The ISC Data and Temporary Network Observations

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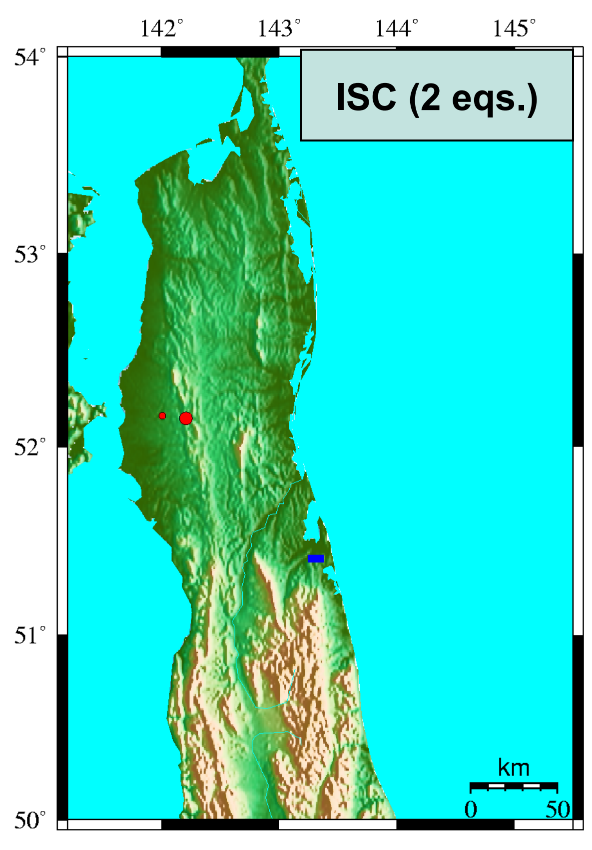
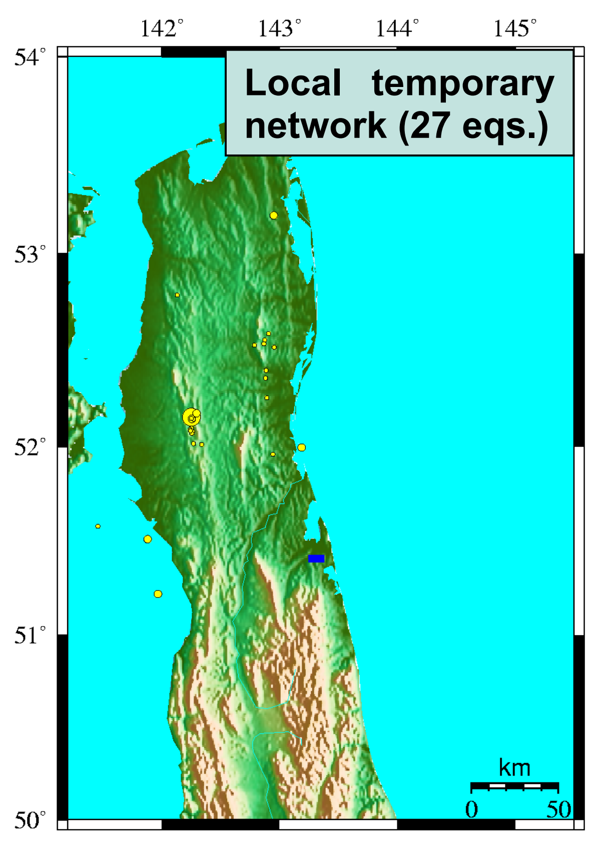
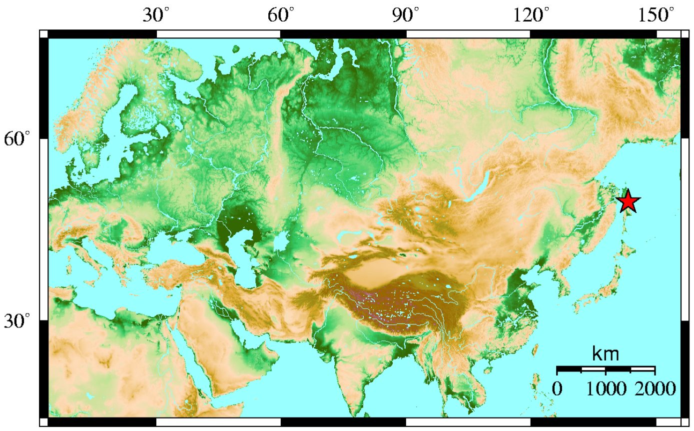
Hazard Assessment: Sakhalin Pipeline Project

