

**MAR-ECO BATHYMETRY COMPILATION: NORTHERN  
MID-ATLANTIC RIDGE CREST:  
37°N (AZORES) TO 63°N (ICELAND).**



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## Contents

1. Objective
2. Data coverage and quality
  - 2.1 Regional bathymetry
  - 2.2 Quality control
  - 2.3 Resources
3. Data merging
4. Quality Control
5. Data sources for the three major areas of detailed bathymetry for the Mid-Atlantic Ridge
6. Data Sources for the MAR-ECO bathymetry compilation (by region).
  - 6.1 Reykjanes Ridge
  - 6.2 45° North to the Azores
  - 6.3 Charlie Gibbs Fracture Zone
  - 6.4 General background data

Appendix 1. GMT command lines

## 1. Objective:

The Objective of the MAR-ECO bathymetry compilation project was to identify and interrogate data resources for the bathymetry of the Mid-Atlantic Ridge between Iceland and the Azores. Specifically these resources would be used to provide overviews of the data and its sources, and be combined digitally to make new charts (with an emphasis on the latest and most reliable bathymetry from along the crest of the Mid Atlantic Ridge). These resources would be used in the planning and field phases of the MAR-ECO project.

## 2 Data coverage and quality:

### 2.1 Regional bathymetry

Regional bathymetry for the Mid-Atlantic Ridge from south Iceland (63°N) to north Azores (37°N). The bathymetry compilation is based on a variety of data sources: regional, background bathymetry is taken from the new GEBCO 1' digital grid (pre-release version). These charts are based on single echo soundings and seismic line depth soundings. Superimposed on this regional data are several grids of data acquired by direct echo sounding. These are mainly multibeam echo sounder data, acquired from academic and commercial sources, that have an average spatial resolution of 100m. Such high quality data exist for the entire ridge axis from ~63°N to 57°N, and from 47°N to 37°N. The Charlie Gibbs fracture zone (centred on 52°N) is largely unmapped by continuous echo soundings, and certainly there is not any systematic multibeam sonar coverage. New grids, at a variety of resolutions, have been produced from the merged data and made available to the MAR-ECO community as electronic images and paper copies..

### 2.2 Quality control

The regional bathymetry compilation has been re-gridded at a 2' interval and correlated against regional gravity and predicted bathymetry data sets of the same spatial resolution, while accounting for aliasing by ensuring the data grids are all of identical projection parameters.

### 2.3 Resources

A list of the data resources is given, with an indication of the priority given each set of data in the compilation. In general, the priority of data is: multibeam echo soundings have the highest priority, followed by single beam echo soundings and seismic profiles, followed by single beam soundings supplemented with bathymetry interpreted from sidescan sonar images. The final, background data, with the lowest priority in the compilation, is the 1' GEBCO digital atlas data. Included are references to papers with bathymetry, gravity or seismic profiles, for which sources of data have been incorporated.

The chart set comprises a total of 8 charts:

- One sheet, gridded at 1', contoured at 500m, and extending from 37°N – 63°N.
- Two sheets, each gridded at 0.5', contoured at 250m, a southern sheet, extending from 37°N – 50°N; and a northern sheet, extending from 50°N – 63°N, each printed to A0 at 1:500,000 scale.
- Five sheets each gridded at 0.25', contoured at 100m (with colour wrapped contours) and printed to A0 at 1:1,000,000 scale.

### 3. Data merging:

Five data grids were created from the various sources of bathymetry: Reykjanes\_North, Reykjanes\_South, 45\_46n, triatnord, and 1minMARbram. The first four of these data sets comprise high quality multibeam echo sounder data. The last data set combines 1 min. spaced data from the new GEBCO digital compilation with higher-resolution chart data from the Charlie Gibbs Fracture Zone (data digitised from the IOSDL special chart series).

