Data Preprocessing

Importing Required Libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Load the dataset

In [2]:
```
data = pd.read_csv('events.csv')
```

In [3]:
```
data.head()
```

Out[3]:

	date	latitude	longitude	event-type	city	county	state
0	01-01-2003 05:00	26.33	-81.14	FLOOD	UNKNOWN	HILLSBOROUGH	FL
1	01-01-2003 05:00	27.22	-81.13	FLOOD	UNKNOWN	MANATEE	FL
2	01-01-2003 08:00	45.28	-120.12	FLOOD	UNKNOWN	SOUTH CENTRAL OREGON COAST	OR
3	01-01-2003 14:15	38.54	-86.03	FLOOD	UNKNOWN	JACKSON	IN
4	01-01-2003 18:00	38.59	-85.38	FLOOD	UNKNOWN	JEFFERSON	IN

In [4]:
```
data.tail()
```

Out[4]:

	date	latitude	longitude	event-type	city	county	state
370246	10-10-2022 19:10	18.38	-66.12	FLASH FLOOD	GUAYNABO	GUAYNABO	PR
370247	10-10-2022 19:43	18.39	-66.14	FLASH FLOOD	1 ENE BAYAMON	BAYAMON	PR
370248	10-10-2022 20:36	18.44	-66.18	FLOOD	LEVITTOWN	TOA BAJA	PR
370249	10-10-2022 21:16	37.25	-112.95	FLASH FLOOD	ZION NP	WASHINGTON	UT
370250	10-10-2022 23:30	30.89	-102.89	FLASH FLOOD	FORT STOCKTON	PECOS	TX

Display basic information about the dataset

In [5]:
```
print(data.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 370251 entries, 0 to 370250
Data columns (total 7 columns):
 #   Column      Non-Null Count   Dtype  
---  ------      --------------   -----  
 0   date        370251 non-null  object 
 1   latitude    370251 non-null  float64
 2   longitude   370251 non-null  float64
 3   event-type  370251 non-null  object 
 4   city        370247 non-null  object 
 5   county      369713 non-null  object 
 6   state       370251 non-null  object 
dtypes: float64(2), object(5)
memory usage: 19.8+ MB
None
```

Summary statistics

In [6]:
```
print(data.describe())
```

```
            latitude      longitude
count  370251.000000  370251.000000
mean       39.557714     -91.896276
std         4.956872      13.171591
min         1.980000    -171.720000
25%        37.300000     -97.310000
50%        40.100000     -89.780000
75%        42.640000     -84.020000
max        75.000000      73.410000
```

Check for missing values

In [7]:
```
print(data.isnull().sum())
```

```
date            0
latitude        0
longitude       0
event-type      0
city            4
county        538
state           0
dtype: int64
```

