Time series forecasting of the pre-event Air RPM (Revenue Passenger Miles) series using Moving average and Holt Exponential smoothing methods.

Jeet Patel | N015101518 | Github - https://github.com/jeeeet25/Holt_Exponential_Smoothing-and-Moving-Average

In [ ]:

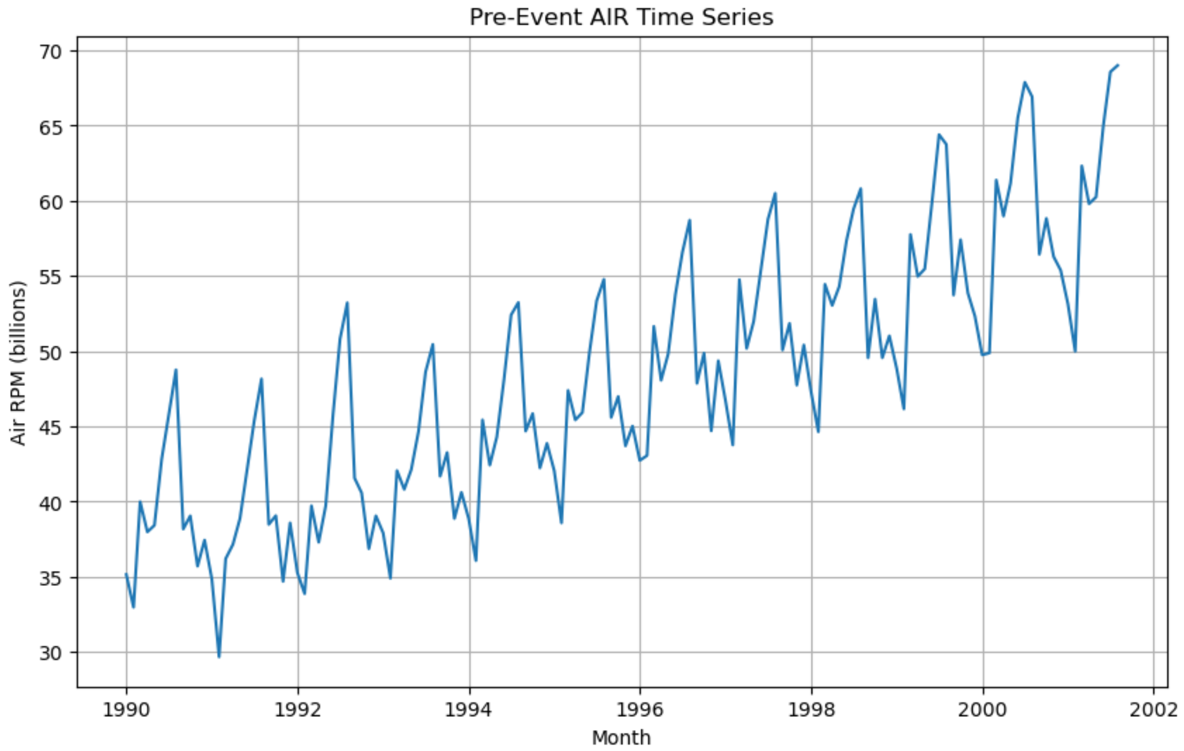
```
import pandas as pd
from datetime import datetime
import matplotlib.pyplot as plt

# Load the data from the CSV file
data = pd.read_csv('air_miles.csv')
```

In [31]:

```
data['Month'] = pd.to_datetime(data['Month'], format='%b-%y')

pre_event_data = data[data['Month'] < pd.to_datetime('2001-09-01')]
```

In [32]:

```
plt.figure(figsize=(10, 6))
plt.plot(pre_event_data['Month'], pre_event_data['Air RPM (billions
plt.xlabel('Month')
plt.ylabel('Air RPM (billions)')
plt.title('Pre-Event AIR Time Series')
plt.grid(True)
plt.show()
```



Since the time plot shows the presence of trend, seasonality, and random fluctuations in the Air RPM series, it becomes evident that the data demonstrates a combination of sustained long-term changes (trend) and repetitive short-term fluctuations (seasonality). we can proceed with analyzing and selecting the most appropriate smoothing method.

Considering the characteristics observed in the plot, Moving average with what window width range of (2-4) OR the Holt Exponential Smoothing method would likely be the most suitable choice for forecasting this time series.