Time period June-July, 2010





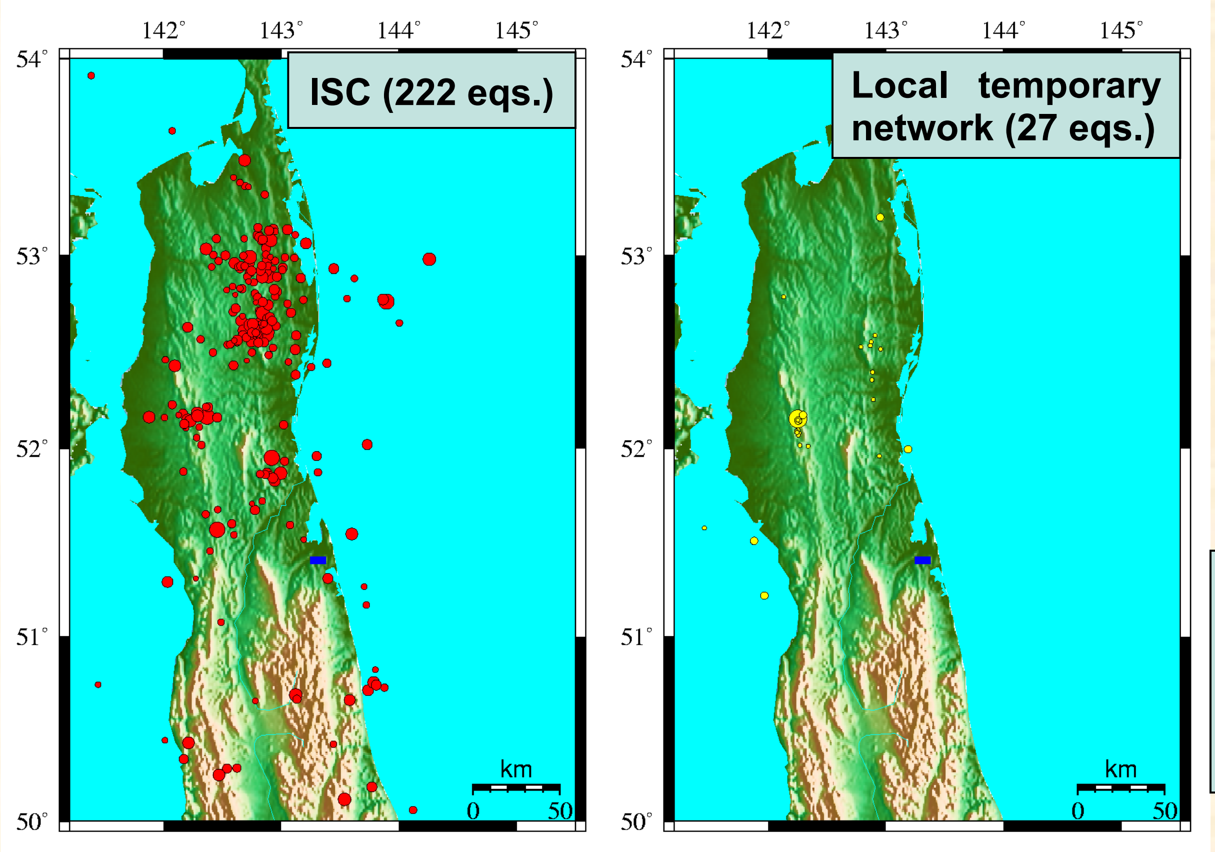


In short time windows, the ISC data may be rather incomplete (small events are missing).

HOWEVER!

Hazard Assessment: Sakhalin Pipeline Project

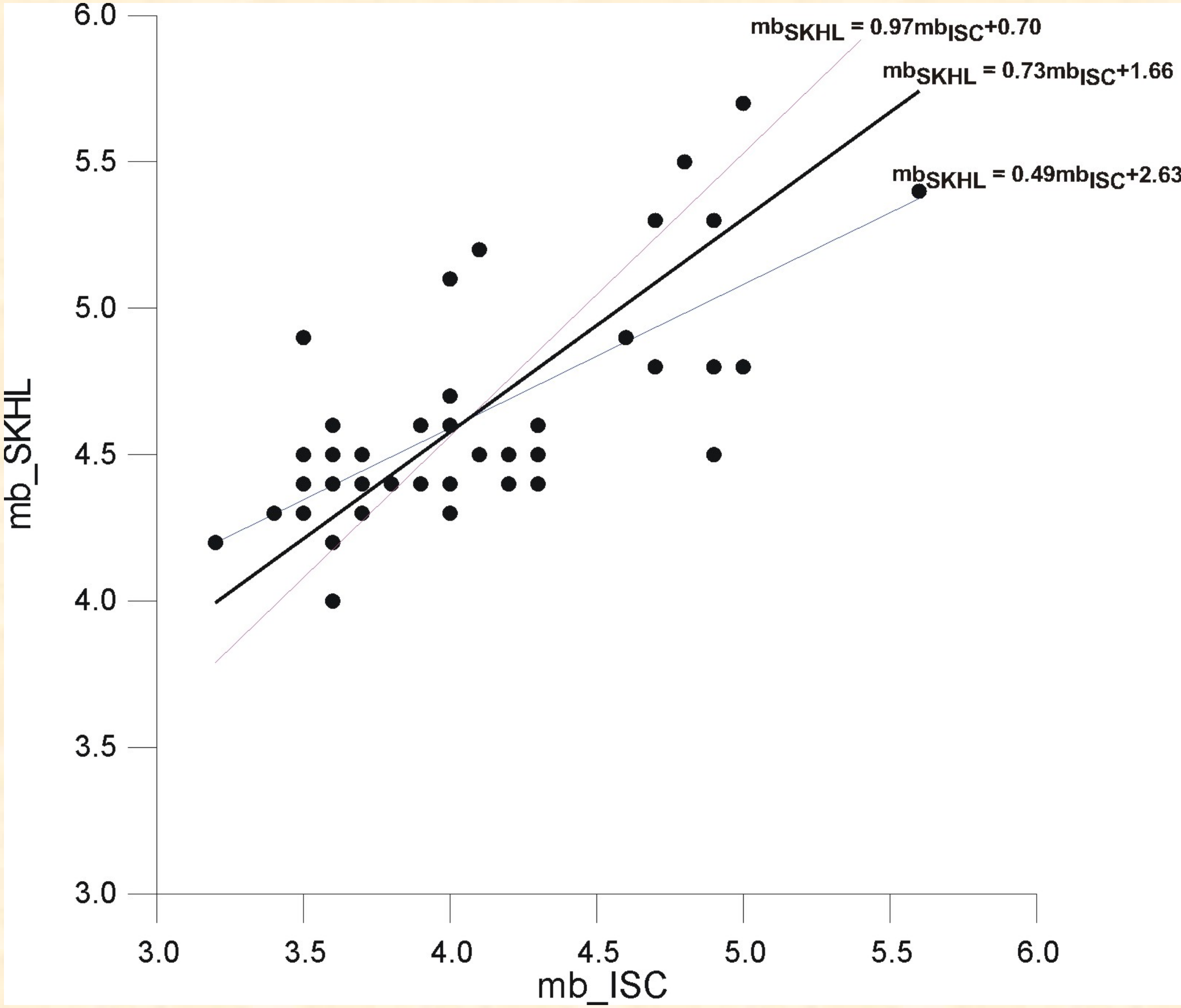
Time period 1964 - 2012



When the task requires analysis of long-term seismicity, the ISC provides data, which is the basis for solution

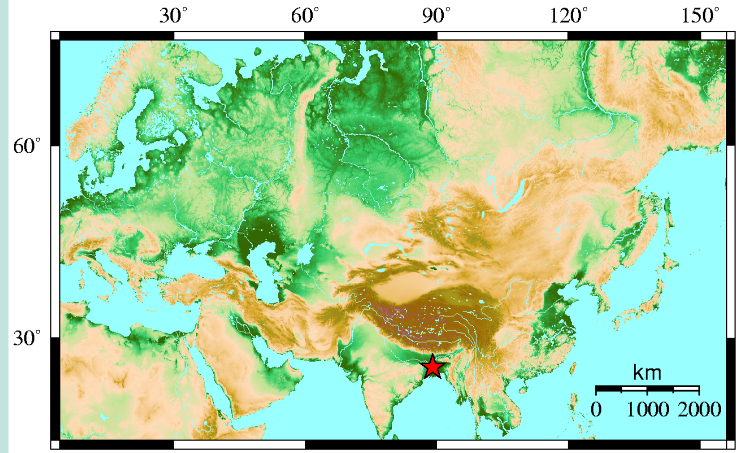
Making Homogeneous Magnitude Calibration

The ISC is the background for achieving homogeneous magnitude assessments in the catalogues built on data from different agencies. Through the ISC data it is possible to link the pieces.



mb magnitudes reported by the ISC and the regional agency SKHL for the same events.

