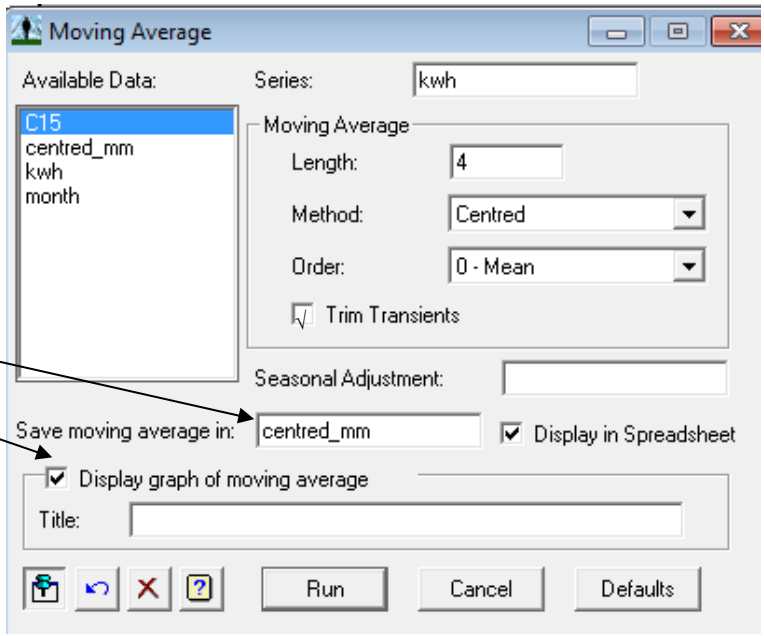
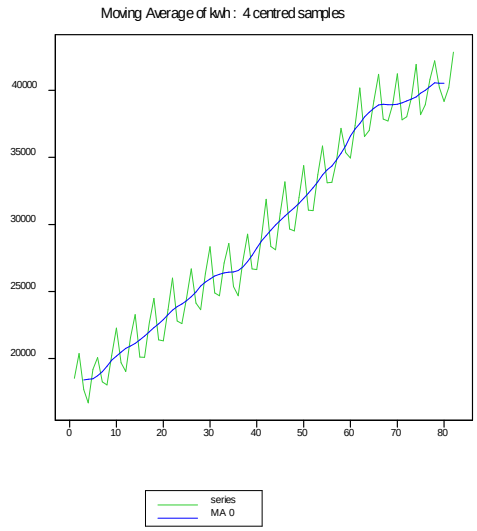
Time Series using Genstat

Open the file *Auselec*

Smoothing the data

- From the **Stats** menu choose **Time Series** and then **Moving Average**
- the series will be *kwh*
- Length will be 4 as quarterly data
- Method will be centred
- Type in a name for the column
- Click Display in Spreadsheet
- You should now have a column in your spreadsheet called centred_mm, which is the smoothed data and also a graph as shown below.



