

## USING THE USGS VERSION OF SOURCE PARAMETER IMAGING (LOCAL.BAT & LOCDEP.EXE)

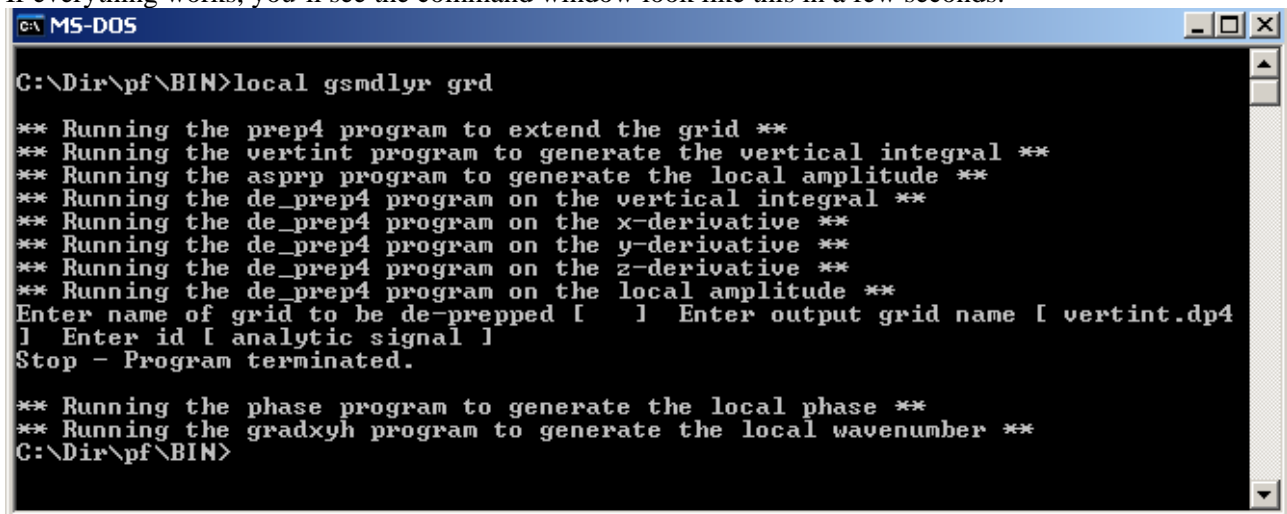
### LOCAL.BAT:

These instructions are for when you are assuming a thin sheet model for the source of the magnetic anomalies. If you want to assume sloping contacts with infinite depth extent, then use the horizontal gradient of the total field as the input grid. The pertinent papers are: Thurston & Smith, 1997, *Automatic conversion of magnetic data to depth, dip, and susceptibility contrast using the SPI™ method*, Geophysics, v. 62, #3, p. 907-813. See also, Smith et al., 1998, *iSPI™ - the improved source parameter imaging method*, Geophysical Prospecting, v. 46, p. 141-151.

1. Use PFdriver08 to change your GS binary(\*.grd) [not Surfer 7(\*.grd)] grid of to USGS format with a descriptive 8-character file name.
2. Put that grid into the directory that holds the USGS Potential Field software. If it is not in c:\pf\bin then you will have to fix a couple of their files as they fix the subdirectory to the one they use. You'll know this happened if the local.bat file doesn't complete. The files to fix are: 1STVER.PRM, 1STVER.PRM, FFTINV.PRM, FFTFWD.PRM. Look for wrong drives or directories in these file (and maybe another), fix them and save them with NOTEPAD.EXE
3. At the command prompt in the appropriate directory:

LOCAL.BAT grid\_prefix grid\_suffix e.g. "local mygrid grd"

If everything works, you'll see the command window look like this in a few seconds:



```
C:\Dir\pf\BIN>local gsmdlyr grd
** Running the prep4 program to extend the grid **
** Running the vertint program to generate the vertical integral **
** Running the asrpr program to generate the local amplitude **
** Running the de_prep4 program on the vertical integral **
** Running the de_prep4 program on the x-derivative **
** Running the de_prep4 program on the y-derivative **
** Running the de_prep4 program on the z-derivative **
** Running the de_prep4 program on the local amplitude **
Enter name of grid to be de-prepped [  ] Enter output grid name [ vertint.dp4
] Enter id [ analytic signal ]
Stop - Program terminated.
** Running the phase program to generate the local phase **
** Running the gradxyh program to generate the local wavenumber **
C:\Dir\pf\BIN>
```

4. You will now have a number of new files in the subdirectory. All of these result from the work/theory of Thurston & Smith (1997) as implemented by J. Phillips, USGS.

LOCAL.BAT produces several grids as it runs; the immediately important among those are:

- PHASE.H (this is the local wavenumber of the first vertical integral and its peaks define the edges of causative sources)
- PHASE.GRD (the local phase of the first vertical integral)
- VERTINT.DP4 (a USGS grid of the first vertical integral)
- VERTINT.AS (the local amplitude of the first vertical integral)
- VERTINT.Z (vertical derivative of the first vertical integral)

- VERTINT.Y (horizontal (y) derivative of the first vertical integral)
- VERTINT.X (horizontal (x) derivative of the first vertical integral)

**LOCDEP.EXE** – this USGS program uses the results of LOCAL.BAT to estimate location, depth, dip, etc.

LOCDEP.EXE passes a 5x5 window over the wavenumber and derivative grids to make its estimates. You input the acceptable error. You can watch several windows and determine if you want to change what you are accepting – experiment.

