Mapping and modeling Earth Science Data

Segment II: Making maps with GMT, another exercise and iGMT

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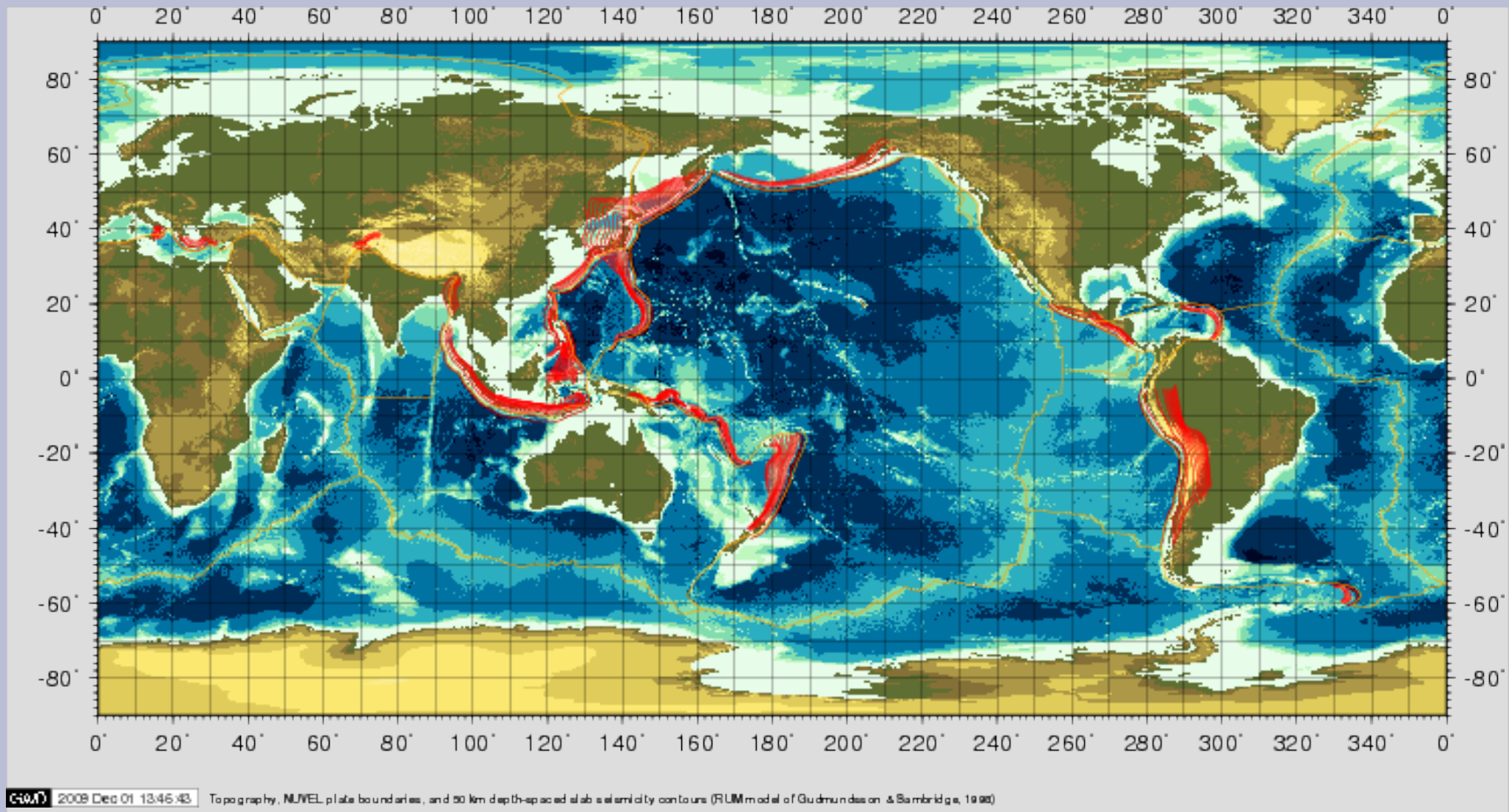
GMT exercise: Example 2