Hazard Assessment: Regions without National Seismological Network

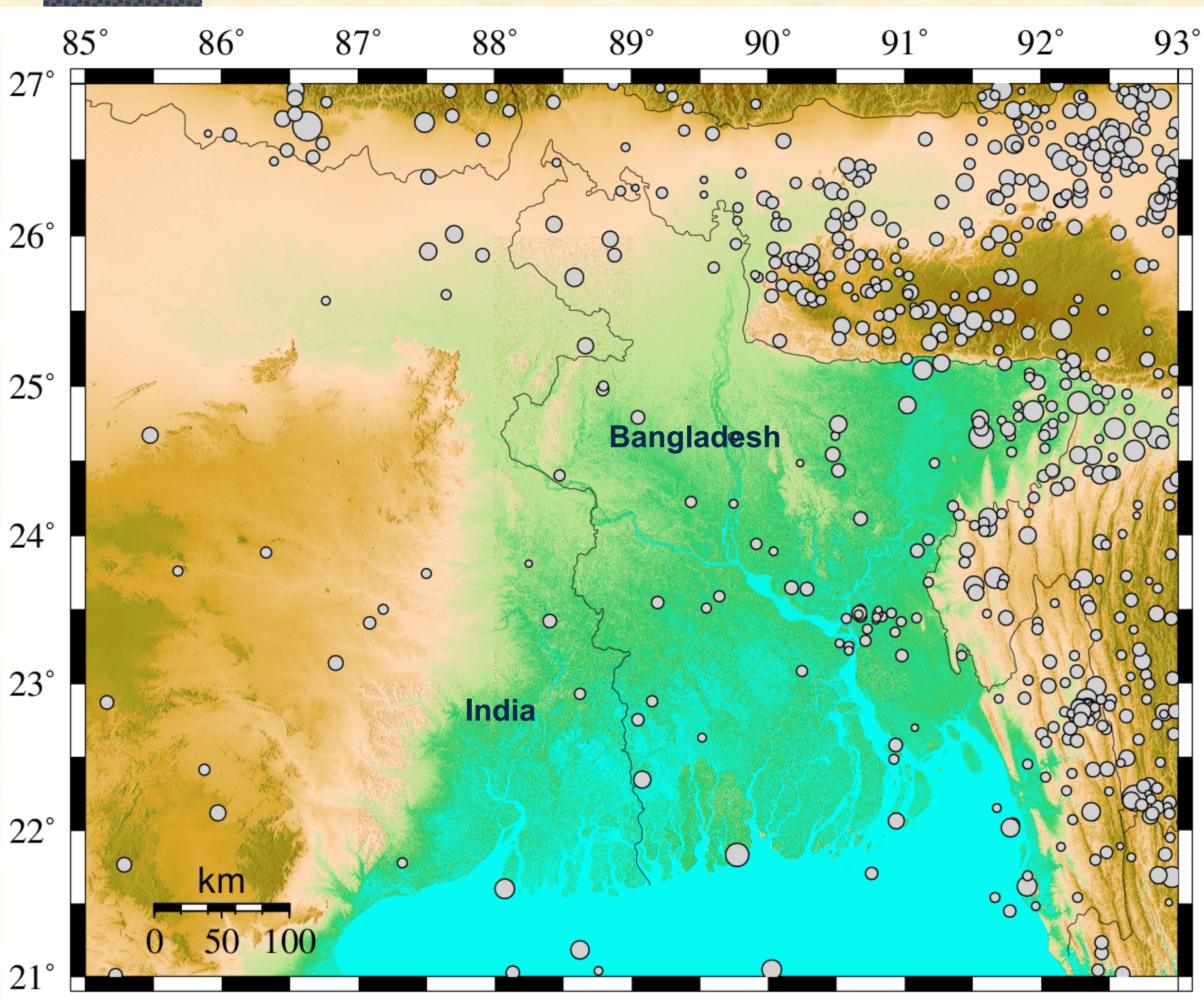


Code	Description	Period	n
BER	Department of Earth Science Bergen, Norway. Status: active		2
BGR	Bundesanstalt fuer Geowissenschaften und Rohstoffe. Status: active		1
BGS	Global Seismology Unit, United Kingdom. Status: active		3
BJI	(PEK 1963 - 1987) China Earthquake Networks Center, Beijing, China. Status: active	1963-2014	241
BKK	Thai Meteorological Department, Bangkok, Thailand. Status: active	2009-2013	38
NEIC	(USCGS 1964 - 1970; NEIS 1971 - 1984) National Earthquake Information Center, U.S.A. Status: active	1964-2015	410
CNRM	Centre National de Recherche, B.P. 1346, R.P. Rabat, Morocco. Last data: 2012-12-31		1
CRAAG	Centre de Recherche en Astronomie, Astrophysique et Geophysique, Craag, Algiers, Algeria. Status: active		1
CSEM	Centre Sismologique Euro-Mediterraneen, c/o LDG, BP12, 91680 Bruyeres-le-Chatel, France. Status: active		2
DJA	Badan Meteorologi dan Geofisika, Jakarta Pusat 10720, Indonesia. Status: active	2007-2014	12
DMN	Department of Mines and Geology, Kathmandu, Nepal. Status: active	2001-2013	94
DSN	Dubai Seismic Network, Dubai Municipality, Dubai, United Arab Emirates. Status: active		1
DUSS	Department of Geology, Faculty of Sciences, Damascus, Syria. Last data: 2005-05-24		1
EHB	Engdahl, E.R., R.D. van der Hilst, and R. Buland (1998). Global teleseismic earthquake relocation with improved travel times and procedures. Bull. Seis. Soc. Amer., 88, 722-743. Last data: 2008-12-31	1963-2008	129

Hazard Assessment: Regions without National Seismological Network

EIDC	Center for Monitoring Research, U.S.A. Last data: 2000-02-25	1995-2000	88
IDC	International Data Centre, Vienna International Centre, Vienna, Austria. Status: active	2000-2015	417
GCMT	(HRVD 1976 - 2007) Lamont Doherty Earth Observatory (LDEO), U.S.A. Status: active	1984-2013	26
GFZ	GEOFON Program, Telegrafenberg, Potsdam, Germany. Status: active	2006-2014	20
HFS	(HFS1, HFS2) Hagfors Observatory, The National Defence Research Institute, Sweden. Last data: 1994-06-22	1973-1994	60
ISC	**International Seismological Centre. Last data: 2012-09-30**	**1963-2012**	**597**
ISS	International Seismological Summary. Last data: 1963-12-31		2
KLM	Malaysian Meteorological Service. Status: active		1
LDG	Laboratoire de Détection et de Géophysique/CEA. Status: active	1999-2009	29
MOS	Geophysical Survey of Russian Academy of Sciences. Status: active	1963-2013	116
NAO	NORSAR, Norway. Status: active	1978-2012	95
NDI	India Meteorological Department (IMD), New Delhi, India. Status: active	1966-2013	162
QUE	Geophysical Centre, Pakistan Meteorological Department, Pakistan. Last data: 1988-09-29		6
RRLJ	Regional Research Laboratory Jorhat, Jorhat 785006, Assam, India. Last data: 1995-08-31	1992-1995	41
SHL	Central Seismological Observator, Shillong-5, Assam, India. Last data: 1972-04-25	1963-1970	7
SOME	Seismological Experimental Methodological Expedition, Almaty, Kazakhstan. Status: active		2
SYO	National Institute of Polar Research, Tokyo 173-8515, Japan. Status: active		1
TEH	Institute of Geophysics, University of Tehran, 16 Azar Street, Enghelab Ave., Tehran, Iran. Status: active		1
ZUR	Swiss Federal Institute of Technology, Zurich, Switzerland. Status: active		2