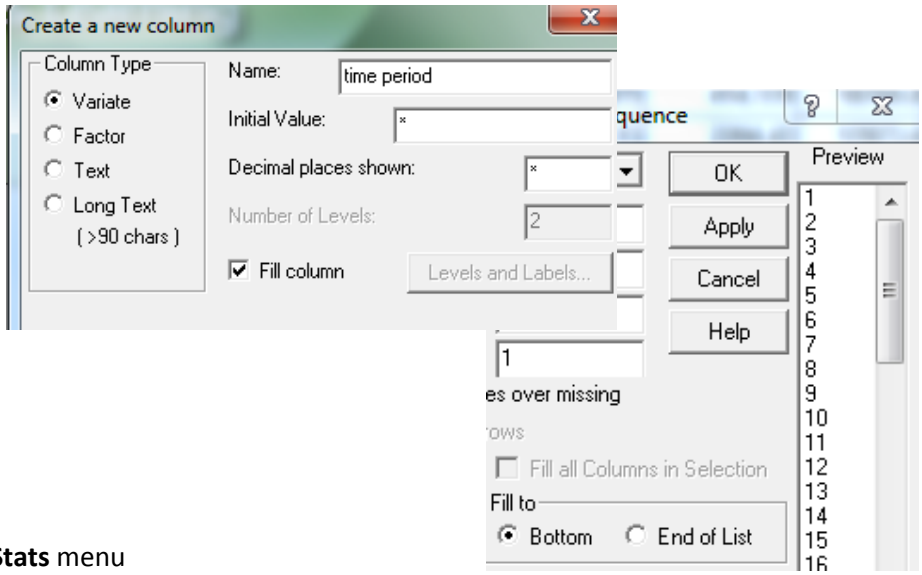


dialogue box as shown – remember to tick Fill column.

To create a time period column

You need to know how many time periods have passed. You can insert a new column (Choose **Insert, Column** from the **Spread** menu) or

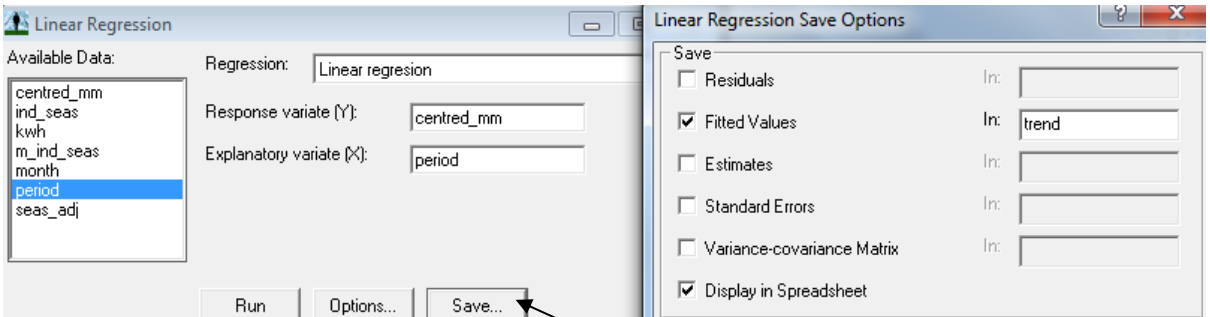
- Click on insert column 
- Fill in



To get the trend line and its equation

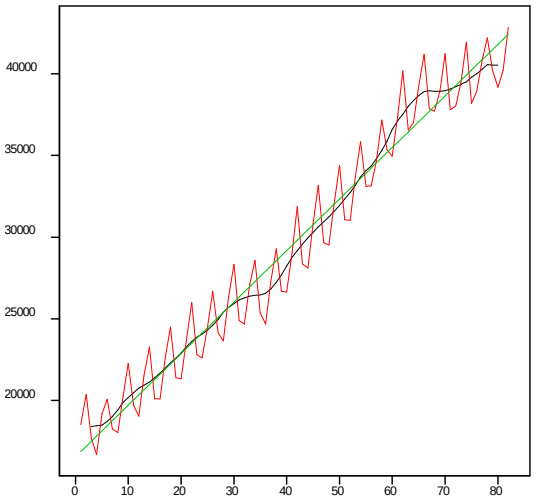
You need to perform **Linear Regression.**

- Choose **Linear Regression** from the **Stats** menu



- To save the fitted values, you click on the **Save** option ***after you have run*** the **Linear Regression**

