LinSlipInv

## General input files

List of the general input files:

|  |  |  |
| --- | --- | --- |
| Name | Needed by | Purpose |
| *input.dat* | DWN  Inversion codes  Graphical codes | Information about the source (moment, mechanism, fault dimensions), discretization in time and space, filtering frequencies, time windows, etc. |
| *SlipInvSVD.in* | Inversion codes | Information regarding the slip inversion (synthetic vs. real data, truncation, smoothing, etc.) |
| *crustal.dat* | DWN  Inversion codes | Information about the crustal model (1D homogeneous layers). |
| *stations.dat* | DWN  Inversion codes | List of station coordinates. Can be created by conversion from lat, lon using stations.f90. |
| *stainfo.in* | Inversion codes  Plot of seismogr. | Specifies which stations/components are to be used in the inversion, individual station component weights and station names. |
| *rvseis[nez].dat* | Inversion codes | N, E, Z components of seismograms to be inverted if real-data inversion is chosen. |

In the following the individual input files are described in detail:

input.dat

This input file is almost self-explanatory:

No. of computed frequencies (should be larger than half of the temporal discretization)

130

Length of seismograms, slip rate time window, start and end time for waveform comparison (sec)

102.4 10. 30. 70.

Artificial time shift (sec)

30.

Number of receivers (waveforms, GPS)

56 0

Spatial discretization along strike and dip

35 20

Scalar seismic moment (Nm)

1.06d19

Strike Dip Rake

90. 80. 180.

Depth of fault reference point (m)

10.

Length and width of the fault (m)

35000. 20000.

Position of reference point on the fault (m)

17500. 20000.

Temporal discretization

256

Rupture velocity (m/s)

3000

Number of filter ranges, followed by corner frequencies

1

0.05 .5

SlipInvSVD.in

Data (0 = read from files, 1 = synth. data, -1 = synth. data – read from file)

1

10 5

Std.dev for slip rate (0 = no smoothing), Std.dev for GF's, GPS weight, M0 constraint weight, Weight of additional constraint

1.d0 0.01 .1d0 1.d0 0.d0

Station component weights (1=no distance distance-dependent weights, 2=distance-dependent weights)

1

Choice of use of eigenvectors (see further)

1

1: single minimum singular value, 2: defined min and max number of eigenvectors to be considered

100.

Additional temporal shift (in sec)

0.

Compact SVD (0=NO, 1=YES - then it is not possible to use ANNLS)

1

Explanations:

|  |  |  |
| --- | --- | --- |
| Data | Option number |  |
|  | 0 | data are read from files rvsei[nez].dat |
|  | 1 | synthetic data are created assuming a point source on fault plane location specified at the same input line (0 0 for Haskell-like model) |
|  | -1 | Target model is read from file specified on the next line |
| Weights | Five values in a row |  |
|  | 1st | Std. dev for slip velocity (typically 1., 0. = no smoothing), |
|  | 2nd | Std. dev for GF's |
|  | 3rd | General weight of GPS |
|  | 4th | Weight of M0 constraint (typically 1) |
|  | 5th | Weight of additional slip constraint (0. = not applied) |
| Station component weights | Option number | Note: weights are modified according to stainfo.dat |
|  | 1 | No distance dependent weights |
|  | 2 | Weights according to the fault distance R (max(R,L/4)/(L/4), L being fault length); resulting weights are written in file stainfo.out. |
| Use of eigenvectors | Option number |  |
|  | 1 | Defined single cut-off singular value (by means of fraction of the largest singular value) |
|  | 2 | Defined min and max number of eigenvectors to be taken into account |
| Eigenvector specifications | Value(s) | Specify values according to the option above |
| Additional temporal shift | Value | Specify additional data shift (in sec) |
| Compact SVD | Option number |  |
|  | 0 | Do not use compact SVD (waste of memory if Augmented NNLS is not used) |
|  | 1 | Use compact SVD (Augmented NNLS cannot be applied) |

crustal.dat

Another self-explanatory input file:

Crustal model (free format)

number of layers

2

Parameters of the layers

depth of layer top(km) Vp(km/s) Vs(km/s) Rho(g/cm\*\*3) Qp Qs

0.00 4.00 2.000 2.600 9000. 9000.

1.00 6.00 3.464 2.700 9000. 9000.

The first layer has to be always 0.00 (free surface). The model finishes below the last interface by a homogeneous half-space.

stations.dat

An example of this input file:

13.9579 8.4784 0. STA1

9.1667 7.6681 0. STA2

The columns are:

#1: X distance from the reference point to the north (in km)

#2: Y distance from the reference point to the east (in km)

#3: Depth of the station (in km)

#4: Optional station name

stainfo.dat

An example of this input file:

1 1 1 1. 1. 1. 1 I01

1 1 1 1. 1. 1. 1 I02

The columns are:

#1-3: For N, E, Z components either 1 or 0 to select whether the station component is or is not used in the inversion, respectively

#4-6: Weights of N, E, Z components

#7: Refers to the number of the filter range specified in file input.dat.

#8: Station name (used just for seismogram plotting)

rvseis[nez].dat

Three files consisting of displacement seismograms sampled, time shifted and filtered according to the specification in *input.dat*. The file format is as follows: the first column corresponds to time and the other columns give amplitudes for all the stations. Note that the filtering must be exactly the same as the filtering of GFs utilized in the inversion code (see *CreateGandD.f90*).

## Main output files

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Created by | Input for | Purpose |
| *NEZsor.dat* | DWN | Inversion codes | Contains all Green’s functions. |
| *mtilde.dat* | Inversion codes | Graphical codes | Result of the inversions: slip rate samples along time and space in a single column. The order of the samples is as follows:  do k=1,NW !Samples along dip  do j=1,NL !Samples along strike  do i=1,NT !Time samples  May consists of several columns if applicable. |
| *mtildeslip2D.dat* | Inversion codes | Graphical codes | Inverted model in terms of static slip distribution in a matrix format. |
| *srcmod.dat* | Inversion codes |  | Result of the inversions in the srcmod format. |
| *rvseisnez.dat* | Inversion codes | Graphical codes | Parts of input seismograms that are actually used in the inversion. In case of synthetic tests the file contains synthetics of the target model. |
| *svseisnez.dat* | Inversion codes | Graphical codes | Parts of output seismograms that are actually used in the inversion. Seismograms due to the inverted model. |
| *singularvalues.dat* | SlipInvSVD1 |  | Singular values of the forward matrix (including smoothing, M0 constraint, etc., if considered). |
| *singularvectors.dat* | SlipInvSVD1 |  | 10 first singular (i.e. eigen) vectors in columns. The column format is the same as in case of mtilde.dat |

## AXITRA for Green’s function calculations

AXITRA consists of three codes. The best way is to use batch files *firststep.sh* and *calculate.sh*. The first file compiles all the codes and runs code *prepare.f90* for preparation of the AXITRA calculations, in particular it prepares list of elementary sources covering the rupture in regular grid.

Then, a parallel loop using *xargs* is to be started by *calculate.sh*. The number of processors can be set in the batch file. For each elementary source the codes *gr\_nez.for* and *cnv\_nez.for* are run automatically. Intermediate results including Green’s functions (GFs) for the individual elementary sources are stored in the *dat* directory. Finally, the Green’s functions are resorted by *resort.f90* into the *NEZsor.dat* file. Note that the order of the GFs is such that the outer loop is over stations. Thus if more crustal models are to be considered, the *NEZsor.dat* files for the individual subsets of stations and then simply appended one after each other.