

# XMGR - Grace Graphics

## Refresher Training & Reference Guide

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# XMGR - Grace Graphics

 The Basics

 Features & Capabilities - Old & New

 Examples

 Sample Graphics

 Tricks & Suggestions

 Reference Material & Hyperlinks

# Xmgr-Grace Basics

- Xmgr-Grace is an XY plotting tool for workstations
- User defined graph type, appearance, scaling, symbols, line styles, colors, labels, tick marks, text strings and more
- Well adapted to work with scripting languages
- Can Read and Write Parameter settings for uniformity in graphics

# Xmgr-Grace Basics

- Data transformations possible:
  - Polynomial regression, splines, running averages, cross and auto correlations and more
- Batch mode capable for unattended plotting
  - HSM scripts generate PM Graphics in grbatch mode
- Hardcopy support for Post Script
  - Grace supports many formats: jpeg, pdf, png, ps(several formats)

## Xmgr-Grace References Material

- Grace Homepage (5.1.9):
  - <http://plasma-gate.weizmann.ac.il/Grace/>
- Xmgr 4.1.2
  - <ftp://plasma-gate.weizmann.ac.il/pub/xmgr4/src/xmgr-4.1.2.tar.gz>
  - </vol/hsm/apps/xmgr/xmgr-4.1.2/doc/>

# Xmgr Set-up

- `setenv GR_HOME /vol/hsm/bin/solaris/xmgr4`
- `setenv GR_EDITOR textedit`
  - You can select the texteditor you prefer as your default
- `setenv GR_PS_PRSTR lp -c -d hsm1j4k`
  - You can select the printer you prefer as your default

**Tip:** create an alias (e.g. v4) to xmgr4 to execute an xmgr  
“\*.fig” file in a “HSM” favorable format and size:

```
alias v4 "/vol/hsm/bin/solaris/xmgr4 -landscape - geometry =1140+870+0+0"
```

# Xmgr Utilities

- Xmgr \*.fig file viewer **pm4** automates opening \*.fig files
  - Run */net/ibis/usr1/cwhite/bin/pm4* in the directory containing \*.fig files or copy pm4 to your own /bin
- Date conversion utilities: greg2jul\_ymd  
echo 1965 01 01 | greg2jul\_ymd ==> 2438762 (julian)
- Date conversion utilities: jul2greg  
echo 2451910 | jul2greg ==> 2000 12 31 (gregorian)
- ☠ NOTE: MS Excel julian dates are different !!!!!

# Xmgr-Grace Terminology

- Sets – collection of points and associated values
  - Values can be used to displayed error bars, high-low open-closed plots among others
  - Sets are numbered from 0 onwards (29 Xmgr, unlimited Grace)
  - Number of points in a set limited by virtual memory size
  - Plot/Symbols pop-up menu

# Xmgr-Grace Terminology

- Graphs – collection of data sets, tick marks, titles, etc. drawn to display the data
  - 10 graphs w/up to 30 sets each Xmgr, Grace unlimited
  - Graphs are number 0-9 (Xmgr), Grace unlimited
  - Graphs arranged in rows & columns or user defined locations
  - Graphs/Graph operations pop-up menu



# Xmgr-Grace Terminology

- Regions – sections of graphs
  - defined by the interior or exterior of a polygon
  - defined by an area above-below-left-right of a line
  - Data/Region operations pop-up menu
- To implement features, characteristics & changes to graphs, parameter files, written sets and MORE, YOU MUST “Click” the ACCEPT button/icon or they will not be SAVED. It is easy to lose edits by missing this!

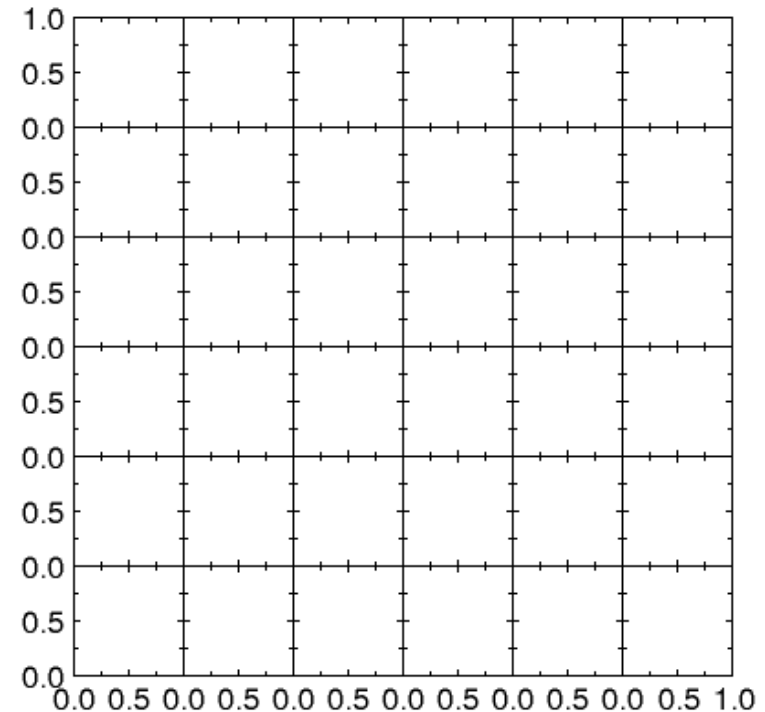
# Xmgr & Grace Graphing Capabilities

- Grace
  - unlimited # of sets
  - unlimited # of graphs
- Xmgr
  - 30 set limit per graph
  - 10 graph limit
- Graphs can arrange in layers, side by side, stacked or mixed to suit graphing needs

## WEAKNESSES

- ❖ No Undo Feature
- ❖ Must “Accept” Changes

Demo of many graphs

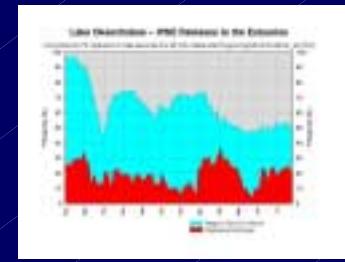
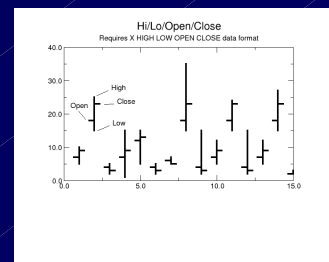
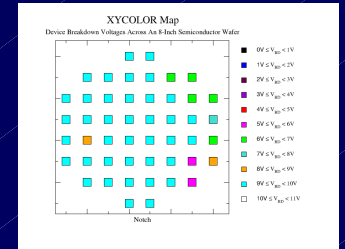
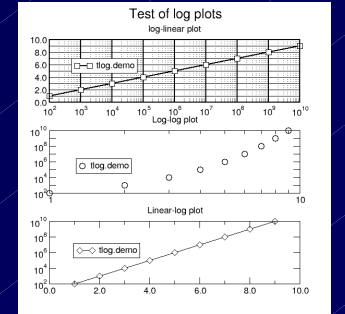
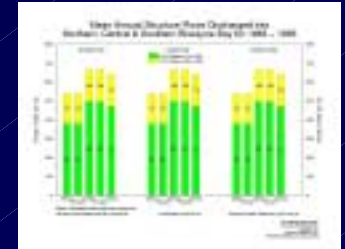
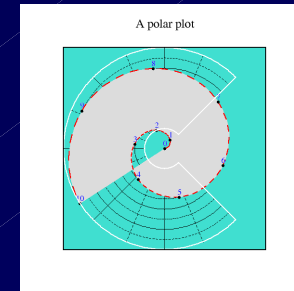
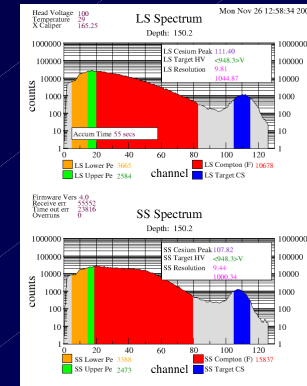
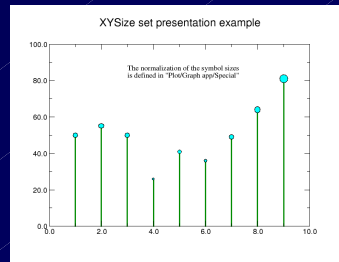
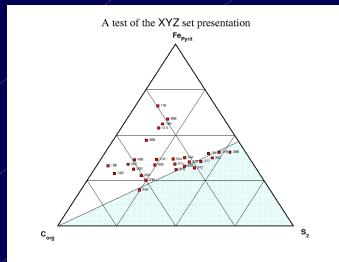
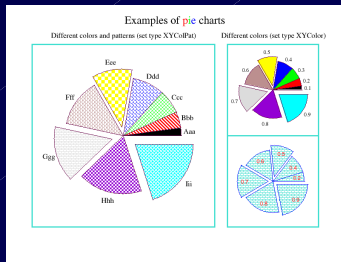
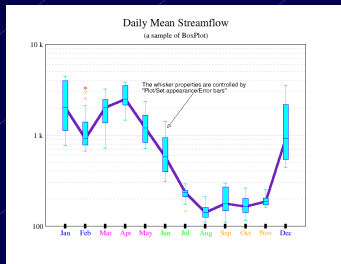
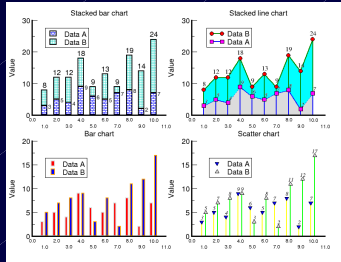
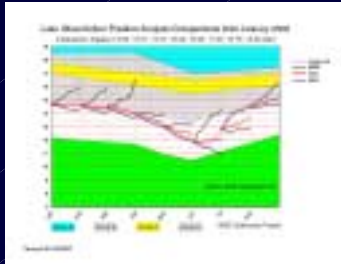


Grace no longer has limits on the number of graphs or the number of sets in a graph. This demo is a matrix of graphs 6x6 for a total of 36.

# Xmgr-Grace Graph Types

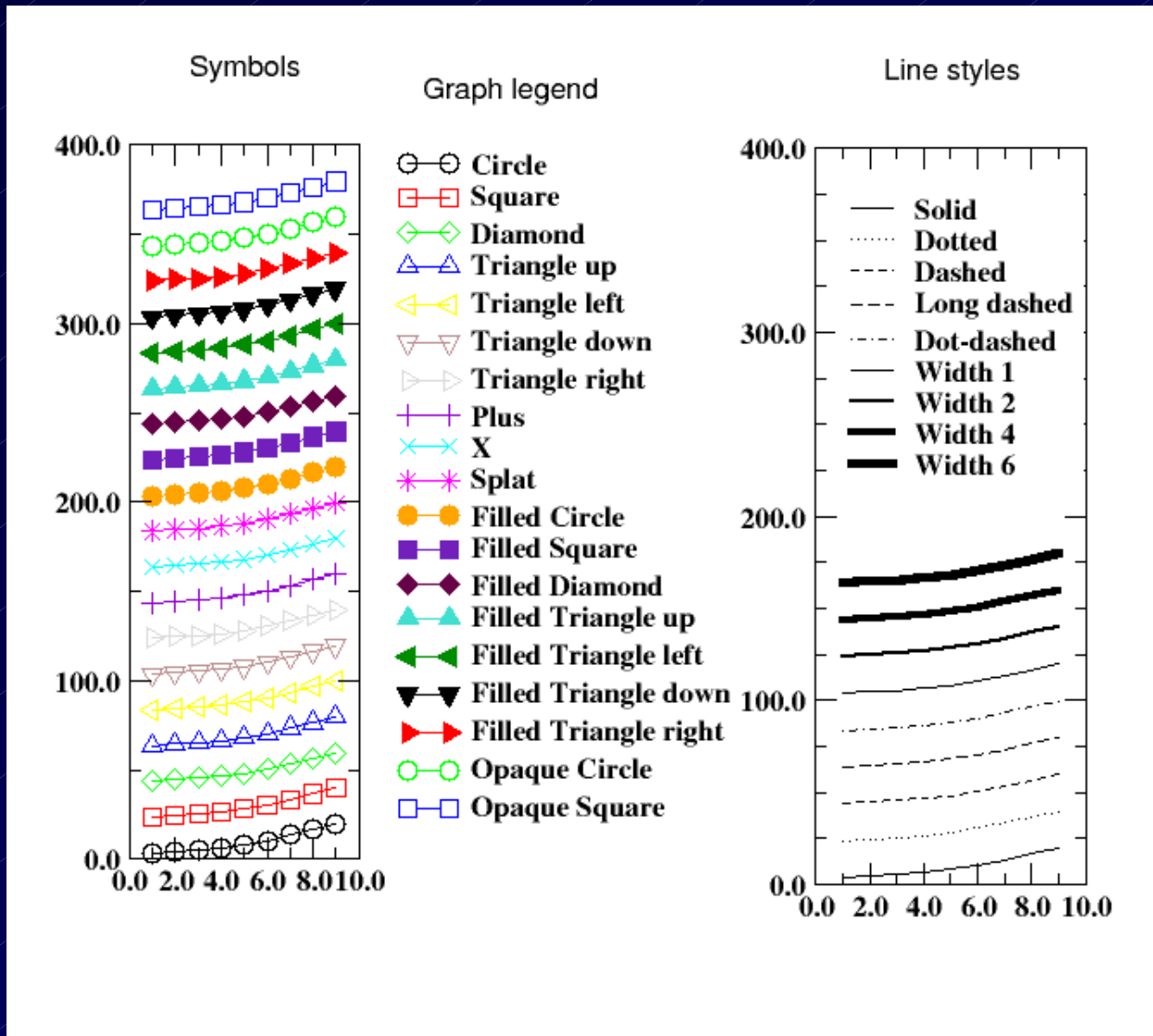
- Graph Types

- XY graph
- Log-linear
- Log-log
- Bar Chart
- Stacked Bar
- Horizontal Bar
- Horizontal Stacked Bar
- Polar Chart
- Smith Chart
- Scatter
- XYZ



# Xmgr - Grace Features

## *Line & Symbol Colors and Characteristics*



# Xmgr - Grace Font Types

## Times-Roman

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Times-Bold

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Times-Italic

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Times-BoldItalic

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Helvetica

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Helvetica-Bold

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Helvetica-Oblique

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Helvetica-BoldOblique

```
!#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

## Symbol (lower 128 chars)

```
!#&%'()*+,-./0123456789:;<=>?@ABXΔBΦΓHIΘKAMNOΠΘPΣTYζΩΞΨZ[. ]_`αβγδεφγηιφκλμνοπρστυωξψζ{|}~
```

## Symbol (continuation, upper 128 chars)