Understanding the correaltion of Dataset

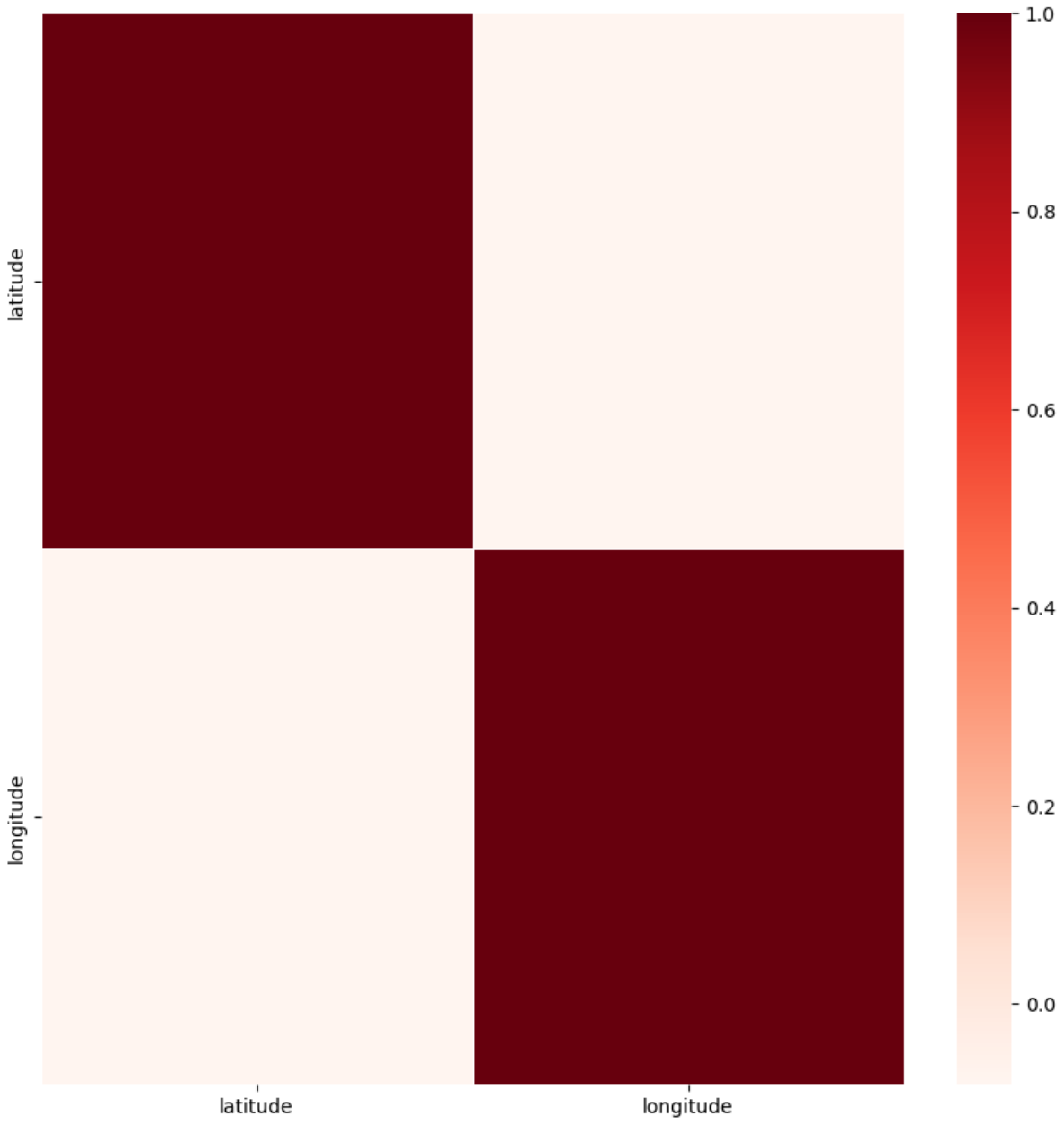
In [8]:
```
data.corr()
```

Out[8]:

	latitude	longitude
latitude	1.000000	-0.081209
longitude	-0.081209	1.000000

In [9]:
```
plt.figure(figsize=(10,10))
corr = data.corr()
sns.heatmap(corr, cmap="Reds",linewidths=.5)
```

