Republic of Lebanon
National Council for Scientific Research

Provisional Seismological Bulletin

from the

NATIONAL SEISMIC NETWORK

December

2004

Prepared by

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GENERAL BULLETIN INFORMATION

The National Centre for Geophysical Research is a governmental agency established 1975 in Lebanon by the National Council for Scientific Research (CNRS). The mission of the Centre, among other assignments, is the monitoring of seismic activity within the national territory. Currently, the national seismic network is under deployment; it has been officially registered as GRAL, an acronym for Geophysical Research Arrays of Lebanon. Station coordinates and status are given below.

Since 1993, the Centre has been participating in a regional initiative by the UNESCO and the USGS known as RELEMR, i.e. Reducing Earthquake Losses in the Eastern Mediterranean Region.

Within this framework, the Centre routinely contributes to the database set up for this purpose and maintained by the Euro-Mediterranean Seismological Centre (EMSC). For coherence, the Centre has adopted the recommended seismic analysis system SEISAN developed by Jens Havskov and Lars Ottemoller from the University of Bergen, Norway.

The localization program currently used for locating earthquakes is Hypocenter (Lienert et al.,1986). Plane parallel layers are assumed for local and regional events, while the IASPEI travel time tables are used for distant events.

The velocity model used for all local and regional events is the one currently adopted by the RELEMR initiative.

P-wave velocity (km/sec)	**depth to top of layer (km)**
6.2	**0.0**
6.8	**14.0**
8.05	**34.0**
8.25	**50.0**
8.5	**80.0**

Magnitudes are calculated from the coda duration. The coda wave magnitude is estimated via the formula:

Mc = 0.08 + 1.63 * log10(T) + 0.0009 * D.

where T is the coda duration (sec) and D is the epicentral distance (km). The coefficients above were adopted at the outset of our Centre in 1980 and thus are still in use for the sake of continuity.

All available coda values are used for magnitude calculations. No station corrections are used for either travel times or magnitudes calculations. The Vp/Vs velocity ratio used in both layered models above is 1.74.

As a general policy, neither depths, nor epicenters, are fixed unless stated otherwise since this might restrict later use of the data. Consequently, some event locations might be unrealistic such as zero depth earthquakes or teleseismic locations off by 1000 km. However, the locations are based on the available data and reflect the localization procedure and the models used.

STATIONS USED

The stations listed below are operated by the National Centre for Geophysical Research. They constitute the basic setup of the National Seismic Network of Lebanon.

However, readings from other cooperating agencies are also used in locating the events and thus more stations may appear in the event lists than in the station list; it is worth mentioning the systematic use of arrival times from the Cypriot seismic network CSS in order to constrain events corresponding to an active zone off the Lebanese shorelines.

STATION	LATITUDE	LONGITUDE	HEIGHT(m)	NAME	COMMENTS
BHL	3354.25N	3539.25E	1000	BHANNES	Opened May 1980
HWQ	3416.68N	3556.78E	1161	HAWQA	Opened Jan 2001
MATL	3329.32N	3519.78E	5	MATARIH	Opened Nov 2000
FKH	3414.13N	3624.11E	1170	FAKEHEH	Opened Dec 2004
RCY	3329.08N	3549.13E	1360	RACHAYA	Scheduled 2003
DWR	3323.13N	3524.08E	420	DWEIR	Scheduled 2003

MACROSEISMIC DATA

Macroseismic data, if available, are included in the bulletin.

MONTHLY EPICENTER MAPS

Maps will be found on the last page.

ELECTRONIC PUBLICATION

This provisional bulletin is available for download in pdf format on:
http://www.cnrs.edu.lb/grdownload.html

REFERENCES

Havskov, J. and Ottemoller, L.(2001). SEISAN: The Earthquake Analysis Software. -version 7.2-
Institute of Solid Earth Physics, University of Bergen.
http://www.ifjf.uib.no/seismo/software/seisan.html

Lienert, B.R., Berg, E. and Frazer, L.N.(1986). Hypocenter: An earthquake location method using centered, scaled, and adaptively least squares. Bull. Seism. Soc. Am., 76.,
pp 771-783.

Abbreviations:

TIME:	Origin time in UTC (hr. min. and sec.) or data file onset time if event is not located.
LAT:	Latitude of epicenter
LON:	Longitude of epicenter
DEPTH:	Focal depth in kilometer (trailing F indicates fixed depth)
AGENCY:	GRL throughout the bulletin, aka. Geophysical Research Lebanon
MAGNITUDES:	Up to 3 different magnitudes can be given followed by type and and reporting agency, e.g. 3.1 MC GRL - coda magnitude calculated according to GRL standard parameters.
RMS:	Root mean square value of travel time residuals
STAT:	Station code
CO:	Component; S:short period, L:long period, B:broadband.
DIST:	Epicenter distance (km)
AZI:	Azimuth from source to station
PHAS:	Phase; The first letter characterizes onset E(mergent) or I(mpulsive)
P:	Polarity (C for compression, D for dilatation)
HR:	Hour
MN:	Minute
SECON:	Seconds
TRES:	Residual (seconds)
CODA:	Signal duration in seconds
AMPL:	Ground Amplitude (0.5*(peak to peak)), (nm) at period PERI
PERI:	Period where amplitude is measured
BAZ:	Back azimuth (station to event)
ARES:	Back azimuth residual
VELO:	Apparent phase velocity (km/sec)
WT:	Weight of phase in the location
*:	An asterisk before the phase arrival time implies a potential timing error. If an S phase is read, differential S-P times will be used in the hypocenter location.

