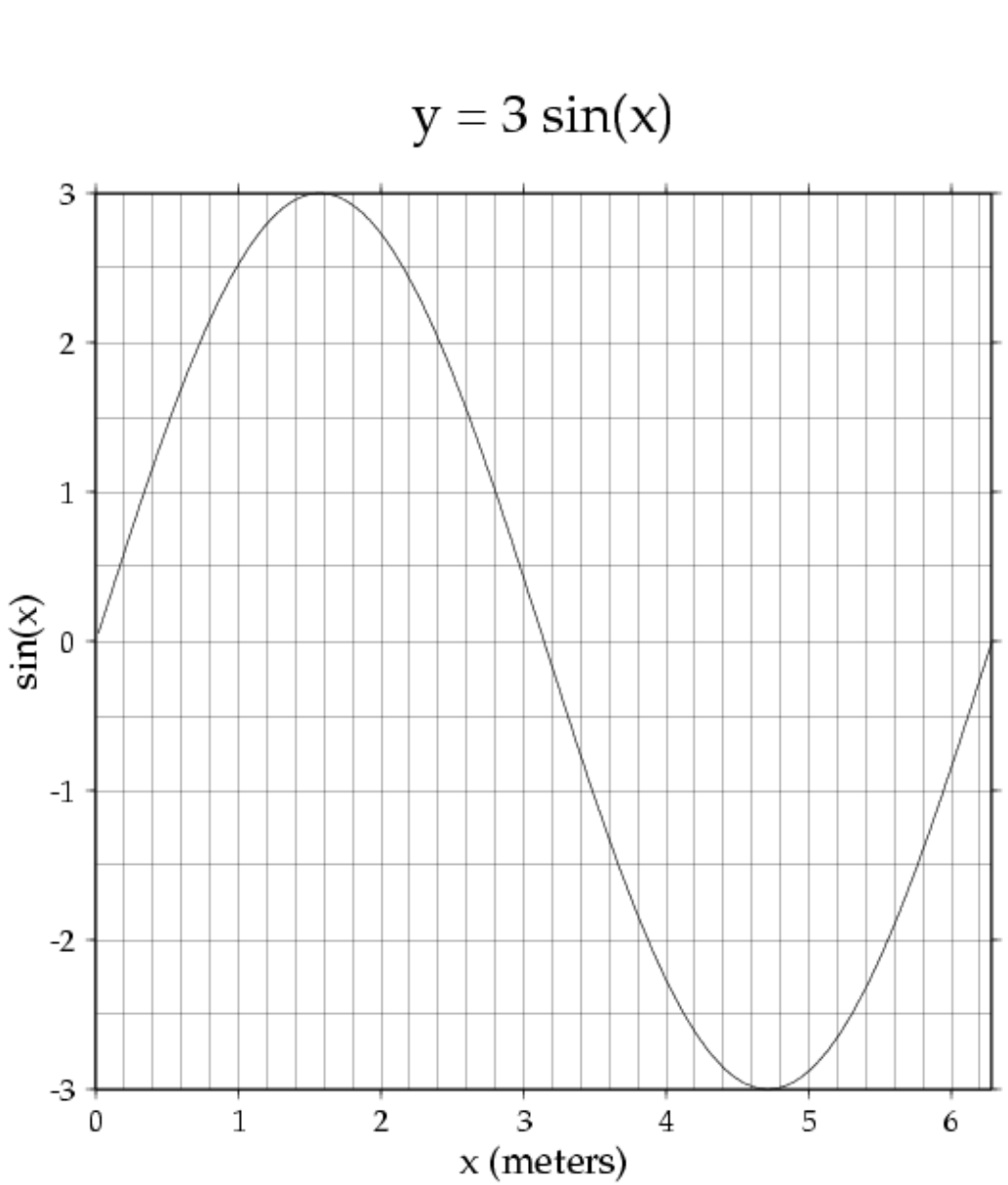
Non geographic plots with psxy

- GMT can be used to polt xy graphs
- Let's plot $y = 3sin(x)$
- First, let's create a data file with awk:

```
echo 3 | awk '{for(i=1;i<=360;i++) \
     {r=i*3.14/180;print r,$1*sin(r)}}' > tmp.sin
```

- Then plot the data with psxy, using `-Jx`:

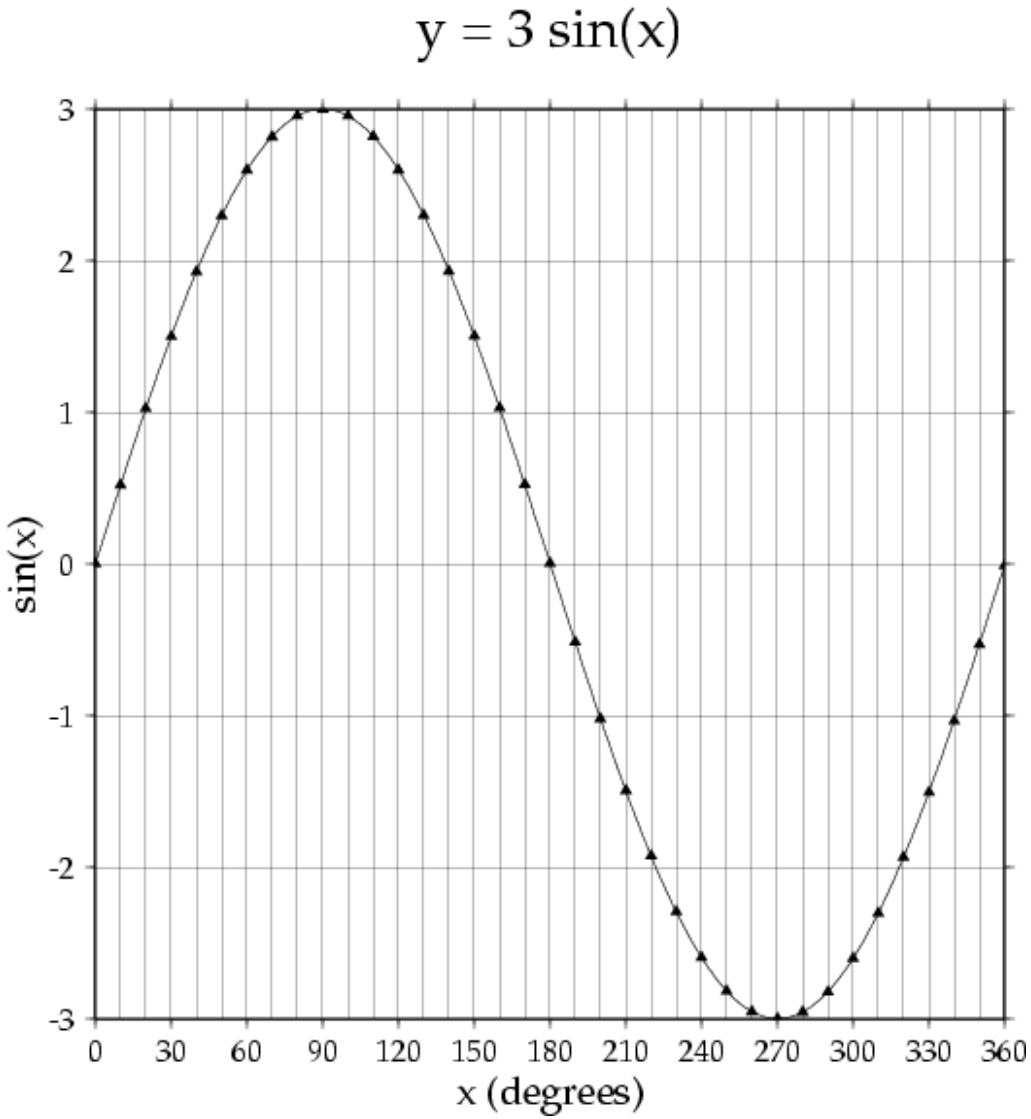
```
psxy tmp.sin -JX6.5i -R0/6.28/-3/3 -W2/0 -P \
-Bg0.2a1:"x (meters)":/g0.5a1:"sin(x)":WSne:."y = 3 sin(x)": \
> sin.ps
```


y = 3 sin(x)
3
2
1
0
-1
-2
-3
sin(x)
0
1
2
3
4
5
6
x (meters)

GMT knows maths...

