Exercise: Time Series for a single variable *(iNZight Lite version)*

In this exercise we will use iNZight Lite to create a Time Series plot and get the Additive and Multiplicative Decomposition for it.

The skills addressed are:

1. Use iNZight Lite to generate a Time Series plot and a Seasonplot for a single numeric variable.

2. Use iNZight Lite to get Additive and Multiplicative Decomposition.

3. Use iNZight Lite to make a forecast for the future.

INSTRUCTIONS

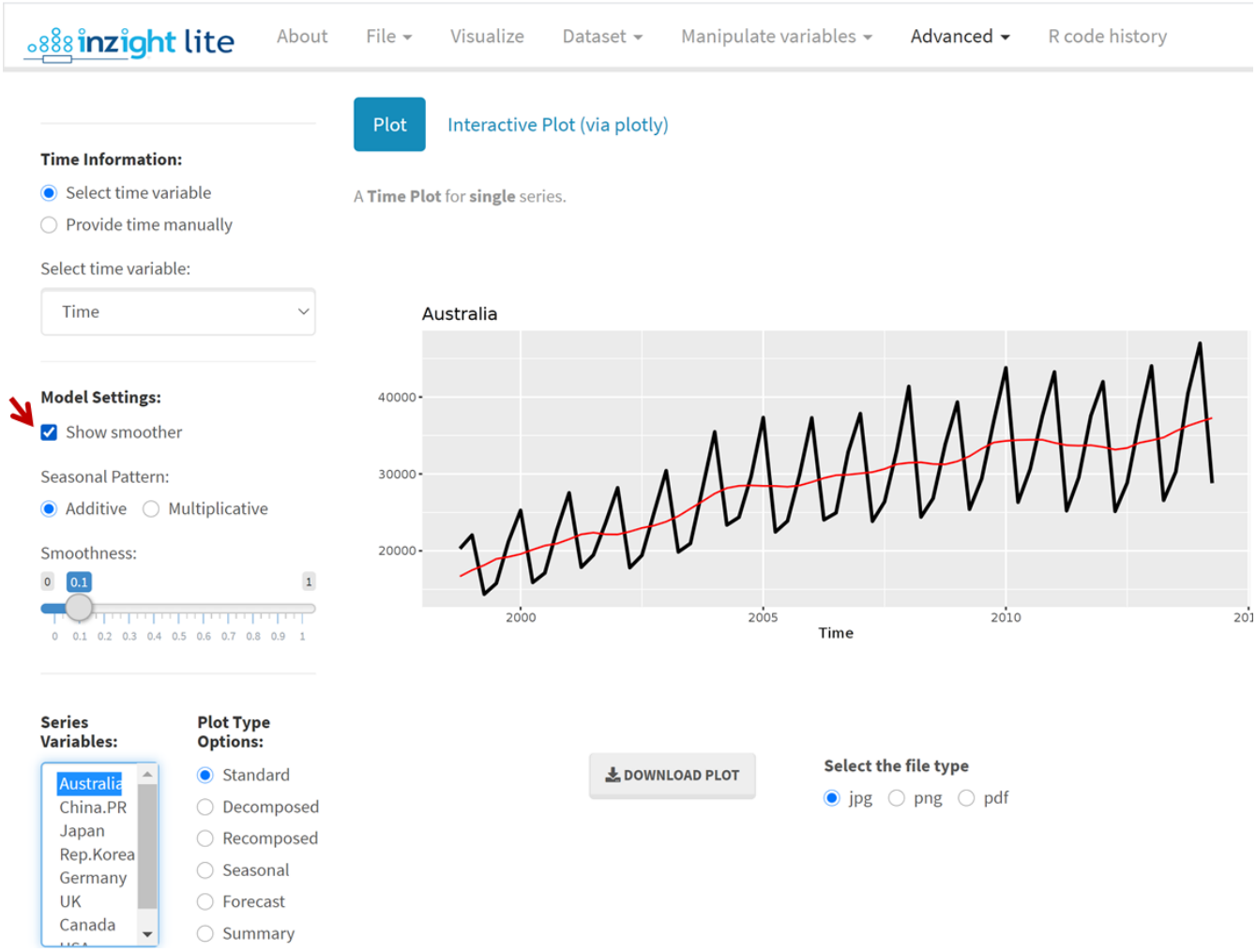
Start iNZight Lite and import the **Wk8-AverageVisitorsQuarterly** dataset into iNZight Lite using **File > Dataset Examples** and select Dataset Category: **Future-Learn**. Select **Wk8-AverageVisitorsQuarterly** and click on **Select Set.**

If you have any problems during this exercise, see the **Common questions** on page 7.

