

**IEE 579**

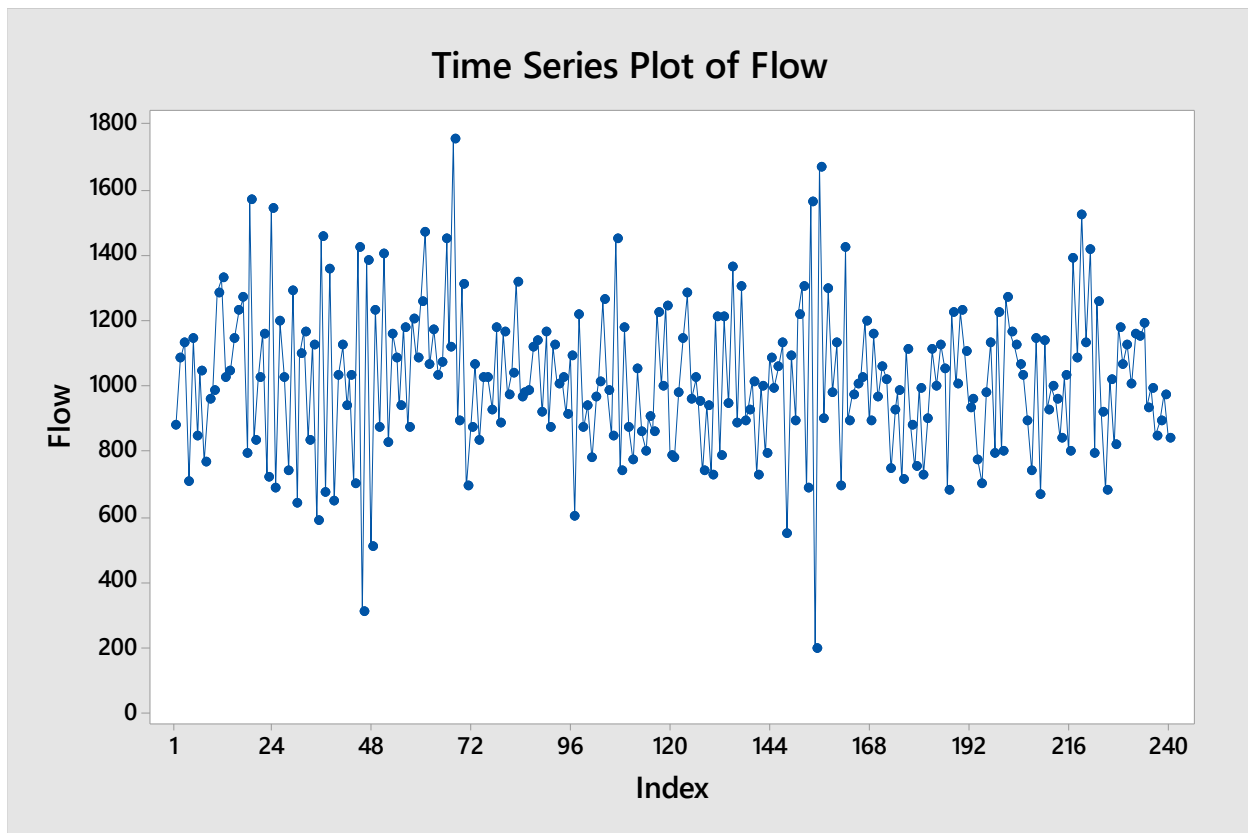
**Case Study: 1**

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**Software used: Minitab**

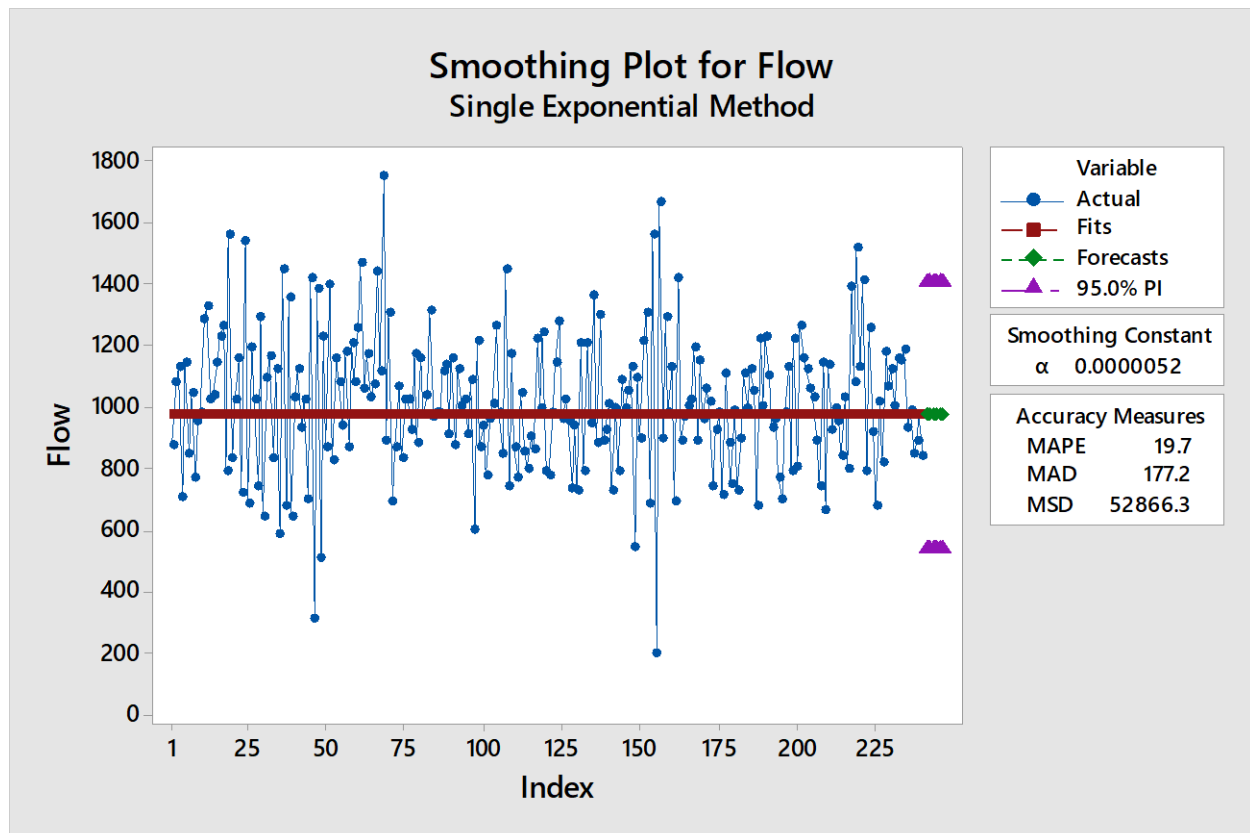
The time series plot of the data obtained from the Minitab is attached below:



From the graph, it's very clear that we have a stationary time series here as the mean and variance are fluctuating that much and approximately stays the same. Now we move on to building a model:

**1) Single exponential smoothing:**

Here, I have tried different values of smoothing constant as 0.2 and 0.3. But the model performance statistics (MAD, MAPE and MSE) are lowest for optimal smoothing constant. Also, 6 forecasts have been generated.



Here,  $MSE = 52866.3$ . Thus,  $RMSE = 229.9267$ . We're interested in finding the relative RMSE which is

$RMSE / y_{\max} - y_{\min}$  which in our case is  $229.9267 / 1558.47 = 0.1475$

Hence the relative RMSE in this case is 14.75%.