December 2 2004 Hour: 17: 3 53.9 Lat: 32.08N Lon: 35.33E Depth: 29 Agency: REL Local
Magnitudes: 3.2MC REL Rms: 0.4 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
MATL	SZ	156.1	360	IPG		17 4	18.37	0.5							1.0
MATL	SZ	156.1	360	ISG		17 4	35.47	-0.2							1.0
BHL	SZ	204.4	8	IPG		17 4	25.24	0.2	63						1.0
BHL	SN	204.4	8	ISG		17 4	47.79	-0.3							1.0
HWQ	SZ	250.3	13	IPG		17 4	31.09	-0.7							1.0
HWQ	SE	250.3	13	ISG		17 5	0.32	0.5							1.0

December 4 2004 Hour: 7:42 54.0 Lat: 33.71N Lon: 35.53E Depth: 0 Agency: REL Local
Magnitudes: 2.2MC REL Rms: 1.0 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	SZ	23.95	28	IPG		742	57.59	-0.3	19			208	0	9.3	1.0
BHL	SN	23.95	28	ISG		742	59.28	-1.4							1.0
HWQ	SZ	73.35	31	IPG		743	6.11	0.3							1.0
HWQ	SE	73.35	31	ISG		743	16.03	1.4							1.0

December 6 2004 Hour: 11:40 3.3 Lat: 33.48N Lon: 36.50E Depth: 15 Agency: REL Local
Magnitudes: 3.0MC REL Rms: 0.2 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	SZ	91.38	301	IPG		1140	17.51	-0.2				61	-58	14.8	1.0
BHL	SN	91.38	301	ISG		1140	28.41	0.0							1.0
HWQ	SZ	102.0	330	IPG		1140	19.19	-0.1	51						1.0
HWQ	SE	102.0	330	ISG		1140	31.37	0.3							1.0

December 11 2004 Hour: 11: 7 52.2 Lat: 34.53N Lon: 36.78E Depth: 0 Agency: REL Local
Magnitudes: 2.8MC REL Rms: 1.1 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	48.24	227	IPG		11 7	58.99	-1.0	47						1.0
FKH	SE	48.24	227	ISG		11 8	5.09	-0.7							1.0
HWQ	SZ	82.02	250	IPG		11 8	7.26	1.8				60	-8	42.1	1.0
HWQ	SN	82.02	250	ISG		11 8	15.22	0.0							1.0

December 11 2004 Hour: 13:45 17.3 Lat: 34.55N Lon: 36.76E Depth: 0 Agency: REL Local
Magnitudes: 2.8MC REL Rms: 1.1 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	47.69	223	IPG		1345	24.72	-0.3	42						1.0
FKH	SN	47.69	223	ISG		1345	29.77	-1.0							1.0
HWQ	SZ	80.29	248	IPG		1345	29.06	-1.2							1.0
HWQ	SN	80.29	248	ISG		1345	39.54	-0.3							1.0
BHL	SZ	124.2	235	IPG		1345	39.03	1.7							1.0
BHL	SE	124.2	235	ISG		1345	53.36	1.2							1.0

December 12 2004 Hour: 7:16 4.5 Lat: 33.86N Lon: 35.85E Depth: 15 Agency: REL Local
Magnitudes: 2.7MC REL Rms: 0.4 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	SZ	18.26	285	IPG		716	9.13	0.7				143	38	7.5	1.0
BHL	SE	18.26	285	ISG		716	10.90	-0.4							1.0
HWQ	SZ	47.17	11	IPG		716	12.14	-0.3	39						1.0
HWQ	SE	47.17	11	ISG		716	18.27	-0.1							1.0

December 12 2004 Hour: 18:38 14.3 Lat: 32.19N Lon: 33.93E Depth: 14 Agency: REL Local
Magnitudes: 3.6MC REL Rms: 0.3 secs

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
MATL	SZ	194.9	42	IPG		1838	43.56	-0.4							1.0
MATL	SZ	194.9	42	ISG		1839	5.41	-0.4							1.0
BHL	SZ	249.4	40	EPN		1838	50.10	0.1				245	25	12.0	1.0
BHL	SE	249.4	40	SN		1839	16.52	0.1							1.0
HWQ	SZ	298.5	38	EPN		1838	56.21	0.1	102						1.0
HWQ	SE	298.5	38	SN		1839	27.55	0.5							1.0

