



SEISCOMP Introduction

Dr. Bernd Weber and Jan Becker

gempa GmbH, Potsdam, Germany

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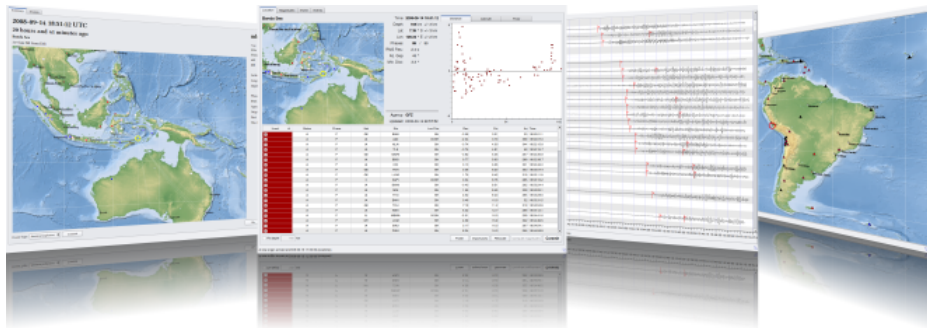
1 GITEWS

2 SeisComP

- Overview
- BMKG, Jakarta/Indonesia
- Architecture
- Modules
- GUIs



- SeisComP3 is developed in the scope of the GITEWS (German Indonesian Tsunami Early Warning) project
- GITEWS project was running from 2005 to 2010, follow up project is PROTECTS
- Total budget of 50 Mio EUR for GITEWS and 10 Mio EUR for PROTECTS





- Software package handling
 - ▶ acquisition
 - ▶ archiving
 - ▶ processing
 - ▶ analysis
 - ▶ quality control
- of seismological data
- Graphical user interfaces for
 - ▶ visualization of waveforms and station status
 - ▶ event visualization
 - ▶ state-of-health monitoring
 - ▶ manual analysis
- Emphasis on simplicity and speed
- Developed in the context of tsunami warning



- Originally designed as acquisition and archiving software for GEOFON¹
- **2001** SeedLink as core acquisition protocol and software becomes a de-facto standard in Europe
- **2003** Development of simple automatic analysis tools (after Algerian earthquake)
- **2005**
 - ▶ global associator/locator
 - ▶ interactive analysis using Seismic Handler (SEISCOMP2)
 - ▶ ArcLink server as distributed waveform and meta-data server

¹<http://geofon.gfz-potsdam.de>



- **2006** Development of the 3rd generation of SEISCOMP within GITEWS project
- **2007** Installation at BMKG, Jakarta/Indonesia in May 2007
- **2008** Major release SEISCOMP3 *Barcelona* (first public release)
- **2009** Major release SEISCOMP3 *Erice*
- **2010** Major release SEISCOMP3 *Potsdam*
- **2011** Major release SEISCOMP3 *Zurich*
- **2012** Major release SEISCOMP3 *Seattle*
- Seattle version is stable, 11 major updates since release.



- Distributed processing
- SeedLink for data acquisition
- SeisComP3XML, a branch of QuakeML² for database schema and communication protocol
- Automatic 2 level P- and S-picker (STA/LTA and AIC)
- Automatic location modules supporting different velocity models and locators
- Magnitudes: MLv, ML, Md, mb, mB, Mw(mB), Mwp, Mw(Mwp), Mjma, Ms(BB)
- Graphical user interfaces
 - ▶ Real-time traces
 - ▶ Network/station status
 - ▶ Event visualization
 - ▶ Event and waveform analysis
 - ▶ State-of-health monitoring
 - ▶ Data quality monitoring