```
<=>?@ABXΔBΦΓHIΘKAMNOΠΘPΣTYζΩΞΨZ[. ]_`αβγδεφγηιφκλμνοπρστυωξψζ{|}~
```

## Fonts and font mappings

Grace no longer uses the Hershey fonts for drawing text on the screen.  
There should be no discrepancies between the display and hardcopy outputs.

**Use sans-serif fonts (Helvetica) & avoid serif fonts (Times)**  
Grace supports mixed font styles, size and colors

# Grace Enhancements to Text

Text transformations

Text transformations

V-Extent

Normal

Λ-M!LOL

10riiM-H

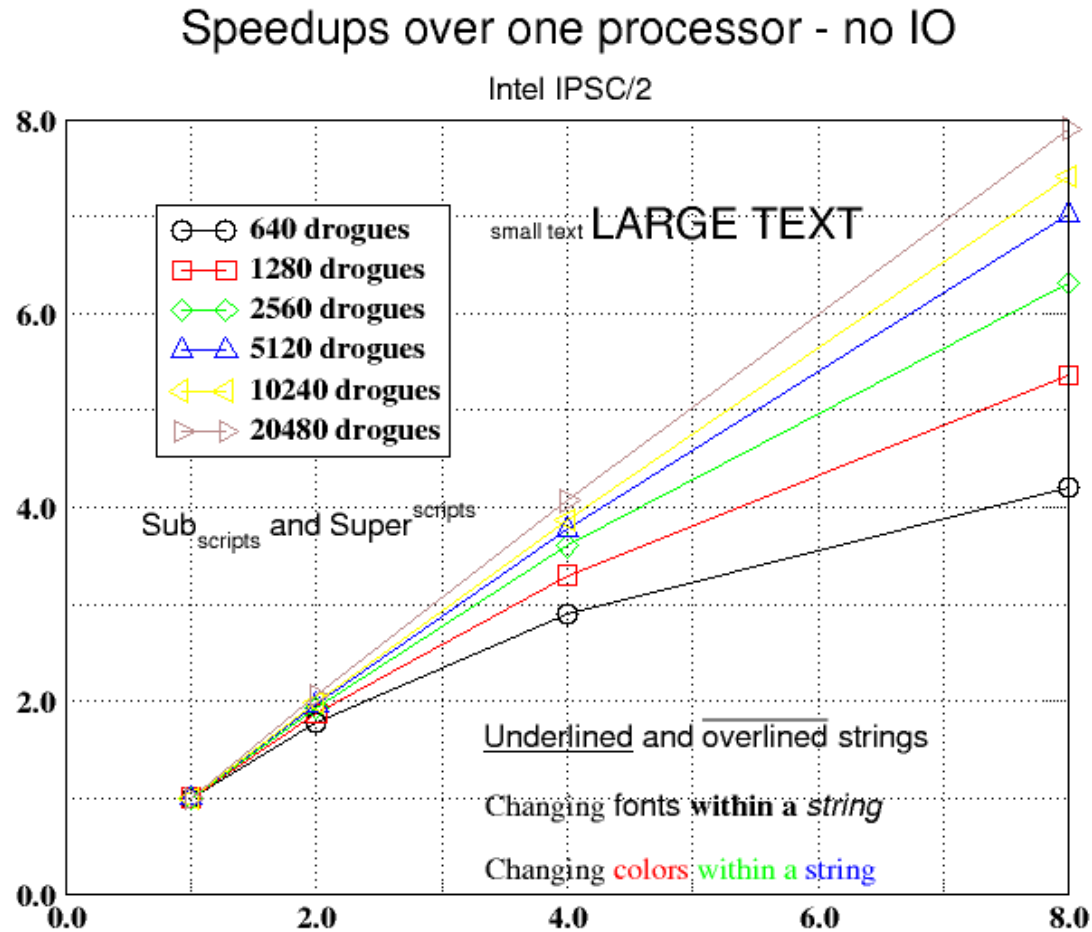
H-Extent

Slant

A totally silly and crazy transformation!

Another Slant

# Grace Enhancements to Strings



# Xmgr-Grace Data Transformations

- Histograms
- Fourier Transforms
- Running Averages
- Regressions
- Non-linear curve fitting
- Differences
- Interpolation
- Splines
- Linear convolution
- Geometric Transforms
- others
- Cross/auto correlations

## Data types available

xy, nxy, xydx, xydy, xydxdx, xydydy, xydxdy, xyr, xyz,  
xybox, xyhilo boxplot, netCDF



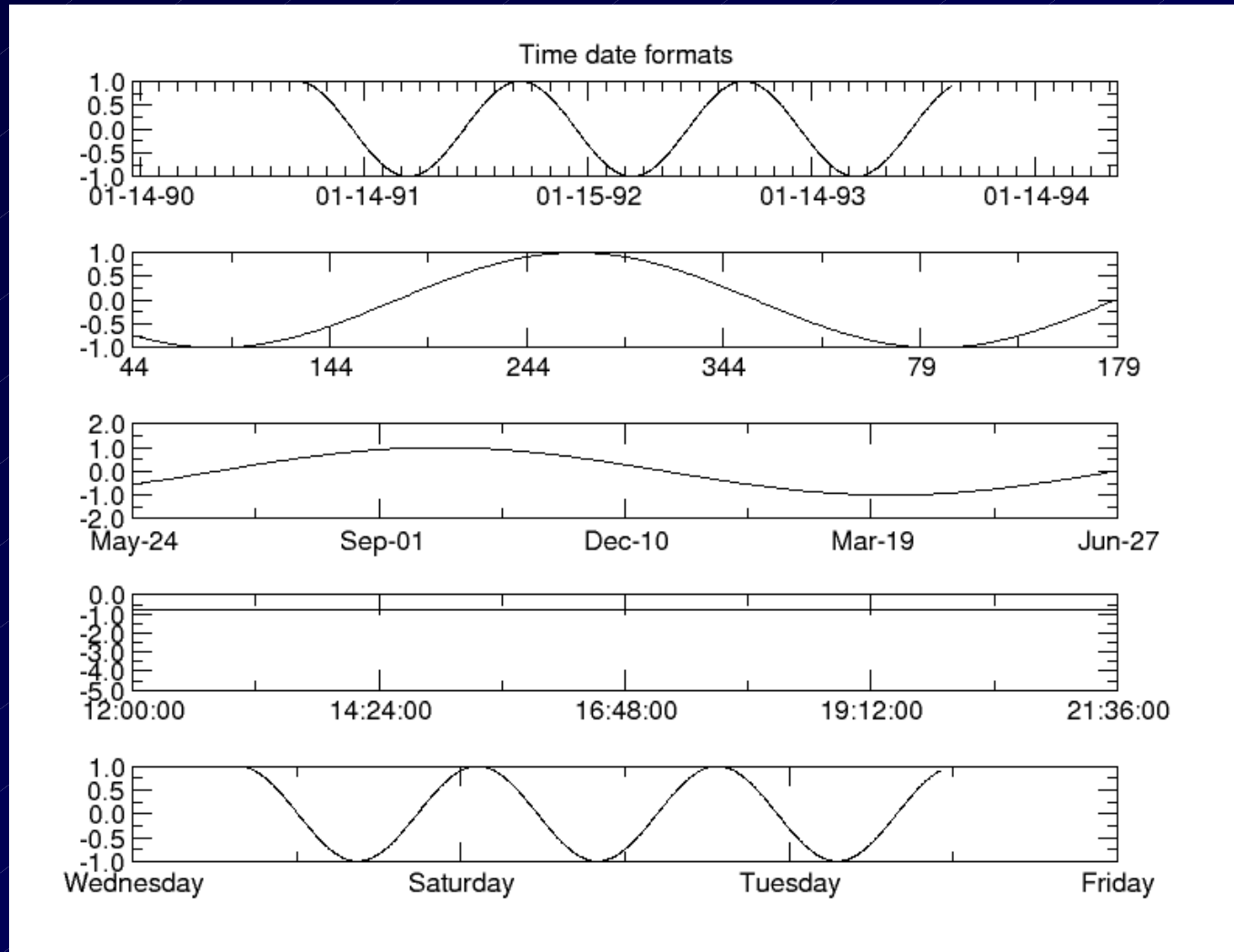
# Data Set Operations

- De-Activate
- Re-Activate
- Set length
- Set type
- Copy set
- Move set
- Activate
- Join
- Split
- Kill set -- Kill All
- Sort
- Reverse
- Swap
- Pack

Executed from the Status Window pop-up or Set Operations pop-up

# Xmgr - Grace Time & Date Formats\*

- Decimal
- Exponential
- Power
- General
- DD-MM-YY
- YY-MM-DD
- Day(abrev)
- Month
- Degrees (lat)  
or (lon)
- DD MM'
- DD MM' SS''

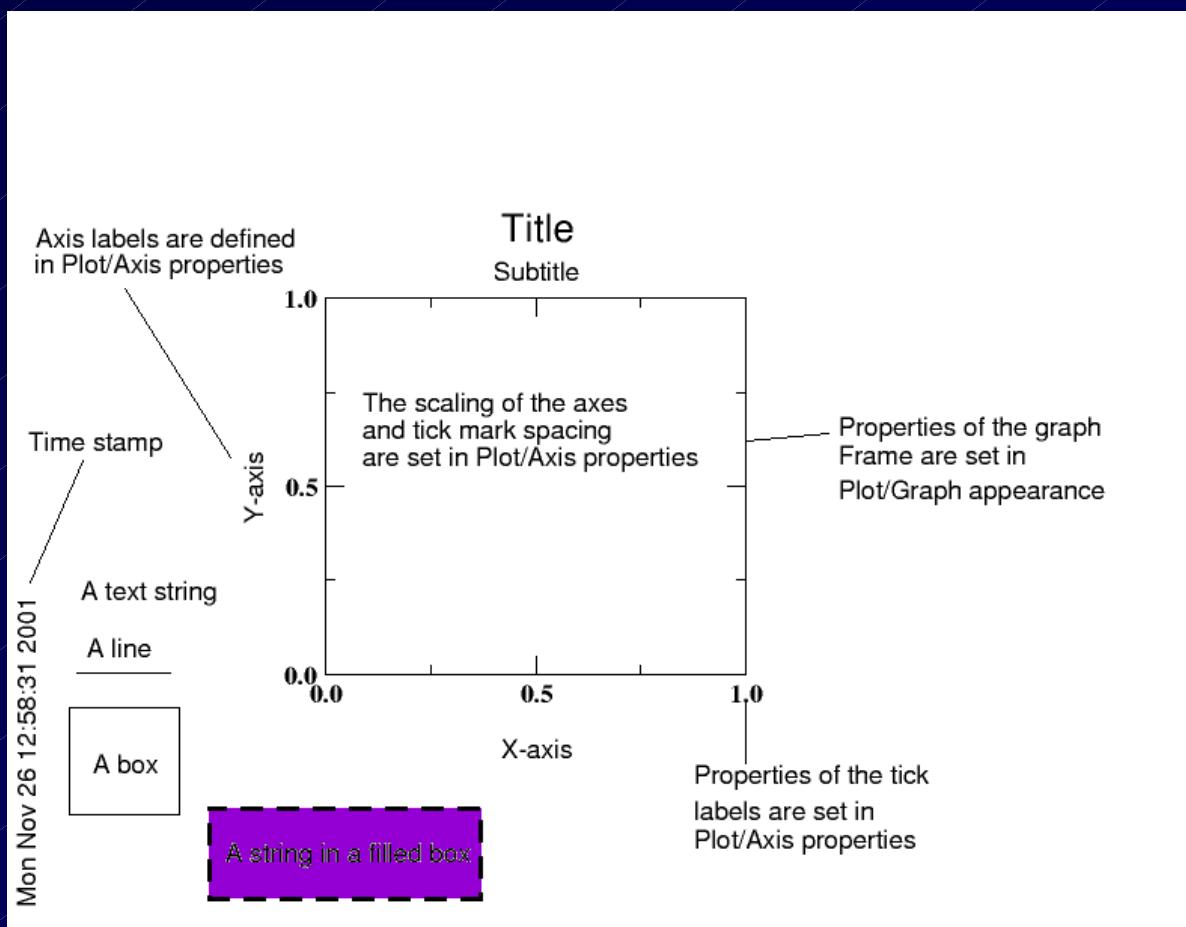


\* Julian date data format required for most date formats

Use utility `greg2jul_ymd` to convert YYYY MM DD to julian 7 digit date

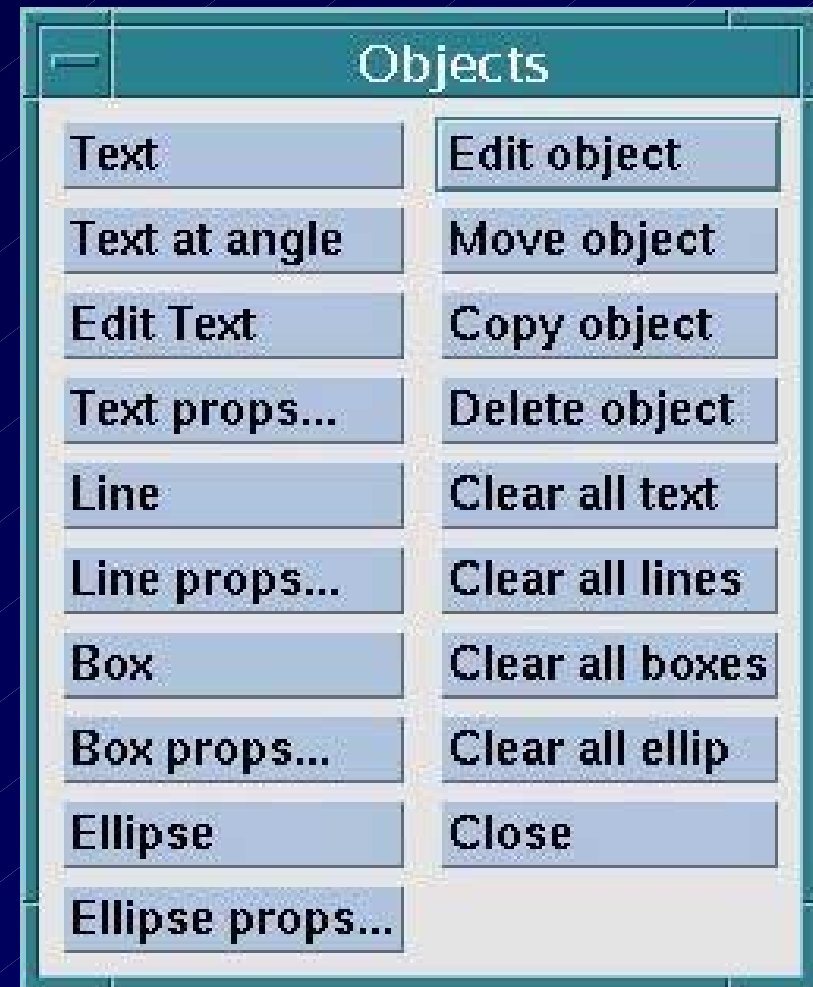
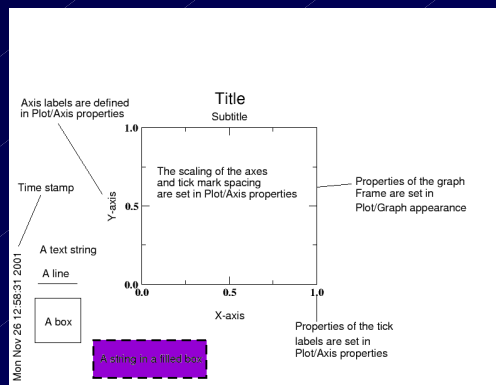
# Graph Labels & Text Strings

## Xmgr Plot Strings & Things Menu



# Xmgr Strings & Things “Pop-up” Menu

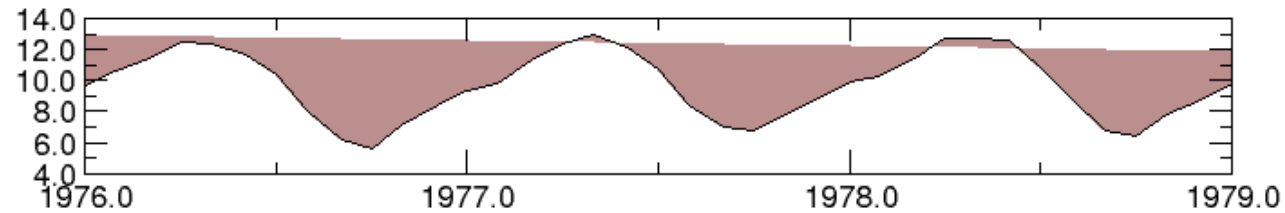
- Insert Text
  - Font, Color, Size and Justification
  - Text Orientation 0 to 360 degrees
  - Line properties
  - Style, Color, Thickness, Arrows
- Insert Boxes & or Ellipses
  - Line thickness, Color and Fill
- Editing Strings and Things
  - Text properties & locations
  - Copying Objects
  - Deleting Objects



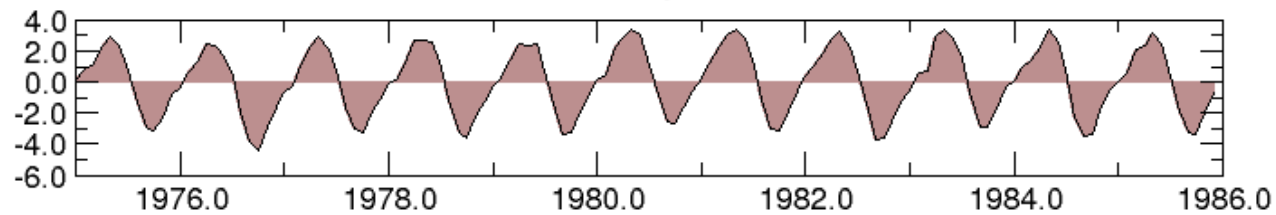
# Using Fill in XY Line Graphs

See Plot/Set appearance (line tab) for fills

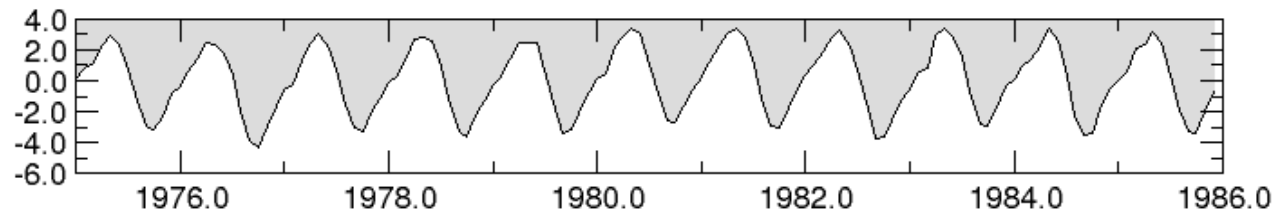
Filled as a polygon



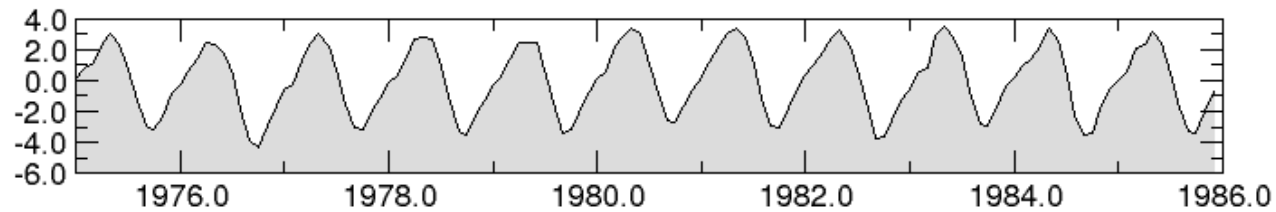
Filled to y = 0.0



Filled to World Y max



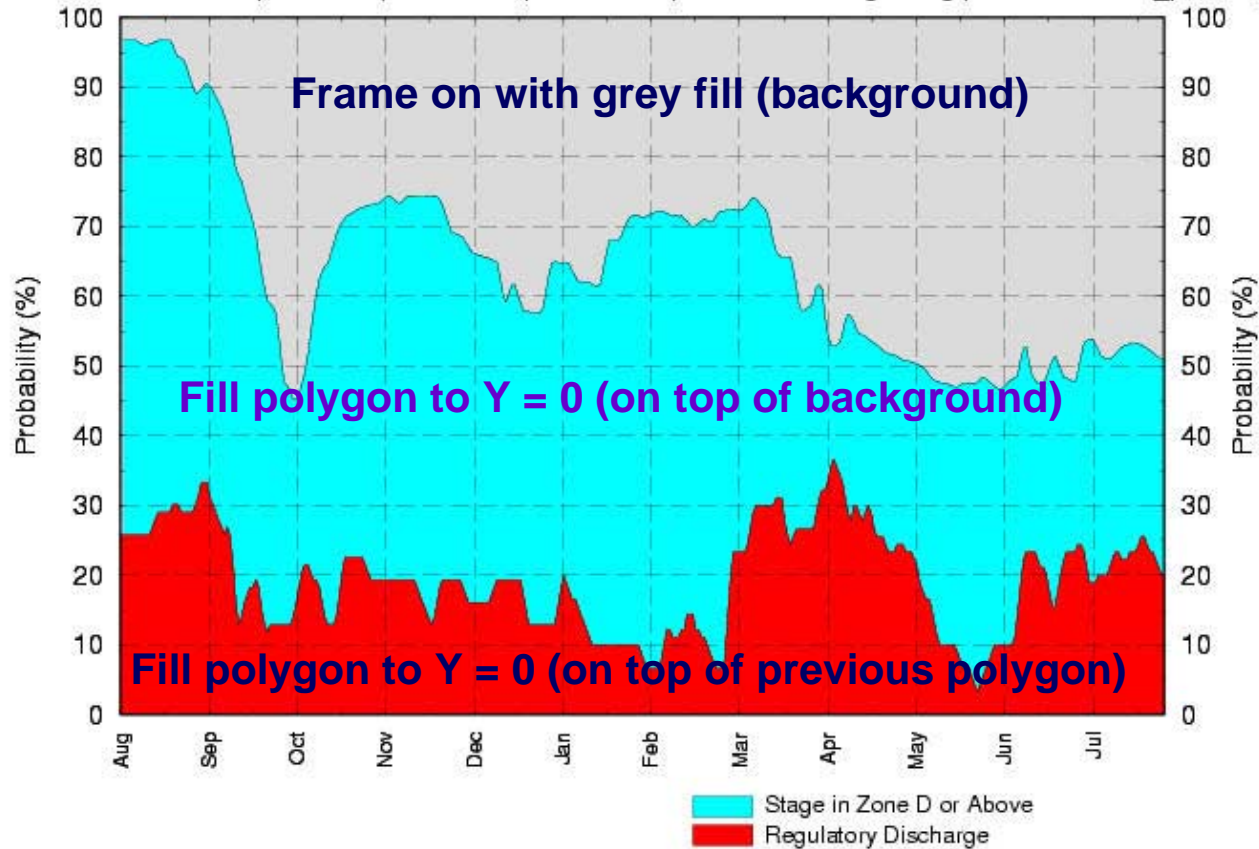
Filled to World Y min



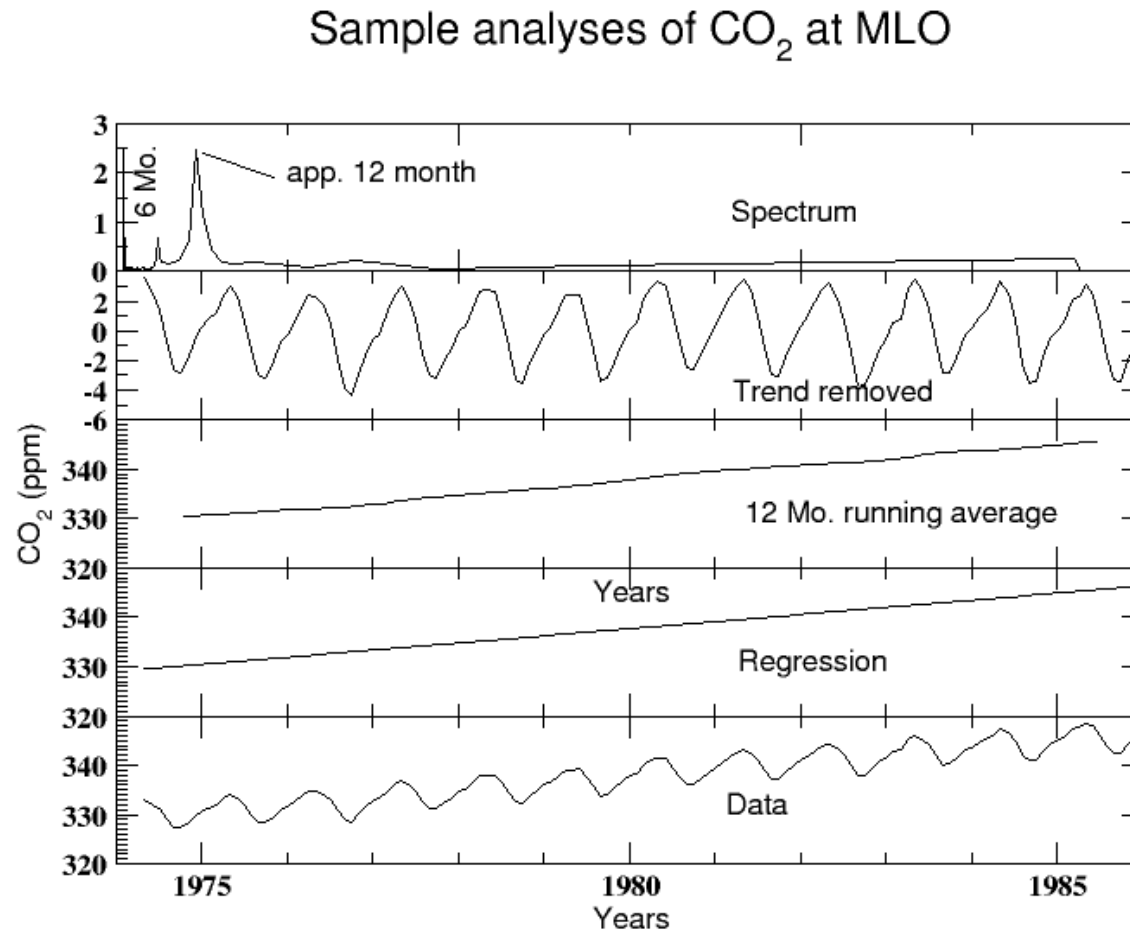
# Xmgr XY Line Plot with Polygon Fill

## Lake Okeechobee – WSE Releases to the Estuaries

Unconditional PA Operations (See assumptions @ [http://www.sfwmd.gov/org/pld/hsm/sfwmm\\_pa.html](http://www.sfwmd.gov/org/pld/hsm/sfwmm_pa.html))



# Multiple Graphs Arranged in a Stack

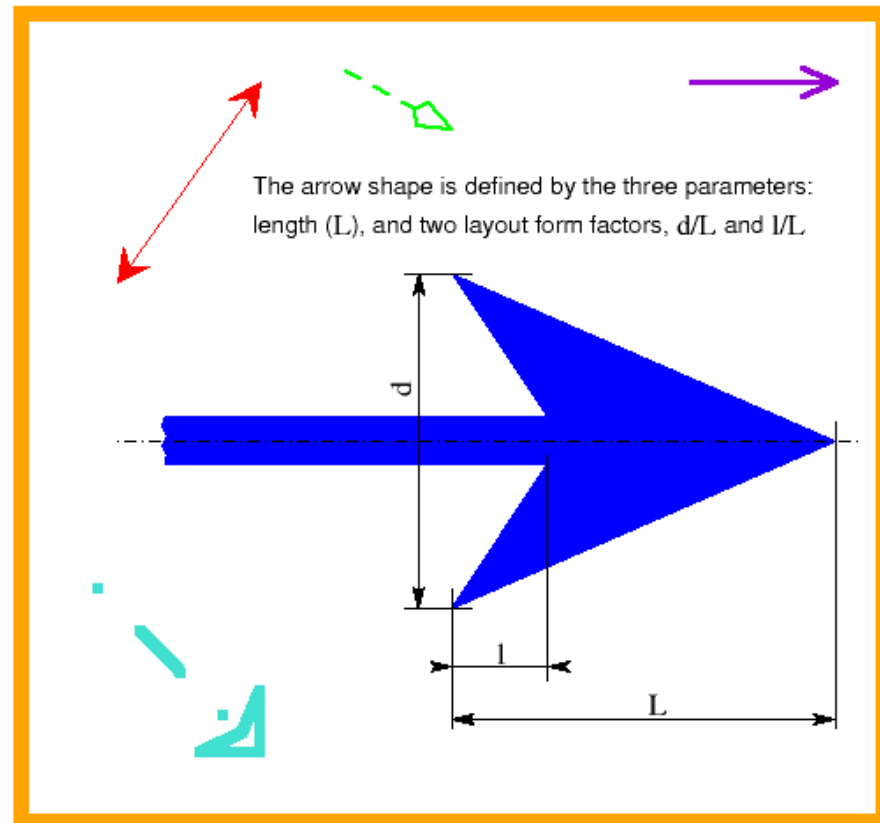


# XMGR - Grace Graphics

- ♠ Grace arrows illustrated

- ♠ Xmgr arrows can not define (L) and the layout factors  $d/L$  or  $l/L$  shown

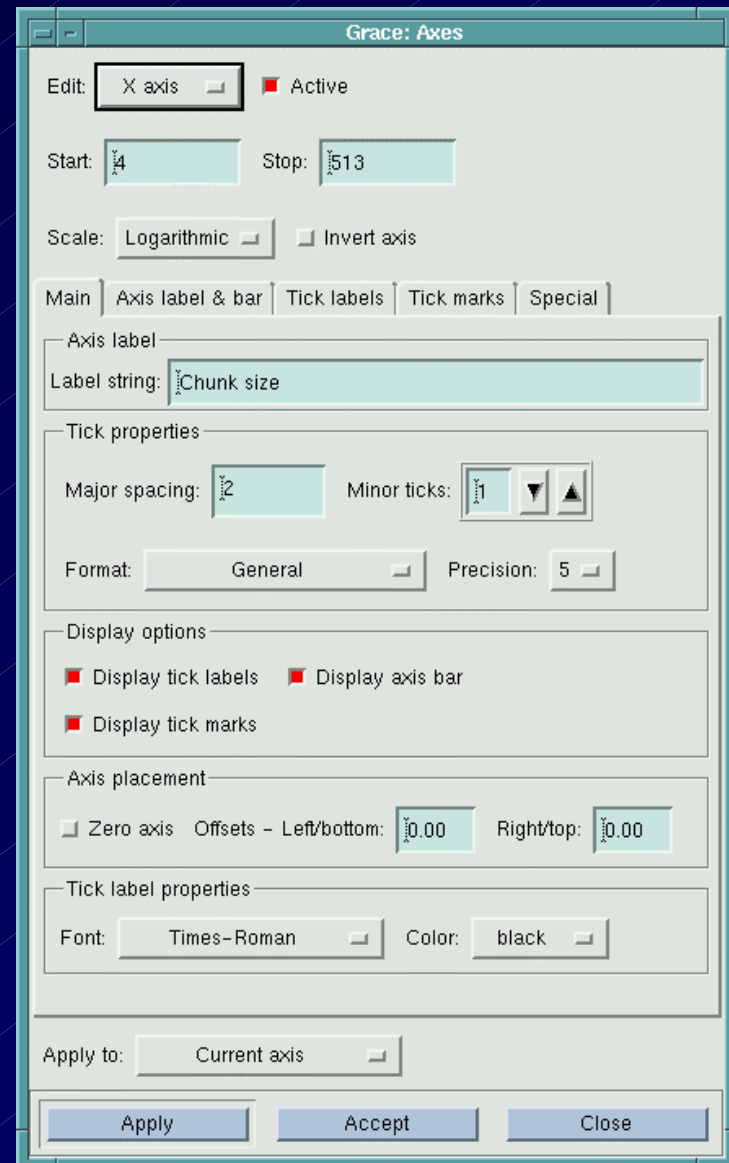
## Anatomy of arrows





# Xmgr & Grace Axes Menus

Many graph characteristics can be modified from these windows or their pop-up menus



# Xmgr-Grace World Scaling

- Define Xmin & Xmax
  - Julian dates shown
- Define Ymin & Ymax
- Define Tick Spacing
  - X-major & X-minor
  - Y-major & Y-minor
- Apply to:
  - Current graph
  - X current graph
  - X all graphs
  - Y current graph
  - Y all graphs
- Accept – to implement

The image shows a dialog box titled "World" with two main sections: "World (axis scaling)" and "Tick spacing".

World (axis scaling)	Tick spacing
Xmin: 2452276	X-major: 30.4
Xmax: 2452519	X-minor: 30.4
Ymin: 7	Y-major: 1
Ymax: 19	Y-minor: 0.5

Apply to:

Buttons: Accept, Update, Close

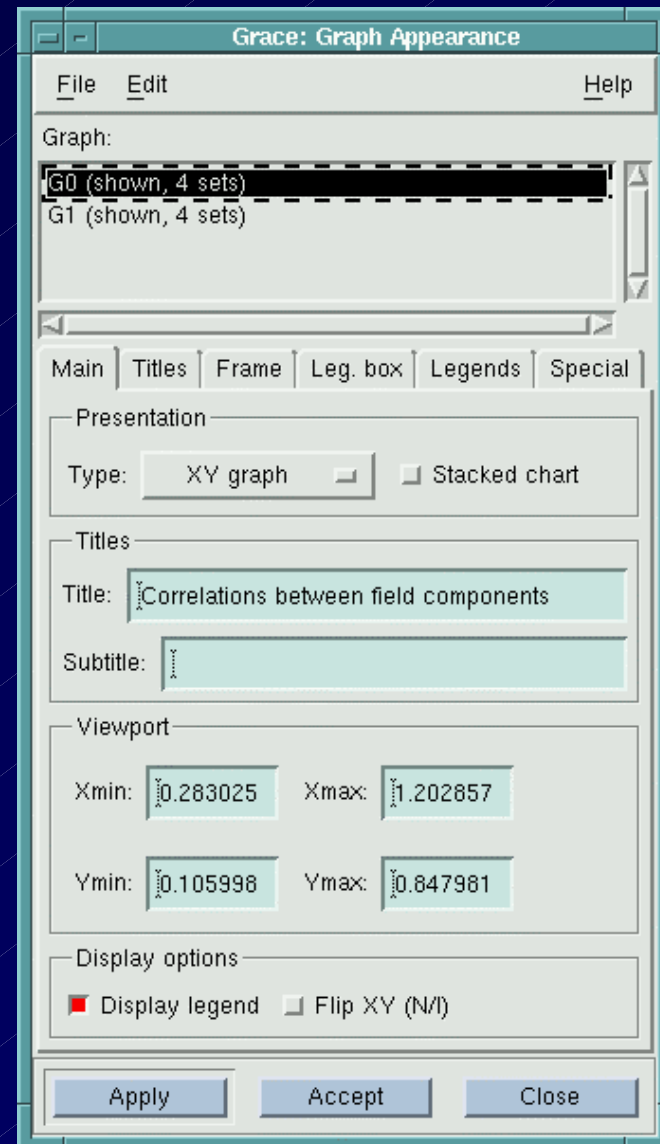
# Saving Data From Graphics

- Select sets to save
- Select graph
  - Often more than one
- Embed Parameters
  - be careful with this
- Format

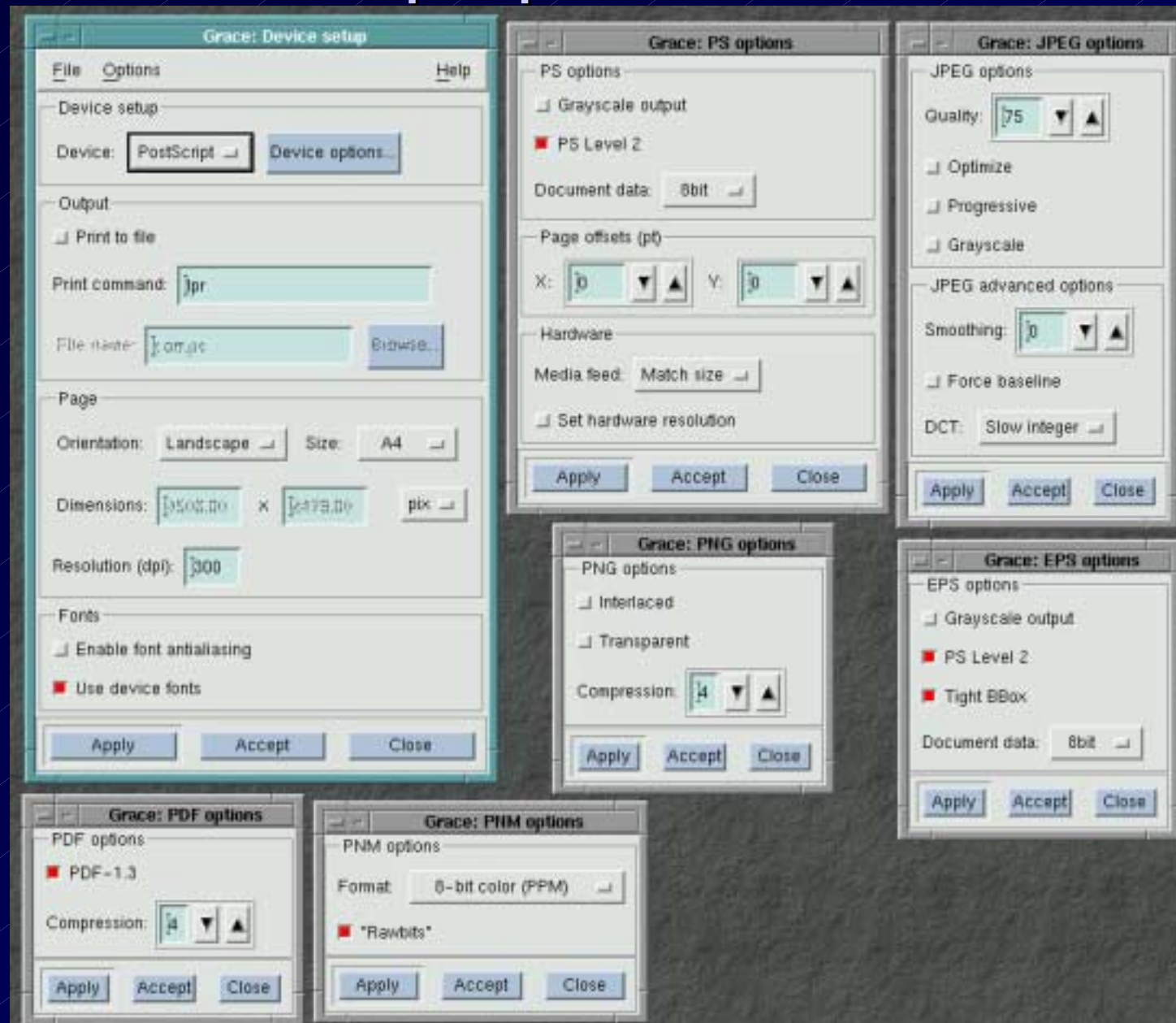


# Grace Graph Appearance Menu

- Grace Graph Menu with pop-ups included
  - User friendly & efficient



# Grace "Pop-up" Menu Windows



# Reading/Loading Data Sets into Graphs

- Xmgr-Grace data sets
  - Read directly