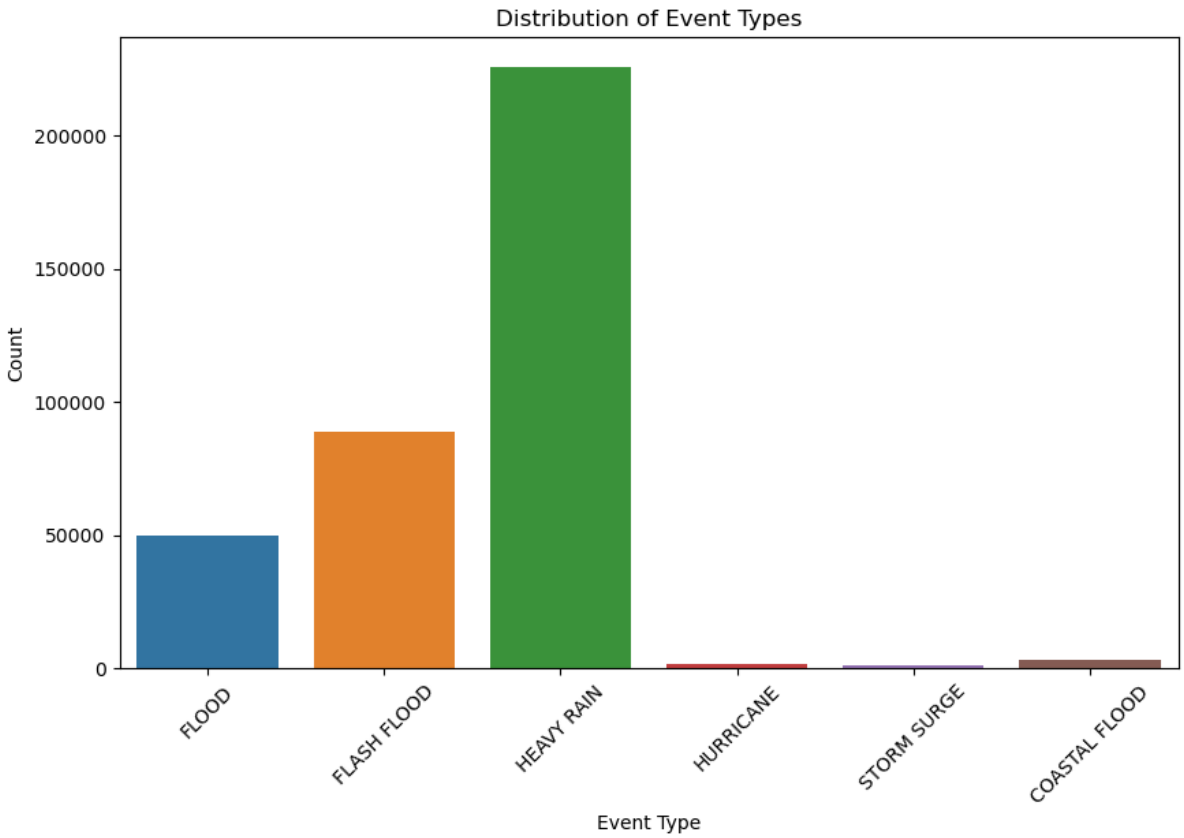
Out[9]: <AxesSubplot:>



Perform EDA (Exploratory Data Analytics)

In [10]:
```
# Plot distribution of event types
plt.figure(figsize=(10,6))
sns.countplot(x='event-type', data=data)
plt.title('Distribution of Event Types')
plt.xlabel('Event Type')
plt.ylabel('Count')
```

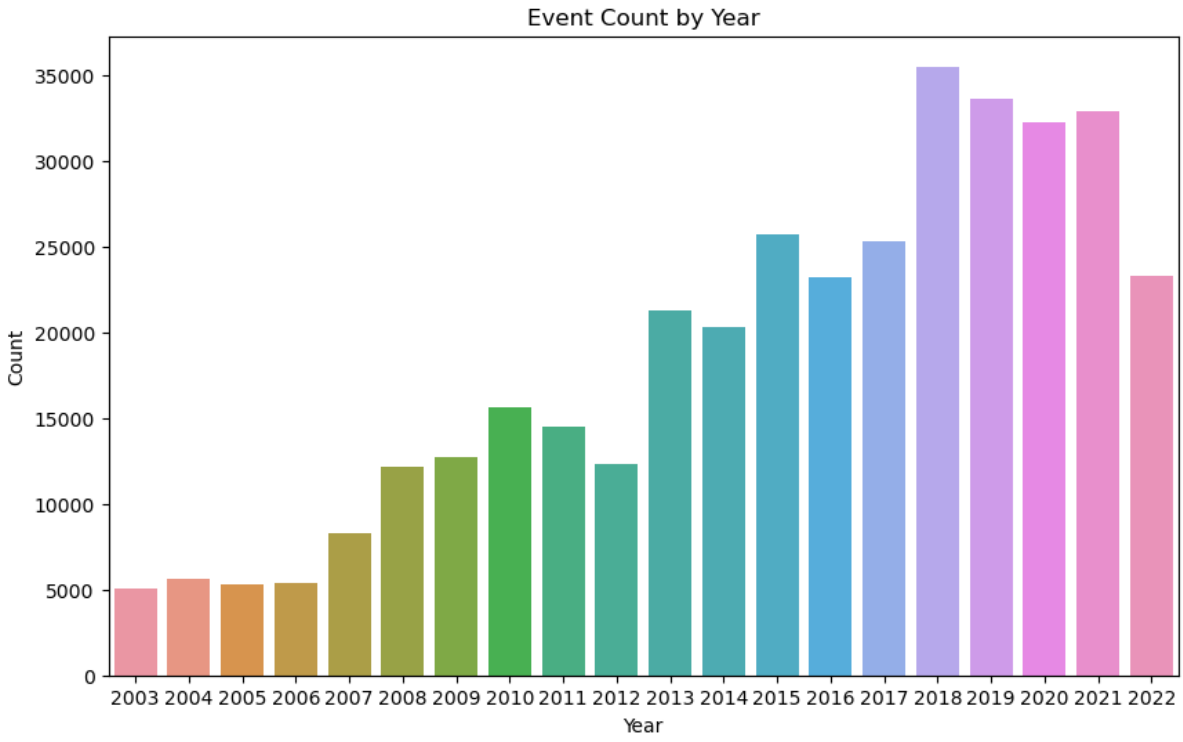
```
plt.xticks(rotation=45)
plt.show()
```