Generate a Time Series plot and a Season plot for a single numeric variable

The data we are using shows us the number of visitors from different countries who are currently staying in New Zealand. We will investigate the changes in the number of visitors from Australia over time using a Time Series plot for our data.

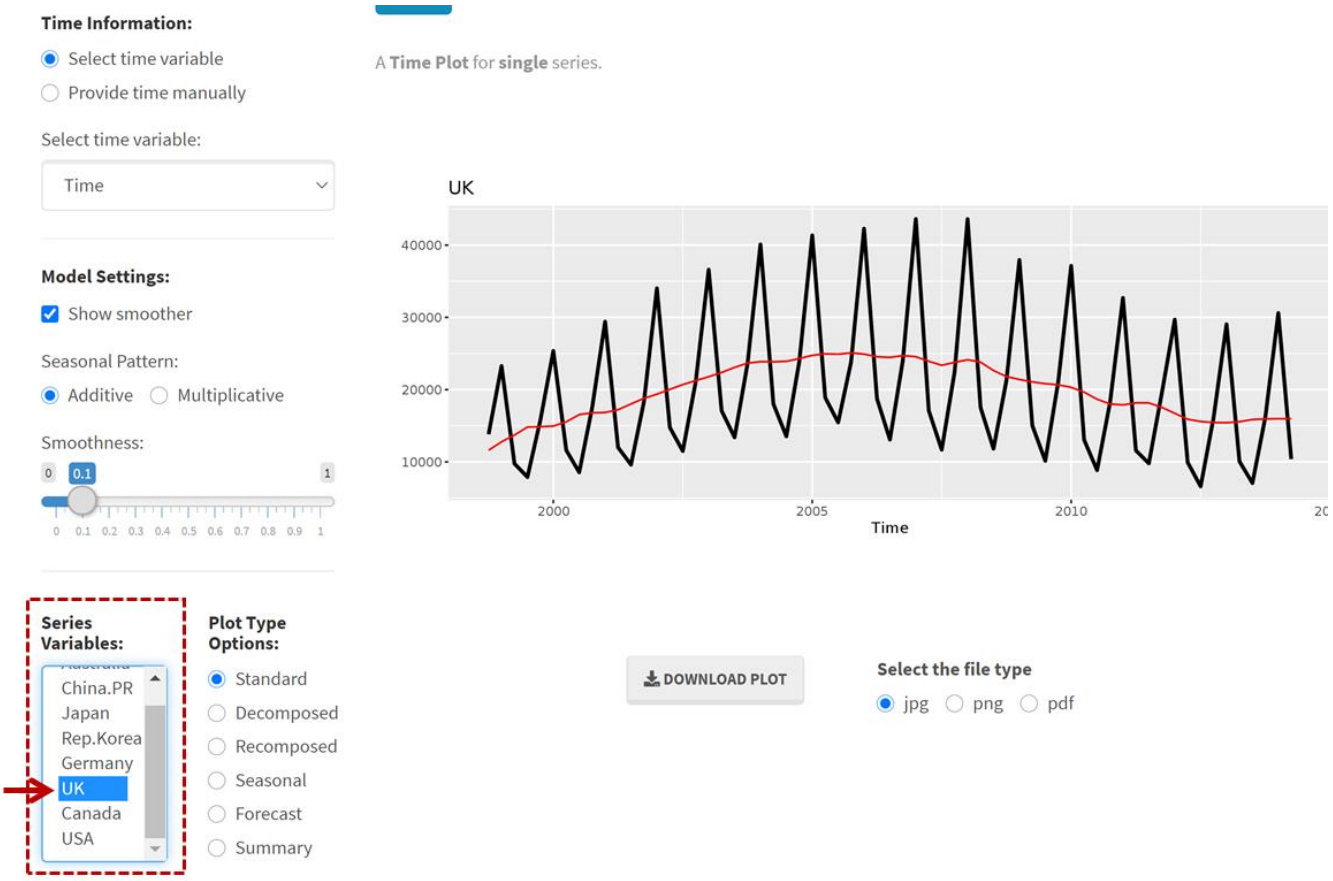
- Go to the **Advanced** Menu (at top) and select **Time Series**.



