

INTERNATIONAL SEISMOLOGICAL CENTRE (ISC)

2015

Annual Director's Report



The year 2015 was another successful year for the ISC thanks to the extended support of 65 Members and 10 Project Sponsors. We marked our 50th Anniversary with a dedicated symposium during the IUGG Assembly in Prague. We hired and trained many new staff. Bulletin data for earthquakes and other seismic events during recent (2012-2015) and historical (1935-1949) periods were added to the ISC database that grew by 28% in one year. The Station Registry, GT-List, ISC-GEM catalogue, the ISC Event Bibliography and CTBTO Link were further extended. A large number of scientific articles published in 2015 indicate an extensive worldwide use of the ISC data.

EXECUTIVE SUMMARY.....	3
STAFF and CONSULTANTS.....	5
OPERATIONS.....	9
INTERNATIONAL SEISMOGRAPH STATION REGISTRY (IR) as PART of the ADSL DATABASE	9
COLLECTING PRELIMINARY NETWORK BULLETINS	10
BUILDING PRELIMINARY ISC BULLETIN	12
COLLECTING REVISED NETWORK BULLETINS.....	12
ISC BULLETIN REVIEW	18
VISUAL BULLETIN ANALYSIS SYSTEM (VBAS)	21
GENERAL STATISTICS of the ISC BULLETIN	22
PRINTED SUMMARY of the BULLETIN of the ISC	27
IASPEI GT LIST	28
EHB BULLETIN	29
ISC EVENT BIBLIOGRAPHY.....	30
SEISMOLOGICAL CONTACTS	31
ISC DATABASE	31
ISC WEB and FTP SITES	32
ISC DATABASE and WEBSITE BACKUP and MIRRORS	33
DEVELOPMENT PROJECTS	34
EXTENSION of the ISC-GEM CATALOGUE	34
CTBTO LINK to the ISC DATABASE	36
ISC BULLETIN REBUILD	38
The ISC FDSNWS WEB-SERVICE	40
FINANCE	41
INCOME	41
EXPENDITURE	41
RESERVES.....	42
CASH FLOW	42
SCIENTIFIC LIAISONS	43
VISITORS to the ISC.....	43
CONFERENCES, MEETINGS, WORKSHOPS, TRAINING COURSES.....	43
ISC STAFF VISITING OTHER INSTITUTIONS.....	43
ISC PRIZE for OXFORD UNIVERSITY STUDENTS	44
USGS ComCat TELECALLS.....	44
SCIENTIFIC PAPERS PUBLISHED by the ISC STAFF	44
SCIENTIFIC PAPERS PUBLISHED in 2015 that USED the ISC DATA.....	46
SUMMARY OF ACHIEVEMENTS	64

EXECUTIVE SUMMARY

- ❑ The ISC marked the 50th anniversary of its services by way of a dedicated scientific symposium during the IUGG Assembly in Prague.
- ❑ The ISC finances remained in good shape thanks to the continued support from 65 Member-Institutions in 47 countries, additional project grants (27% of the total income) from CTBTO, GEM Foundation, USGS, US NSF, FM Global, Lighthill Risk Network, OYO, UK KTP, IRIS as well as sponsorship from Reftek.
- ❑ Two new Member-Institutions have joined the ISC.
- ❑ 13-17 staff members, 6 consultants and 2 members of Oxford University staff worked at the ISC during the year.
- ❑ Three new analysts have been hired and trained for the standard Analysis Team and two for the Bulletin Rebuild Team. A Data Collection Seismologist has been hired.
- ❑ 547 more stations were registered in the **International Seismograph Station Registry**.
- ❑ Within hours and days after event occurrence, the ISC collected and grouped preliminary data from 28 networks and distributed the **Preliminary ISC Bulletin**.
- ❑ The main collection of revised bulletins from 122 institutions stood at 12 months behind real time; 22 agencies were not able to adhere to this deadline.
- ❑ Following closure of the Euro-Med bulletin production at **EMSC**, several new direct contributions from agencies in the area have been set up at the ISC.
- ❑ 9 data months were added to the Reviewed **ISC Bulletin** with ~46,000 seismic events and ~4.25 million arrivals with two further data months in advanced stage of review.
- ❑ The overall ISC Bulletin (reviewed and unreviewed parts) is substantially more complete than the bulletins of either the NEIC/USGS or the IDC/CTBTO.
- ❑ We continued work on the Bulletin **Rebuild** and the **Visual Bulletin Analysis System**.
- ❑ We released three further issues of the printed **Summary of the ISC Bulletin**.
- ❑ The size of ISC database increased by ~28% during the year and reached 201Gb.
- ❑ The **ISC-GEM Global Instrumental Earthquake Catalogue** has been extended to include all known earthquakes with M_W 5.5 and above during 1935-1949 and 2012.
- ❑ Arrival times, amplitudes and periods as well as body and surface wave magnitudes from the historical part of the ISC-GEM catalogue have been included into the ISC Bulletin.
- ❑ The **ISC Event Bibliography** now includes ~17,900 articles related to ~14,900 events.
- ❑ We continued operating and improving the **CTBTO Link to the ISC database** with a healthy stream of recorded queries from the NDCs and IDC.
- ❑ The ISC database and the website mirrors at IRIS DMC in Seattle, ERI in Tokyo and LLNL in Livermore guaranteed improved speed of access to ISC data.
- ❑ We continued maintaining and distributing the IASPEI Reference (GT) Event List, the **EHB Bulletin** and the List of **International Contacts in Seismology**.
- ❑ The **FDSN-compliant web-service** has been put in action.
- ❑ The ISC staff published several scientific articles and participated in several international conferences and contributed to the work of IASPEI.
- ❑ The large number of published scientific articles using ISC data indicates a wide-range use of ISC products by many researchers worldwide.

FOREWORD

A dedicated all-day scientific session “50 years of the ISC Service to Seismology” took place in Prague, Czech Republic, during the 26th General Assembly of the IUGG.

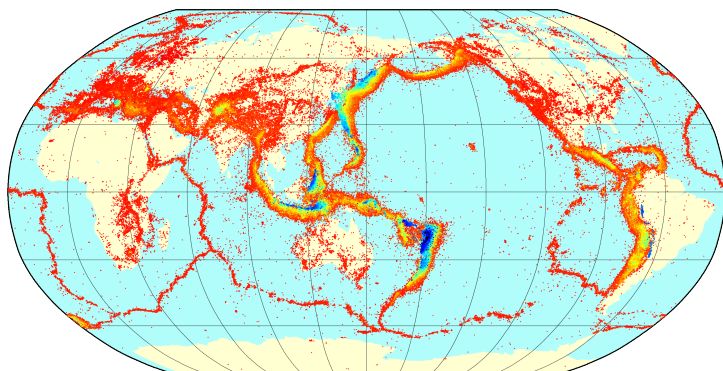


Figure 1. ISC hypocentres covering the 50 year period

Sciences including tectonics, Earth's structure, seismic hazard assessment, global nuclear test monitoring and education. Most importantly, the session speakers provided suggestions on how the services of all global parametric data centres can be advanced and extended to meet the requirements of current and future geophysicists.

The meeting hall was decorated with poster-testimonies (Fig. 2) provided by ten scientists that described successful use of the ISC data.

