Tips and Tricks:

Cool Techniques for Creating Graphs

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Contents

# *S-PLUS Graphics*

General Information

- Graphs are created in and can be saved as Graph Sheets. Saved Graph Sheets have the file extension of **.SGR**. These saved graph sheets can be opened later – even after you have quit and restarted S-PLUS. They can also be distributed to others and opened within an S-PLUS version 4.x for Windows session.

- Graphical objects can be placed on the graph sheet or anywhere on the desktop and are saved when the Graph Sheet is saved to disk.

- Plots can be linked to data from other applications directly.

- Multiple plots can be combined on one graph, multiple graphs can be combined on one Graph Sheet, and Graph Sheets can contain multiple pages.

- Graph Sheets can be exported to formats, such as JPG, GIF, and TIF.

The S-PLUS Graph Sheet

- There are three primary, active areas of the **graph sheet**.

- The **graph sheet** is the actual page the plot is drawn on. Attributes such as the margin, orientation, and spacing are specified in the **Graph Sheet Properties** dialog.

    ◊ The **Graph Area**: the area outside the plot axis but within the Graph Sheet.

    ◊ The **Plot Area**: the area of the plot including the axis.

    ◊ The **Plot**: the actual points that constitute a plot.

The Graph Sheet

The Graph Area

The Plot Area

The Plot
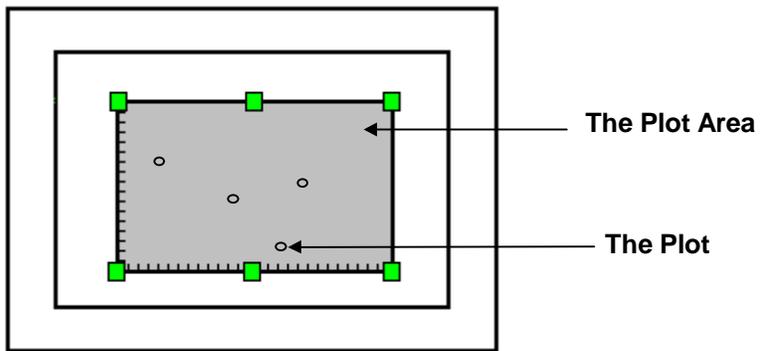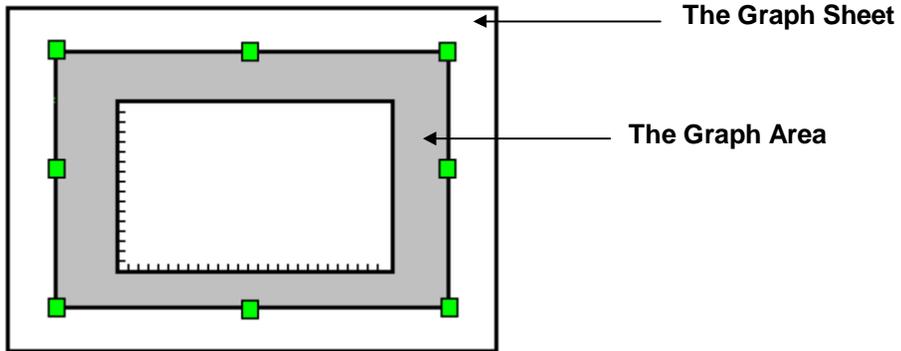
Hot Spots in The Graph Sheet

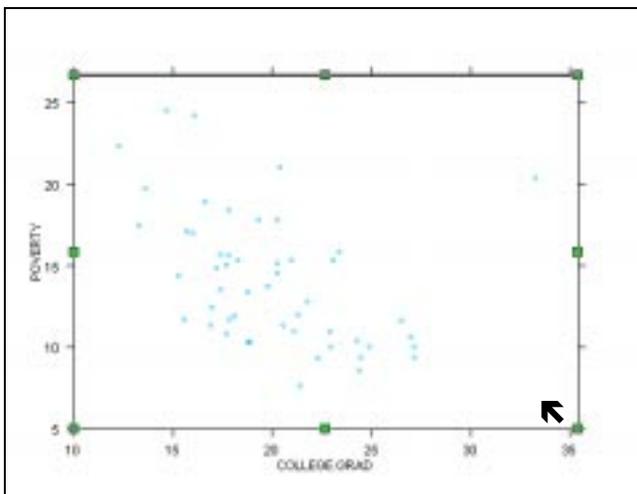- To select the Graph sheet, position your pointer near the edge of the sheet and click.