I have had to click the **Show smoother** checkbox to get the trend to appear.

To see the Time Series plot for the UK

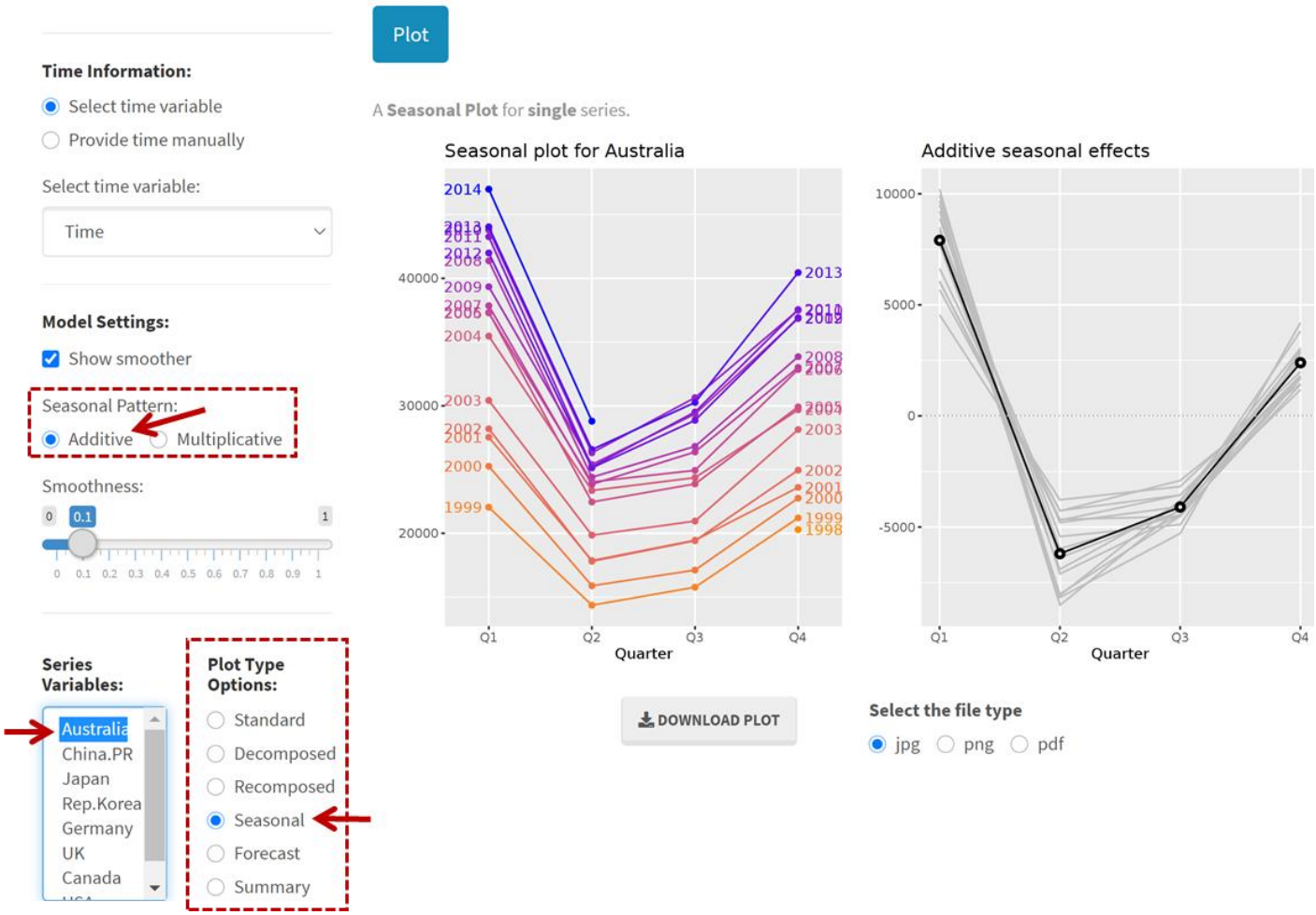
- Select **UK**



What is happening in the graphics window?