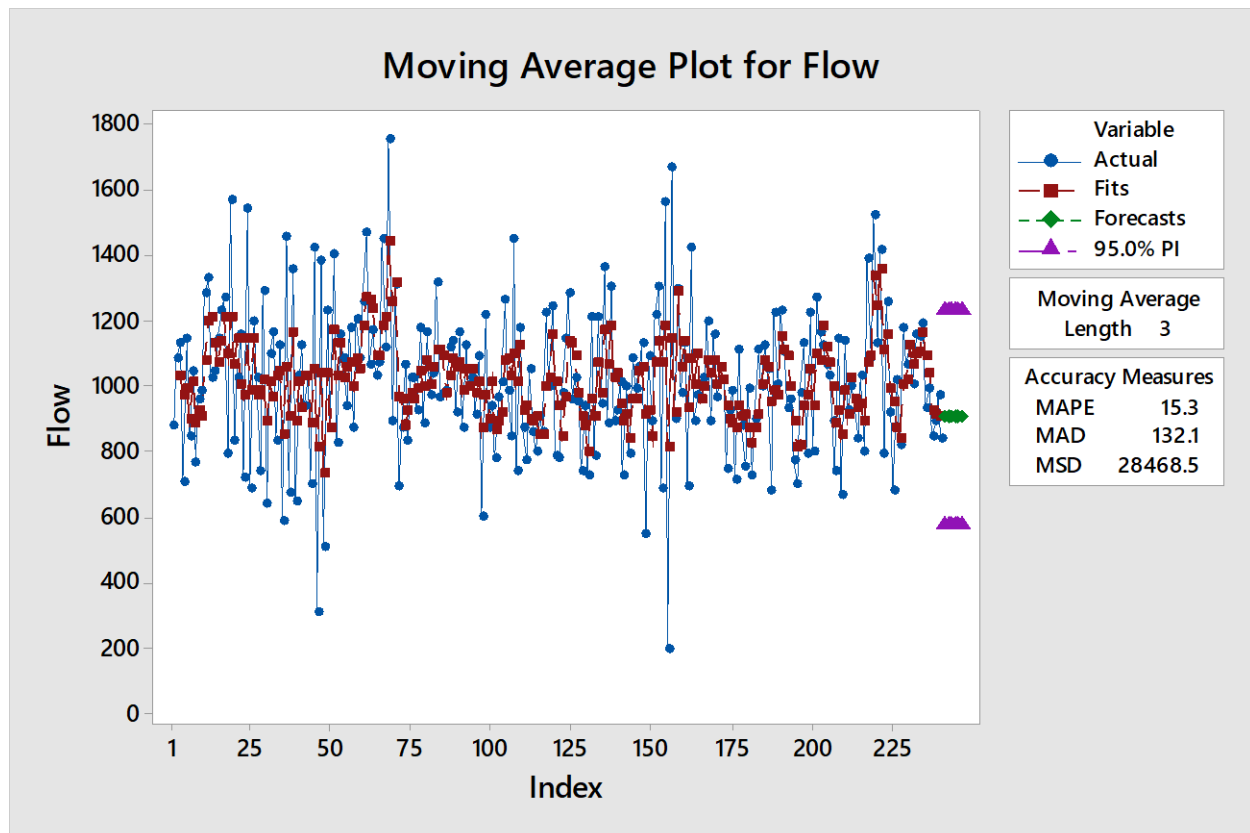
The next 6 month forecasts are:

## Forecasts

Period	Forecast	Lower	Upper
241	972.325	538.293	1406.36
242	972.325	538.293	1406.36
243	972.325	538.293	1406.36
244	972.325	538.293	1406.36
245	972.325	538.293	1406.36
246	972.325	538.293	1406.36

## 2) Moving Average:

Now, I'm gonna use the Moving Average to build a model. Here how it works:



Here,  $MSE = 28468.5$ . Thus,  $RMSE = 168.726109$ . We're interested in finding the relative RMSE which is

$RMSE / y_{\max} - y_{\min}$  which in our case is  $168.726109 / 1558.47 = 0.1082$

Hence the relative RMSE in this case is 10.82%.

The next 6 month forecasts are:

## Forecasts

Period	Forecast	Lower	Upper
241	900.687	569.990	1231.38
242	900.687	569.990	1231.38
243	900.687	569.990	1231.38
244	900.687	569.990	1231.38
245	900.687	569.990	1231.38
246	900.687	569.990	1231.38

Hence, here we are 95% confident that the forecasted values for 6 months will lie between 570 and 1231.

**Model building process:**

- So, I have built two models based on the time series data given. The first model is single exponential smoothing and the second model is moving average model. As there is no specific trend or season in this data, I have decided to use these two models.

- From the values of MAPE, MAD and MSE, we can see that the moving average model performs better than the single exponential smoothing model as the errors for MA model are less. So, I am gonna be using the MA(3) model for predicting the next 6 month response.

- Here, I have used minitab to fit the MA model with MA length = 3 and the observations have also been centered.