- Look in the **Output Window** for the estimates



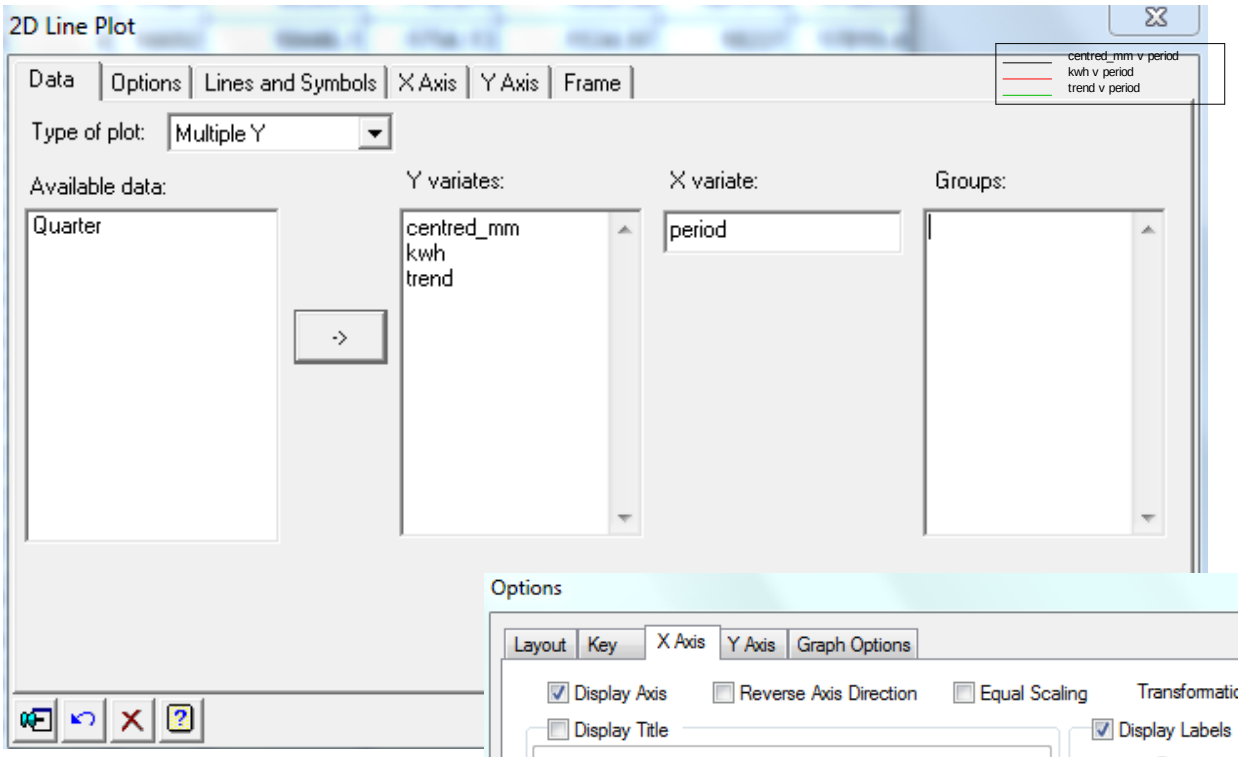
Estimates of parameters

Parameter	estimate	s.e.	t(76)
Constant	16557.	168.	98.40
period	315.57	3.56	88.55

So the model is kwh = 315.57 * quarter period + 16557

Graphing the raw data, smoothed data and trend

- Choose **Line graph** from the **Graphics** Menu
- Change type of Plot to **Multiple Y**

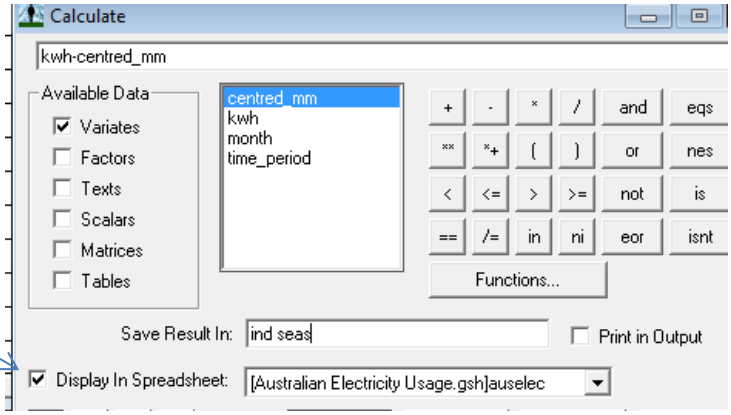


If you prefer a graph with the dates along the bottom graph just select month rather than period for the X variate, however you will need to edit the graph to change the axis to read in dates...