The Time Series plot shows us that there is a basic pattern that repeats every year. To have a better look at that pattern we can use a Seasonal plot.

- Click on the **Plot** Type option **Seasonal**.



In the new window we have the **Seasonal plot for Australia** on the left. It shows that we were right and there really is a repeated seasonal pattern.

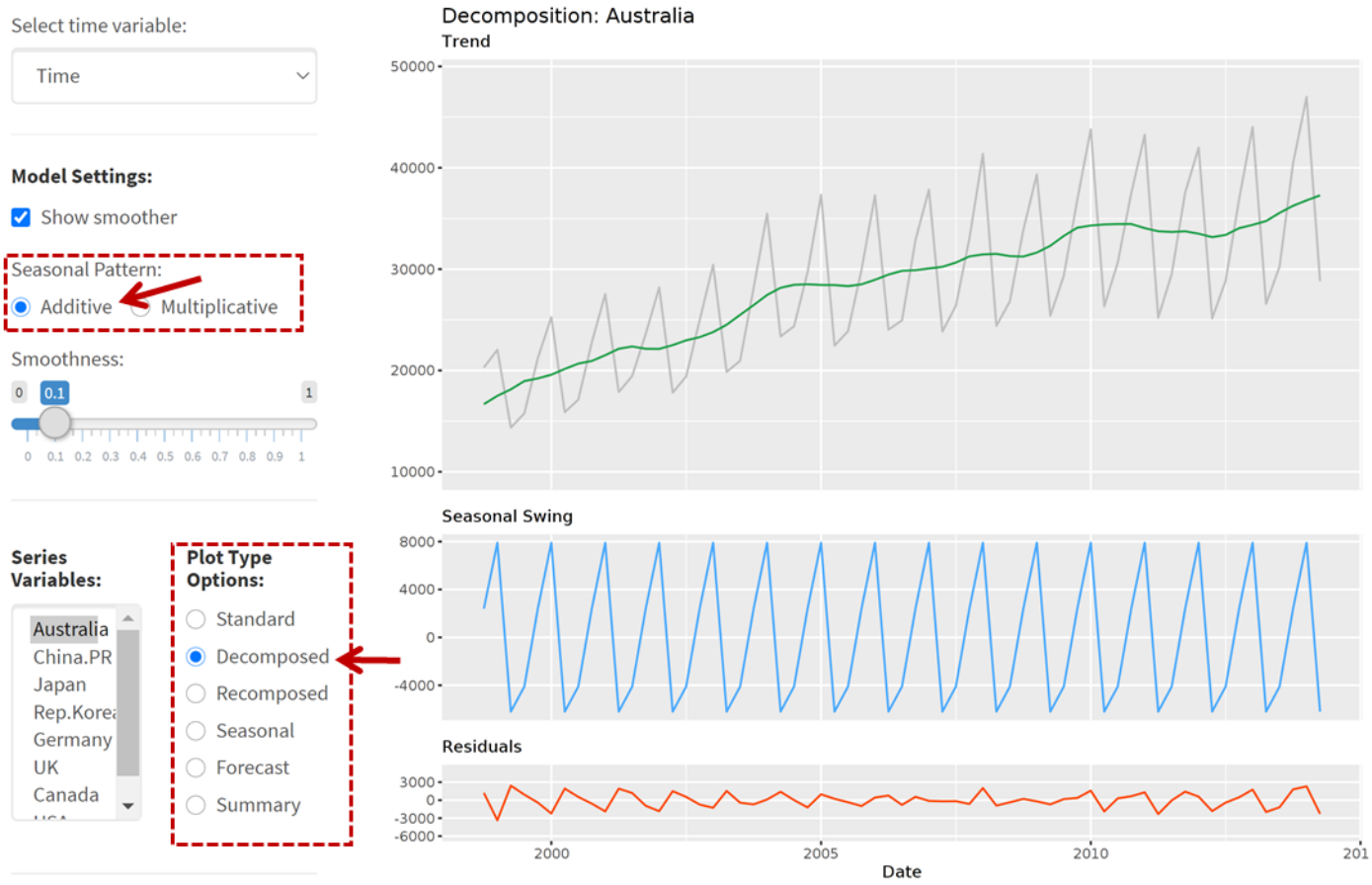
As you can see in the heading, **Additive seasonal effects**, a sum of the patterns for the different years is being generated. For the Multiplicative seasonal effects select Seasonal Pattern: **Multiplicative**.

