

ABC's of Graphs in Version 8

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Abstract

Version 8 has greatly increased the versatility and usability of graphs that can be created by SAS. This paper will discuss the new graphic capabilities and how they can be used to upgrade the look and feel of graphs. In addition, the Output Delivery System (ODS) in regards to graph creation and drill down capabilities will be discussed.

Introduction

The introduction of Version 8 has included new options and abilities for creating graphics from your data. This new functionality includes the availability of the Output Delivery System (ODS) to enable created graphs to be displayed within a browser. An understanding of ODS is assumed. The object of this paper is to give an overview of all the new capabilities in Version 8.

Updated Graph Appearance

- 3D Charts - Proc GCHART can now produce 3D bar and pie charts (see Appendix for example and Fig. 1a)

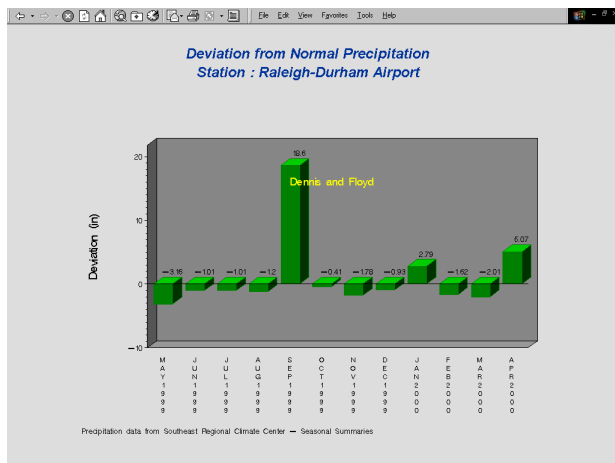


Fig 1a. Vertical 3D bar chart.

- Labeling points – the SYMBOL statement has a new option called POINTLABEL. This option will label specific points within a GPLOT or all points depending upon the options selected (see Appendix for example and Fig.1b).

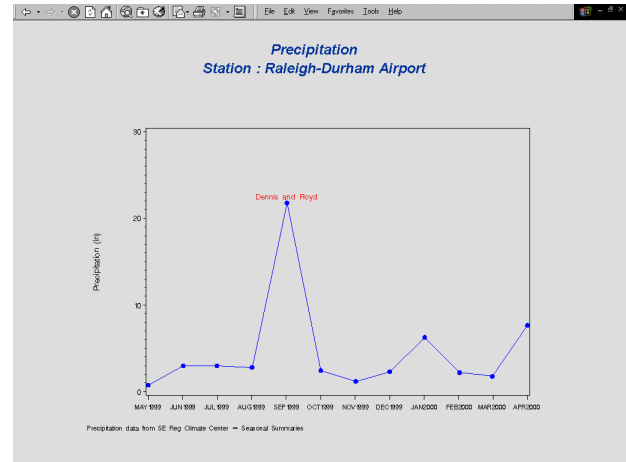


Fig 1b. Labeling a point on a plot.

- Text height – Text height can be specified as points in AXIS, GOPTIONS, LEGEND, TITLE, FOOTNOTE and NOTE statements (see footnote statements in appendix SESUG2).

Drivers

In Version 8, several new browser-dependent drivers have been introduced. The new additions are listed below

Drivers	Procedure Availability
HTML	GCHART, GCONTOUR, GMAP, GPLOT, and G3D
WEBFRAME	GCHART, GCONTOUR, GMAP, GPLOT, and G3D
ACTIVEX	GCHART, GCONTOUR, GMAP, GPLOT, and G3D
JAVA	GCHART, GCONTOUR, GMAP, GPLOT, and G3D

The first, HTML, creates a single HTML file that displays each of the created graphs one after another. Graphs are viewed by scrolling down through the HTML document. This type of output can also be obtained using one of the GIF drivers and ODS.