    ◊ Green knobs identify the Graph sheet as being selected.
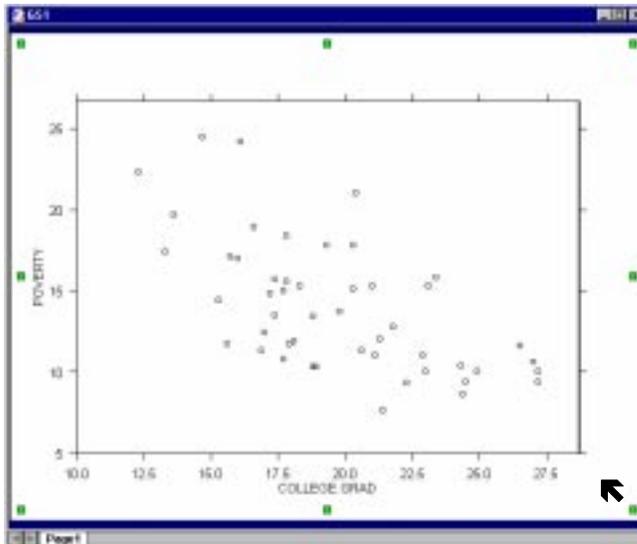
- To select the graph or plot area, position your pointer in the right-bottom (inside) corner of the graph or plot area and click.

    ◊ Green knobs identify the graph or plot area as being selected.

- To select an axis, position your mouse directly on a tick mark and click.

  ◊ A single green knob at the center of the axis identifies it as being selected.

- To select a plot, position your mouse directly on a data point and click.

  ◊ A single green knob near the bottom of the plot identifies it as being selected.
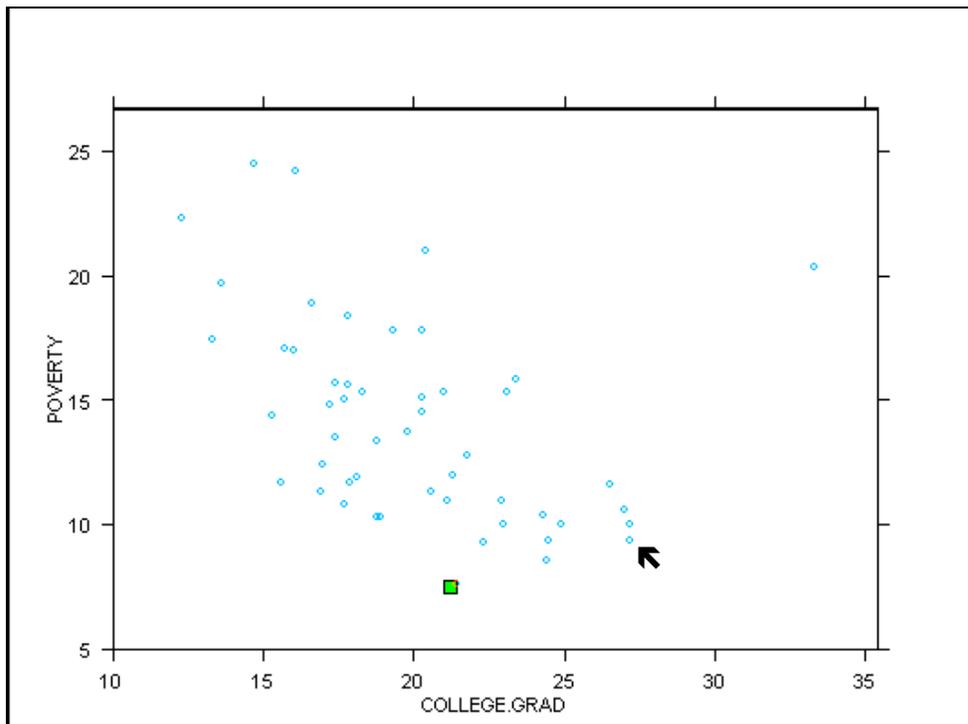
- To open up the dialog corresponding to the selected S-PLUS object, double-click on the green knob.

