SC2SEI
Automatic transfer of phase readings and waveforms from a SeisComp3 data base to a SEISAN data base

Version 1.0

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Questions and suggestions

Any questions or suggestions concerning the software can be sent to the email addresses on the front page.

1 INTRODUCTION

Within the seismological community one of the most popular data acquisition and automatic processing system is the SeisComp3(SC3) system (seiscomp3.org). The system is maintained by Gempa (gempa.de). The system has limited facilities for manual processing of events, so many people choose to transfer the data to the SEISAN analysis software for further processing (Havskov and Ottemöller (1999), www.seisan.info). However this is a slightly cumbersome task since the data manually has to be extracted out of the SC3 relational data base (based on date and time and component) and then manually inserted into the SEISAN data base.

The SC2SEI utility is an attempt to make a simple interface to automatically extract triggered and located events recorded by SC3 and store them in the SEISAN database complete with phase readings, locations and magnitudes as well as a corresponding extracted waveform file. The data in the SEISAN data base will then be ready for the operator for further processing.
SEISAN can also read the continuous data from the SC3 archive so manual extraction of events with SEISAN can be done as well as offline event detection, both using the SC3 archive. The combination SC3-SEISAN will then provide the user with a good system for both automatic and manual processing.

This version of SC2SEI must run on the same computer as the SC3 and SEISAN as utilities in both systems are used.

Version 1.0 is a beta version and any feedback will be appreciated.

2 INSTALLATION

Pre-requisites:

SEISAN installed according to SEISAN documentation.
SC3 installed according to SC3 documentation.

2.1 STEP-BY-STEP installation of SC2SEI

STEP 1:

It is assumed there is a user account in where SC2SEI can be installed. If not or you want to use a separate account, first create a user account with a username and directory name. An account **seismo** will be used throughout this manual, but any account name will work.

Username: **seismo**
Password: selected by the user.

Making this account will create a home directory: /home/seismo.

Log into this account to start the installation.

STEP 2:

Copy the distribution tar file into your /home/seismo directory and extract the distribution files:

gunzip sc2sei_v1.00.tar.gz
tar -xvf sc2sei_v1.00.tar

A new directory SC2SEI will be created with the subdirectories:

bin	executables
par	parameter files
slinktool	modified version of the SC3 slinktool
src	sc2sei source files and Makefile

STEP 3:

Change to the SC2SEI directory and type:

make clean
make all
make install

the sc2sei re-compiled executable is now stored in the SC2SEI/bin directory.

NB! Add the SC2SEI/bin to the path of your system.

3 How SC2SEI works

SC3 is often operated with both local and remote stations and will thus, in addition to triggering on local events, also trigger on distant events which might not be of interest for the local monitoring. SC2SEI has therefore implemented a latitude-longitude and magnitude window within which the event must occur to be transferred to SEISAN. SC3 must be running for SC2SEI to work. To ensure this, SC2SEI enters a loop checking if SC3 is active. When SC3 is active, SC2SEI will continue.

The program can work in two different modes:

- The program is started to extract out data in a given time interval *-begin* to *-end*. When all data from this time window is extracted, the program exits.
- The program runs continuously to extract out data shortly after an event has been processed by SC3. An input parameter tells the program how far back in time it should start to look for data. When all data up until current time has been transferred, the program will continue checking for new events every minute. When data up to current time has been extracted, the next waveform extracts is delayed post event time to ensure data availability.

In both modes, the main tasks performed by SC2SEI are:

- Checks if the magnitude is within the range specified in the parameter file.
- Checks if the location is within the area specified in the parameter file.
- A waveform file (MiniSeed format) with the detected event is extracted from the SC3 archives and stored in the SEISAN database, the S-file is created with the corresponding link to the waveform file. The SC3 archives are normally several days or weeks long. This is a SC3 parameter.

SC2SEI does not transfer all SC3 parameters. Currently the following are transferred:
origin time, hypocentre, magnitude (ml assumed), number of stations used, residuals each p-phase reading, rms residual and all automatic p-phase readings.
As agency is not available in the SC3 bulletin, agency in the s-file is set to SC3.
In addition, the user must make his own SEISAN station and model file and the response files. In a future version of SC2SEI this might be automated.

SC2SEI takes 4 command line arguments:

-time	n	number of hours to check back in time at startup. Note: -time cannot be used together with -begin and -end.
-u	username	username SC3 database
-p	password	password SC3 database
-begin	time1	format: “2012-01-28 10:30:00”
-end	time2	format: “2012-01-30 15:30:00”

- The username and password must always be present.
- The -time n option will extract data from the n hours back in time until current time and continue checking for new events every minute.

- The -begin time1 -end time2 will extract events from time1 to time2 and exit. The format must be as shown above (as for SC3).