² <http://www.quakeml.org>



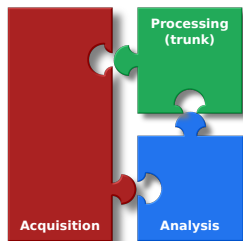
- Use of de-facto standards for waveform and parameter exchange (QuakeML, SeedLink, ArcLink, FDSN web services)
- Interprocess communication between modules builds on TCP/IP
- Database support for MYSQL, SQLite3, PostgreSQL
- Scripting interface for Python



Operator's desk with a 4 monitor system connected to the processing server (new warning room)



- ~30 tsunami warning centers
- ~60 universities
- ~50 earthquake monitoring centers
- ~50 research centers
- ~10 commercial companies



Retrieves waveform data from remote stations, archives it and delivers it to clients on request

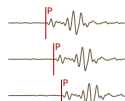
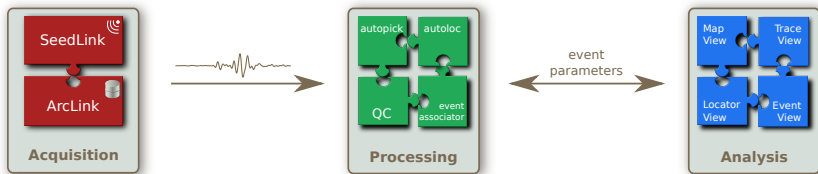
Modules: **SeedLink**, **slarchive** and **ArLink**

Processes waveform data automatically and emits derived parameters such as picks, amplitudes, magnitudes, hypocenters and events

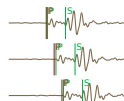
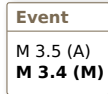
Modules: **scmaster**, **scautoloc**, **scautopick**, **scamp**, **scmag** and **scevent**

Provides graphical user interfaces to analyse and verify results and waveforms interactively either in realtime or as post event analysis

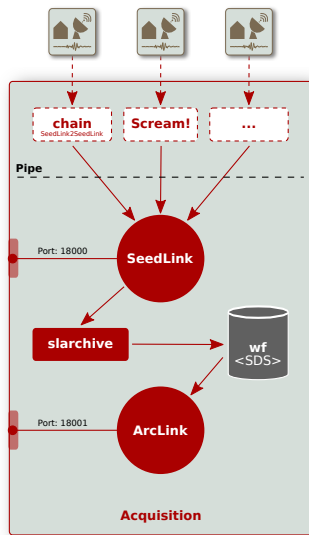
Modules: **scrttv**, **scmv**, **scolv** and **scsv**



M 3.5



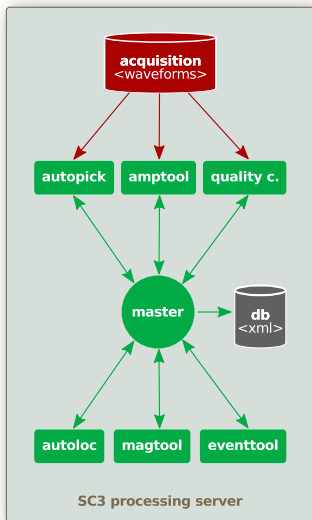
M 3.4



SeedLink collects waveform data from stations through plugins. Many plugins for various digitizers are available. **SeedLink** is a TCP server and delivers TCP data streams to remote clients on port 18000 (configurable).

slarchive stores the waveforms in an archive (SDS structure).

ArcLink provides the archived data as a TCP server to local/remote clients on port 18001 (configurable).

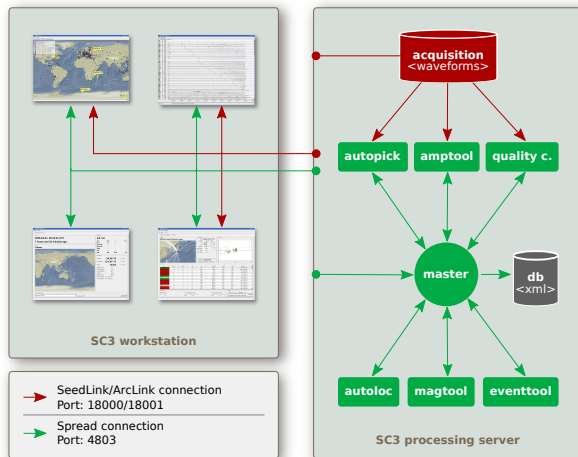


Waveform server provides real time data with SeedLink and archived data with ArcLink

Master is messaging server^a which handles meta data exchange between SC3 modules and stores objects in a database. Connections are excepted from TCP clients on port 4803.