Plot events over time

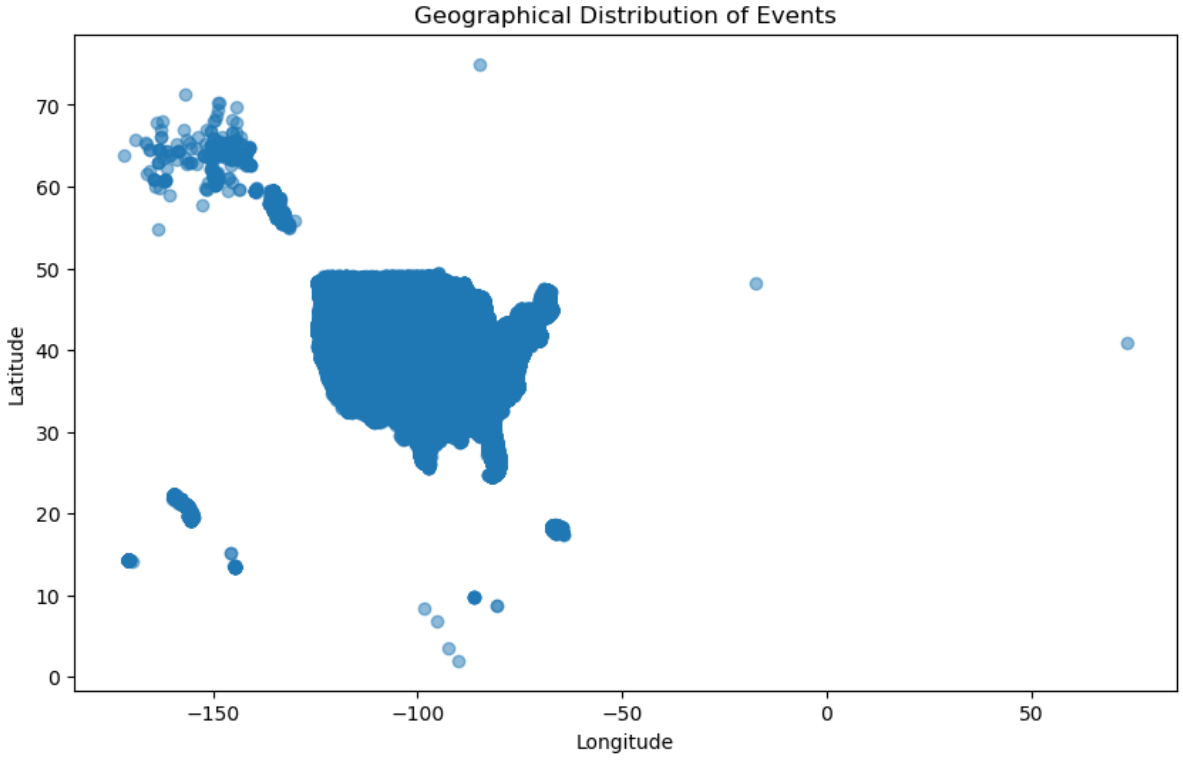
In [11]:
```
data['date'] = pd.to_datetime(data['date'])
data['year'] = data['date'].dt.year
```

In [12]:
```
plt.figure(figsize=(10,6))
sns.countplot(x='year', data=data)
plt.title('Event Count by Year')
plt.xlabel('Year')
plt.ylabel('Count')
plt.show()
```