The second, WEBFRAME, creates two (2) sets of GIF files for each graph produced, INDEX.HTML, SASTHUMB.HTML, and associated HTML files for each of the graphs produced. The final product is a web page that contains two (2) sections. The left-

hand section is SASTHUMB.HTML and contains a set of smaller (thumbnail) versions of each graph produced. These graphs can be clicked to display a full-size version of the graph on the right-hand side (see Fig 1).

To produce this type of graph:

- Use a GOPTIONS statement to define the device needed. In the example below, RESET was used to clear all previous graphic options.

```
goptions reset=all
        device=WEBFRAME
        gsfname=odsout
        transparency
        noborder
        vsize=7in hsize=6in;
```

- Create a set of graphs using a BY statement (see Appendix for example). Note on graph numbering – WEBFRAME automatically numbers the graphs created using the text entered in the NAME option (PLOT, VBAR etc) and starting with the “name” and then numbering each subsequent graph. The number depends upon the internal counter and how many times you have created the graphs.

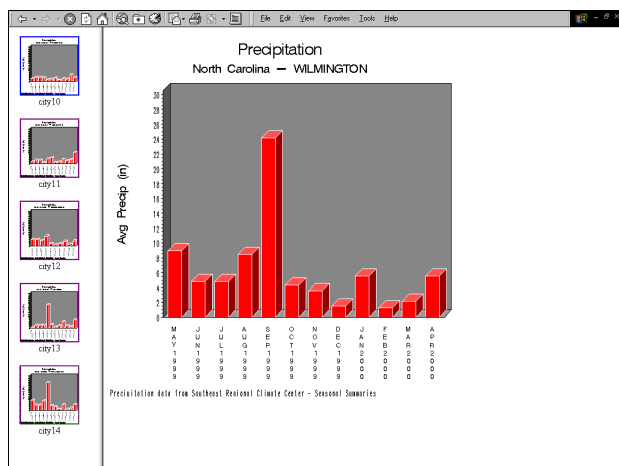


Fig. 2. Output produced by WEBFRAME.

The next two (2) drivers need to be used in conjunction with ODS and come under the heading of super cool graphs. The ACTIVEX and JAVA drivers create graphs that are interactive in that the user can change how the graph colors and labels appear, how the data is summarized, how the graph is oriented (horizontal or vertical), etc. Note - the JAVA driver has a richer set of controls including the ability to save the changed graph. The advantage of using this type of graph is that users can interact with the graph, changing it so that it meets their needs (Fig 3 and 4).

The ACTIVEX driver creates a graph utilizing a set of ACTIVEX controllers. To create a graph with the ACTIVEX driver -

- Use the GOPTION statement to set the driver and pixel size of the graph.

```
goptions reset=all device=ACTIVEX
        xpixels=500 ypixels=350
        cback=white border;
```

- Create a graph (see Appendix for example). Note ODS is required for creating the HTML output. An example of the ODS HTML statement is below:

```
ods html file=precip;
```

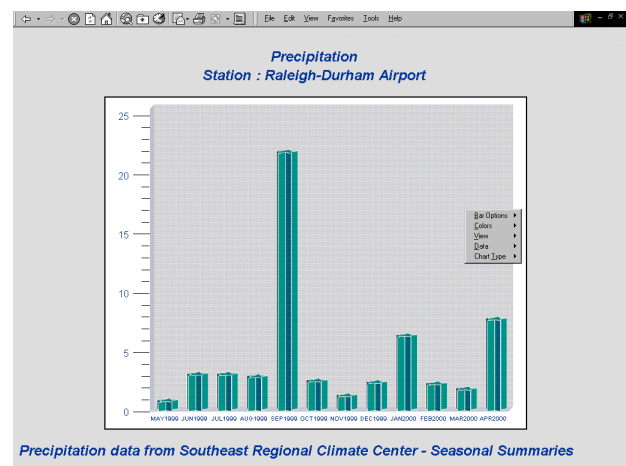


Fig 3. Graph created with ACTIVEX driver.

The JAVA driver creates a graph utilizing a JAVA applet. To create a graph using the JAVA driver -

- Use the GOPTION statement to set the driver and pixel size of the graph.

```
goptions reset=all device=JAVA
        xpixels=500 ypixels=350
        cback=white border;
```

- Create a graph (see Appendix for example).

