SeisComp3 at the Israeli National Data Center

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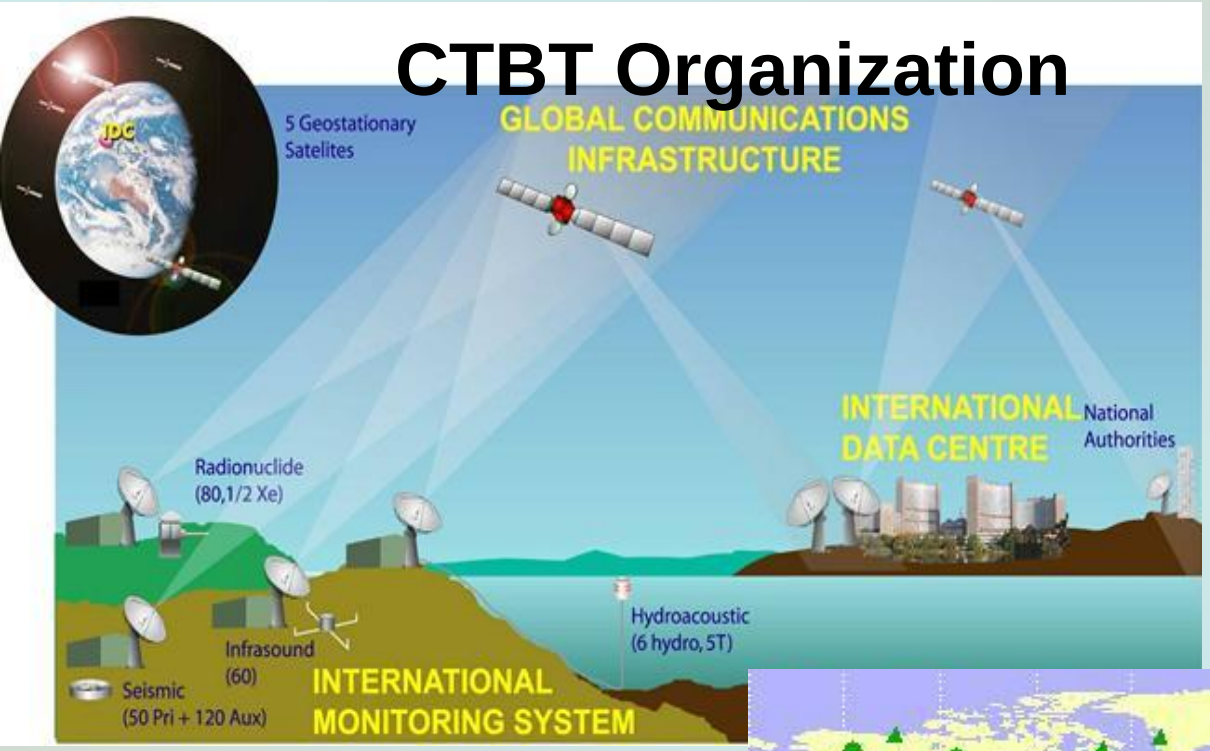
Israeli NDC, Soreq NRC

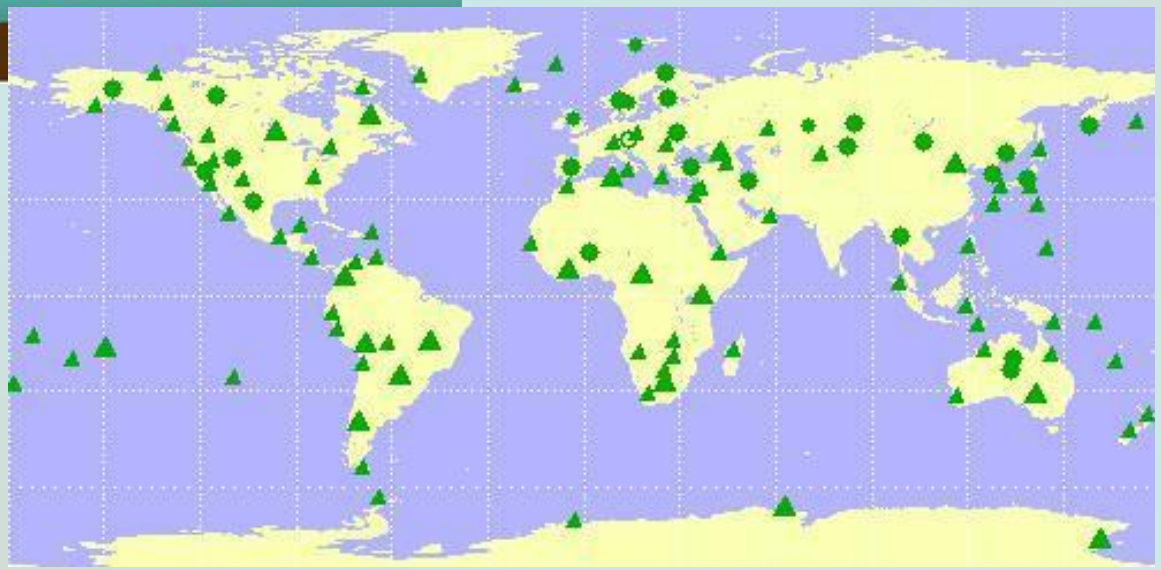
Israeli National Data Center (NDC):

- ***Serves as a national scientific center of expertise for Comprehensive Nuclear-Test Ban Treaty (CTBT) issues.***
- ***Since 1996 - SeedLink***
- ***Since 2008 - SeisComp3***