Graphs

Creating and Formatting a Multiple Plots on a Graph

The Problem

A graph is needed to inspect the behavior of two different variables. These variables were measured over the same range of independent variables (i.e., time), but the ranges of these variables are orders of magnitude different. The graph we want is one with a line connecting points, one line for each set of data.

The Data

- We will use two built-in S-PLUS data sets that are time series objects. They are called **hstart** and **ship**.

    ◊ You don't need time series objects to create this graph. You only need the x-axis to be the same for both data sets.

- To find the **hstart** and **ship** data sets.
    1. Click on the **Find Objects** (binoculars) icon on the Object Browser toolbar
    2. In the **Pattern** field type **hstart**
    3. Click **OK**
   4. Find the **ship** data set the same way

Creating the Plot

- Create the first time series plot of **hstart**
    1. Select the column, either in the Object Browser or in a Data Window.

    2. Click on the **Time Series** plot button on the 2D Plot palette

- With the plot window in view, add the second time series

  1. Select the graph; the knobs should appear around the border of the graph.

  2. Select the time series column in **ship** data set.

  3. SHIFT-click on the **Time Series** plot button on the 2D plot palette

Scaling to a Right Y-axis

- To add a new Y-axis and scale *one* of our time series plots to it, turn off the current y-axis frame. This will allow us to visualize the details of each line plot in the graph.

  1. Right-click on the y-axis and choose **Display/Scale** from the context menu. The **Y-axis** dialog appears.

  2. In the **Frame** field, choose **None** from the pull-down menu

  3. Click **OK**

- Then, create a new right y-axis linked to the **ship** data

  1. Double-click on the line plot (the uppermost plot) to display the **Line/Scatter** plot dialog

  2. In the Scale to portion of the **Data to Plot** page, specify **2** for the **Y-axis #**

  3. Click **OK**

  ◊ The second time series is automatically scaled to the new right y-axis.

- Turn off the right y-axis frame

  1. Right-click on the right y-axis and choose **Display/Scale** from the context menu. The **Y-axis** dialog appears.

  2. In the **Frame** field, choose **None** from the pull-down menu

  3. Click **OK**
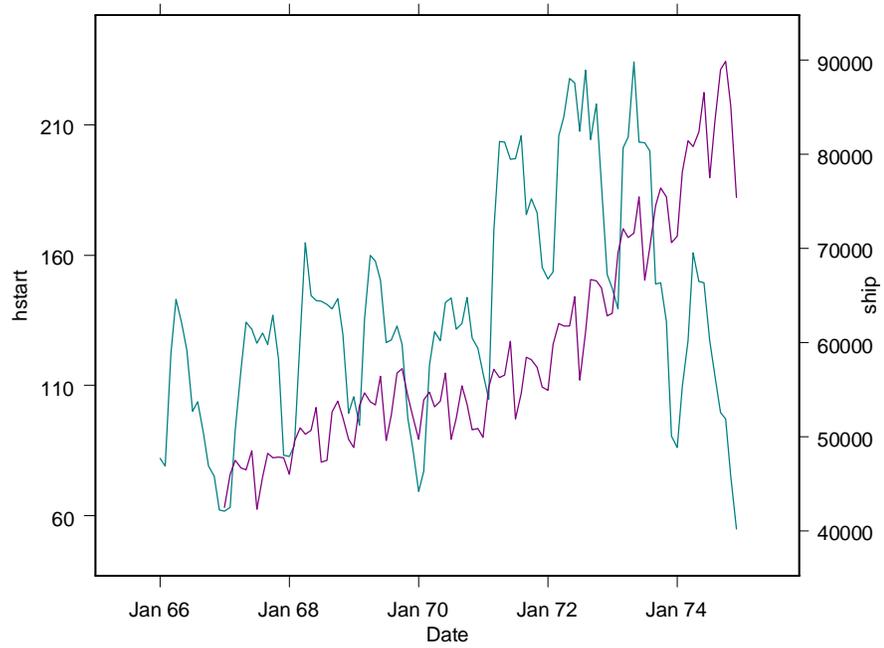
Figure 1: Multiple time series plots on one graph.

Trellis Graphics

Trellis graphs allow you to view multivariate relationships and interactions between different variables in your data set through *conditioning*.

