Basically

1 2 3

command infile flags > outfile

psxy points.xy –R.. –J.. –B.. –V > plot.ps

Basically

1 2 3

command infile flags > outfile

psxy points.xy –R.. –J.. –B.. –V > plot.ps

order doesn't matter for input and flags

psxy –J.. –V points.xy –B.. R.. > plot.ps

Basically

1 2 3

command infile flags > outfile

psxy points.xy –R.. –J.. –B.. –V > plot.ps

order doesn't matter for input and flags

psxy –J.. –V points.xy –B.. R.. > plot.ps

depending on how you installed gmt...

gmt4 psxy –J.. –V points.xy –B.. R.. > plot.ps

gmt psxy –J.. –V points.xy –B.. R.. > plot.ps

Unix and shell Environment

- Login
- Using stdin, stdout, and stderr
- I/O redirection
- Pipes
- Wild cards
- File permissions
- Command history
- UNIX tools
- UNIX man pages

Input/Output

- UNIX initialises 3 file handles:
  - stdin: Standard input [keyboard]
  - stdout: Standard output [screen]
  - stderr: Standard error [screen]
- These can all be redirected so that read (or write) instead takes place from (or to):
  - files on the disk
  - a process (e.g., another UNIX program)

Redirection examples

- GMTprogram inputfile › outputfile
  - psxy point.xy ... › test.ps
- GMTprogram inputfile ›› outputfile
  - psxy morepoints.xy ›› test.ps

- Notes:
  - The last example appends to an existing file
  - If no input file is given the program reads stdin

Piping and other plumbing

- Pipes are used to connect the output of one program to the input of another:
  - program1 | program2 < results.dat
  - program3 inputfile | lp
  - cat inputfile | program4 | lp

Notes:

1. lp is the printing program
2. cat sends contents of file to stdout

UNIX File Permissions

- File permissions may be any combination of read (r), write (w), and execute (x)
- This combination may be set differently for the user (u), the group (g), or others (o)
- To see a file's permission, use "ls -l":
  - ls -l myfile
  - The permission is printed [d]rwxrwxrwx
  - - means a permission is not given
  - a leading d indicates a directory

Output may look like this:

```
-rw-r--r--  1 marias  marias  15597 Aug 26 12:15 myfile
```

Command History

- The command "history n" will show the last n commands you have issued
- history | grep gmt
- To repeat a previous command, try:
  - !n, where n is the command number
    - !203 (will run command # 203 once more)
  - !! will repeat the previous command

UNIX and Windows Tools

- terminal (for entering commands)
  - Terminal, xterm
- editor (for writing scripts)
  - gedit, vi, emacs, textmate
- PostScript previewer
  - ghostview (or gv), preview
- UNIX utilities
  - ksh, awk, grep, sed, wc, head, tail, sort

Executable shell scripts

- A script is a file with one or more ksh/bash or UNIX commands in it
- Scripts must start with magic line:
  - #!/bin/ksh
  - #!/bin/bash
- Add comments by starting lines with #
  - # This script makes Fig 7 in Thesis
- Save script to a filename (e.g., fig7.sh)
- Make executable
  - chmod +x fig7.sh

Useful UNIX commands

- pwd (print working directory)
- cd dir (changes directory to dir)
- mkdir dir (makes the directory dir)
- rm file(s) (removes the given files)
- rmdir dir (removes an empty directory)
- cp a b (copies file a to file b)
- mv old new (moves old to new)
- ls (list contents of current directory)

UNIX Wild cards

- Wild cards allow many files to be addressed one by one at the same time
- Four kinds of UNIX wild cards exist
  - ls *.grd

*	Matches anything (even nothing)
?	Matches any single character
[list]	Matches any one character in list
[range]	Matches any one character in range