- Plot CMT data
- From the files in `examples.tgz` go to `examples/gmt/example_2` (or from UGESCE ~/Desktop/user_data) and check out `cmt_012112.mdat`
- Generate a regional focal mechanism map for Tonga with plate boundaries and coastlines, using seismicity deeper than 100 km, plotted shallow events on top, color coded by depth. Use `gmtselect` to cut out regional data from `cmt_012112.mdat`

Hint for exercise 2: psmeca

```
psmeca 4.5.7 [64-bit] - Plot seismological symbols on maps

usage: psmeca <infiles> -J<params> -R<west>/<east>/<south>/<north>[r]
   -S<format><scale>[/fontsize[/justify/offset/angle/form]]
   [-B<params>] [-C[<pen>][P<pointsize>]]
   [-Ddepmin/depmax] [-E<fill>] [-G<fill>]
   [-H[<nrec>]] [-K] [-L<pen>] [-M] [-N] [-O] [-P] [-r]
   [-Tnplane[/<pen>]] [-U[<just>/<dx>/<dy>/][c|<label>]]
   [-V] [-W<pen>] [-X[a|c|r]<x_shift>[u]] [-Y[a|c|r]<x_shift>[u]]
   [-Z<cpt>] [-z] [-a[size[/Psymbol[Tsymbol]]]

(...)

      (m) Sesmic moment tensor (Harvard CMT, with zero trace)
            X, Y, depth, mrr, mtt, mff, mrt, mrf, mtf, exp, newX, newY, event_title

(...)
```