Choose **Edit** then **Edit graph** as you did earlier and change the **x-axis** as shown.

To find the individual seasonal effect

- To find the Individual seasonal value, use the calculator 
- You need to tick display in spreadsheet

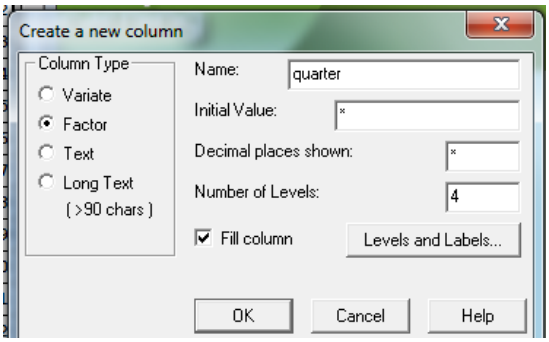


Finding the Average seasonal

First we need a factor column with the quarters (or months or days)

If the quarter column isn't there, just insert a column (from the ***Spread*** menu) with the required number of factors and use Fill from the ***Spread*** menu

- It needs to be a factor
- Give the column a name eg quarter
- Put in appropriate length in this case 4
- Tick Fill column
- If Levels and Labels is there click to name each quarter (if not click ok and then right click in column and chose **column attributes** to find levels and labels)

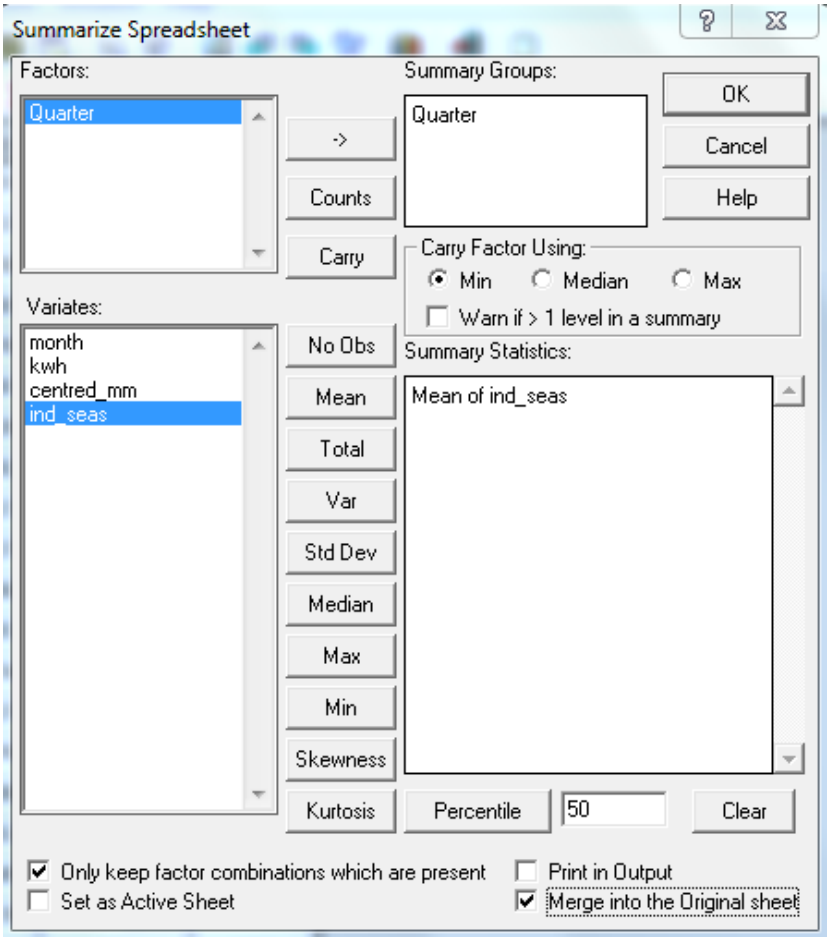


	kwh	time_period	quarter
74	18515	1	Mar
74	20377	2	Jun
74	17681	3	Sep
74	16692	4	Dec
75	19184	5	Mar
75	20078	6	Jun
75	18260	7	Sep

rdinals	Levels	Labels
1	1	Mar
2	2	Jun
3	3	Sep
4	4	Dec

Now choose **Calculate** then **Summary Stats** from the **Spread** menu

Now to get the average seasonal effect, choose **Calculate** from the **Spread** menu and then **Summary Statistics.** Remember to click **Merge**!