The session was convened by D.A. Storchak (ISC), S. Myers (LLNL, USA), M. Assumpção (USP, Brazil) and B. Delouis (GeoAzur/CNRS, France)

22 leading scientists, including the two invited, A. Dziewonski and B.L.N. Kennett, demonstrated the impact that the ISC data (Fig.1) has made and continues to make in all areas of Earth

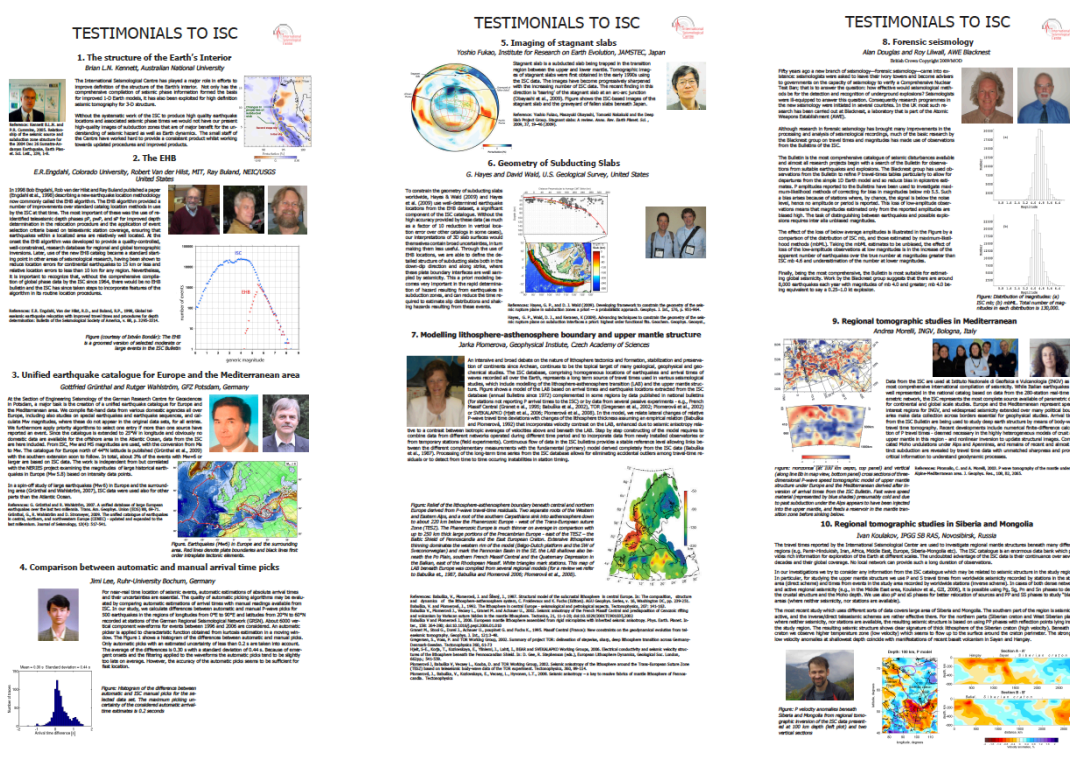


Figure 2. Testimonials to the ISC

STAFF and CONSULTANTS

13-17 members of staff and 6 consultants worked at the ISC during 2015, thanks to the regular Member's and sponsor's support and a number of additional grants given to the ISC by the international and public institutions and commercial companies to work on the ISC-GEM Catalogue, CTBTO Link and the Visual Bulletin Analysis System (VBAS).

In addition, members of the Oxford University e-Science Research Centre (OeRC), Dr Hui Fang followed by Mr Saiful Khan, worked at the ISC full time as part of the joint three-year project, the VBAS, part-funded by UK Government Knowledge Transfer Programme (KTP).

Among the ISC staff members, there are 7 Ph.D., 4 M.Sc. or equivalent, and 4 B.Sc. or equivalent degrees. The ISC staff represents 10 different countries from 3 continents. Several members of staff took part in professional meetings, travelled to international conferences and participated in professional training programmes.

The ISC staff often organise sessions during major scientific conferences. Several ISC staff are members of professional organizations such as IASPEI, SECED, EGU, AGU and SSA. ISC staff members are engaged in the IASPEI's Executive Committee, commissions and working groups.

MANAGEMENT and ADMINISTRATION



Dmitry Storchak, Ph.D.
Director/Seismologist
Russia/UK



Maureen Aspinwall
Administration Officer
UK

DATA and SYSTEMS ADMINISTRATION



James Harris
Senior Systems & Database
Administrator, *UK*



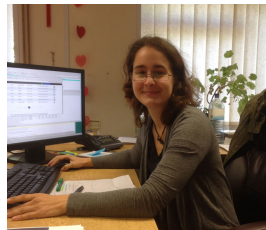
Przemek Ozgo
Systems and Web Administrator
Poland

BULLETIN DATA COLLECTION

During the year, the bulletin data collection team was strengthened with a Seismologist, who was able to initiate and set up collection of bulletins from newly established permanent networks as well identifying, sourcing and parsing bulletins from past and present temporary seismic deployments and experiments around the globe.



John Eve, B.Sc.
Data Collection Officer
UK



Edith Korger, Ph.D.
Data Collection Seismologist,
joined in September, Austria

BULLETIN ANALYSIS and BULLETIN REBUILD

During this year, 5 new bulletin analysts have been trained. Each member of the team was given an additional task either in development projects or in data collection. The plan is to relieve the strain associated with routine work by mixing routine and development tasks, increase staff's interest in development of a better ISC and improve staff retaining.



Rosemary Wylie,
M.Phys.Geog., *Analyst*
Admin of the Analysis Team
from *April, UK*



Blessing Shumba, M.Sc.
Seismologist / Analyst
Zimbabwe



Rebecca Verney, B.Sc.,
Analyst,
UK



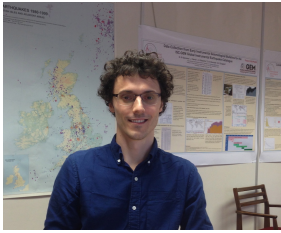
Elizabeth Entwistle, Ph.D.
Seismologist / Analyst
joined in August, UK



Jennifer Weston, Ph.D.
Seismologist / Analyst,
joined in August, UK



Elizabeth Ball, B.Sc.Geog.,
promoted to Analyst / Data
Entry Officer in *August, UK*



Lonn Brown, M.Sc.
Analyst / Administrator of the
Bulletin Rebuild project,
joined in October
Canada



Kathrin Lieser, Ph.D.
Seismologist / Analyst,
joined in October
Germany



Emily Delahaye, M.Sc.
Transferred from Lead
Analyst to Consultancy in
April
Canada

DEVELOPMENT PROJECTS



Domenico Di Giacomo,
Ph.D.
Seismologist
Italy



Kostas Lentas, Ph.D.,
Seismologist/Developer
Greece

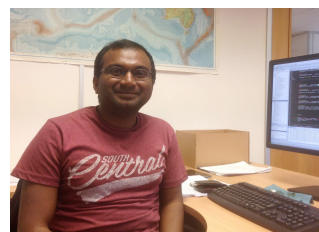


Daniela Catanescu,
M.Sc.Admin.,
Data Entry Officer
Romania

VBAS PROJECT (UK KTP Programme)



Hui Fang,
Ph.D. in Computer Science,
China
Based at the ISC, an employee of Oxford
University e-Research Centre (OeRC),
left the project in October



