SRTP project analysis Group 9 (Andaman)

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Data obtained from the ISC catalogue at http://www.isc.ac.uk/iscbulletin/search/catalogue/ for the Andaman Region for the years 1980 to 2020 and for min magnitude M_b = 0.1 to max magnitude M_b = 10, where M_b is the Body wave magnitude of the earthquake and for min. depth of 0 to max. depth of 6731 $\approx$ Radius of earth or R_e.

In [87]:

```
import pandas as pd
import requests
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import scipy.stats as stats
plt.style.use('seaborn-pastel')

import geopandas as gpd
from descartes import PolygonPatch
from matplotlib.animation import FuncAnimation
# from matplotlib.patches import Polygon
```

In [88]:

```
df = pd.read_csv('Andaman_data.csv')
```

In [89]:

```
df.head()
```

Out[89]:

	year	month	date	Time	latitude	longitude	depth	magnitude	DATE
0	1980	2	21	16:05:50	10.5276	92.9652	78.7	4.6	1980-02-21
1	1980	5	26	11:37:30	11.0789	92.8553	43.2	4.8	1980-05-26
2	1980	8	20	6:21:54	11.0277	92.9682	54.0	5.0	1980-08-20
3	1980	9	29	0:18:31	13.0346	93.0987	32.0	4.5	1980-09-29
4	1980	10	31	8:01:10	12.2750	92.8534	41.0	4.6	1980-10-31

In [90]:

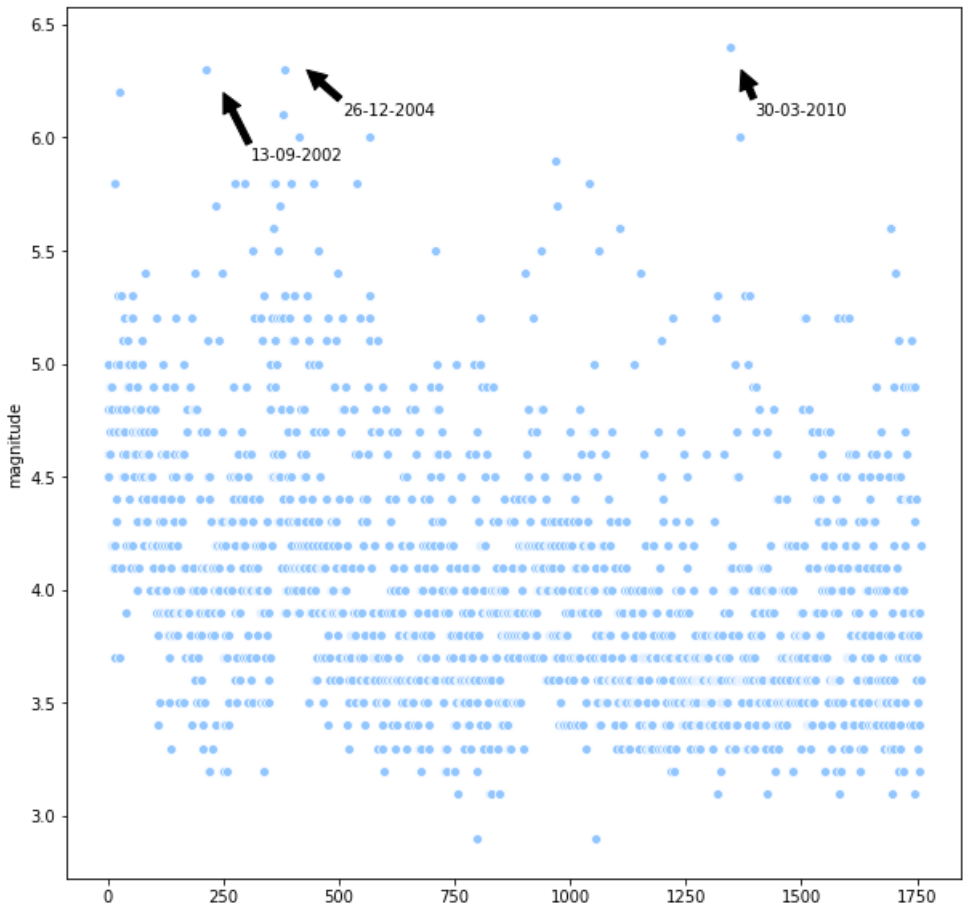
```
df.describe()
```

Out[90]:

	year	month	date	latitude	longitude	depth	magnitude
count	1759.000000	1759.000000	1759.000000	1759.000000	1759.000000	1759.000000	1759.000000
mean	2006.017624	6.469585	17.370665	12.217075	92.725736	25.825867	4.017112
std	6.697191	3.901819	9.060043	1.072680	0.445045	27.593395	0.543749
min	1980.000000	1.000000	1.000000	10.280000	91.900600	0.000000	2.900000
25%	2004.000000	3.000000	10.000000	11.174000	92.370050	0.000000	3.600000
50%	2005.000000	6.000000	17.000000	12.438400	92.749400	26.400000	3.900000
75%	2009.000000	10.000000	26.000000	13.137250	93.065350	32.450000	4.300000
max	2020.000000	12.000000	31.000000	13.727700	93.586700	291.600000	6.400000

In [91]:

```
plt.figure(figsize=(10,10))
sns.scatterplot(y="magnitude", x=df.magnitude.index , data=df)
plt.annotate('30-03-2010', xy=(1370, 6.3), xytext=(1400, 6.1),arrowprops=dict(facecolor='black', sh
rink=0.01),)
plt.annotate('26-12-2004', xy=(430, 6.3), xytext=(510, 6.1),arrowprops=dict(facecolor='black', shri
nk=0.01),)
plt.annotate('13-09-2002', xy=(250, 6.2), xytext=(310, 5.9),arrowprops=dict(facecolor='black', shri
nk=0.01),)
plt.savefig('overall_earthquakes_andaman.png')
```

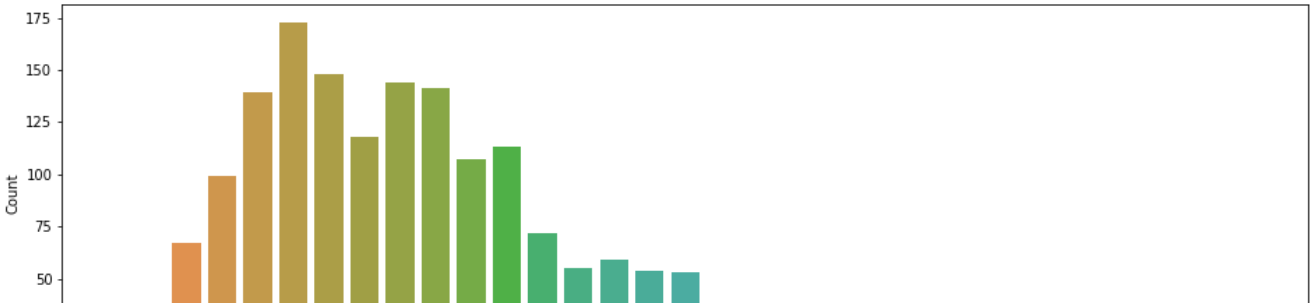


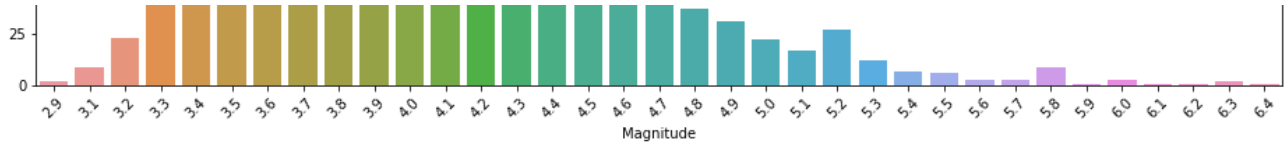
In [24]:

```
#group by magnitude counts
df_magnitude_count = pd.DataFrame(df.magnitude.groupby(df.magnitude).count())
df_magnitude_count['index'] = df_magnitude_count.index
df_magnitude_count.columns = ["Count","Magnitude"]
```

In [92]:

```
plt.figure(figsize=(16,5))
ax = sns.barplot(x="Magnitude", y="Count", data=df_magnitude_count)
ax.set_xticklabels(ax.get_xticklabels(),rotation=45)
plt.savefig('magnitude_count_andaman.png')
```





Earthquake Magnitude classes

In [26]:

```
scale = []
for magnitude in df.magnitude:
    if magnitude >= 3.0 and magnitude <=3.9:
        scale.append("Limited Damage")
    elif magnitude >=4.0 and magnitude <=4.9:
        scale.append("Minor Damage")
    elif magnitude >=5.0 and magnitude <=5.9:
        scale.append("Slight Damage")
    elif magnitude >=6.0 and magnitude <=6.9:
        scale.append("Severe Damage")
    elif magnitude >=7.0 and magnitude <=7.9:
        scale.append("Serious Damage")
    else:
        scale.append("Great Damage")
```