CTBT Organization

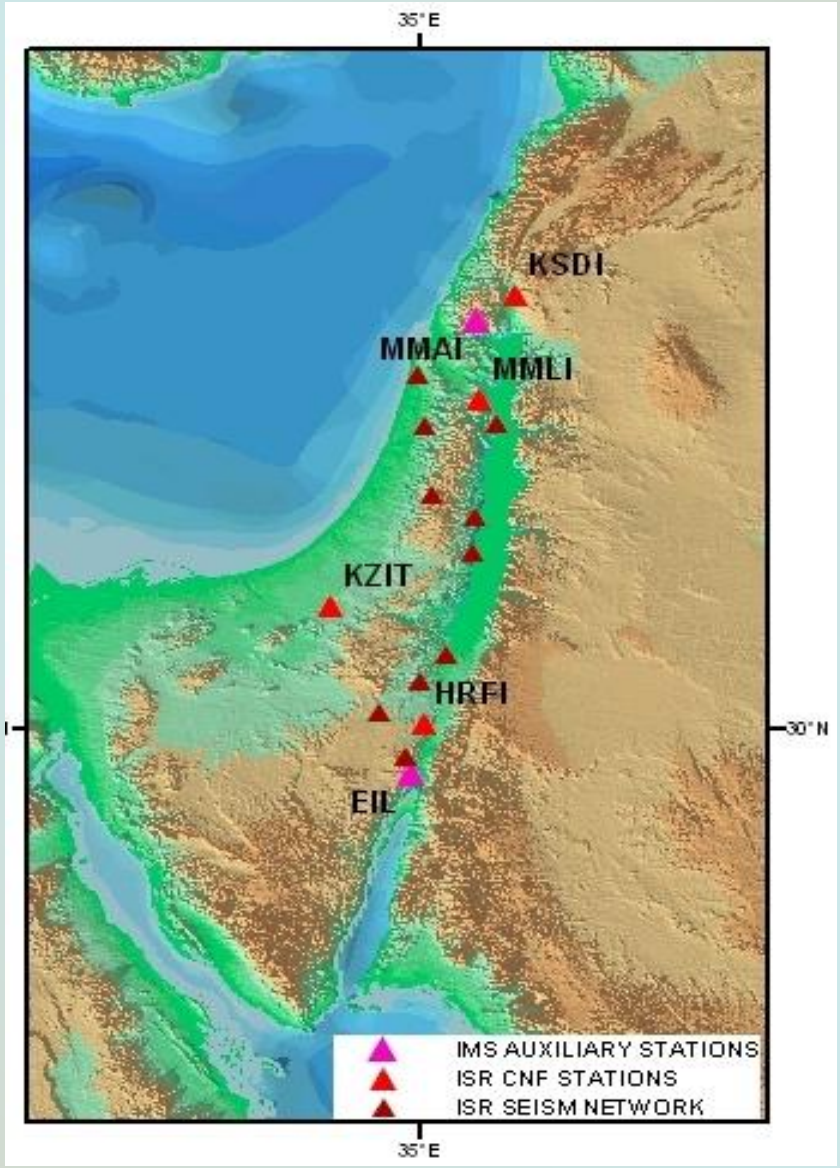


IMS seismic stations



Seismic data sources

- ***IMS stations (MMAI & EIL are located in Israel region)***
- ***Israel Seismic Network (operated by the Geophysical Institute of Israel, GII) mainly 6 designated 3C-BB stations (CNF)***
- ***Other sources like Geophone, IRIS***


35°E
KSDI
MMAI
MMLI
KZIT
HRFI
EIL
30°N
35°E
IMS AUXILIARY STATIONS
ISR CNF STATIONS
ISR SEISM NETWORK

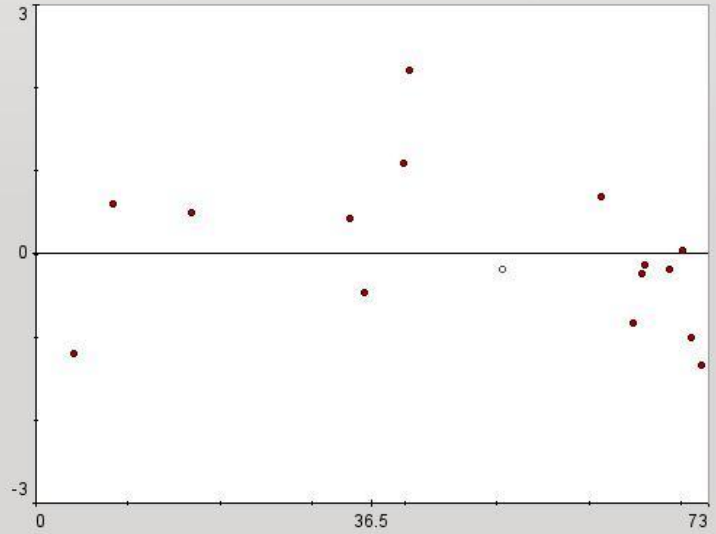
North Korea 25 May 2009 nuclear test

North Korea

Time: **2009-05-25 00:54:50**
Depth: **45** km +/- 10 km
Lat: **41.13** ° N +/- 7 km
Lon: **129.03** ° E +/- 5 km
Phases: **16** / 16
RMS Res.: 0.9 s
Az. Gap: 87 °
Min. Dist.: 4.1 °