Explore (~5min)
Try this for a few other countries. What similarities or differences can you see between the Additive and Multiplicative seasonal effects? Notice the **y label** option in the Time Series window and **type a suitable label**. Post a comment if you see something interesting.

Decompose and recompose your time series plot

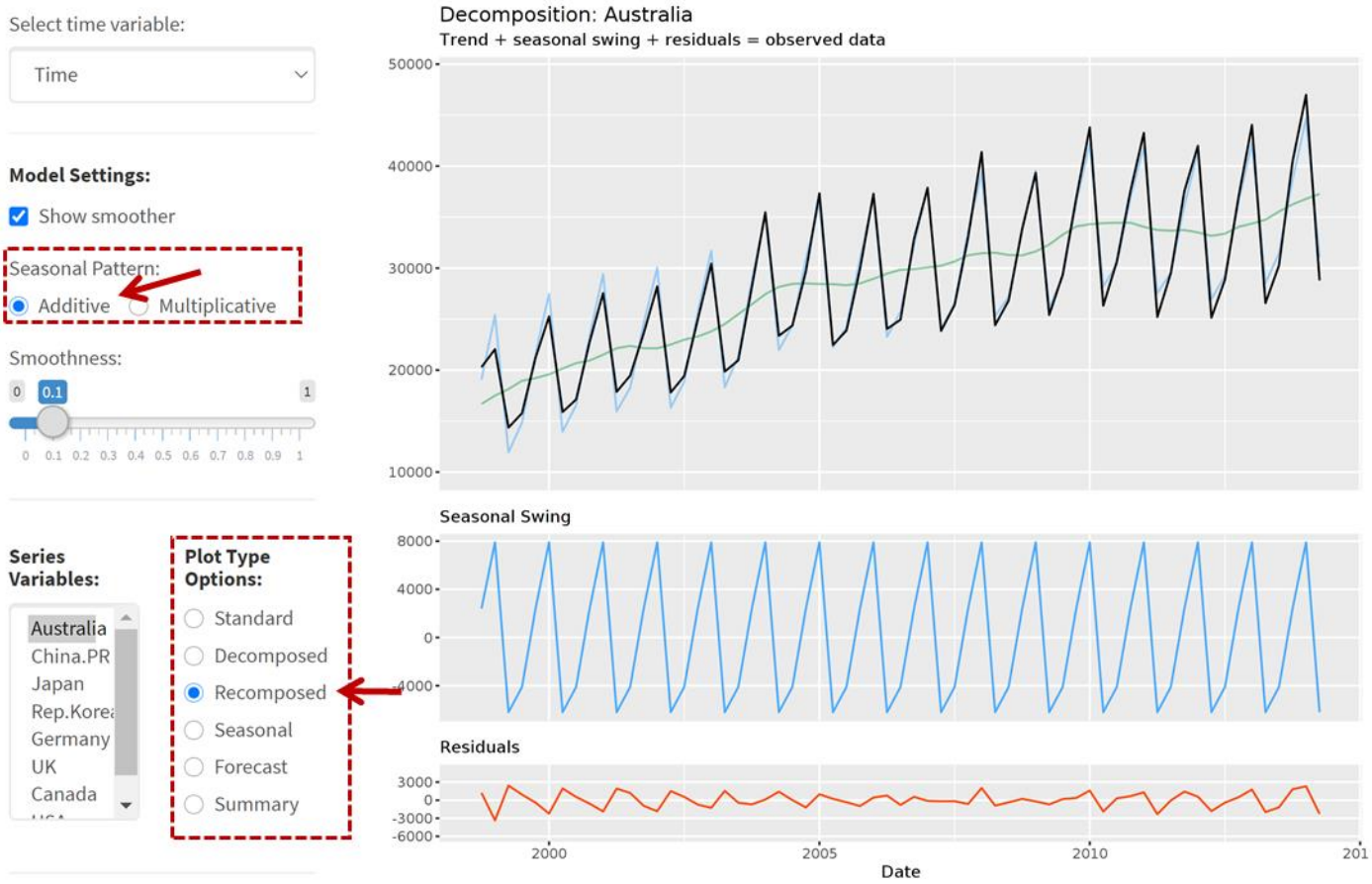
We will now get the Decomposition Plot for Australia.