Note: the JAVA driver is creating a JAVA applet and load time can be slow!

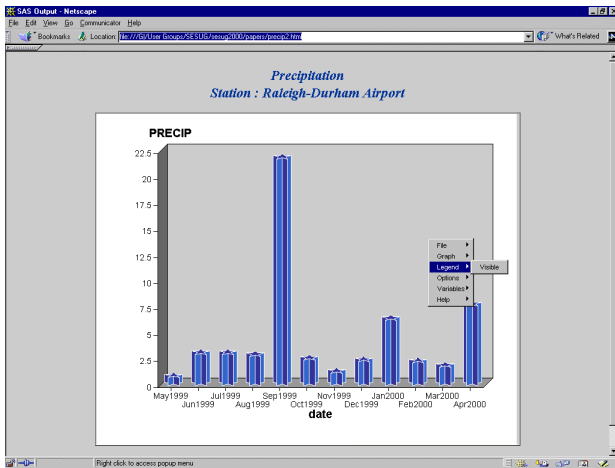


Fig 4. Graph created with JAVA driver.

In determining when to use the ACTIVEX versus the JAVA driver the following factors need to be considered:

- Type of graph being created - are drill-down capabilities needed? Use JAVA driver.
- Type of controls needed – if the ability to save the graph is needed then use the JAVA driver
- Type of browser that will be used to view the graph. Note: the ACTIVEX driver controls are not currently supported by any ACTIVEX plugs in Netscape¹.

Drill-Down Capabilities

“Drilling-down” is the ability to click on a point on a graph or map and link to another graph or report that contains information that is specific for the region selected. A clickable region can be a section of a bar in a bar chart, a map region, a point on a plot, or a graphic area designed using ANNOTATE. For example, drilling-down could occur when a user clicks on a state and is linked to a graph that contains the sales trend for that state.

Graphs with drill-down capabilities can be created from the following procedures with the use of ODS:

- PROC GANNO
- PROC GCHART
- PROC GMAP
- PROC GPLOT

The following driver can be used to create drill-down graph in conjunction with ODS:

- JAVA driver

Anatomy of a drill-down graph –

- The data used to create all of the graphs, maps or reports is prepared and variables are added that contain link (anchor) information.
- A high level graph or map is created with summary information. Areas of the graph are

defined to be clickable using either the IMAGEMAP option in the PROC statement or HTML and HTML_LEGEND options in the plotting, charting or mapping statement. Note: HTML_LEGEND defines areas of the legend as clickable.

- A set of lower summary level graphs, maps, or reports are created that will be accessed when the user clicks on the appropriate area of the high level graph or map.

Note: it is possible to have one or more levels of drill-downs that are dependent on a specific hierarchy.

The following example creates a map of the US with each state clickable.

- Prepare data – in this example the following DATA step creates a data set specifically designed to assign a drillable area to each state. Note: the drill variable defines the anchor for a drillable area. In this case it links to a single HTML document but the link could be to multiple documents.

```
proc sort data=maps.us
out=makemap(keep=state) nodupkey;
  by state;
run;
```

```
data makemap;
  set makemap;
  y=1; n=_n_;
  statedrill=compress('HREF="states.html
#state'||n||'");
run;
```

- Assign the ODS and GOPTION parameters for the map.

```
filename odsout 'g:\sesug2000\papers';

ods html body='state.html' nogtitle
  path=odsout;

goptions device=gif ftext=swissl
  transparency hsize=7in vsize=6in;
```

- Create the map. The HTML option is used on the CHORO statement to indicate the variable that contains the link information. Note: in this case the drillable area is the state.

```
pattern color=green;
title1;
proc gmap map=maps.us data=makemap;
  id state;
  choro y / coutline=blue nolegend
```

```
html=statedrill;
```

```
run;
quit;
```