Saiful Khan,
M.Sc. in Computer Science,
India
Based at the ISC, an employee of Oxford
University e-Research Centre (OeRC),
joined the project in October

CONSULTANTS

During the year, the following individuals also contributed to the ISC as consultants either working remotely or at the ISC or both:

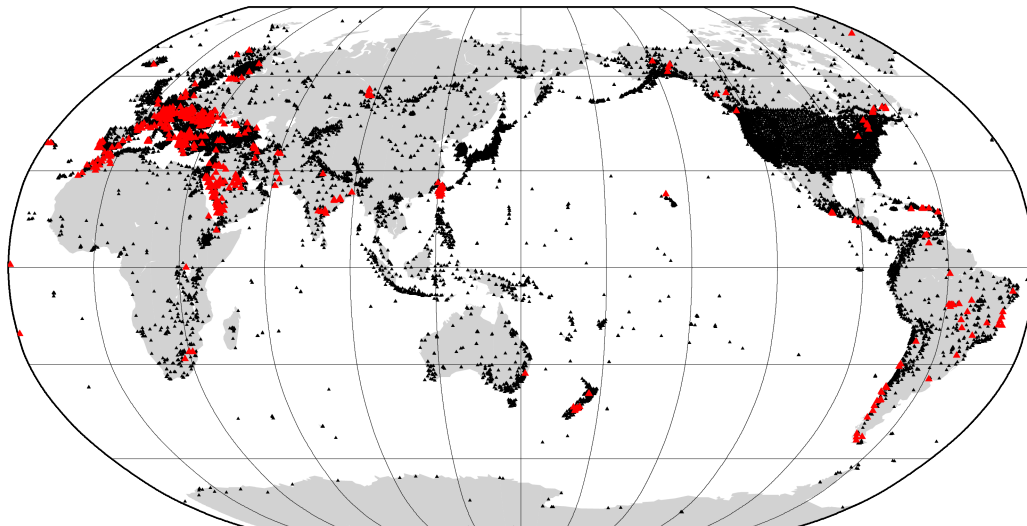
- **Emily Delahaye**, M.Sc., *Canada/France*; duties: consulting the VBAS team, training new analysts, assisting with the ISC Bulletin analysis and rebuild;
- **Wayne P. Richardson**, Ph.D., *New Zealand*; duties: Chief-Editor of the printed Summary of the ISC Bulletin;
- **István Bondár**, Ph.D., *Hungary*; duties: updating the ISC earthquake location program (ISCloc);
- **Baokun Li**, M.Sc., *China*, assisting re-evaluation of earthquakes, especially in China, under the Bulletin Rebuild project;
- **Robert E. Engdahl**, Ph.D., *USA*; duties: taking part in the project of extending the ISC-GEM Global Instrumental Earthquake Catalogue;
- **Min Chen**, Prof., Ph.D. in Computer Science, *China/UK*; supervising the VBAS project on behalf of OeRC.

The first four are former members of the ISC staff.

OPERATIONS

INTERNATIONAL SEISMOGRAPH STATION REGISTRY (IR) as PART of the ADSL DATABASE

Traditionally, the ISC maintained the International Seismograph Station Registry (IR) together with NEIC/USGS. The IR allocates globally unique codes to seismic stations worldwide.



***Figure 3.** 22,112 stations, open or closed, were fully registered in the International Seismographic Station Registry at the end of 2015; parameters of 547 of those (in red) were either registered or modified during 2015.*

At the end of 2015, the IR contained information on 22,112 stations. In 2015, the IR has been particularly improved and extended in Europe, Mediterranean, Arabian Peninsula, India, Central and South America (Fig. 3) as part of the work on:

- including additional or previously missing datasets for ISC Bulletin Rebuild project;
- taking over former EMSC bulletin data collection in Europe and Mediterranean;
- updating the IASPEI Reference Event (GT) List and participation in the CTBTO initiative of building the Regional Seismic Travel Times (RSTT).

The ISC runs a popular web page giving an account of already registered stations as well as inviting the submission of parameters required to register a new station. Figure 4 gives per country account of the IR related web searches.

In fact, the IR has become part of the ADSL database (Agency.Deployment.Station.Location) that we designed and continue maintaining jointly with the NEIC. The ISC maintains the agency.deployment “ISC.IR” as a subset of ADSL. In order to use all waveform data available on-line, NEIC routinely updates the ADSL database with stations under the deployment codes equal to corresponding FDSN two-character network codes, based on

dataless mini-SEED files available at IRIS DMC. The ADSL database is housed at the ISC and the changes are copied to NEIC once a week.

Now and in the future, the globally unique ISC.IR station codes will remain an exclusive source of station position information for the historical period of time. Also, the ISC.IR will continue to cover a large number of stations whose waveform data aren't available to the international waveform data centres.

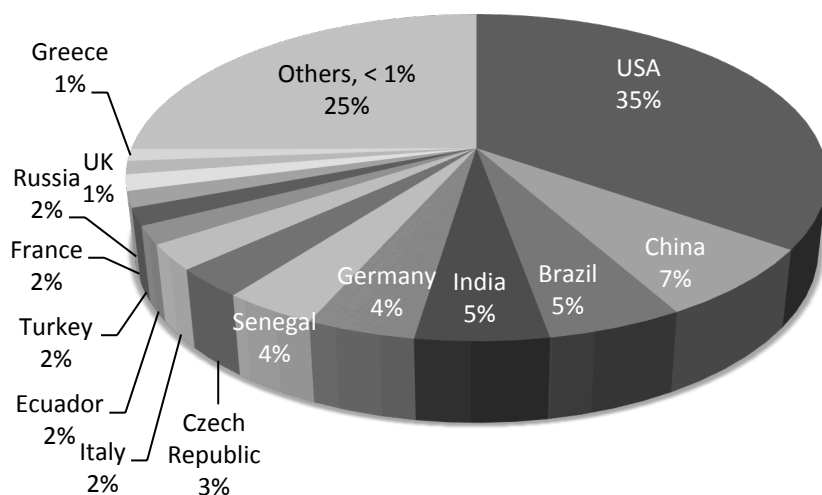


Figure 4. *Per country statistics of the web-searches related to the IR.*

At present, for majority of its standard operational activities, the ISC uses just the IR (almost equivalent to ISC.IR element of the ADSL database). In order to be able to deal with a multitude of additional stations becoming available in significant numbers for data years 2015-2016, largely from NEIC, the ISC will need to switch to working with the entire ADSL. To make this happen, a very large effort is required to update, test and validate almost the entire operational and web distribution computer code at the ISC.

COLLECTING PRELIMINARY NETWORK BULLETINS

The ISC continues to collect preliminary bulletin data from a large number of networks and data centres. These data are expected to undergo at least a minimal review by local analysts. Typically the incoming data include a preliminary hypocentre location, magnitude estimates, moment tensor solution and station arrival data, though variations are large from agency to agency. 28 agencies reported preliminary data to the ISC during year 2015 (Table 1).

In 2015, the MTA Research Centre for Astronomy and Earth Sciences of the Geodetic and Geophysical Research Institute (Hungary) began contributing its preliminary bulletins in addition to the final bulletins that had been reported for many years. Also, following an unfortunate gap of several years and recent review of its data distribution policy, the Council for Geosciences of South Africa has restarted its preliminary bulletin contribution.