Hazard Assessment: Regions without National Seismological Network



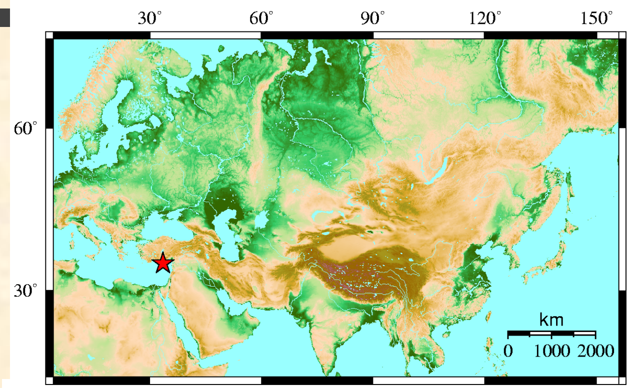
Seismic network in Bangladesh is developing now. It does not yet produce earthquake catalogue

There are 34 agencies in the Table. Eight agencies randomly report earth-quakes in the area (only 1 record); some gives rather regular data

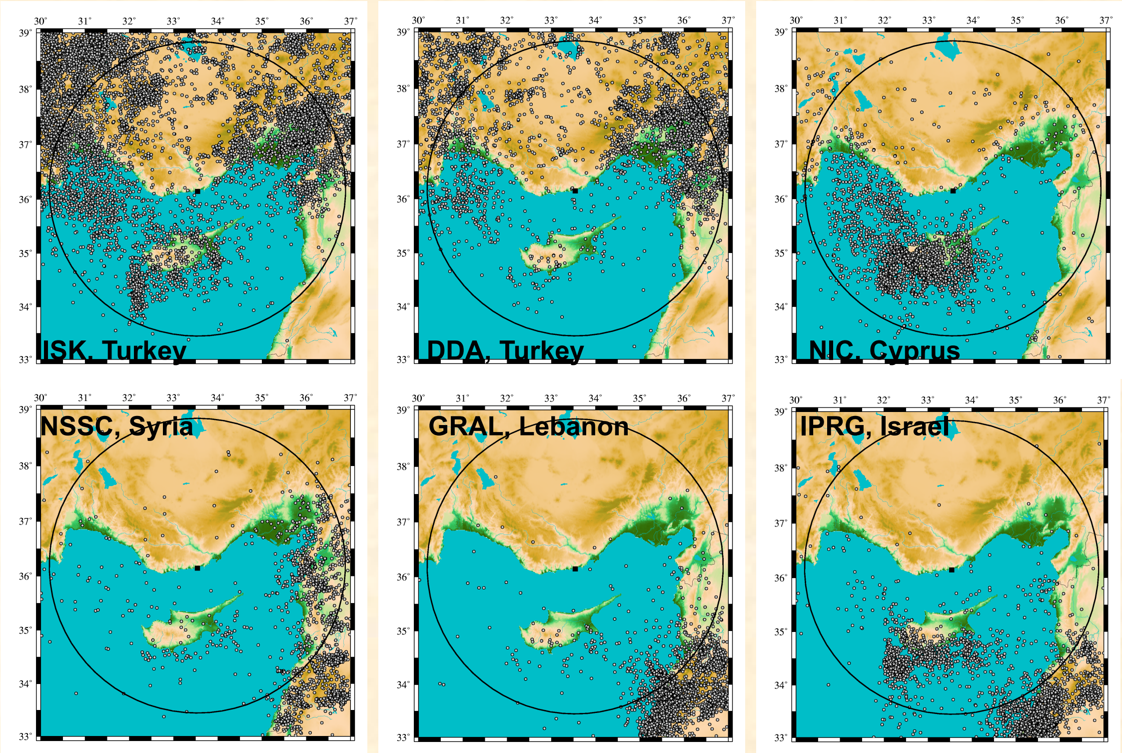
ISC (1964–2014, 597 eqs., mb≥3.0) is the most complete homogeneous dataset for the region

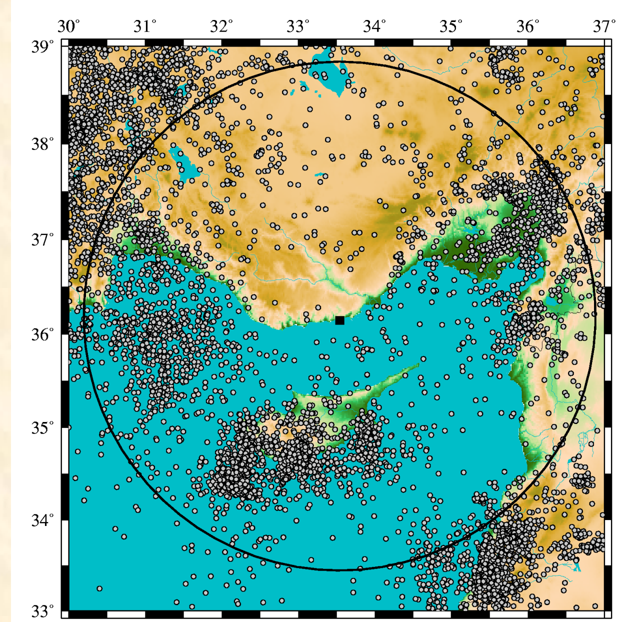
Hazard Assessment: Regions Split among National Seismological Network

Hazard assessment needs not only long-term data: the studied area has to be large enough to take into account all major source zones



