

Author: David Zhen Yin, [yinzhen@stanford.edu](mailto:yinzhen@stanford.edu) (<mailto:yinzhen@stanford.edu>); Lijing Wang, [lijing52@stanford.edu](mailto:lijing52@stanford.edu) (<mailto:lijing52@stanford.edu>); Jef Caers, [jcaers@stanford.edu](mailto:jcaers@stanford.edu) (<mailto:jcaers@stanford.edu>) (2020)

## 1 Load datasets

```
In [ ]: ## Clone data from our GitHub repository  
! git clone https://github.com/sdyinzhen/GS240_resources.git
```

```
In [ ]: pip install geopandas
```

```
In [4]: %matplotlib inline  
%config InlineBackend.figure_format = 'retina'  
import numpy as np  
import matplotlib.pyplot as plt  
import matplotlib  
import pandas as pd  
from shapely.geometry import Point  
import geopandas as gpd  
from geopandas import GeoDataFrame  
import datetime
```

/usr/local/lib/python3.6/dist-packages/statsmodels/tools/\_testing.py:19: FutureWarning: pandas.util.testing is deprecated. Use the functions in the public API at pandas.testing instead.

```
import pandas.util.testing as tm
```

## 2 Overview of Earthquake dataset

We plot distributions of the global earthquake dataset

### 2.1 Global

```
In [ ]: earthq_data = pd.read_csv('/content/GS240_resources/EVS_Earthquakes/global_database.csv')
```

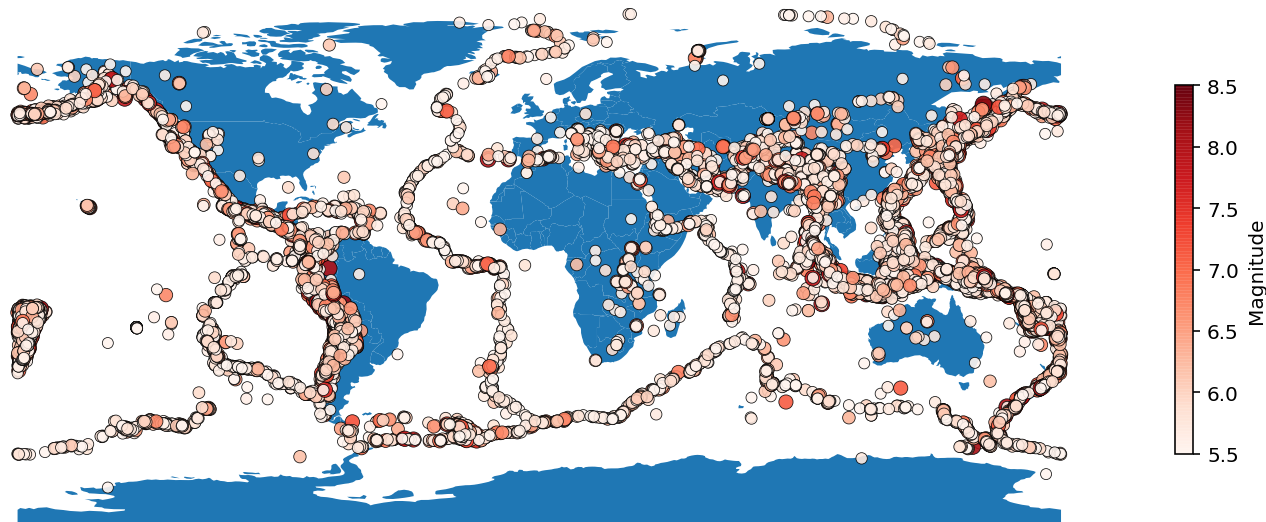
```
In [11]: world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
geometry = [Point(xy) for xy in zip(earthq_data['Longitude'], earthq_data['Latitude'])]
gdf = GeoDataFrame(earthq_data[['Longitude', 'Latitude']], geometry=geometry)
world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
# gdf.plot(ax=, marker='o', color='red', markersize=15);

world.plot(figsize=(11, 6))
plt.scatter(earthq_data['Longitude'], earthq_data['Latitude'], marker='o',
            c=earthq_data['Magnitude'], cmap='Reds', vmin = 5.5, vmax= 8.5, alpha=0.9,
            s=earthq_data['Magnitude']**2, linewidths=0.4, edgecolors='k')

plt.colorbar(label='Magnitude', fraction=0.015)

plt.title('Significant Earthquakes (>= M5.5), 1965-2016', fontsize = 15)
plt.axis('off')
plt.show()
```