Start sc2sei:

The command below will start *sc2sei*, look for events back in time 1 hour, and it will log in to the database with the username *alfa* and password *beta*.

sc2sei -time 1 -u alfa -p beta

The command below will start *sc2sei*, look for events in the time window from *-begin* to *-end*, and it will log in to the database with the username *alfa* and password *beta*. Then it will exit.

sc2sei -u alfa -p beta -begin "2012-01-28 10:30:00" -end "2012-01-30 15:30:00"

NB! -time cannot be used together with -begin and -end

3.1 Starting sc2sei as a cron job.

Cron jobs can be set up to run sc2sei. An example is shown below (edit the two files below to fit your installation):

cron_restart.bash

```
#!/bin/bash
#
MAILTO=""
PROCESS='sc2sei'
if ps ax | grep -v grep | grep $PROCESS > /dev/null
then
echo "SC2SEI running, EXIT"
exit
else
echo "$PROCESS is not running"
echo "start the process"
echo "Start $PROCESS !"
#echo "put in the start command here"
/home/seismo/SC2SEI/par/start_sc2sei.bash &
fi
```

start_sc2sei.bash

```
#!/bin/bash
source /home/seismo/COM/SEISAN.bash
export SEISCOMP_ROOT=/home/seismo/seiscomp3
export PATH=/home/seismo/seiscomp3/bin:$PATH
export LD_LIBRARY_PATH=/home/seismo/seiscomp3/lib:$LD_LIBRARY_PATH
export PYTHONPATH=/home/seismo/seiscomp3/lib/python:$PYTHONPATH
export MANPATH=/home/seismo/seiscomp3/share/man:$MANPATH
cd /home/seismo
/home/seismo/SC2SEI/bin/sc2sei -time 1 -u alfa -p beta  &
```

Run crontab –e and add the following line to check every 2 minutes that sc2sei is running. If not running, it will be re-started.

```
*/2 * * * * /home/seismo/SC2SEI/par/cron_restart.bash >/dev/null 2>&1
```

4 PARAMETER FILES

4.1 Overview of parameter files.

SC2SEI needs 2 parameter files as input:

sc2sei.par is used to configure sc2sei to look for events within a certain range of magnitude and geographical area.
It also specifies the name of the SEISAN database where the waveform and s-files are to be stored.

sc2sei.cfg is used for sc2seis to specify which station components are to be extracted from the Seiscomp3 archives.

4.2 sc2sei.par

```
This file is parameter file for SC2SEI.
Only the lines with recognized keyword under KEYWORD will be read.
The comments have no importance.
Columns Par 1-Par 2 start in columns 41,51.


All keywords in capital letters.

KEYWORD.............Comments..............Par 1.....Par 2
-----------------------------------------name of SEISAN database-----------------------
DBASENAME           For SEISAN           SC3__
-----------------------------------------pre-event in seconds--------------------------
PRE_EVENT           Pre-event (seconds)  60
-----------------------------------------post-event in seconds-------------------------
POST_EVENT          Post-event (seconds) 240
-----------------------------------------magnitude min---------------------------------
MAG_MIN             Minimum magnitude    2.0
-----------------------------------------magnitude max---------------------------------
MAG_MAX             Maximum magnitude    9.0
-----------------------------------------latitude min----------------------------------
LAT_MIN             Minimum latitude     -40.0
-----------------------------------------latitude max----------------------------------
LAT_MAX             Maximum latitude     -10.0
-----------------------------------------longitude min---------------------------------
LON_MIN             Minimum longitude    -80.0
-----------------------------------------longitude max---------------------------------
LON_MAX             Maximum longitude    -50.0
```

DBASENAME	SEISAN database name (up to 5 letters)
PRE_EVENT	Number of seconds to record before the SC3 origin time.
POST_EVENT	Number of seconds to record after the origin time.
MAG_MIN	Minimum magnitude.
MAG_MAX	Maximum magnitude.
LAT_MIN	Minimum latitude.
LAT_MAX	Maximum latitude.
LON_MIN	Minimum longitude.
LON_MAX	Maximum longitude.

4.3 sc2sei.cfg

The sc2sei.cfg file specifies which stations and components to be extracted from the SC3 archives. The format is column specific:

The top line RECORD CHILE1 is just a header.
NW Network name
STAT Station name
LOC Location (no location is specified as ..)
CMP Component

```
RECORD CHILE1
NW STAT  LOC CMP
CX PB01  ..  BHZ
CX PB01  ..  BHN
CX PB01  ..  BHE
CX PB02  ..  BHZ
CX PB02  ..  BHN
CX PB02  ..  BHE
CX PB03  ..  BHZ
CX PB03  ..  BHN
CX PB03  ..  BHE
CX PB04  ..  BHZ
CX PB04  ..  BHN
CX PB04  ..  BHE
CX PB05  ..  BHZ
CX PB05  ..  BHN
CX PB05  ..  BHE
CX PB06  ..  BHZ
CX PB06  ..  BHN
CX PB06  ..  BHE
CX PB07  ..  BHZ
CX PB07  ..  BHN
CX PB07  ..  BHE
CX PB08  ..  BHZ
CX PB08  ..  BHN
CX PB08  ..  BHE
CX PB09  ..  BHZ
CX PB09  ..  BHN
CX PB09  ..  BHE
CX PB10  ..  BHZ
CX PB10  ..  BHN
CX PB10  ..  BHE
CX PB11  ..  BHZ
CX PB11  ..  BHN
CX PB11  ..  BHE
CX PB12  ..  BHZ
CX PB12  ..  BHN
CX PB12  ..  BHE
CX PB14  ..  BHZ
CX PB14  ..  BHN
CX PB14  ..  BHE
```

```
CX PB15  ..  BHZ
CX PB15  ..  BHN
CX PB15  ..  BHE
CX PB16  ..  BHZ
CX PB16  ..  BHN
CX PB16  ..  BHE
CX MNMCX ..  BHZ
CX MNMCX ..  BHN
CX MNMCX ..  BHE
CX PATCX ..  BHZ
CX PATCX ..  BHN
CX PATCX ..  BHE
CX PSGCX ..  BHZ
CX PSGCX ..  BHN
CX PSGCX ..  BHE
```

5 Files in distribution

SC2SEI/Makefile	Makefile for all source codes
SC2SEI/bin/sc2sei	executable of SC2SE
SC2SEI/bin/getwindow	executable of modified slinktool. Does not reconnect after timeout.
SC2SEI/par/sc2sei.cfg	configuration file
SC2SEI/par/sc2sei.par	parameter file
SC2SEI/par/cron_restart.bash	cron file
SC2SEI/par/start_sc2sei.bash	file to start SC2SE from cron file
SC2SEI/slinktool/libslink	original seedlink library files needed for getwindow
SC2SEI/slinktool/src	source slinktool and getwindow
SC2SEI/src	source code for sc2sei

6 REFERENCES

Havskov, J and L. Ottemøller (1999). SEISAN earthquake analysis software. Seismological Research letters, 70, 532-534. For current version see seisan.info.
Seiscomp3, Gempa, Potsdam, Germany. See www.seiscomp3.org

7 Console output examples

Start sc2sei in continuous mode and look for data 1 hour back in time

```
rt>/home/seismo/SC2SEI/bin/sc2sei -time 1 -u alfa -p beta
seedlink: not running.......wait....
```

SC3 not active, wait until started by operator

```
seedlink: not running.......wait....
seedlink: not running.......wait....
seedlink: 3467  running, continue
pretime: 3600
SC2SEI: SEISCOMP_ROOT.........: /home/seismo/seiscomp3
SC2SEI: SEISAN_TOP............: /home/seismo
SC2SEI: SC2SEI................: /home/seismo/SC2SEI
SC2SEI: Read_Parameters.......: /home/seismo/SC2SEI/par/sc2sei.par
SC2SEI: PRE_EVENT.............:  60 seconds
SC2SEI: POST_EVENT............: 180 seconds
SC2SEI: LAT_MIN...............: -40.00
SC2SEI: LAT_MAX...............: -10.00
SC2SEI: LON_MIN...............: -80.00
SC2SEI: LON_MAX...............: -50.00
SC2SEI: MAG_MIN...............:  2.00
SC2SEI: MAG_MAX...............:  9.00
SC2SEI: DBASENAME.............: SC3__
SC2SEI: WAVE_DB_ACTIVE........: 1
SC2SEI: WAVEDIR...............: /home/seismo/WAV
************ Read sc2sei ****************************
SC2SEI: Read_Config_to_MEM.....: /home/seismo/SC2SEI/par/sc2sei.cfg
number of lines in parameter file:  56
request_mode: 0
```

No data to extract at startup, check every minute

```
Setting start to 2015-04-01 12:43:34
Setting end to 2015-04-01 13:43:34
Setting start to 2015-04-01 13:39:34
Setting end to 2015-04-01 13:44:34
Setting start to 2015-04-01 13:40:34
Setting end to 2015-04-01 13:45:34
Setting start to 2015-04-01 13:41:34
Setting end to 2015-04-01 13:46:34
Setting start to 2015-04-01 13:42:34
Setting end to 2015-04-01 13:47:34
Setting start to 2015-04-01 13:43:34
Setting end to 2015-04-01 13:48:34
Setting start to 2015-04-01 13:44:34
Setting end to 2015-04-01 13:49:34
Setting start to 2015-04-01 13:45:35
Setting end to 2015-04-01 13:50:35
Setting start to 2015-04-01 13:46:35
Setting end to 2015-04-01 13:51:35
Setting start to 2015-04-01 13:47:35
Setting end to 2015-04-01 13:52:35
Setting start to 2015-04-01 13:48:35
Setting end to 2015-04-01 13:53:35
```