Check geographical distribution of events

In [13]:
```
plt.figure(figsize=(10,6))
plt.scatter(data['longitude'], data['latitude'], alpha=0.5)
plt.title('Geographical Distribution of Events')
plt.xlabel('Longitude')
plt.ylabel('Latitude')
plt.show()
```



Spatial Clustering to Identify High Risk Zones:

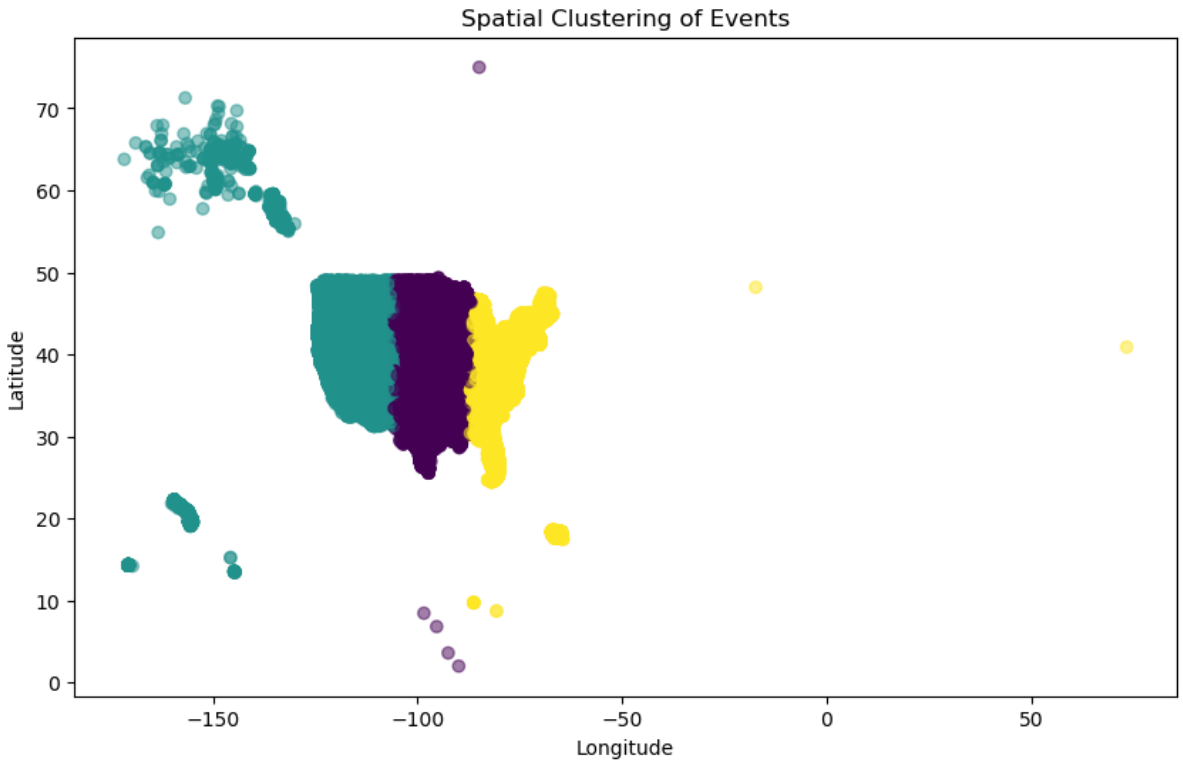
In [14]:
```
from sklearn.cluster import KMeans
```

Perform KMeans clustering

In [15]:
```
X = data[['latitude', 'longitude']]
kmeans = KMeans(n_clusters=3) # You can adjust the number of clusters as needed
data['cluster'] = kmeans.fit_predict(X)
```

Visualize clusters

In [16]:
```
plt.figure(figsize=(10,6))
plt.scatter(data['longitude'], data['latitude'], c=data['cluster'], cmap='viridis',
plt.title('Spatial Clustering of Events')
plt.xlabel('Longitude')
plt.ylabel('Latitude')
plt.show()
```



Script to Calculate Total Events Within 50 KM of a Point:

In [17]:
```
pip install geopy
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: geopy in c:\users\patil\appdata\roaming\python\pyth
on39\site-packages (2.4.1)
Requirement already satisfied: geographiclib<3,>=1.52 in c:\users\patil\appdata\ro
aming\python\python39\site-packages (from geopy) (2.0)
Note: you may need to restart the kernel to use updated packages.
```