- ASCII Block data
  - Data read by selecting x axis and y axis from columns in block data

## Block Data Example

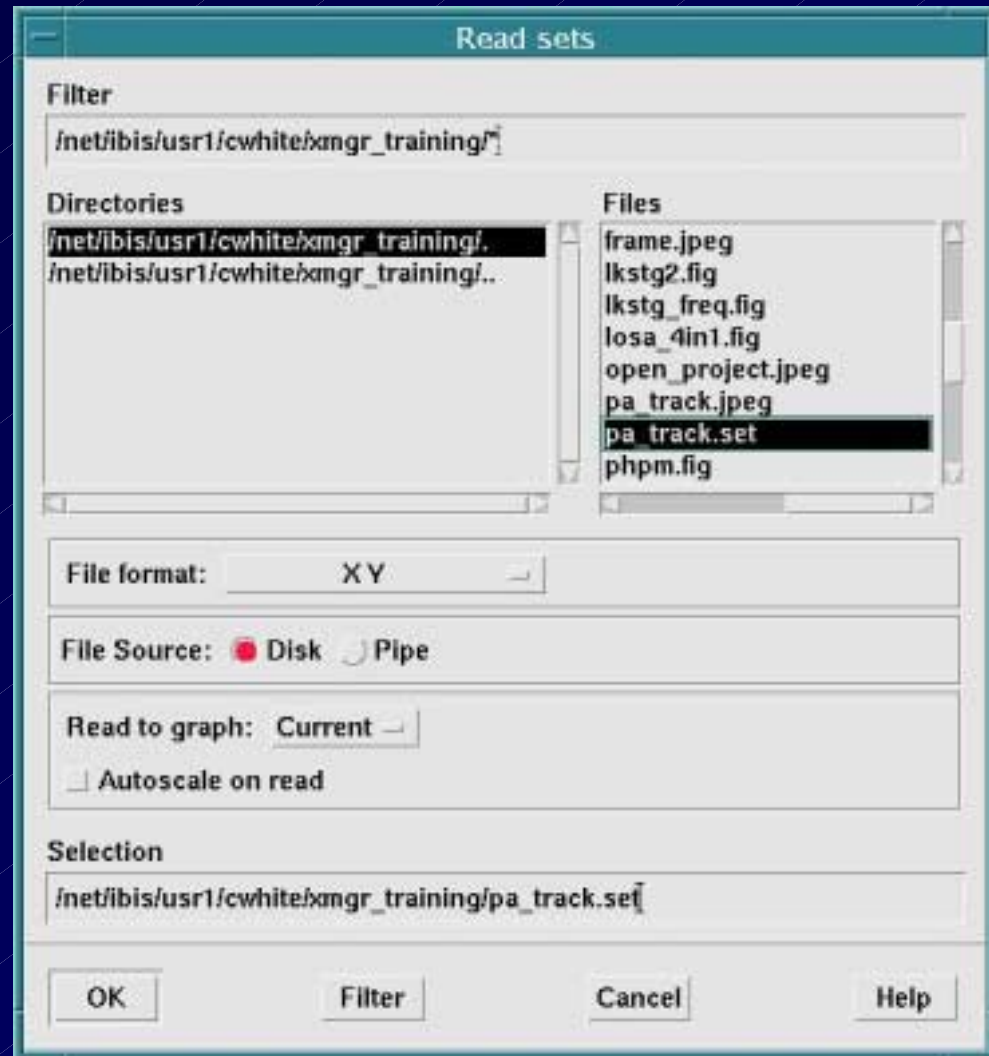
x = column 0

y<sub>1</sub> = column 1

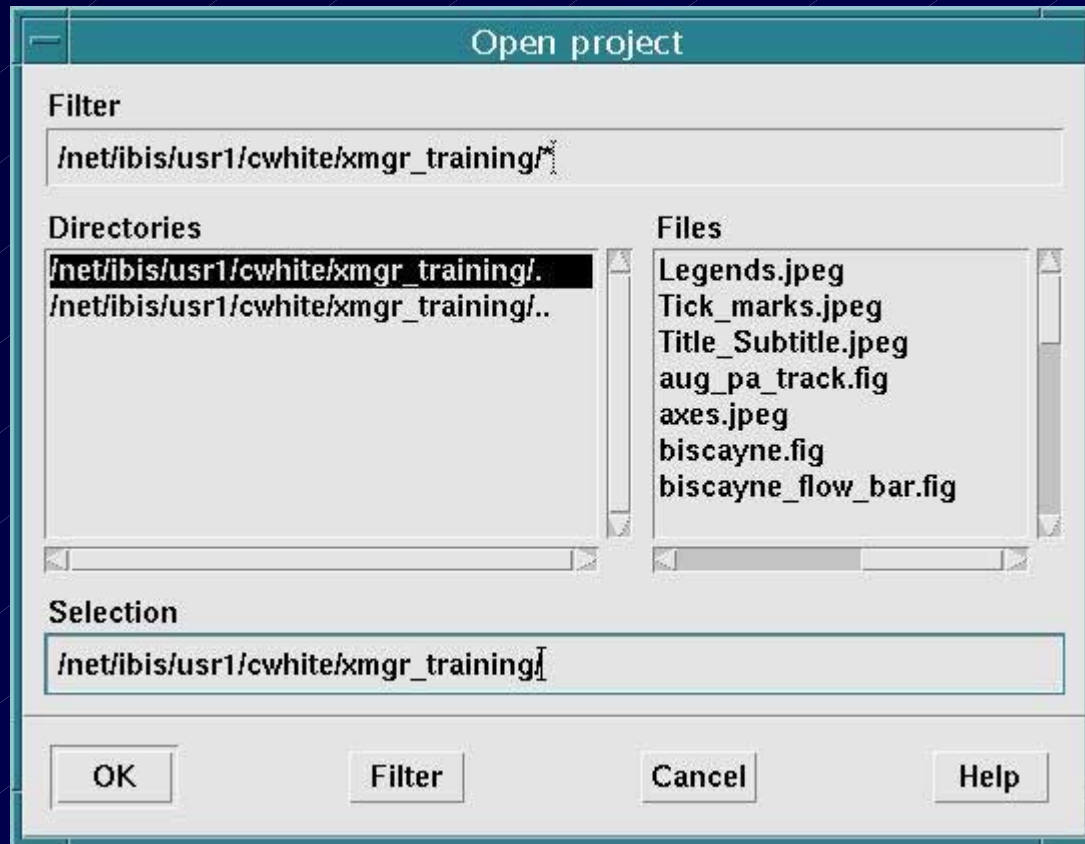
x = column 0

y<sub>2</sub> = column 2

Yields two xy sets



# Xmgr-Grace Graphics are “.fig” Files



Xmgr-Grace “.fig” files  
aug\_pa\_track.fig  
biscayne.fig  
biscayne\_flow\_bar.fig

# Xmgr Print File “Pop-up” Menu



- “Fig” files can sent to printer directly
- “Fig” files can be printed to a post script file
- Grace is capable of printing multiple formats:
  - “fig”, ps, pdf, jpeg directly



# Xmgr Tick Marks & Labels Menus

The 'Tick marks' dialog box is titled 'Tick marks'. It has a teal header bar. The settings are as follows:

- Tick marks pointing: **In** (dropdown)
- Draw tick marks on: **Both sides** (dropdown)
- Major ticks grid lines:  (unchecked)
- Minor ticks grid lines:  (checked)
- Major tick length: **100** (slider)
- Minor tick length: **50** (slider)
- Major tick color: **black** (dropdown)
- Minor tick color: **red** (dropdown)
- Major tick line width: **1** (dropdown)
- Minor tick line width: **1** (dropdown)
- Major tick line style: **Solid line** (dropdown)
- Minor tick line style: **Dashed line** (dropdown)
- Apply to: **Current axis** (dropdown)

Buttons at the bottom: **Accept** and **Close**.

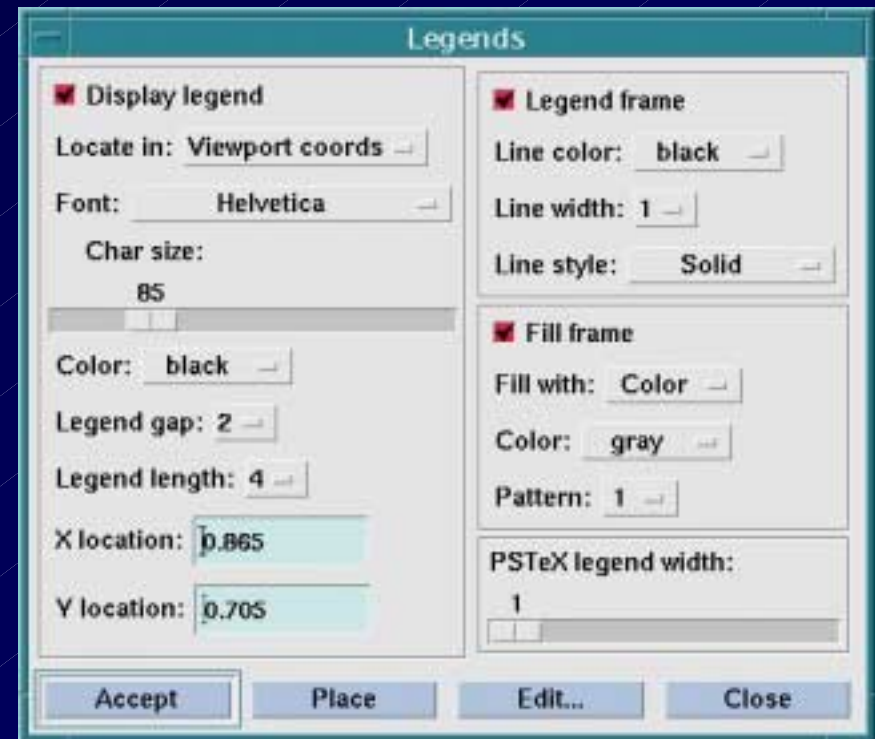
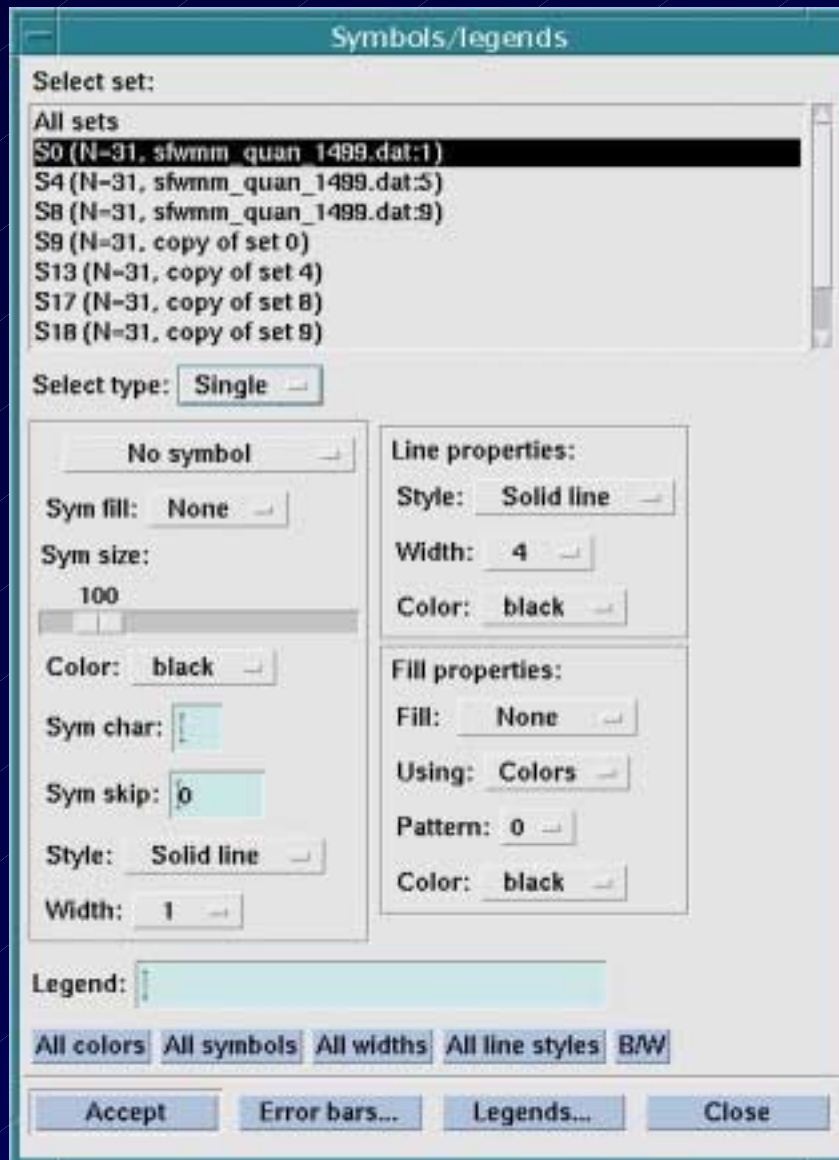
The 'Tick labels' dialog box is titled 'Tick labels'. It has a teal header bar. The settings are as follows:

- Font: **Helvetica** (dropdown)
- Color: **black** (dropdown)
- Line width: **1** (dropdown)
- Char size: **85** (slider)
- Format: **Month (abbrev.)** (dropdown)
- Precision: **0** (dropdown)
- Append to labels: [ ] (text input)
- Prepend to labels: [ ] (text input)
- Stagger labels: **0** (dropdown)
- Skip every: **0** (dropdown)
- Start labels at: Specified: **2451850.0000** (text input)
- Stop labels at: Specified: **2452091.0000** (text input)
- Location: **On ticks** (dropdown)
- Layout: Specified (degrees): **58** (slider)
- Draw tick labels on: **Normal side** (dropdown)
- Sign of label: **As is** (dropdown)
- Apply to: **Current axis** (dropdown)

Buttons at the bottom: **Accept** and **Close**.

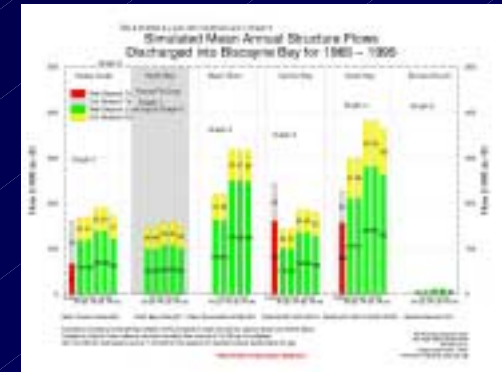
Major & minor tick grid lines are often useful references:  
Suggest using dashed or dotted line styles, line width 1  
and grey, red, or turquoise color to give “shadow” or  
“ghost” image

# Xmgr Symbols/Legends & Legend Menu



# Xmgr Graph Setup

- **Viewport**
  - origin (0,0) lower left corner
  - max at (1,1) upper right corner
- **Frame**
  - Outline for graph
  - Fill color for graph interior
- **Arrange graphs**
  - Size, space, and orientation



**Viewports**

Xmin: 0.12

Xmax: 0.82

Ymin: 0.2

Ymax: 0.85

Apply to: Current graph

Accept Pick Close

**Frame**

Display graph frame

Frame type: Closed

Line color: black

Line width: 2

Line style: Solid line

Fill graph frame Fill color: white

Apply to: Current graph

Accept Close

**Arrange graphs**

Rows: 1

Columns: 1

Packing: None

Vertical gap: 0.05

Horizontal gap: 0.05

Start at X = 0.1

Start at Y = 0.1

Graph width: 0.8

Graph height: 0.8

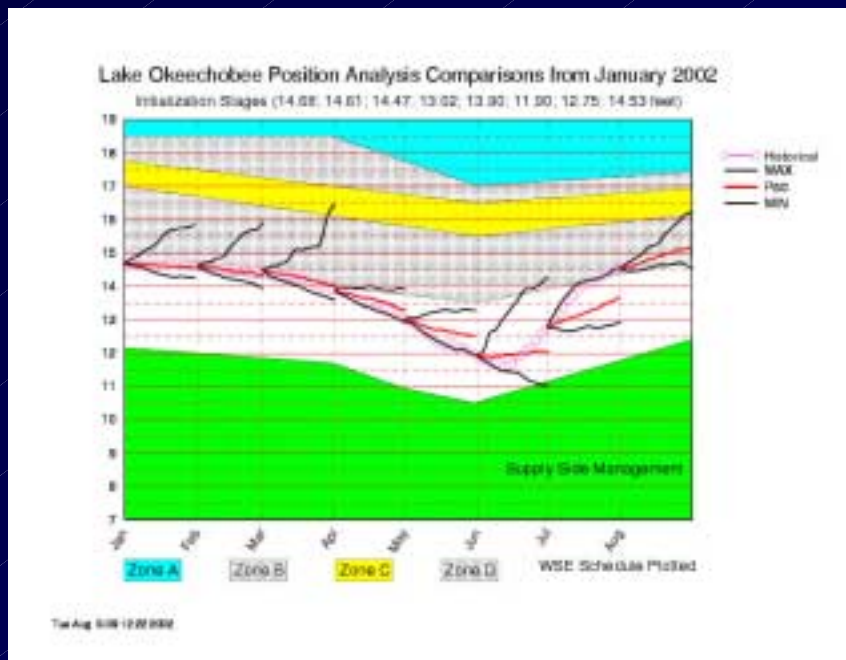
Accept Close

# Xmgr Graph Titles

**Title/Subtitle**

Title:

Subtitle:



**Frame**

Display graph frame

Frame type:

Line color:

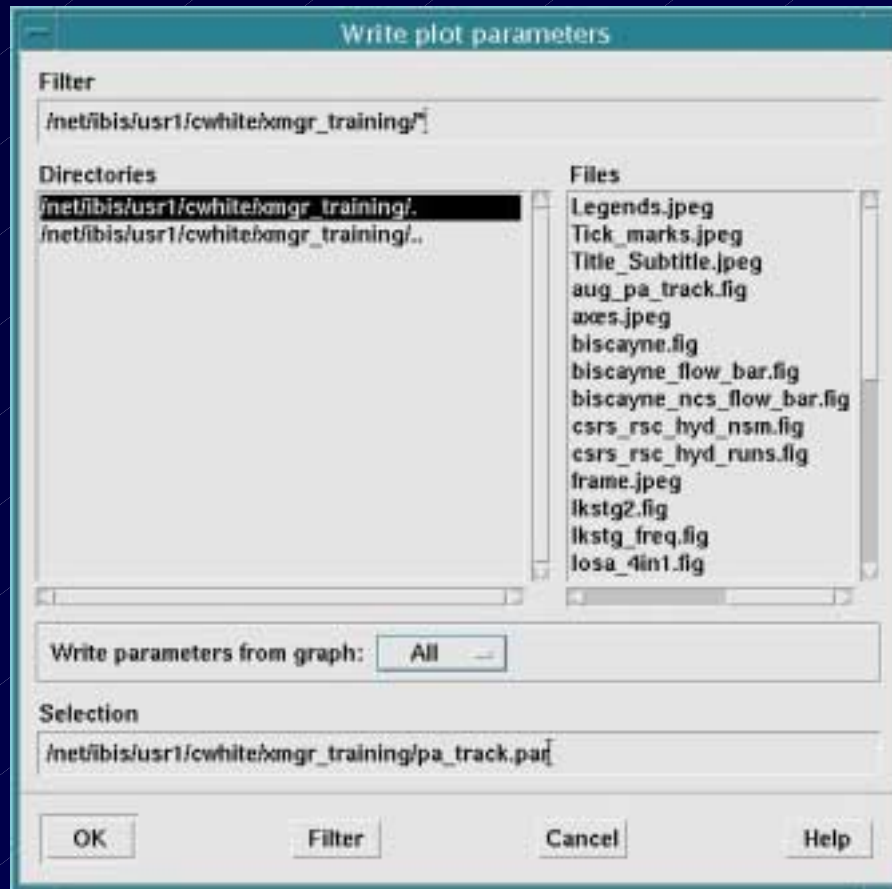
Line width:

Line style:

Fill graph frame Fill color:

Apply to:

# Xmgr-Grace Write Parameters/Sets



# Xmgr-Grace Batch process

- To batch process figures in Xmgr you have to link to grbatch
  - e.g. In -s /vol/hsm/bin/solaris/grbatch grbatch
- To plot consistent figures use the desired xmgr parameter file
  - parameter files can be written/created from a template graph which contains the graph style, format and other characteristics you want saved. Conventional parameter file extension is ".par"
- Hard copies or xmgr figure ".fig" files can be batch processed
- The c-shell code below checks to see if hard copies are desired, if YES, it prints hard copies at the default printer, if NO, it writes ".fig" files to the /Output/ directory