Regional catalogues cover some pieces



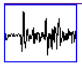


The ISC catalogue covers the whole area

ISC Provides Initial Data Useful for Verification of Solutions

ISC Comprehensive Bulletin

Event 798219 Turkey



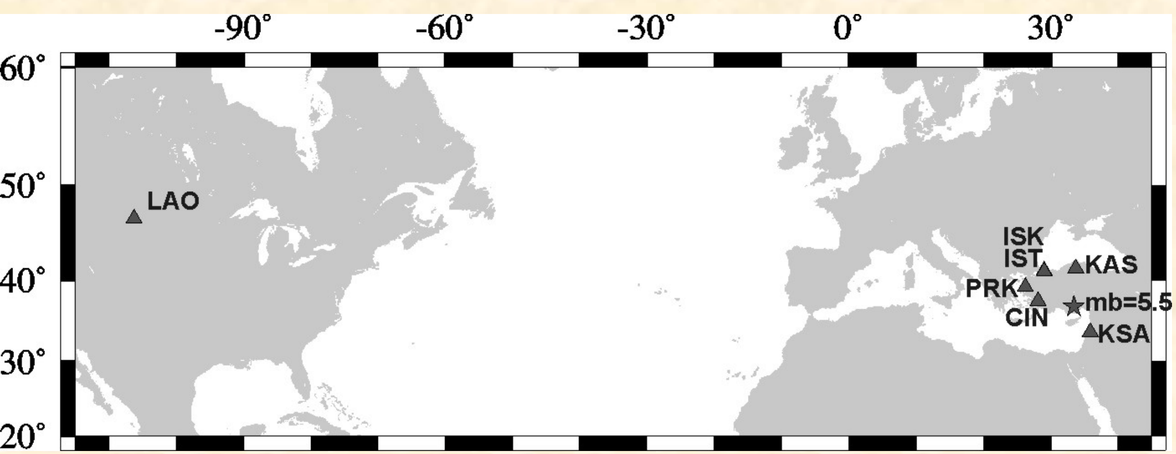
Date	Time	Err	RMS	Latitude	Longitude	Smaj	Smin	Az	Depth	Err	Ndef	Nsta	Gap	mdist	Mdist	Qual	Author
1970/03/20	08:50:04.00	3.70	9.630	36.9000	33.5000	48.82	45.5	90	33.0f		7	7	144	4.00	89.00	m i uk	ISC

(Preliminary determination)

Magnitude		Err	Nsta	Author	OrigID
mb	5.5		1	ISC	1764304

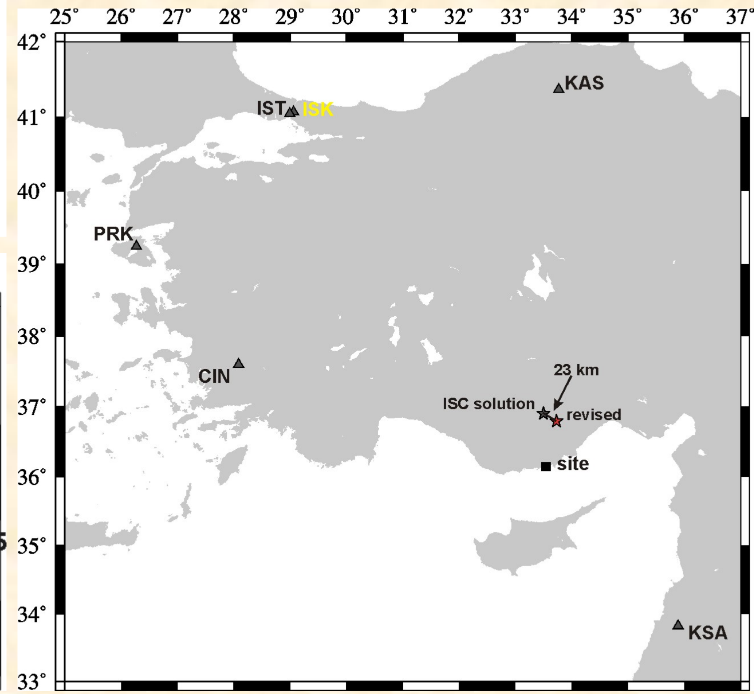
Sta	Dist	EvAz	Phase	Time	TRes	Azim	AzRes	Slow	SRes	Def	SNR	Amp	Per	Qual	Magnitude		ArrID
KSA	3.64	147.0	PN	08:50:54.0	-5.30					T__				__			26208703
KSA	3.64		SN	08:51:56.0						___				__			26208704
CIN	4.38	281.0	PN	08:51:16.0	6.2					T__				__			26208705
KAS	4.47	3.0	PN	08:51:15.0	3.9					T__				__			26208706
ISK	5.41	322.0	PN	08:51:17.9	-6.50					T__				_i			26208707
ISK	5.41		S	08:52:12.0						___				__			26208708
IST	5.43	321.0	PN	08:51:17.0	-7.70					T__				_e			26208709
IST	5.43		S	08:51:28.0						___				__			26208710
PRK	6.16	295.0	PN	08:51:34.0	-1.10					T__				_e			26208711
LAO	89.28	334.0	P	09:03:12.7	15.00					T__				_i	mb	5.5	26208712
LAO	89.28			09:03:22.0						___				_e			26208713

STOP



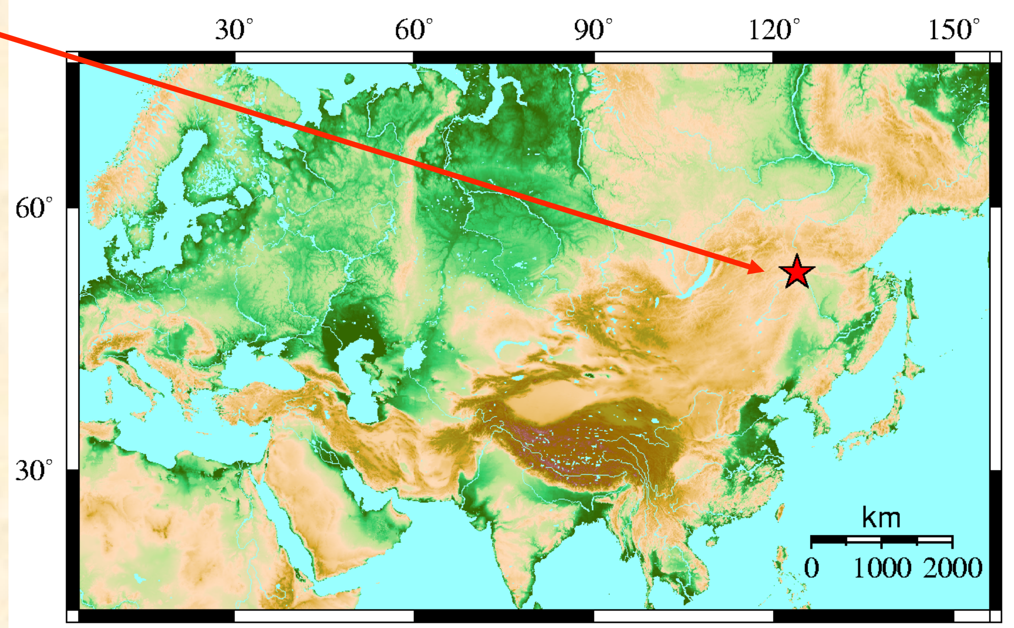
Initial information on 1970/03/20 eq.