- Select **Australia**
- Click on the **Plot** Type option **Decomposed**.



The upper part shows the normal Time Series plot as before. Below that is the additive **Seasonal Swing**, which is a repeat of the **Additive seasonal effects** from before. The **Residuals** demonstrates the difference between what you would expect if you add the **Seasonal Swing** to the **Trend** and **Raw data**. To view that

plot, click on the **Plot** Type option **Recomposed**.



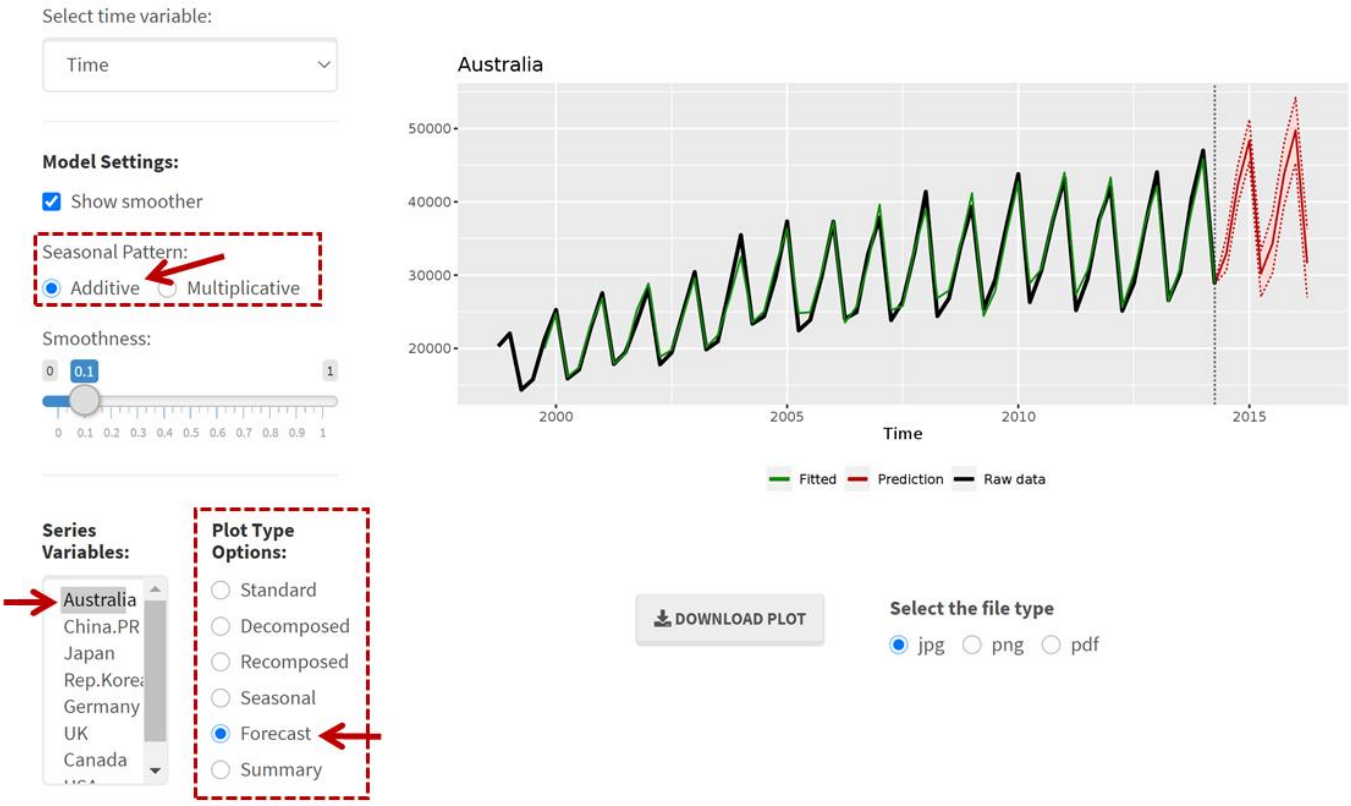
What is happening in the graphics window?