Unfortunately, the contributions of preliminary solutions from the INGV (Italy) and IIEES (Iran) were temporarily interrupted.

Table 1. 28 agencies reported preliminary hypocentre determinations and corresponding arrival time data to the ISC in 2015.

Country	Reporting Agency
Armenia	National Survey of Seismic Protection
Australia	Geoscience Australia
Canada	National Earthquake Hazards Program
China	China Earthquake Administration
Cyprus	Cyprus Geological Survey Department
Czech Republic	Geophysical Institute, Academy of Sciences of the Czech Republic
Denmark	Geological Survey of Denmark and Greenland
Egypt	National Research Institute of Astronomy and Geophysics
France	European Mediterranean Seismological Centre
France	Institut de Physique du Globe de Paris
Georgia	Seismic Monitoring Centre of Georgia
Germany	Helmholtz Centre Potsdam GFZ German Research Centre Geosciences
Germany	Landeserdbbeindienst Baden-Wuerttemberg
Hungary	MTA Research Centre, Geodetic and Geophysical Research Institute
Indonesia	Badan Meteorologi dan Geofisika
Israel	Geophysical Institute
Japan	Japan Meteorological Agency
Kyrgyzstan	Institute of Seismology, Academy of Sciences of Kyrgyz Republic
Norway	NORSAR
Romania	National Institute for Earth Physics
Russia	Geophysical Survey, Russian Academy of Sciences (GSRAS)
Russia	Baykal Branch, GSRAS
Russia	Kamchatka Branch, GSRAS
South Africa	Council for Geosciences
Spain	Instituto Geografico Nacional
Syria	National Syrian Seismological Center
UK	British Geological Survey
USA	National Earthquake Information Center, USGS

In addition, there are 16 agencies that switched to a speedy mode of data processing, where bulletins are produced soon after event occurrence and their staff members never return to event re-analysis unless there is a special need (Table 2). These agencies can be considered as reporting both preliminary and final bulletins at the same time.

Table 2. Agencies performing final analysis within a month of event occurrence.

Country	Reporting Agency
Albania	Institute of Seismology, Academy of Sciences of Albania
Algeria	Centre de Recherche en Astronomie, Astrophysique et Geophysique
Chinese Taipei	Institute of Earth Sciences, Academia Sinica
French Polynesia	Laboratoire de Geophysique, CEA

Germany	Alfred Wegener Institute for Polar and Marine Research
Germany	Berggiesshubel Observatory, TU Bergakademie, Freiberg
Greece	National Observatory of Athens
Greece	Department of Geophysics, Aristotle University of Thessaloniki
Greece	University of Patras, Department of Geology
Ivory Coast	Station Geophysique de Lamto
Moldova	Institute of Geophysics and Geology
Namibia	The Geological Survey of Namibia
Poland	Institute of Geophysics, Polish Academy of Sciences
Portugal	Instituto Geofisico do Infante Dom Luiz
Puerto Rico, USA	Red Sismica de Puerto Rico
Switzerland	Swiss Seismological Service (SED)

BUILDING PRELIMINARY ISC BULLETIN

Preliminary hypocentre solutions and station arrivals are grouped in the ISC database with corresponding solutions from other agencies and made available through the standard ISC Bulletin search procedure within a few hours of receipt. For each event an output includes several hypocentre solutions reported by various agencies, all reported source mechanisms and magnitude estimates as well as corresponding station arrival data. Earthquake headers include logo images of each reporting agency and, by clicking on the logo, Preliminary ISC Bulletin users can get further information from each agency directly.

Almost all events with magnitude 5 and above and many of smaller magnitudes are reported within the first week. Further reports beyond one week add information to already reported large and moderate events and also inform about smaller events.

This process is there to fill the gap between the event occurrence and the time when the final Reviewed ISC Bulletin becomes available. It presents an attempt to consolidate the effort of many data centres and networks to make their data available internationally in good time. At this stage ISC does not compute or publish its own event solutions. This service is not intended for use by the media or civil protection agencies. It is designed to be used by seismologists to receive as much information as possible in one single format from one single place and then to get access to details using provided links to the original data reporters.

No later than one year after each seismic event occurrence, the preliminary data from agencies are substituted with their final, revised versions; this is well before the ISC analysts make their final review of the ISC Bulletin. The ISC hypocentre solutions are still based only on the revised set of bulletin parametric data given by each reporting institution.

COLLECTING REVISED NETWORK BULLETINS

The standard ISC data collection is the collection of revised bulletin data from many agencies (network data centres and single observatories) around the world up to 12 months behind real

time. With a few exceptions, this delay gives the data contributors enough time for reviewing and finalising their bulletin data before submission to the ISC.

Table 3 lists 122 agencies that contributed revised seismic bulletins to the ISC during the year 2015. It is important to note here that among that number there are at least two regional data concentrators. The East and South Africa Regional Seismological Working Group (ESARSWG, agency code EAF) in fact contributes a coordinated collection of local bulletins from 9 countries: *Ethiopia, Eritrea, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe*. US National Earthquake Information Center (NEIC) bulletin is also a product based on a multitude of US regional seismic networks. Thus, there were in fact more than 122 agencies that reported to the ISC in 2015.

Table 3. 122 agencies reported revised bulletin data to the ISC in 2015; note that one of them, ESARSWG, represents 9 countries and the other one, NEIC, reports on behalf of all US regional networks.

Country	Reporting Agency
Albania	The Institute of Seismology, Academy of Sciences
Algeria	Centre de Recherche en Astronomie, Astrophysique et Geophysique (CRAAG)
Argentina	Universidad Nacional de La Plata
Armenia	National Survey of Seismic Protection
Australia	Geoscience Australia
Austria	International Data Centre Division, CTBTO
Austria	Zentralanstalt für Meteorologie und Geodynamik (ZAMG)
Azerbaijan	Republic Center of Seismic Survey
Belarus	Centre of Geophysical Monitoring
Belgium	Royal Observatory of Belgium
Bolivia	Observatorio San Calixto
Bosnia and Herzegovina	Sarajevo Seismological Station
Brazil	Instituto Astronomico e Geofisico
Canada	Canadian Hazards Information Service, Natural Resources Canada
Chile	Departamento de Geofisica, Universidad de Chile
China	China Earthquake Networks Center
Chinese Taipei	Institute of Earth Sciences, Academia Sinica
Chinese Taipei	CWB
Colombia	Red Sismologica Nacional de Colombia
Costa Rica	University of Costa Rica
Croatia	Seismological Survey of the Republic of Croatia
Cyprus	Cyprus Geological Survey Department
Czech Republic	The Institute of Physics of the Earth (IPEC)
Czech Republic	Geophysical Institute, Czech Academy of Sciences
Czech Republic	West Bohemia Seismic Network
Denmark	Geological Survey of Denmark and Greenland
Djibouti	Observatoire Geophysique d'Arta