Class Exercise – Create a directory

- Go to your terminal
- Type pwd – this prints your working directory
- Now we want to create a directory called GMT_Course
- Type mkdir GMT_Course
- View the contents of that directory by typing

  cd GMT_Course

  pwd

  ls *

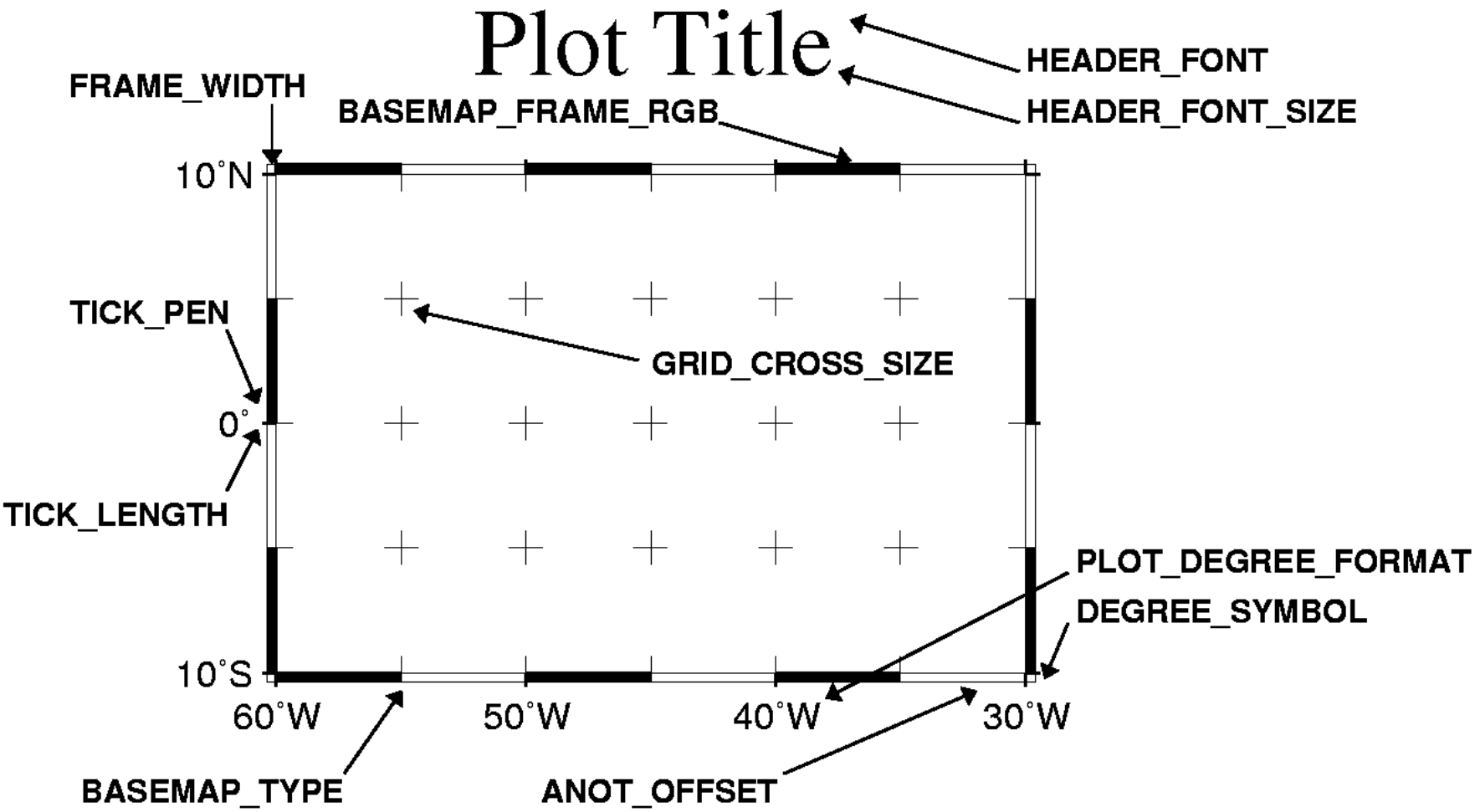
GMT General Features

- Default settings
- Measurement units
- Standardized command line switches
- Table data formats
- Grid file formats
- Color palette tables
- Pens and Fills
- Character escape sequences