EventTool associates origins (locations) to events and chooses the best location and magnitude among all candidates

^abased on Spread toolkit [▶ http://www.spread.org](http://www.spread.org)



Automatic and interactive system each running on a dedicated computer. Both systems are connected to the same messaging and waveform server.



Name	Description
seedlink	Real time data acquisition
slinktool	SeedLink query interface
slarchive	Storing waveform data in SDS structure
arclink	Retrieval of archived waveform data
arclinktool	ArcLink query interface



Name	Description
scmaster	TCP/IP messaging server
scautopick	Automatic P detector/picker
scautoloc	Automatic locator
screloc	Automatic relocater
scamp	Amplitude calculation
scmag	Magnitude calculation
scevent	Event associator
scqc	Quality parameters of waveforms
scevtlog	Logging of event states
scdb	Database storage of parametric data
scvoice	Acoustic alerts
scalert	Custom alarms



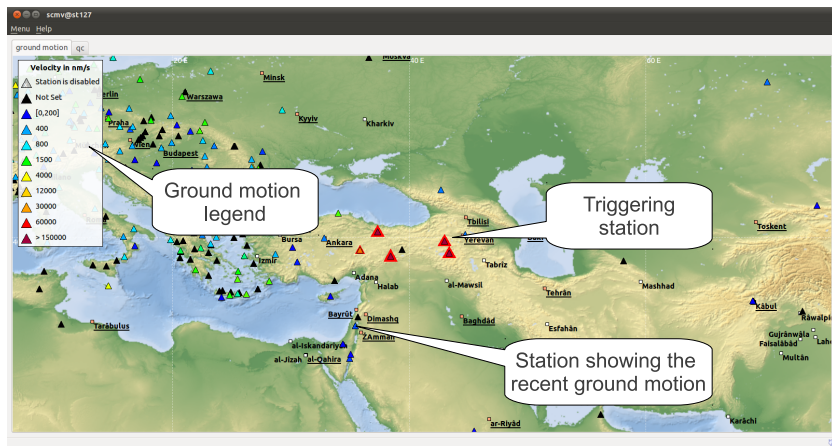
Name	Description
scrttv	Real time trace viewer
scmv	Map viewer showing the overall situation
scolv	Revision of processing results and manual picker
scesv	Event summary viewer
scqcv	Waveform quality viewer
scheli	Helicorder