```
# do you want to make hard copies?
if($graph_yn == "Y") then
echo "Sending hard copy to Printer"
#
# to print hard copy & save "fig" files
grbatch -noask -device 1 -p bar.par flow.out. -saveall /Output/flow_bar.fig
else
#
# to print "fig" files only
grbatch -noask -device 1 -printfile /dev/null -p bar.par flow.out.$$ -saveall /Output/flow_bar.fig
endif
#
```

# Xmgr Special Tick Marks/Labels

Specified ticks/ticklabels

Use special tick locations

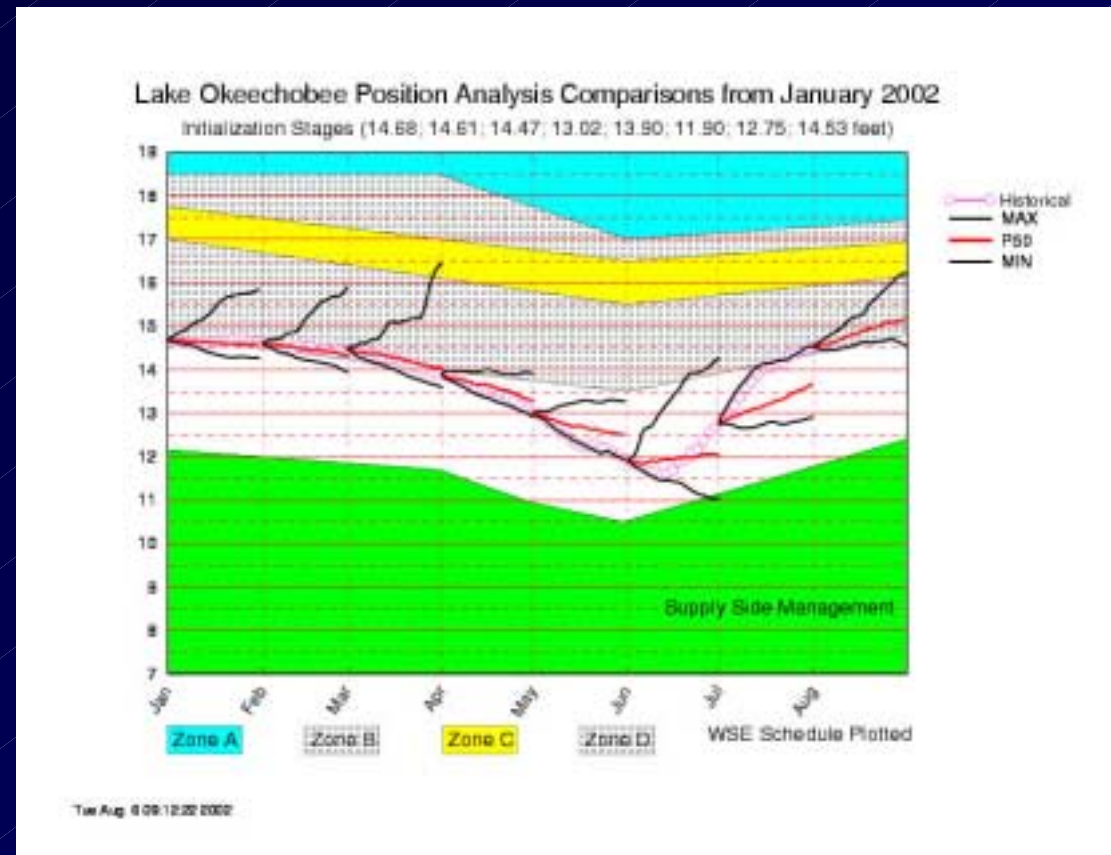
Use special tick labels

# of user ticks/labels to use: 15

Tick location - Label:

1	2452245.0000	Dec
2	2452276.0000	Jan
3	2452307.0000	Feb
4	2452335.0000	Mar
5	2452366.0000	Apr
6	2451870.0000	Mar
7	2452001.0000	Apr
8	2452031.0000	May
9	2452427.0000	Jun
10	2452082.0000	Jul
11	2452123.0000	Aug
12	2452386.0000	May
13	2452184.0000	Oct
14	2452457.0000	Jul
15	2452488.0000	Aug
16		

Accept Close



Special tick marks used for irregular month lengths in example  
Note X axis tick mark orientation is specified at angle (55 degrees)

# Checking Graphs Using the “Stack”

Each graph allows up to 20 different world and tick settings to be pushed onto the world stack.

**Pu** = Push the current world

**PZ** = Push the current world and pick a zoom area

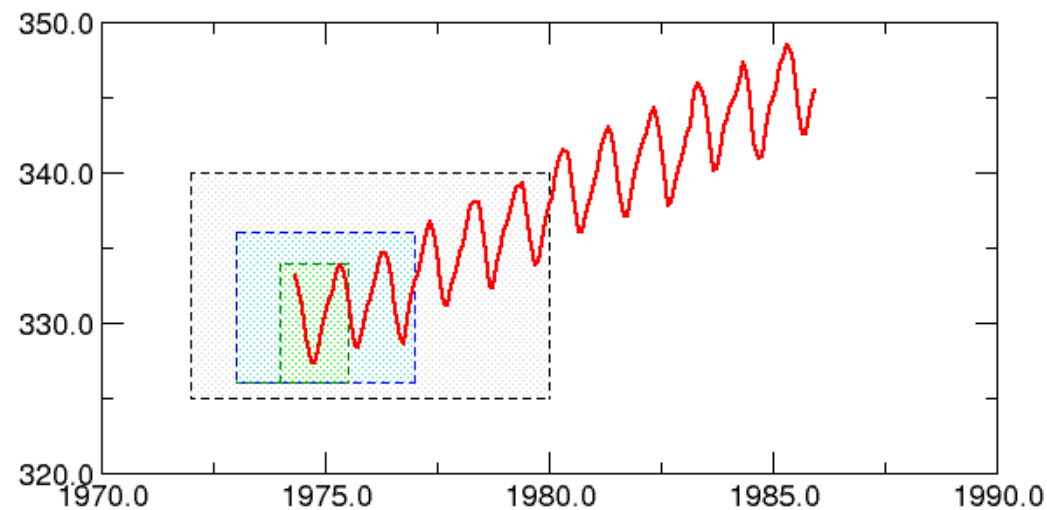
**Po** = Pop the top of the stack and make the new stack top the current setting

**Cy** = Cycle through the world stack

Use these buttons for stack manipulations

The **SD**: item indicates the current stack depth

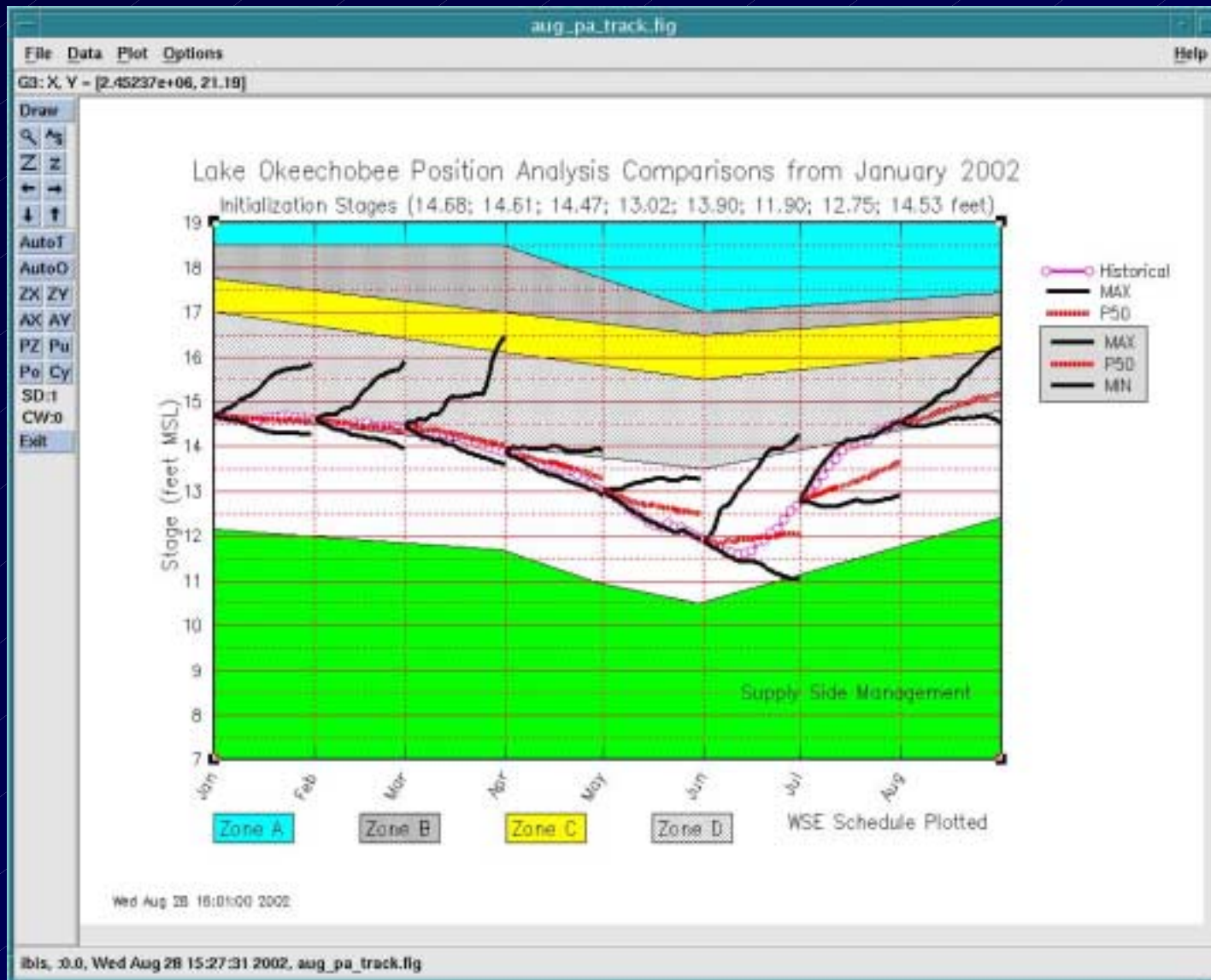
The **CW**: item indicates the stack entry with the current world settings



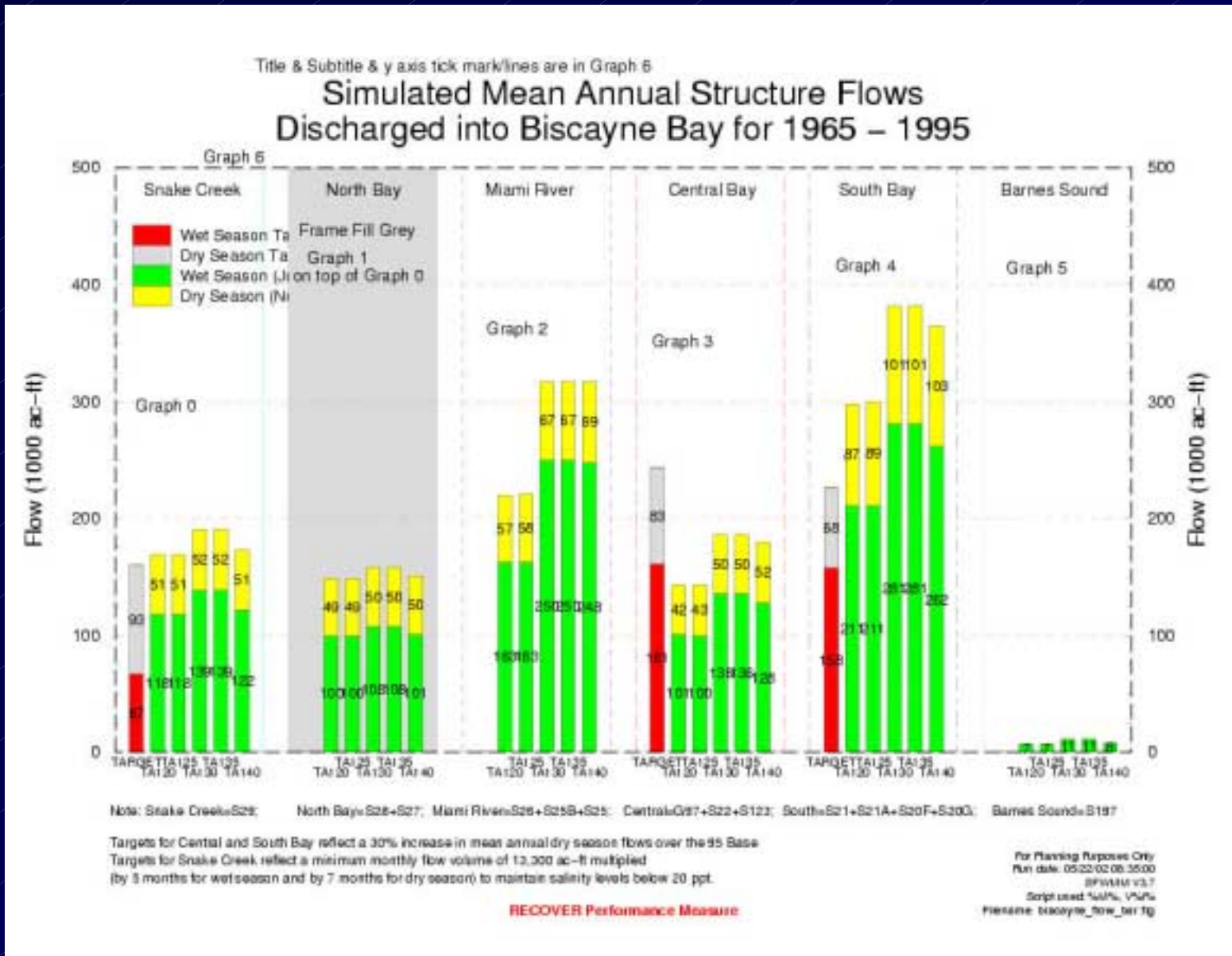