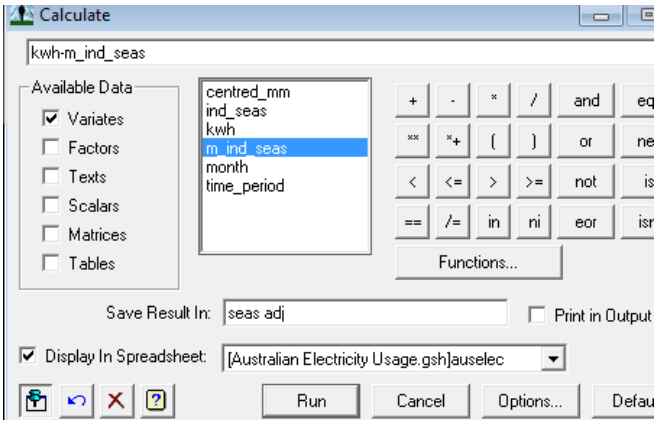


Predictions

To make predictions, you can just use the formula for the trend line and then add on the average seasonal effect.

Seasonally Adjusted Data

You can now also find the seasonally adjusted data using the **Calculator**

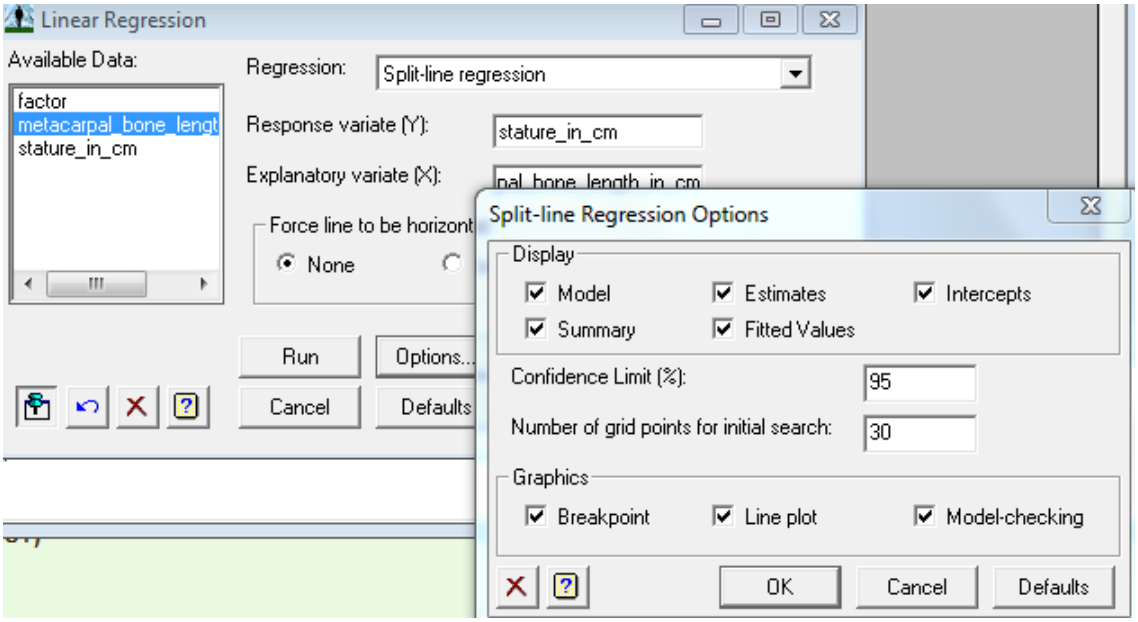


Piecewise Functions

If you think your model would be better as two straight lines rather than one (or even three lines!) you can fit a piecewise model. Genstat will fit the model and even find the best breakpoint (where to split the model) for you. This example uses metacarpal but Mens 1500m works better Use time as the response and year as the explanatory. You will get graphs as shown

