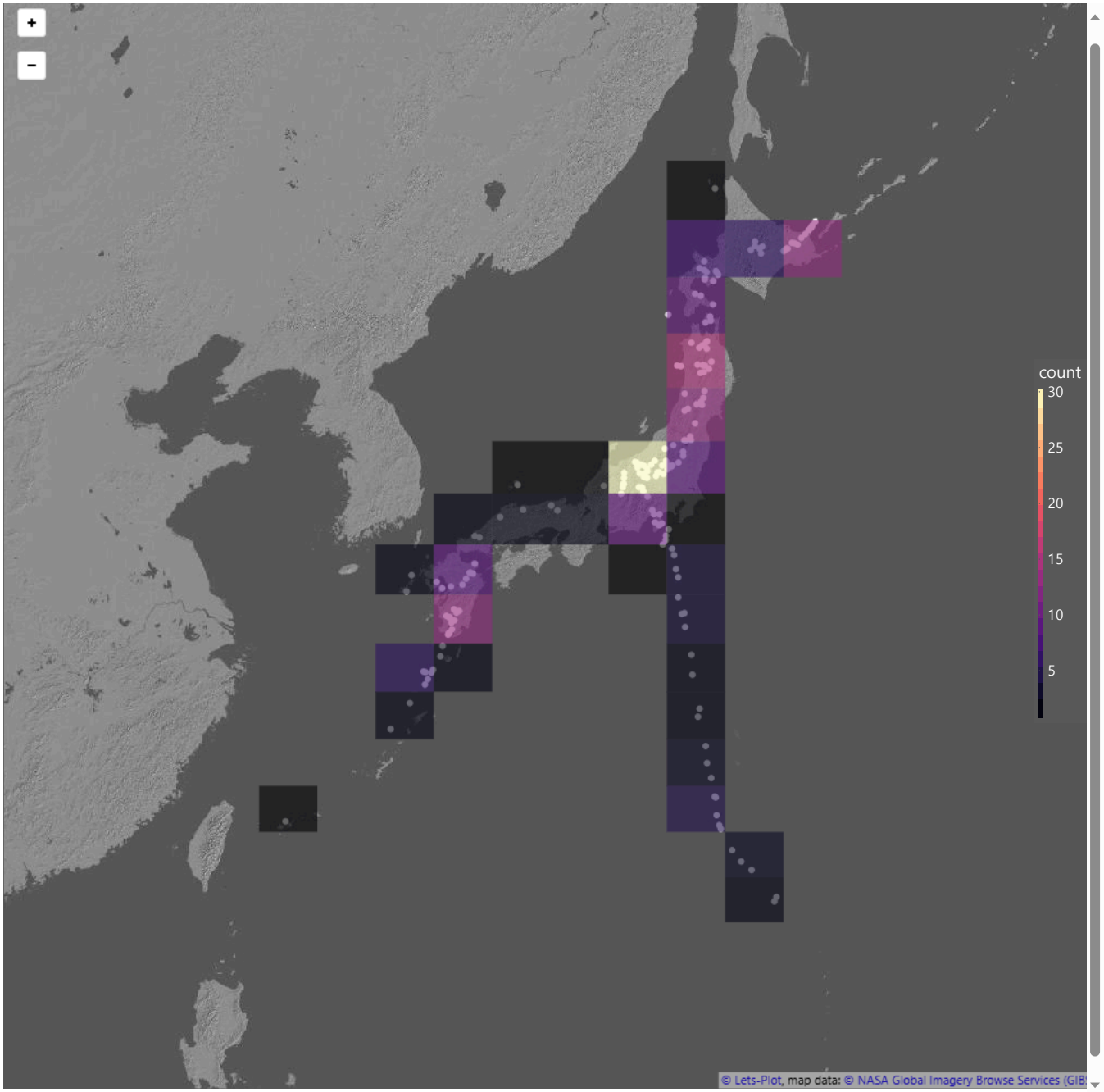
Volcanoes Heatmap

```
coords_data = dict(
    lon=longitudes,
    lat=latitudes
)

(ggplot(coords_data) + geom_livemap() +
 # Volcano locations
 geom_point(data=gdf_volc,
            tooltips=layer_tooltips(["Region", "Last_eruption"])
                .title("@Name")
                .line("Elevation | @Elevation_meters(m)/@Elevation_ft(ft)"),
            color='white', size=2) +