- Close the map ODS HTML call.

```
ods html close;
```

- Create the data for the report.

```
proc sort data=maps.uscity(keep=state
city pop capital) out=cities;
  where pop > 40000;
  by state city;
run;
```

```
data cities;
  set cities;
  statename=fipname1(state);
run;
```

- Assign ODS parameters for the report. A new parameter is added – anchor. Use of the anchor parameter ensures that when the state is clicked, the correct part of the state report will be displayed. In this case, the anchor names start with STATE1 and will automatically be incremented. Note: This matches the statedrill parameter created in the makemap data set which uses *n* instead of the state FIP's code to number the #state.

```
ods html body='states.html'
  anchor='state1' path=odsout;
```

- Create the report and close the ODS statement.

```
options nobyline;
proc report data=cities nowd headline;
  by state statename;
  title '#byval(statename)';
  column city pop;
```

```
  define city / display width=50 City';
  define pop / display width=20
  format=comma10. 'Population (1990)';
run;
```

```
ods html close;
```

Figures 4 and 5 demonstrate how the map and report function. State.html is used to display the US map and when a user clicks a state, the city report is displayed with the appropriate section for that state.

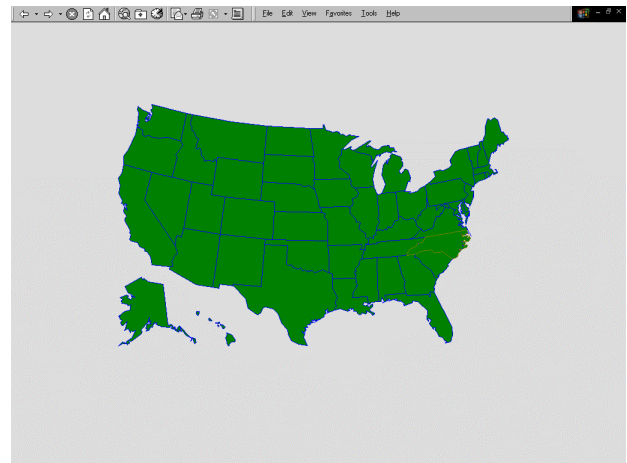


Fig 5. Map created with clickable areas. North Carolina has been clicked.

North Carolina

City	Population (1990)
Asheville	61,607
Cary	43,858
Charlotte	395,934
Durham	136,611
Fayetteville	75,695
Gastonia	54,732
Goldsboro	40,709
Greensboro	183,521
Greenville	44,972
High Point	69,496
Raleigh	207,951
Rocky Mount	48,997
Wilmington	55,530
Winston-Salem	143,485

North Dakota

City	Population (1990)
------	-------------------

Fig 6. North Carolina portion of report displayed when state clicked.

Clickable graphs from GCHART and GPLOT output can be created using the same steps as described above.

The next drilldown example illustrates creating a drilldown bar chart where clicking on a bar opens another bar chart. This type of drilldown can be created for total bars or segments of a bar and is very effective when used with hierarchical data.

The code for this example is in the Appendix, SESUG4. Fig 7 shows the top level bar chart. Each bar within this chart will display a bar chart for with data specific for that month. Fig 8 illustrates one of the lower level graphs.

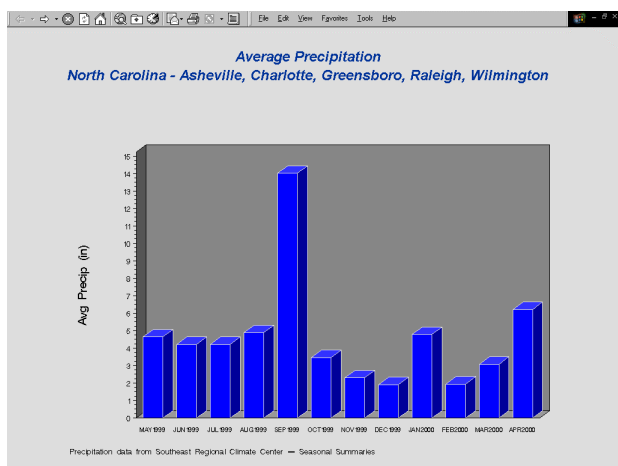


Fig 7. Top level bar chart.