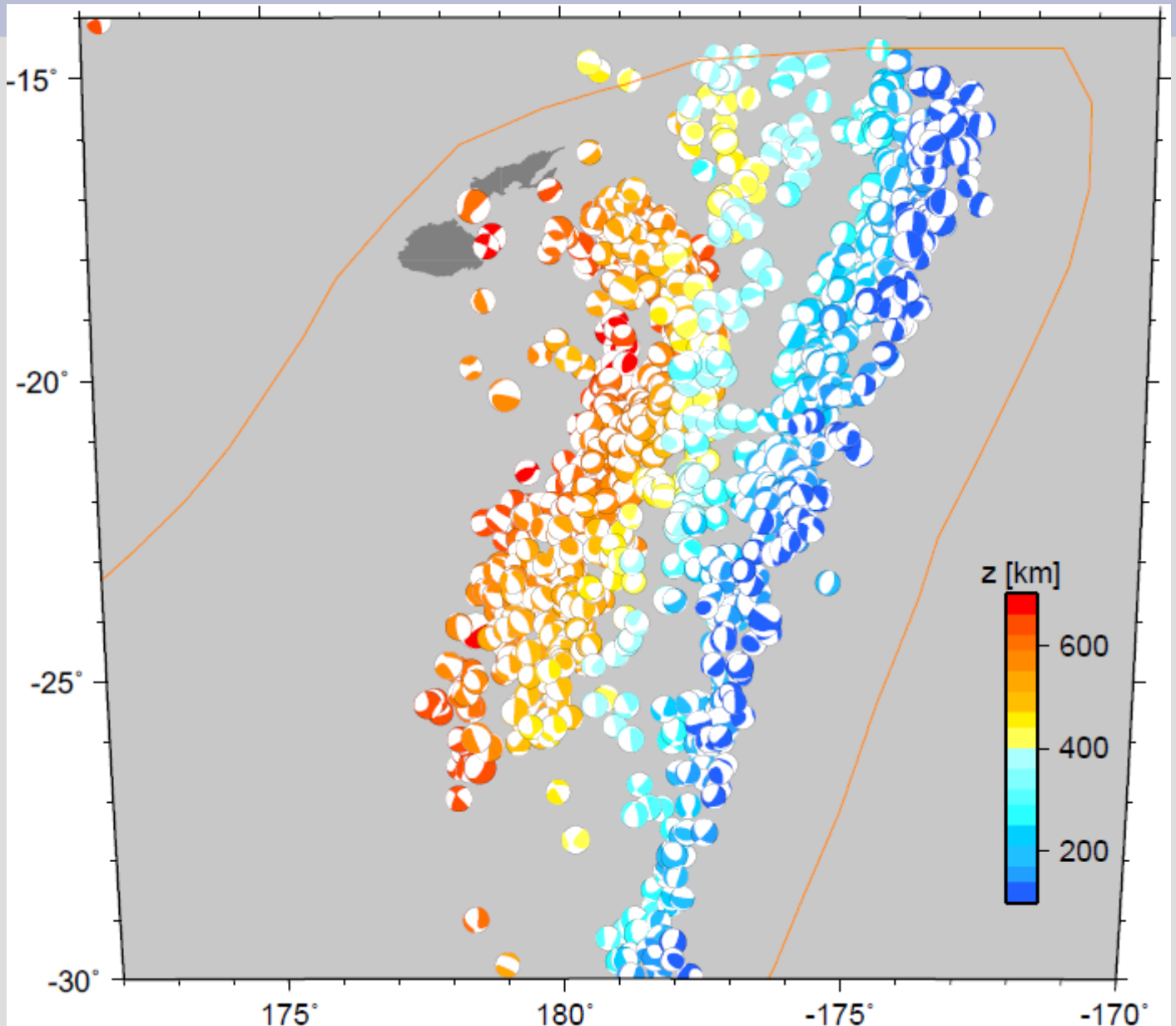
Hint for exercise 2: world map



My example 2 solution

```
#!/bin/bash
# plot CMTs for Tonga
dfile=../cmt_012112.mdat        # data
dmin=100                        # minimum depth
ofile=tonga.ps
reg=-R172/190/-30/-14
proj=-JH`echo $reg | gawk -f reg2midlon.awk`/7
makecpt -T$dmin/700/10 -Cno_green -D > tmp.cpt
ann=-Ba5f1WeSn
# data selection
gmtselect $reg -fg $dfile > regional_cmt.dat
pscoast -Df -A5000 $reg $proj -K -P -G128 -S200 > $ofile
# for momement tensor
sort -n +2 -r regional_cmt.dat | psmeca $reg $proj -Ztmp.cpt  -Sm0.15/-1 -D$dmin/1000 -K -O >> $ofile
# for actual double couple
#sort -n +2 -r regional_cmt.dat | psmeca $reg $proj -Ztmp.cpt  -Sd0.15/-1 -D$dmin/1000 -K -O >> $ofile
psxy ../nuvel.360.xy -O $reg $proj -K -m -fg -W2,darkorange >> $ofile
psscale -D6/1.5/2/.2 -Ctmp.cpt -Ba200/:"z [km]": -O -K >> $ofile
psbasemap $ann $reg $proj -O  >> $ofile
echo $0: output in $ofile
modifybb $ofile
rm tmp.*
```

My example 2 solution



Worked GMT examples: Example 3

- Plot velocities and Interpolate point data
- From the files in `examples.tgz` go to

