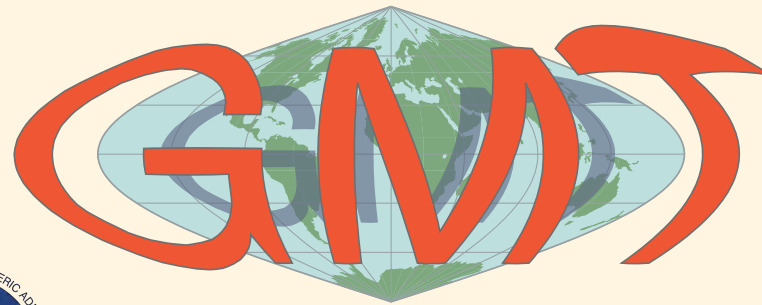
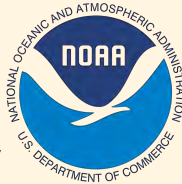


THE GENERIC MAPPING TOOLS 6: CLASSIC VERSUS MODERN MODE

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THE GENERIC MAPPING TOOLS



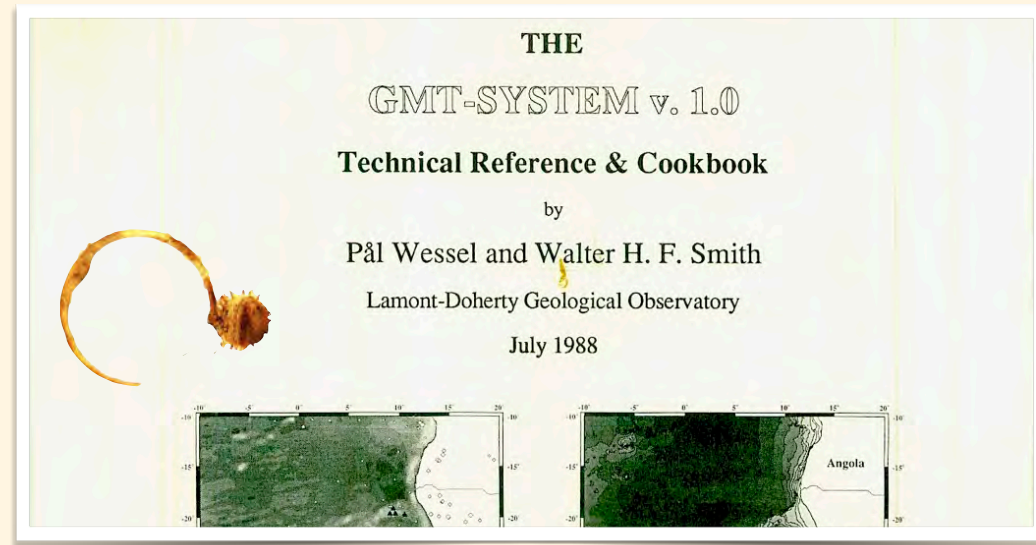
WHAT IS GMT?

- GMT is an open source set of ~140 command-line modules for data processing and map making, and is available for all major OS
- GMT has been called the “Swiss Army Knife” of mapping tools as it is infinitely scriptable and configurable
- Scripting has been a key to harnessing GMT’s potential, typically performed within a UNIX shell environment
- It is possible to cut your fingers if not careful (and well trained)