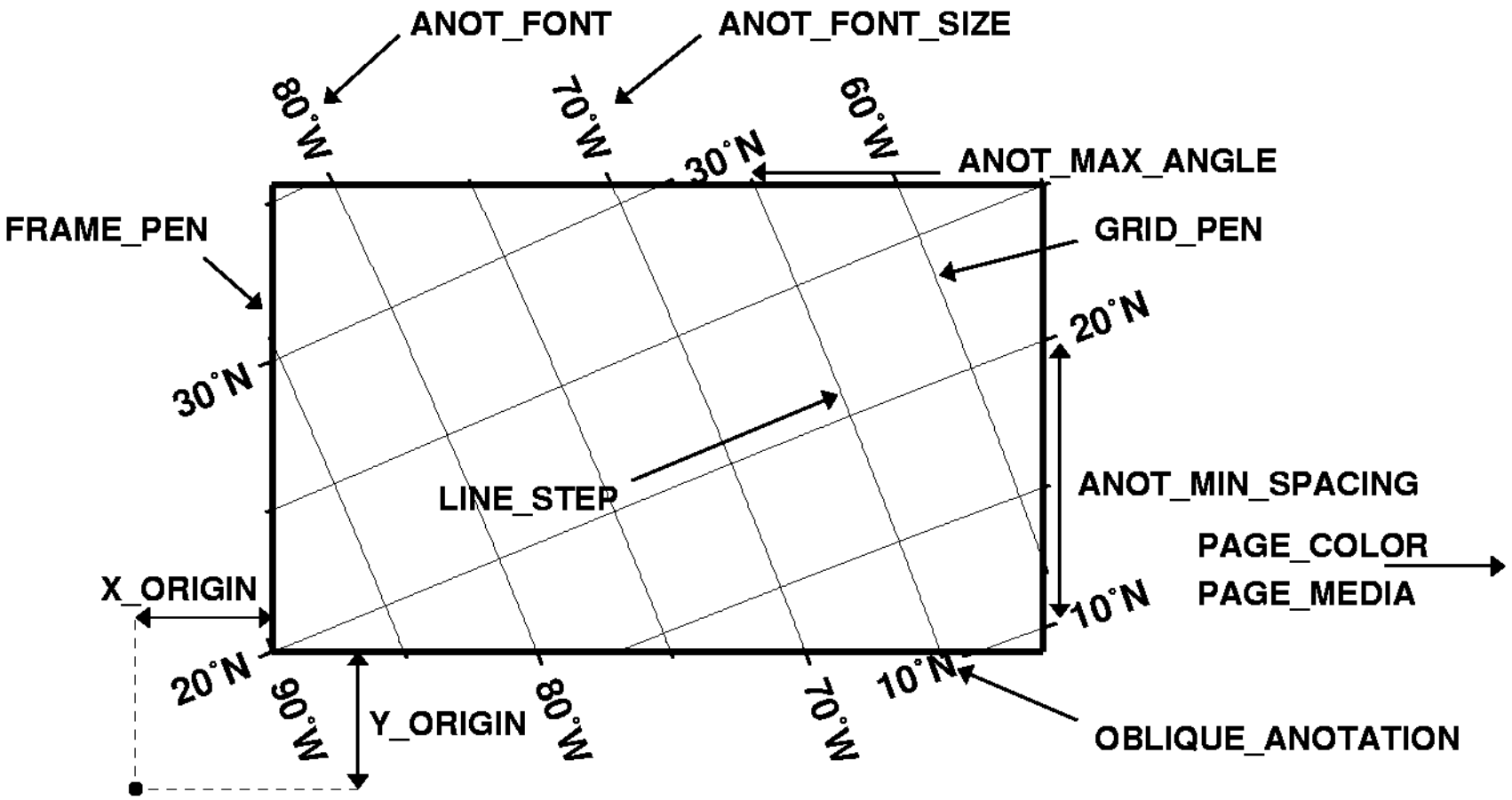
GMT Default parameters

- More than 100 parameters that affect many aspects of GMT operations

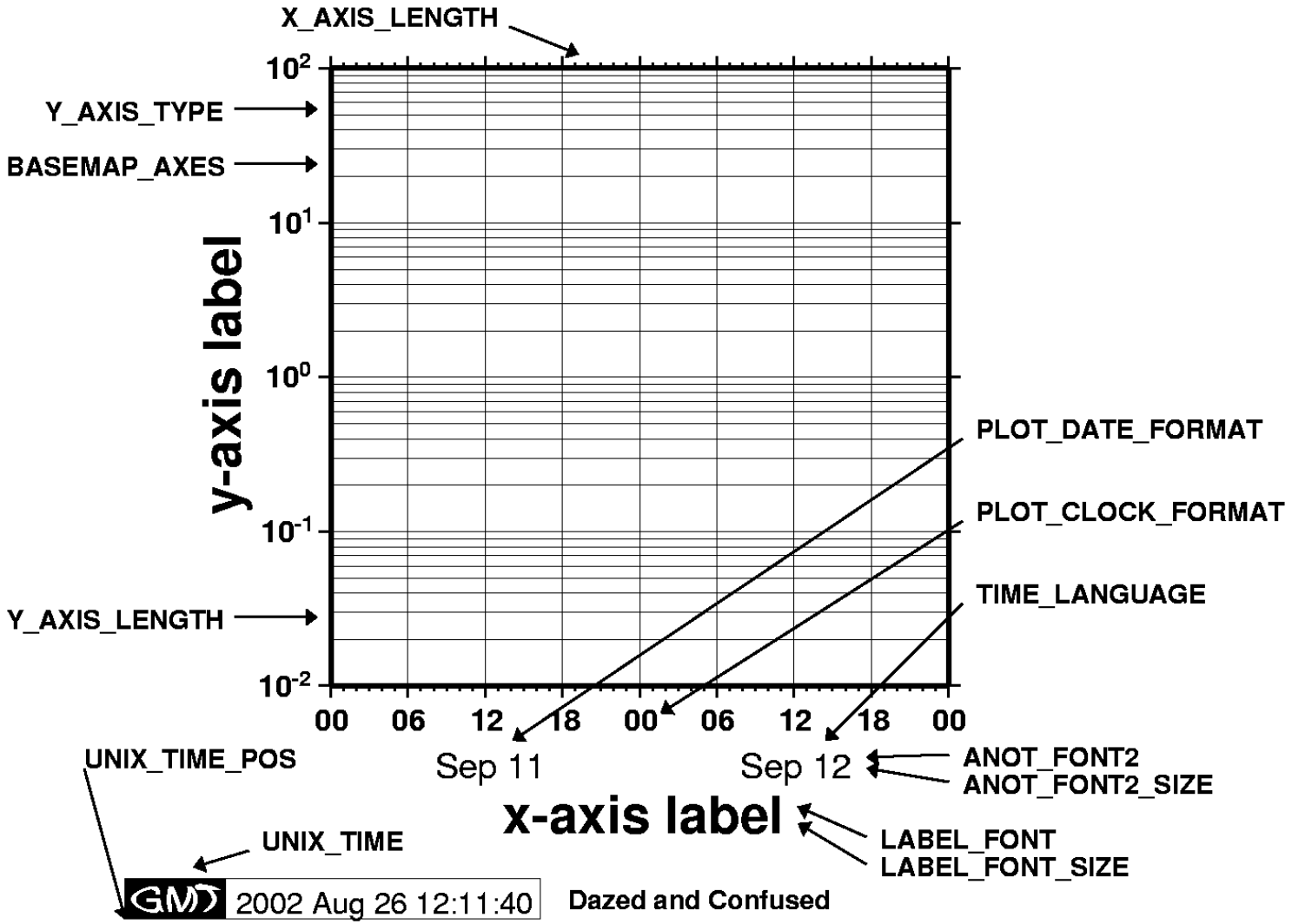
GMT Defaults Parameters（1）



GMT Defaults Parameters（2）



GMT Defaults Parameters (3)



GMT Measurement Units

Can accept cm, inch, meter, or point

- Append unit abbreviation to value:
  - 4c, 3.5i, 18p
- Set MEASURE_UNIT(GMT4)/ PROJ_LENGTH_UNIT(GMT5) to desired unit
  - Values without trailing unit imply the default unit

GMT Default parameters

- More than 100 parameters that affect many aspects of GMT operations
- You can modify these directly in your scripts or you can create a separate file for your defaults and have this present when running scripts:
  - GMT4 searchers for .gmtdefaults4 in
    - The current directory or home directory
    - Defaults to the GMT install settings
  - GMT5 searches for gmt.conf…

Class Exercise – browsing the GMT Defaults

- GMT4: In the GMT_Course directory, type
  gmtdefaults -D
- GMT5: In the GMT_Course directory, type
  gmtdefaults