The data treatment was carried out using GMT (Wessel and Smith, 1998, 2002.) - a software package for geographical mapping. The software runs on unix OS and is driven by command lines. A list of GMT command line are given in appendix 1. The first treatment of the data was to re-project all grids to the same geoid model. The multibeam bathymetry resources were acquired from their authors as geographically registered grids. All multibeam bathymetry grids were supplied with a 100m or 500m grid-node spacing. To avoid problems with geographic projection and spatial resolution, all the data were re-projected from UTM (i.e. with a grid spacing expressed in metres) into latitude/longitudinal parameters (i.e. with a grid spacing converted to fractions of a degree), using the world geoid simulation, WGS84.

Creation of grids at any given scale involved merging all the digital bathymetry data, regardless of resolution, and re-sampling at a common grid resolution. The background, regional data base (e.g. the 1' GEBCO digital data) was masked with (i) the area covered by higher resolution data from the IOSDL chart of the Charlie Gibbs Fracture Zone; (ii) by Hydrosweep and Simrad EM12 multibeam data coverage for the Reykjanes Ridge, (iii) by the commercially acquired multibeam bathymetry data of the 45°-46°N region, and (iv) by the Tritnord Simrad EM300 multibeam data for the region 37°-44.5°N. The result of the masking was the generation of bathymetry data in which the highest quality data has precedence over any lesser quality data. These data file were then concatenated and re-sampled forming new grids.

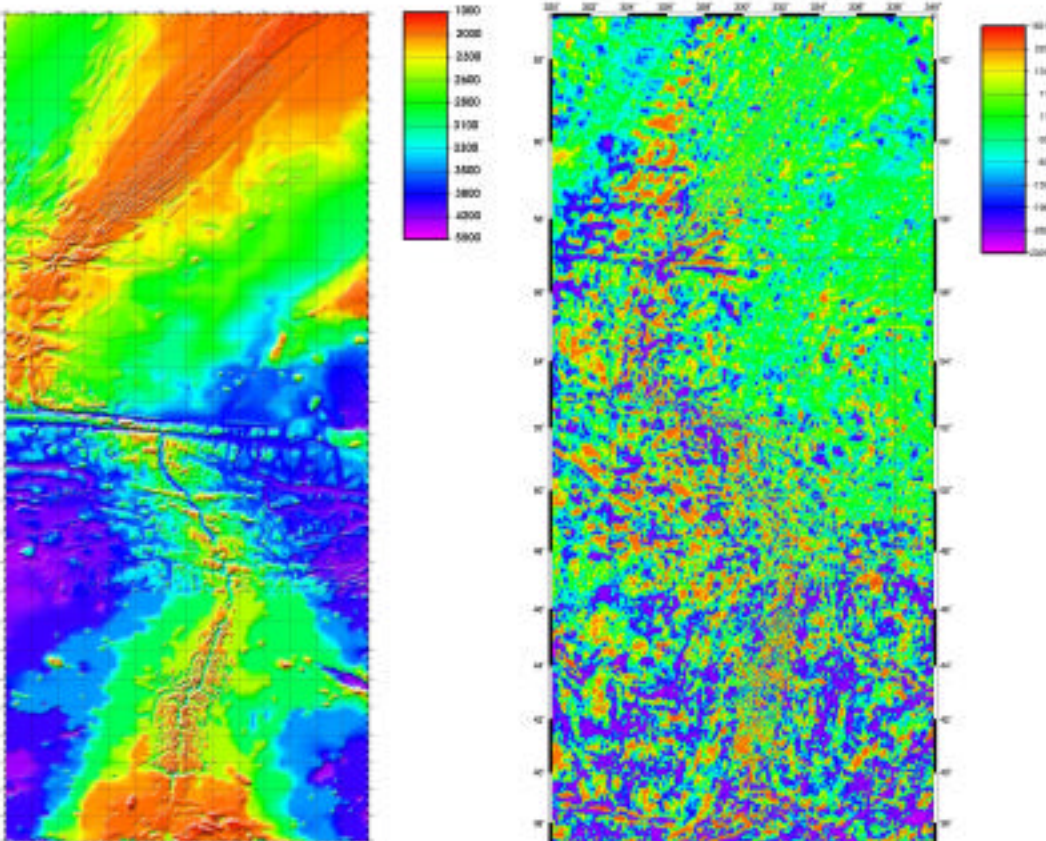
Creation of contoured plots for each of the new grids was achieved by first using the GMT command "surface" to interpolate smoothly between data points and to allow smooth transition for high to low resolution data coverage. The "surface" command fits a minimum surface-tension surface to the data while retaining the original values of the data. Interpolated values could then be contoured at a variety of intervals.