Agency: **NDC**
Author: **scautoloc@analysi**
Updated: 2009-05-25 01:06:59

Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
☑	A	P	IU	INCN	00.BHZ	-1.20	4.10	207	00:55:48.7
☑	A	P	IU	MAJO	00.BHZ	0.60	8.48	119	00:56:50.5
☑	A	P	IU	ULN	00.BHZ	0.50	17.0	300	00:58:43.6
☑	A	P	IU	CHTO	00.BHZ	0.43	34.0	238	01:01:29.3
☑	A	P	II	KURK	00.BHZ	-0.47	35.6	303	01:01:43.0
☑	A	P	II	AAK	00.BHZ	1.10	39.9	290	01:02:21.1
☑	A	P	II	BRVK	00.BHZ	2.20	40.5	307	01:02:26.9
☐	A	P	IU	COLA	00.BHZ	-0.19	50.7	33	01:03:44.9
☑	A	P	II	WRAB	00.BHZ	0.69	61.3	174	01:04:58.4
☑	A	P	IU	KIEV	00.BHZ	-0.82	64.7	316	01:05:23.0
☑	A	P	GE	SUW	BHZ	-0.23	65.7	321	01:05:30.4
☑	A	P	GE	SUMG	BHZ	-0.13	66.0	355	01:05:32.0
☑	A	P	GE	KWP	BHZ	-0.18	68.6	318	01:05:49.2
☑	A	P	II	RAYN	00.BHZ	0.05	70.1	284	01:05:58.1
☑	A	P	GE	MORC	BHZ	-1.01	71.1	320	01:06:03.5

Requirements for SC3:

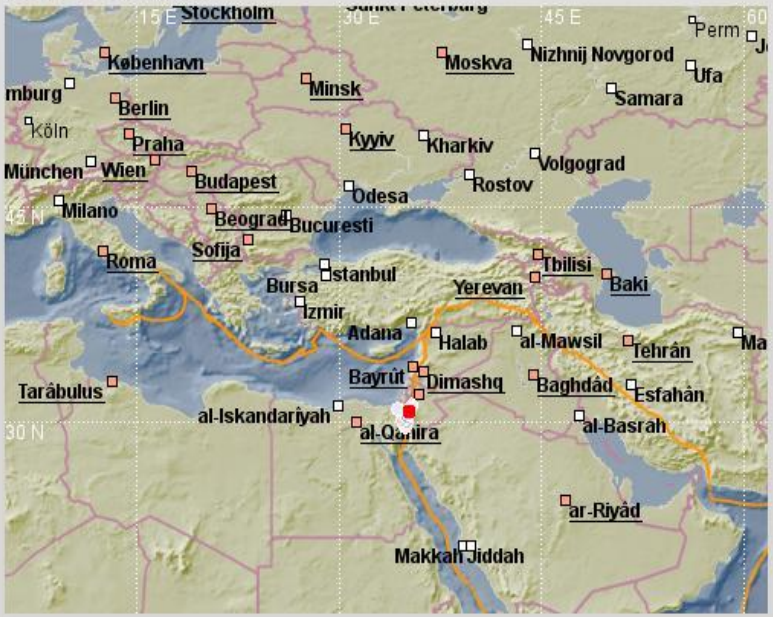
detection and location of:

- ***seismic events with mb>5 worldwide***
- ***events with ML>3 in Israel region***

Problem:

False pick association of local stations with distant stations worldwide

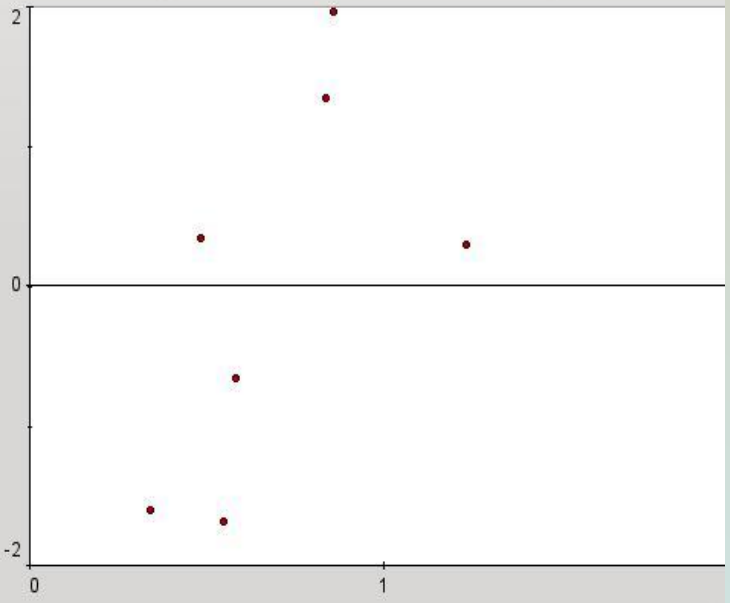
Dead Sea Region



Time:	**2011-02-02 10:37:18**
Depth:	**10** km fixed
Lat:	**30.89** ° N +/- 4 km
Lon:	**35.08** ° E +/- 6 km
Phases:	**7** / 7
RMS Res.:	1.3 s
Az. Gap:	135 °
Min. Dist.:	0.3 °