New event, get event id and extract the sc3 bulletin

```
 0 gfz2015gjms
nolines: 1
Extract ID: gfz2015gjms
 0
 1   Alert gfz2015gjms: determined by 7 stations, type A
 2
 3  LOCSAT solution with earthmodel iasp91 (with start solution, 7 stations used, weight 7):
 4
 5   Chile-Bolivia Border Region  M=0.0  2015/04/01  13:51:29.3  21.12 S  68.16 W   10 km
 6
 7   Stat  Net   Date       Time          Amp    Per   Res  Dist  Az mb  ML  mB
 8   PB09  CX  15/04/01  13:51:53.0         0.0  0.0   1.5   1.2 236 0.0 2.5 0.0
 9   PB01  CX  15/04/01  13:51:52.3         0.0  0.0   0.2   1.2 273 0.0 2.4 0.0
10   PB08  CX  15/04/01  13:51:54.8         0.0  0.0   1.1   1.4 316 0.0 2.3 0.0
11   PB07  CX  15/04/01  13:51:56.9         0.0  0.0  -2.1   1.7 249 0.0 0.0 0.0
12   PB06  CX  15/04/01  13:52:03.4         0.0  0.0  -0.4   2.1 219 0.0 0.0 0.0
13   MNMCX CX  15/04/01  13:52:07.8         0.0  0.0  -0.9   2.4 326 0.0 0.0 0.0
14   PB05  CX  15/04/01  13:52:11.4         0.0  0.0   0.5   2.6 227 0.0 0.0 0.0
15
```

```
16  RMS-ERR:         1.14
17
18  First location:  2015/04/01 13:53:19
19  This location:   2015/04/01 13:53:19
20
```

Extract information for SEISAN from bulletin, include pre-event and post-event for extracting waveform data and check if the event is inside the magnitude window and location window.

```
PLINE: M=0.0  2015/04/01  13:51:29.3  21.12 S  68.16 W   10 km
MINTRGTID: 01/04/2015 13:51:29.3
MAGNITUDE: 0.0 LAT: -21.12 LNG: -68.16 DEPTH: 10
```

Magnitude was 0.0, wait 80 seconds for sc3 to finish, and get a new bulletin

```
 0
 1   Alert gfz2015gjms: determined by 7 stations, type A
 2
 3  LOCSAT solution with earthmodel iasp91 (with start solution, 7 stations used, weight 7):
 4
 5   Chile-Bolivia Border Region  M=2.6  2015/04/01  13:51:29.3  21.12 S  68.16 W   10 km
 6
 7   Stat  Net   Date       Time          Amp    Per   Res  Dist  Az mb  ML  mB
 8   PB09  CX  15/04/01  13:51:53.0         0.0  0.0   1.5   1.2 236 0.0 2.5 0.0
 9   PB01  CX  15/04/01  13:51:52.3         0.0  0.0   0.2   1.2 273 0.0 2.4 0.0
10   PB08  CX  15/04/01  13:51:54.8         0.0  0.0   1.1   1.4 316 0.0 2.3 0.0
11   PB07  CX  15/04/01  13:51:56.9         0.0  0.0  -2.1   1.7 249 0.0 2.7 0.0
12   PB06  CX  15/04/01  13:52:03.4         0.0  0.0  -0.4   2.1 219 0.0 2.8 0.0
13   MNMCX CX  15/04/01  13:52:07.8         0.0  0.0  -0.9   2.4 326 0.0 2.9 0.0
14   PB05  CX  15/04/01  13:52:11.4         0.0  0.0   0.5   2.6 227 0.0 0.0 0.0
15
16  RMS-ERR:         1.14
17
18  First location:  2015/04/01 13:53:19
19  This location:   2015/04/01 13:53:19
20
PLINE: M=2.6  2015/04/01  13:51:29.3  21.12 S  68.16 W   10 km
MINTRGTID: 01/04/2015 13:51:29.3
MAGNITUDE: 2.6 LAT: -21.12 LNG: -68.16
SC2SEI:.waveform filename....: 2015-04-01-1350-29.SC3__
SC2SEI:.fullpath and filename: /home/seismo/snew/WAV/SC3__/2015/04/2015-04-01-1350-29.SC3__
SC2SEI:.waveform directory...: /home/seismo/snew/WAV/SC3__/2015/04
 7 stations used, weight 7):
nophases: 7
  PB09  CX  15/04/01  13:51:53.0         0.0  0.0   1.5   1.2 236 0.0 2.5 0.0
  PB01  CX  15/04/01  13:51:52.3         0.0  0.0   0.2   1.2 273 0.0 2.4 0.0
  PB08  CX  15/04/01  13:51:54.8         0.0  0.0   1.1   1.4 316 0.0 2.3 0.0
  PB07  CX  15/04/01  13:51:56.9         0.0  0.0  -2.1   1.7 249 0.0 2.7 0.0
  PB06  CX  15/04/01  13:52:03.4         0.0  0.0  -0.4   2.1 219 0.0 2.8 0.0
  MNMCX CX  15/04/01  13:52:07.8         0.0  0.0  -0.9   2.4 326 0.0 2.9 0.0
  PB05  CX  15/04/01  13:52:11.4         0.0  0.0   0.5   2.6 227 0.0 0.0 0.0
buffer: 04-01-2015  13:54:56.
3636971609.30 - 3636971696.00 =      -86.700
```