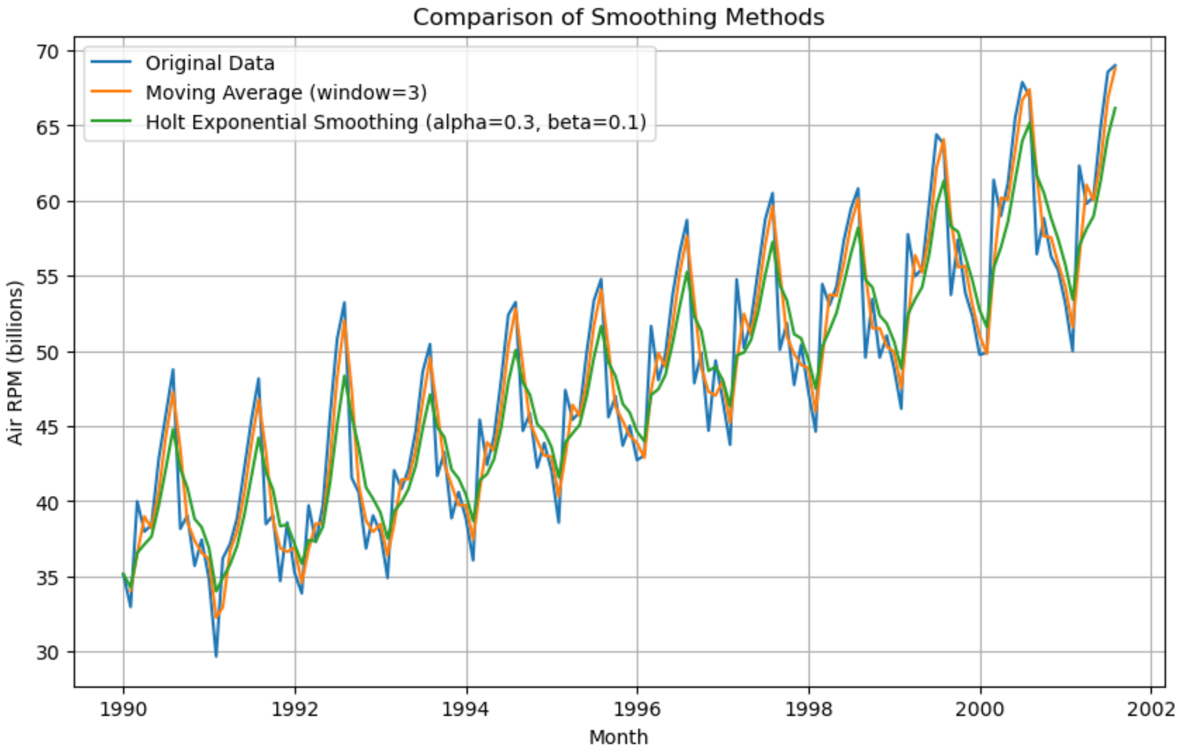
In [42]:
```
summary_stats = pre_event_data['Air RPM (billions)'].describe()

print(summary_stats)
```

```
count    140.000000
mean      48.213286
std        8.691648
min       29.670000
25%       41.650000
50%       47.960000
75%       53.977500
max       69.000000
Name: Air RPM (billions), dtype: float64
```

In [60]:
```python
# Moving Average (with window width)
window_width = 2
pre_event_data['Moving_Average'] = pre_event_data['Air RPM (billion

#Holt Exponential Smoothing (assuming alpha and beta values)
alpha = 0.4
beta = 0.1
pre_event_data['Holt_Exponential_Smoothing'] = pre_event_data['Air

print(pre_event_data)
```

```
          Month  Air RPM (billions)   Air RPM  Moving_Average  \
0    1990-01-01               35.15  35153577             NaN
1    1990-02-01               32.97  32965187          34.060
2    1990-03-01               39.99  39993913          36.480
3    1990-04-01               37.98  37981886          38.985
4    1990-05-01               38.42  38419672          38.200
..          ...                 ...       ...             ...
135  2001-04-01               59.80  59801562          61.060
136  2001-05-01               60.25  60246477          60.025
137  2001-06-01               64.99  64987625          62.620
138  2001-07-01               68.57  68573410          66.780
139  2001-08-01               69.00  69003617          68.785

     Simple_Exponential_Smoothing  Holt_Exponential_Smoothing
0                       35.150000                   35.150000
1                       34.496000                   34.278000
2                       36.144200                   36.562800
3                       36.694940                   37.129680
4                       37.212458                   37.645808
..                            ...                         ...
135                     57.817170                   58.111434
136                     58.547019                   58.966860
137                     60.479913                   61.376116
138                     62.906939                   64.253670
139                     64.734858                   66.152202

[140 rows x 6 columns]
```

In [61]:
```
plt.figure(figsize=(10, 6))
plt.plot(pre_event_data['Month'], pre_event_data['Air RPM (billions
plt.plot(pre_event_data['Month'], pre_event_data['Moving_Average'],
plt.plot(pre_event_data['Month'], pre_event_data['Holt_Exponential_
plt.xlabel('Month')
plt.ylabel('Air RPM (billions)')
plt.title('Comparison of Smoothing Methods')
plt.legend()
plt.grid(True)
plt.show()
```



The Moving Average smoothing method with a window width of 2 provides the best fit for forecasting the pre-event Air RPM (billions) series.