- Data are viewed in a series of panels where each panel contains a subset of the original data.

- The subsets are created based on intervals of the values of the conditioning variable.

- In S-PLUS, all graphs can be conditioned using Trellis graphics.

    ◊ Data columns used in Trellis must all be of equal length

    ◊ Axes specifications and panel display attributes are identical in each panel. This is done automatically by S-PLUS.

Creating a Trellis Graph Using Plot Buttons

Creating A Trellis Graph When All Variables Are Continuous

- To create a Trellis graph using the plot buttons:

    1. **Find** the **environmental** data set
    2. Click on the + sign next to the Found Objects folder to display the list of found objects. Double-click on **environmental** to open it in a Data window.
    3. Turn on the conditioning mode by pressing the **Set Conditioning Mode** button on the Standard toolbar.
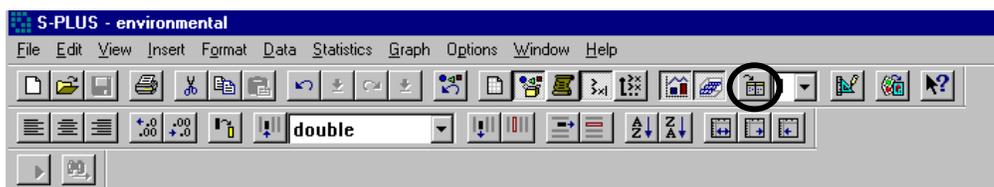
    4. On the toolbar, next to the **Set Conditioning Mode** button, set the number of conditioning variables to the desired number

        ∗ For this example, choose **2** from the drop-down list.
    5. Open the 2D plot palette (yellow conditioning bars appear on each plot button when Conditioning Mode is turned on)
    6. Select the x and y columns you wish to plot, followed by the conditioning variable(s):

        ∗ For this example, CTRL-click on **radiation**, then **ozone**, then **wind**, then **temperature**
    7. Click the **Linear Fit** plot button .
        ◊ S-PLUS automatically divides each of the two conditioning variables, **temperature** and **wind**, into two groups.

        ◊ Trellis graphs can also be created using the Graph Properties dialog or using drag-and-drop (S-PLUS User's Guide, chapter 9, page 209)
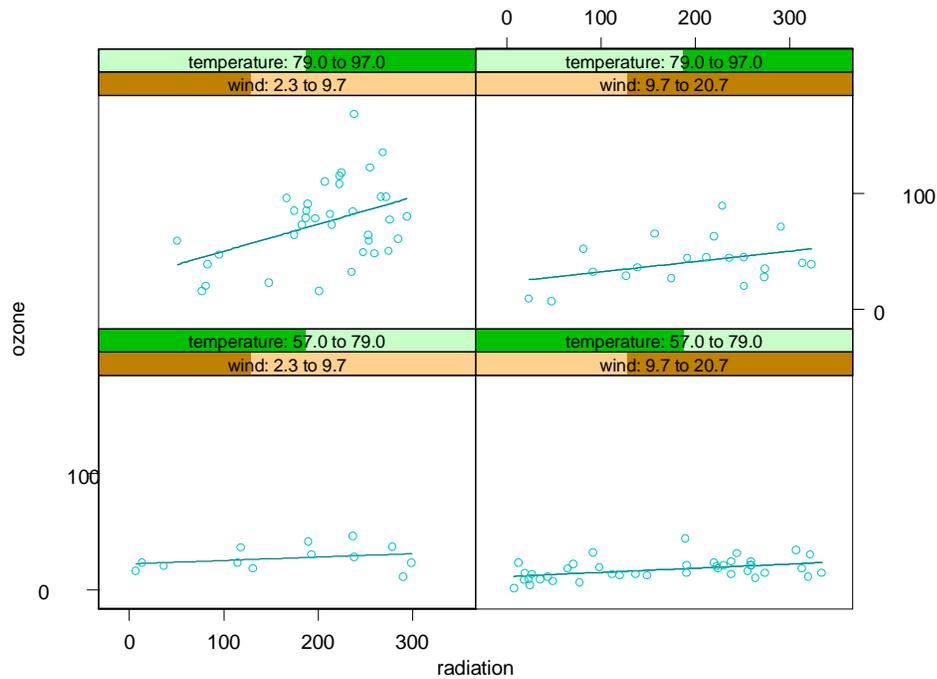
Figure 2: ozone vs. radiation conditioned on wind and temperature.