Changing defaults in a script

- The "gmtset" command
- GMT4
  - gmtset ANNOT_FONT_SIZE_PRIMARY=24p
- GMT4 (through MacPorts)
  - gmt4 gmtset ANNOT_FONT_SIZE_PRIMARY=24p
- GMT5:
  - gmt gmtset FONT_ANNOT_PRIMARY=24p

Alternatively…

- You can change the defaults within a given command line using "--":

pscoast -R… -J… -W… -B… --ANNOT_FONT_SIZE_PRIMARY=8p › Plot.ps

gmt4 pscoast -R… -J… -W… -B… --ANNOT_FONT_SIZE_PRIMARY=8p › Plot.ps

gmt pscoast -R… -J… -W… -B… --FONT_ANNOT_PRIMARY=8p › Plot.ps

Common Command Line Options

OPTION	MEANING
–B	Define annotation-, tick-, and grid-intervals, axes labels, and title
–H	Indicate that ASCII tables have header record(s)
–J	Sets the current map projection or coordinate transformation
–K	Allows more plot code to be appended to current plot
–O	Overlay more plot code on current plot
–P	Select Portrait orientation [Default is landscape]
–R	Define the world coordinates domain
–U	Plot time-stamp on the plot
–V	Run program in verbose mode
–X	Set x-coordinate for plot origin
–Y	Set y-coordinate for plot origin
–b	Selects binary input or output
–c	Specify number of plot copies
–f	Specify data format on a per column basis
–:	Input geographic data are (lat, lon) rather than (lon, lat)

GMT file formats

- Data tables
  - ASCII (slow but human readable)
    - Single segment (default)
    - Multi-segment with internal headers
    - May have header records
    - fields can be separated by tabs, space or commas
  - Binary (faster for larger files)
    - Single segment (default)
    - Multi-segment (internal headers)

Example：ASCII data table with 1 line header record

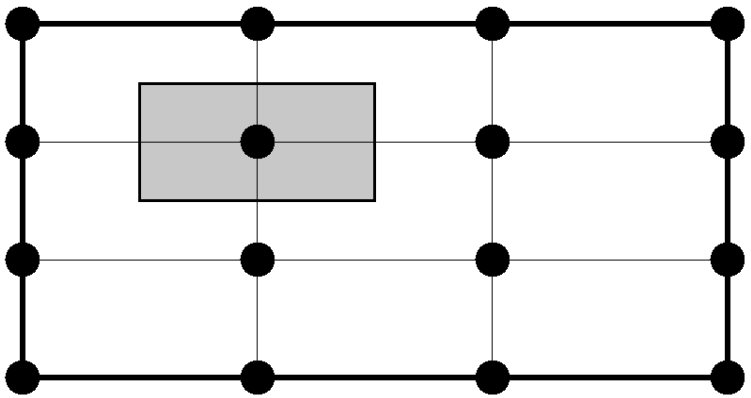
> time (Ma), conv. rate (mm/yr), angle, abs.rate (mm/yr), abs.rate.normal (mm/yr), strike

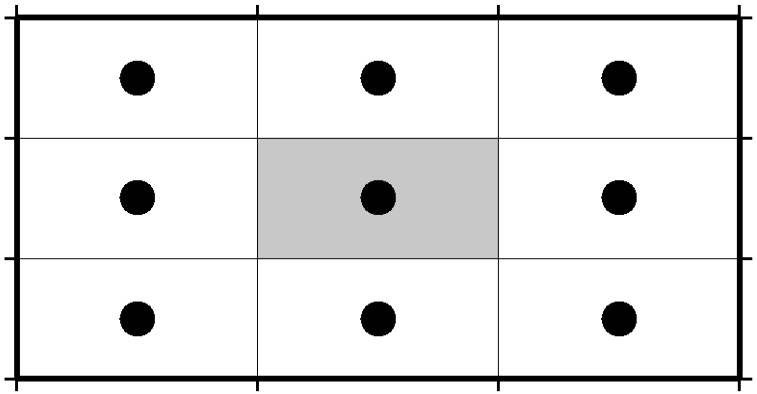
2.5	37.8	-46.6	34.4	31.1893	9
7.5	41.6	-49.0	32	35.2788	9
12.5	52.4	-53.2	28.8	45.9185	8
17.5	53.4	-52.5	29.5	46.477	8
22.5	51	-60.6	21.4	47.4838	8
27.5	61.2	-54.2	27.8	54.1364	8
30	nan	90.0	9	nan	9
17.5	51.8	-54.5	26.5	46.3576	9
7.5	41.6	-49.0	34	34.488	7
12.5	52.4	-53.2	29.8	45.4709	7
17.5	53.4	-52.5	30.5	46.011	7
22.5	51	-60.6	22.4	47.1518	7
27.5	61.2	-54.2	25.8	55.0995	10
30	nan	90.0	-0	nan	
17.5	51.8	-54.5	-0	51.8	
7.5	41.6	-49.0	-0	41.6	

