5.5 Miscellaneous Projections

GMT supports 6 common projections for global presentation of data or models. These are the Hammer, Mollweide, Winkel Tripel, Robinson, Eckert VI, and Sinusoidal projections. Due to the small scale used for global maps these projections all use the spherical approximation rather than more elaborate elliptical formulae.

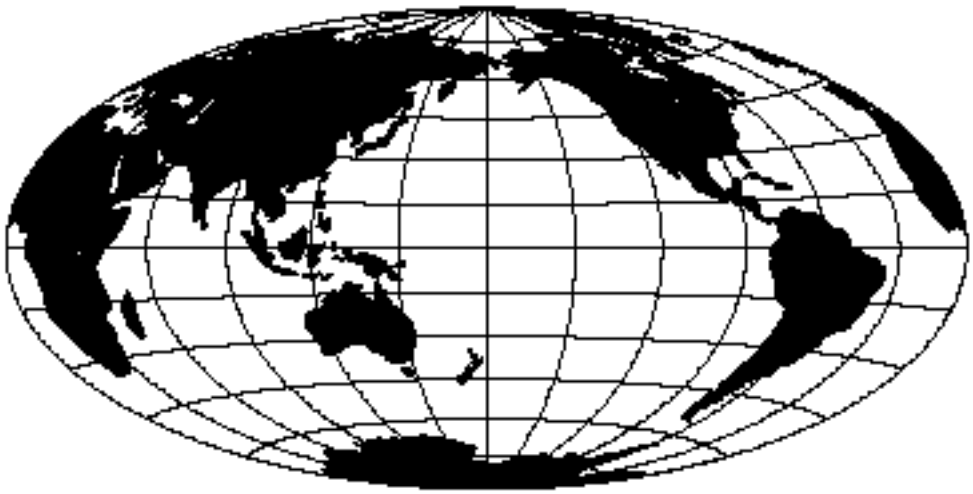
5.5.1 Hammer Projection (–Jh or –JH)

The equal-area Hammer projection, first presented by Ernst von Hammer in 1892, is also known as Hammer-Aitoff (the Aitoff projection looks similar, but is not equal-area). The border is an ellipse, equator and central meridian are straight lines, while other parallels and meridians are complex curves. The projection is defined by selecting

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Jh**), or map width (**–JH**)

A view of the Pacific ocean using the Dateline as central meridian is accomplished by running the command

```
pscoast -R0/360/-90/90 -JH180/5 -Bg30/g15 -Dc -A10000 -G0 -P -X0.1 -Y0.1 > hammer.ps
```



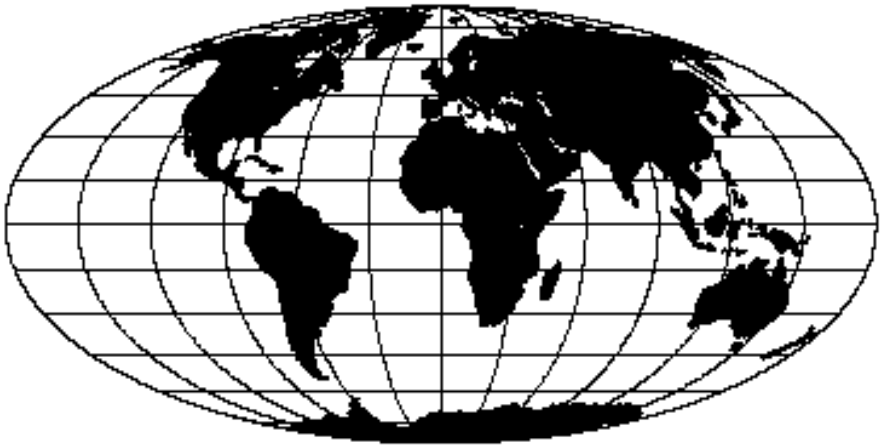
5.5.2 Mollweide Projection (–Jw or –JW)

This pseudo-cylindrical, equal-area projection was developed by Mollweide in 1805. Parallels are unequally spaced straight lines with the meridians being equally spaced elliptical arcs. The scale is only true along latitudes 40° 44' north and south. The projection is used mainly for global maps showing data distributions. It is occasionally referenced under the name homalographic projection. Like the Hammer projection, outlined above, we need to specify only two parameters to completely define the mapping of longitudes and latitudes into rectangular *x*/*y* coordinates:

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Jw**), or map width (**–JW**)

An example centered on Greenwich can be generated thus:

```
pscoast -R-180/180/-90/90 -JW0/5 -Bg30/g15 -Dc -A10000 -G0 -P -X0.1 -Y0.1 > mollweide.ps
```



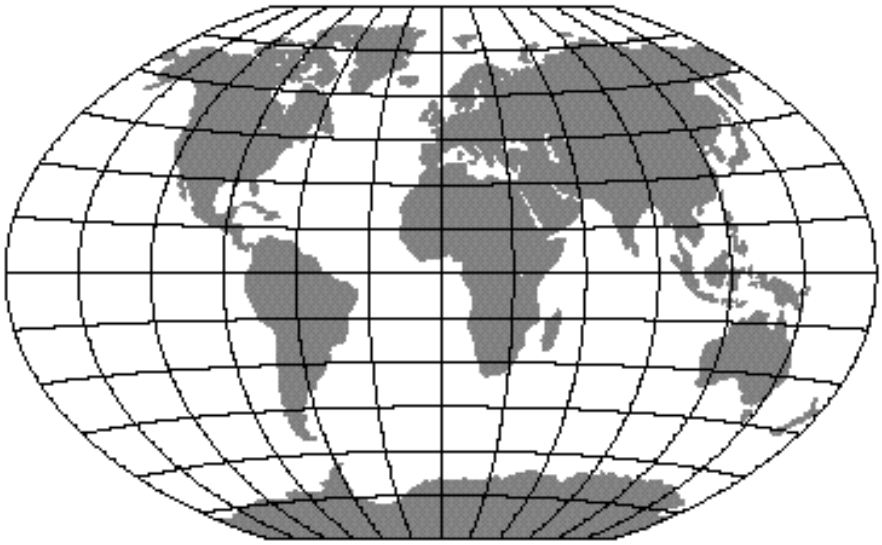
5.5.3 Winkel Tripel Projection (–Jr or –JR)

The Winkel Tripel projection, presented by Oswald Winkel in 1921, is a modified azimuthal projection that is neither conformal nor equal-area. Central meridian and equator are straight lines; other parallels and meridians are curved. The projection is obtained by averaging the coordinates of the Equidistant Cylindrical and Aitoff (not Hammer-Aitoff) projections. The poles map into straight lines 0.4 times the length of equator. To use it you must enter

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Jr**), or map width (**–JR**)

Centered on Greenwich, the example below was created by this command:

```
pscoast -R-180/180/-90/90 -JR0/5 -Bg30/g15 -Dc -A10000 -G128 -P -X0.1 -Y0.1 > winkel.ps
```



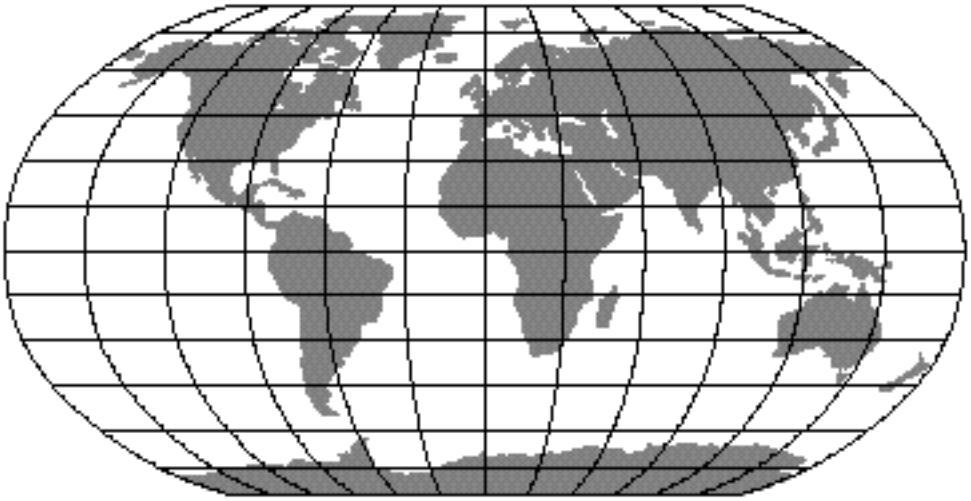
5.5.4 Robinson Projection (–Jn or –JN)