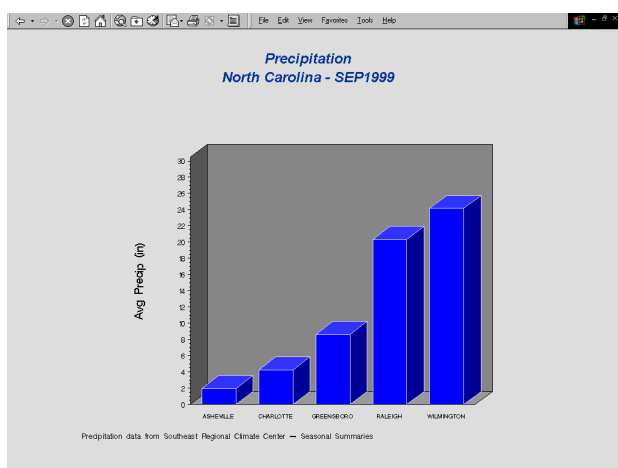


Fig. 8. Lower level bar chart.

The final type of drilldown graph to be discussed is created using the JAVA driver. An example of the output created is in Fig. 9. Each bar when clicked will display a graph containing the individual sections.

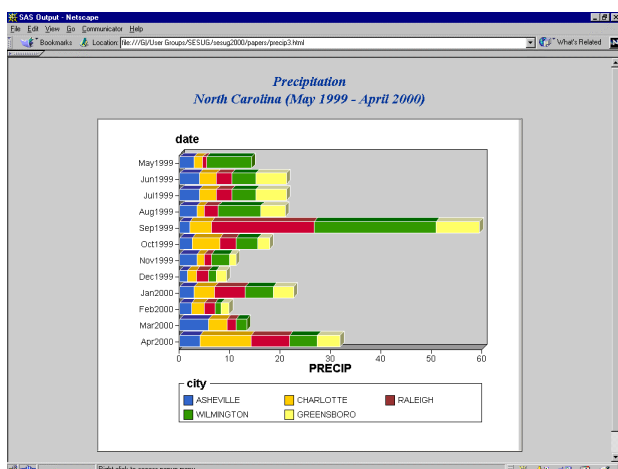


Fig 9. Drill down graph created with JAVA driver.

References

1. TS602 Compatibility Document for the ACTIVEX Device Driver. <http://ftp.sas.com/techsup/download/technote/ts602.html>
2. GCHART. SAS® Online Doc Version 8. SAS Graph Software Reference. Proc GCHART.
3. GPLOT. SAS® Online Doc Version 8. SAS Graph Software Reference Proc. GPLOT.
4. GMAP. SAS® Online Doc Version 8. SAS Graph Software Reference Proc GMAP.
5. SYMBOL. SAS® Online Doc Version 8. SAS Graph Software Reference SAS/GRAPH Statement. SYMBOL.
6. SAS® Online Doc Version 8. SAS Graph Software Reference. Proc G3D.
7. JAVA driver. <http://www.sas.com/rnd/webgraphs/javaapplets.htm>
8. ACTIVEX driver. <http://www.sas.com/rnd/webgraphs/activexgraphs.htm>
9. Web Graph Examples. <http://www.sas.com/products/graph/demos/index.html>
10. Output Delivery System. SAS® Online Doc Version 8. BASE SAS Software, Guide to the Output Delivery System.
11. SAS Institute Inc. 1999. What's New in SAS® Software for version 7 and the Version 8 Developer's Release, Cary, NC. SAS Institute. Pp.221-230.