Details

By default, if your data are continuous, S-PLUS uses an equal counts algorithm to condition the plots. Each panel contains, as close as possible, the same number of points. You can optionally choose to use equal ranges algorithm, which conditions the data by creating subsets using the conditioning variables whose subset ranges (maximum-minimum) are equal.

The **Multipanel** page of the **Graph2D Properties** dialog contains the fields for changing these options.

Adding Another Plot to the Trellis Graph

You can combine multiple plots on a single Trellis graph. In this example we will create a plot of **ozone** vs. **radiation** conditioned on wind, and add a plot of **temperature** vs. **radiation** to our existing Trellis graph. The result will be two different sets of points in each panel.

- Create a trellis plot. For this example create a Linear Fit plot of **ozone** vs. **radiation** conditioned on **wind**. That is, select **radiation**, **ozone**, and **wind**, in this order, then select the **Linear Fit** button on the 2D Plot palette.

- To add another plot:

    1. Select the existing Trellis graph by clicking on the graph area (but not on a plot). Knobs will appear around the edges of the graph.
    2. Select the columns**.** In this example, we will select **radiation**, **temperature**, then **wind**.

        ◊ **Note:** Be sure to choose the x-axis variable being used for the current Trellis plot as the x-axis variable for the plot you are adding.

    3. Open the 2D Plot palette if not already open.

    4. Hold down the SHIFT key while clicking on the **Linear Fit** button. That is, SHIFT-click on the **Linear Fit** button.
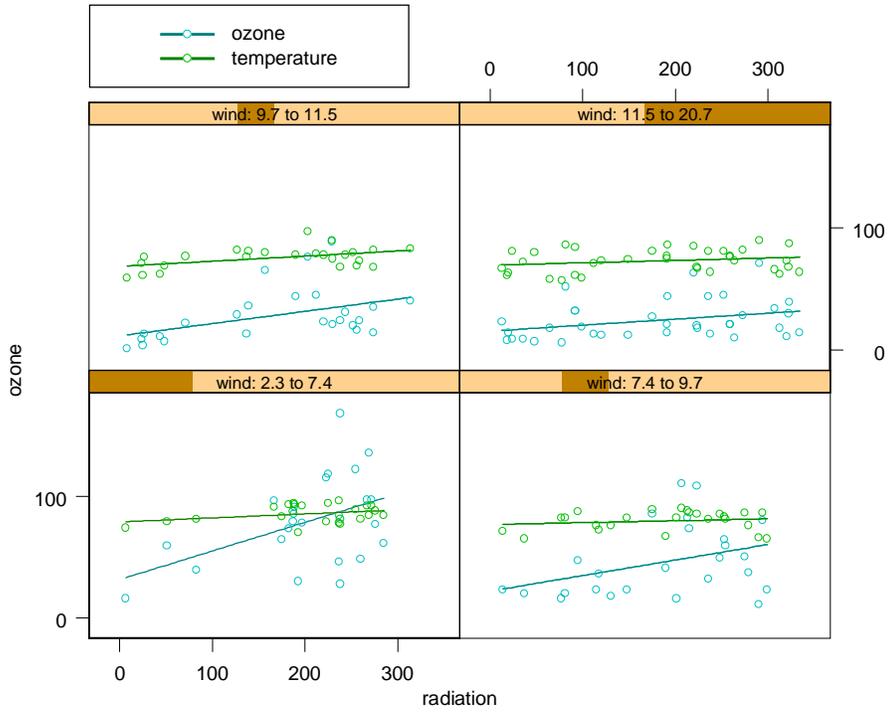
Figure 3: Two plots in a Trellis Graph.

Additional Tips and Tricks

Placing Multiple Graphs on a Graph Sheet

Adding a New Graph to an Existing Graph Sheet

- In this example, we are creating and adding a graph to an existing graph sheet.