Agency:	**NDC**
Author:	**scautoloc@analysi**
Updated:	2011-02-02 10:38:27

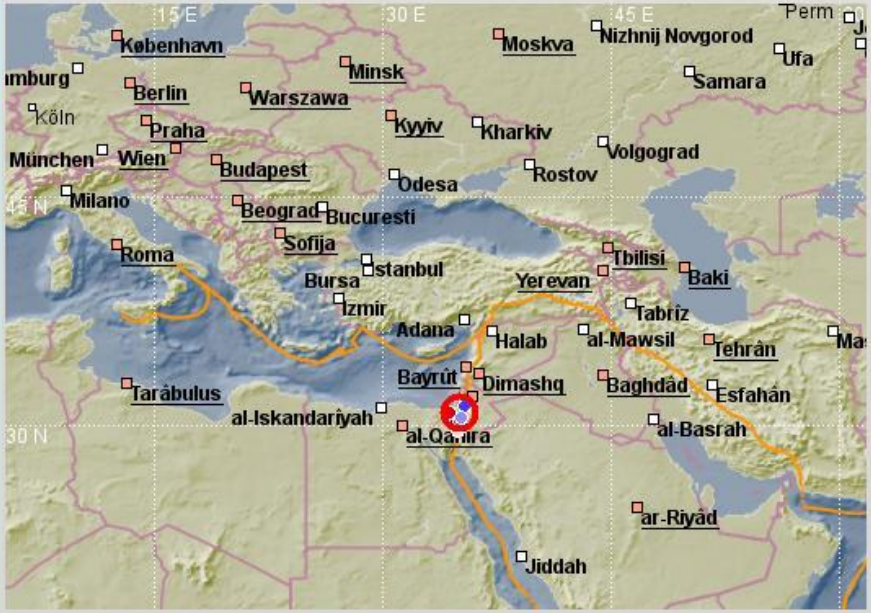
Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
☑	A	P	IS	ZFRI	SHZ	-1.60	0.34	165	10:37:23.7
☑	A	P	IS	MZDA	SHZ	0.34	0.48	30	10:37:27.9
☑	A	P	IS	PRNI	SHZ	-1.68	0.55	186	10:37:26.9
☑	A	P	IS	KZIT	BHZ	-0.66	0.58	271	10:37:28.6
☑	A	P	IS	KRMI	SHZ	1.34	0.83	201	10:37:34.5
☑	A	P	IS	HRFI	BHZ	1.96	0.86	182	10:37:35.5
☑	A	P	GE	EIL	BHZ	0.29	1.23	185	10:37:39.8

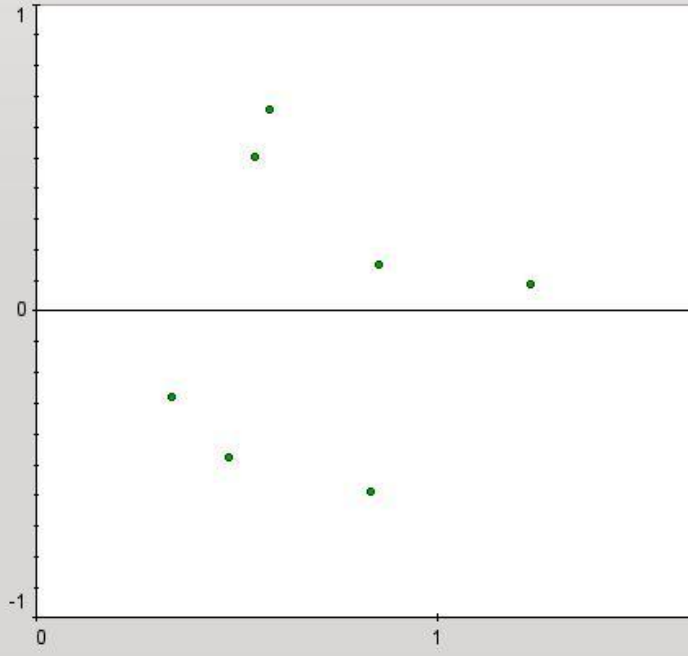
MLv 2.23 | M 2.23

Dead Sea Region



Value: **2.23**
+/-: 0.40
Count: **7 (7)**
Min: 1.64
Max: 2.89

Agency: **NDC**
Author: **scmag@analys**
Method: **trimmed mean**

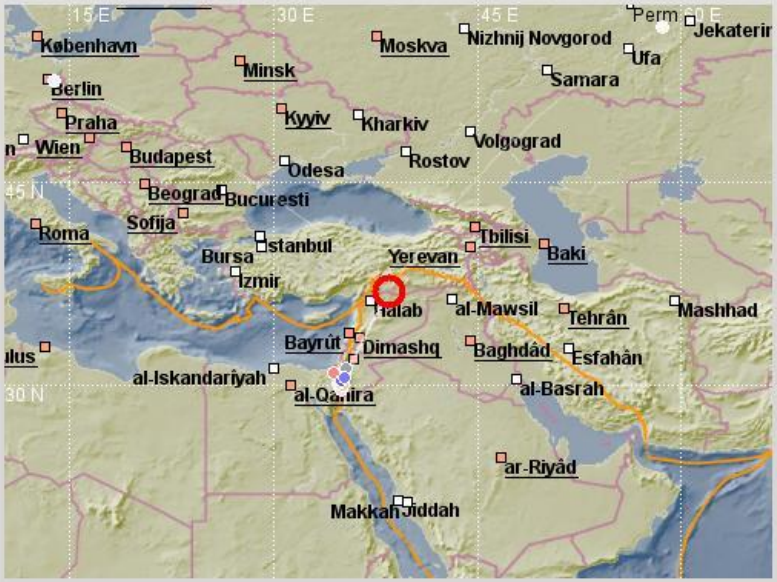


Sel	Net	Sta	Loc/Cha	Mag	Res	Dis
1.000	GE	EIL	BHZ	2.32	0.09	1.20
1.000	IS	HRFI	BHZ	2.38	0.15	0.90
1.000	IS	MZDA	SHZ	1.76	-0.47	0.50
1.000	IS	PRNI	SHZ	2.74	0.50	0.50
1.000	IS	ZFRI	SHZ	1.95	-0.28	0.30
0.125	IS	KRMI	SHZ	1.64	-0.59	0.80
0.125	IS	KZIT	BHZ	2.89	0.66	0.60