STATUS OF GMT, DEC. 2017

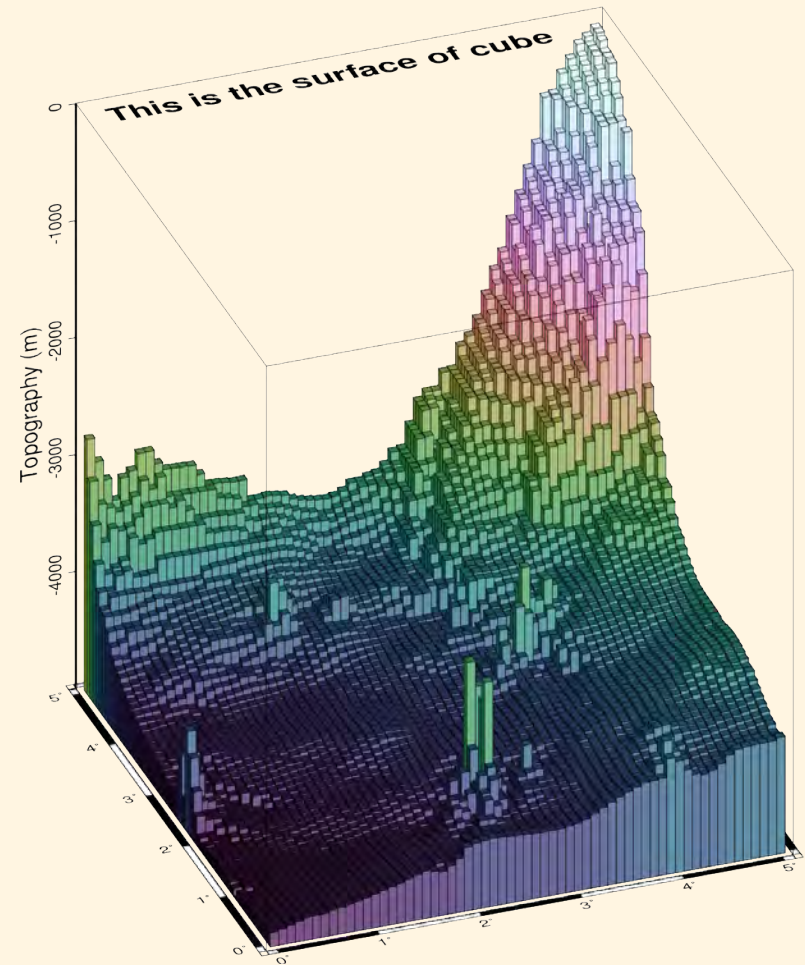
- There are tens of thousands of GMT users worldwide, and usage is increasing
- 15% are associated with US institutions
 - OS: 50% OSX, 40% Windows, 10% Linux
- 85% belong to non-US institutions
 - OS: 25% OSX, 65% Windows, 10% Linux
- GMT will be 30 years next summer...
- We are addressing an inevitable transition:
 - Ensure that both NSF and community contributions will have a lasting effect
 - Prepare for “passing the baton” to new developers when the present team retires