☛ In this example, the stack depth is 4, indicating 4 different settings for the axis scaling. Use the **Cy** button to cycle through them.



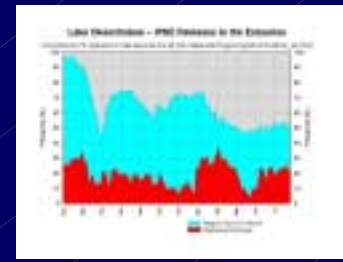
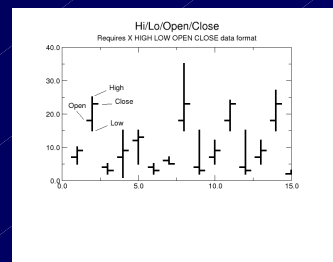
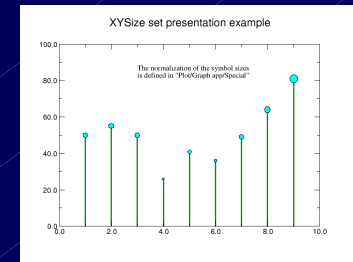
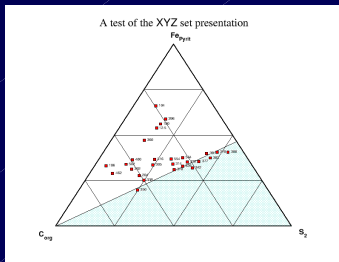
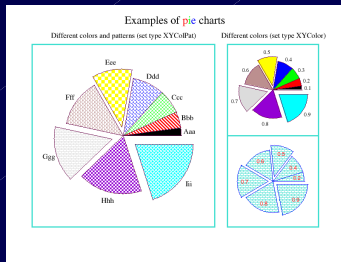
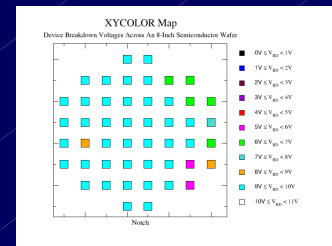
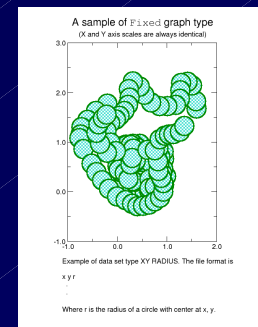
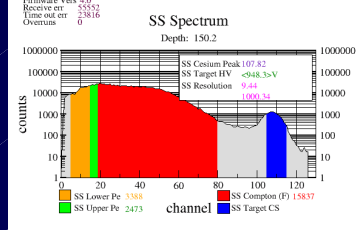
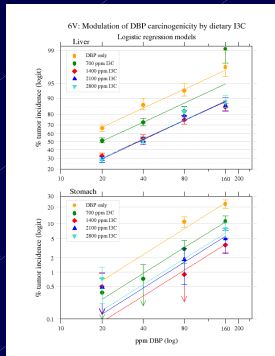
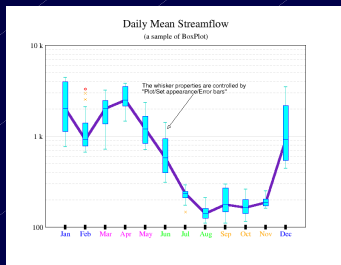
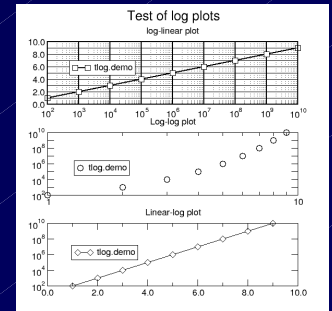
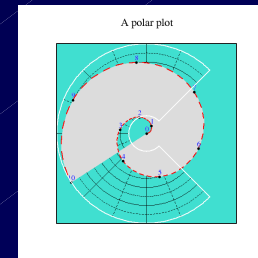
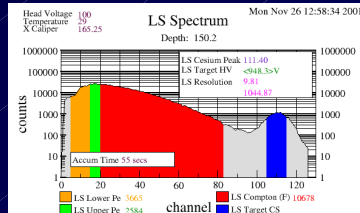
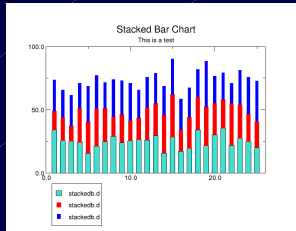
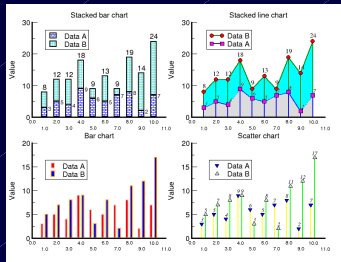
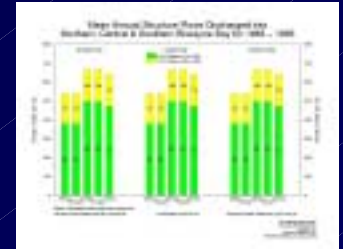
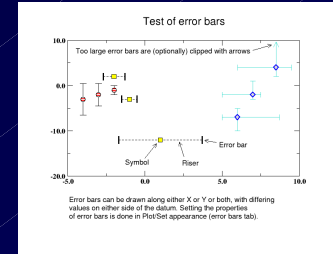
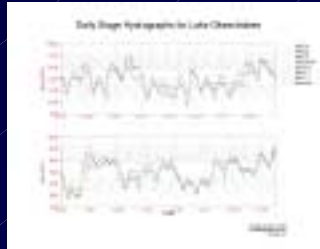
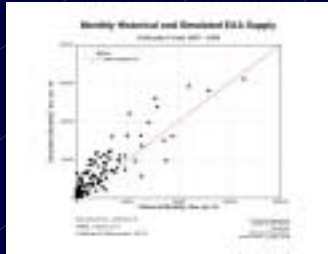
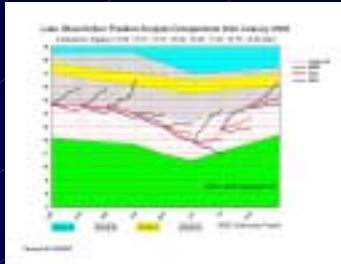
# Xmgr Multiple Layered Graphs



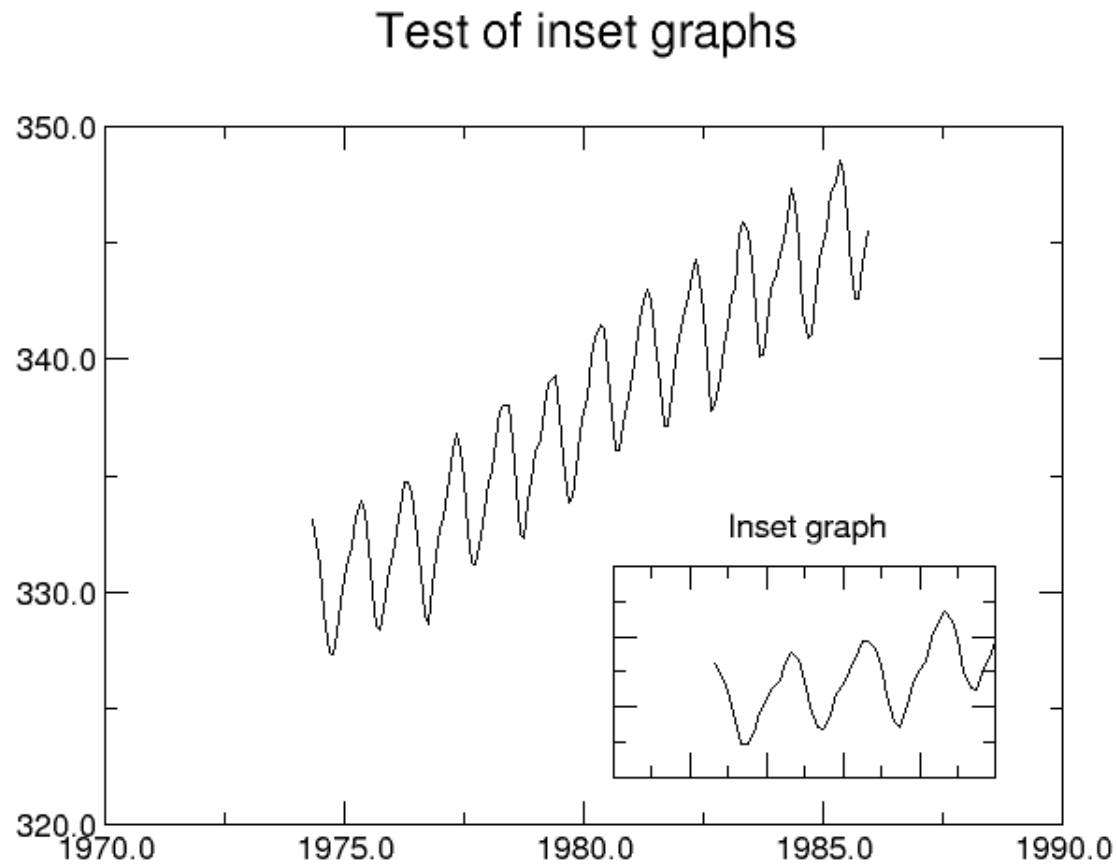
# Xmgr Multiple Stacked Bar Plot Explained



# Xmgr-Grace Sample Graphs

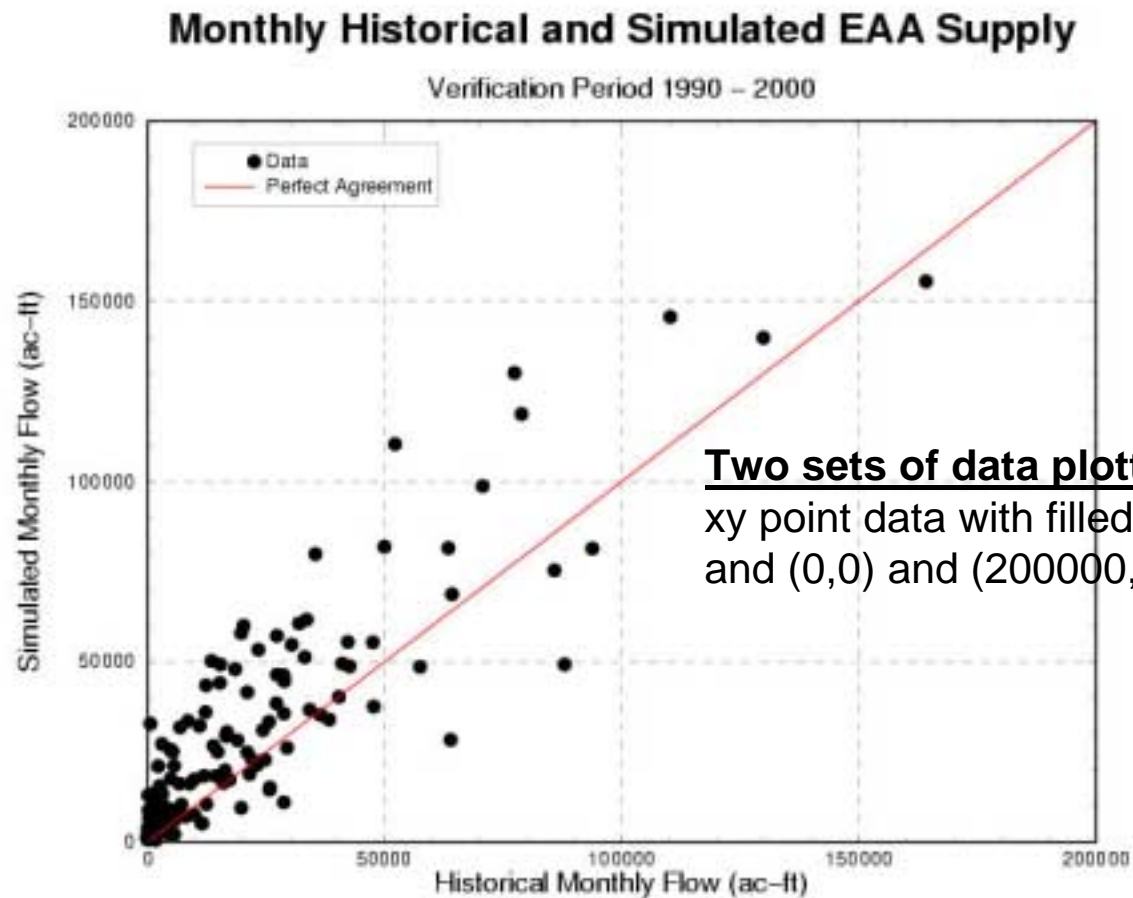


# Sample Graph with Inset Graph



To make a graph within a graph, simply activate a graph and set the viewport to the desired location. Some problems may arise with getting/setting the graph focus, use the popup menu of any graph selector (e.g. in Plot/Graph appearance) to set the focus to a particular graph.

# Xmgr-Grace Scatter Plot

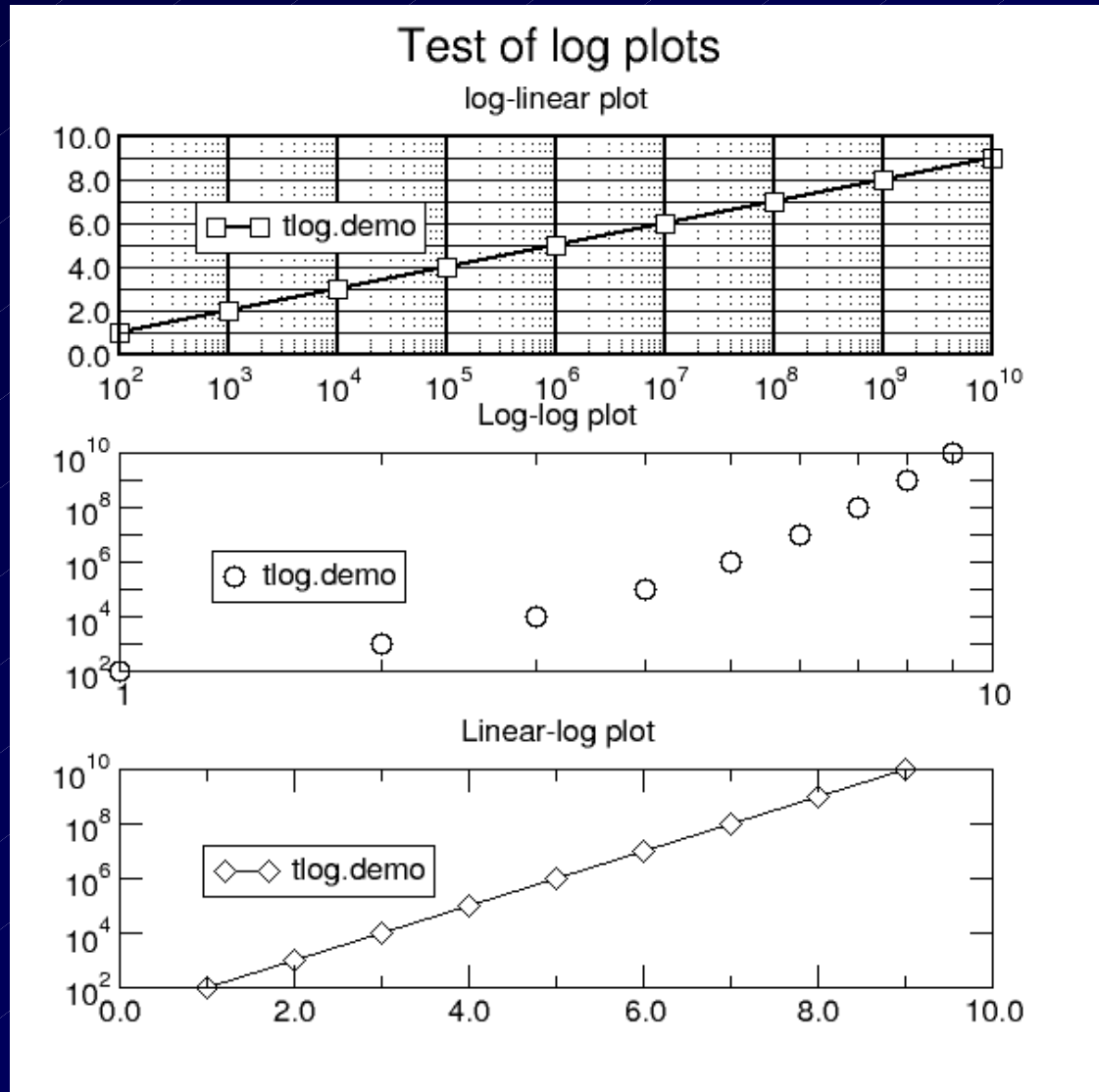


Bias (Hist-Sim): -9129.5 ac-ft  
RMSE: 17616.2 ac-ft  
Coefficient of Determination: 0.8774

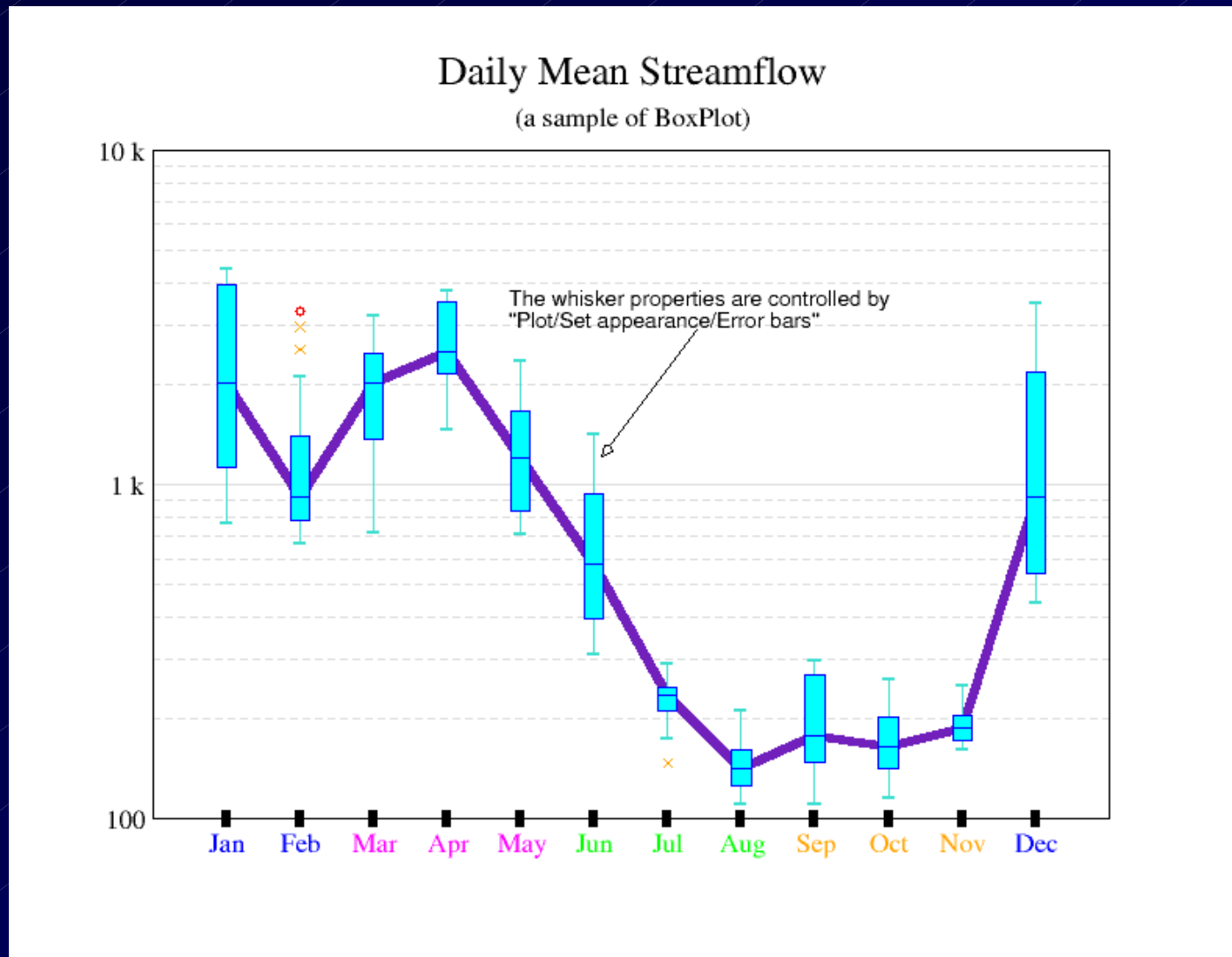
For Planning Purposes Only  
Run date: 07/25/02 15:02:50  