	East and South African Regional Seismological Working Group (ESARSWG)
Ecuador	Servicio Nacional de Sismologia y Vulcanologia
Egypt	National Research Institute of Astronomy and Geophysics
El Salvador	Servicio Nacional de Estudios Territoriales
Ethiopia	University of Addis Ababa
Finland	Institute of Seismology, University of Helsinki
France	Institut de Physique du Globe de Paris
France	Laboratoire de Detection et de Geophysique, CEA
French Polynesia	Laboratoire de Geophysique, CEA
Georgia	Seismic Monitoring Centre of Georgia
Germany	Alfred Wegener Institute for Polar and Marine Research
Germany	Bundesanstalt fur Geowissenschaften und Rohstoffe
Germany	Berggiesshubel Observatory, TU Bergakademie Freiberg
Germany	Geophysikalisches Observatorium Collm
Germany	Helmholtz Centre Potsdam GFZ German Research Centre For Geosciences
Germany	Landeserdbebendienst Baden-Wurttemberg
Greece	National Observatory of Athens
Greece	Department of Geophysics, Aristotle University of Thessaloniki
Greece	University of Patras, Department of Geology
Guatemala	INSIVUMEH
Hong Kong	Hong Kong Observatory
Hungary	Geodetic and Geophysical Research Institute
Iceland	Icelandic Meteorological Office
India	National Geophysical Research Institute
India	National Centre for Seismology of the Ministry of Earth Sciences of India
Indonesia	Badan Meteorologi, Klimatologi dan Geofisika
Iran	International Institute of Earthquake Engineering and Seismology
Iraq	Iraqi Meteorological and Seismology Organisation
Israel	The Geophysical Institute of Israel
Italy	MedNet Regional Centroid - Moment Tensors
Italy	Osservatorio Sismologico Universita di Bari
Italy	Istituto Nazionale di Geofisica e Vulcanologia
Italy	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale
Ivory Coast	Station Geophysique de Lamto
Jamaica	Jamaica Seismic Network
Japan	Japan Meteorological Agency
Japan	The Matsushiro Seismological Observatory
Japan	National Institute of Polar Research
Jordan	Jordan Seismological Observatory
Kazakhstan	National Nuclear Center
Kazakhstan	Seismological Experimental Methodological Expedition
	Seismic Institute of Kosovo
Kyrgyzstan	Institute of Seismology, Academy of Sciences of Kyrgyz Republic
Latvia	Latvian Seismic Network

Lebanon	National Council for Scientific Research
Lithuania	Geological Survey of Lithuania
Macao, China	Macao Meteorological and Geophysical Bureau
Malawi	Geological Survey Department Malawi
Malaysia	Malaysian Meteorological Service
Mexico	Red Sismica del Noroeste de Mexico (RESOM)
Mexico	Instituto de Geofisica de la UNAM
Moldova	Institute of Geophysics and Geology
Morocco	Centre National de Recherche
Namibia	The Geological Survey of Namibia
Nepal	National Seismological Centre, Nepal
Netherlands	Koninklijk Nederlands Meteorologisch Instituut
New Zealand	Institute of Geological and Nuclear Sciences
Norway	University of Bergen
Norway	Stiftelsen NORSAR
Philippines	Philippine Institute of Volcanology and Seismology
Philippines	Manila Observatory
Poland	Institute of Geophysics, Polish Academy of Sciences
Portugal	Instituto Geofisico do Infante Dom Luiz
Portugal	Instituto Portugees do Mar e da Atmosfera
Portugal	Sistema de Vigilancia Sismologica dos Azores
Romania	National Institute for Earth Physics
Russia	Geophysical Survey of Russian Academy of Sciences (GS RAS)
Russia	Baykal Branch, GS RAS
Russia	Altay-Sayan Branch, GS RAS
Russia	Kola Branch, GS RAS
Russia	Kamchatka Branch, GS RAS
Russia	North Eastern Branch, GS RAS
Russia	Yakutia Branch, GS RAS
Russia	Mining Institute, Ural Branch, RAS
Russia	Institute of Environmental Problems of the North, RAS
Saudi Arabia	Saudi Geological Survey
Serbia	Seismological Survey of Serbia
Slovakia	Geophysical Institute, Slovak Academy of Sciences
Slovenia	Environmental Agency of the Republic of Slovenia
South Africa	Council for Geoscience
Spain	Instituto Geografico Nacional
Spain	Real Instituto y Observatorio de la Armada
Switzerland	Swiss Seismological Service (SED)
Syria	National Syrian Seismological Center
Trinidad and Tobago	The University of the West Indies
Turkey	Kandilli Observatory and Research Institute (KOERI)
USA	The Global CMT Project (Ekström et al, 2012)

USA	IRIS Data Management Center
USA	National Earthquake Information Center, USGS
Puerto Rico, USA	Red Sismica de Puerto Rico
Ukraine	Subbotin Institute of Geophysics, National Academy of Sciences
United Kingdom	British Geological Survey
Venezuela	Fundacion Venezolana de Investigaciones Sismologicas
Vietnam	National Center for Scientific Research
Zimbabwe	Goetz Observatory

It is also important to remember that the ISC no longer receives seismic bulletins from the European-Mediterranean Seismological Centre (EMSC). All bulletin contributions from this region arrive to the ISC directly from individual institutions.

Table 4 lists all new or restarted contributions in 2015. Table 5 lists delayed contributions. Obviously, in case of interrupted or delayed contributions, we aim at filling the gap where possible.

Table 4. *The new or previously interrupted contributions.*

Country	Reporting Agency
Bosnia and Herzegovina	Sarajevo Seismological Station
Brazil	Instituto Astronomico e Geofisico
El Salvador	Servicio Nacional de Estudios Territoriales
Guatemala	INSIVUMEH
Italy	MedNet Regional Centroid Moment Tensors
Latvia	National Seismic Network
Malawi	Geological Survey Department
Morocco	Centre National de Recherche (CNRM)
Russia	Altai-Sayan Branch, GS RAS
Spain	Real Instituto y Observatorio de la Armada
	Seismic Institute of Kosovo

Table 5. *Delayed or interrupted contributions.*

Country	Reporting Agency
Argentina	INPRES
Bulgaria	Geophysical Institute, Bulgarian Academy of Sciences
France	Institut de Physique du Globe
FYR Macedonia	Seismological Observatory Skopje
Iran	Tehran University
Italy	Dipartimento per lo Studio del Territorio e delle sue Risorse, Genoa
Italy	Laboratory of Experimental and Computational Seismology, Napoli
Japan	National Research Institute for Earth Science and Disaster Prevention

Oman	Sultan Qaboos University
Pakistan	Micro Seismic Studies Programme, PINSTECH
Republic of Korea	Korea Meteorological Administration
Russia	Institute of the Earth Crust, Irkutsk, SB RAS
Russia	Sakhalin Branch, GS RAS
Solomon Islands	Ministry of Mines, Energy and Rural Electrification
Sweden	University of Uppsala
Thailand	Thai Meteorological Department
Tunisia	National Institute of Meteorology
Turkey	The Earthquake Research Center, Ataturk University
Turkey	Disaster and Emergency Management Presidency
UAE	Dubai Seismic Network
Yemen	Yemen National Seismological Center
Zambia	Geological Survey Department

Figure 5 shows countries and agencies that contributed revised bulletins to the ISC directly or indirectly (via other agencies) during 2015. It is important to note, that there is currently a 22 months gap between the data collection deadline and the Bulletin production start date. Thus, the figure reflects the timeliness and completeness of the data collection. The completeness of the ultimate product – the Bulletin – is expected to be much higher and to include data from approximately 20 agencies/countries missing from the figure.