### 4. Quality Control:

As a way of quality control, the new gridded data are examined for roughness and then compared with independently-derived regional data (e.g. satellite altimetry-based predicted bathymetry).

The left hand image below (Figure 1a) shows shaded relief of the new compilation. The location of the high resolution data is shown where the shaded relief has a high frequency of roughness. These areas are predominately located along the ridge axis. The Charlie Gibbs Fracture Zone region has an intermediate wavelength texture since the new data are derived from the single beam echo soundings and GLORIA data at a higher resolution than the background GEBCO bathymetry. The smoothest areas are the background GEBCO data and are included to provide a geographical context for the ridge axis data.

The right hand image below (Figure 1b) is a file showing the difference between predicted bathymetry (gridded at 2' resolution - Sandwell and Smith, 2002) and the new compilation. Predicted bathymetry is based on satellite derived gravity anomalies and an assumed admittance value relating the gravity field to seafloor depth. The predicted bathymetry matches the Reykjanes Ridge axis well, but less so for the other areas. This is because the Reykjanes Ridge data were used in the predicted bathymetry compilation. Elsewhere, however, the predicted bathy is poor, as can be seen in the areas where we have new, reliable multibeam data (e.g. outlined areas 40-46°N and 57-62°N).



**Figure 1a**

**Figure 1b**

The main differences shown by figure 1b are on the crest and near-axis flanks of the ridge. The least difference is in the region where we have data from the Reykjanes Ridge and this data have been used in the predicted bathymetry compilation of Smith and Sandwell, 19XX). Most of the regions outside the new data are taken from the new 1' digital GEBCO atlas. These are not well matched by the satellite-derived predicted bathymetry because they have not been used in Smith and Sandwell's data set.

There are three aspects of the new MAR-ECO maps that give them more confidence than either the GEBCO or predicted bathymetry charts: (a) the new data on the ridge axis now comprise mainly best-quality multibeam bathymetry and dense coverage of single beam lines with bathymetry enhanced by sidescan sonar data from the GLORIA system (e.g. for the Charlie Gibbs Fracture Zone region); (b)

The Mid-Atlantic ridge axis is not in isotatic equilibrium (i.e. the bathymetry is not in equilibrium with the gravity), so the Smith and Sandwell predicted bathymetry will not yield reliable, precise depths close to the ridge crest; (c) The relationship between bathymetry and gravity (i.e. the admittance) changes along the Mi-Atlantic Ridge towards Iceland (because of the increasing temperature of the mantle towards Iceland). This means that the Smith and Sandwell predicted bathymetry needs careful calibration between the satellite altimetry data and the real bathymetry. To date, this calibration relies strongly on the multibeam echosounder data for the Reykjanes Ridge.

## 5. Data sources for the three major areas of detailed bathymetry for the Mid-Atlantic Ridge:

Reykjanes Ridge: Data is based on high-resolution multibeam swath bathymetry. Data sources: Keeton et al., 1997, Sinha et al. (1998), Searle et al. (1992), Parson et al. (1993), Murton, & Parson (1993). Also included are data from SEAMARC 1 sidescan sonar and interferential swath bathymetry (Appelgate & Shor, 1994), used to supplement the Reykjanes Ridge data where there is no multibeam swath bathymetry coverage (i.e. south of 57°N). Gravity studies included are Sandwell and Smith (1997), Heller & Marquart (2002) and Hwang et al. (1994).