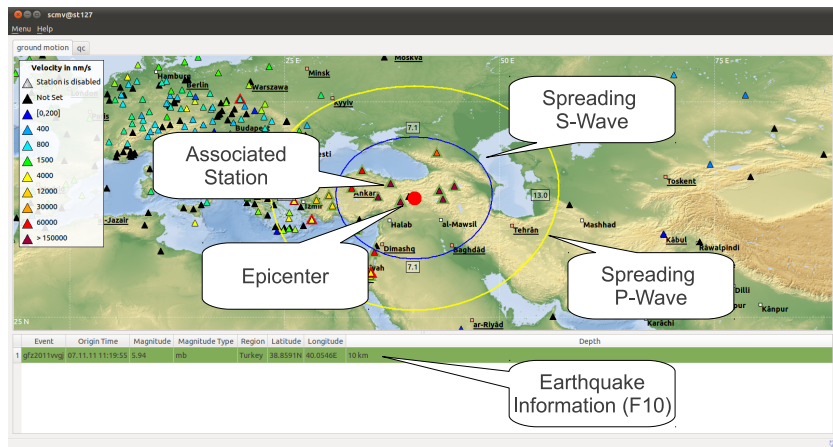


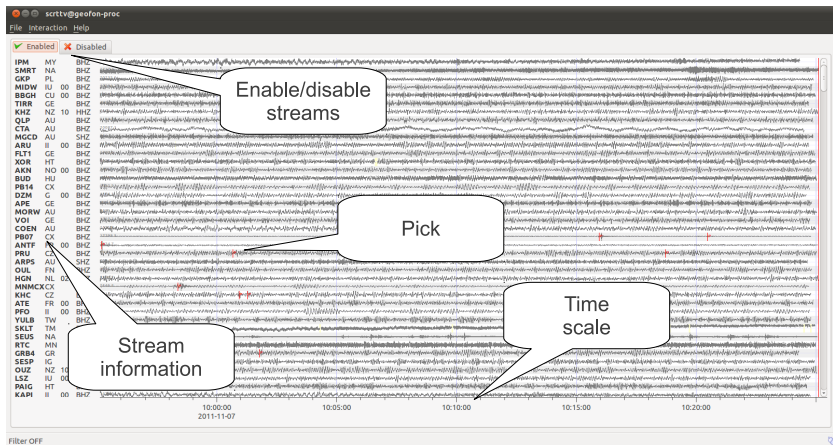
Name	Description
scconfig	GUI for configuration of SeisComp3
wsfdsn	FDSN webservice implementation
import_inv	Wrapper for inventory converter
inv2dlsv	Inventory to dataless Seed converter
invextr	Extracts or removes networks, stations or channels from an inventory XML file
scinv	Inventory XML merger
stationconf	Station metadata configurator (the old way)
scsohlog	State-of-health logging
scchkcfg	Checks seiscomp configuration for case-sensitivity issues
sdispatch	Sends simple SeisComp3 objects

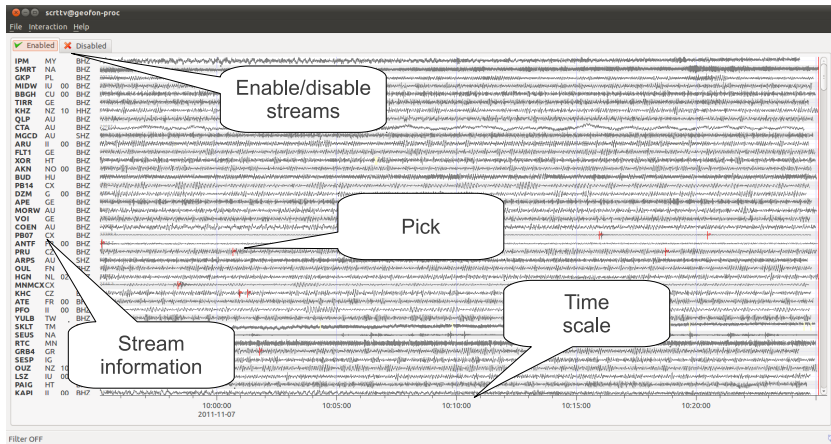


Name	Description
scart	Export/import waveforms from/into archive
scbulletin	Create event bulletins
scmm	Message and performance monitor
scevtls	List available events
scevtstreams	Extract stream information from events
scimex	Import/export for earthquake parameters
scimport	Message relaying
scm	state-of-health monitor
scxmldump	Dumping event parameters to XML
sczip	SEISCOMP3 file (de)compressor

