

NAME

sacdata2inv – processes SAC data files for moment tensor inversion by mtinv

SYNOPSIS

sacdata2inv par=(string) path=(string) respdir=(string) [no]dumpsac [no]verbose [no]parallel

DESCRIPTION

sacdata2inv takes input from command line and the parameter file mtinv.par (same PAR file used by glib2inv, and mtinv) about the station information, window processing, filtering. The path parameter points to the directory path where the 3-component SAC files are located. The application generates input files for moment tensor inversion using "mtinv" *.data files one per station.network.location. The directories of the SAC files and Sac Pole and Zero response correction files are scanned automatically. The data files are processed, detrended, bandpass filtered, interpolated, windowed, scaled to the correct units, tapered and rotated into the Vertical, Radial and Transverse (Z,R,T) coordinate system. Writes out *.data files for mtinv. The stations are specified in mtinv.par (see below for format).

Processing steps (data and Green's functions processed identically):

- 1 scale amplitudes after converting meters to centimeters
- 2 remove trend
- 3 window in time
- 4 correct instrument response (counts -> volts -> meters displacement)
- 5 remove the amplitude of first sample (avoids truncated step function artifact)
- 6 bandpass filter
- 7 differentiate from displacement to velocity (if needed)
- 8 convolve source-time function (triangle or trapezoid; default is do nothing--delta function)
- 9 bandpass filter
- 10 interpolate using fft to new sampling rate
- 11 taper, only taper data since synthetics are not windowed
- 12 rotate channels 1 and 2 horizontals to radial and transverse or tangential
- 13 compute and store signal-to-noise ratios for each channel using signal and pre-event windows

New Features:

- (1) Rotational Green's functions
- (2) Mij formatted Green's functions

REQUIRED PARAMETERS

par={string}

The file name of the mtinv.par parameter file. See format of this file below (PARAMETER FILE FORMAT).

path={string}

The relative or absolute path to where the SAC files are stored. Use rdseed -d -p -f myrdseed.seed to extract SAC and SAC pole zero files from a seed file. Since rdseed is deprecated, then use unpack.csh.

respdir={string}

The relative or absolute path to where the SAC pole zero files are stored. Use rdseed -d -p -f myrdseed.seed to extract SAC and SAC pole zero files from a seed file. Since rdseed is deprecated,

then use unpack.csh.

OPTIONAL PARAMETERS

[no]verbose

Verbosity output for debugging is *verbose* and for no verbosity output is *noverbose* [optional, default no verbose].

[no]dumpsac

Write out "Dump" the processed data as SAC formatted binary files [optional, default nodump].

[no]parallel

The parallel option performs processing of each station in separate thread simultaneously (up to 50) otherwise serial operation processes each station at a time (default off).

PARAMETER FILE FORMAT (usually named **mtinv.par**)

A '#' in the first column signifies that the following is a non printing comment. Also used to remove station from mtinv. Use (y or n) column 15 to predict instead of removing a station.

CM A 'CM' in columns 1-3 marks the beginning of a comment, typically the region, area, city and country name for reference purposes only.

OT A 'OT' in columns 1-3 is followed by the earthquake origin time string in year/month/day,hour:minute:seconds format, (e.g., 2005/06/12,15:41:46.000 or 2005-06-12T15:41:46.000). Origin time is required for setting the origin time in the synthetics and shifting the observed seismograms in time to improve the fit the synthetics and percent double couple component.

EV A 'EV' in columns 1-3 is followed by six free formatted floating point values: strike, dip, rake, Mw, event_longitude, event_latitude, and event_depth. Only event_longitude and event_latitude need to be set for the correct calculation of the source and receiver azimuth and distance. Should be the same as the *evla=* and *evlo=* values used to calculate the Green's function library using "mkgrnlib". Other values can be set to zero and are only used to forward calculate synthetic ground displacements when the dump option is set (dumpsac).