Soreq

Location | Magnitudes | Event | Events

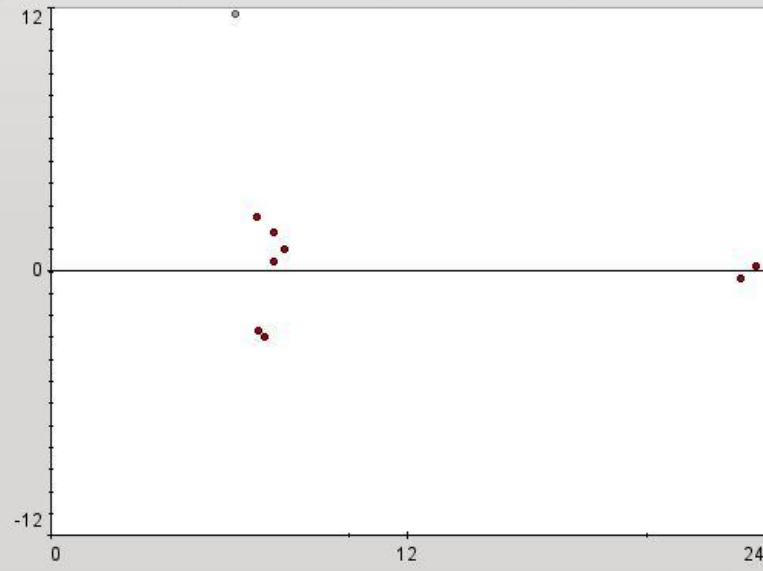
Jordan/Syria Region



Time:	**2011-02-02 10:35:45**
Depth:	**10** km fixed
Lat:	**36.98** ° N +/- 6 km
Lon:	**38.42** ° E +/- 14 km
Phases:	**8** / 9
RMS Res.:	1.8 s
Az. Gap:	174 °
Min. Dist.:	6.9 °

Agency:	**NDC**
Author:	**scautoloc@analysi**
Updated:	2011-02-02 10:42:21

Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
	A	P	IS	MZDA	SHZ	11.69	6.21	204	10:37:27.9
✓	A	P	IS	KZIT	BHZ	2.50	6.93	209	10:37:28.6
✓	A	P	IS	ZFRI	SHZ	-2.70	6.95	203	10:37:23.7
✓	A	P	IS	PRNI	SHZ	-2.96	7.21	204	10:37:26.9
✓	A	P	IS	HRFI	BHZ	1.78	7.49	203	10:37:35.5
✓	A	P	IS	KRMI	SHZ	0.43	7.52	205	10:37:34.5
✓	A	P	GE	EIL	BHZ	1.03	7.86	202	10:37:39.8
✓	A	P	GE	RUE	BHZ	-0.32	23.2	319	10:40:50.3
✓	A	P	II	ARU	00.BHZ	0.24	23.7	28	10:40:55.6

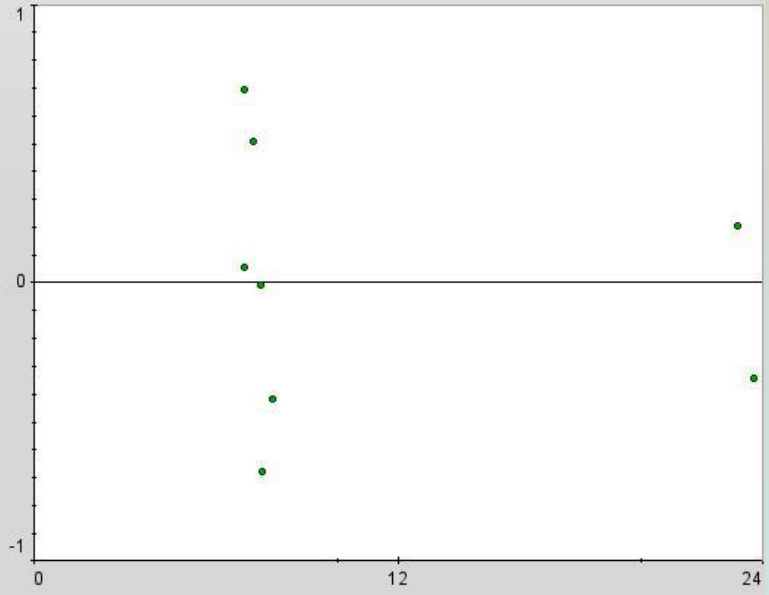
Location | Magnitudes | Event | Events

MLv 4.90 | mB 5.10 | Mw(mB) 4.45 | mb 4.85 | M 4.78

Jordan/Syria Region

Value: **4.85**
+/-: 0.34
Count: **8 (8)**
Min: 4.17
Max: 5.55

Agency: **NDC**
Author: **scmag@analys**
Method: **trimmed mean**



Sel	Net	Sta	Loc/Cha	Mag	Res	Dis
1.000	GE	EIL	BHZ	4.44	-0.42	7.90
1.000	GE	RUE	BHZ	5.06	0.20	23.2
1.000	II	ARU	00.BHZ	4.51	-0.34	23.7
1.000	IS	HRFI	BHZ	4.84	-0.01	7.50
1.000	IS	PRNI	SHZ	5.36	0.51	7.20
1.000	IS	ZFRI	SHZ	4.91	0.05	7.00
0.000	IS	KRMI	SHZ	4.17	-0.68	7.50
0.000	IS	KZIT	BHZ	5.55	0.69	6.90

Solution: 2 pick-loc pipelines

Pipelines	Global	Local
Number of stations	116	16
Grid coverage	worldwide	24<Lat<39, 30<Lon<40
Typical distance between grid nodes	5 deg	0.5 deg
Minimal number of phases for event	8	6
Filter degree and corner frequencies	(4,0.7 Hz, 2 Hz)	(3,1 Hz, 5 Hz)
STA/LTA windows [sec]	80/2	40/3