December 18 2004 Hour: 13:21 44.9 Lat: 34.58N Lon: 36.48E Depth: 11 Agency: REL Local
Magnitudes: 3.1MC REL **Rms: 1.2 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
HWKV	SZ	9.308	229	IPG		1321	45.43	-1.9							1.0
HWKV	SE	9.308	229	ISG		1321	49.90	0.7							1.0
HWQ	SZ	59.24	236	IPG		1321	53.33	-1.3	67			51	-4	30.7	1.0
HWQ	SE	59.24	236	ISG		1322	3.11	1.2							1.0
WRDH	SZ	103.7	356	IPG		1322	01.89	0.1							1.0
WRDH	SE	103.7	356	ISG		1322	15.09	0.9							1.0
BHL	SZ	106.5	226	IPG		1322	1.40	-0.8							1.0
BHL	SE	106.5	226	ISG		1322	16.51	1.5							1.0
SLNF	SZ	115.7	348	IPG		1322	02.29	-1.4							1.0
SLNF	SZ	115.7	348	IPG		1322	19.40								
ARNV	SZ	147.7	18	IPG		1322	08.27	-0.5							1.0
ARNV	SE	147.7	18	ISG		1322	28.12	1.6							1.0

December 20 2004 Hour: 23: 2 15.2 Lat: 36.90N Lon: 28.17E Depth: 22 Agency: REL Regional
Magnitudes: 4.8MC REL **Rms: 0.7 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
MATL	SZ	753.9	118	EPN		23 3	52.34	-0.5							1.0
MATL	SZ	753.9	118	SN		23 5	6.10	1.1							1.0
BHL	SZ	756.7	114	EPN		23 3	53.05	-0.2							1.0
BHL	SN	756.7	114	SN		23 5	4.49	-1.3							1.0
HWQ	SZ	762.4	110	EPN		23 3	54.28	0.3	281						1.0
HWQ	SE	762.4	110	SN		23 5	8.47	1.4							1.0
FKH	SZ	802.6	109	EPN		23 3	59.59	0.6							1.0
FKH	SE	802.6	109	SN		23 5	14.55	-1.2							1.0

December 21 2004 Hour: 0:24 0.5 **Agency: REL Regional**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ			EPN		025	22.29								
HWQ	SZ			EPN		025	15.27								

December 21 2004 Hour: 11:32 11.2 Lat: 33.86N Lon: 36.78E Depth: 0 Agency: REL Local
Magnitudes: 2.8MC REL **Rms: 0.7 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	54.10	320	IPG		1132	19.75	-0.2	44						1.0
FKH	SN	54.10	320	ISG		1132	25.62	-0.8							1.0
HWQ	SZ	89.55	301	IPG		1132	26.07	0.4							1.0
HWQ	SE	89.55	301	ISG		1132	37.38	1.1							1.0
BHL	SE	104.0	273	ISG		1132	39.78	-0.6							1.0

December 22 2004 Hour: 15:57 14.2 Lat: 34.45N Lon: 36.04E Depth: 15 Agency: REL Local
Magnitudes: 2.5MC REL **Rms: 0.3 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
HWQ	SZ	20.51	205	IPG		1557	18.79	0.4	28			22	-2	10.0	1.0
HWQ	SN	20.51	205	ISG		1557	21.21	-0.3							1.0
FKH	SZ	40.72	125	IPG		1557	21.33	0.1							1.0
FKH	SE	40.72	125	ISG		1557	26.15	-0.2							1.0

December 22 2004 Hour: 16: 8 13.7 Lat: 34.36N Lon: 36.02E Depth: 15 Agency: REL Local
Magnitudes: 2.1MC REL **Rms: 0.5 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
HWQ	SZ	11.20	219	IPG		16 8	16.98	0.1	18			9	-29	23.3	1.0
HWQ	SE	11.20	219	ISG		16 8	19.54	0.3							1.0
FKH	SZ	37.39	111	IPG		16 8	20.67	0.4							1.0
FKH	SE	37.39	111	ISG		16 8	24.31	-0.8							1.0

December 23 2004 Hour: 12:22 38.7 Lat: 33.86N Lon: 36.57E Depth: 15 Agency: REL Local
Magnitudes: 2.8MC REL **Rms: 1.6 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	44.05	339	IPG		1222	44.84	-1.4	44			302	142	19.3	1.0
FKH	SE	44.05	339	ISG		1222	50.09	-1.7							1.0
HWQ	SZ	73.74	309	IPG		1222	52.13	1.5							1.0
HWQ	SE	73.74	309	ISG		1223	0.93	1.6							1.0