SPWMM V5.0  
Script used: prj\_eaa\_calib.csr  
Filename: monthly\_x3\_supply\_ver1.tg

# Xmgr-Grace Log Plots

- Log-Linear
- Log-Log
- Linear Log

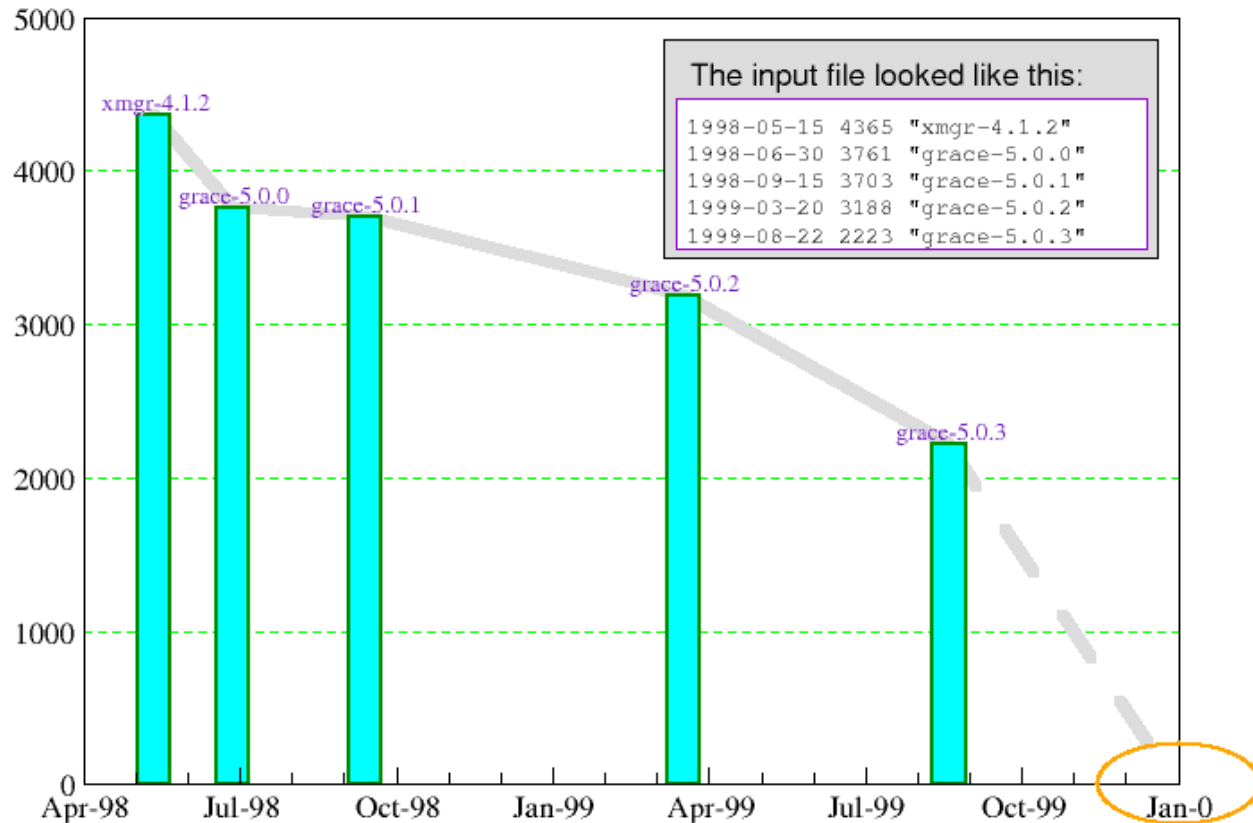


# XMGR - Grace Graphics Whisker Plot



# Xmgr -Grace Evolution

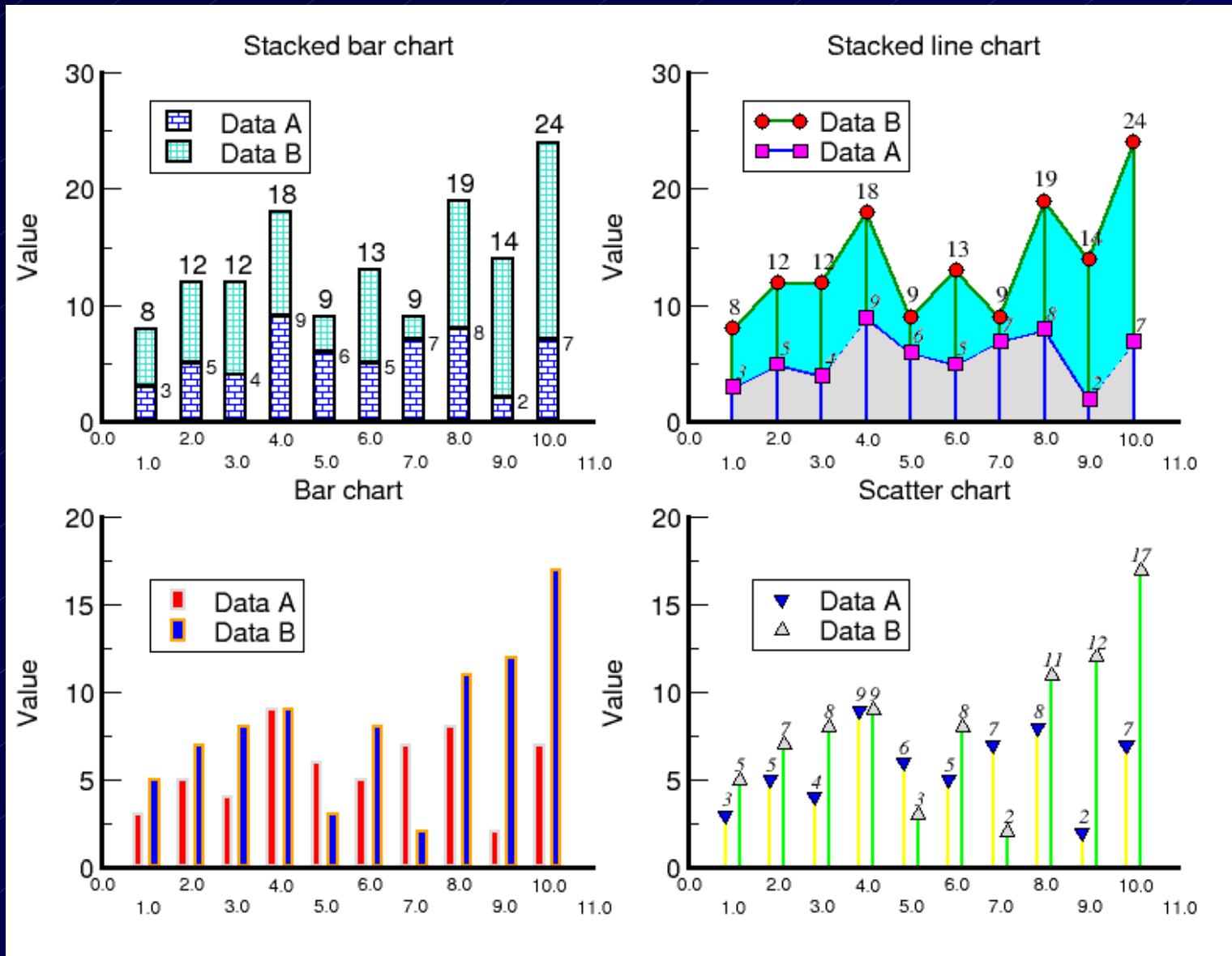
C source lines with Motif™/Xt calls  
(an example of using strings to annotate data values)



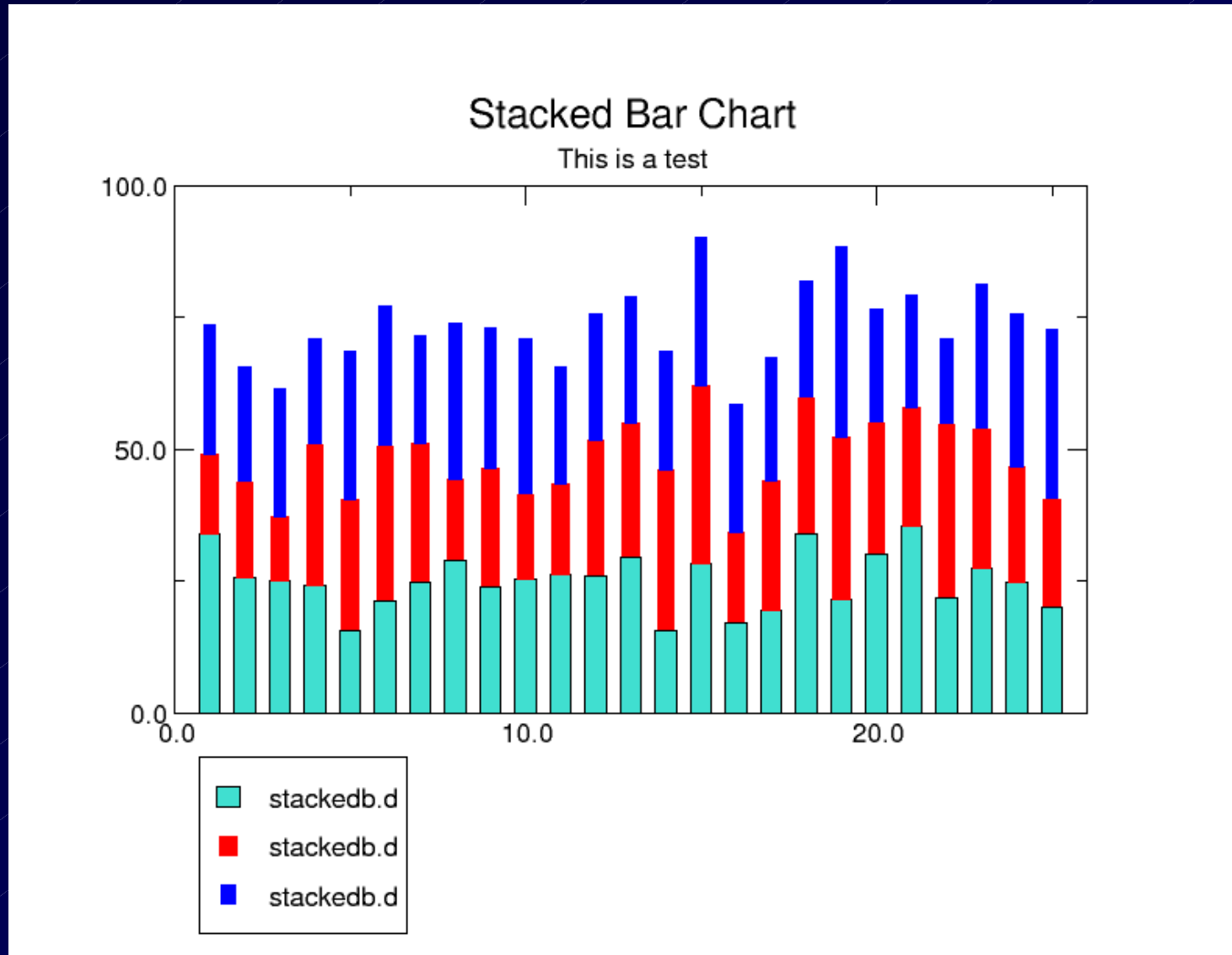
No, it's NOT a Y2K bug :-). The 2-digit year format is set in "Edit/Preferences" popup (off by default).



# Various Graphic Styles

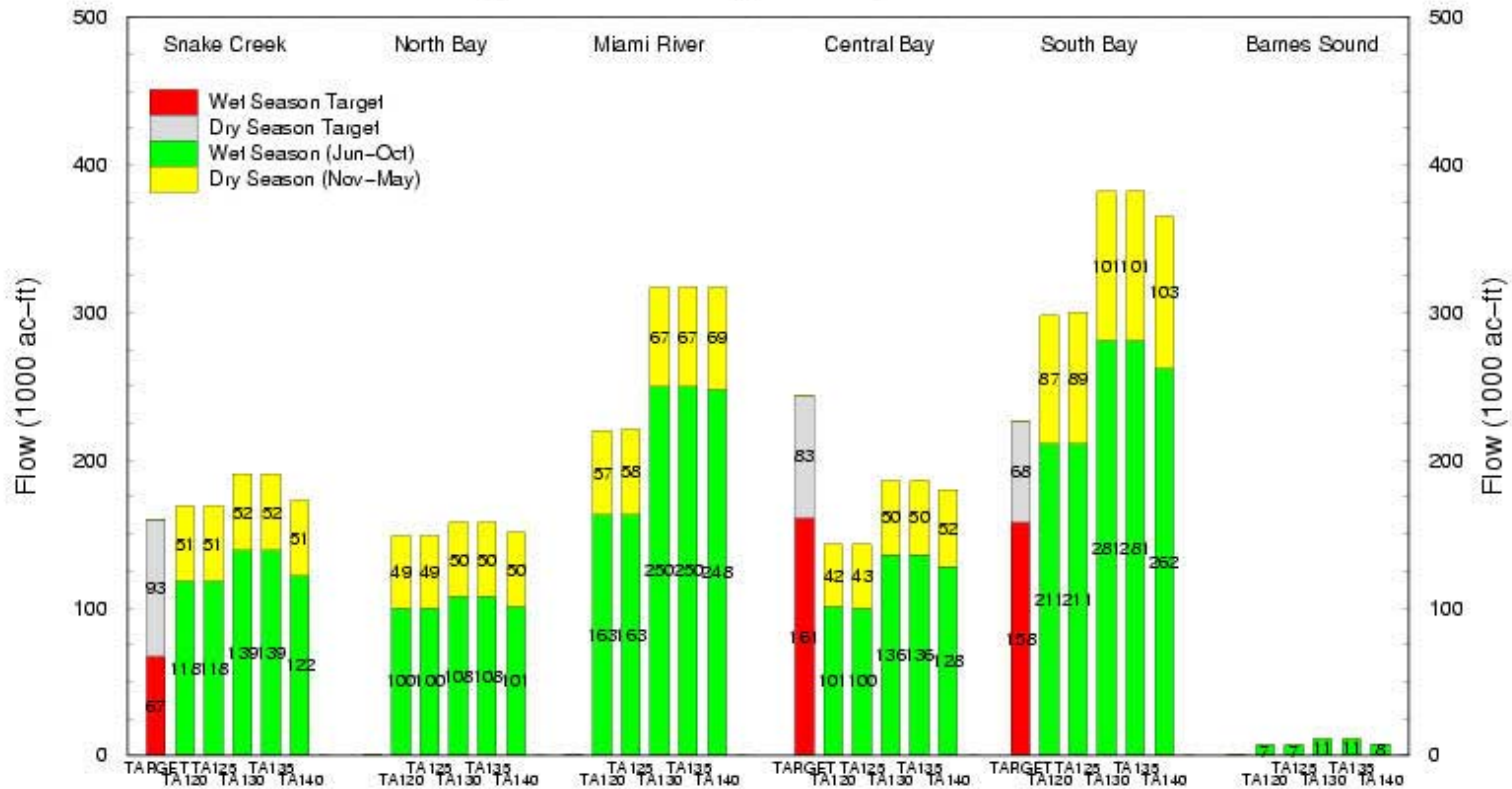


# Stacked Bar Plot w/varying Bar Widths



# Xmgr Multiple Stacked Bar Plot

## Simulated Mean Annual Structure Flows Discharged into Biscayne Bay for 1965 – 1995



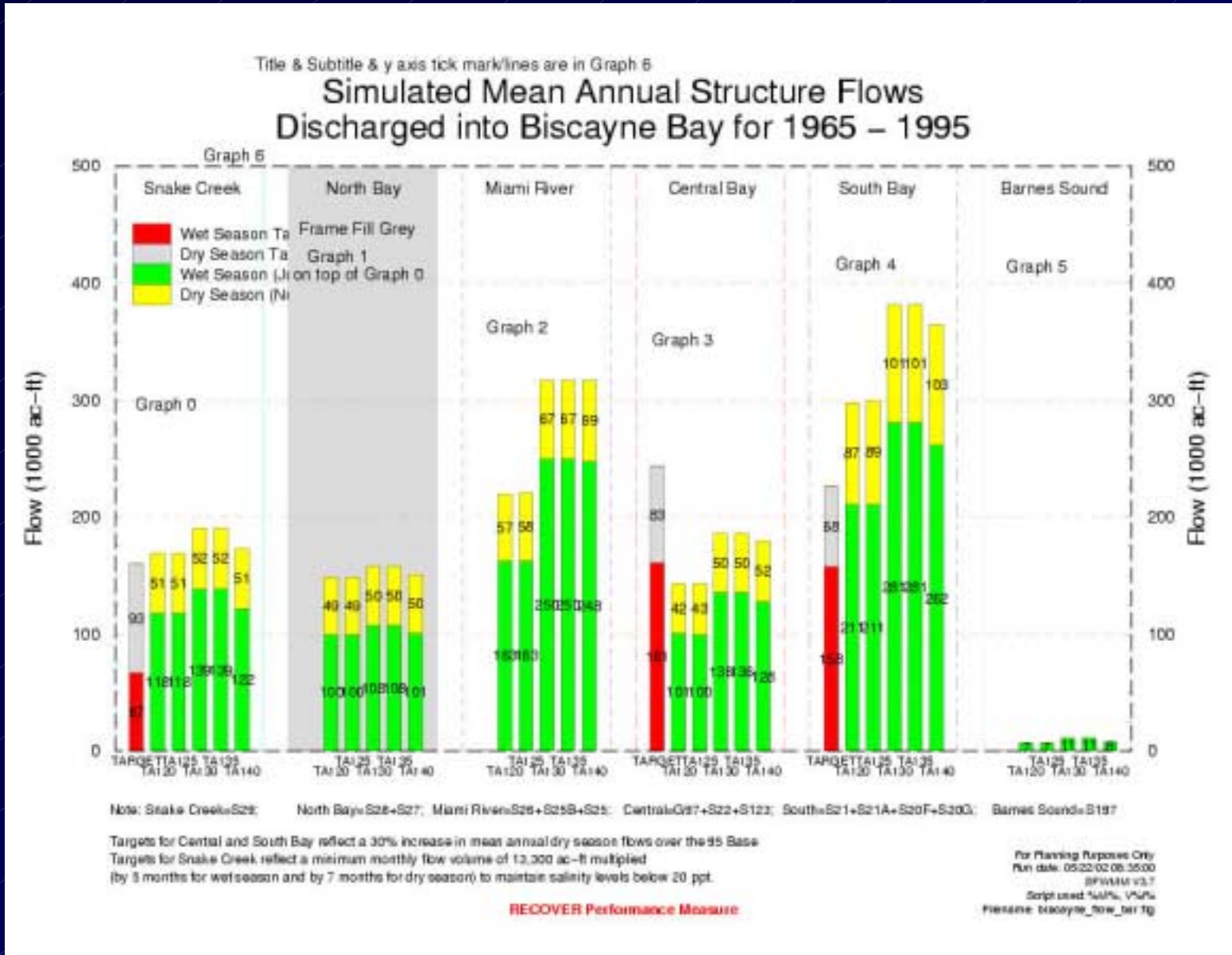
Note: Snake Creek=S29; North Bay=S28+S27; Miami River=S26+S25B+S25; Central=G97+S22+S123; South=S21+S21A+S20F+S20G; Barnes Sound=S197

Targets for Central and South Bay reflect a 30% increase in mean annual dry season flows over the 95 Base  
 Targets for Snake Creek reflect a minimum monthly flow volume of 13,300 ac-ft multiplied  
 (by 5 months for wet season and by 7 months for dry season) to maintain salinity levels below 20 ppt.

RECOVER Performance Measure

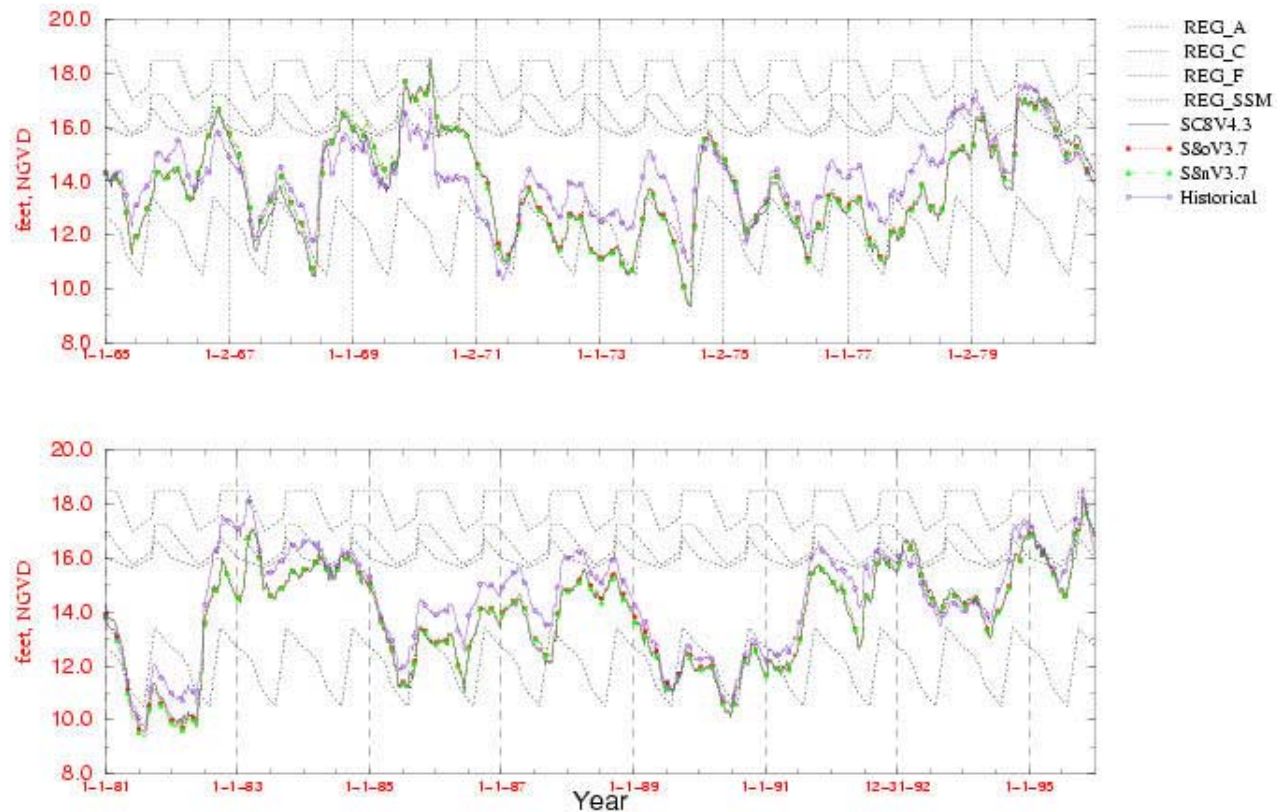
For Planning Purposes Only  
 Run date: 05/22/02 08:35:00  
 SPWMM V3.7  
 Script used: %I%, %P%  
 Filename: biscayne\_flow\_bar.fig

# Xmgr Multiple Stacked Bar Plot Explained



# Xmgr Split Stage Hydrograph Plot

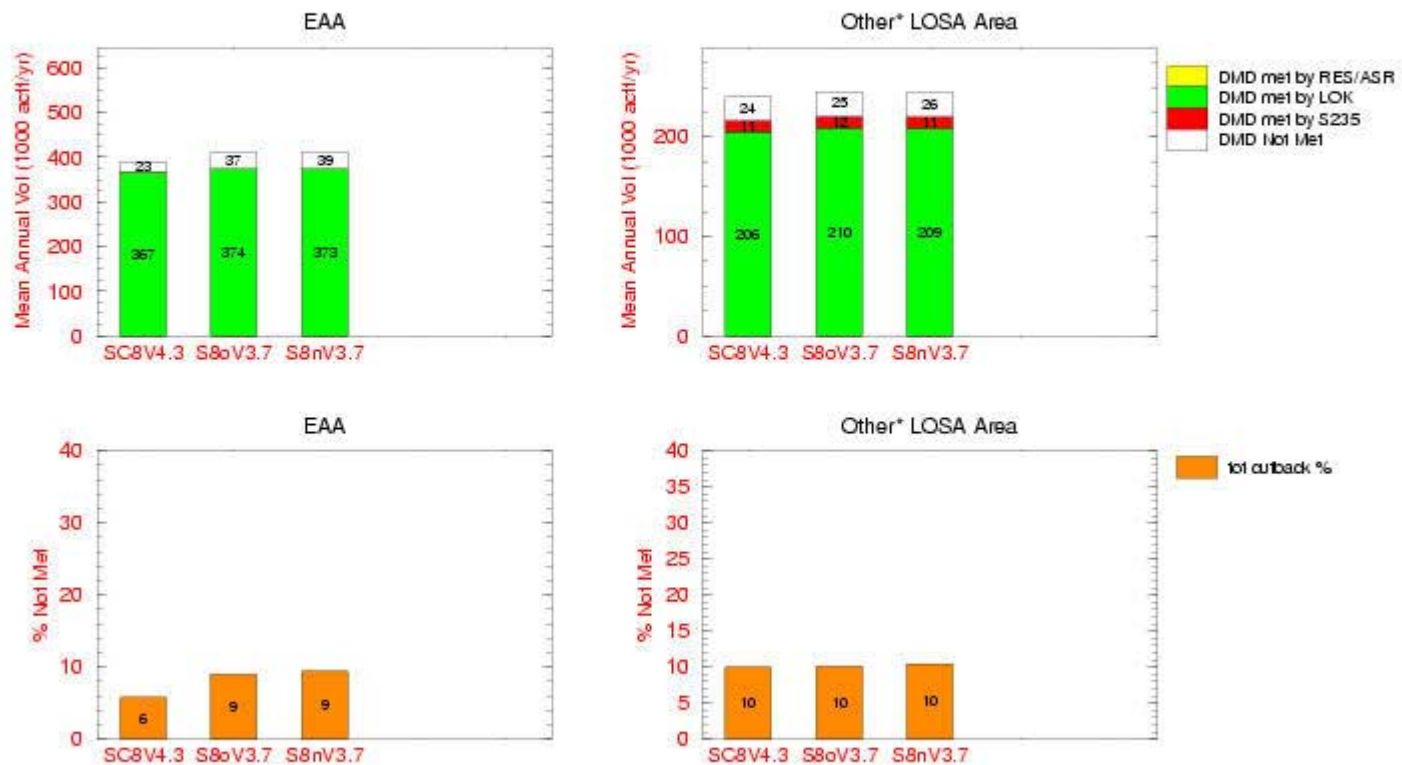
Daily Stage Hydrographs for Lake Okeechobee



Run date: 04/26/02 13:55:05  
For Planning Purposes Only  
SFWMM V3.7

