The Generic Mapping Tools (GMT) Version 5

Paul Wessel\textsuperscript{1}, Walter H.F. Smith\textsuperscript{2}, Remko Scharroo\textsuperscript{3}, Joaquim Luis\textsuperscript{4}, Florian Wobbe\textsuperscript{5}

\textsuperscript{1}SOEST, University of Hawaii at Mānoa, \textsuperscript{2}Laboratory for Satellite Altimetry, NOAA/NESDIS, \textsuperscript{3}Altimetrics LLC, Cornish, NH, \textsuperscript{4}Universidade do Algarve, Faro, Portugal, \textsuperscript{5}Alfred Wegener Institute, Germany
# GMT Podcasts

**GMT – The Generic Mapping Tools**

by Prof. Paul Wessel

To listen to an audio podcast, mouse over the title and click Play. Open iTunes to download and subscribe to iTunes U collections.

## Description

GMT is an open source collection of about 80 command-line tools for manipulating geographic and Cartesian data sets (including filtering, trend fitting, gridding, projecting, etc.) and producing PostScript illustrations ranging from simple x-y plots via contour maps to artificially illuminated surfaces and 3D perspective views; the GMT supplements add another 40 more specialized and discipline-specific tools. GMT supports over 30 map projections and transformations and comes with support data such as GSHHG coastlines, rivers, and political boundaries. GMT is developed and maintained by Paul Wessel, Walter H. F. Smith, Remko Scharroo, Joaquim Luis and Florian Wobbe, with help from a global set of volunteers, and is supported by the National Science Foundation. It is released under the GNU Lesser General Public License version 3 or any later version. These podcasts discusses the basics of GMT and come from a Spring 2014 course in GMT offered by the University of Hawaii at Manoa.

### Table of Podcasts

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Released</th>
<th>Price</th>
<th>View More from this Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Background: 2...</td>
<td>The recorded TGIF session</td>
<td>1/26/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>2 Introduction: G...</td>
<td>Broad overview of GMT</td>
<td>1/23/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>3 Novice 1: The ...</td>
<td>The basic command overview</td>
<td>1/23/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>4 Novice 2: Scrip...</td>
<td>--</td>
<td>1/30/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>5 Novice 3: Plotti...</td>
<td>Brief overview of how to use GMT</td>
<td>2/9/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>6 Novice 4: Time...</td>
<td>More details on annotations</td>
<td>2/10/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>7 Hacker 1: Bash...</td>
<td>First session of quick command</td>
<td>2/17/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>8 Hacker 2: More...</td>
<td>Second part of quick command</td>
<td>2/23/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
<tr>
<td>9 Hacker 3: Auto...</td>
<td>In this session we are...</td>
<td>3/2/2014</td>
<td>Free</td>
<td>View More from this Provider</td>
</tr>
</tbody>
</table>

### Customer Ratings

We have not received enough ratings to display an average for this collection.

### Links

- Report a Concern
Becoming a GMT guru

- Use a flexible shell on a UNIX system
- Think like a programmer
- Automate, abstract away things, write functions for repetitive tasks
- Read documentation
- Register and participate in the GMT Forums
GMT Versatility

- GMT has been called the “Swiss Army Knife” of mapping tools
- Combines a wide array of data manipulation tools
- Infinitely configurable via user scripting
- It is possible to cut your fingers if not careful
News for developers

- GMT 5 has turned all GMT 4 programs into a high-level API, allowing easy access to GMT functionality from custom programs.
- The API also contains functions to read/write data and manage GMT sessions.
- The GMT API is released under the lesser GNU license, broadening its potential use.
- We have a beta Matlab/Octave interface and will start development of a Python API this fall. A few folks are working on a Fortran API as well.
New features for users

- Better GIS interoperability:
  - Import/Export OGR/GMT files
    - ogr2ogr supports a new OGR/GMT ASCII file format developed by Brent Wood (NIWA) and Paul Wessel, and implemented by Frank Warmerdam (now at Google)
    - The OGR/GMT format retains all metadata and may be considered an “ASCII shapefile”
  - Bridge to GDAL for rasters
    - GMT5 can read any grid format supported by GDAL, and can also read images
New features for users

- Improved consistency and flexibility for table i/o across GMT:
  - All programs now use same uniform i/o library with support for multi-segments across GMT
  - New global options `–i` and `–o` allows users to select which columns to read and write
  - Enhanced option `–b` allows freeform native binary files to be read and written
  - Table netCDF files can be used directly [read-only]
New features for users

- Several new tools and many new options:
  - PDF transparency
  - Automatic annotation selection
  - Run-time choice of FFT algorithms
  - Run-time choice of triangulation algorithms
  - 3-D perspective view available in all programs
  - New enhanced macro language for custom symbols with multiple variables
GMT 4 vs GMT 5

- Redesigned from programs to API modules
- I/O done via standard GMT library functions
- Modules in shared library called via `gmt` executable
- Interactive documentation (RST)
- Redesign many default parameter names and option syntax
- Support for faster FFTs (OS X Accelerate, FFTW)
- NetCDF 4 with deflation and chunking, PCRE expressions

- “classic” mode install links to `gmt` with names like `psxy`, `blockmean`,...
- GMT parameter `GMT_COMPATIBILITY = 4` allows for old syntax
- A few new programs, plus many promoted up from supplements
- Lots of new options to many of the programs
- Stronger GDAL integration throughout, plus new OGR/GMT vector format
- Wiki for issue tracking and feature requests
Running a GMT module

To make a basic coastline map in GMT 4, you would run

```bash
pscoast -R0/40/0/40 -JM6i -P -Ba10f5 -Gbrown -W0.25p > map.ps
```

This was the only way to make this map; the -B option was a bit painful.

To make the same coastline map in GMT 5, a new user would run

```bash
gmt pscoast -R0/40/0/40 -JM6i -P -Baf -Gbrown -W0.25p > map.ps
```

In classic mode under GMT4 compatibility, a GMT 4 command will run fine in GMT 5. If you use a deprecated option you will be told so and given the new syntax to use.
GMT common options

- **a** Access aspatial metadata from OGR files and use as GMT columns
- **i** Specify which input columns, their order, and any scaling
- **o** Specify which output columns, their order, and any scaling
- **n** Set grid boundary conditions and resampling method
- **p** Uniform option for setting 3-D perspective view in all programs
- **r** Set grid registration to pixel-mode
- **s** How to handle NaN data
- **t** Sets overall layer transparency [requires PDF processing]

**New options**

**Modified options**

- **b** More flexibility for mixing data types and skipping bytes
- **m** No longer used; we detect multisegment files automatically
- **B** Broken into multiple sub-options for clarity and mnemonics
Revised -B option

- Old -B was extremely complicated, with all possible settings crammed into one long option. Very difficult to remember how to set the various parameters.

- New -B is split into repeated -B options, with each taking responsibility for one aspect of the annotations, canvas, and the axes.
Upcoming Plans

• Release GMT 5.2 this fall
  • 6 new modules
  • ~100 new features
• Release a beta GMT/Matlab-Octave API
• Develop the GMT/Python API
• Add supplement for InSAR processing [gmtsar]
• Add new tools for ternary diagrams
• Add geologic programmable symbols
Making a map with grdimage

- Get a DEM [SRTM1] subset from http://topex.ucsd.edu/gmtsar/demgen
- Quick-and-dirty map [Default color]
- More control with colors [makecpt]
- Add artificial illumination [grdgradient]
- Add color bar [psscale]