Extract waveform data

```
TUMOD network timeout. No data in 2s, next channel
```

non-active stations skipped

```
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
Number of lines: 1
SC2SEI:.......................MINTRGTID: 01/04/2015 13:51:29.3
```

Create SEISAN s-file

```
CREATE_SFILE: S-filename.......: 01-1351-29L.S201504
CREATE_SFILE: S-file path......: /home/seismo/REA/SC3__/2015/04
CREATE_SFILE: S-file full path.: /home/seismo/REA/SC3__/2015/04//01-1351-29L.S201504
S_REC:    IDSFILE: ID:20150401135129
SC2SEI: S_REC.............................: 2015  4 1 1351 29.3   -21.120 -68.160
In S_REC: FILENAME: 2015-04-01-1350-29.SC3__
nchannels: 7
 0 gfz2015gjms
 1
 2
 3
 4
 5
 6
 7
 8
 9
```

Check for new events

```
Setting start to 2015-04-01 13:51:50
Setting end to 2015-04-01 13:56:50
Setting start to 2015-04-01 13:52:50
Setting end to 2015-04-01 13:57:50
```

SEISAN s-file created based on the event above

```
rt>eev 20150401 SC3

 2015  4 Reading events from base SC3__  1
#    1  1 Apr 2015 13:51 29  L -21.120 -68.160 10.0  N 1.1 2.6LSC3    7  ? t

 File name: /home/seismo/REA/SC3__/2015/04/01-1351-29L.S201504
2015  4 1 1351 29.3 L -21.120 -68.160 10.0  SC3  7 1.1                 2.6LSC31
2015-04-01-1350-29.SC3__                                                    6
ACTION:NEW 15-04-01 13:51 OP:SEIS STATUS:              ID:20150401135129     I
 Chile-Bolivia Border Region                                                3
STAT SP IPHASW D HRMM SECON CODA AMPLIT PERI AZIMU VELO SNR AR TRES W  DIS CAZ7
PB09 BZ IP    A  1351 53.0                                      1.50    133 236
PB01 BZ IP    A  1351 52.3                                      0.20    133 273
PB08 BZ IP    A  1351 54.8                                      1.10    155 316
PB07 BZ IP    A  1351 56.9                                     -2.10    189 249
PB06 BZ IP    A  1352  3.4                                     -0.40    233 219
MNMCXBZ IP    A  1352  7.8                                     -0.90    266 326
PB05 BZ IP    A  1352 11.4                                      0.50    289 227
```