You can see that there is a split in the data around 1910. Looking at the output you can see that it is at 1906

1. Choose **Stats** menu then **Linear Regression** then change the regression type to **Splitline regression**

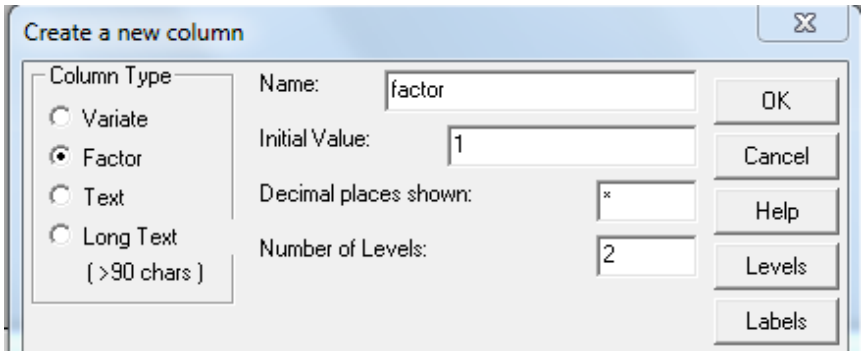


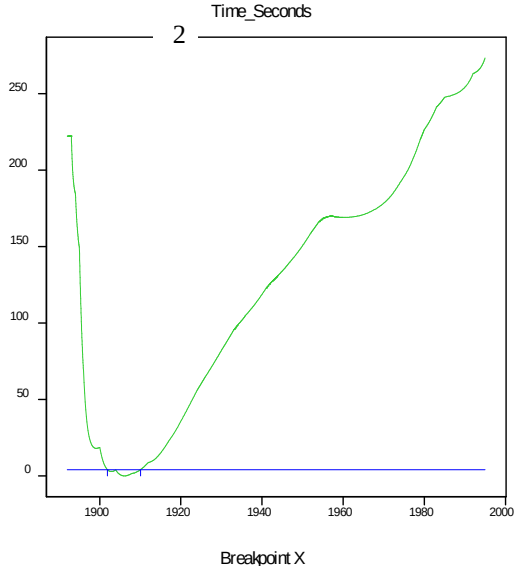
Estimates of parameters

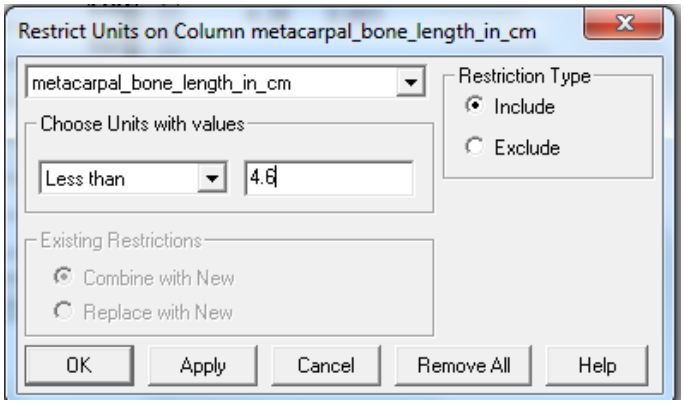
Parameter	estimate	s.e.
Breakpoint_X	1906.07	1.26

However, assume we wish to split the data in the *metacarpal* file at 4.6cm. To do this and graph both models and get the equation for both you will need to divide the data into two groups.