Soreq

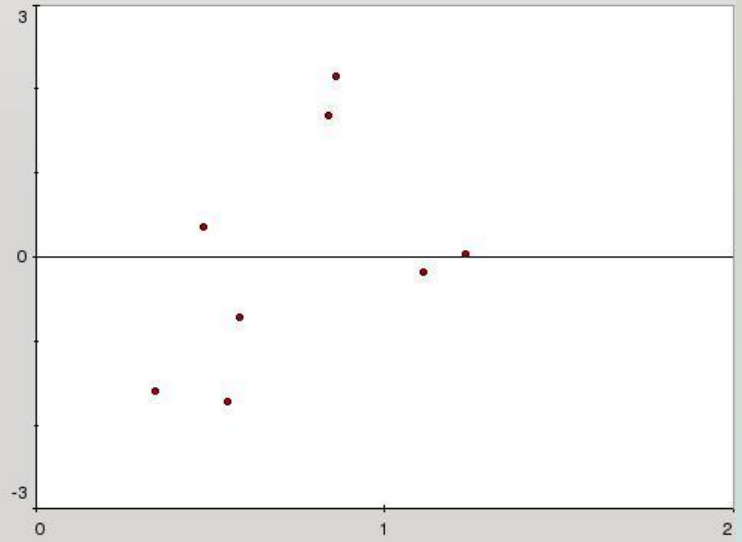
Location | Magnitudes | Event | Events

Dead Sea Region

Time:	**2011-02-02 10:37:18**	
Depth:	**10** km	fixed
Lat:	**30.90** ° N	+/- 4 km
Lon:	**35.08** ° E	+/- 6 km
Phases:	**8** / 8	
RMS Res.:	1.3 s	
Az. Gap:	135 °	
Min. Dist.:	0.3 °	

Agency: **YURI**
Author: **scautoloc2@yuri**
Updated: 2011-02-02 10:38:33

Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
☑	A	P	IS	ZFRI	SHZ	-1.60	0.34	165	10:37:24.5
☑	A	P	IS	MZDA	SHZ	0.36	0.48	30	10:37:28.7
☑	A	P	IS	PRNI	SHZ	-1.72	0.55	186	10:37:27.7
☑	A	P	IS	KZIT	BHZ	-0.72	0.59	271	10:37:29.3
☑	A	P	IS	KRMI	SHZ	1.69	0.84	201	10:37:35.7
☑	A	P	IS	HRFI	BHZ	2.14	0.86	182	10:37:36.5
☑	A	P	IS	MBRI	SHZ	-0.18	1.11	187	10:37:38.2
☑	A	P	GE	EIL	BHZ	0.03	1.23	185	10:37:40.3

Problem:

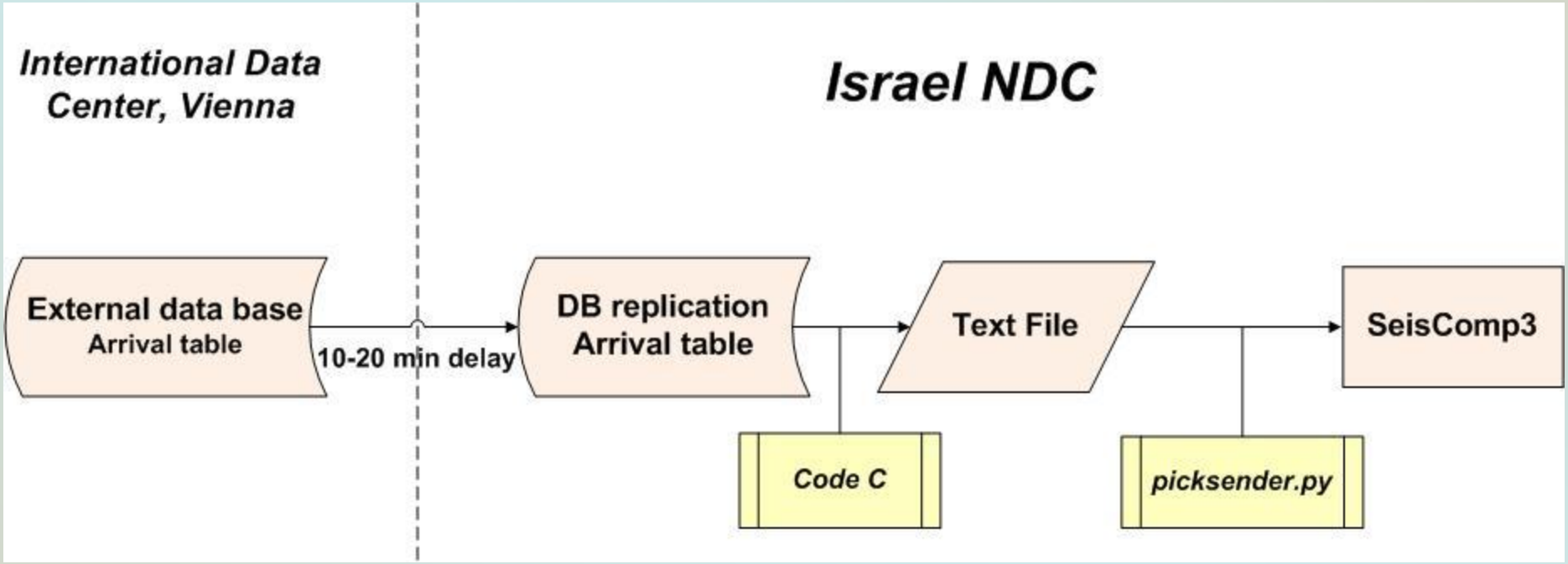
How to incorporate the IMS data into SC3?