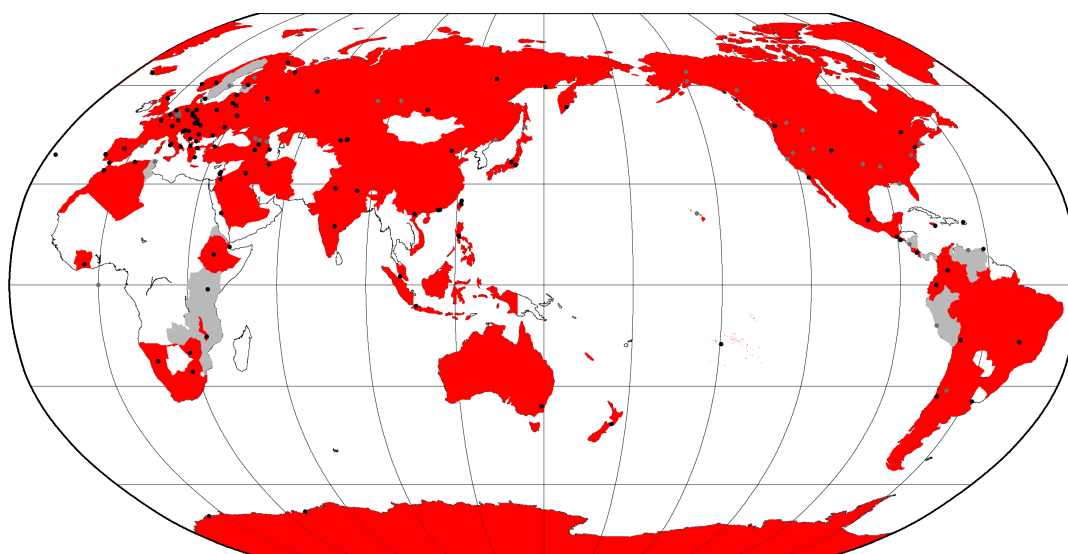


Figure 5. Agencies (black dots) and corresponding countries (in colour) covered by the revised bulletin reports during 2015; red/grey colours indicate direct/indirect contributions. Many gaps will be filled before corresponding data months are subjected to the ISC analysis.

During 2015, the IRIS DMC continued its contribution of station arrival times that were picked and reviewed by the USArray Array Network Facility in the Institute of Geophysics and Planetary Physics (IGPP) of the Scripps Institution of Oceanography, UCSD. The data set represents a considerable fraction of station arrival numbers associated to already known events in the US and moderate to large events worldwide (Fig. 6). Whilst being a major

source of highly useful data for tomographic research, this data set presented a major challenge to the ISC in the past because the large concentration of stations generally biased the ISC solutions. This is no longer the case since data year 2009 when the new ISC Locator has taken correlated travel-time error structure into account. Nevertheless, the increased numbers of stations, reporting the same event, will continue to create a major workload for the ISC Analysts until the Visual Bulletin Analysis System (VBAS) is operational.

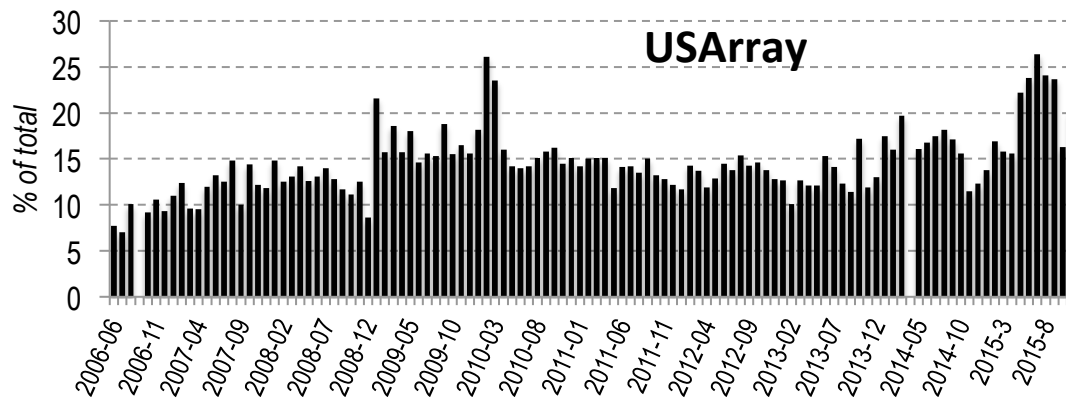


Figure 6. Fraction of arrival time picks reported by USArray network facility as compared to the total number of arrivals associated to ISC Bulletin events of magnitude over 4.5.

ISC BULLETIN REVIEW

The ISC Bulletin is progressively updated with each network report coming in. Preliminary network contributions are substituted with final reviews. New events are built, merged or split with every new report coming to the ISC by e-mail and processed either automatically or manually by the ISC Data Entry Officer, who is working remotely from his home office in Scotland. The Analyst Administrator and the Data Entry Officer regularly review the status of data collection and contact various agencies to avoid reporting gaps.

The ISC seismologists/analysts review approximately one fifth of all events formed in the ISC database by the automatic procedures. This review makes the ISC Bulletin accurate and trustworthy. The accuracy of *ak135*-based ISC solutions and magnitude estimates, proper grouping of reported information between the events in the Bulletin is under constant scrutiny. The ISC analysts also review the correctness of automatic association of reported station arrivals to events, reported arrival's phase identification and travel-time residuals.

When the time comes, one month's worth of data is pulled into a separate database and a set of automatic procedures are run to produce the first automatic ISC event locations and magnitude determinations for those events that are large enough to be reviewed by the ISC seismologists. It would be impossible for the ISC to sustain a review of every reported event, so from data year 1999 the data collection thresholds were removed and review thresholds introduced. Following various recent improvements, this system continues to serve its purpose by limiting the number of seismic events to be reviewed by ISC analysts. The

threshold criteria are complex yet almost all events of magnitude ~ 3.5 and larger are reviewed.

Throughout 2015, the Analysis Team included four to seven members:

- Mrs Rosemary Wylie, promoted to Analyst/Administrator in April;
- Mrs Emily Delahaye, former Lead Analyst, resigned from the staff in March and signed a consultancy contract with responsibilities to train new staff, consult on the VBAS project and contribute to the Bulletin analysis where possible;
- Mr Blessing Shumba, Seismologist/Analyst;
- Ms Rebecca Verney, Analyst;
- Ms Elizabeth Ball, Analyst-Trainee, promoted internally in August;
- Dr Jennifer Weston, Seismologist / Analyst-Trainee, hired in August;
- Dr Elizabeth Entwistle, Seismologist / Analyst-Trainee, hired in August.
- Dr Dmitry Storchak, Seismologist / Director, engaged in the procedure of identifying previously unreported events based on the un-associated station arrivals.

This was a period of considerable change with the new team leader, training of three new analysts and all staff receiving additional development tasks. The ISC was fortunate to secure the services of the former Lead Analyst to guarantee reasonably fast and efficient training. It is expected that by the end of the training period the team will be able to start reducing the accumulated delay with effectively 4.5 full-time fully trained persons (excluding time given to development tasks). It is also important to note that the team now has three PhD, two MSc and two BSc or equivalent qualifications.