The **Seasonal Swing** is added to **Trend** line. The resulting blue line shows what would be expected if the seasonal patterns are exactly the same every year. When you add the **Residuals** you get back the **Raw data**, which is shown in black here.

To have a closer look of the difference between **Raw data** and Trend+Seasonal-swing approximation, use **Ctrl +**.

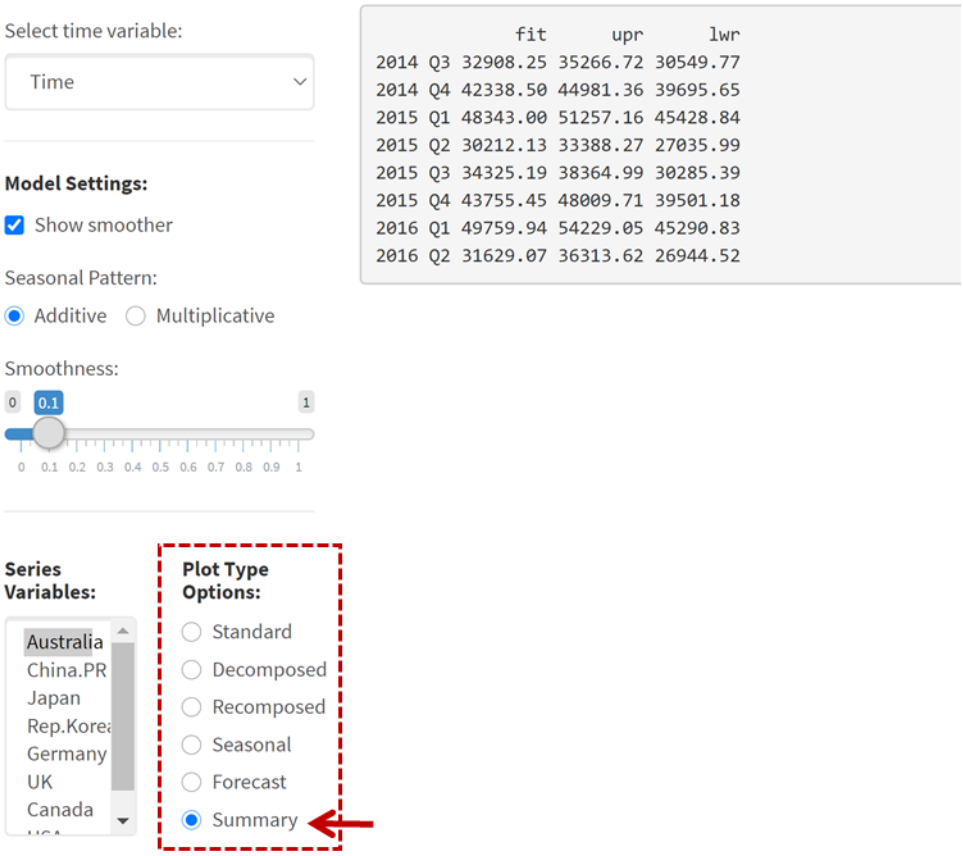
Calculate a Forecast for the future

We want to know how many visitors from Australia will be in New Zealand in the upcoming years. Click on the **Plot** Type option **Forecast**.



What is happening in the graphics window?

We will look at the graph first. Additional to the original Time Series plot, it also shows a prediction for the future (on the right hand side) in red. The light red area around the dark prediction line is the confidence band. The predicted values are calculated with the Holt-Winters method. To get the exact data, on the **Plot** Type option **Summary**.



Explore (~5min)

Try to get the forecast for Australia with a Multiplicative Seasonal Swing. Which forecast is more reliable in this case?

Common questions

Why is the graph of the Seasonal plot for 1998 and 2014 incomplete?

It is due to missing data. They started collecting data at the end of 1998 and the missing data for 2014 will be collected soon (this was written in 2014!).