In [18]:
```
from geopy.distance import geodesic

def count_events_within_radius(data, latitude, longitude, radius_km):
    center_point = (latitude, longitude)
    total_events = 0
    for _, event in data.iterrows():
        event_point = (event['latitude'], event['longitude'])
        distance = geodesic(center_point, event_point).kilometers
        if distance <= radius_km:
            total_events += 1
    return total_events

# Example usage
latitude = 40.7128
longitude = -74.0060
radius_km = 50
total_events_within_radius = count_events_within_radius(data, latitude, longitude,
print("Total events within 50 KM:", total_events_within_radius)
```

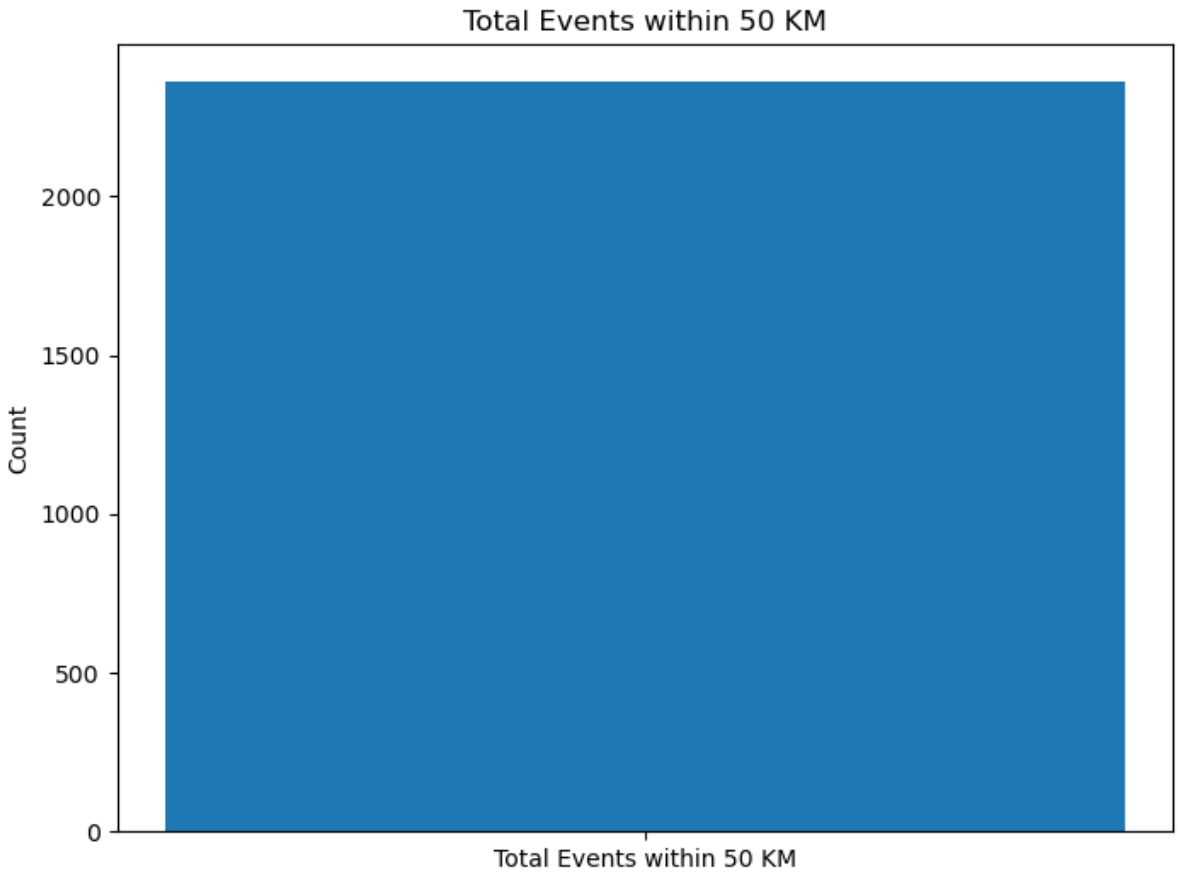
```
Total events within 50 KM: 2360
```

Horizontal bar plot for distribution of event types

plt.figure(figsize=(10, 6)) sns.countplot(y='event-type', data=data, order=data['event-type'].value_counts().index) plt.title('Distribution of Event Types') plt.xlabel('Count') plt.ylabel('Event Type') plt.show()