During 2015, the Analysis Team fully reviewed 9 months of the ISC Bulletin (July 2012 - March 2013). A fair amount of work was also done for April and May 2013. The Analysts were working with a still increasing number of seismic events worthy of analysis (Fig. 7).

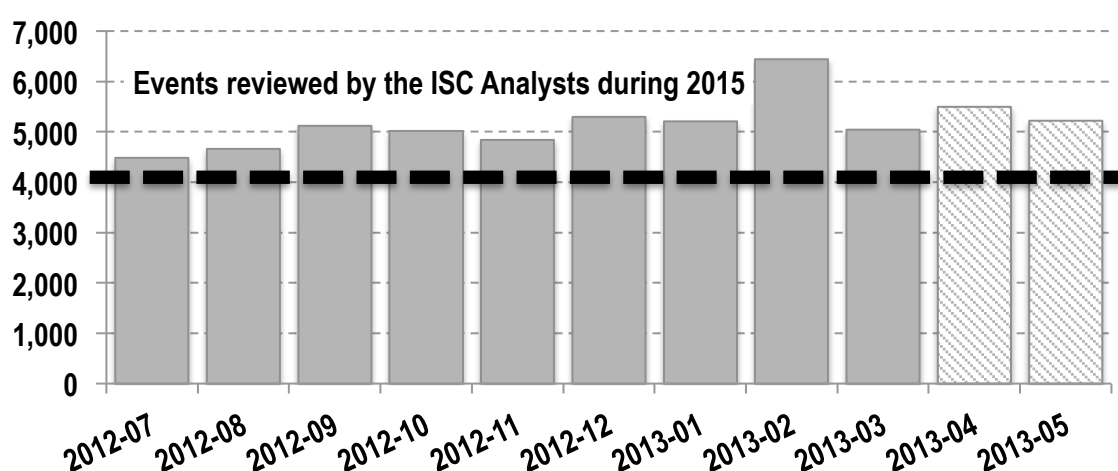


Figure 7. Monthly number of seismic events in the Reviewed ISC Bulletin analysed during 2015; the dashed line shows the average monthly number during the preceding 36 months.

The result of the ISC work can be seen when comparing Figures 8 and 9, showing hypocentre locations reported by all data contributing networks and primary hypocentres in the ISC Bulletin. A fuzzy picture of the worldwide seismicity sharpens up, especially in case of the reviewed ISC Bulletin.

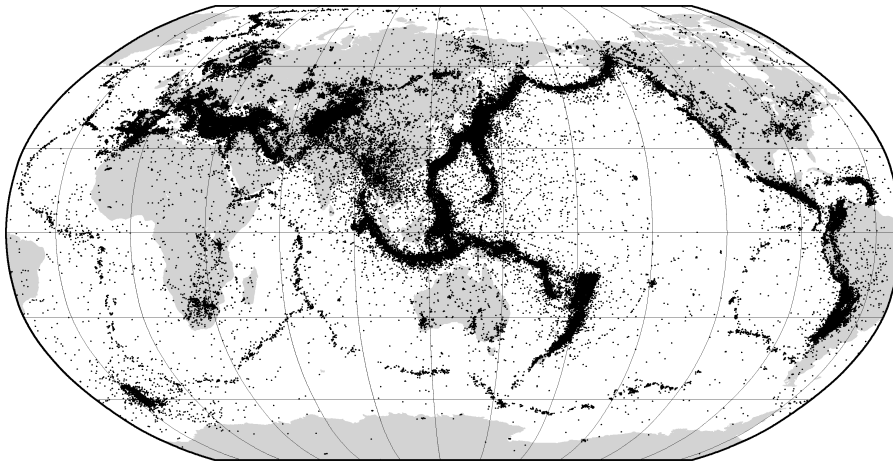


Figure 8. All hypocentres reported by individual networks (July 2012 – March 2013).

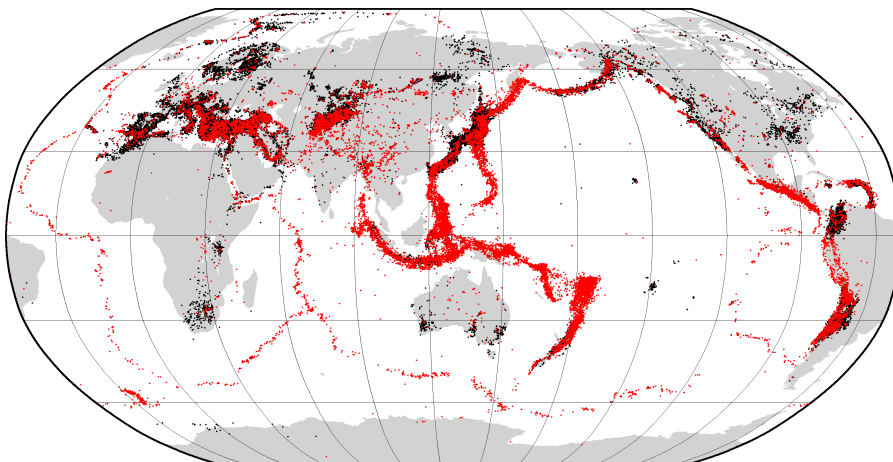


Figure 9. Primary hypocentres in the ISC Bulletin (black) in the period (July 2012 – March 2013); red highlights the events reviewed by the ISC analysts.

Overall, during the calendar year 2015, ~46,000 reviewed events with ~4.25 million of associated phases were added to the reviewed part of the Bulletin by the ISC analysts. Figure 10 demonstrates the diversity of seismic phases included in the ISC Bulletin.