  `examples/gmt/example_3`

  and check out `gps.vel`

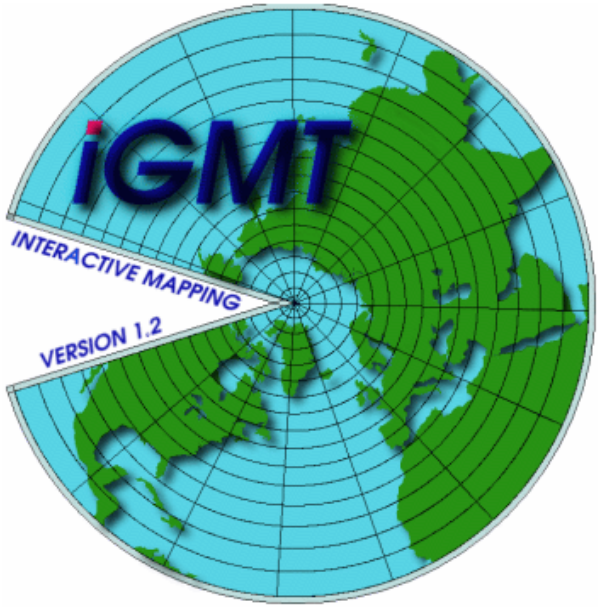
*i*GMT
Interactive mapping of geoscientific datasets

- Written by Thorsten Becker and Alexander Braun
- UNIX based, TclTk script graphical user interfact for GMT
- Access to several Earth science datasets
- Produces GMT/bash scripts
- (development discontinued, in favor of python based SEATREE)
- http://geodynamics.usc.edu/~becker/igmt/

geodynamics.usc.edu/~becker/igmt/

alexander braun

iGMT: Interactive Mapping of Geoscientific Datasets



download iGMT here

Welcome to the home page of the interactive mapping interface iGMT. This program is intended to make working with the Generic Mapping Tools (GMT) easier. iGMT provides a graphical user interface for GMT and is written in the Tcl/Tk computer language. Besides supplying a user friendly way of handling GMT, iGMT comes with built-in support for many different geoscientific data sets, such as topography, gravity, seafloor age, hypocenter catalogs, plate boundary files, hotspot lists, CMT solutions etc.

Our software is a useful tool for learning GMT, taking advantage of both GMT's data processing capabilities and the increasing availability of geoscientific data sets in electronic form. More than 240 institutions world wide are registered iGMT users, used the program in 2002 for map-making and teaching GMT. We stopped counting a while back.

iGMT home
Software
Version history
Documentation
Examples
Data Sets
User Distribution
Reference, Authors and Copyright
Feedback

Feb 2001, alexander braun

- Installed on USC Geodynamics Earth Science Computing Environment

iGMT produced maps

geodynamics.usc.edu/~becker/igmt/

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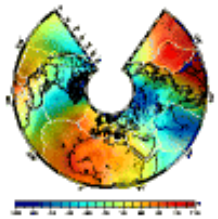
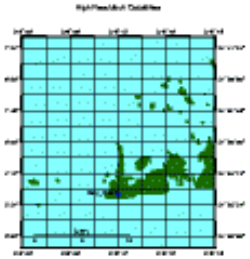
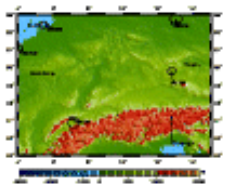
Feb 2001, alexander braun



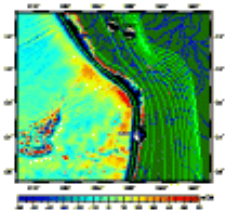
1 - Geoid height and Plate boundaries
example1.ps.gz 171.1 KB



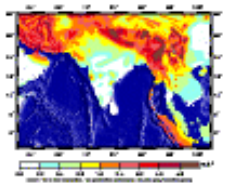
2 - High resolution coastlines
example2.ps.gz 5.1 KB



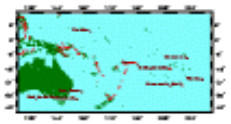
3 - Cities - GPS vectors - Topography
example3.ps.gz 264.9 KB



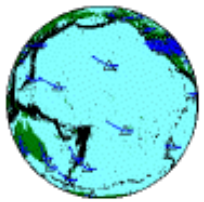
4 - Gravity - Slab boundaries - CMT solutions
example4.ps.gz 710.3 KB



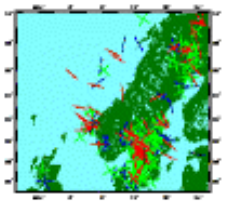
5 - Seismic hazard map (GSHAP)
example5.ps.gz 195.1 KB