When LOCDEP.EXE finishes, it writes **LOCDEP.PST** a USGS post file a binary file that you must convert to ASCII before you can deal with it in SURFER.

P2A.EXE does the post file to ASCII file conversions:

- P2A in the command window
- Infile = LOCDEP.PST
- Outfile = LOCDEP.ASC (or .DAT)

Now you can use post and classed post maps to look at your results or, grid the depths and take a look. Compare to HDEP.EXE, and ASDEP.EXE.

#### **Pertinent resources:**

1. <http://pubs.usgs.gov/of/1997/ofr-97-0725>

2. LOCAL.HLP

This procedure takes a PLUGGED potential-field anomaly grid and computes:

- (1) the first vertical integral (called VERTINT.DP4),
- (2) horizontal and vertical derivatives of the first vertical integral (called VERTINT.X, VERTINT.Y, VERTINT.Z),
- (3) the local amplitude of the first vertical integral (VERTINT.AS),
- (4) the local phase of the first vertical integral (PHASE.GRD), and
- (5) the local wavenumber of the first vertical integral (PHASE.H).

All output grids are plugged, and may need to have holes restored using the mask option of ADDGRD.

USAGE: local P1 P2

P1 is the file name prefix of the PLUGGED input anomaly grid.

P2 is the file name suffix of the PLUGGED input anomaly grid.

#### **EXAMPLE:**

To compute the local amplitude, phase, and wavenumber grids associated with the PLUGGED grid file MYDATA.PLG,

type: local MYDATA PLG

Reference: Thurston, J.B., and Smith, R.S., 1997, Automatic conversion of magnetic data to depth, dip, and susceptibility contrast using the SPI (TM) method:

Geophysics, v.62, no.3, p.807-813.

SEE ALSO: ADDGRD adds (subtracts, multiplies, divides, or masks) two grids.

PLUGGRID fill holes in a grid prior to prepping.

LOCDEP uses the local wavenumber grid and the vertical and horizontal derivative grids to estimate locations, depths, strikes, dips, and susceptibility contrasts across magnetic contacts.

PROGRAMS USED BY LOCAL: PREP4, VERTINT (FFTFIL, F\_POT), ASPRP (SP\_X, TRANSPOS, FFTFIL, ANALYTIC), DE\_PREP4, PHASE, GRADXYH)

Written by Jeff Phillips.

### 3. LOCDEP.HLP

Estimates parameters of magnetic contacts (location, depth, strike, dip angle, dip azimuth, magnetic susceptibility contrast) from a grid of the local wavenumber of the magnetic field, along with grids of the horizontal and vertical derivatives of the magnetic field, and the local geomagnetic field parameters (inclination, declination, magnitude). The contacts are assumed to have infinite depth extent, so it may be a good idea to use the local wavenumber (and derivatives) of the first vertical integral of the magnetic field instead (see LOCAL.HLP). The local wavenumber is computed as the horizontal gradient magnitude of the local phase (using GRADXYH, GRADIENT, or OUNDARY). The local phase is computed from the first horizontal and vertical derivatives of the magnetic field (or first vertical integral of the magnetic field) using PHASE. The first horizontal and vertical derivatives are computed using AS. The first vertical integral can be computed using VERTINT. Local geomagnetic field parameters can be calculated using IGRFPT.

A 5x5 data window is passed over the local wavenumber grid. Within each window, an attempt is made to find several maxima and determine a linear trend (strike) for the maxima. If the attempt is successful, a depth and standard error are estimated from data within a belt perpendicular to the linear trend. Horizontal and vertical derivatives are used to estimate the dip angle, dip azimuth, and magnetic susceptibility contrast across the contact. These parameters are estimated assuming that the total magnetization is parallel (or antiparallel) to the local geomagnetic field. Normally a user should start by plotting data windows in order to get a feel for the largest acceptable standard error. Once the user is confident of his/her parameters, he/she can restart the program by entering the letter 'q'. Output is sent to the post file LOCDEP.PST, which contains the fields:

- post(1)=depth
- post(2)=%error in depth
- post(3)=strike of contact
- post(4)=dip angle
- post(5)=dip azimuth
- post(6)=susceptibility contrast

The data locations can be plotted with the programs PLOTDEP or DETOUR. The post file information can be converted to IMVIS image overlay files using DEP2RAW, DIP2RAW, or CDIP2RAW, and REORDER. Unless the IMVIS images use the "None" projection, the post file must first be unprojected using GENPROJ.

Reference: Thurston, J.B., and Smith, R.S., 1997, Automatic conversion of magnetic data to depth, dip, and

susceptibility contrast using the SPI (TM) method:  
Geophysics, v.62, no.3, p.807-813.