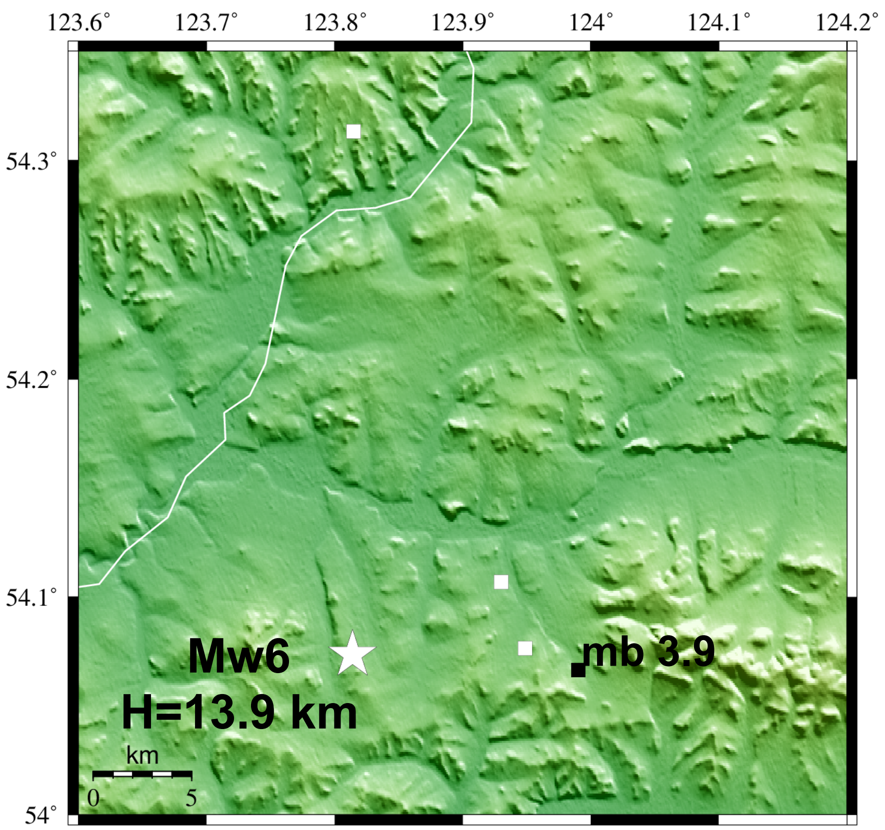
Revised solution 1970/03/20 eq.



The Skovorodino, Mw6, Earthquake

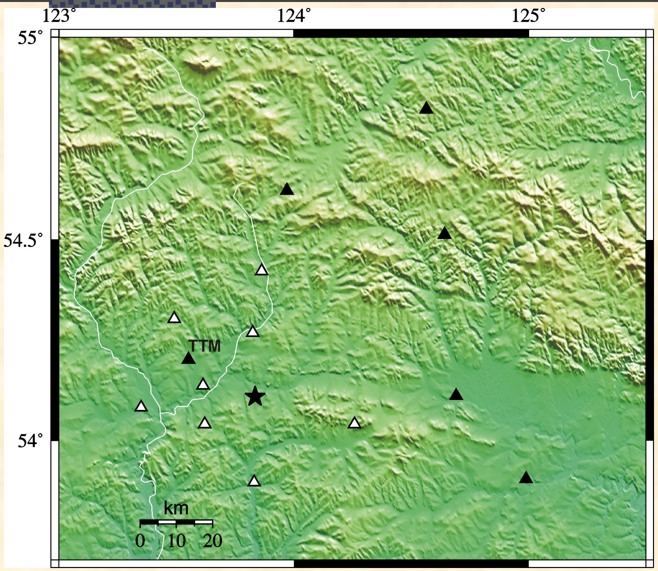
The Skovorodino, October 14, 2011 earthquake is the largest ever instrumentally recorded one in the region. Of course the ISC includes it in the catalogue

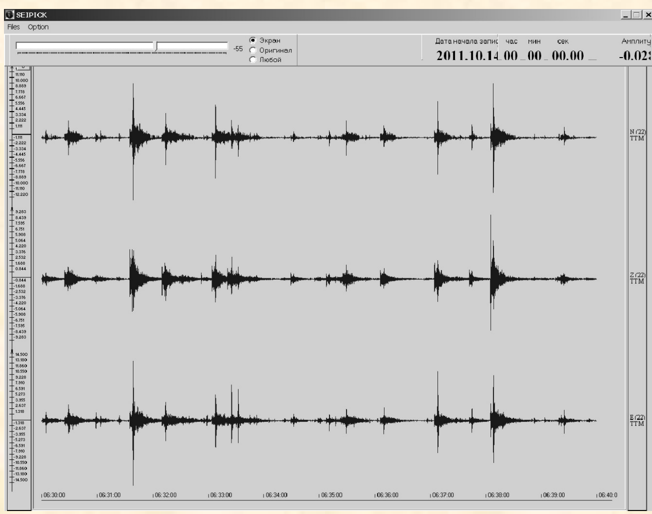




The ISC reported only on 4 aftershocks, out of which magnitude is evaluated for 1. It seems, aftershocks did not follow the mainshock. One can make a lot of science out of this. But local network tells us something very different.