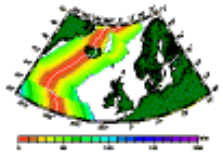
6 - Volcanos and Hotspots
example6.ps.gz 20.3 KB



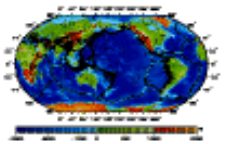
7 - Earthquakes and GPS vectors
example7.ps.gz 218.3 KB



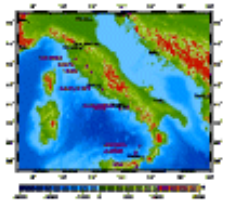
8 - World stress map data
example8.ps.gz 24.3 KB



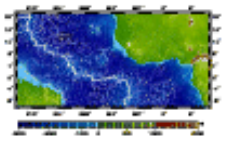
9 - Sea floor age
example9.ps.gz 80.2 KB



10 - Global Topography and Earthquakes
example10.ps.gz 1135.6 KB

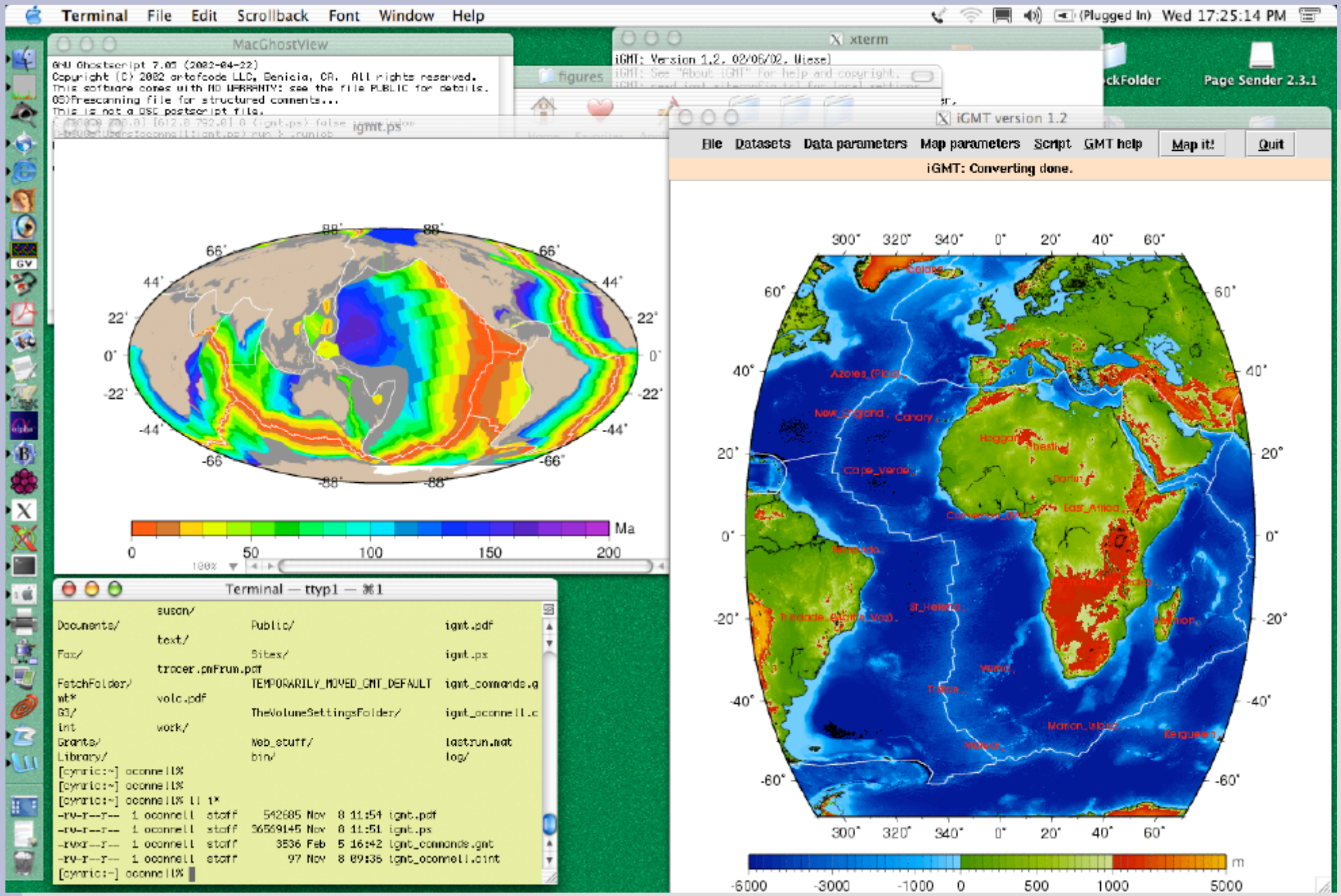


11 - Topography - Cities - Volcanos
example11.ps.gz 75.2 KB



12 - Bathymetry and Plate boundaries
example12.ps.gz 4460.2 KB

*i*GMT on desktop



Solid Earth Research and Teaching Environment (SEATREE)

geosys.usc.edu/projects/seatree/wiki

seatree

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Start Page | Index | History | Last Change

Solid Earth Teaching and Research Environment

A software product by USC Geodynamics

> SEATREE is a modular and user-friendly software to facilitate using solid Earth research tools in the classroom and for interdisciplinary, scientific collaboration. We use python wrappers and make use of modern software design concepts, while remaining compatible with traditional scientific coding. Our goals are to provide a fully contained, yet transparent package that lets users operate in an easy, graphically supported "black box" mode, while also allowing to look under the hood. In the long run, we envision SEATREE to contribute to new ways of sharing scientific research, and making (numerical) experiments truly reproducible again. (Eos Article)

Solid Earth Teaching and Research ...
- Modules
  - Geodynamics
  - Seismology
  - Visualization
- Contributors
  - SEATREE design and coding
  - Module contributors
- Publications and presentations on SEATREE
- Bug reports, feedback, and release history

SEATREE is module based, and the current SVN version includes tools for computing 2D mantle convection, 3D body wave mantle seismic tomography, 3D spherical mantle flow, for inverting for Earth structure by means of surface wave, phase velocity tomography, and a two-dimensional synthetic tomography teaching module. A rudimentary module for earthquake location inversions is also available. The main software design consists of transparent python wrappers that drive the modules, including a GMT plotting tool, a VTK/Paraview 3D visualization interface, and a graphical user interface.

SEATREE is freely available under the GNU license; a desktop installation is required to use SEATREE right now but we are planning on a web-based version as well. We encourage you to take the software for a test drive. If you want to use SEATREE in a classroom setting, we might be able to offer you some installation support and always welcome your feedback. Also, if you like to add your own module to SEATREE, please let us know; we might be able to provide some assistance.