- `gmtmath` can also be used to create the data file
- `gmtmath` is a Reverse Polish Calculator
- Use `man gmtmath` to get the (long) list of operators and functions available
- Then plot as triangles using `psxy` on top of previous graph

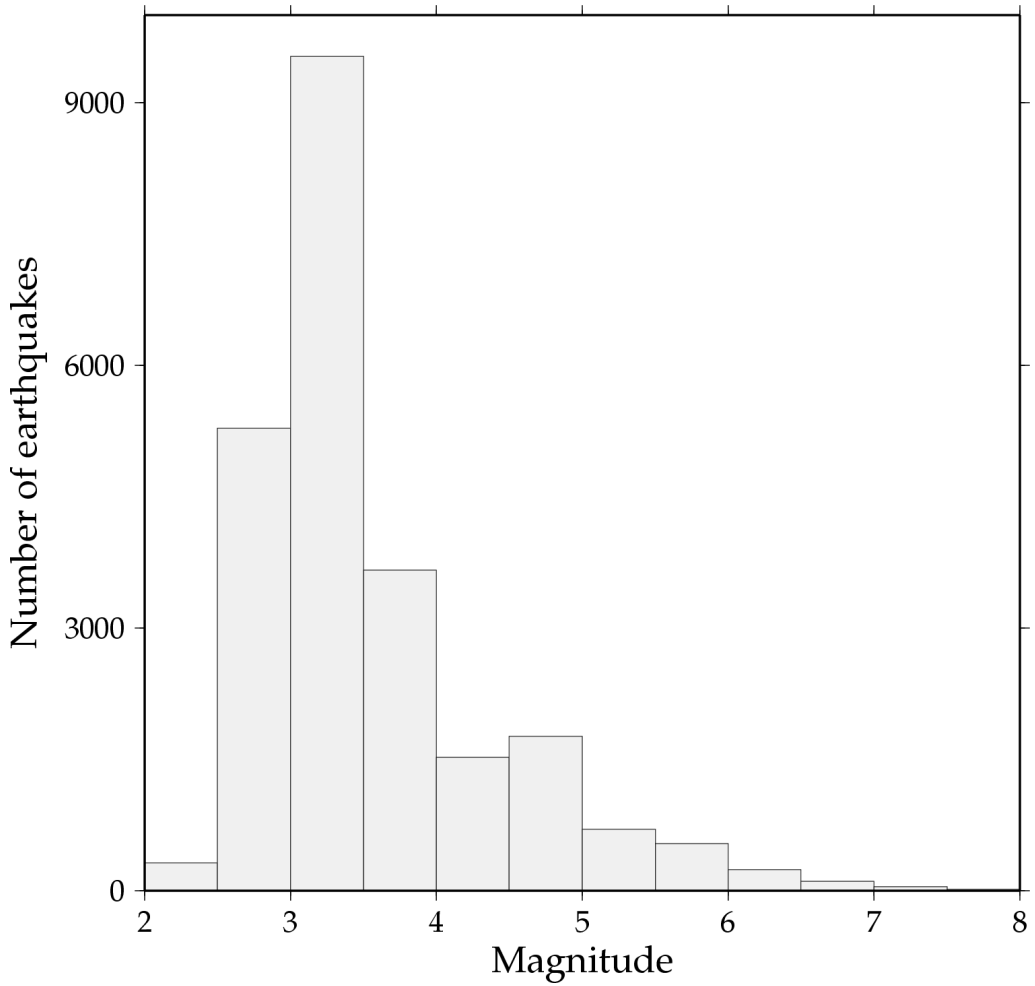
```
gmtmath -T0/360/1 T 3.14 MUL 180 DIV SIN 3 MUL = tmp.sin
gmtmath -T0/360/10 T 3.14 MUL 180 DIV SIN 3 MUL = tmp2.sin
psxy tmp.sin -JX6.5i -R0/360/-3/3 -W2/0 -P \
-Bg10a30:"x (degrees)":/g1a1:"sin(x)":WSne:."y = 3 sin(x)": -K \
> sin.ps
psxy tmp2.sin -JX -R -St0.1 -G0 -O >> sin.ps
```


y = 3 sin(x)
3
2
1
0
-1
-2
-3
sin(x)
0
30
60
90
120
150
180
210
240
270
300
330
360
x (degrees)

Plotting histograms

- Download `socal.sis`: lon lat magnitude for southern California
- Use `pshistogram` to plot the number of earthquakes per bin of 0.5 magnitude:

```
awk ’{print $3}’ socal.sis | \
  pshistogram -JX6.5i -W0.5 \
  -G240 -L1/0 -R2/8/0/10000 \
 -Ba1:Magnitude:/a3000:"Number of earthquakes":WSne \
 -P > socal.ps
```


Number of earthquakes
9000
6000
3000
0
2
3
4
5
6
7
8
Magnitude

Plotting histograms

- Use `pshistogram` to output the binned data:

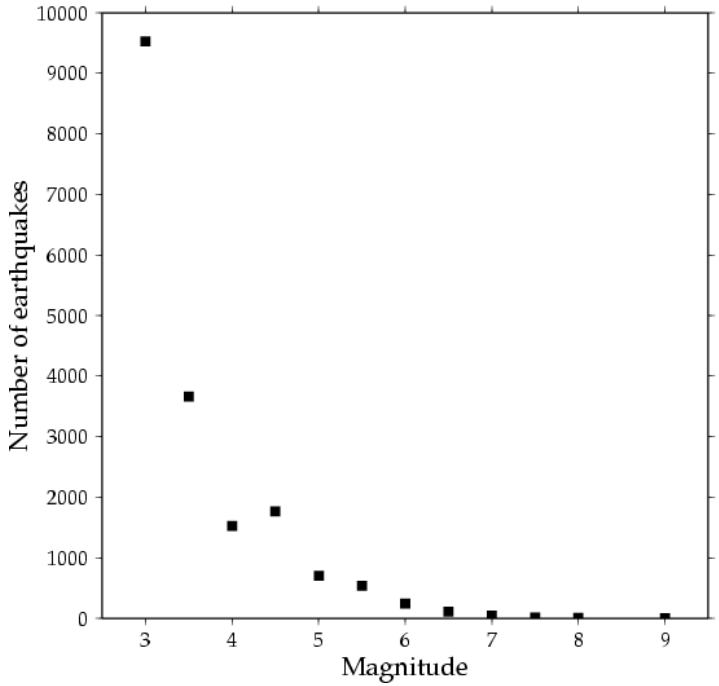
```
awk '{print $3}' socal.sis | pshistogram -W0.5 -Io
```

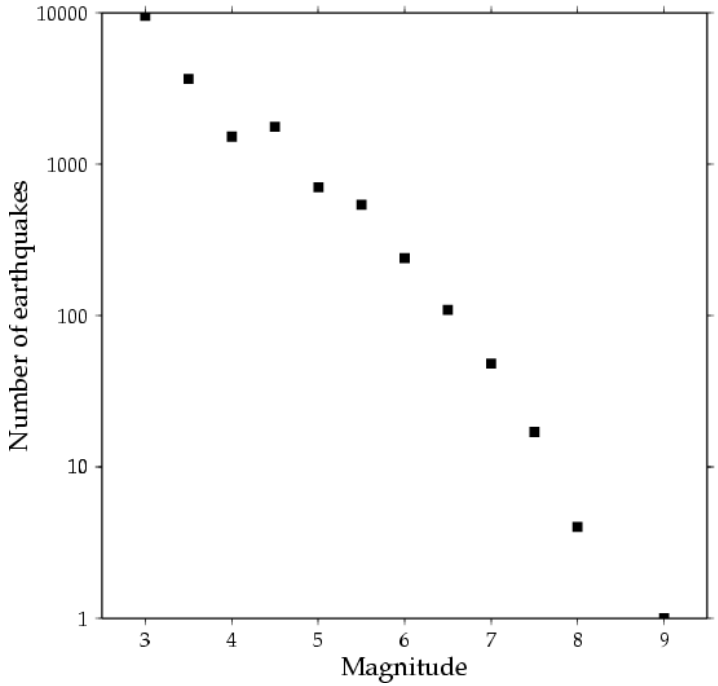
- Save output for M>3 in `socal.bin`
- Plot the number of earthquakes as a function of magnitude:

```
psxy socal.bin -JX6.5i -R2.5/9.5/0/10000 \
 -Ba1:Magnitude:/a1000:"Number of earthquakes":WSne \
 -Ss0.15 -G0 -P > socal2.ps
```

- Same thing, using a semi-log scale:

```
psxy socal.bin -JX6.5i/6.5il -R2.5/9.5/1/10000 \
 -Ba1:Magnitude:/a1000:"Number of earthquakes":WSne \
 -Ss0.15 -G0 -P > socal2.ps
```


Number of earthquakes
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
3
4
5
6
7
8
9
Magnitude