GMT file formats

- Gridded data sets, (x,y,z)
  - Rectangular domain with equidistant grid spacing Δx and Δy
  - x and y-coordinates implied and not stored
  - Contain comments and header info
  - Gridline- or pixel-registration possible
  - Architecture-independent netCDF format
  - Other native binary formats available
  - Custom formats can be accommodated

Grid file registrations



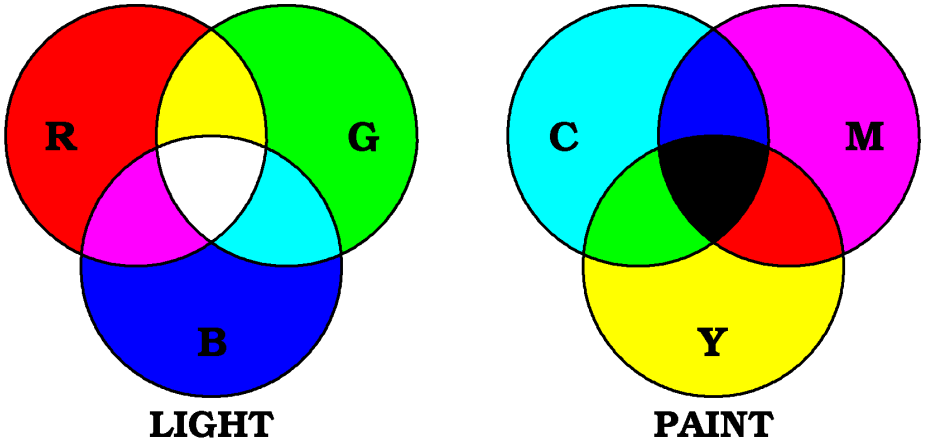


- Gridline registration has 1 row/column more than pixel registration
- Gridline registration has nodes at gridline intersections whereas pixel registration has nodes centered on the grid boxes

GMT file formats

- Colour palette tables
  - ASCII table with optional comments
  - Commonly use the r/g/b system
  - Each record defines colour as a function of z between slice z_0 to z_1
  - Any number of slices allowed; z must be monotonically increasing with no gaps
  - Colour may be constant or change linearly from z_0 to z_1

How does color work?