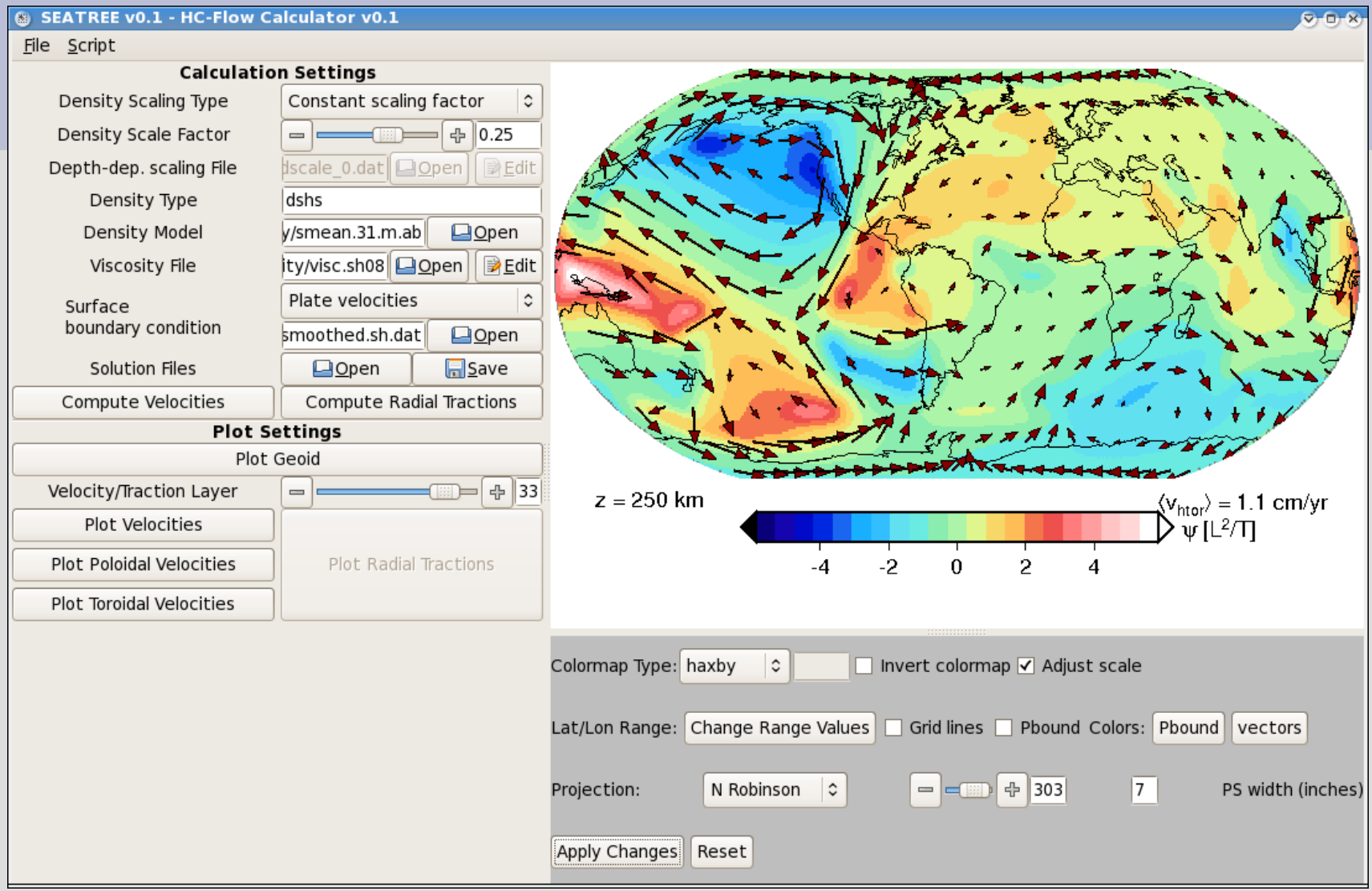
Screenshots Illustrations of the softwares capabilities and design concepts.

Download and installation Instructions on how to obtain and install the whole package. (Release: version 2.0, as of Sep, 2011)

User Documentation User-level documentation of SEATREE and the modules.

Developer Documentation Start here if you want to extend SEATREE and/or add modules.