# Xmgr Multiple Stacked Bar Plots

Mean Annual EAA/LOSA Supplemental Irrigation:  
Demands and Demands Not Met  
for the 1965 – 1995 Simulation Period



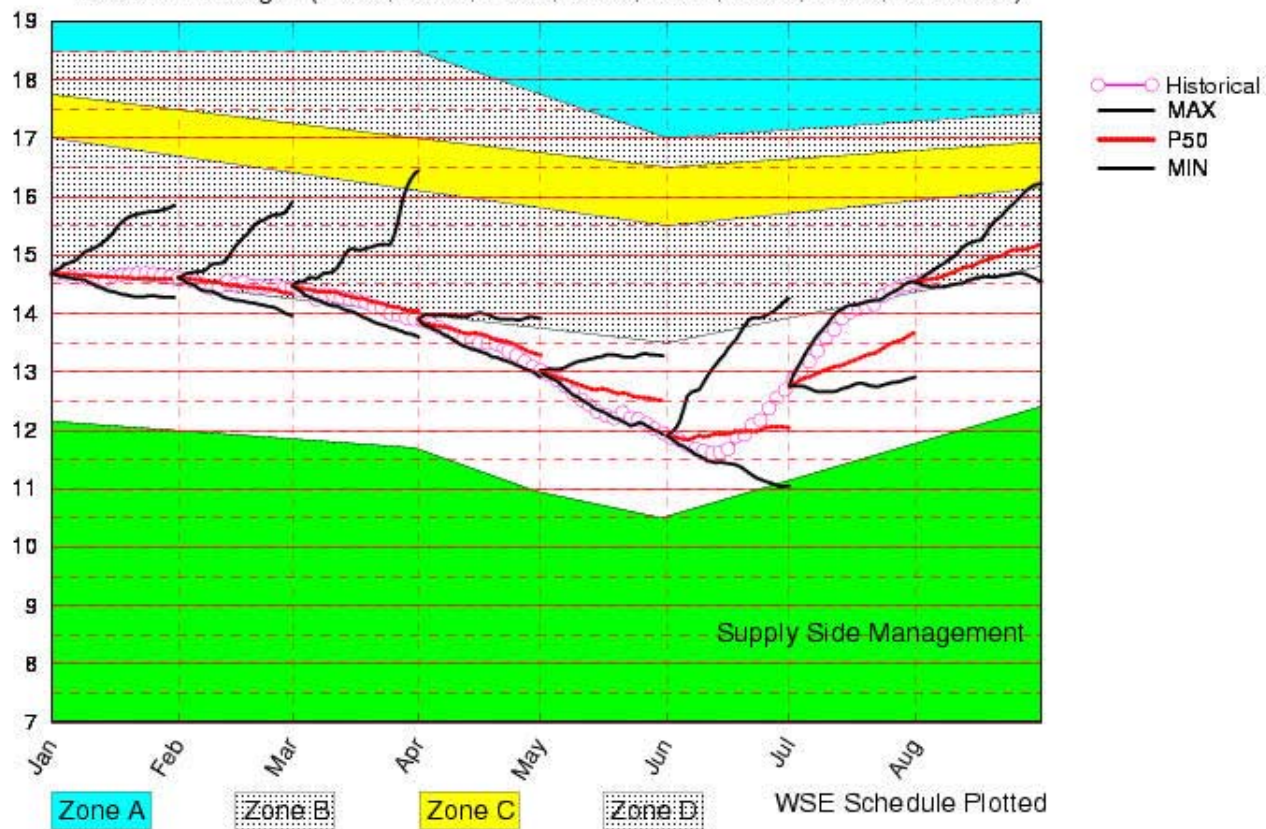
\*Other Lake Service SubAreas (S236, S4, L8, C43, C44, and Seminole Indians (Brighton & Big Cypress)).

Run date: 04/26/02 13:57:09  
For Planning Purposes Only  
SPWMM V3.7  
Script used: ssm\_4in1.scr  
losa\_4in1.fig

# Xmgr Multiple Stacked Bar Plot

## Lake Okeechobee Position Analysis Comparisons from January 2002

Initialization Stages (14.68; 14.61; 14.47; 13.02; 13.90; 11.90; 12.75; 14.53 feet)

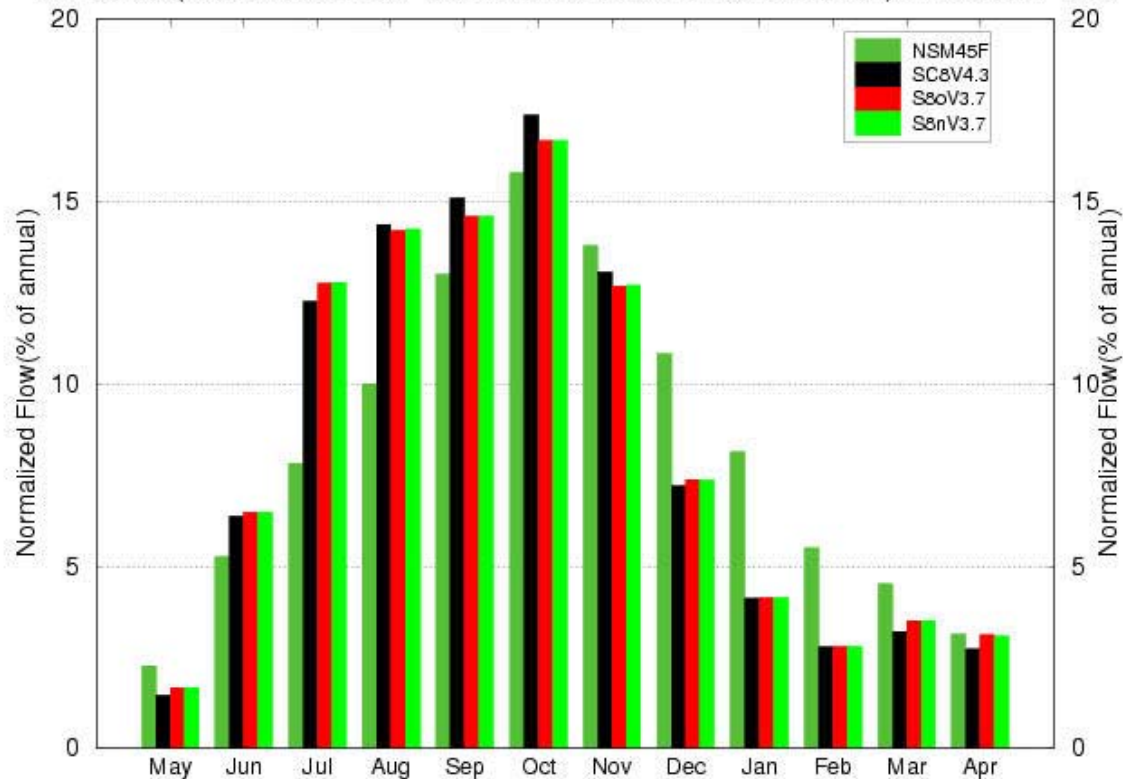


Tue Aug 6 09:12:22 2002

# Xmgr Multiple Bar Plot

## Mean Monthly Overland Flow: Central SRS

Transect 27(R19-C16 R18-C17 R17-C18 R16-C19 R15-C20 R14-C21) from 1965 to 1995



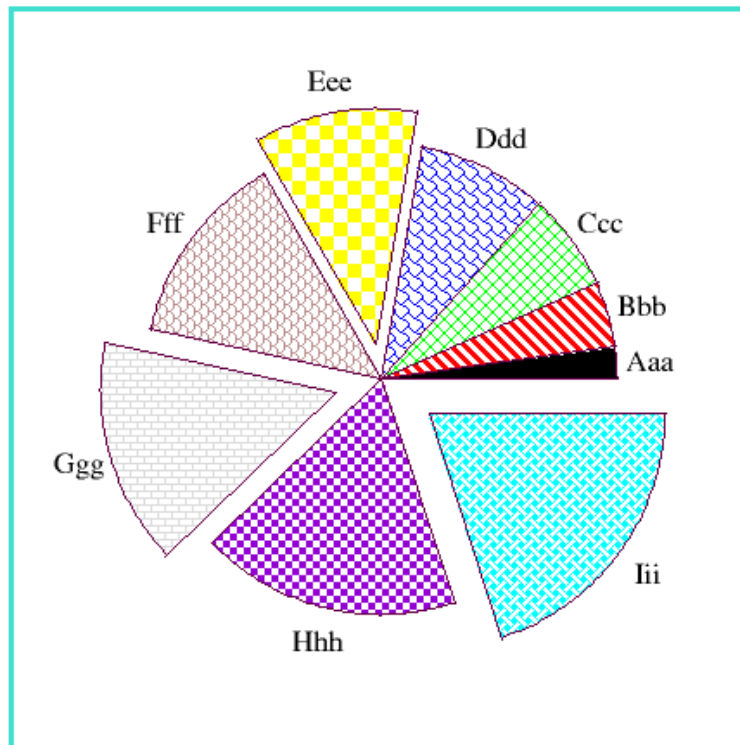
For Planning Purposes Only  
Run date: 04/26/02 15:27:34  
SFMM V3.7  
Script used: csrc\_flow\_hyd1.scr V1.2  
csrc\_rsc\_hyd\_runs.fig



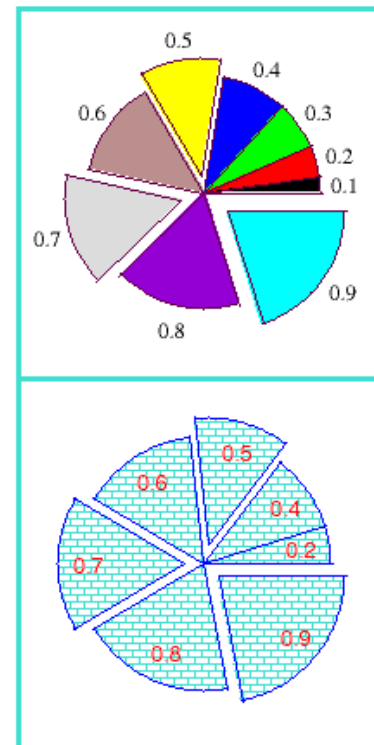
# Grace Pie Charts

## Examples of pie charts

Different colors and patterns (set type XYColPat)

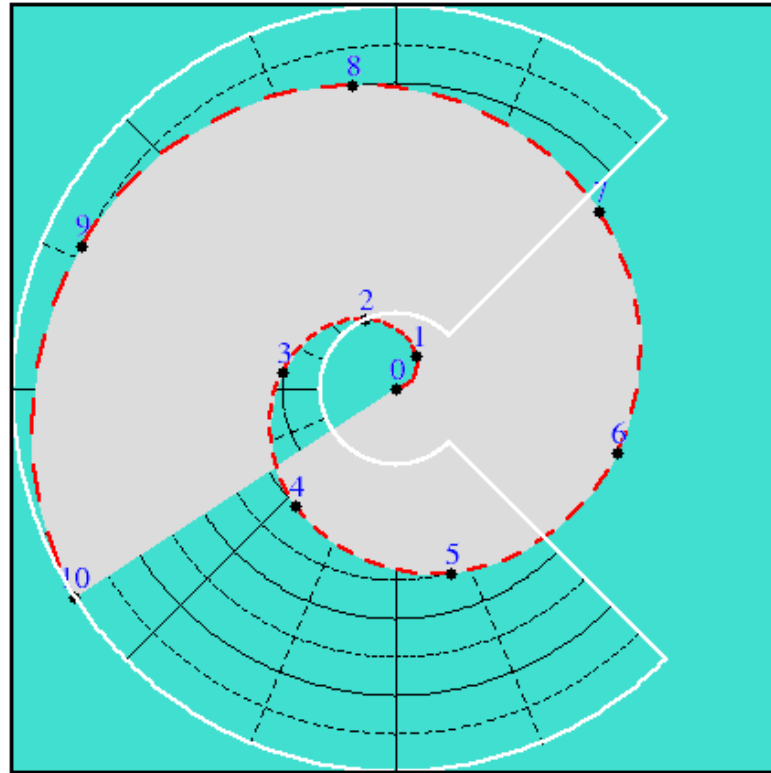


Different colors (set type XYColor)



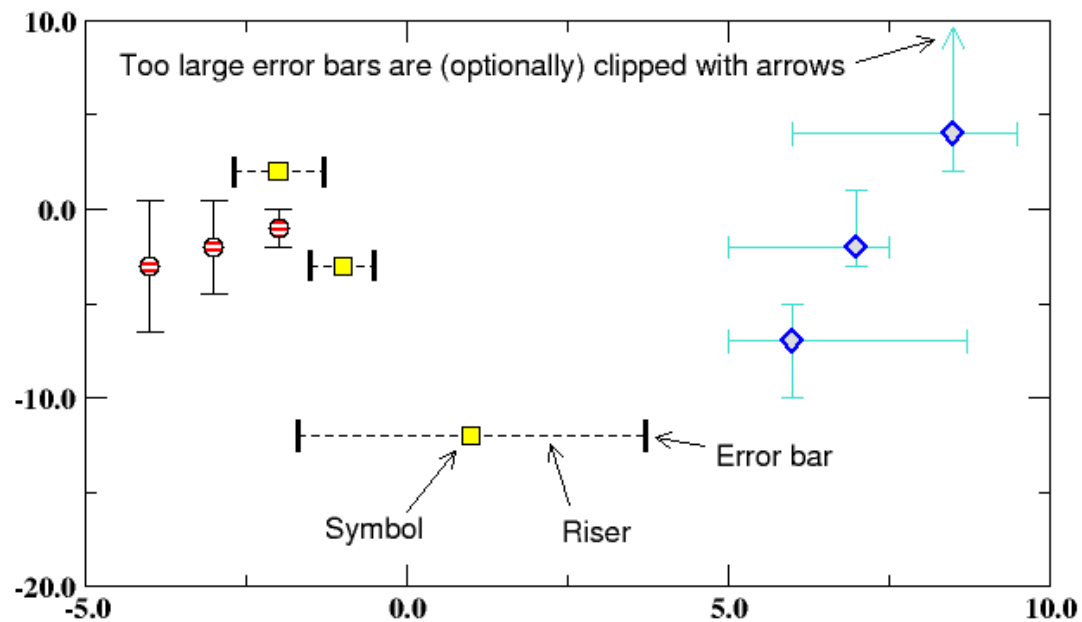
# Grace Polar Chart (Xmgr also plots polar)

A polar plot



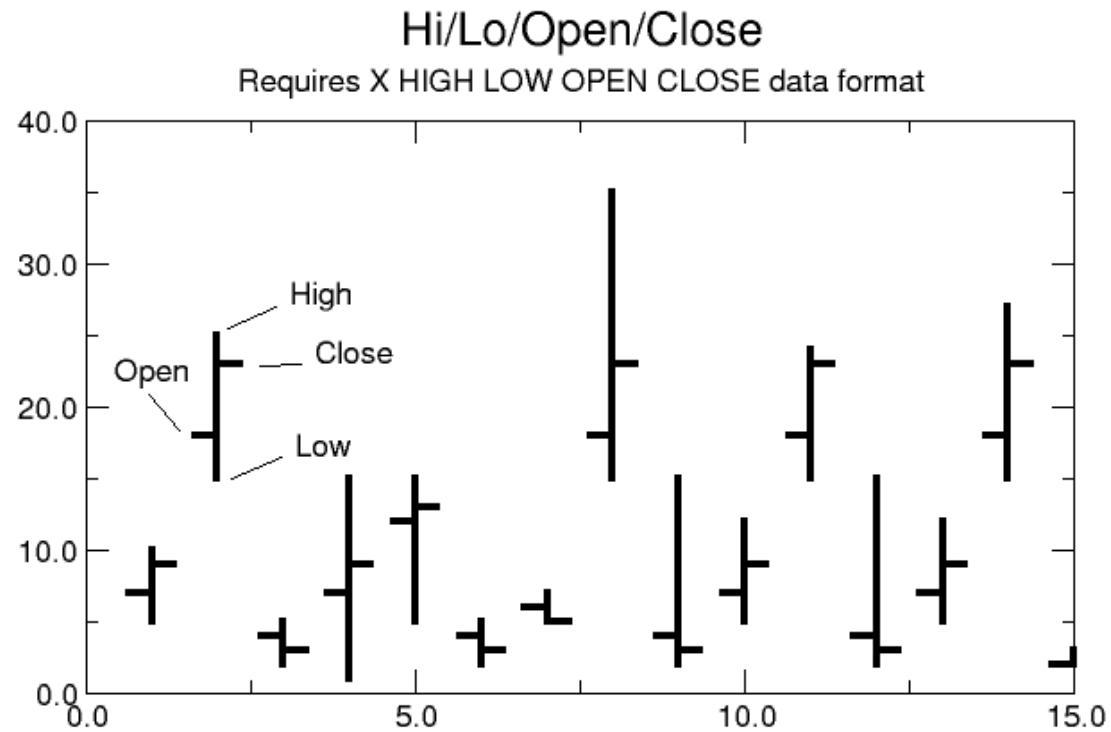
# Graphing with Error Bars

Test of error bars



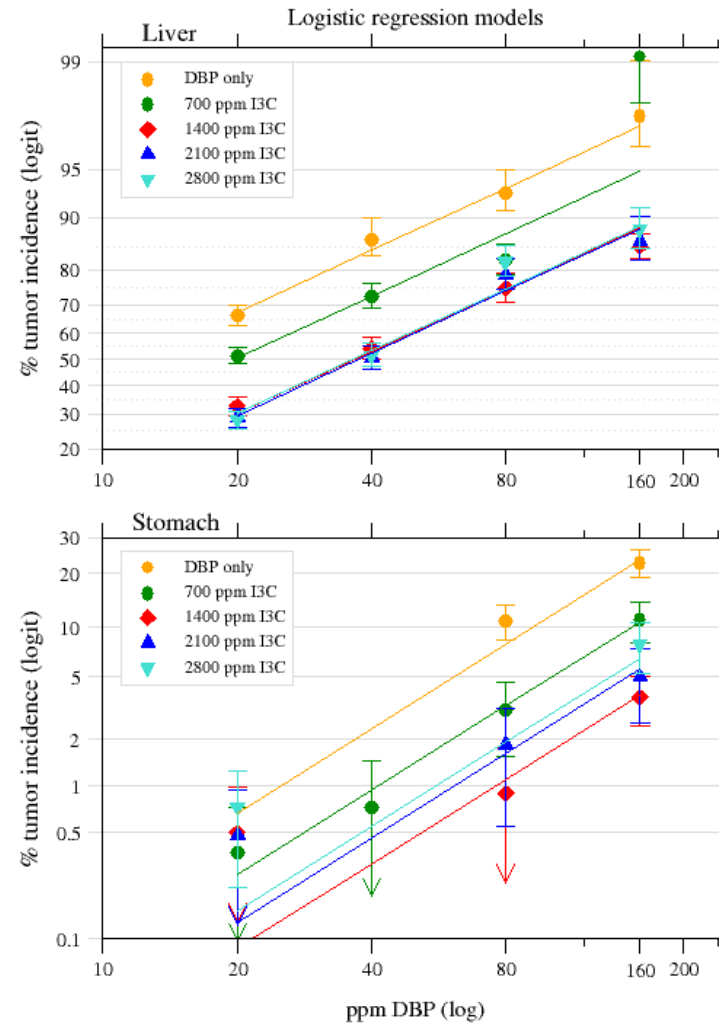
Error bars can be drawn along either X or Y or both, with differing values on either side of the datum. Setting the properties of error bars is done in Plot/Set appearance (error bars tab).

# Xmgr-Grace Hi-Lo Graph

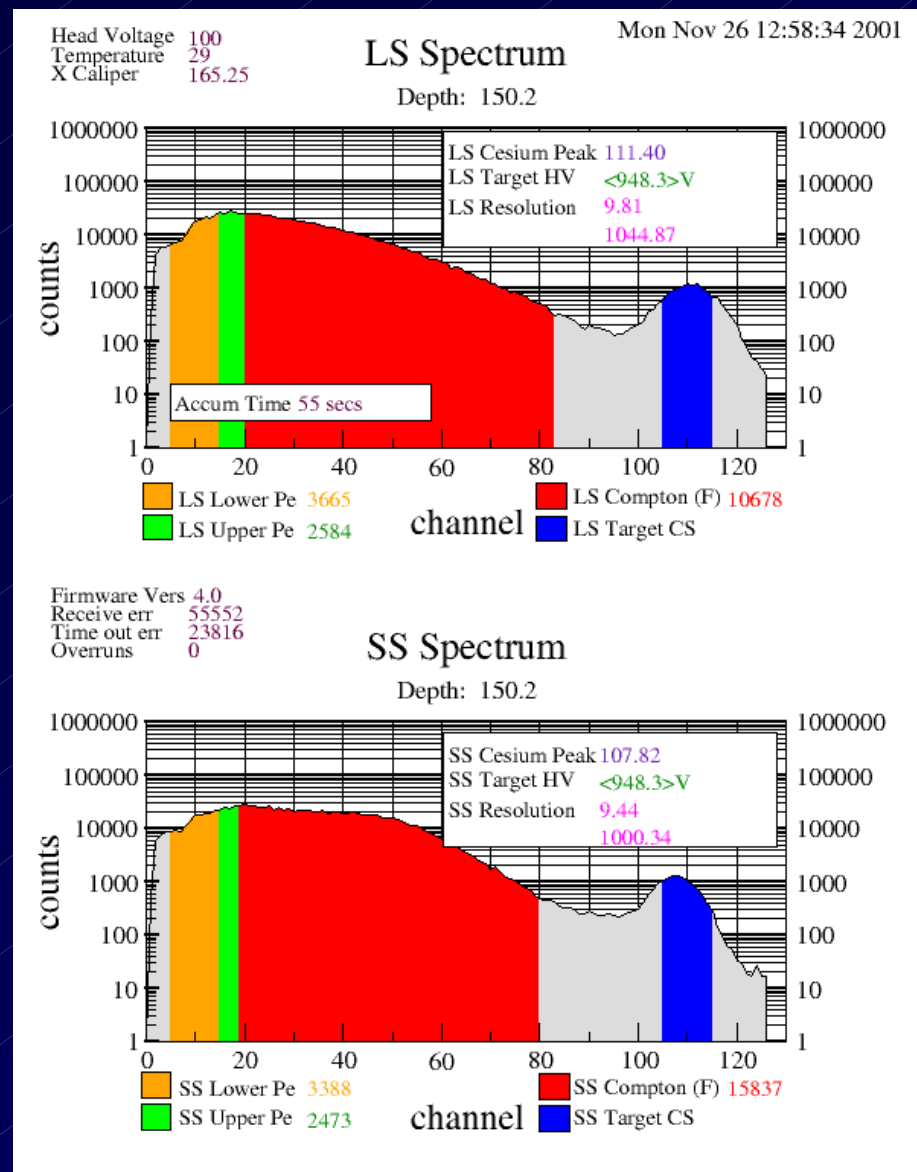