GOAL: Make GMT simpler for developers, maintainers, and users

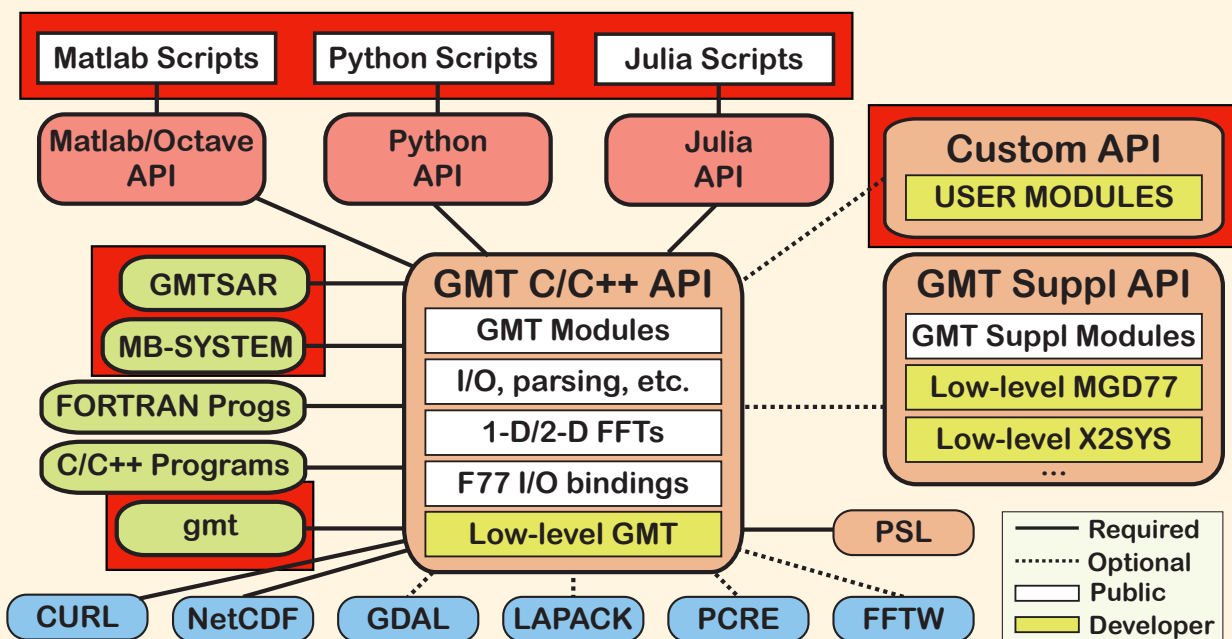
GMT 5: MAJOR CHANGES

- All programs were redesigned as a high-level API (i.e., a library of functions), resulting in a single program (gmt.c) that calls the requested API functions
- The design allows external developers to call GMT modules from their own programs or other computational environments
- GDAL was introduced to improve the interoperability of GMT with other software for grids, images, and vector data (via ogr2ogr)



THE PUBLIC GMT API

- Extends GMT to other computing environments [Matlab, Julia, and Python]
- Simplifies design of new core and supplemental modules
- Allows custom modules to be used by calling the single gmt executable
- Allows external programs to use the API modules [GMTSAR, MB-System]