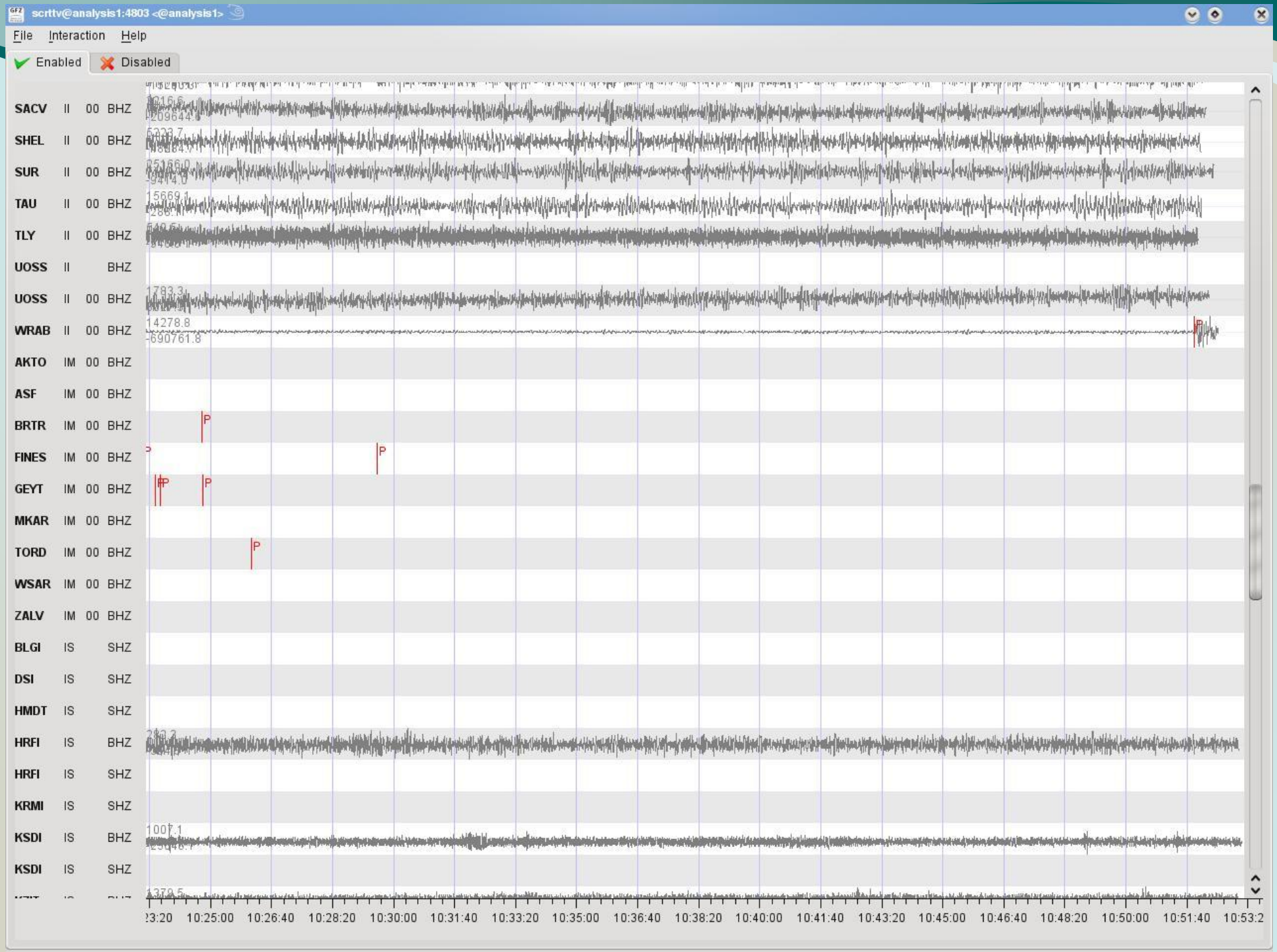
- ***Huge data volumes (most stations are arrays)***
- ***Management & communication problems***
- ***Conversion from CD1.1 format to mseed***
- ***Array processor is not available***

Solution: Pick Import

- Based on Python program *picksender* of Joachim Saul (shown at the SC3UGM2010)
- Define key files for IM network & stations (in ~/seiscomp3/trunk/key & ~/seiscomp3/key)
- *picksender* recursively reads picks from a file (including amplitudes mb & snr)
- Picks are passed to *autoloc* for location while the real waveforms are not available.

IDC arrival import into SC3




scrttv@analysis1:4803 <@analysis1>
File
Interaction
Help
Enabled
Disabled
SACV II 00 BHZ
SHEL II 00 BHZ
SUR II 00 BHZ
TAU II 00 BHZ
TLY II 00 BHZ
UOSS II BHZ
UOSS II 00 BHZ
WRAB II 00 BHZ
14278.8
-690761.8
AKTO IM 00 BHZ
ASF IM 00 BHZ
BRTR IM 00 BHZ
FINES IM 00 BHZ
GEYT IM 00 BHZ
MKAR IM 00 BHZ
TORD IM 00 BHZ
WSAR IM 00 BHZ
ZALV IM 00 BHZ
BLGI IS SHZ
DSI IS SHZ
HMDT IS SHZ
HRFI IS BHZ
HRFI IS SHZ
KRMI IS SHZ
KSDI IS BHZ
KSDI IS SHZ
P
10:25:00
10:26:40
10:28:20
10:30:00
10:31:40
10:33:20
10:35:00
10:36:40
10:38:20
10:40:00
10:41:40
10:43:20
10:45:00
10:46:40
10:48:20
10:50:00
10:51:40