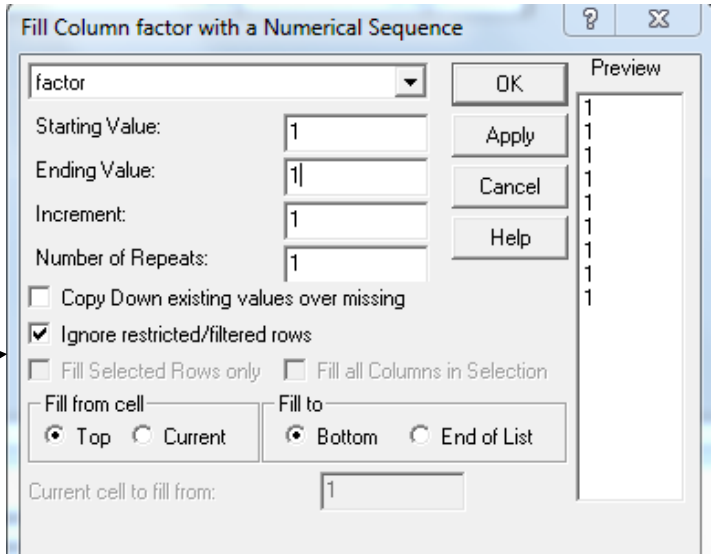
2. Create a factor column and call it **factor**





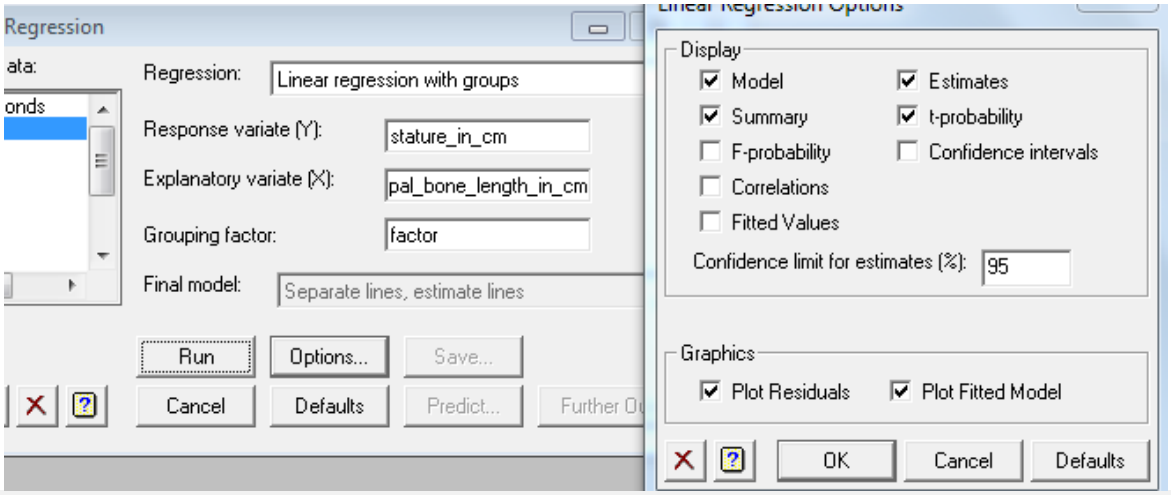


3. Go to **Spread** then **Restrict/Filter** then **By value**: - here the data is restricted to all the values where the metacarpal length is less that 4.6



4. From the **Spread** menu, choose **Calculate,** then **Fill** and fill with the value 1 as shown but make sure you tick **Ignore restricted/filtered rows** as shown

5. Remove the filter with 
6. Now you can use **Linear Regression** but use **Linear Regression with groups**



Estimates of parameters

Parameter	estimate	s.e.	t(5)	t pr.
factor 1	53.1	42.6	1.25	0.268
factor 2	103.5	56.8	1.82	0.128
metacarpal_bone_length_in_cm.factor 1	27.0	10.1	2.66	0.045
metacarpal_bone_length_in_cm.factor 2	15.0	11.8	1.27	0.259

While you don't have an **r** value, you do have the t probabilities and as you can see they are higher than 0.05 and before they were only 0.03 so as mentioned earlier, this data set would be better not as a piecewise model!