curl

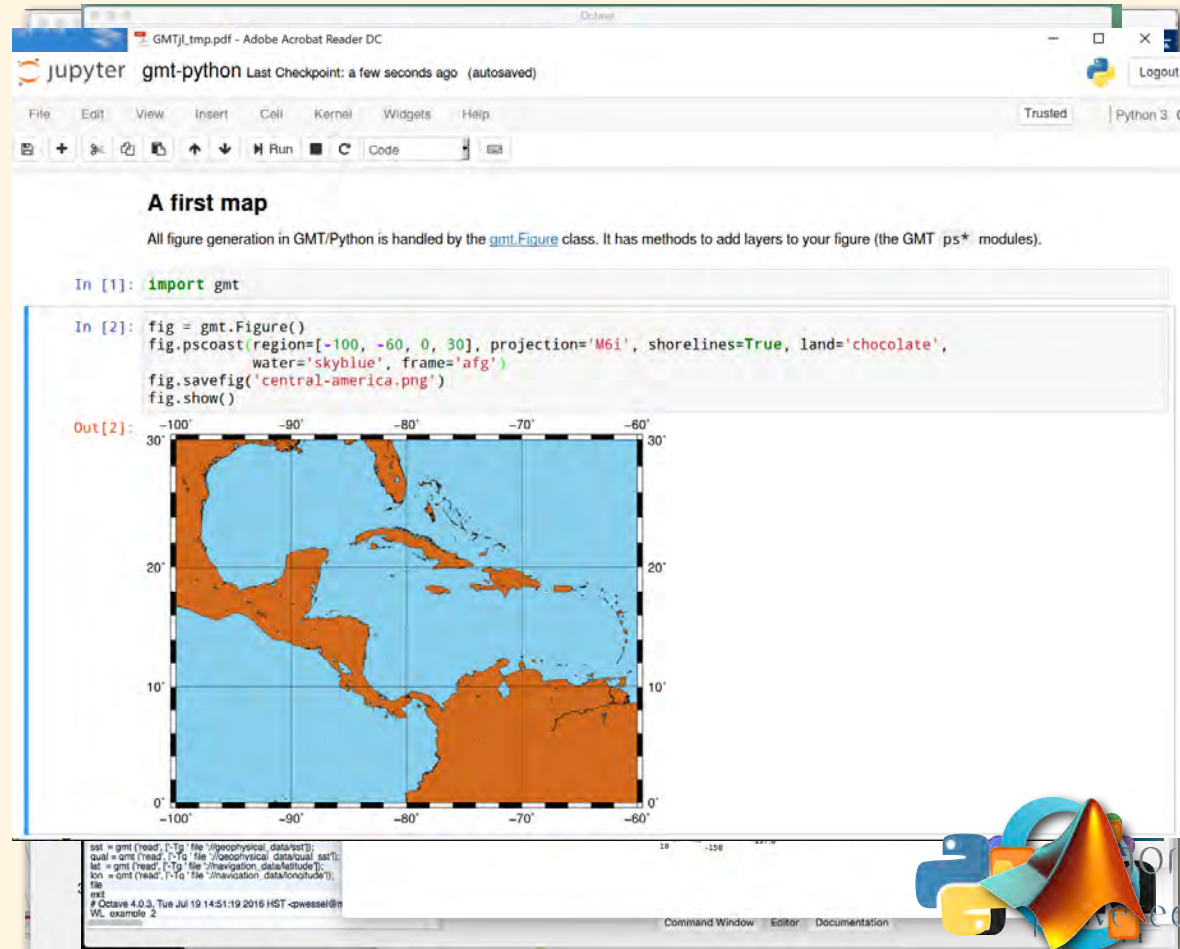


L A P A C K
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L A P A - C - K
L A P - A C K
L - A - P A C - K

FFTW

EXTERNAL TOOLBOXES & GMT API

- GMT/MEX allows full access to all GMT modules from MATLAB or Octave
- Allows users to use the best of both worlds and to simplify their workflows
- A beta toolbox is now available for the Julia language as well
- A GMT/Python package is being designed [see IN51B-0018 : Uieda & Wessel, **A modern Python interface for the Generic Mapping Tools**, Session IN51B Friday morning posters



Wessel, P., and J. F. Luis (2017), The GMT/MATLAB Toolbox, *Geochem. Geophys. Geosyst.*, 18, 811–823, doi:10.1002/2016GC006723.

HOW TO SIMPLIFY GMT?



- GMT has a steep learning curve and we want to make it simpler
- Existing GMT users have thousands of work flows that must continue to run as before once GMT 6 is introduced
- We have standardized similar options across GMT and added more examples, but the biggest hurdles to learn GMT cannot be addressed with such minor changes

“MAKE IT SIMPLER BUT DON’T CHANGE ANYTHING!!!”

MAJOR GMT HURDLES

GMT is asking for too much technical know-how of the user, especially new users

1. The user is responsible for assembling a valid PostScript document from any number of overlays via careful use of the **-O** and **-K** options. One tiny mistake and boom.
2. The user is responsible for properly handling redirection of PostScript from the standard output stream, first to create a new file and then to append to that file. One tiny mistake and boom.
3. The user is responsible for passing region (**-R**) and projection (**-J**) information to each command, even if it does not change. One tiny mistake and you end up with an incorrect plot (or just boom).

In my GMT class at UH we call these “Rookie Errors # 1, 2, 3”

INTRODUCING RUN MODES

CLASSIC versus **MODERN**

- Starting with GMT 6, we introduce a new run mode, called **modern**, to complement the existing **classic** run mode
- Classic is GMT's default behavior. Existing scripts will run in classic mode and thus backwards compatibility is ensured
- Modern mode allows us to address the major obstacles to GMT mastery and to expand GMT in new and different directions
- Modern will be the default mode in the GMT/Python package

OVERVIEW OF MODERN MODE

Expands GMT with 4 new directives:

- **begin**: Initiates a new GMT modern mode session
- **figure**: Names a new figure and sets desired format(s) [optional]
- **subplot**: Simplifies setup for multi-panel plots [optional]
- **end**: Finalizes all plots and terminates modern mode session

Modern sessions run in isolation mode – many sessions can run concurrently

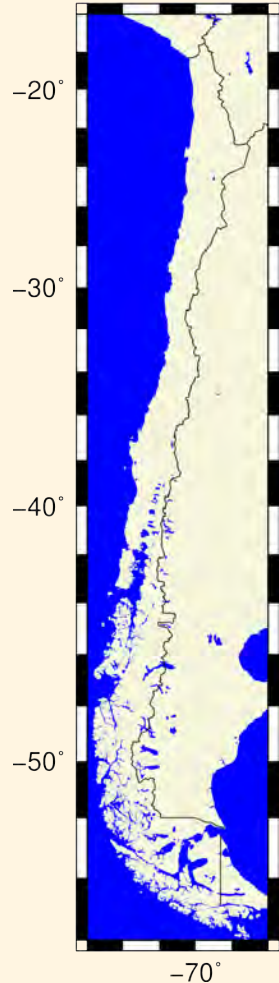
Modern mode eliminates the most severe GMT rookie errors