December 23 2004 Hour: 12:47 15.9 Lat: 34.32N Lon: 36.68E Depth: 15 Agency: REL Local
Magnitudes: 2.8MC REL **Rms: 0.8 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	26.96	251	IPG		1247	19.99	-1.0	42			91	20	31.0	1.0
FKH	SE	26.96	251	ISG		1247	25.58	0.9							1.0
HWQ	SZ	67.48	267	IPG		1247	27.64	0.8							1.0
HWQ	SE	67.48	267	ISG		1247	34.21	-0.7							1.0

December 24 2004 Hour: 14:47 57.4 Lat: 34.33N Lon: 36.54E Depth: 6 Agency: REL Local
Magnitudes: 2.6MC REL **Rms: 0.1 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
FKH	SZ	16.71	230	IPG		1448	0.58	0.2	35						1.0
FKH	SE	16.71	230	ISG		1448	2.45	-0.1							1.0
HWQ	SZ	55.02	264	IPG		1448	6.17	-0.2							1.0
HWQ	SE	55.02	264	ISG		1448	13.12	0.1							1.0
BHL	SE	94.58	240	ISG		1448	24.04	0.0							1.0

December 25 2004 Hour: 4:45 1.9 Lat: 34.09N Lon: 35.57E Depth: 15 Agency: REL Local
Magnitudes: 2.4MC REL **Rms: 0.3 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	BZ	22.19	161	IPG		445	6.57	0.3	27			307	-33	10.0	1.0
BHL	SN	22.19	161	ISG		445	9.58	0.1							1.0
HWQ	SN	39.97	59	ISG		445	13.54	-0.3							1.0

December 25 2004 Hour: 20:22 18.1 Lat: 34.45N Lon: 32.21E Depth: 0 Agency: REL Regional
Magnitudes: 4.1MC REL **Rms: 0.8 secs**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
MATL	SZ	307.1	109	EPN		2023	2.58	0.3							1.0
BHL	SZ	322.9	100	EPN		2023	3.27	-1.0	197						1.0
BHL	SN	322.9	100	SN		2023	37.57	-1.0							1.0
HWQ	SZ	343.8	92	EPN		2023	8.18	1.2							1.0
HWQ	SN	343.8	92	SN		2023	43.51	0.4							1.0
FKH	SZ	386.0	92	EPN		2023	12.31	0.1							1.0
FKH	SE	386.0	92	SN		2023	52.78	0.6							1.0

December 26 2004 Hour: 0:46 48.9 SUMATRA EVENT M9 **Agency: REL Distant**

STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	BZ			EP		1 9	22.09								

December 27 2004 Hour: 10:27 2.9 Lat: 34.65N Lon: 36.06E Depth: 0 Agency: REL Local
Magnitudes: 2.9MC REL **Rms: 4.4 secs**

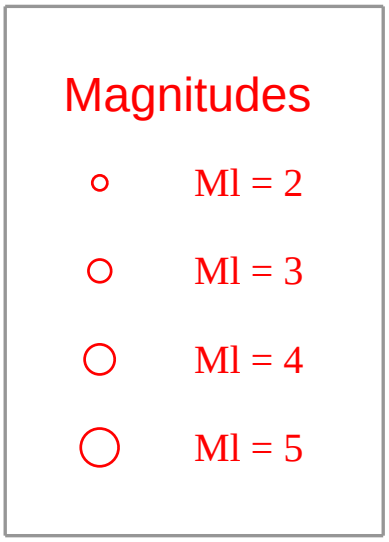
STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
HWQ	SZ	42.38	194	IPG		1027	4.99	-4.8	50						1.0
HWQ	SE	42.38	194	ISG		1027	9.72	-5.1							1.0
WRDH	SZ	100.6	19	IPG		1027	20.11	1.0							1.0
WRDH	SE	100.6	19	ISG		1027	35.95	4.8							1.0
SLNF	SZ	106.1	8	IPG		1027	20.42	0.4							1.0
BARV	SZ	137.6	184	IPG		1027	21.96	-3.1							1.0
BARV	SZ	137.6	184	ISG		1027	49.95	8.4							1.0
ARNV	SZ	156.6	32	IPG		1027	23.95	-4.2							1.0
ARNV	SE	156.6	32	ISG		1027	42.40	-4.5							1.0
BTCH	SZ	158.3	13	IPG		1027	27.31	-1.1							1.0
BTCH	SE	158.3	13	ISG		1027	50.54	3.2							1.0
TCHB	SZ	219.7	182	IPG		1027	43.42	5.1							1.0