Start sc2sei in mode two, extracting events from a time window specified in the example below. When events from the specified window has been extracted, sc2sei exits.

```
/SC2SEI/bin/sc2sei -begin "2015-04-01 12:00:00" -end "2015-04-01 16:00:00" -u alfa -p beta
seedlink: 3467  running, continue
SC2SEI: SEISCOMP_ROOT..........: /home/seismo/seiscomp3
SC2SEI: SEISAN_TOP.............: /home/seismo
SC2SEI: SC2SEI.................: /home/seismo/SC2SEI
SC2SEI: Read_Parameters........: /home/seismo/SC2SEI/par/sc2sei.par
SC2SEI: PRE_EVENT..............:  60 seconds
SC2SEI: POST_EVENT.............: 180 seconds
SC2SEI: LAT_MIN................: -40.00
SC2SEI: LAT_MAX................: -10.00
SC2SEI: LON_MIN................: -80.00
SC2SEI: LON_MAX................: -50.00
SC2SEI: MAG_MIN................:  2.00
SC2SEI: MAG_MAX................:  9.00
SC2SEI: DBASENAME..............: SC3__
SC2SEI: WAVE_DB_ACTIVE.........: 1
SC2SEI: WAVEDIR................: /home/seismo/snew/WAV
************* Read sc2sei ****************************
SC2SEI: Read_Config_to_MEM.....: /home/seismo/SC2SEI/par/sc2sei.cfg
number of lines in parameter file:  56
request_mode: 2
```

```
/home/seismo/seiscomp3/bin/scevtls -d mysql://alfa:beta@localhost/seiscomp3 --begin "2015-04-
01 12:00:00"  --end "2015-04-01 16:00:00"  > newids.txt
Setting start to 2015-04-01 12:00:00
Setting end to 2015-04-01 16:00:00
 0 gfz2015gjms
 1 gfz2015gjnn
 2 gfz2015gjqn
nolines: 3
gfz2015gjms
 0
 1   Alert gfz2015gjms: determined by 9 stations, type A
 2
 3  LOCSAT solution with earthmodel iasp91 (with start solution, 9 stations used, weight 9):
 4
 5   Chile-Bolivia Border Region  M=2.5  2015/04/01  13:51:33.1  21.10 S  68.61 W   99 km
 6
 7   Stat  Net   Date       Time          Amp    Per   Res  Dist  Az mb  ML  mB
 8   PB01  CX  15/04/01  13:51:52.3         0.0  0.0  -0.0   0.8 274 0.0 2.2 0.0
 9   PB09  CX  15/04/01  13:51:53.0         0.0  0.0   0.2   0.9 220 0.0 2.3 0.0
10   PB08  CX  15/04/01  13:51:54.8         0.0  0.0   0.3   1.1 332 0.0 2.1 0.0
11   PB07  CX  15/04/01  13:51:56.9         0.0  0.0  -0.6   1.3 242 0.0 2.5 0.0
12   PB03  CX  15/04/01  13:51:57.9         0.0  0.0  -0.6   1.4 228 0.0 2.5 0.0
13   PB06  CX  15/04/01  13:52:03.4         0.0  0.0  -0.1   1.8 209 0.0 2.7 0.0
14   MNMCX CX  15/04/01  13:52:07.8         0.0  0.0  -0.2   2.2 335 0.0 2.8 0.0
15   PB05  CX  15/04/01  13:52:11.4         0.0  0.0   2.0   2.3 220 0.0 2.9 0.0
16   PB14  CX  15/04/01  13:52:29.7         0.0  0.0  -0.9   3.9 205 0.0 3.7 0.0
17
18  RMS-ERR:         0.79
19
20  First location:  2015/04/01 13:53:19
21  This location:   2015/04/01 15:34:07
22
PLINE: M=2.5  2015/04/01  13:51:33.1  21.10 S  68.61 W   99 km
MAGNITUDE: 2.5 LAT: -21.10 LNG: -68.61 DEPTH: 99
MINTRGTID: 01/04/2015 13:51:33.1
SC2SEI:.waveform filename....: 2015-04-01-1350-33.SC3__
SC2SEI:.fullpath and filename: /home/seismo/WAV/SC3__/2015/04/2015-04-01-1350-33.SC3__
SC2SEI:.waveform directory...: /home/seismo/WAV/SC3__/2015/04
 9 stations used, weight 9):
nophases: 9
  PB01  CX  15/04/01  13:51:52.3         0.0  0.0  -0.0   0.8 274 0.0 2.2 0.0
  PB09  CX  15/04/01  13:51:53.0         0.0  0.0   0.2   0.9 220 0.0 2.3 0.0
  PB08  CX  15/04/01  13:51:54.8         0.0  0.0   0.3   1.1 332 0.0 2.1 0.0
  PB07  CX  15/04/01  13:51:56.9         0.0  0.0  -0.6   1.3 242 0.0 2.5 0.0
  PB03  CX  15/04/01  13:51:57.9         0.0  0.0  -0.6   1.4 228 0.0 2.5 0.0
  PB06  CX  15/04/01  13:52:03.4         0.0  0.0  -0.1   1.8 209 0.0 2.7 0.0