Significant Earthquakes (>= M5.5), 1965-2016



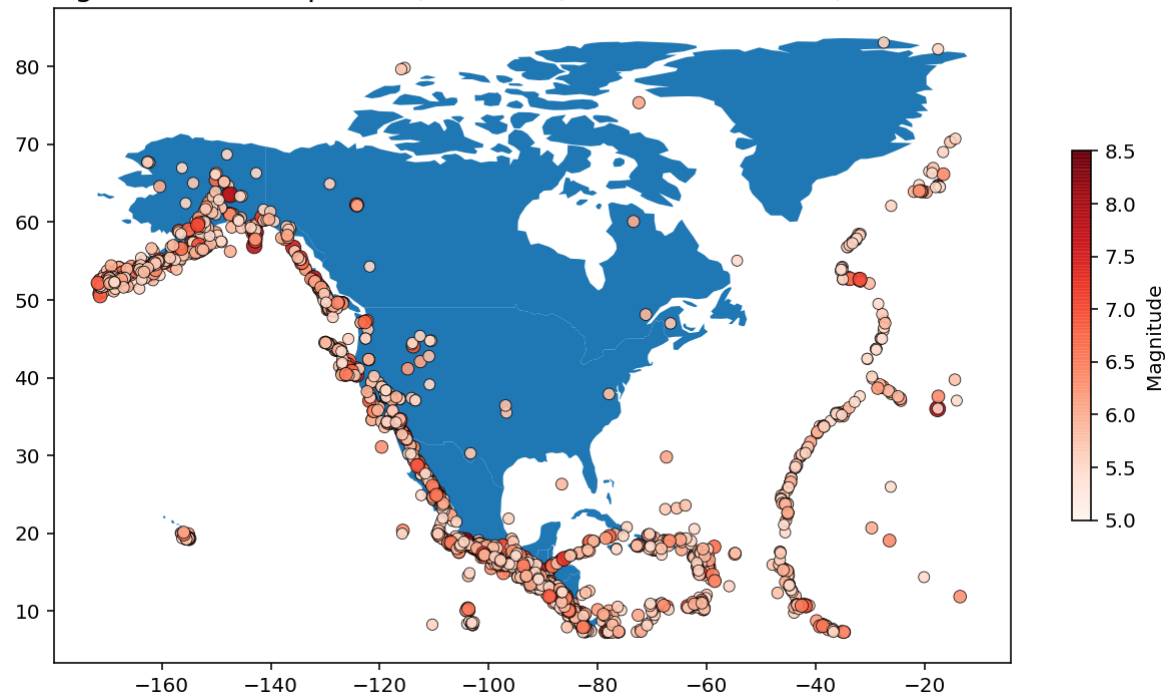
## 2.2 North America

```
In [7]: nor_am_earthq = pd.read_csv('/content/GS240_resources/EVS_Earthquakes/north_america_earthquakes.csv')
```

```
In [8]: print('Total {} earthquake events >= M5.5 '.format(len(nor_am_earthq['Longitude'])))
world[world.continent == 'North America'].plot(figsize=(11, 6))
plt.scatter(nor_am_earthq['Longitude'], nor_am_earthq['Latitude'], marker='o',
            c=nor_am_earthq['Magnitude'], cmap='Reds', vmin = 5, vmax= 8.5, alpha=0.9,
            s=nor_am_earthq['Magnitude']**2, linewidths=0.4, edgecolors='k')
plt.colorbar(label='Magnitude', fraction=0.015)
plt.title('Significant Earthquakes (>= M5.5) in North America, 1965-2016', fontsize = 15)
plt.show()
```

Total 2152 earthquake events >= M5.5

Significant Earthquakes (>= M5.5) in North America, 1965-2016



## 2.3 Asia

```
In [9]: asia_earthq = pd.read_csv('/content/GS240_resources/EVS_Earthquakes/asia_earthquakes.csv')
```

```
In [10]: print('Total {} earthquake events >= M5.5 '.format(len(asia_earthq['Longitude'])))
world[world.continent == 'Asia'].plot(figsize=(11, 6))
plt.scatter(asia_earthq['Longitude'], asia_earthq['Latitude'], marker='o',
            c=asia_earthq['Magnitude'], cmap='Reds', vmin = 5, vmax= 8.5, alpha=0.9,
            s=asia_earthq['Magnitude']**2, linewidths=0.4, edgecolors='k')
plt.colorbar(label='Magnitude', fraction=0.015)
plt.title('Significant Earthquakes (>= M5.5) in Asia, 1965-2016', fontsize = 15)
plt.show()
```

Total 8039 earthquake events >= M5.5