 # Heatmap by Count-2D stat.
 geom_bin2d(aes("lon", "lat"), bins=[10, 15], alpha=.6, tooltips='none') +

 scale_fill_viridis(option='magma', guide=guide_colorbar(barwidth=4, barheight=300)) +
 flavor_high_contrast_dark() +
 theme(plot_background=element_rect(fill='#585858')) +
 theme(legend_position=[1, 0.5], legend_justification=[1, 0.5], legend_background=element_rect(fill='#585858'),
       plot_inset=0) +
 ggsize(1000, 1000)
)
```



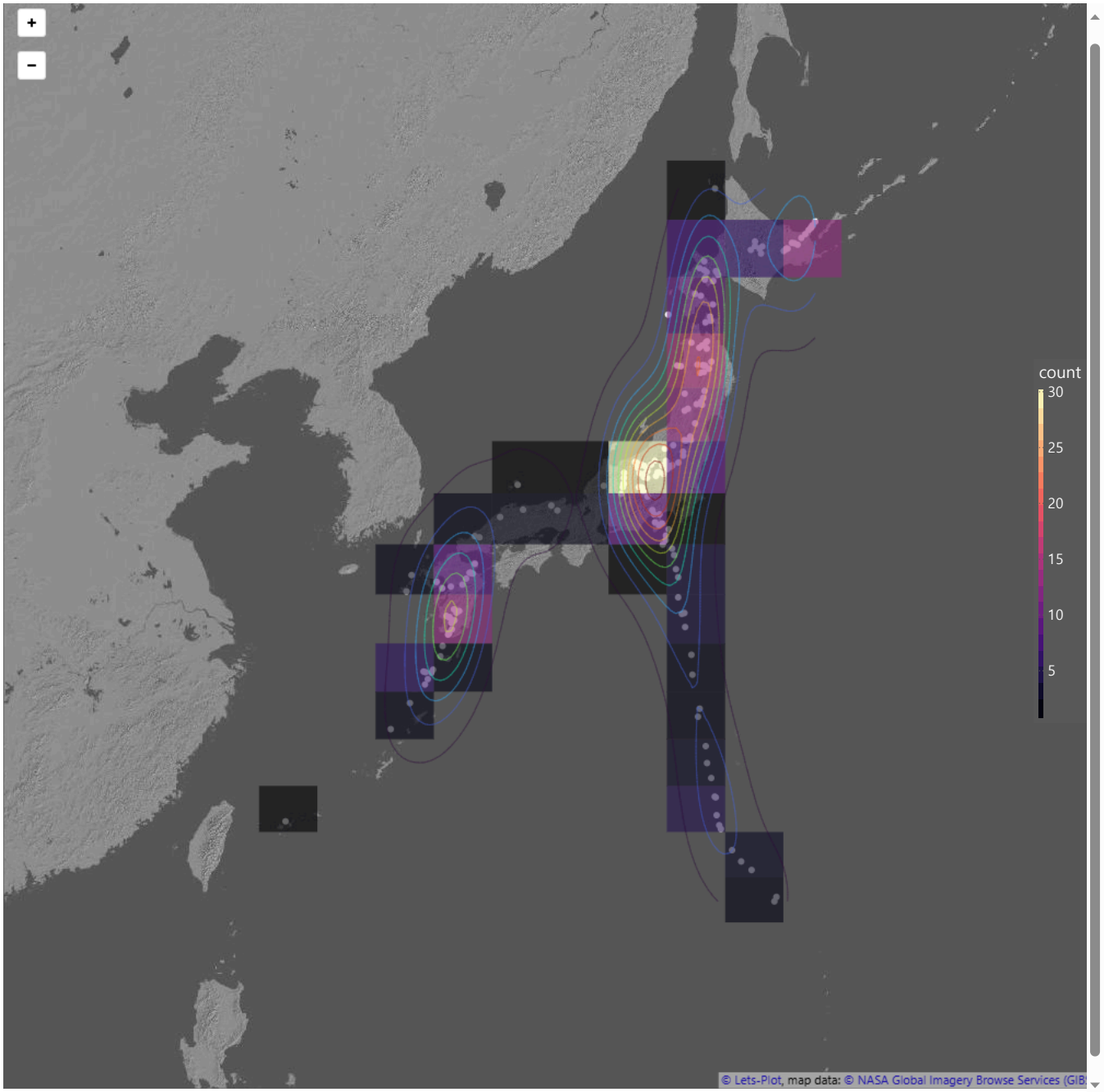
Heatmap and Contours of a 2D Density

```
(ggplot(coords_data) + geom_livemap() +
 # Volcano locations
 geom_point(data=gdf_volc,
            tooltips=layer_tooltips(["Region", "Last_eruption"])
                .title("@Name")
                .line("Elevation | @Elevation_meters(m)/@Elevation_ft(ft)"),
            color='white', size=2) +

 # Heatmap by Count-2D stat.
 geom_bin2d(aes("lon", "lat"), bins=[10, 15], alpha=.6, tooltips='none') +
 scale_fill_viridis(option='magma', guide=guide_colorbar(barwidth=4, barheight=300)) +

 # Contours by Density-2D stat.
 geom_density2d(aes("lon", "lat", color='..level..'), size=0.4, alpha=.6, tooltips='none', show_legend=False) +
 scale_color_viridis(option='turbo') +

 flavor_high_contrast_dark() +
 theme(plot_background=element_rect(fill='#585858')) +
 theme(legend_position=[1, 0.5], legend_justification=[1, 0.5], legend_background=element_rect(fill='#585858'),
       plot_inset=0) +
 ggsize(1000, 1000)
)
```



Filled Contour Bands

```
(ggplot(coords_data) + geom_livemap() +
 # Volcano locations
 geom_point(data=gdf_volc,
            tooltips=layer_tooltips(["Region", "Last_eruption"])
                .title("@Name")
                .line("Elevation | @Elevation_meters(m)/@Elevation_ft(ft)"),
            color='white', size=2) +

 # Contours by Density-2D Filled stat.
 geom_density2df(aes("lon", "lat", fill='..level..'), alpha=.6, tooltips='none', show_legend=False) +
 scale_fill_viridis(option='magma') +

 flavor_high_contrast_dark() +
 theme(plot_background=element_rect(fill='#585858'),
       plot_inset=0) +
 ggsize(1000, 1000)
)
```