FIRST MODERN MODE EXAMPLE

```
gmt begin Chile png
gmt coast -RCL+r2 -JM15c+ -BWSne -B -Gbeige -Sazure -N1/1p
gmt end
```

INITIATE MODERN SESSION, SET PLOT PREFIX, REQUEST PNG PLOT FORMAT
PLOT COASTLINES FOR ROUNDED SUB-REGION SUITABLE FOR CHILE
FINALIZE POSTSCRIPT PLOT, RASTERIZE TO PNG, TERMINATE MODERN SESSION
FOR SUCH “ONE-LINERS” WE HAVE AN EXPEDITED “BEGIN & END” SYNTAX:

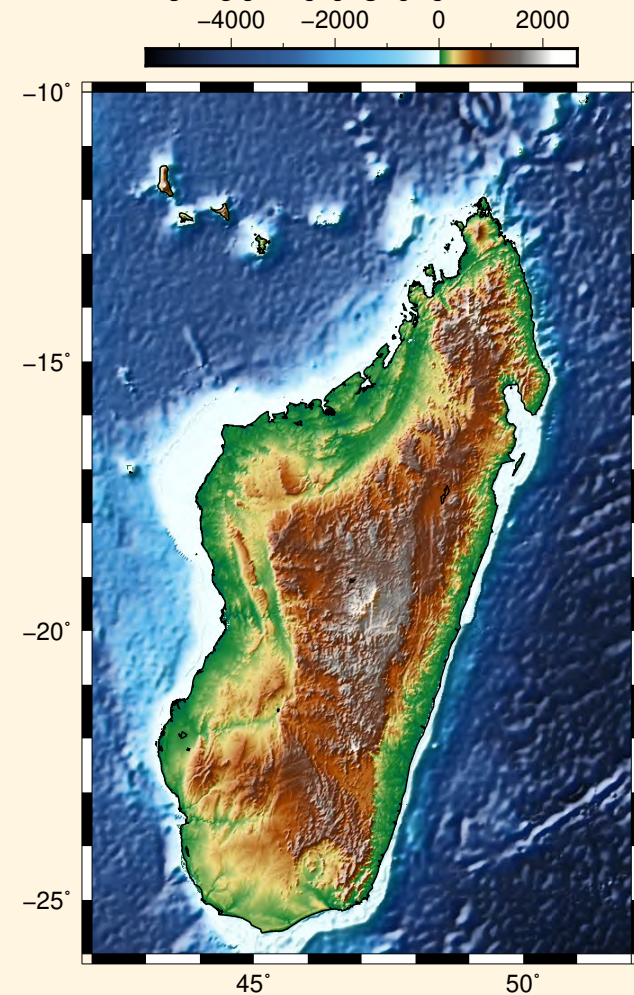
```
gmt coast -RCL+r2 -JM15c+ -BWSne -B -Gbeige -Sazure -N1/1p -png Chile
```



SECOND MODERN MODE EXAMPLE

```
gmt begin map png,pdf
gmt grdimage @earth_relief_01m -RMG+r2 -I+ -Cgeo
gmt coast -Wthin -BWSne -B
gmt colormap -DJTC -B
gmt end
```