  MNMCX CX  15/04/01  13:52:07.8         0.0  0.0  -0.2   2.2 335 0.0 2.8 0.0
  PB05  CX  15/04/01  13:52:11.4         0.0  0.0   2.0   2.3 220 0.0 2.9 0.0
  PB14  CX  15/04/01  13:52:29.7         0.0  0.0  -0.9   3.9 205 0.0 3.7 0.0
buffer: 04-01-2015  16:02:28.
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
Number of lines: 3
SC2SEI:.........................MINTRGTID: 01/04/2015 13:51:33.1
CREATE_SFILE: S-filename.......: 01-1351-33L.S201504
CREATE_SFILE: S-file path......: /home/seismo/REA/SC3__/2015/04
CREATE_SFILE: S-file full path.: /home/seismo/REA/SC3__/2015/04//01-1351-33L.S201504
S_REC:    IDSFILE: ID:20150401135133
SC2SEI: S_REC.............................: 2015  4 1 1351 33.1   -21.100 -68.610
In S_REC: FILENAME: 2015-04-01-1350-33.SC3__
nchannels: 9
gfz2015gjnn
 0
 1   Alert gfz2015gjnn: determined by 14 stations, type A
 2
 3  LOCSAT solution with earthmodel iasp91 (with start solution, 14 stations used, weight 14):
 4
 5   Salta Province, Argentina  M=4.7  2015/04/01  14:15:33.3  24.06 S  66.83 W   209 km
 6
```

```
 7   Stat  Net   Date       Time          Amp    Per   Res  Dist  Az mb  ML  mB
 8   PB15  CX  15/04/01  14:16:15.8         0.0  0.0  -2.8   2.6 289 0.0 5.1 0.0
 9   PB06  CX  15/04/01  14:16:22.4         0.0  0.0   0.6   2.9 298 0.0 4.5 0.0
10   PB09  CX  15/04/01  14:16:26.5         0.0  0.0   1.1   3.2 315 0.0 4.2 0.0
11   PB14  CX  15/04/01  14:16:27.5         0.0  0.0   0.5   3.3 259 0.0 4.6 0.0
12   PB05  CX  15/04/01  14:16:27.4         0.0  0.0   0.2   3.3 291 0.0 4.7 0.0
13   PB03  CX  15/04/01  14:16:28.0         0.0  0.0   0.4   3.4 306 0.0 4.8 0.0
14   PB10  CX  15/04/01  14:16:29.1         0.0  0.0   0.3   3.5 278 0.0 4.7 0.0
15   PB04  CX  15/04/01  14:16:29.9         0.0  0.0   0.5   3.5 299 0.0 4.8 0.0
16   PB07  CX  15/04/01  14:16:31.3         0.0  0.0   0.1   3.7 309 0.0 4.7 0.0
17   PB01  CX  15/04/01  14:16:34.0         0.0  0.0   0.0   3.9 320 0.0 4.4 0.0
18   PB08  CX  15/04/01  14:16:42.1         0.0  0.0   1.0   4.5 331 0.0 4.9 0.0
19   PSGCX CX  15/04/01  14:16:51.0        74.8  0.5  -1.9   5.4 325 4.7 4.6 5.0
20   MNMCX CX  15/04/01  14:16:54.4       153.1  0.4  -0.4   5.6 332 5.0 4.9 5.2
21   PB16  CX  15/04/01  14:17:03.8        44.6  0.5   0.3   6.2 336 4.4 4.5 0.0
22
23  RMS-ERR:         1.04
24
25  First location:  2015/04/01 14:17:11
26  This location:   2015/04/01 15:34:40
27
PLINE: M=4.7  2015/04/01  14:15:33.3  24.06 S  66.83 W   209 km
MAGNITUDE: 4.7 LAT: -24.06 LNG: -66.83 DEPTH: 209
MINTRGTID: 01/04/2015 14:15:33.3
SC2SEI:.waveform filename....: 2015-04-01-1414-33.SC3__
SC2SEI:.fullpath and filename: /home/seismo/WAV/SC3__/2015/04/2015-04-01-1414-33.SC3__
SC2SEI:.waveform directory...: /home/seismo/WAV/SC3__/2015/04
 14 stations used, weight 14):
nophases: 14
  PB15  CX  15/04/01  14:16:15.8         0.0  0.0  -2.8   2.6 289 0.0 5.1 0.0
  PB06  CX  15/04/01  14:16:22.4         0.0  0.0   0.6   2.9 298 0.0 4.5 0.0
  PB09  CX  15/04/01  14:16:26.5         0.0  0.0   1.1   3.2 315 0.0 4.2 0.0
  PB14  CX  15/04/01  14:16:27.5         0.0  0.0   0.5   3.3 259 0.0 4.6 0.0
  PB05  CX  15/04/01  14:16:27.4         0.0  0.0   0.2   3.3 291 0.0 4.7 0.0
  PB03  CX  15/04/01  14:16:28.0         0.0  0.0   0.4   3.4 306 0.0 4.8 0.0
  PB10  CX  15/04/01  14:16:29.1         0.0  0.0   0.3   3.5 278 0.0 4.7 0.0
  PB04  CX  15/04/01  14:16:29.9         0.0  0.0   0.5   3.5 299 0.0 4.8 0.0
  PB07  CX  15/04/01  14:16:31.3         0.0  0.0   0.1   3.7 309 0.0 4.7 0.0