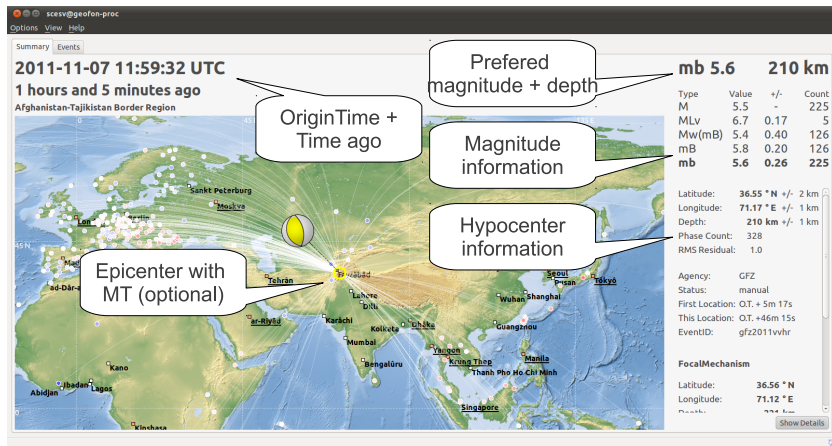


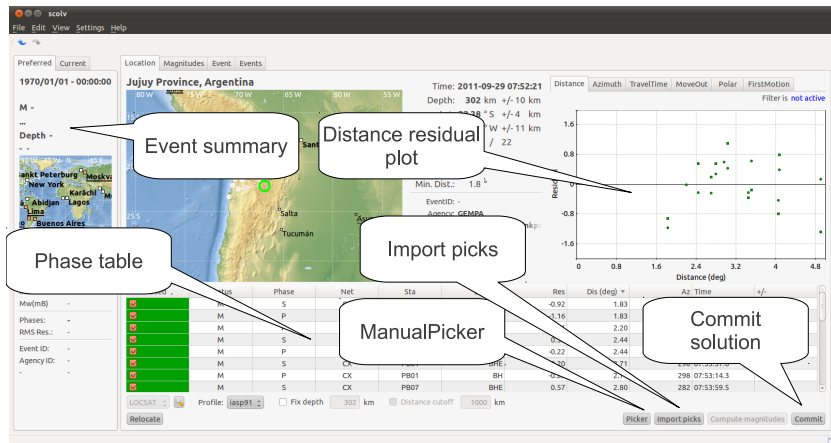






Filter OFF



The screenshot shows the OriginLocatorView interface for a seismic event in Jujuy Province, Argentina. The event occurred on 1970/01/01 at 00:00:00. The event summary shows a depth of 302 km +/- 10 km. A distance residual plot shows residuals versus distance in degrees. The interface includes a phase table, a manual picker, and buttons for importing picks and committing the solution.