The Skovorodino, Mw6, Earthquake Local Temporary Network



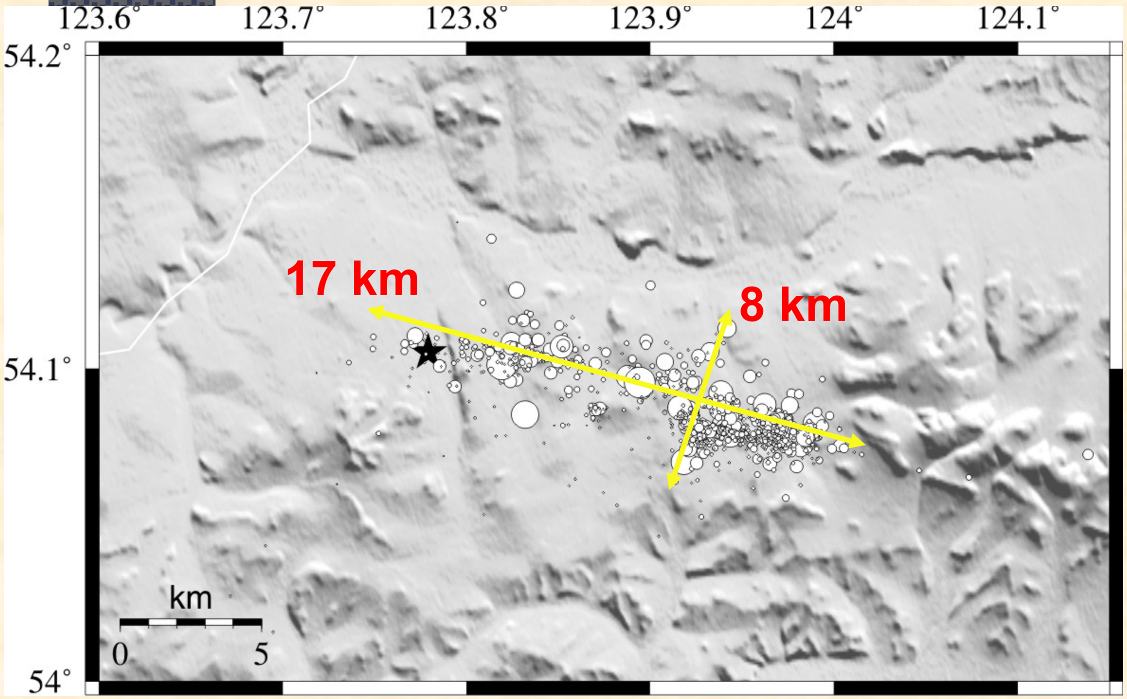


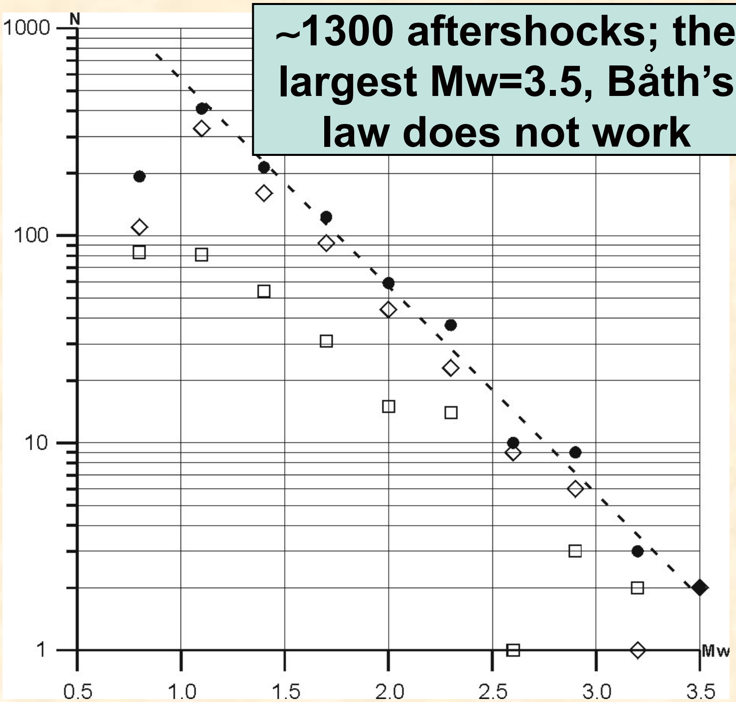
Record of 10-minute interval at the nearest to the epicenter station TTM (Δ~21 km); just 20 minutes after the mainshock.

At least 29 aftershocks can be identified. They are all mixed up or not recorded at far stations – phase picking is impossible. These events will not enter into the aftershock catalogue.

Any statistics of number of aftershocks (like Omori's law) strongly depends on the network resolution. Incomplete data contaminate the result.

The Skovorodino, Mw6, Earthquake Data Completeness and Spatial Distribution of Aftershocks





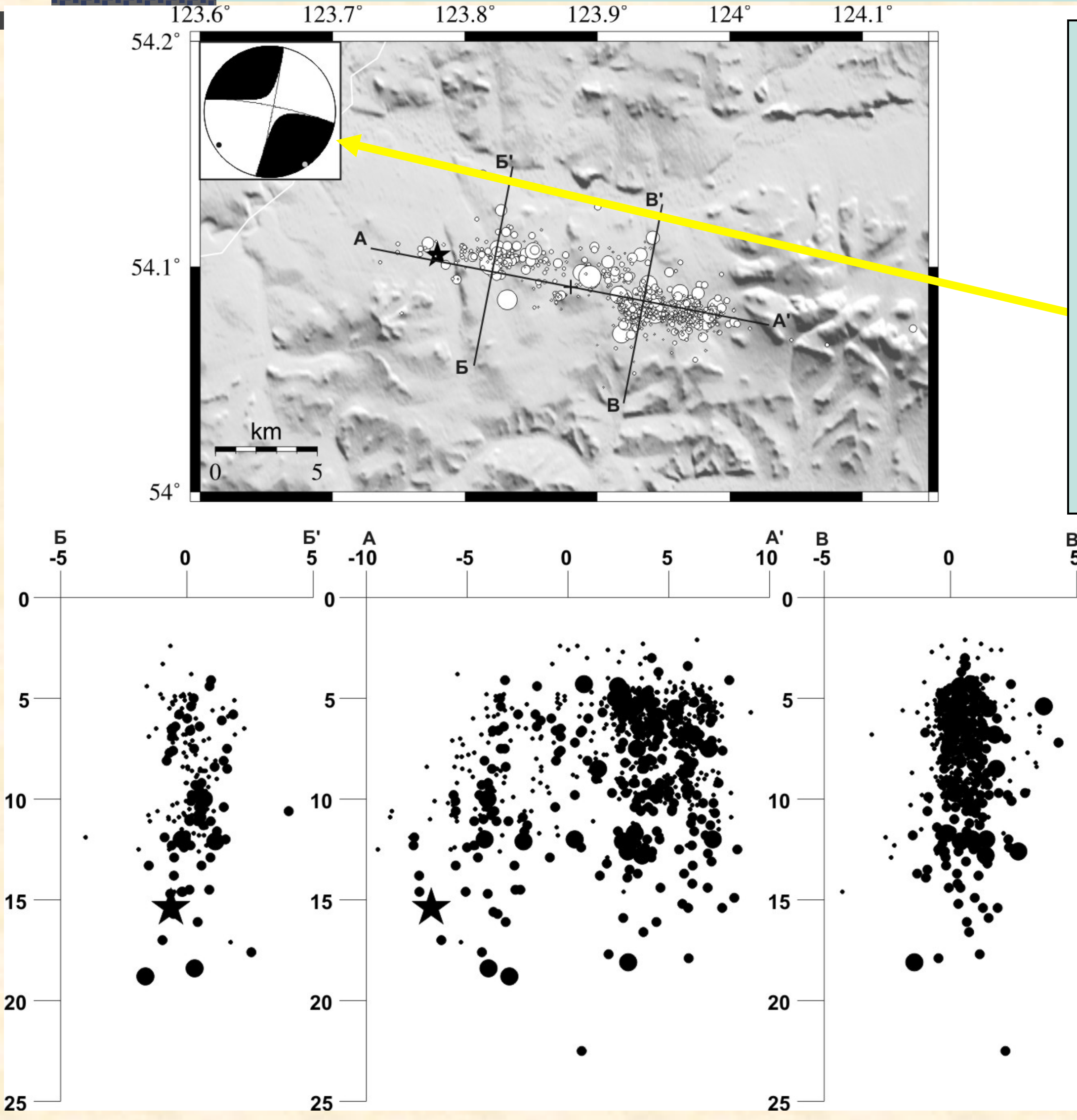
~1300 aftershocks; the largest Mw=3.5, Båth's law does not work

Epicenters of recorded aftershocks

Two clusters are clearly visible – possibly, reflecting fault segmentation. Rupture geometry (L&W) can be inferred