Charlie Gibbs fracture zone: Data is based on single-beam bathymetry, sidescan sonar, seismic profiles and marine gravity. Data sources: Smoot & Sharman (1985), Calvert & Whitmarsh (1986), Detrick et al. (1993), Karcher & Lippert (1994), and Saunders (1994). Many of the pre-1988 data are included along with the IOSDL chart for the Reykjanes Ridge and Rockall Plateau (Laughton et al., 1982). The latter has better resolution of features than the GEBCO 1' digital grid, although the absolute depth of features is less reliable since the chart calls upon sidescan sonar imagery to inform the bathymetry. Coverage is from 51.5°N to 54°N and 323°E to 331°E.

North Azores: data is based on high resolution multibeam swath bathymetry. Data sources: Goslin (1999), Mello et al. (1999), Lourenco et al. (1998) and Thibaud et al. (1998). *The area of the Mid-Atlantic Ridge between 37°N and 44.5°N contains bathymetry for the axis of the ridge that are the property of Goslin et al. These data are released on the strict understanding that they are used for the planning and execution on MAR-ECO objectives only.*

## 6. Data Sources for the MAR-ECO bathymetry compilation (by region).

### 6.1 Reykjanes Ridge

- Appelgate B, Shor An The Northern Mid-Atlantic And Reykjanes Ridges - Spreading Center Morphology Between 55-Degrees-50'N and 63-Degrees-00'N. J. Geophys. Res., 17935-17956, 1994
- Heller D A, Marquart G An admittance study of the Reykjanes Ridge and elevated plateaux between the Charlie-Gibbs and Senja fracture zones. Geophy J Int., 148, 65-76, 2002
- Hwang, C. Parsons, B. Strange, T. Bingham, A. A detailed gravity field over the Reykjanes Ridge from Seasat, Geosat, ERS-1 and TOPEX/POSEIDON altimetry and shipborne gravity. Geophysical Research Letters, 21, 2841-2844, 1994
- Keeton, J. A., R. C. Searle, B. Parsons, R. S. White, B. J. Murton, L. M. Parson, C. Peirce, and M. Sinha. Bathymetry of the Reykjanes Ridge , Marine Geophysical Researches 19, 55-64, 1997

- Murton, B. J. & Parson, L. M. Segmentation, volcanism and deformation of oblique spreading centres: a quantitative study of the Reykjanes Ridge. *Tectonophysics*, 222, 237-257, 1993.
- Parson, L. M. , Murton, B. J. , Searle, R. C. , Booth, D. , Evans, J. , Field, P. , Keeton, J. , Laughton, A. , McAllister, E. , Millard, N. , Redbourne, L. , Rouse, I. , Shor, A. , Smith, D. , Spencer, S. , Summerhayes, C. & Walker, C. En echelon axial volcanic ridges at the Reykjanes Ridge: a life cycle of volcanism and tectonics. *Earth and Planetary Science Letters*, 117, 73-87, 1993.
- Searle, R. C. , Keeton, J. , Lawson, K. , Pearce, J. A. , Allerton, S. , Murton, B. & Schouten, H. High resolution sonar and magnetic studies of the western Kane transform and adjacent Mid-Atlantic Ridge. *Annales Geophysicae*, 10, p 115-123, 1992.
- Sinha, M C; Constable, S C; Peirce, C; White, A; Heinson, G S; MacGregor, L M; Navin, D A , Magmatic processes at slow spreading ridges; implications of the RAMESSES experiment at 57 degrees 45'N on the Mid-Atlantic Ridge, *Geophysical Journal International*, 135, 731-745, 1998.