Python interface for GMT plots

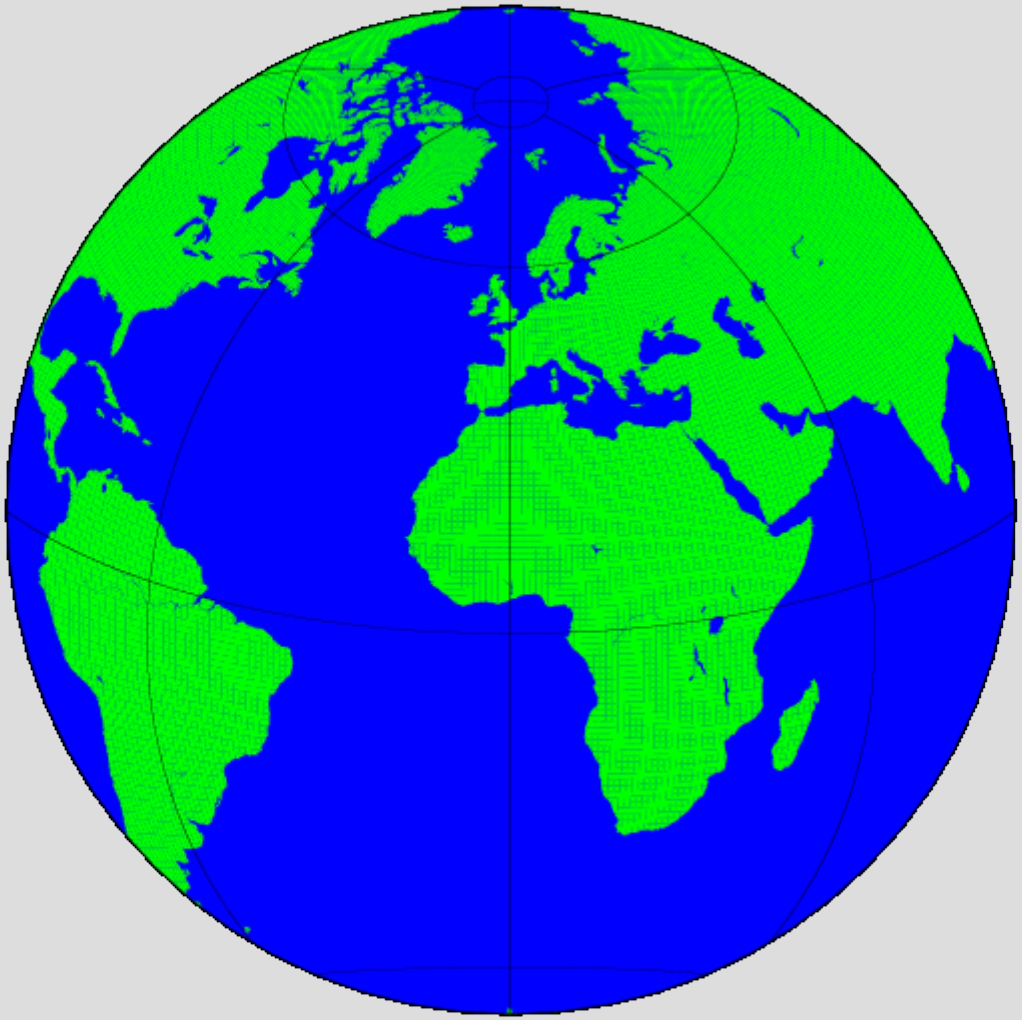


(Only very rudimentary implementation; there are previous attempts on python-GMT, and a proper interface is in the works.)

Making movies with GMT

- Write a script that loop through parameters
- Convert PS to GIF
- Use `gifsicle` or similar to make a GIF movie

Making movies with GMT



Making movies with GMT

Terminal

File Edit View Terminal Tabs Help

Terminal | Terminal

```
#!/bin/bash

i=1
lon=0
while [ $lon -lt 360 ];do
    il=`echo $i | gawk '{printf("%05i",$1)}'` # for labeling
    pscoast -Rg -JA$lon/20/7 -Bg60 -Df -A5000 -Sblue -Ggreen > tmp.ps
    /usr/bin/convert -rotate 90 tmp.ps tmp.$il.gif
    rm tmp.ps
    ((i=i+1))
    ((lon=lon+5))
done
gifsicle tmp.000*gif > wmov.gif
```