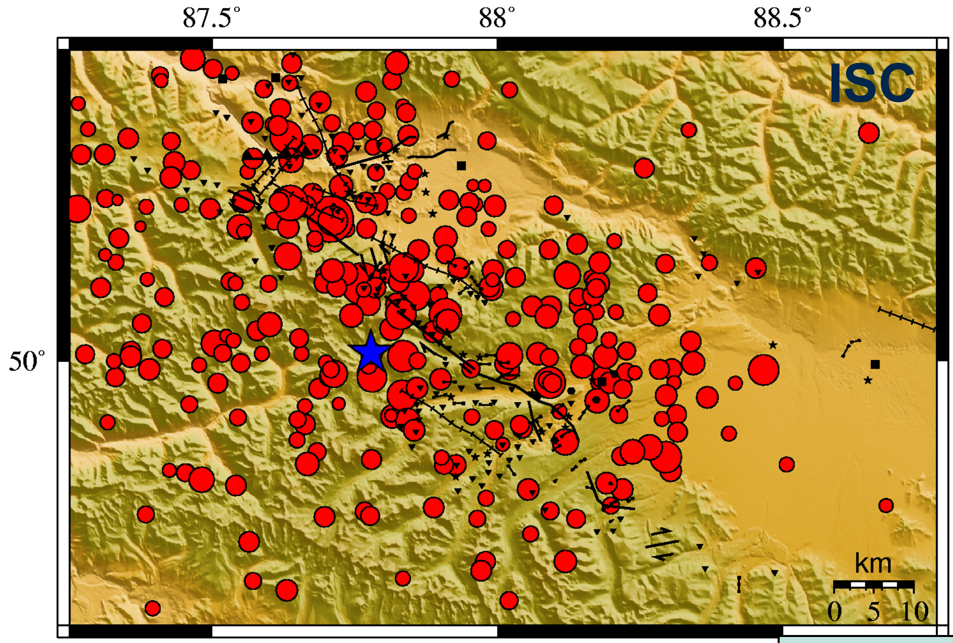
Aftershocks with magnitudes ≥1 are recorded without omissions. Such data completeness can not be achieved by a distant network

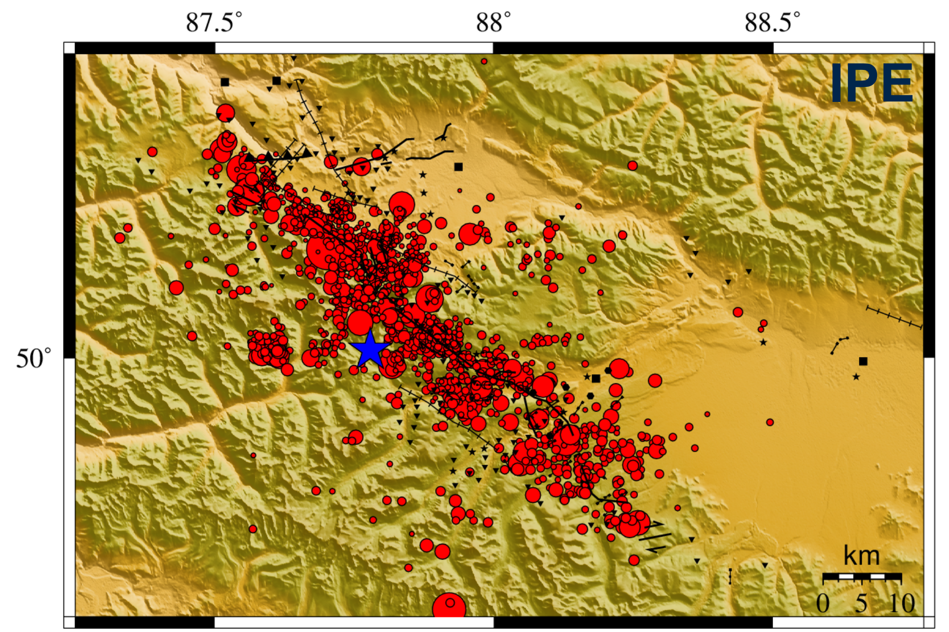
The Skovorodino, Mw6, Earthquake FPS and Cross-Sections on Depth

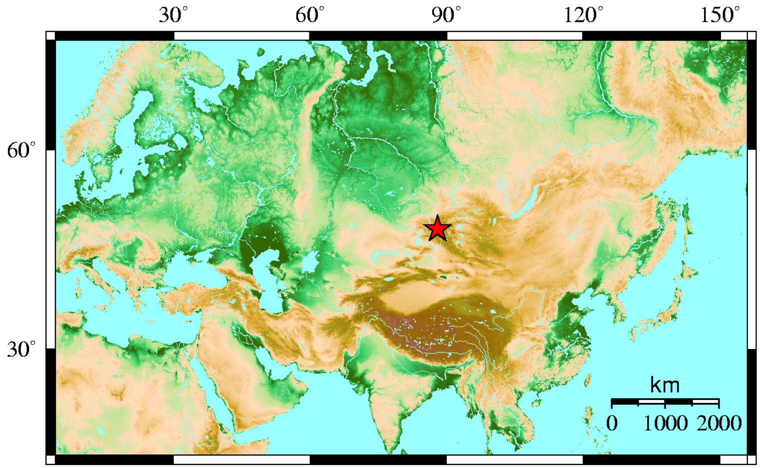


Orientation of the EW nodal plane is consistent with the spatial distribution of aftershocks. This plane is assumed as rupture plane. This result is very important for identification of active fault and hazard assessment.

Altai Mw7.3 September 27, 2003, Earthquake







The ISC reported the main shock; time interval up to June 25, 2004 is shown in the Figure. All large aftershocks (including Ms7) occurred in first 5 days.

The first earthquake in the IPE catalogue is dated to June 25, 2004 – 9 months after the mainshock; 2.5 months of observations are presented in the IPE catalogue.

Conclusions

1. The ISC is the basic data-source in the areas, where regional seismic networks have not been yet developed.
2. The ISC data is of the highest priority when the studied area is located in the region, parts of which are covered by different regional networks (agencies); especially, when the parts overlap.
3. Temporary networks can not be in competition with the ISC in seismic hazard assessment task as it requires long-term data collected over large region. Temporary network can provide detailed information on a selected part of the territory only. It can help to identify active fault or its segment.
4. The ISC is an important bridge making possible to build up homogeneous magnitude system based on data from different agencies, often following their own magnitude calibration standards.
5. Dense temporary networks give valuable data on earthquake source zone structure and regime for developing realistic source models.
6. If the temporary network can not be installed immediately after strong earthquake, the gap can be effectively filled with the ISC data.

Acknowledgments

The presentation is based on data of expeditions organized by the IPE, RAS. The staff did their best in hard field conditions to get high quality data. Authors are deeply in debt to all members of the Epicentral expeditions.