The Robinson projection, presented by Arthur H. Robinson in 1963, is a modified cylindrical projection that is neither conformal nor equal-area. Central meridian and all parallels are straight lines; other meridians are curved. It uses lookup tables rather than analytic expressions to make the world map "look" right[†]. The scale is true along latitudes ±38˚. The projection was originally developed for use by Rand McNally and is currently used by the National Geographic Society. To use it you must enter

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Jn**), or map width (**–JN**)

Again centered on Greenwich, the example below was created by this command:

```
pscoast -R-180/180/-90/90 -JN0/5 -Bg30/g15 -Dc -A10000 -W1 -P -X0.1 -Y0.1 > robinson.ps
```



5.5.5 Eckert VI Projection (–Jk or –JK)

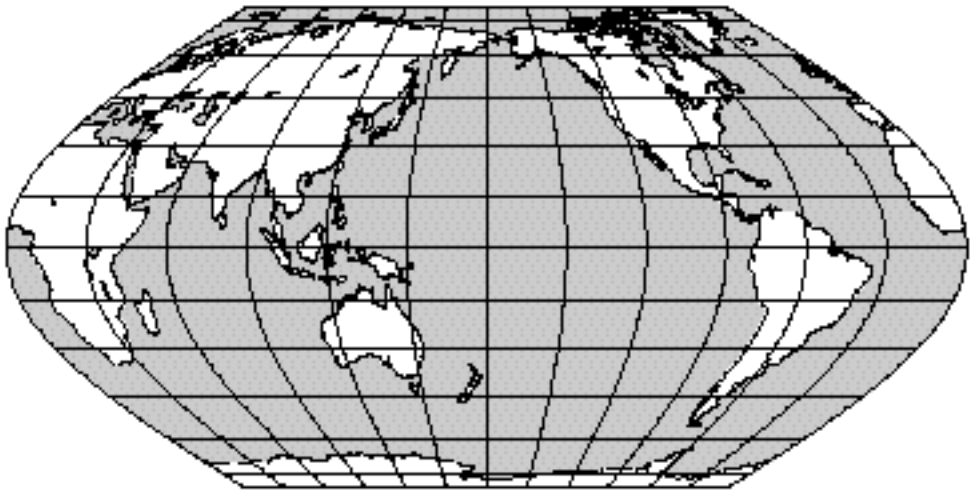
The Eckert VI projection, presented by Max Eckert in 1906, is a pseudocylindrical equal-area projection. Central meridian and all parallels are straight lines; other meridians are equally spaced sinusoids. The scale is true along latitudes ±49˚16'. Its main use is in thematic world maps. To use it you must enter

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Jk**), or map width (**–JK**)

Centered on the Dateline, the example below was created by this command:

```
pscoast -R0/360/-90/90 -JK180/5 -Bg30/g15 -Dc -A10000 -W1 -G255 -S200 -P -X0.1 -Y0.1 >
eckert.ps
```

[†] Robinson provided a table of *y*-coordinates for latitudes every 5˚. To project values for intermediate latitudes one must interpolate the table. Different interpolants may result in slightly different maps. GMT uses the interpolant selected by the parameter INTERPOLANT in the .gmtdefaults file.



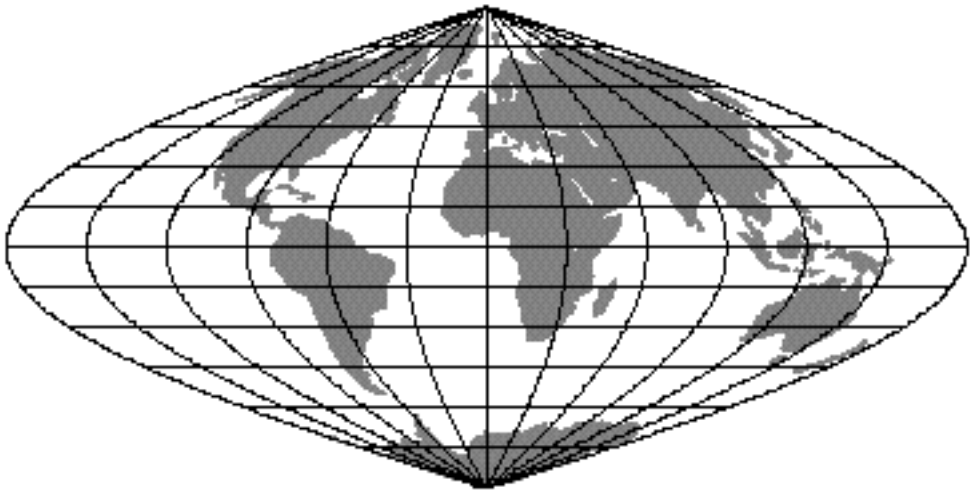
5.5.6 Sinusoidal Projection (–Ji or –JI)

