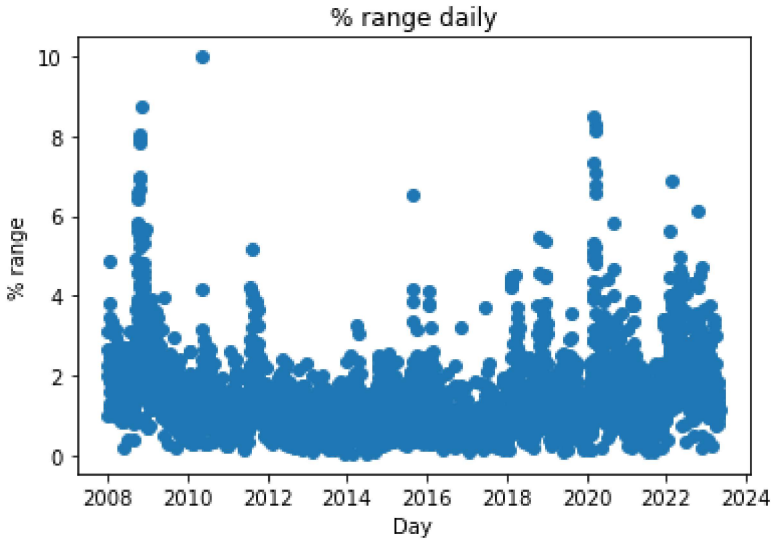
In [2]:
```
dat1 =pd.read_csv('NQ_1min_continuous_adjusted.txt',names = ["times","open","high","low

# Define a function to extract the date and time from a datetime object
def extract_date_time(datetime_str):
    datetime_obj = pd.to_datetime(datetime_str)
    return pd.Series([datetime_obj.date(), datetime_obj.time()])

# Apply the function to the 'times' column and create new columns for 'date' and 'time'
dat1[['date', 'time']] = dat1['times'].apply(extract_date_time)
```

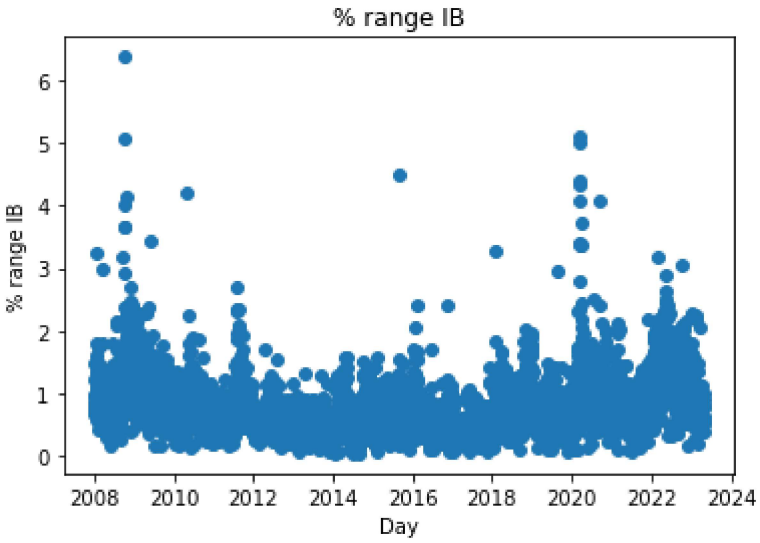
In [3]:
```
#Filter to times you want for opening range (IB) and just the day range
opening_range = dat1[(dat1.time >= datetime.time(9, 30)) & (dat1.time <= datetime.time(
open_to_close = dat1[(dat1.time >= datetime.time(9, 30)) & (dat1.time <= datetime.time(
```

In [4]:
```
# Group by 'date' and calculate the max and min for 'high' and 'low' for both opening_r
opening_range_stats = opening_range.groupby('date').agg(high_ib=('high', 'max'), low_ib
open_to_close_stats = open_to_close.groupby('date').agg(high_daily=('high', 'max'), low

# Calculate the ranges
opening_range_stats['opening_range_ib'] = 100 * (opening_range_stats['high_ib'] - openi
open_to_close_stats['range_daily'] = 100 * (open_to_close_stats['high_daily'] - open_to

# Merge the two sets of statistics into a single DataFrame
data_save_optimized = opening_range_stats.merge(open_to_close_stats, on='date')
```

In [5]:
```
#Plot Daily range
plt.plot(data_save_optimized.range_daily,'o')
plt.xlabel('Day')
plt.ylabel('% range')
plt.title('% range daily')
plt.show()
```



In [6]:
```
#Plot Opening range
plt.plot(data_save_optimized.opening_range_ib,'o')
plt.xlabel('Day')
plt.ylabel('% range IB')
plt.title('% range IB')
plt.show()
```



In [7]:
```
# Calculate correlation
x = data_save_optimized.range_daily
y = data_save_optimized.opening_range_ib
correlation_matrix = np.corrcoef(x, y)
correlation = correlation_matrix[0, 1]
print(correlation)
# 1 means they are 100% correlated so having a .78 shows they are very closely related
```

```
0.7853384551491553
```

This analysis aims to demonstrate that the Initial Balance (IB) range is a critical indicator of the daily market range, suggesting that the volatility within the first hour of trading can be predictive of the day's overall volatility. This insight is particularly useful for traders, as it assists in identifying optimal times for initiating or holding positions. By integrating this concept with the Average Daily Range (ADR), specifically a 5-day mean, traders can make more informed decisions about when to commence trading activities. Furthermore, incorporating this approach into a Brownian motion simulation enhances its realism and efficacy in mirroring actual market movements, thereby improving predictive capabilities for real-world market dynamics.