## 6.2 Charlie Gibbs Fracture Zone

- Calvert, A.J. and Whitmarsh, R.B., The structure of the Charlie-Gibbs Fracture Zone, *J. Geol. Soc. Lon.*, 143, 819-821, 1986.
- Detrick, R.S. White, R.S. and Purdy, G.M. Crustal structure of North Atlantic fracture zones, *Reviews of Geophysics*, 31, 439-458, 1993
- Karcher, M. And Lippert, A. Spin-up and breakdown of source-driven deep North Atlantic flow over realistic bottom topography, *Journal of Geophysical Research*, 99, 12357-12373, 1994
- Laughton, A.S., Roberts, D. G. & Hunter, P. M., Bathymetry of the northeast Atlantic. Sheet 1 : Reykjanes Ridge and Rockall Plateau. Scale 1 : 2,400,000 at 41N, 1982.
- Saunders, P.M. The flux of overflow water through the Charlie-Gibbs Fracture Zone. *Journal of Geophysical Research*, 99, 12343-12355, 1994
- Smoot, N.C. and Sharman, G.F. Charlie Gibbs: a fracture zone ridge. *Tectonophysics*, 116, 137-142, 1985.
- Whitmarsh, R.B. and Calvert, A.J., Crustal structure of Atlantic fracture zones: I - The Charlie-Gibbs Fracture Zone, *Geophys. J.R. Astr. Soc.*, 86, 107-138, 1986.

## 6.3 45° North to the Azores

- Goslin J. Extent of Azores plume influence on the Mid-Atlantic Ridge, north of the hotspot. *Geology*, 27, 991-994, 1999
- Lourenco N, Miranda J M, Luis J F, et al. Morpho-tectonic analysis of the Azores Volcanic Plateau from a new bathymetric compilation of the area, *Mar. Geophys. Res.* 20, 141-156 1998
- Mello S L M, Cann J R, Fowler C M R, Anomalous mantle at 45 degrees N Mid-Atlantic Ridge? *J. Geophys. Res.*, 104, 29335-29349, 1999
- Thibaud R, Gente P, Maia M. A systematic analysis of the Mid-Atlantic Ridge morphology and gravity between 15 degrees N and 40 degrees N: Constraints of the thermal structure. *J Geophys. Res.* 103, 24223-24243 OCT 10 1998

## 6.4 General background data

GEBCO – General Bathymetric Chart of the Oceans – 1' Digital Atlas of the North Atlantic (pre-release version), The International Hydrographic Organisation (IHO) and the Intergovernmental Oceanographic Commission (IOC), 2003.

Sandwell, D.T. and Smith, W.H.F. Marine gravity anomaly from Geosat and ERS 1 satellite altimetry. Journal of Geophysical Research, 102, 10039-10054, 1997

Smith, W. H. F., and D. T. Sandwell, Global seafloor topography from satellite altimetry and ship depth soundings, Science, 277, 1957-1962, 1997.

## APPENDIX 1

### GMT command lines.

#### TO MAKE 0.25 MIN GRIDS

```
grdsample Reykjanes_North.grd -G1min.Reykjanes_North.grd -I0.25m -V
```

```
grdsample Reykjanes_South.grd -G1min.Reykjanes_South.grd -I0.25m -V
```

```
grdsample batsurf45n.grd -G1min.45_46n.grd -I0.25m -V
```

```
grdsample triatnord_500x500.grd -G1min.triatnord.grd -I0.25m -V
```

```
grdsample 1minMARbram.grd -G1minMARbram.grd -I0.25m -V
```

#### TO MAKE 1MIN GRIDS

```
grdsample Reykjanes_North.grd -G1min.Reykjanes_North.grd -I1.0m -V
```

```
grdsample Reykjanes_South.grd -G1min.Reykjanes_South.grd -I1.0m -V
```

```
grdsample batsurf45n.grd -G1min.45_46n.grd -I1.0m -V
```

```
grdsample triatnord_500x500.grd -G1min.triatnord.grd -I1.0m -V
```

```
grdsample 1minMARbram.grd -G0.25minMARbram.grd -I1.0m -V
```