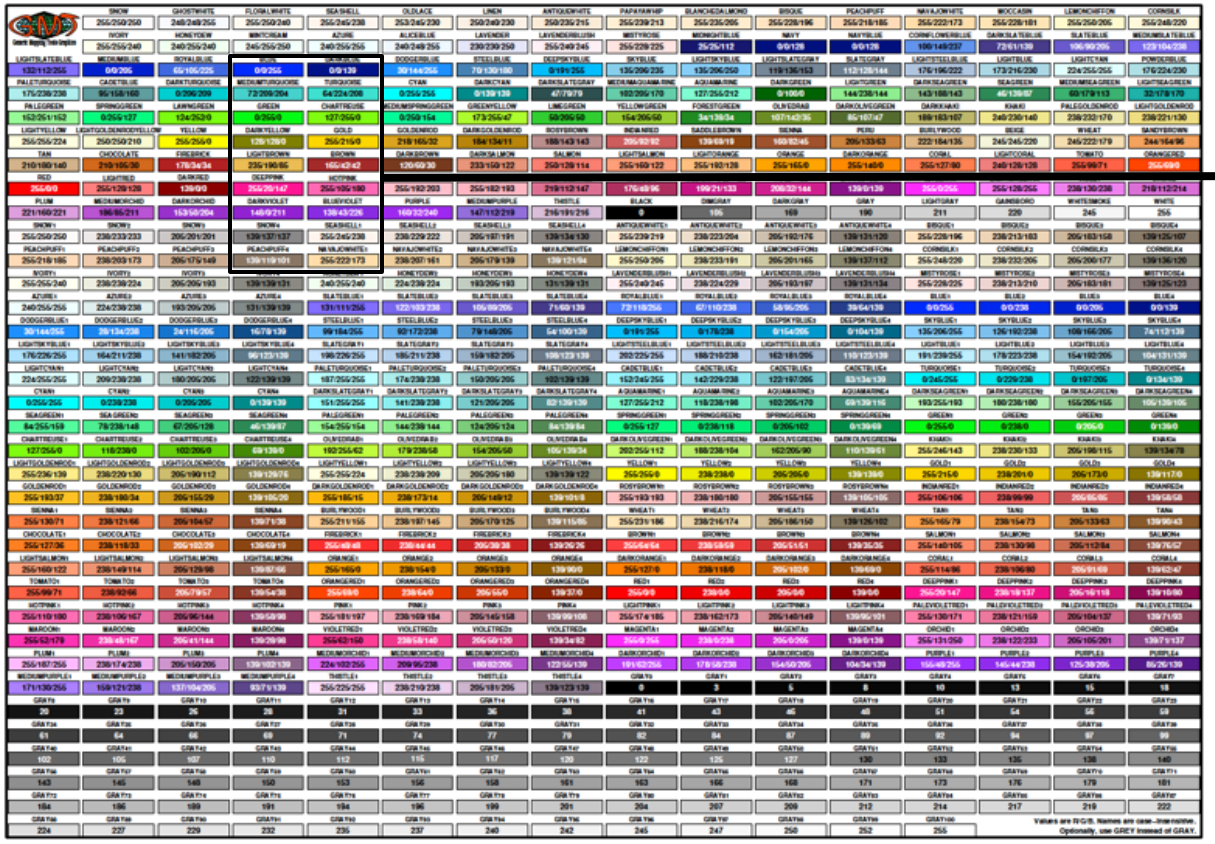
- Computer monitors mix light to make colors
  - RGB is always end-product
- Printers mix paint to make colors
  - Black (K) is used as 4th paint
  - CMY are reduced given the amount of K present
- !! Printing posters for conferences or printing your thesis !!

Specifying Color

- Color is specified in one of four ways:
  - Color names: Give standard X11 names such as red, green, violet, etc.
  - RGB system: Give r/g/b where each integer indicates intensity of light from 0 to 255. If r = g = b we have gray and only r needs to be specified.
  - HSV system: Give h-s-v for hue, saturation, and value.
  - CMYK system: Give c/m/y/k values, each in the 0-100% range.

Very Helpful!

- Appendix H – Color Space: The Final Frontier



BLUE	DARKBLUE
0/0/255	0/0/139
MEDIUMTURQUOISE	TURQUOISE
72/209/204	64/224/208
GREEN	CHARTREUSE
0/255/0	127/255/0
DARKYELLOW	GOLD
128/128/0	255/215/0
LIGHTBROWN	BROWN
235/190/85	165/42/42
DEEPPINK	HOTPINK
255/20/147	255/105/180
DARKVIOLET	BLUEVIOLET
148/0/211	138/43/226
SNOW4	SEASHELL1
139/137/137	255/245/238
PEACHPUFF4	NAVAJOWHITE1
139/119/101	255/222/173

Colour palette table

```
#       cpt file created by makecpt on Fri Mar  9 17:26:19 2001
#       No input V1.0 shade table was given; a gray scale was made.
#       Contours were made using a mid-value of -3500 and a contour interval of 1000
#
-6500   15      15      15      -5500   15      15      15
-5500   47      47      47      -4500   47      47      47
-4500   79      79      79      -3500   79      79      79
-3500   111     111     111     -2500   111     111     111
-2500   143     143     143     -1500   143     143     143
-1500   175     175     175     -500    175     175     175
-500    207     207     207     500     207     207     207
B       0       0       0
F       255     255     255
```