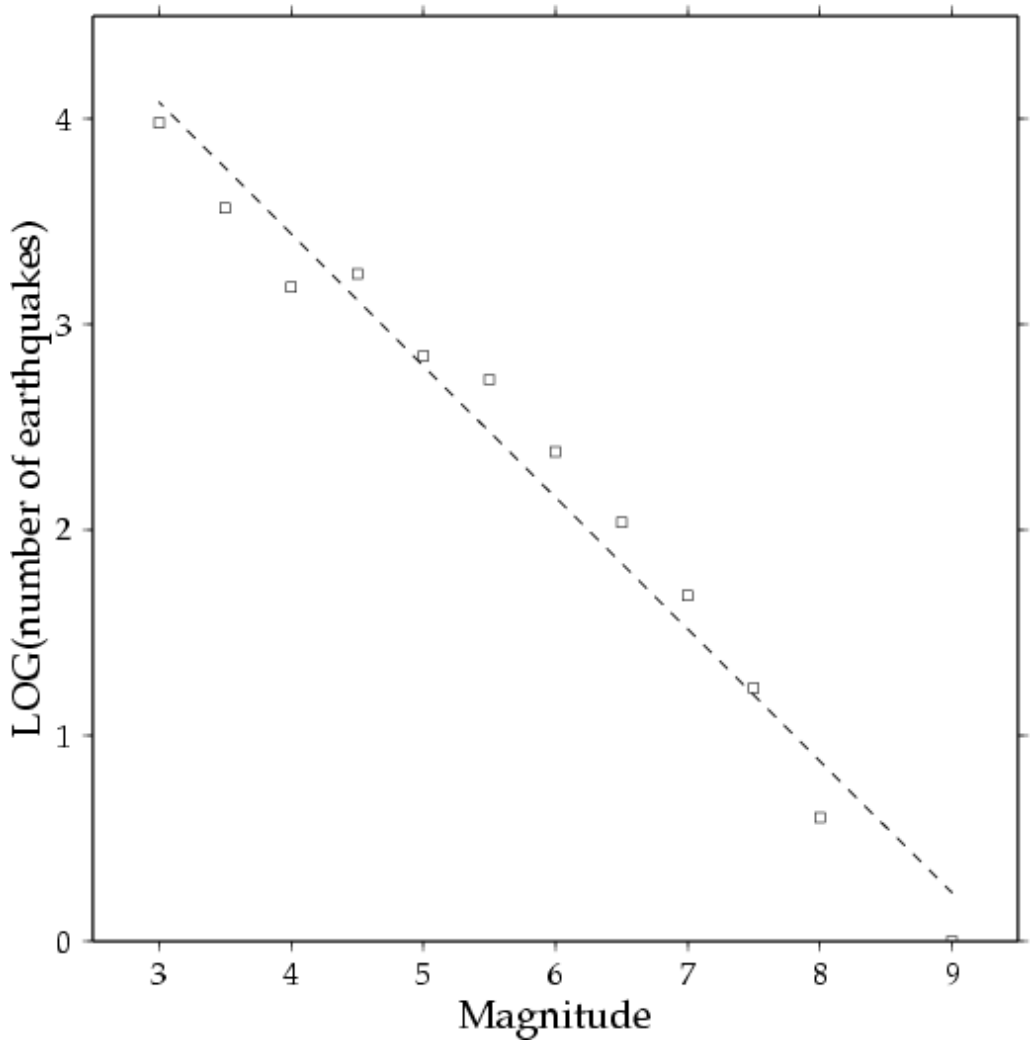

Number of earthquakes
10000
1000
100
10
1
3
4
5
6
7
8
9
Magnitude

The Gutemberg relation:

$$Log(N) = a - b\ M$$

- Get Log of number of earthquakes per bin using `gmtmath`
- Use `trend1d` to fit a straight line through the data
- Use `psxy` to plot the data and the model

```
gmtmath -C1 socal.bin LOG10 = socal.log
trend1d socal.log -Fxm -N2 -V > socal.trend
psxy socal.log -JX6.5 -R2.5/9.5/0/4.5 \
 -Ba1:Magnitude:/a1:"LOG(number of earthquakes)":WSne \
 -Ss0.1 -W2/0 -K > socal2.ps
psxy socal.trend -JX6.5i -R -W3ta -O >> socal2.ps
```


LOG(number of earthquakes)
0
1
2
3
4
3
4
5
6
7
8
9
Magnitude

A word on GMT defaults...

- GMT uses a number of defaults for the annotation font, angle, basemap frame, ellipsoid for maps, etc.
- Type `man gmtdefaults` for a list of defaults
- If you are not happy with some of these defaults, you can change them with the command `gmtset`
- For instance:

```
gmtset ANOT_FONT 29
gmtset ANOT_FONT_SIZE 16
gmtset LABEL_FONT 29
gmtset LABEL_FONT_SIZE 20
gmtset HEADER_FONT 29
gmtset HEADER_FONT_SIZE 28
```

A word on GMT defaults...