#### #TO BUILD A COLOURED CONTOUR CHART

```
psbasemap -R-38/-32/51.5/57 -Jm1:1000000 -Ba1f10mg1 -K -V -P >! cont100_3.ps
```

```
#grdimage SwathandGEBSCO05min.grd -R -Jm -Cgrey.cpt -B -K -Iswathgrad1min.grd -O -V >>
```

```
cont100_3.ps
```

```
grdcontour SwathandGEBSCO1min.grd -R -Jm -C500 -S -T -Wa0.35p/0/0/0 -A500f6 -B -G4 -K -O -V
```

```
>> cont100_3.ps
```

```
#colours
```

```
#250/0/0
```

```
#0/250/0
```

```
#200/0/250
```

```
#0/0/250
```

```
grdcontour SwathandGEBSCO05min.grd -R -Jm -C100 -L-101/-99 -W0.25p/250/0/0 -B -G4 -K -O -V
```

```
>> cont100_3.ps
```

```
grdcontour SwathandGEBSCO05min.grd -R -Jm -C100 -L-1101/-1099 -W0.25p/250/0/0 -B -G4 -K -O
```

```
-V >> cont100_3.ps
```

```
grdcontour SwathandGEBSCO05min.grd -R -Jm -C100 -L-2101/-2099 -W0.25p/250/0/0 -B -G4 -K -O
```

```
-V >> cont100_3.ps
```

```
grdcontour SwathandGEBSCO05min.grd -R -Jm -C100 -L-3101/-3099 -W0.25p/250/0/0 -B -G4 -K -O
```

```
-V >> cont100_3.ps
```

grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4101/-4099 -W0.25p/250/0/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5101/-5099 -W0.25p/250/0/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-201/-199 -W0.25p/0/250/0 -B -G4 -K -O -V  
>> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1201/-1199 -W0.25p/0/250/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2201/-2199 -W0.25p/0/250/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3201/-3199 -W0.25p/0/250/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4201/-4199 -W0.25p/0/250/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5201/-5199 -W0.25p/0/250/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-301/-299 -W0.25p/0/0/250 -B -G4 -K -O -V  
>> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1301/-1299 -W0.25p/0/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2301/-2299 -W0.25p/0/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3301/-3299 -W0.25p/0/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4301/-4299 -W0.25p/0/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5301/-5299 -W0.25p/0/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-401/-399 -W0.25p/200/0/250 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1401/-1399 -W0.25p/200/0/250 -B -G4 -K -  
O -V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2401/-2399 -W0.25p/200/0/250 -B -G4 -K -  
O -V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3401/-3399 -W0.25p/200/0/250 -B -G4 -K -  
O -V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4401/-4399 -W0.25p/200/0/250 -B -G4 -K -  
O -V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5401/-5399 -W0.25p/200/0/250 -B -G4 -K -  
O -V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-601/-599 -W0.25p/250/0/0 -B -G4 -K -O -V  
>> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1601/-1599 -W0.25p/250/0/0 -B -G4 -K -O  
-V >> cont100\_3.ps  
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2601/-2599 -W0.25p/250/0/0 -B -G4 -K -O  
-V >> cont100\_3.ps

```
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3601/-3599 -W0.25p/250/0/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4601/-4599 -W0.25p/250/0/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5601/-5599 -W0.25p/250/0/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-701/-699 -W0.25p/0/250/0 -B -G4 -K -O -V
>> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1701/-1699 -W0.25p/0/250/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2701/-2699 -W0.25p/0/250/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3701/-3699 -W0.25p/0/250/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4701/-4699 -W0.25p/0/250/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5701/-5699 -W0.25p/0/250/0 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-801/-799 -W0.25p/0/0/250 -B -G4 -K -O -V
>> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1801/-1799 -W0.25p/0/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2801/-2799 -W0.25p/0/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3801/-3799 -W0.25p/0/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4801/-4799 -W0.25p/0/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5801/-5799 -W0.25p/0/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-901/-899 -W0.25p/200/0/250 -B -G4 -K -O
-V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-1901/-1899 -W0.25p/200/0/250 -B -G4 -K -
O -V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-2901/-2899 -W0.25p/200/0/250 -B -G4 -K -
O -V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-3901/-3899 -W0.25p/200/0/250 -B -G4 -K -
O -V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-4901/-4899 -W0.25p/200/0/250 -B -G4 -K -
O -V >> cont100_3.ps
grdcontour SwathandGEBCO05min.grd -R -Jm -C100 -L-5901/-5899 -W0.25p/200/0/250 -B -G4 -K -
O -V >> cont100_3.ps
gs -sPAPERSIZE=a0 cont100_3.ps
```