In [27]:

```
df['scale'] = scale
```

In [28]:

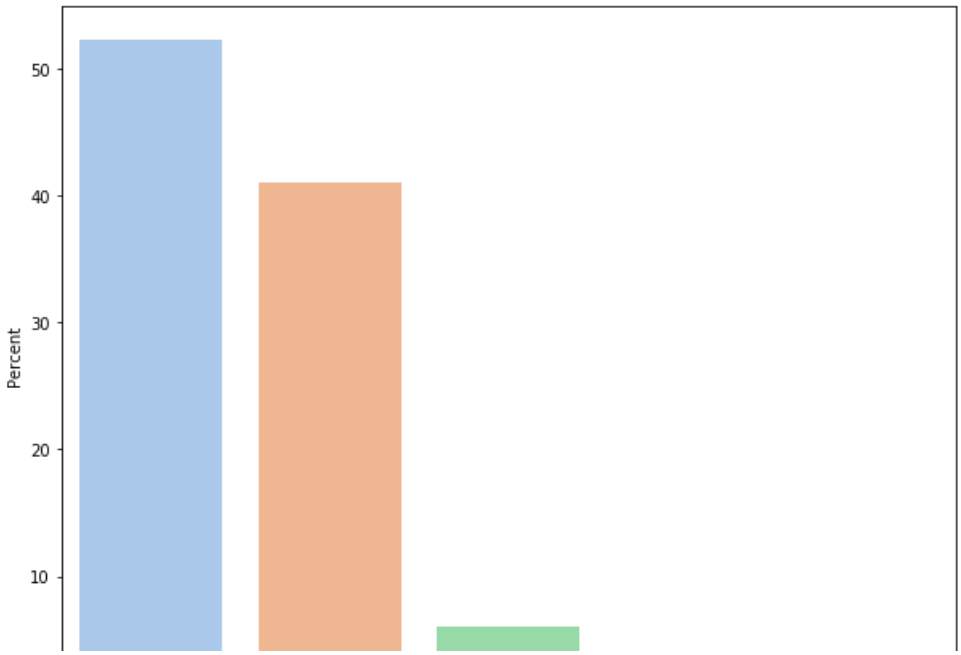
```
df_damage_count = pd.DataFrame(df.scale.groupby(df.scale).count().sort_values(ascending=False))
df_damage_count['percent'] = ((df_damage_count.scale)/sum(df_damage_count.scale))*100
```

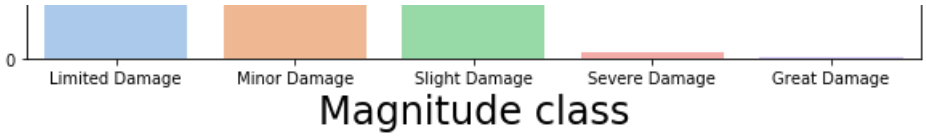
In [29]:

```
plt.figure(figsize=(10,8))
sns.barplot(df_damage_count.index,df_damage_count.percent, palette="pastel")
# plt.xticks(df_damage_count.index, rotation= 10)
plt.ylabel('Percent')
plt.xlabel('Magnitude class', fontsize=24)
```

Out[29]:

```
Text(0.5, 0, 'Magnitude class')
```





Magnitude class size: "Great", "Major", "Strong", "Moderate", "Light", "Minor", "Less than 3.9")

In [30]:

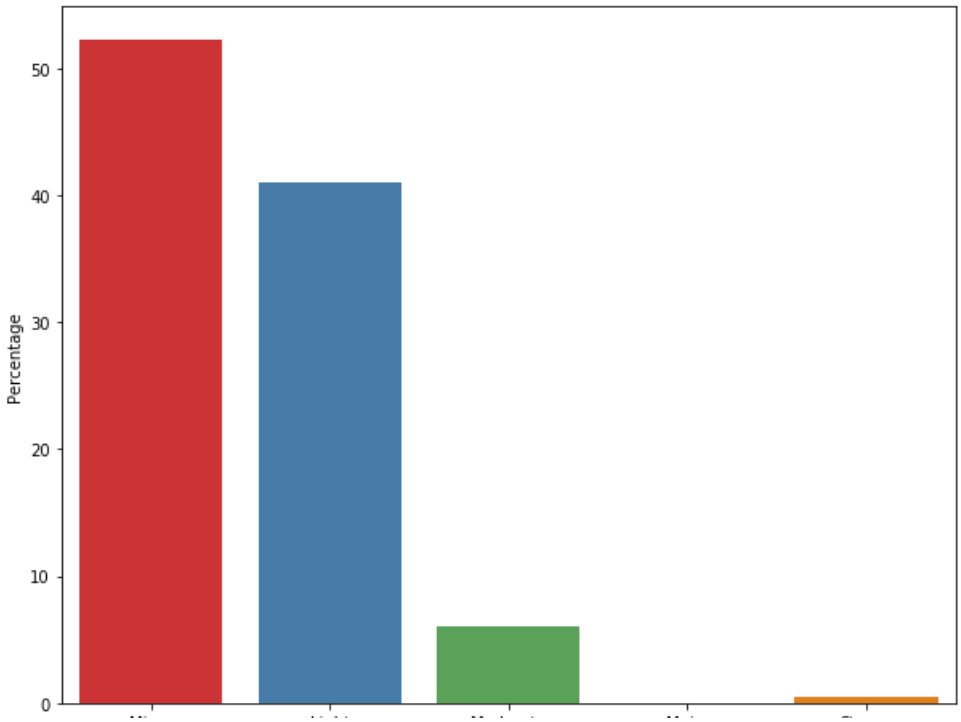
```
#array for storing the size_class
size_class = []

for magnitude in df.magnitude:
    if magnitude >= 3.0 and magnitude <=3.9:
        size_class.append("Minor")
    elif magnitude >=4.0 and magnitude <=4.9:
        size_class.append("Light")
    elif magnitude >=5.0 and magnitude <=5.9:
        size_class.append("Moderate")
    elif magnitude >=6.0 and magnitude <=6.9:
        size_class.append("Strong")
    elif magnitude >=7.0 and magnitude <=7.9:
        size_class.append("Major")
    else:
        size_class.append("Great")

#Creating a column in the datafram called class_size
df['size_class'] = size_class
```

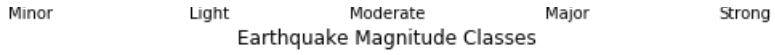
In [31]:

```
df_size_class = pd.DataFrame(df.size_class.groupby(df.size_class).count())
df_size_class['percent'] = ((df_size_class.size_class)/sum(df_size_class.size_class))*100
```

In [93]:

```
plt.figure(figsize=(10,8))
sns.barplot(df_size_class.index,df_size_class.percent, palette="Set1", order = ['Minor','Light','Mo
derate',
                                                                                'Major',
                                                                               'Strong'])
plt.ylabel('Percentage')
plt.xlabel('Earthquake Magnitude Classes', fontsize=12)
plt.savefig('magnitude_classes_andaman.png')
```





Earthquake Magnitude Classes

In [94]:

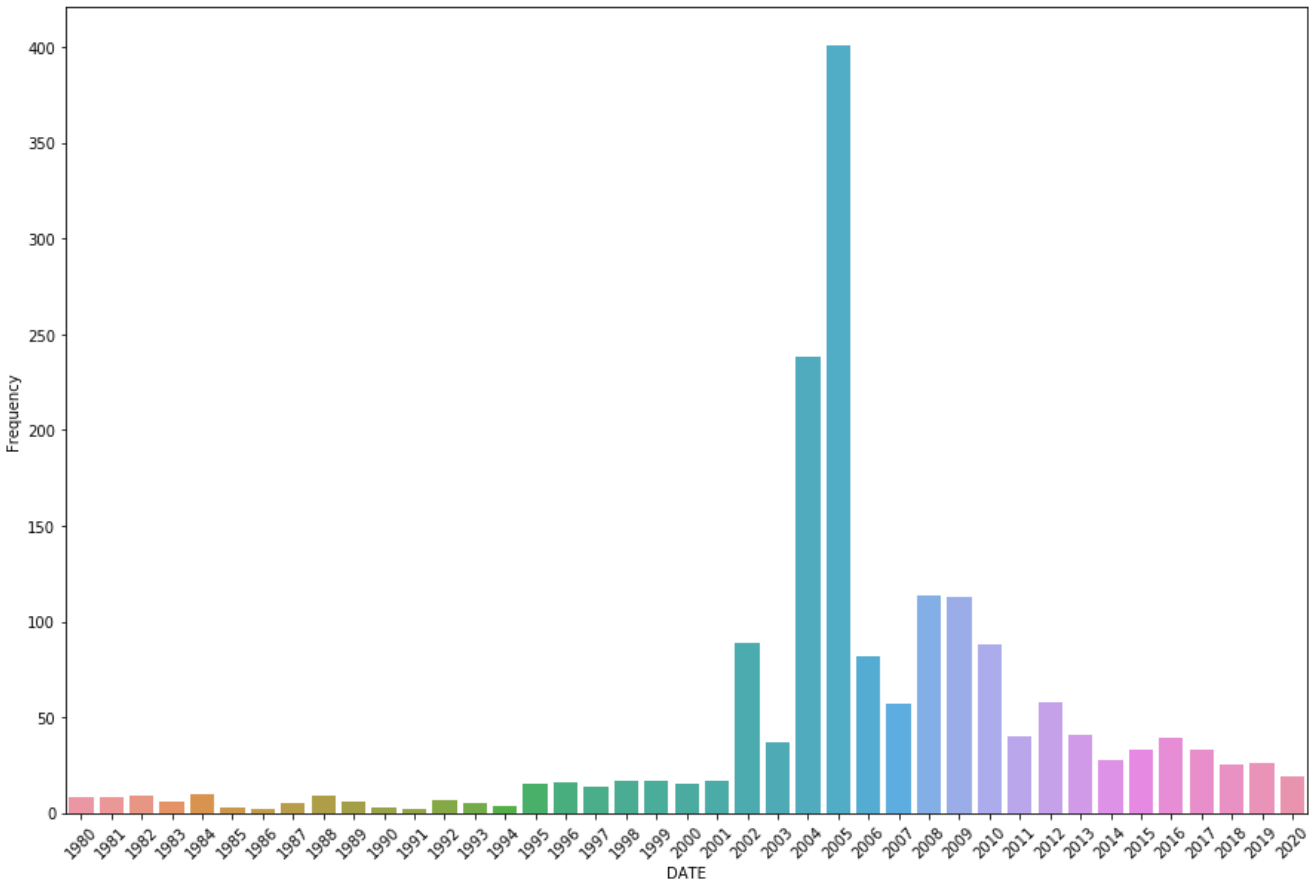
```
mag_class = []
for magnitude in df.magnitude:
    if magnitude >= 3.0 and magnitude <=3.9:
        mag_class.append("3-3.9")
    elif magnitude >=4.0 and magnitude <=4.9:
        mag_class.append("4-4.9")
    elif magnitude >=5.0 and magnitude <=5.9:
        mag_class.append("5-5.9")
    elif magnitude >=6.0 and magnitude <=6.9:
        mag_class.append("6-6.9")
    elif magnitude >=7.0 and magnitude <=7.9:
        mag_class.append("7-7.9")
    else:
        mag_class.append("Above 8")
df['mag_class'] = mag_class
```

In [95]:

```
df['DATE'] = pd.to_datetime(df['DATE'], errors='coerce')
group_by_year = pd.DataFrame(df.magnitude.groupby([df['DATE'].dt.year]).count())
group_by_year.columns = ['Frequency']
```

In [96]:

```
plt.figure(figsize=(15,10))
by_year = sns.barplot(x=group_by_year.index, y=group_by_year.Frequency)
by_year.set_xticklabels(by_year.get_xticklabels(),rotation=45)
plt.savefig('yearly_eq_andaman.png')
```



In [97]:

```
df.head()
```

Out[97]:

	year	month	date	Time	latitude	longitude	depth	magnitude	DATE	mag_class
0	1980	2	21	16:05:50	10.5276	92.9652	78.7	4.6	1980-02-21	4-4.9
1	1980	5	26	11:37:30	11.0789	92.8553	43.2	4.8	1980-05-26	4-4.9
2	1980	8	20	6:21:54	11.0277	92.9682	54.0	5.0	1980-08-20	5-5.9
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4	1980	10	31	8:01:10	12.2750	92.8534	41.0	4.6	1980-10-31	4-4.9

In [99]:

```
df.drop(['mag_class'],axis=1,inplace=True)
df.head()
```

Out[99]:

	year	month	date	Time	latitude	longitude	depth	magnitude	DATE
0	1980	2	21	16:05:50	10.5276	92.9652	78.7	4.6	1980-02-21
1	1980	5	26	11:37:30	11.0789	92.8553	43.2	4.8	1980-05-26
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4	1980	10	31	8:01:10	12.2750	92.8534	41.0	4.6	1980-10-31

In [101]:

```
df.to_csv(r'Andaman.csv', index = False)
```

In [ ]:

```

```