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Appendix – Code to generate the examples

Used by all programs.

```
libname metdata 'g:\data\meterological';
```

```
filename odsout 'g:\sesug2000\papers';
```

```
/*-----*
* PROGRAM:      SESUG1.SAS                                *
* DESCRIPTION:  Creating a 3D vertical bar chart          *
*-----*/
options device=gif text=swissl transparency hsize=7in vsize=6in ;

/* bar label - label a specific bar */
data barlabel;
  length color style $ 8;
  retain color 'yellow' when 'a' style 'swiss'
           xsys ysys '2' position '9' size 3 hsys '3';
  set precip;
  where date='01SEP1999'd and station='RALEIGH DURHAM WSFO AP';
  midpoint=date;
  text='Dennis and Floyd';
run;

ods html body='pcpdev.html' path=odsout nogtitle;

/* create a 3D bar chart with block bars */
proc gchart data=metdata.ncprecip annotate=barlabel;
  where station='RALEIGH DURHAM WSFO AP';
  title1 f=swiss h=2 'Deviation from Normal Precipitation';
  title2 f=swiss h=1.5 'Station : Raleigh-Durham Airport';
  footnote j=l 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=(a=90 f=swiss h=1.5 'Deviation (in)');
  axis2 label=none;
  vbar3d date / sumvar=dev discrete raxis=axis1 maxis=axis2 shape=b outside=sum;
run; quit;
ods html close;

/*-----*
* PROGRAM:      SESUG2.SAS                                *
* DESCRIPTION:  Labeling a point on a plot              *
*-----*/
data precip;
  set metdata.ncprecip;
  where station='RALEIGH DURHAM WSFO AP';
  if date='01SEP1999'd then label='Dennis and Floyd';
run;

ods html body='plotlabel.html' path=odsout nogtitle;
/* create plot with labeled point */
proc gplot data=precip;
  title1 f=swiss h=14pt 'Precipitation';
  title2 f=swissb h=12pt 'Station : Raleigh-Durham Airport';
  footnote j=l h=8pt 'Precipitation data from SE Reg Climate Center - Seasonal Summaries';
  axis1 label=(a=90 f=swiss h=10pt 'Precipitation (in)');
  axis2 label=none value=(h=8pt);
  symbol v=dot i=join c=blue pointlabel = ("#label" c=red);
  plot precip*date / vaxis=axis1 haxis=axis2;
run; quit;
ods html close;
```

```

/*-----*
* PROGRAM:      SESUG3.SAS                                *
* DESCRIPTION:  JAVA and ACTIVEX Graph Creation          *
*-----*/
filename precip 'g:\sesug2000\papers\precip1.html';
filename precip 'g:\sesug2000\papers\precip2.html';

/*-----*/
/* ACTIVEX driver - graph creation                        */
/*-----*/

ods html file=precip;

options reset=all device=activex xpixels=500 ypixels=350 cback=white border;

proc gchart data=metdata.ncprecip;
  where station='RALEIGH DURHAM WSFO AP';
  title1 f=swiss h=2 'Precipitation';
  title2 f=swiss h=1.5 'Station : Raleigh-Durham Airport';
  footnote j=1 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=none;
  axis2 label=none value=(h=.8 f=swiss);
  vbar3d date / sumvar=precip discrete raxis=axis1 maxis=axis2 shape=s coutline=white;
run; quit;

/*-----*/
/* JAVA driver - graph creation                          */
/*-----*/
ods html file="precip" parameters=("DRILLDOWNMODE"="LOCAL");

options reset=all device=java xpixels=500 ypixels=350 cback=white border;

proc gchart data=metdata.ncprecip;
  where station='RALEIGH DURHAM WSFO AP';
  title1 f=swiss h=2 'Precipitation';
  title2 f=swiss h=1.5 'Station : Raleigh-Durham Airport';
  footnote j=1 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=none;
  axis2 label=none value=(h=.8 f=swiss);
  vbar3d date / sumvar=precip discrete raxis=axis1 maxis=axis2 shape=s coutline=white;
run; quit;