- Defaults are stored in your working directory in file `.gmtdefaults`
- You can edit that file to change your defaults
- Useful defaults to changes, sometimes:
  - BASEMAP_TYPE
  - DEGREE_FORMAT
  - ANOT LABEL HEADER
  - MEASURE_UNIT
  - PAPER_MEDIA

Plotting a time series

- Let's plot an xy graph that shows the position of a GPS station as a function of time, with errors bars
- Go to http://www.eas.purdue.edu/ ecalais/projects/denali/time_series/ and download files `DRMC.N` and `DRMC.E`
- Data file `DRMC.N` contains the north-south component, `DRMC.E` the east-west component
- Data format is as follows: date (in decimal year) - position (in mm) - uncertainty

Plotting a time series

- Find the data range: `minmax`

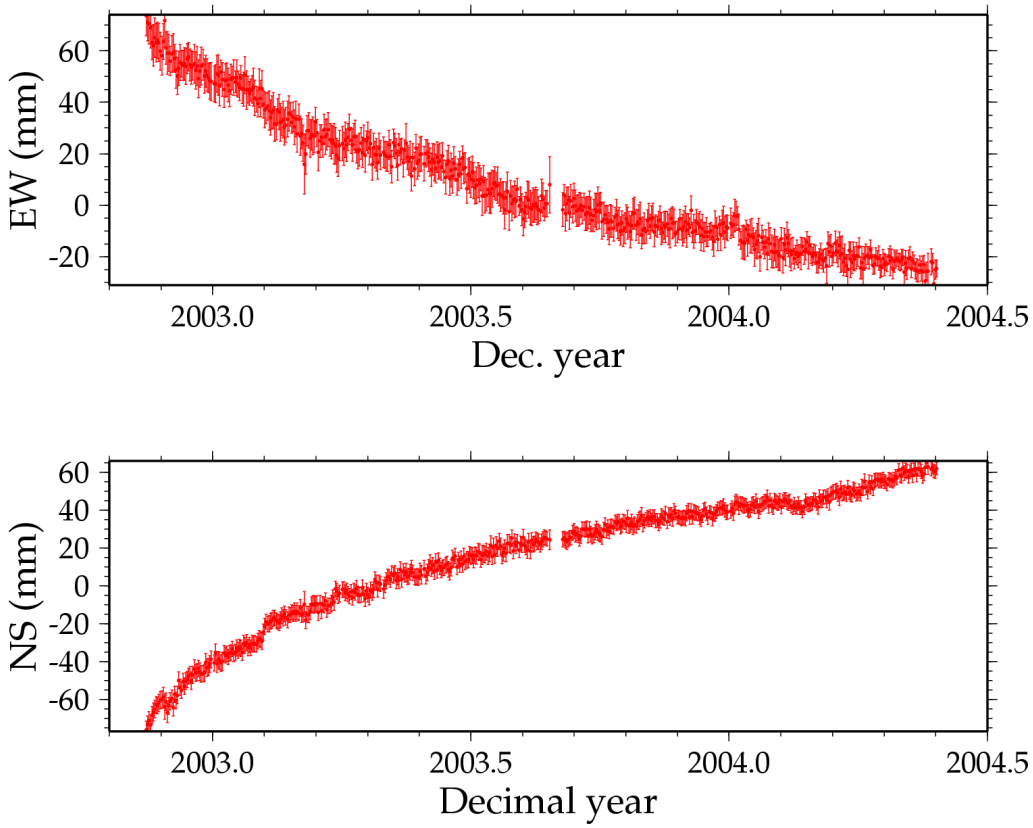
```
set RE = ‘minmax -I0.1/1 DRMC.E‘
set RN = ‘minmax -I0.1/1 DRMC.N‘
```

- Then plot:

```
psxy DRMC.E $RE -JX6.5/2.0 \
-Ba0.5f0.1:"Dec. year":/a20f5:"EW (mm)":WSen:."DRMC": \
-Ey0.02/2/255/0/0 -Sc0.03 -G255/0/0 -K -P -Y7i > drmc.ps

psxy DRMC.N $RN -JX6.5/2.0 \
-Ba0.5f0.1:"Decimal year":/a20f5:"NS (mm)":WSen \
-Ey0.02/2/255/0/0 -Sc0.03 -G255/0/0 -O -Y-3.3i >> drmc.ps
```

DRMC


EW (mm)
60
40
20
0
-20
2003.0
2003.5
2004.0
2004.5
Dec. year
NS (mm)
60
40
20
0
-20
-40
-60
2003.0
2003.5
2004.0
2004.5
Decimal year