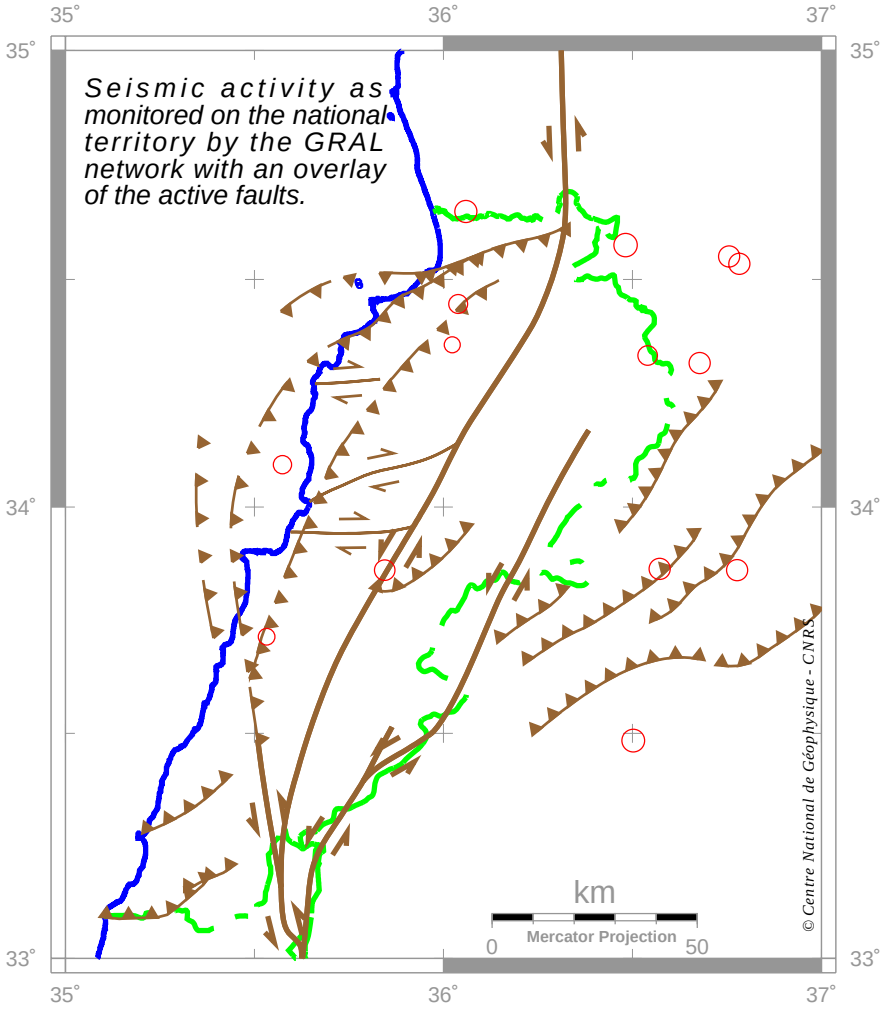
December 27 2004 Hour: 15:28 0.7 **Agency: REL Local**

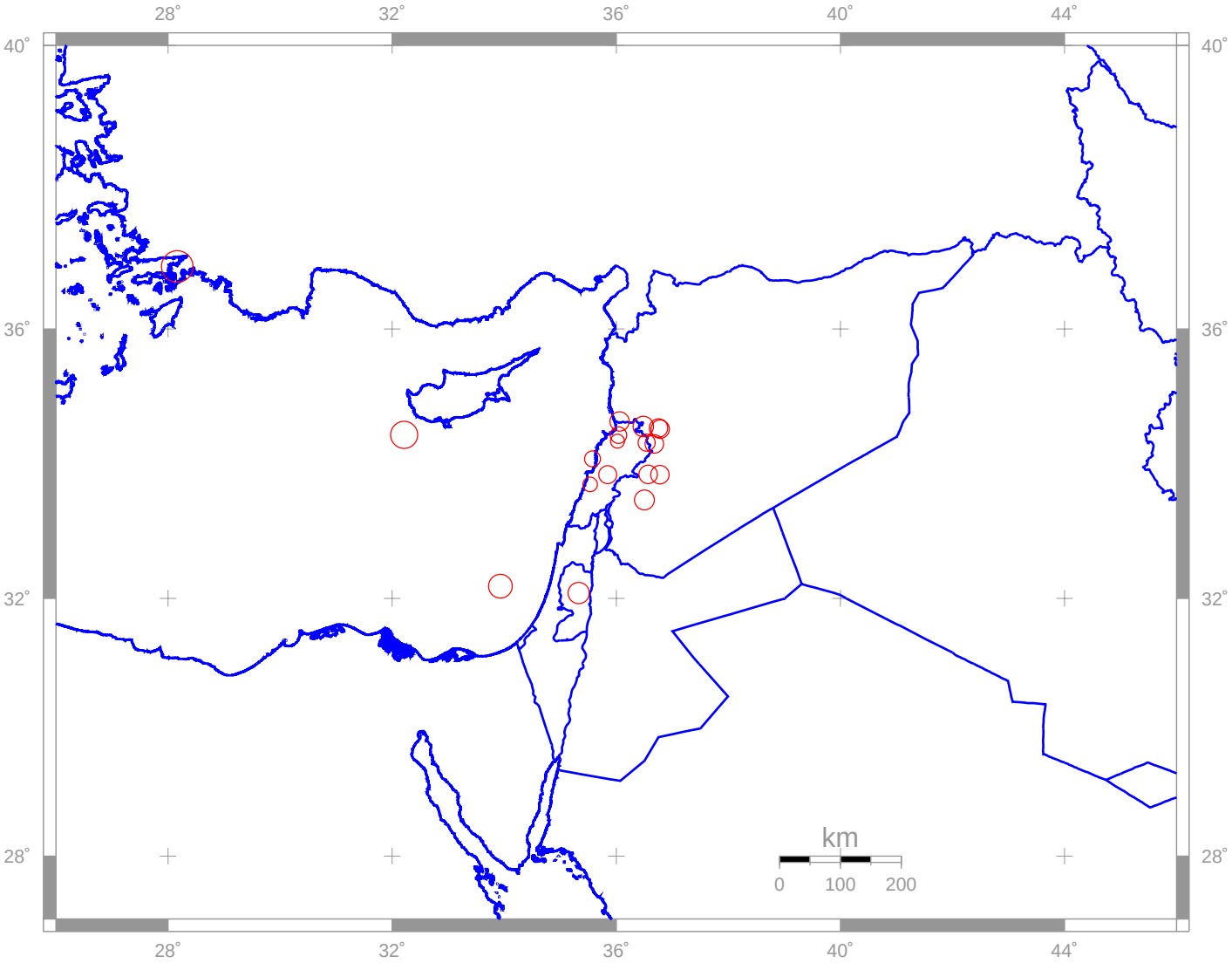
STAT	CO	DIST	AZI	PHASE	P	HRMN	SECON	TRES	CODA	AMPL	PERI	BAZ	ARES	VELO	WT
BHL	SZ			IPG		1528	35.95								
BHL	SN			ISG		1528	38.73								
HWQ	SE			ISG		1528	48.02								