Event summary

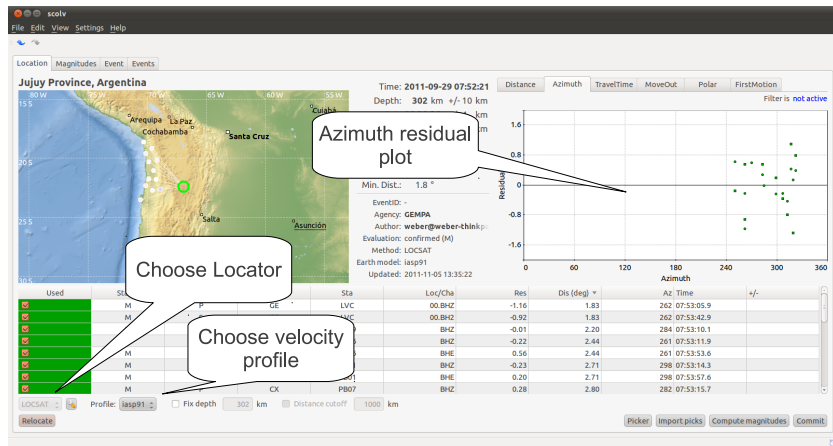
Distance residual plot

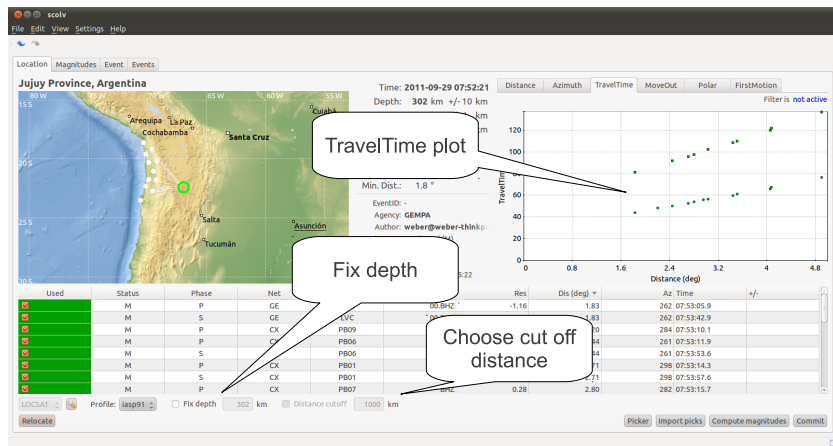
Phase table

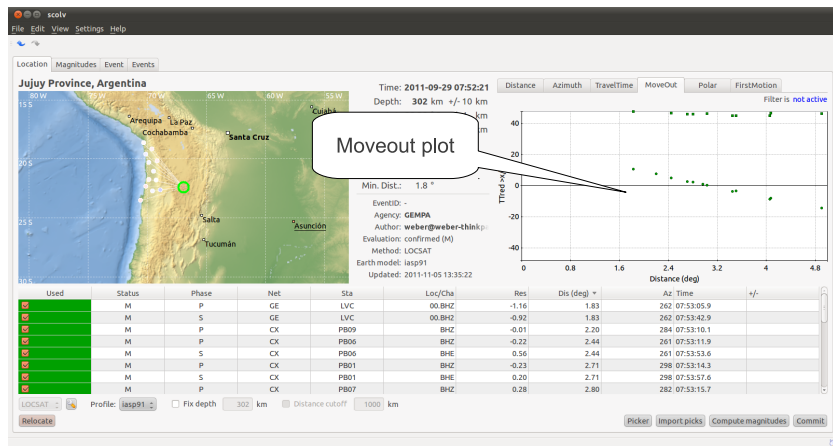
Res	Dis (deg)	Az Time
-0.92	1.83	
-1.16	1.83	
2.20	2.20	
2.44	2.44	
2.44	2.44	
2.71	2.71	
2.71	2.71	
2.71	2.71	298 07:53:14.3
2.80	2.80	282 07:53:59.5

ManualPicker

Commit solution









scolv
File Edit View Settings Help

Location Magnitudes Event Events

Jujuy Province, Argentina

Time: 2011-09-29 07:52:21
Depth: 302 km +/- 10 km

Distance Azimuth TravelTime MoveOut Polar FirstMotion
Filter is not active

Polar plot

Min. Dist.: 1.8 °

EventID: -
Agency: GEMPA
Author: weber@weber-thinkp...
Evaluation: confirmed (M)
Method: LOCSAT
Earth model: iasp91
Updated: 2011-11-05 13:35:22

Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis (deg)	Az Time	+/-
<input checked="" type="checkbox"/>	M	P	GE	LVC	00.BHZ	-1.16	1.83	262 07:53:05.9	
<input checked="" type="checkbox"/>	M	S	GE	LVC	00.BHZ	-0.92	1.83	262 07:53:42.9	
<input checked="" type="checkbox"/>	M	P	CX	PB09	BHZ	-0.01	2.20	284 07:53:10.1	
<input checked="" type="checkbox"/>	M	P	CX	PB06	BHZ	-0.22	2.44	261 07:53:11.9	
<input checked="" type="checkbox"/>	M	S	CX	PB06	BHE	0.56	2.44	261 07:53:53.6	
<input checked="" type="checkbox"/>	M	P	CX	PB01	BHZ	-0.23	2.71	298 07:53:14.3	
<input checked="" type="checkbox"/>	M	S	CX	PB01	BHE	0.20	2.71	298 07:53:57.6	
<input checked="" type="checkbox"/>	M	P	CX	PB07	BHZ	0.28	2.80	282 07:53:15.7	