    1. Open the graph sheet in which you wish to add a graph. *Make sure nothing on the graph sheet is selected.*
    2. Select the data columns for the new plot.
    3. Open the 2D plot palette (if you don't have one open).
    4. SHIFT-click the plot button of your choice on the plot palette.
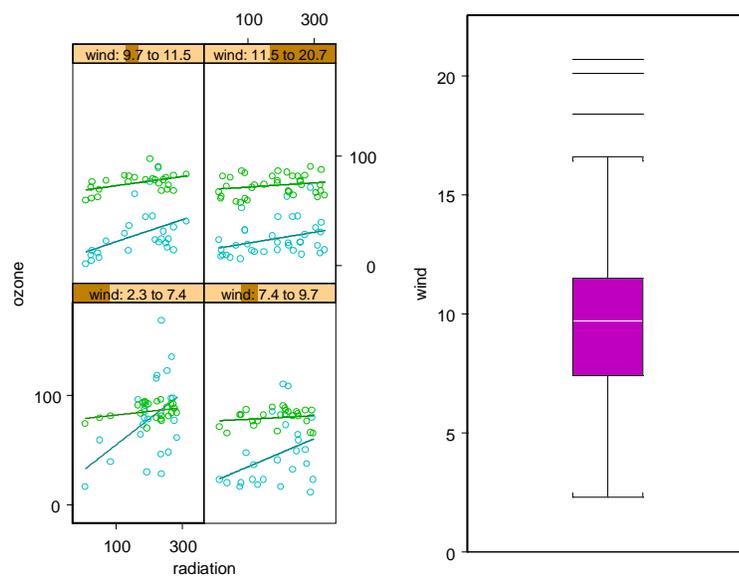
Figure 4: Two graphs on a single graph sheet.

   ◊ A second graph is added to the existing graph sheet. Notice that the first graph is automatically moved over to accommodate the new graph. S-PLUS has options for automatically arranging multiple graphs on a page, found in the **Format**/**Arrange Graphs** on the main menu.

- In S-PLUS, it's a good idea to lay out multiple graphs on a page before adding details such as text, formulas, legends, and annotations. When you combine graphs after you have added these objects, the objects will have to be rescaled and may require further editing.

- Graphs can also be combined using drag and drop or the **Insert/Graph** option. Please refer to the Users Manual, Chapter 8.

Combining Graphs from Different Pages or Different Graph Sheets

In this example we will combine graphs that have already been created, but exist on separate pages or graph sheets.

- To combine graphs from different graph sheets:

    1. Open all individual graph sheets you want to combine, then
    2. Choose the **New** button on the standard toolbar.
    3. Choose **Graph Sheet**.
    4. Select one of the individual graph sheets.
    5. From the **Edit** menu, choose **Copy GraphSheet Page.**
    6. Select the empty graph sheet window.
    7. From the **Edit** menu, choose **Paste.**
    8. Repeat the above steps for each individual graph sheet.

Helpful Hint:
To add additional pages to your graph sheet, right-click on the page tab bar at the bottom of the graph sheet, and select Add Page.

Formatting Axis Ticks

- To modify the tick mark ranges:

    1. Use or create a plot, such as a scatter plot.
        ◊ We are modifying a scatterplot of **ozone** vs. **radiation**, data found in the built-in data set **environmental**.
    2. Right-click on the y-axis and choose **Range** from the context menu
    3. Specify 0 for the **Axis Minimum**
    4. Specify 200 for the **Axis Maximum**
    5. In the Major Tick Placement section, specify **20** for the **Interva**l and **Size** for the **Interval Type**
    6. Click **OK**

- The y-axis is now scaled from 0 to 200 and the size of the interval is 20.

Adding Minor Ticks

- Using the same scatterplot as above:

    1. Right-click on the y-axis and choose Range from the context menu.

    2. In the **Minor Tick Placement** section, specify 10 for the **Interval** and **Size** for the **Interval Type.**

    3. Turn to the **Grids/Ticks** page of the dialog.

    4. In the Minor Ticks section, change the **Length** field to any length you want.

        ◊ As a guide for minor tick length, look in the length field of the Major Ticks section. This number is the length of the major ticks for this axis.

        ◊ An initial suggestion for a minor tick length is half that of the major tick length. Use trial and error to find the minor tick length that you prefer.