  PB01  CX  15/04/01  14:16:34.0         0.0  0.0   0.0   3.9 320 0.0 4.4 0.0
  PB08  CX  15/04/01  14:16:42.1         0.0  0.0   1.0   4.5 331 0.0 4.9 0.0
  PSGCX CX  15/04/01  14:16:51.0        74.8  0.5  -1.9   5.4 325 4.7 4.6 5.0
  MNMCX CX  15/04/01  14:16:54.4       153.1  0.4  -0.4   5.6 332 5.0 4.9 5.2
  PB16  CX  15/04/01  14:17:03.8        44.6  0.5   0.3   6.2 336 4.4 4.5 0.0
buffer: 04-01-2015  16:03:02.
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
Number of lines: 3
SC2SEI:.........................MINTRGTID: 01/04/2015 14:15:33.3
CREATE_SFILE: S-filename.......: 01-1415-33L.S201504
CREATE_SFILE: S-file path......: /home/seismo/REA/SC3__/2015/04
CREATE_SFILE: S-file full path.: /home/seismo/REA/SC3__/2015/04//01-1415-33L.S201504
S_REC:    IDSFILE: ID:20150401141533
SC2SEI: S_REC.............................: 2015  4 1 1415 33.3   -24.060 -66.830
In S_REC: FILENAME: 2015-04-01-1414-33.SC3__
nchannels: 14
gfz2015gjqn
 0
 1   Alert gfz2015gjqn: determined by 7 stations, type A
 2
 3  LOCSAT solution with earthmodel iasp91 (with start solution, 7 stations used, weight 7):
 4
 5   Near Coast of Northern Chile  M=2.5  2015/04/01  15:47:35.1  20.40 S  70.53 W   5 km
 6
 7   Stat  Net   Date       Time          Amp    Per   Res  Dist  Az mb  ML  mB
 8   PSGCX CX  15/04/01  15:47:51.9         0.0  0.0  -0.2   0.9  26 0.0 2.2 0.0
 9   PB01  CX  15/04/01  15:47:55.7         0.0  0.0  -1.3   1.2 124 0.0 2.2 0.0
10   PB08  CX  15/04/01  15:47:59.7         0.0  0.0   0.3   1.3  79 0.0 2.3 0.0
11   PB07  CX  15/04/01  15:48:00.7         0.0  0.0  -0.7   1.5 156 0.0 2.6 0.0
12   MNMCX CX  15/04/01  15:48:02.8         0.0  0.0   0.1   1.5  35 0.0 2.5 0.0
```

```
13   PB03  CX  15/04/01  15:48:06.5         0.0  0.0  -0.0   1.8 156 0.0 2.6 0.0
14   PB09  CX  15/04/01  15:48:09.1         0.0  0.0   1.8   1.8 139 0.0 2.8 0.0
15
16  RMS-ERR:         0.91
17
18  First location:  2015/04/01 15:48:56
19  This location:   2015/04/01 15:48:56
20
PLINE: M=2.5  2015/04/01  15:47:35.1  20.40 S  70.53 W   5 km
MAGNITUDE: 2.5 LAT: -20.40 LNG: -70.53 DEPTH: 5
MINTRGTID: 01/04/2015 15:47:35.1
SC2SEI:.waveform filename....: 2015-04-01-1546-35.SC3__
SC2SEI:.fullpath and filename: /home/seismo/WAV/SC3__/2015/04/2015-04-01-1546-35.SC3__
SC2SEI:.waveform directory...: /home/seismo/WAV/SC3__/2015/04
 7 stations used, weight 7):
nophases: 7
  PSGCX CX  15/04/01  15:47:51.9         0.0  0.0  -0.2   0.9  26 0.0 2.2 0.0
  PB01  CX  15/04/01  15:47:55.7         0.0  0.0  -1.3   1.2 124 0.0 2.2 0.0
  PB08  CX  15/04/01  15:47:59.7         0.0  0.0   0.3   1.3  79 0.0 2.3 0.0
  PB07  CX  15/04/01  15:48:00.7         0.0  0.0  -0.7   1.5 156 0.0 2.6 0.0
  MNMCX CX  15/04/01  15:48:02.8         0.0  0.0   0.1   1.5  35 0.0 2.5 0.0
  PB03  CX  15/04/01  15:48:06.5         0.0  0.0  -0.0   1.8 156 0.0 2.6 0.0
  PB09  CX  15/04/01  15:48:09.1         0.0  0.0   1.8   1.8 139 0.0 2.8 0.0
buffer: 04-01-2015  16:03:35.
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
TUMOD network timeout. No data in 2s, next channel
Number of lines: 3
SC2SEI:.........................MINTRGTID: 01/04/2015 15:47:35.1
CREATE_SFILE: S-filename.......: 01-1547-35L.S201504
CREATE_SFILE: S-file path......: /home/seismo/REA/SC3__/2015/04
CREATE_SFILE: S-file full path.: /home/seismo/REA/SC3__/2015/04//01-1547-35L.S201504
S_REC:    IDSFILE: ID:20150401154735
SC2SEI: S_REC.............................: 2015  4 1 1547 35.1   -20.400 -70.530
In S_REC: FILENAME: 2015-04-01-1546-35.SC3__
nchannels: 7
rt>
```