Soreq

scolv@localhost:4803

Edit View Settings Help

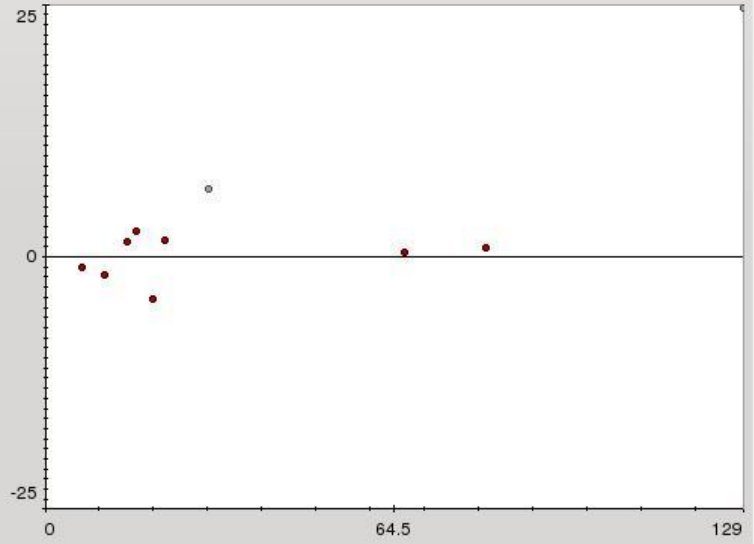
Location | Magnitudes | Event | Events

Afghanistan-Tajikistan Border Region

Time:	**2011-08-29 08:28:44**		
Depth:	**10** km	fixed	
Lat:	**36.25** ° N	+/- 7 km	
Lon:	**71.90** ° E	+/- 7 km	
Phases:	**8** /	10	
RMS Res.:	2.1 s		
Az. Gap:	147 °		
Min. Dist.:	6.7 °		

Agency:	**YURI**
Author:	**scautoloc@yuri**
Updated:	2011-08-29 09:05:40

Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
☑	A	P	II	AAK	00.BHZ	-1.10	6.69	16	08:30:20.9
☑	A	P	IM	GEYT	00.BHZ	-1.83	11.1	282	08:31:20.8
☑	A	P	II	KURK	00.BHZ	1.46	15.2	16	08:32:19.0
☑	A	P	II	BRVK	00.BHZ	2.55	16.8	356	08:32:40.7
☑	A	P	IM	ZALV	00.BHZ	-4.20	19.8	22	08:33:10.1
☑	A	P	II	ARU	00.BHZ	1.64	22.1	340	08:33:40.2
☐	A	P	IM	BRTR	00.BHZ	6.72	30.1	288	08:35:00.7
☑	A	P	IM	TORD	00.BHZ	0.51	66.4	269	08:39:33.7
☑	A	P	II	WRAB	00.BHZ	0.95	81.4	122	08:41:01.0
☐	A	PKP	II	HOPE	10.BHZ	24.60	128.9	225	08:48:15.3

scolv@localhost:4803

Edit View Settings Help

Location | Magnitudes | Event | Events

Carlsberg Ridge

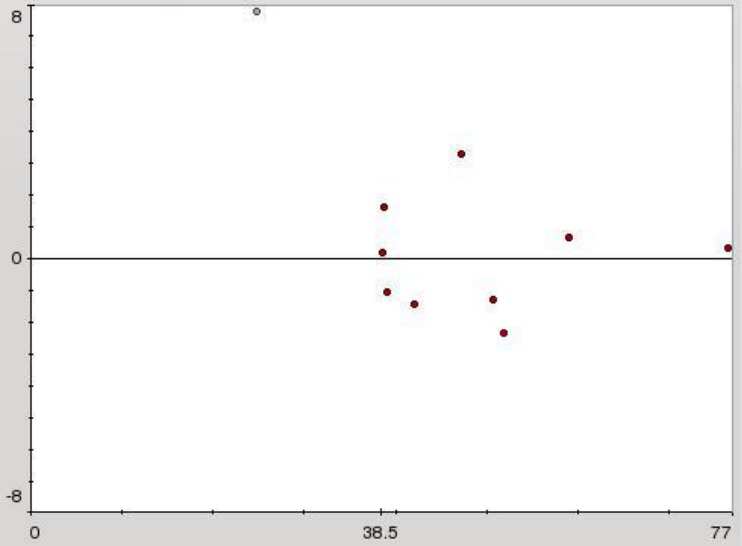
Time:	2011-08-31 05:59:28		
Depth:	131	km	+/- 59 km
Lat:	5.80	° N	+/- 13 km
Lon:	61.17	° E	+/- 8 km
Phases:	9	/ 10	
RMS Res.:	1.7	s	
Az. Gap:	170	°	
Min. Dist.:	38.5	°	

Agency: **YURI**

Author: **scautoloc@yuri**

Updated: 2011-08-31 06:49:31

Distance | Azimuth | Polar



Used	Status	Phase	Net	Sta	Loc/Cha	Res	Dis	Az	Time
☐	A	P	GE	KMBO	00.BHZ	7.78	24.9	254	06:04:46.3
☑	A	P	GE	MALT	BHZ	0.19	38.5	330	06:06:36.9
☑	A	P	II	AAK	00.BHZ	1.64	38.7	15	06:06:39.5
☑	A	P	IU	CHTO	00.BHZ	-1.05	39.0	67	06:06:41.3
☑	A	P	IM	BRTR	00.BHZ	-1.42	42.0	327	06:07:04.2
☑	A	P	II	KURK	00.BHZ	3.30	47.2	14	06:07:49.9
☑	A	P	II	ARU	00.BHZ	-1.29	50.7	358	06:08:11.4
☑	A	P	IM	ZALV	00.BHZ	-2.36	51.8	17	06:08:19.2
☑	A	P	IM	TORD	00.BHZ	0.66	59.0	281	06:09:15.1
☑	A	P	II	WRAB	00.BHZ	0.33	76.4	112	06:11:03.6

Unsolved problem:

How to use azimuth and slowness for the location?

Summary

- ***SC3 is a routine tool for automatic seismic analysis at the Israeli NDC.***
- ***2 picking-location pipelines enable to monitor the local events together with teleseismic events on the global scale.***
- ***Pick import program allows to include the IMS data into SC3***