# Grace

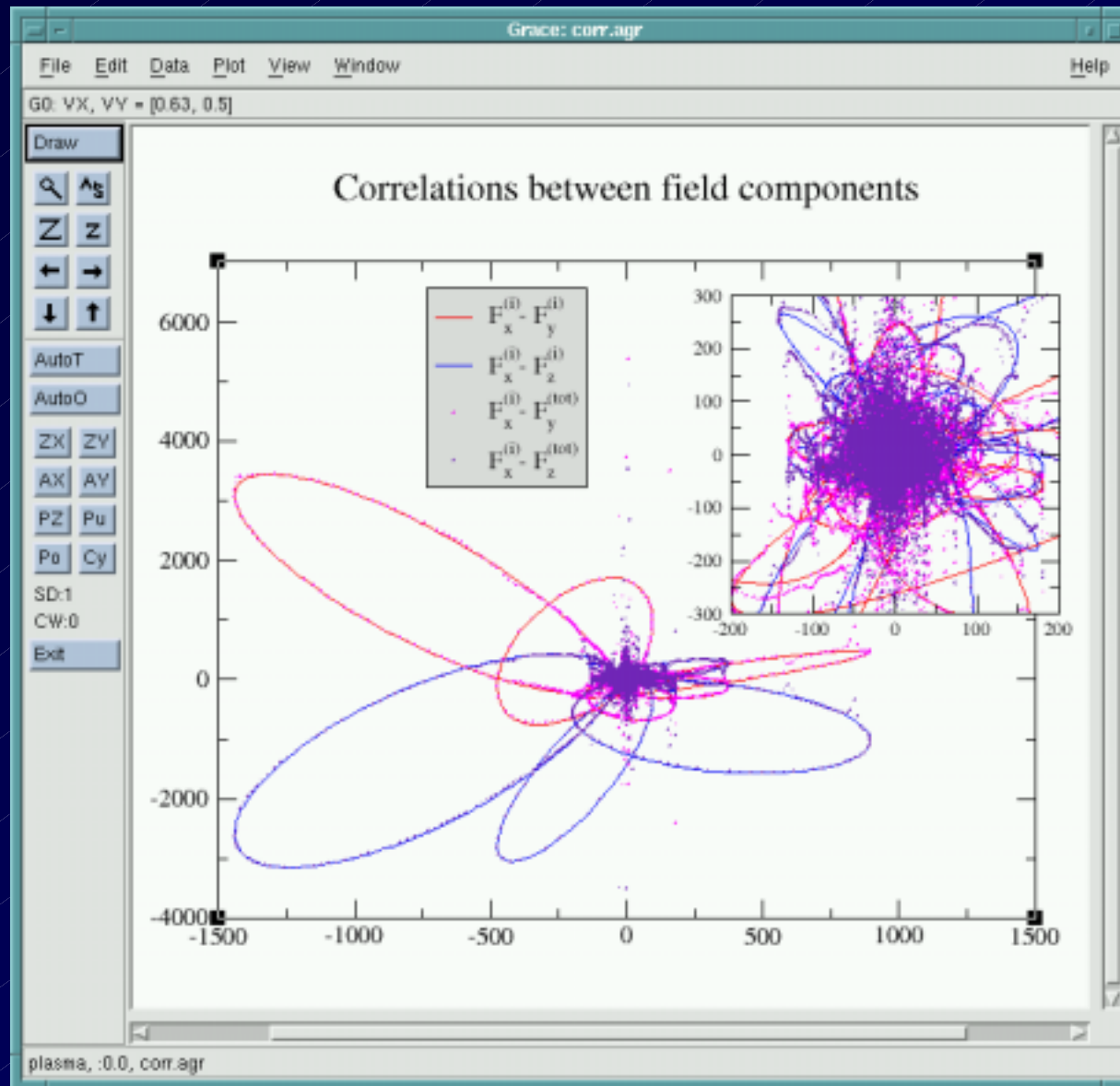
6V: Modulation of DBP carcinogenicity by dietary I3C



# Grace



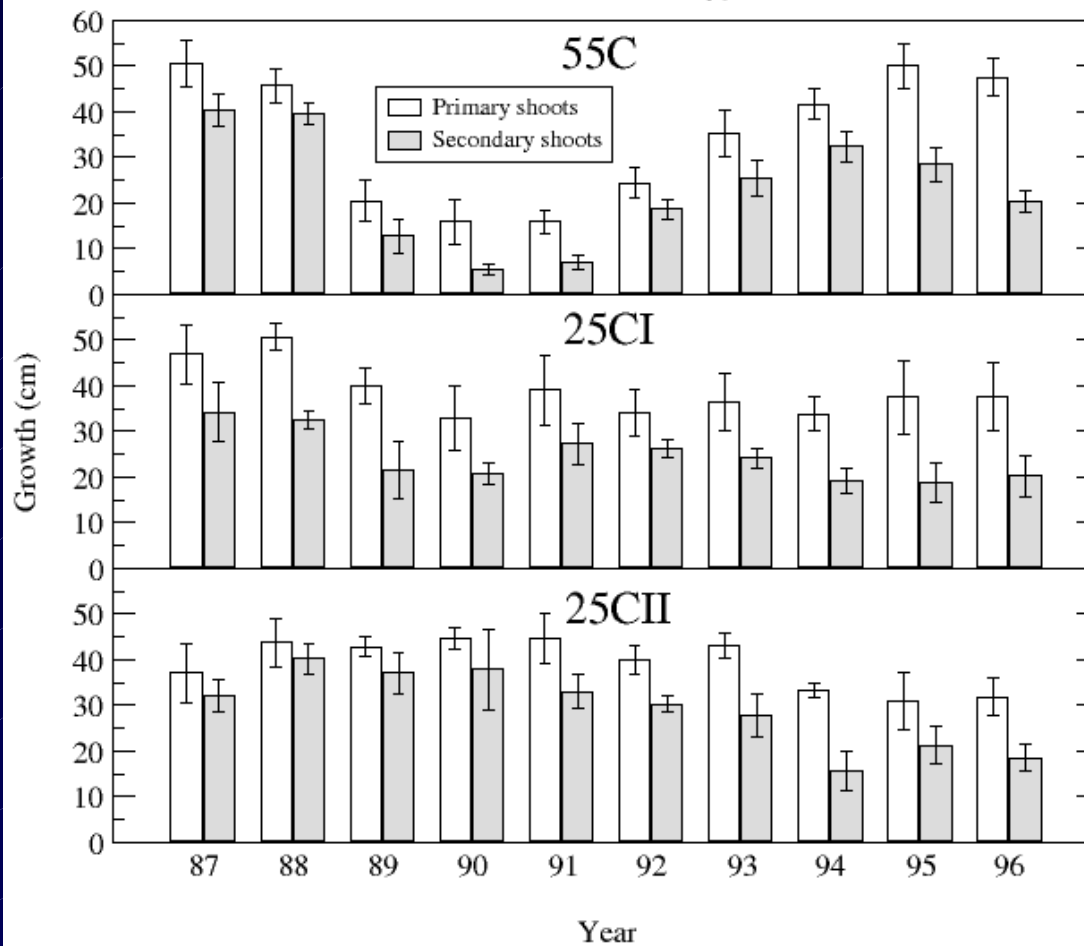
# Grace Correlations Enhanced



# Grace Bar DY Graph

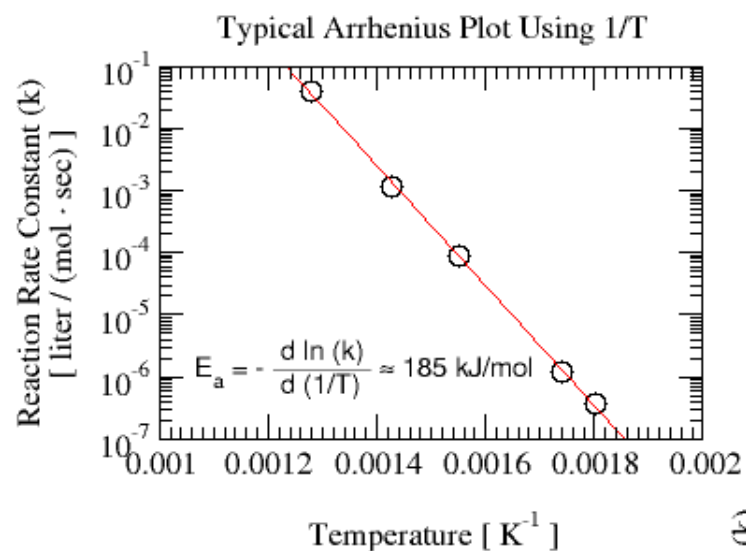
## Mean yearly growth of beech tree shoots

(sets of the BarDY type)





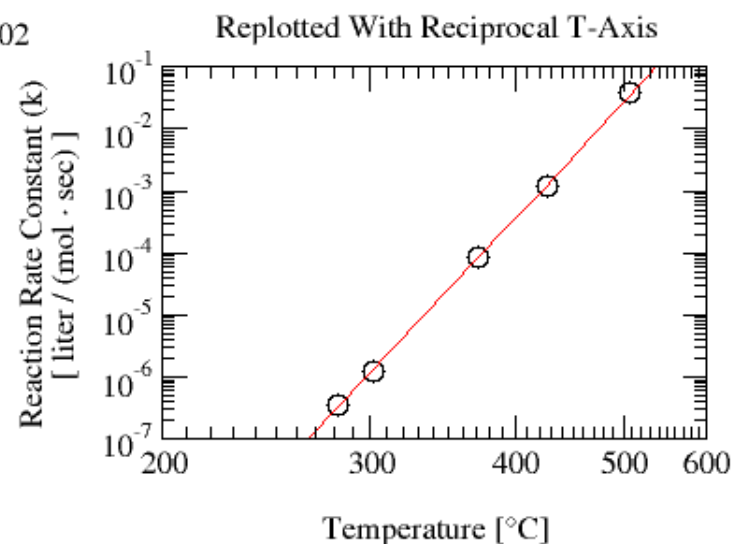
# Grace Enhancements to Log Plots



Data is from the sixth edition of *College Chemistry With Qualitative Analysis*, by Nebergall, Holtzclaw, and Robinson, published in 1980 by D. C. Heath & Company, Lexington, Massachusetts (pp. 383-384).

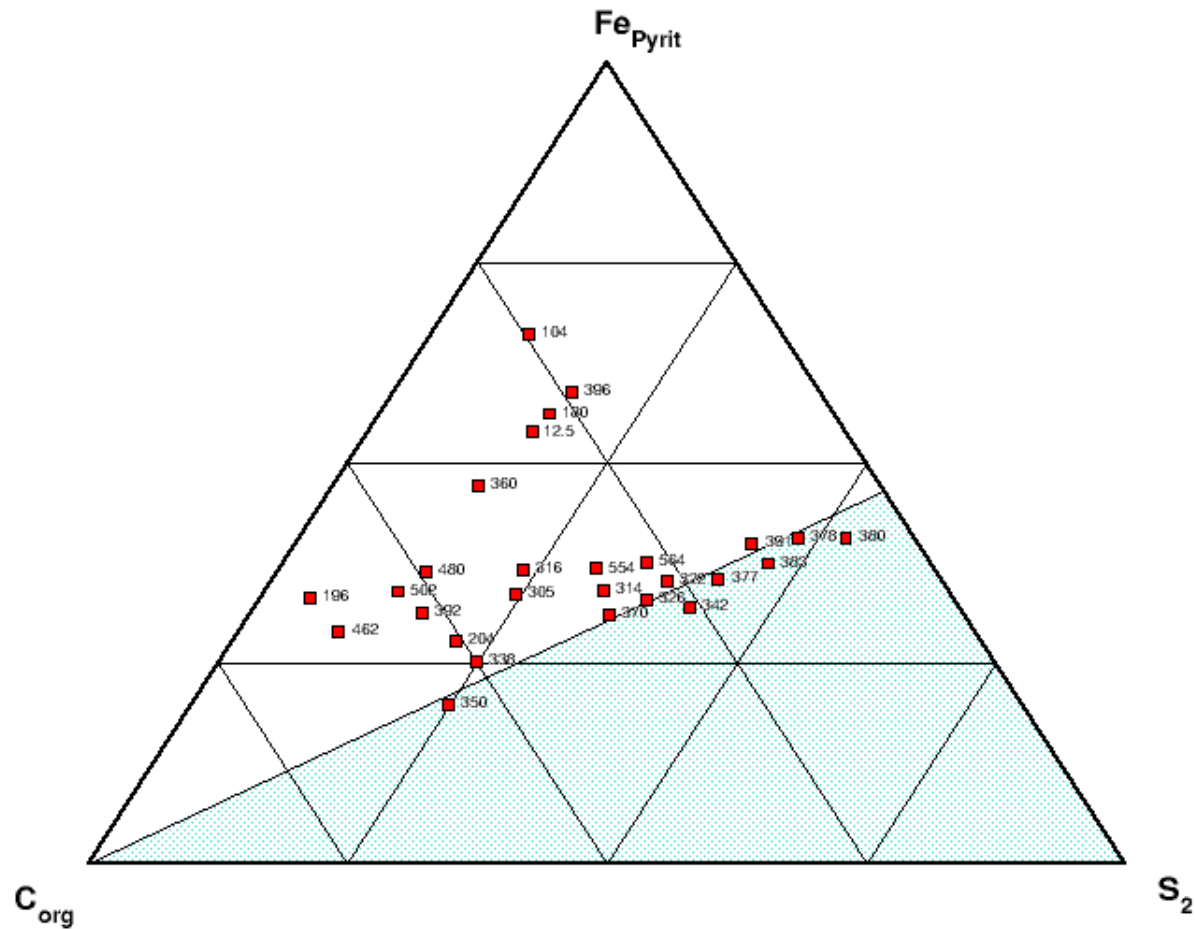
The activation energy is estimated to be 185 kJ/mol.

- 1) Plot the data using T (in Kelvin), instead of 1/T
  - 2) Select "Invert axis"
  - 3) Assign special tick labels for °C
- or
- Apply axis transform "\$t -273.15"



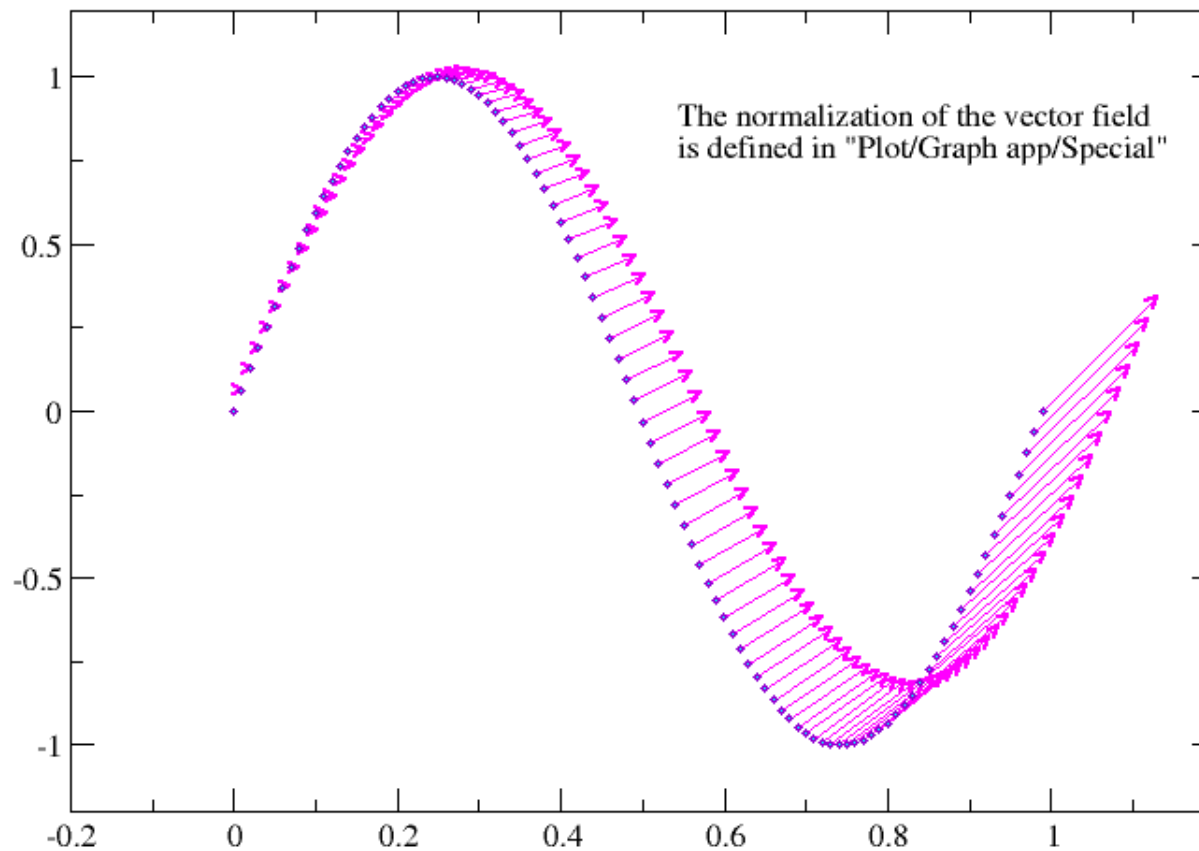
# Xmgr-Grace XYZ Graph

A test of the XYZ set presentation



# Grace Enhancement in Vector Plot

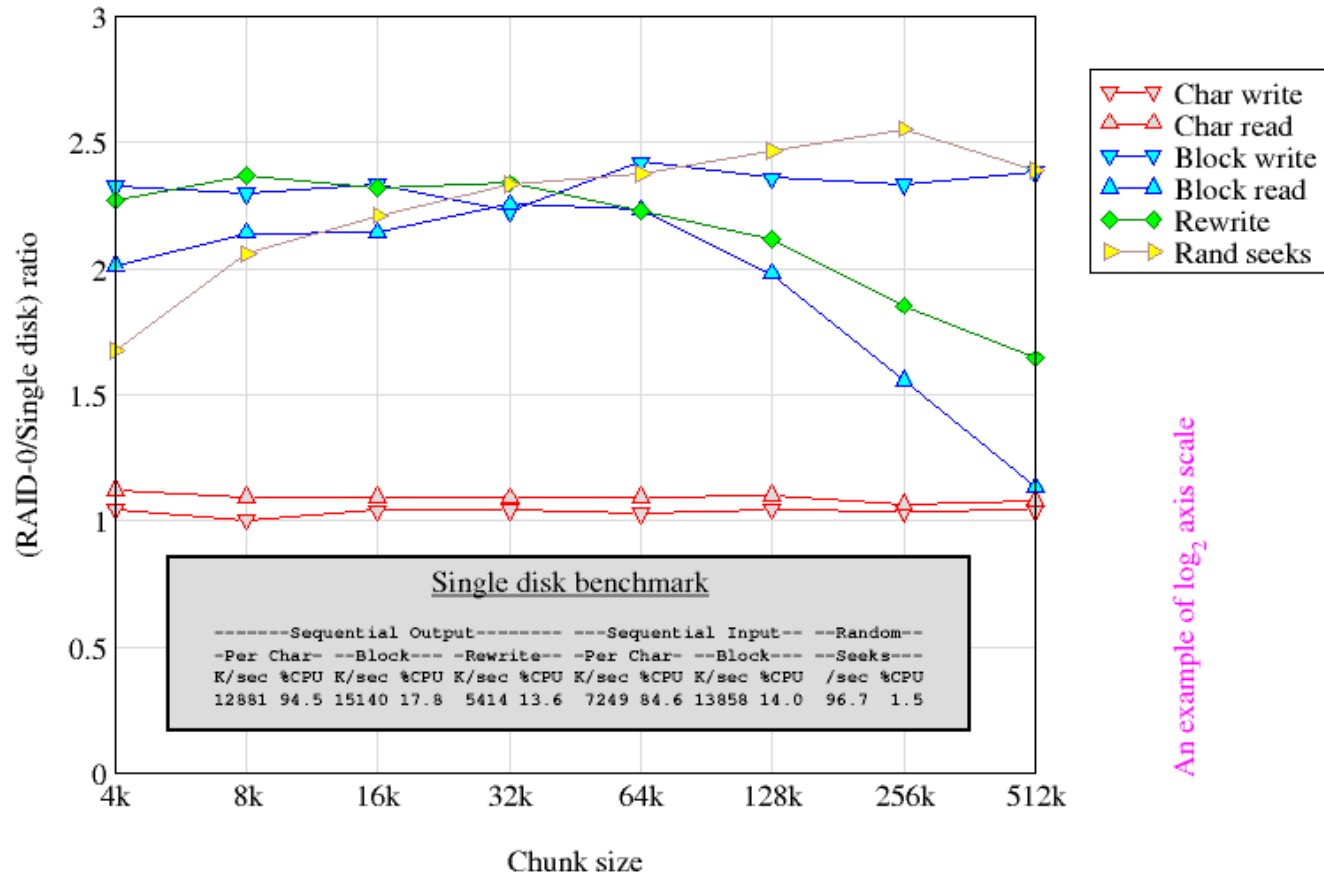
An example of vector map



# Grace

## RAID-0 performance (3 disks)

file size: 800MB; ext2fs flags: -b 4096

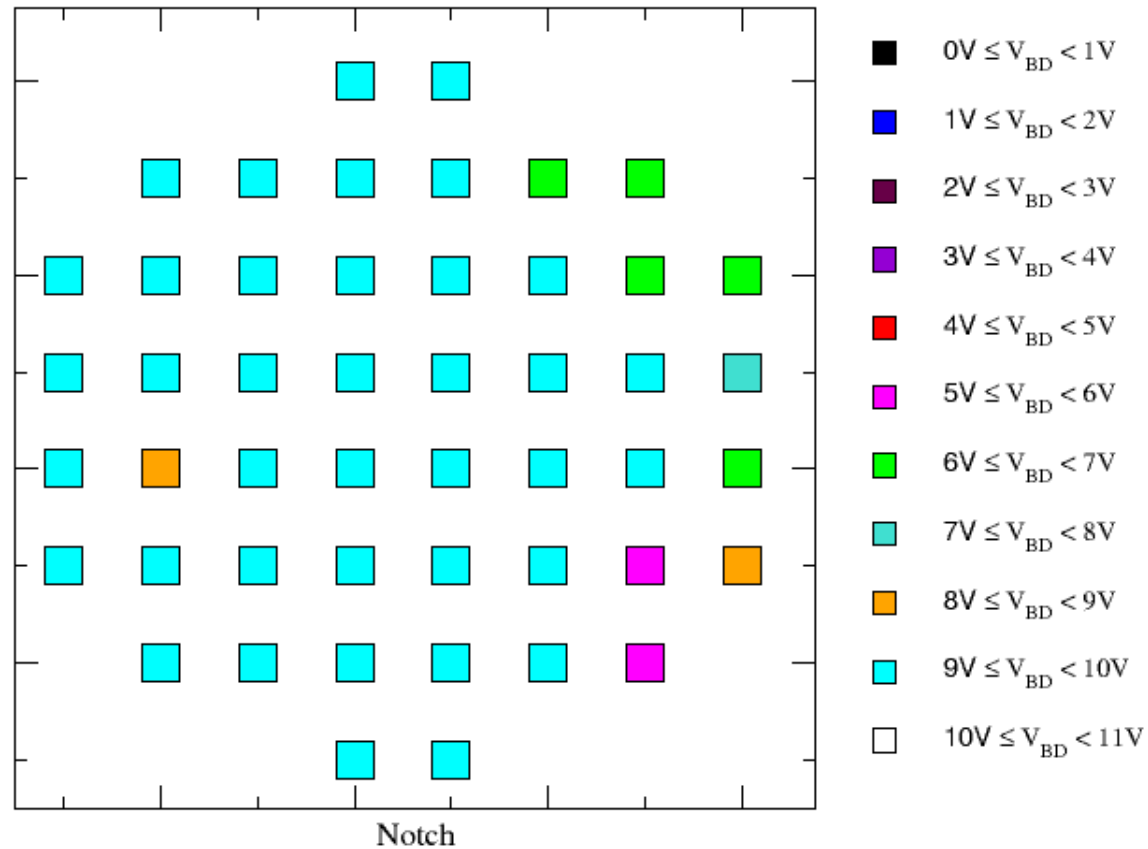


An example of  $\log_2$  axis scale

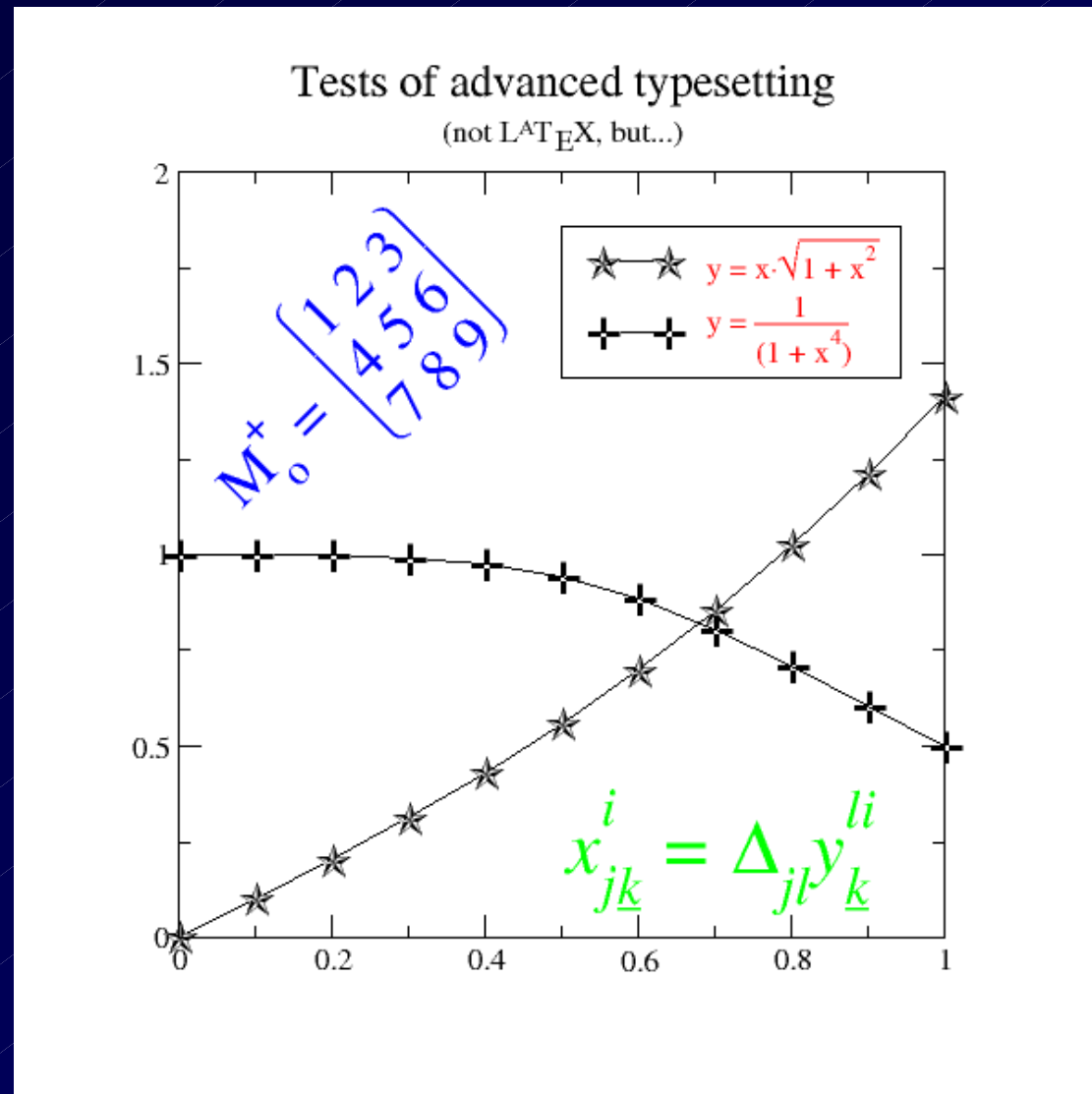
# Grace Graphic

## XYCOLOR Map

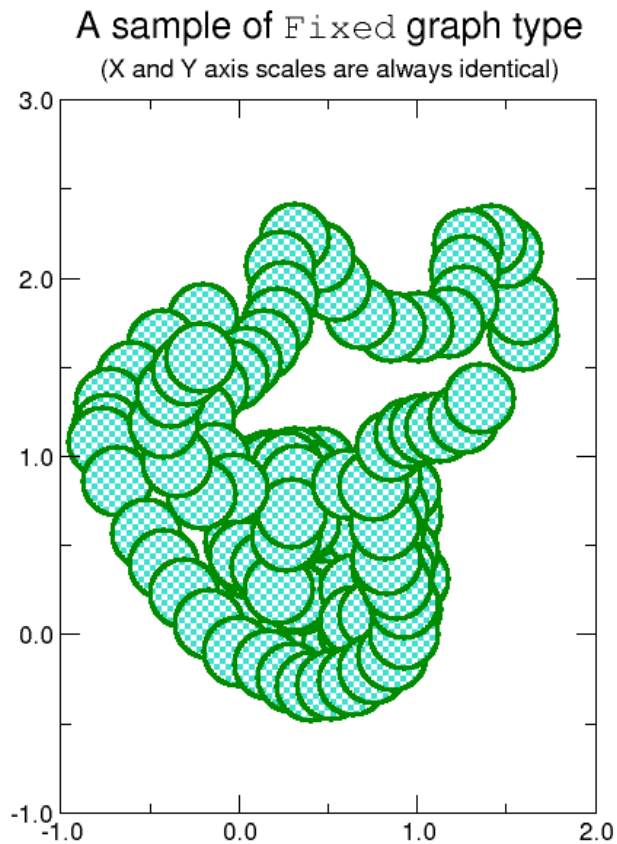
Device Breakdown Voltages Across An 8-Inch Semiconductor Wafer



# Grace Enhancements to Text



# Xmgr-Grace Radius Graphic



Example of data set type XY RADIUS. The file format is

```
x y r  
:  
:
```

Where  $r$  is the radius of a circle with center at  $x, y$ .

# Grace Graphic

XYSize set presentation example