LOCSAT Profile: iasp91 Fix depth 302 km Distance cutoff 1000 km

Relocate Picker Import picks Compute magnitudes Commit



scolv
File Edit View Settings Help

Location Magnitudes Event Events

Jujuy Province, Argentina

Time: 2011-09-29 07:52:21
Depth: 302 km +/- 10 km

Distance Azimuth TravelTime MoveOut Polar FirstMotion

Filter is not active
NP1: 0/79/158 NP2: 266/68/12

First motion plot

Min. Dist.: 1.8 °

EventID: -
Agency: GEMPA
Author: weber@weber-thinkp...
Evaluation: confirmed (M)
Method: LOCSAT
Earth model: iasp91
Updated: 2011-11-05 13:43:35

Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis (deg)	Az	Time	+/-
<input checked="" type="checkbox"/>	M	S	GE	LVC	00.BH2	-0.84	1.83	262	07:53:42.9	
<input checked="" type="checkbox"/>	M	P	GE	LVC	00.BH	-1.12	1.83	262	07:53:05.9	
<input checked="" type="checkbox"/>	M	P	CX	PB09	BH	0.05	2.20	284	07:53:10.1	
<input checked="" type="checkbox"/>	M	S	CX	PB06	BHE	0.68	2.44	261	07:53:53.6	
<input checked="" type="checkbox"/>	M	P	CX	PB06	BH	-0.15	2.44	261	07:53:11.9	
<input checked="" type="checkbox"/>	M	S	CX	PB01	BHE	0.29	2.71	299	07:53:57.6	
<input checked="" type="checkbox"/>	M	P	CX	PB01	BH	-0.18	2.71	299	07:53:14.3	
<input checked="" type="checkbox"/>	M	S	CX	PB07	BHE	0.63	2.80	282	07:53:59.5	

LOCSAT Profile: iasp91 Fix depth 302 km Distance cutoff 1000 km

Relocate Picker Import picks Compute magnitudes Commit



scolv
File Edit View Settings Help

Location Magnitudes Event

Jujuy Province, Argentina

Used Stat

LOCSAT Profile: las

Relocate

Calculate amplitudes

Source: chile_test.sorted.mseed

	Stream	Type	Progress
1	CX.HMBCX..BHZ	MLv	100%
2	CX.HMBCX..BHZ	Mwp	distance out of range (3.45)
3	CX.HMBCX..BHZ	mB	distance out of range (3.45)
4	CX.HMBCX..BHZ	mb	distance out of range (3.45)
5	CX.MNMCX..BHZ	MLv	incomplete data (87.00%)
6	CX.MNMCX..BHZ	Mwp	distance out of range (4.08)
7	CX.MNMCX..BHZ	mB	distance out of range (4.08)
8	CX.MNMCX..BHZ	mb	distance out of range (4.08)
9	CX.PB01..BHZ	MLv	100%
10	CX.PB01..BHZ	Mwp	distance out of range (2.71)
11	CX.PB01..BHZ	mB	distance out of range (2.71)
12	CX.PB01..BHZ	mb	distance out of range (2.71)
13	CX.PB04..BHZ	MLv	100%