The sinusoidal projection is one of the oldest known projections, is equal-area, and has been used since the mid-16th century. It has also been called the "Equal-area Mercator" projection. The central meridian is a straight line; all other meridians are sinusoidal curves. Parallels are all equally spaced straight lines, with scale being true along all parallels (and central meridian). To use it, you need to select:

- The central meridian
- Scale along equator in inch/degree or 1:xxxxx (**–Ji**), or map width (**–JI**)

A simple world map using the sinusoidal projection is therefore obtained by

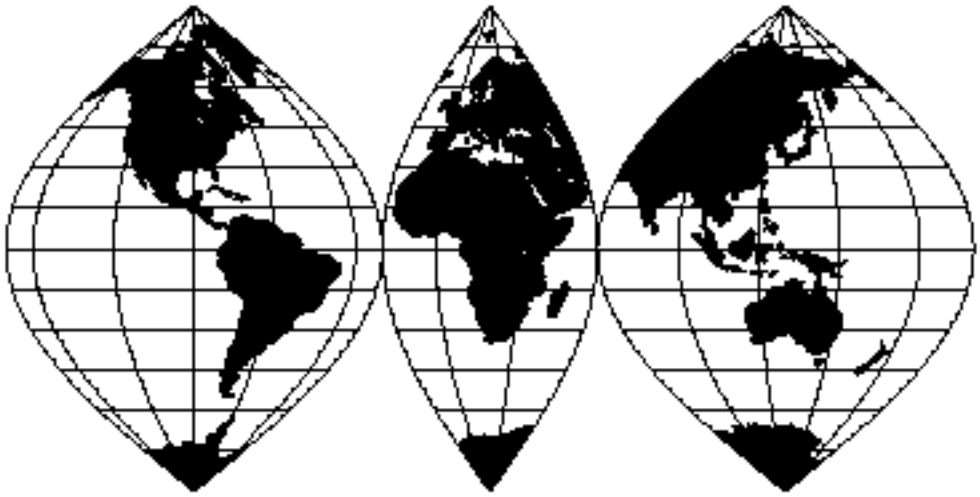
```
pscoast -R-180/180/-90/90 -JI0/5 -Bg30/g15 -Dc -A10000 -G128 -P -X0.1 -Y0.1 > sinusoidal.ps
```



To reduce distortion of shape the interrupted sinusoidal projection was introduced in 1927. Here, three symmetrical segments are used to cover the entire world. Traditionally, the interruptions are at 160˚W, 20˚W, and 60˚E. To make the interrupted map we must call *pscoast* for each segment and superpose the results. To produce an

interrupted world map (with the traditional boundaries just mentioned) that is 5.04 inches wide we use the scale 5.04/360˚ = 0.014 and offset the subsequent plots horizontally by their widths (140˚·0.014 and 80˚·0.014):

```
pscoast -R-160/-20/-90/90 -Ji-90/0.014 -B30g30/15g15 -Dc -A10000 -G0 -P -K -X0.1 -Y0.1 >
sine.ps
pscoast -R-20/60/-90/90 -Ji20/0.014 -B30g30/15g15 -Dc -A10000 -G0 -O -K -X1.96 >> sine.ps
pscoast -R60/200/-90/90 -Ji130/0.014 -B30g30/15g15 -Dc -A10000 -G0 -O -X1.12 >> sine.ps
```



The usefulness of the interrupted sinusoidal projection is basically limited to display of global, discontinuous data distributions like hydrocarbon and mineral resources, etc.