```

```

/*-----*
* PROGRAM:      SESUG4.SAS                                *
* DESCRIPTION:  Creating a drill-down bar chart and subsequent *
*              graphs                                     *
*-----*/
/* prepare data for top-level graph - average precipitation */
data precip;
  set metdata.ncprecip;
  length city $50.;
  if index(station,'ASHEVILLE') > 0 then city='ASHEVILLE';
  if index(station,'RALEIGH') > 0 then city='RALEIGH';
  if index(station,'CHARLOTTE') > 0 then city='CHARLOTTE';
  if index(station,'WILMINGTON') > 0 then city='WILMINGTON';
  if index(station,'GREENSBORO') > 0 then city='GREENSBORO';
  if city ne ' ' then output;
run;

proc sort data=precip;
  by date;
run;

proc summary data=precip;
  by date;
  var precip;
  output out=avgpcpnc mean=precip;
run;

/* average precipitation data with drilldown by month added */
data avgpcpnc;
  set avgpcpnc;
  select(date);
    when('01MAY1999'd) datedrill='href="city.html"';
    when('01JUN1999'd) datedrill='href="city1.html"';
    when('01JUL1999'd) datedrill='href="city2.html"';
    when('01AUG1999'd) datedrill='href="city3.html"';
    when('01SEP1999'd) datedrill='href="city4.html"';
    when('01OCT1999'd) datedrill='href="city5.html"';
    when('01NOV1999'd) datedrill='href="city6.html"';
    when('01DEC1999'd) datedrill='href="city7.html"';
    when('01JAN2000'd) datedrill='href="city8.html"';
    when('01FEB2000'd) datedrill='href="city9.html"';
    when('01MAR2000'd) datedrill='href="city10.html"';
    when('01APR2000'd) datedrill='href="city11.html"';
    otherwise;
  end;
run;

goptions device=gif ftext=swissl transparency hsize=9in vsize=7in ;

ods html body='date.html' path=odsout nogtitle;

proc gchart data=avgpcpnc;
  title1 f=swiss h=2 'Average Precipitation';
  title2 f=swiss h=1.5 'North Carolina - Asheville, Charlotte, Greensboro, Raleigh,
Wilmington';
  footnote j=l 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=(a=90 f=swiss h=1.5 'Avg Precip (in)');
  axis2 label=none value=(h=0.9);
  pattern1 c=blue;
  vbar3d date / sumvar=precip discrete raxis=axis1 maxis=axis2 shape=b
          coutline=white
          html=datedrill name='date';
run; quit;

ods html close;

```

```

/* prepare data for secondary graphs */
proc sort data=precip;
  by date city;
run;

proc summary data=precip;
  by date city;
  var precip;
  output out=avgpcp mean=precip;
run;

/* create a separate html file for each graph */
ods html body='city.html' path=odsout nogtitle newfile=page;

options nobyline;
proc gchart data=avgpcp;
  by date;
  title1 f=swiss h=2 'Precipitation';
  title2 f=swiss h=1.5 'North Carolina - #byval(date)';
  footnote j=l 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=(a=90 f=swiss h=1.5 'Avg Precip (in)')
    order = 0 to 30 by 2;
  axis2 label=none value=(h=.8 f=swiss);

  vbar3d city / sumvar=precip
    raxis=axis1
    maxis=axis2
    shape=b
    coutline=white
    name='city'
    des='#byval(date)';

run;
quit;

ods html close;

/*-----*
* PROGRAM:      SESUG5.SAS                               *
* DESCRIPTION:  Creating a drill-down bar chart with JAVA driver *
*-----*/
/* In this case the drilldown parameter will continue until the lowest level */
ods html file=precip3
  parameters=("DRILLDOWNMODE"="LOCAL");

options reset=all device=java xpixels=700 ypixels=550 cback=white border;

proc gchart data=avgpcp;
  title1 f=swiss h=2 'Precipitation';
  title2 f=swiss h=1.5 'North Carolina (May 1999 - April 2000)';
  footnote j=l 'Precipitation data from Southeast Regional Climate Center - Seasonal
Summaries';
  axis1 label=(f=swiss h=1.5 'Avg Precip (in)');
  axis2 label=none
    value=(h=.8 f=swiss);
  hbar3d date / sumvar=precip type=mean subgroup=city raxis=axis1 maxis=axis2 discrete
    coutline=white;

run; quit;

ods html close;

```