MT (OPTIONAL - EXPERIMENTAL)

A 'MT' in columns 1-3 is followed by seven free formatted floating point values: Mxx, Mxy, Mxz, Myy, Myz, Mzz, Mo. The normalized moment tensor elements and seismic moment in dyne*cm.

All other lines are for station and synthetic data processing parameters. There are 18 columns in the following order:

sta, net, loc, model, np, pas, lf, hf, nt, dt, tr, tt, grdmo, mulfac, used, ts, weight, wavetype, comments

sta station code (see stadb file).

net network code (see stadb file).

loc location code (empty quotes for null "" otherwise 00, 10, 01, 02, 60, etc...)

model velocity model name (without .mod extension)

np number of poles (0,1,2,3,4) for Butterworth bandpass filter

pas number of passes (1 or 2) for Butterworth bandpass filter

lf low frequency corner in Hz for Butterworth bandpass filter

hf high frequency corner in Hz for Butterworth bandpass filter

nt number of points (in power of 2)

dt sampling rate in sec/sample

tr rise time or duration of ramp in trapezoid function in seconds

tt duration of boxcar portion of trapezoid function in seconds (tt=0 then triangle function of duration 2*tr)

grdmo(v or d) Ground motion type is either 'd' for displacement or 'v' for velocity (no default)

mulfac Multiplication factor applied to all components for this station. Useful for applying gain corrections easily. Default is 1.

used (y or n) Use this station for inversion 'y' or just make a prediction 'n'

ts Time shift in sec for all components in seconds. Negative is backward time shift in time and positive shifts are forward shift in time. Default is 0;

weight Weight factor applied in A matrix in MT inversion

wavetype Green's function: Surf/Pnl or Rotational

comments Free format comments are allowed after column 18. In autogenerated file src-rec distance and azimuth are listed for reference.

EXAMPLE PARAMETER FILE (mtinv.par)

```
##### REGION COMMENT #####
CM New Madrid, MO
##### Date and Origin Time #####
OT 2021-11-18T02:53:04.00
##### Forward Calculations #####
##  stk  dip  rak  Mw  evlo  evla  Z #####
EV -999.0 -999.0 -999.0 0.0 -90.543 36.9077 15.0
#####
#sta net loc mod np pas lf hf nt dt tr tt v/d mulfac used ts0 wt wvtyp #
CGM3 NM 00 cus 3 2 0.075 0.15 1024 0.05 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=89 Az=61
PENM NM 00 cus 3 2 0.075 0.15 1024 0.05 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=96 Az=122
HENM NM 00 cus 3 2 0.075 0.15 1024 0.05 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=97 Az=102
GNAR NM 00 cus 3 2 0.075 0.15 1024 0.05 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=114 Az=156
CCM IU 00 cus 3 2 0.075 0.15 1024 0.07 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=141 Az=334
CCM IU 10 cus 3 2 0.075 0.15 1024 0.07 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=141 Az=334
SIUC NM 00 cus 3 2 0.075 0.15 1024 0.07 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=147 Az=52
SLM NM "" cus 3 2 0.075 0.15 1024 0.08 0.0 0.0 d 1.0 y +0.0 1.0 Surf/Pnl # R=193 Az=8
#####
#WVT IU 00 cus 3 2 0.075 0.15 1024 0.11 0.0 0.0 d 1.0 n +0.0 +1.0 Surf/Pnl # R=257 Az=109
```

```
#WVT IU 10 cus 3 2 0.075 0.15 1024 0.11 0.0 0.0 d 1.0 n +0.0 +1.0 Surf/Pnl # R=257 Az=109
```

Example C-Shell Script

```
#!/bin/csh
### PROCESS DATA ### sacdata2inv par=mtinv.par path=../Data respdir=../Resp noverbose nodumpsac
parallel
```

SEE ALSO

glib2inv(1), *setupMT(1)*, *mtinv(1)*