Epicentral Map of Lebanon

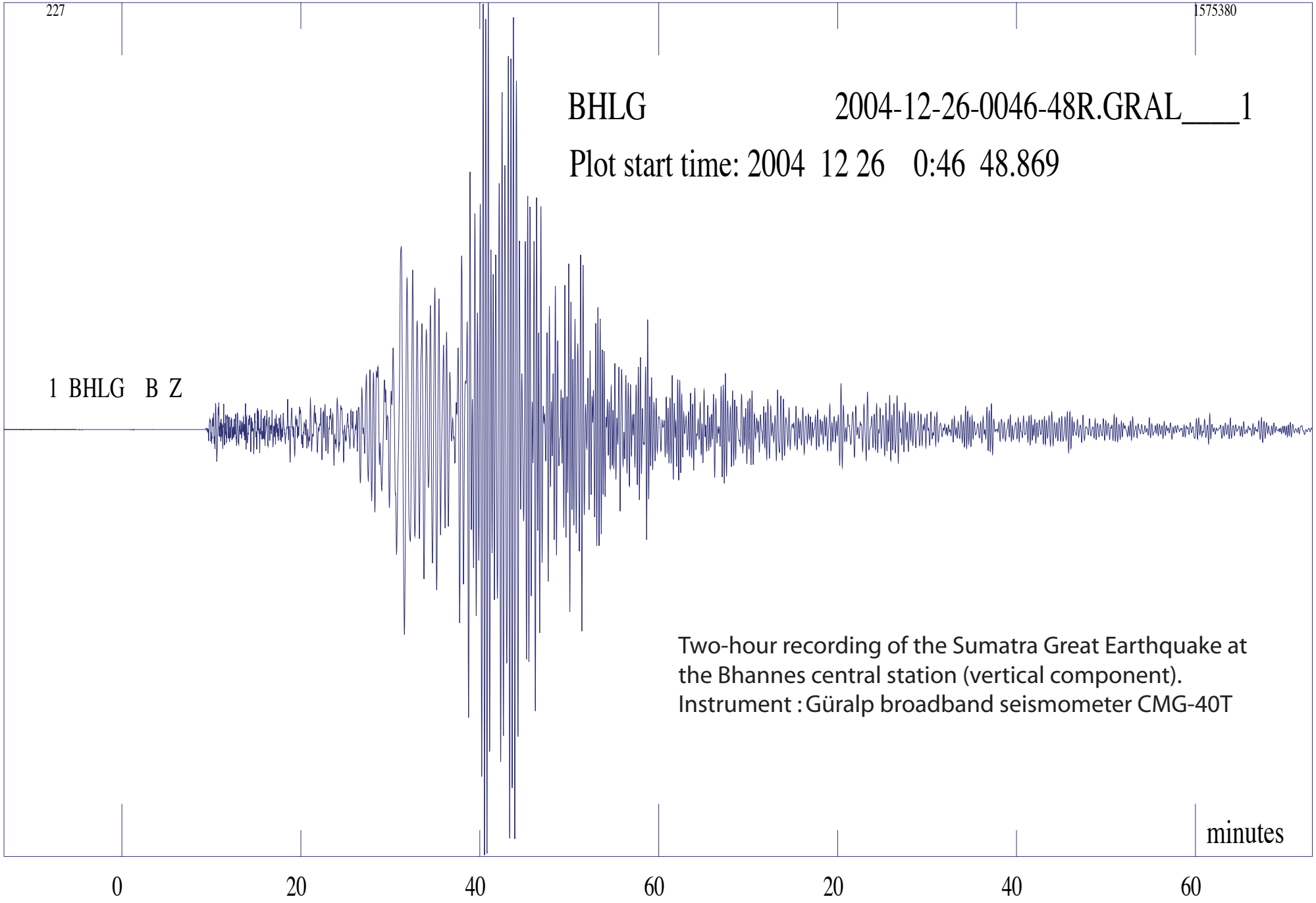
DECEMBER 2004

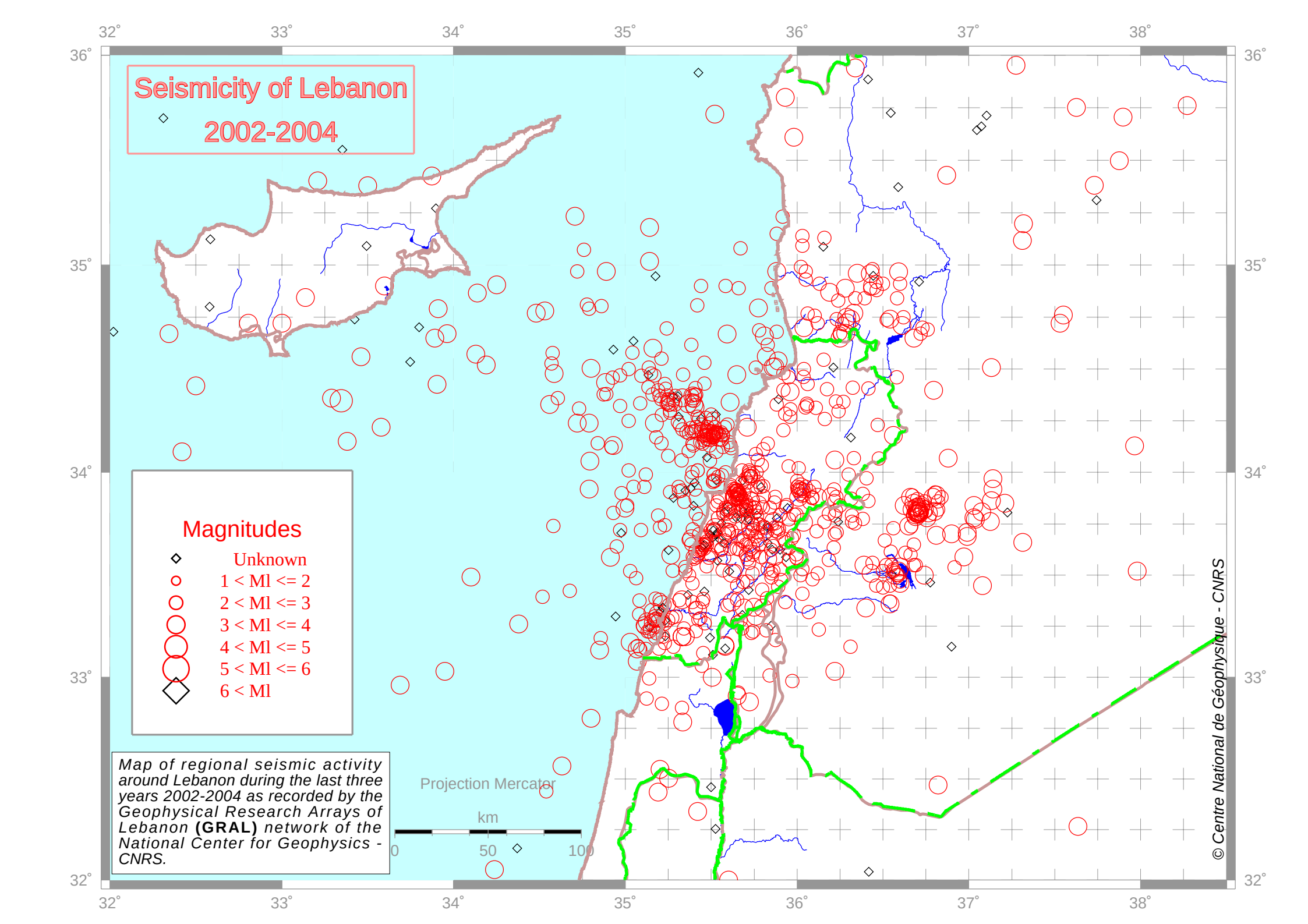


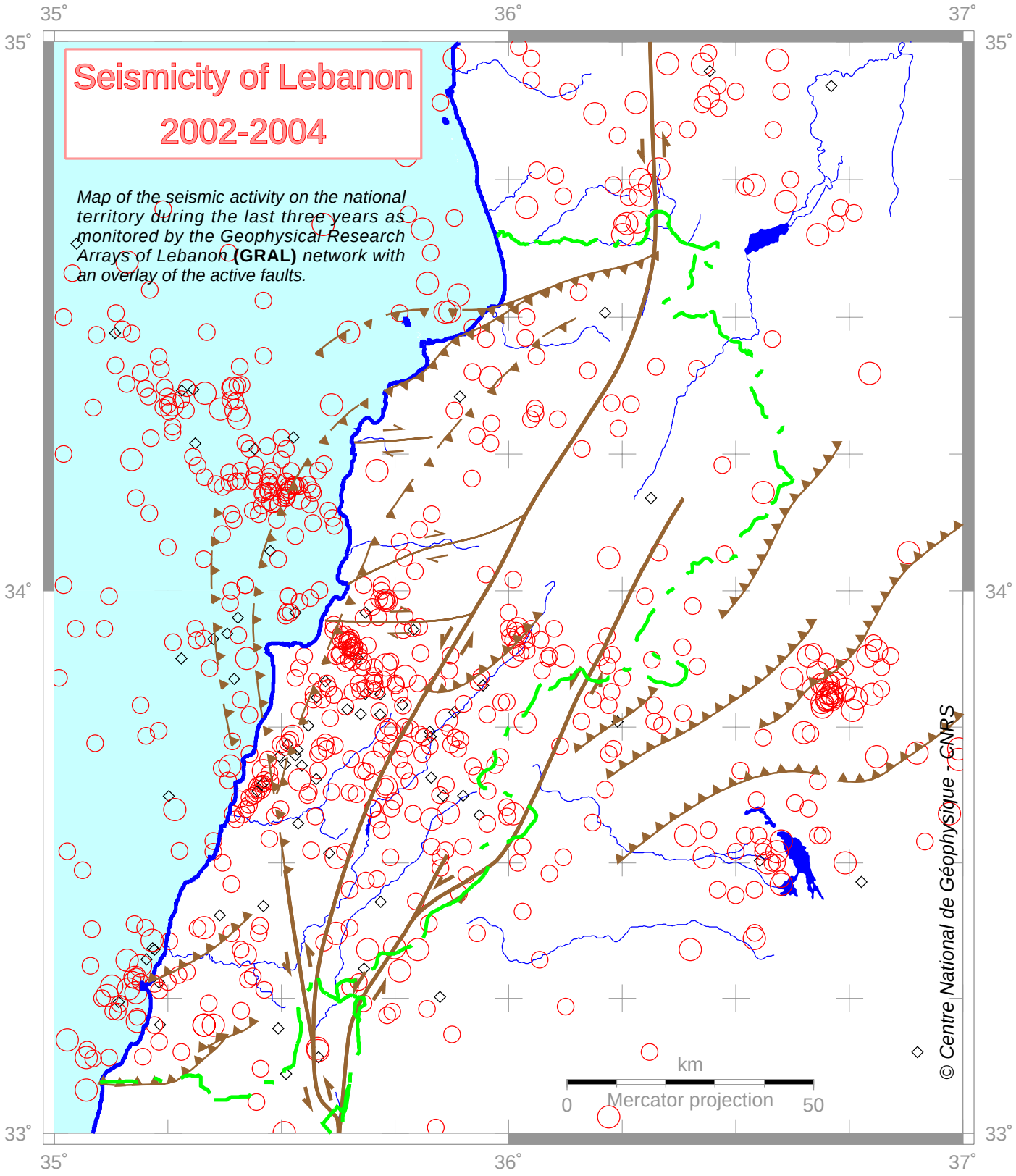




The Sumatra M9 Great Earthquake as recorded by the GRAL network




Seismicity of Lebanon
2002-2004
Magnitudes
Unknown
1 < Ml <= 2
2 < Ml <= 3
3 < Ml <= 4
4 < Ml <= 5
5 < Ml <= 6
6 < Ml
Map of regional seismic activity around Lebanon during the last three years 2002-2004 as recorded by the Geophysical Research Arrays of Lebanon (GRAL) network of the National Center for Geophysics - CNRS.
Projection Mercator
km
0
50
100
32°
33°
34°
35°
36°
37°
38°
© Centre National de Géophysique - CNRS



Magnitudes

- Unknown
- 1 < Ml <= 2
- 2 < Ml <= 3
- 3 < Ml <= 4
- 4 < Ml <= 5
- 5 < Ml <= 6
- 6 < Ml