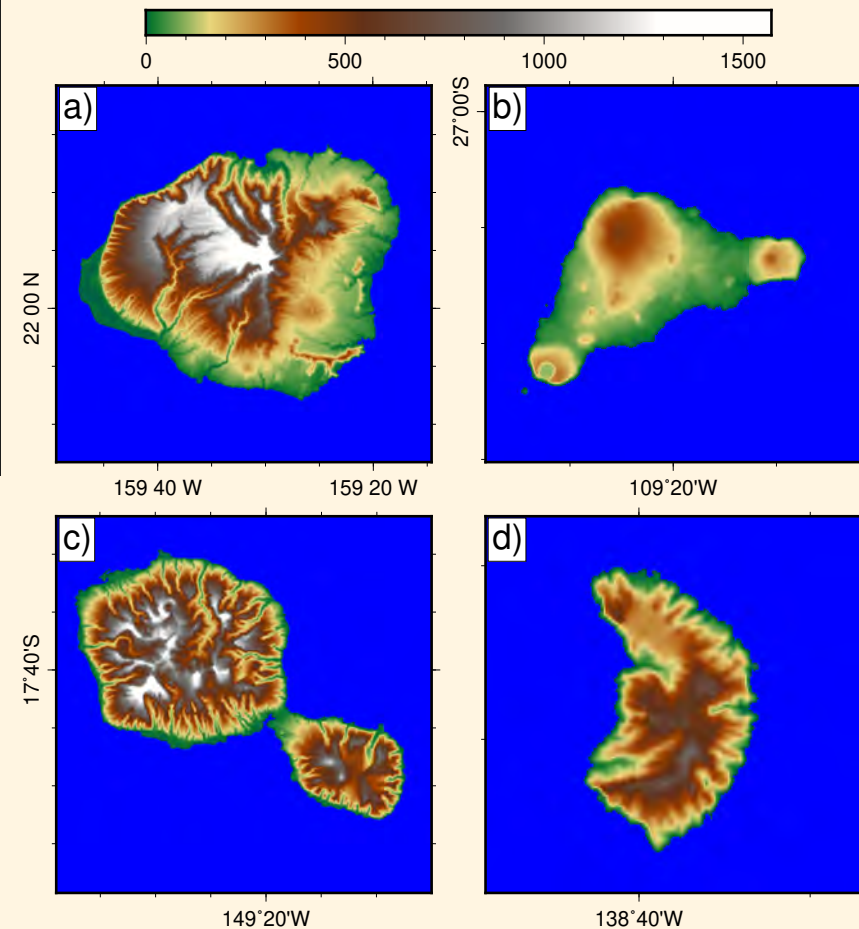
INITIATE SESSION, SET PLOT PREFIX TO MAP, REQUEST PNG & PDF FORMAT
ACCESS THE 1X1 ARC MINUTE RELIEF GRID FROM URL SERVER
SELECT ROUNDED SUB-REGION SUITABLE FOR MADAGASCAR
AUTO-DERIVE INTENSITY GRID FROM RELIEF GRID FOR HILL SHADING
USE GEO COLOR TABLE, SCALED TO FIT THE DATA, SAVE AS CURRENT CPT
OVERLAY COASTLINES AND PLOT SELECTED FRAME SIDES
CENTER COLOR BAR OVER MAP, USING CURRENT COLOR TABLE
FINALIZE POSTSCRIPT PLOT, CONVERT TO PNG & PDF, TERMINATE SESSION



THIRD MODERN MODE EXAMPLE

```
gmt begin islands
gmt subplot begin 2x2 -M0.05i -Fs3i -BWSne -A
gmt grdimage @earth_relief_01s ... -c1,1 -Csrtm
gmt grdimage @earth_relief_01s ... -c1,2
gmt grdimage @earth_relief_01s ... -c2,1
gmt grdimage @earth_relief_01s ... -c2,2
gmt subplot end
gmt colorbar -B -Dx0/0.4i+jBC+w5i+h -Xw/2 -Yh
gmt end
```

BEGIN A SUBPLOT, SET 2X2 LAYOUT, MARGINS, AND LABELING
SET CURRENT PANEL WHERE PLOTTING SHOULD BE PLACED
END THE SUBPLOT
PLACE CURRENT COLOR BAR CENTERED ON TOP OF SUBPLOT



CONCLUSIONS

- Modern mode simplifies GMT learning and scripting
- Details of plot file manipulation, positioning, and scaling are hidden
- Modern mode enables simpler external access to GMT
- Modernization and simplification is part of our succession planning
- GMT 6 beta is available via subversion for early testers
- We expect to release GMT 6 in spring 2018

GMT 6 modern mode running in browser will be demo'd at our poster Friday am