Bar plot for Total events within 50 KM

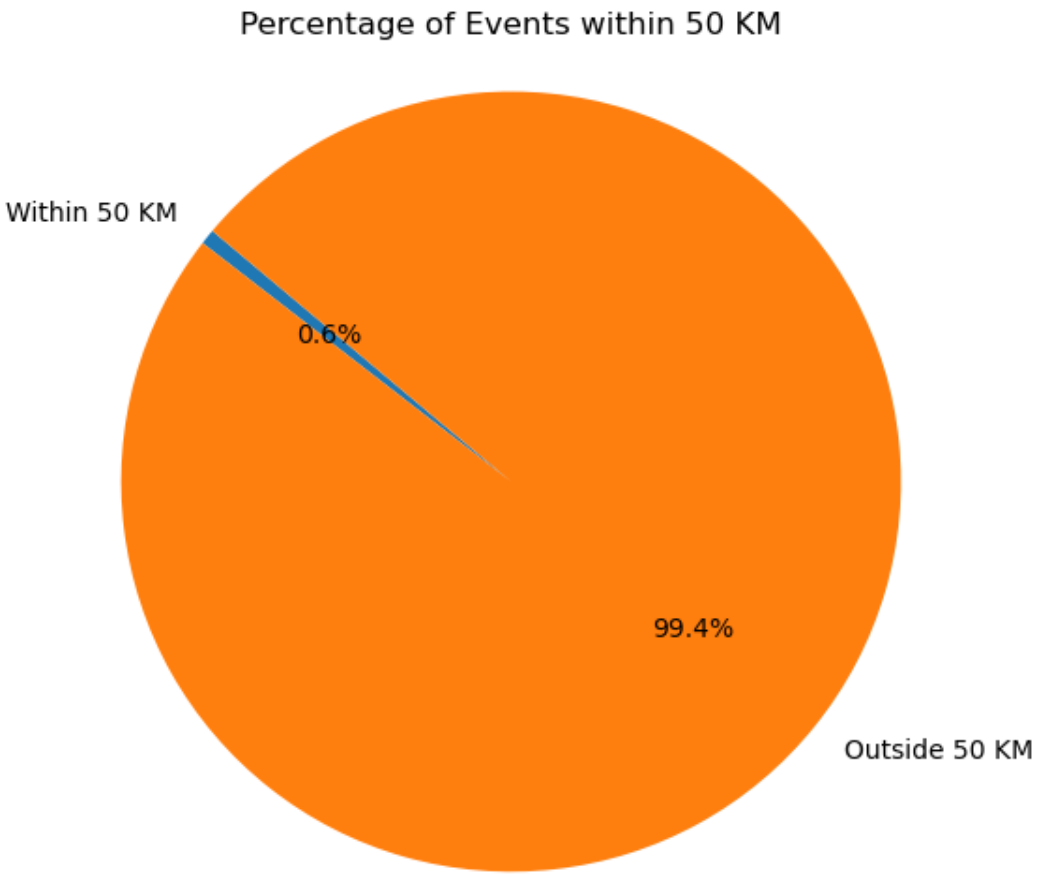
In [20]:
```
plt.figure(figsize=(8, 6))
plt.bar(['Total Events within 50 KM'], [total_events_within_radius])
plt.title('Total Events within 50 KM')
plt.ylabel('Count')
plt.show()
```



Pie chart for Total events within 50 KM

In [21]:
```
labels = ['Within 50 KM', 'Outside 50 KM']
sizes = [total_events_within_radius, len(data) - total_events_within_radius]

plt.figure(figsize=(8, 6))
plt.pie(sizes, labels=labels, autopct='%1.1f%%', startangle=140)
plt.title('Percentage of Events within 50 KM')
plt.axis('equal')
plt.show()
```



Conclusion

Based on analysis, we have determined that only a mere 0.6 percent of events occur within a 50 km radius, while a staggering 99.4 percent are situated outside this range. In concrete terms, this translates to a total of 2360 events occurring within this 50 km radius.