Show errors only

OK Cancel

Distance Azimuth TravelTime MoveOut Polar FirstMotion
Filter is not active

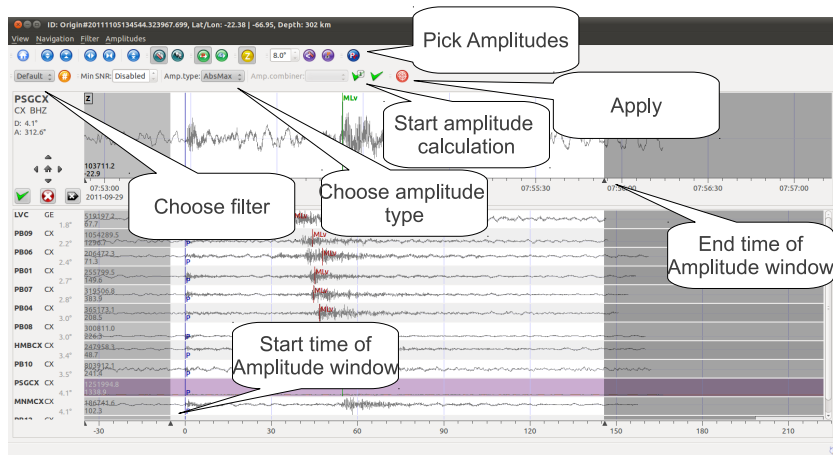
Amplitude status window

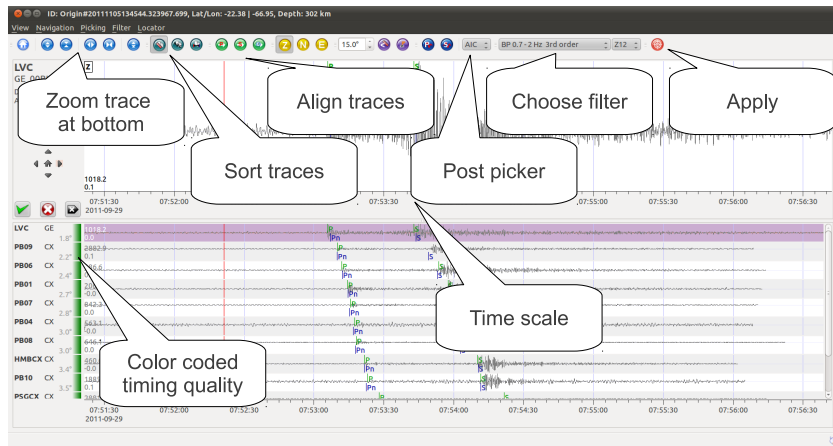
Res Dis (deg) Az Time +/-

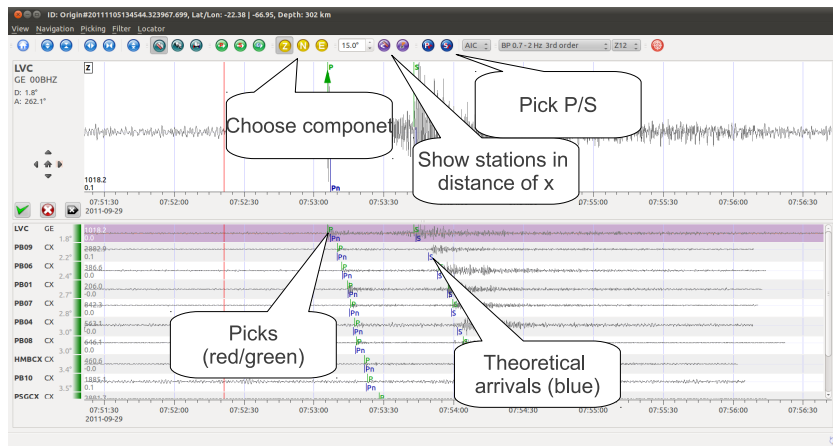
-1.16				
-0.92				
-0.01				
-0.22				
0.56				
2.71	2.71	298 07:53:57		
-0.23	2.71	298 07:53:57		
0.20	2.71	298 07:53:57		
0.28	2.80	282 07:53:15.7		

Picker Import picks Compute magnitudes Commit

Compute magnitude









<http://www.seiscomp3.org>