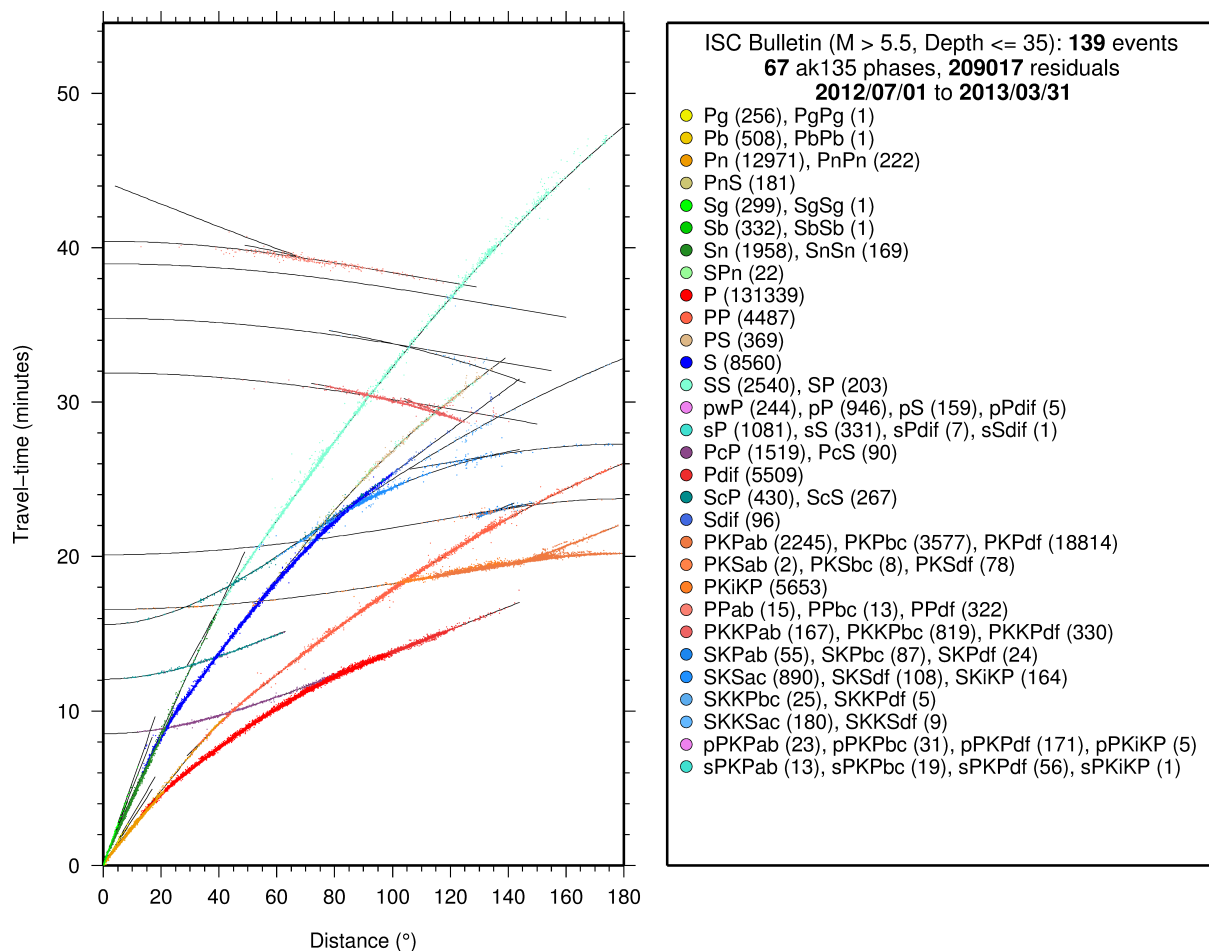


Figure 10. The travel-time graph and associated table show the statistics of various seismic phases generated by large shallow events reviewed by the ISC analysts during 2015; events with depth ≤ 35 km and magnitude above 5.5 are shown.

VISUAL BULLETIN ANALYSIS SYSTEM (VBAS)

The issue of the constantly increasing amount of station arrival information available for each event in the Bulletin is pressing. With partial support (66.6%) from the UK Government Knowledge Transfer Programme (KTP) and jointly with the Oxford University e-Research Centre (OeRC) we are working on the development of the Visual Bulletin Analysis System (VBAS) to replace the existing paper-scanner-screen based batch-type analysis. The new system allows the ISC analysts to concentrate on the review of graphical information summaries with highlighted outliers instead of reviewing all data in text format.

In October, Mr Saiful Khan has been appointed by the OeRC to take over from Dr Hui Fang to continue work on this project. His permanent office is at the ISC. Saiful Khan is supported by computer visualization specialist, Prof. Min Chen of OeRC. The project is greatly assisted by Emily Delahaye (Consultant and former Lead Analyst) and James Harris (the ISC Database Administrator).

During the past year, we designed and coded the Version 1 that presents seismological bulletin information in graphical way (Fig. 11) and allows the analysts to prepare commands, test their actions and implement them in the database.

Quarterly LMC meetings bring together those in the ISC and OeRC responsible for the project running along with Dr Gillian Rysiecki, the KTP Coordinator.

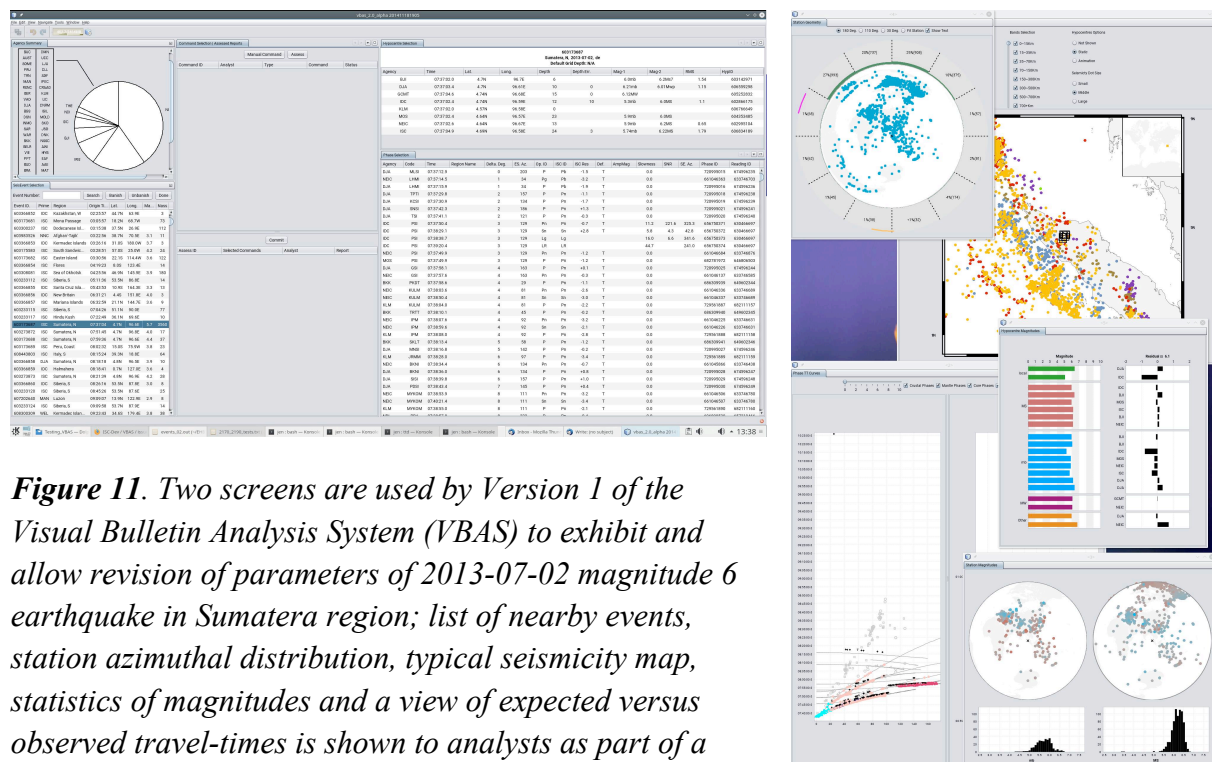


Figure 11. Two screens are used by Version 1 of the Visual Bulletin Analysis System (VBAS) to exhibit and allow revision of parameters of 2013-07-02 magnitude 6 earthquake in Sumatra region; list of nearby events, station azimuthal distribution, typical seismicity map, statistics of magnitudes and a view of expected versus observed travel-times is shown to analysts as part of a standard view.

Version 1 is currently tested by selected analysts as they perform the every day traditional bar-code assisted analysis. Version 2 will benefit from the tests and expand in terms of better interactivity. It is aimed to be used as standard in operations. It is the plan to offer Saiful Khan employment at the ISC to maintain and develop the VBAS in the coming 18 months.

GENERAL STATISTICS of the ISC BULLETIN

The ISC Bulletin and the ISC database grow by the day in both seismic event (earthquake or explosion) numbers and reported seismic wave arrival times and amplitudes at stations registered in IR (Fig. 12a and 12b).

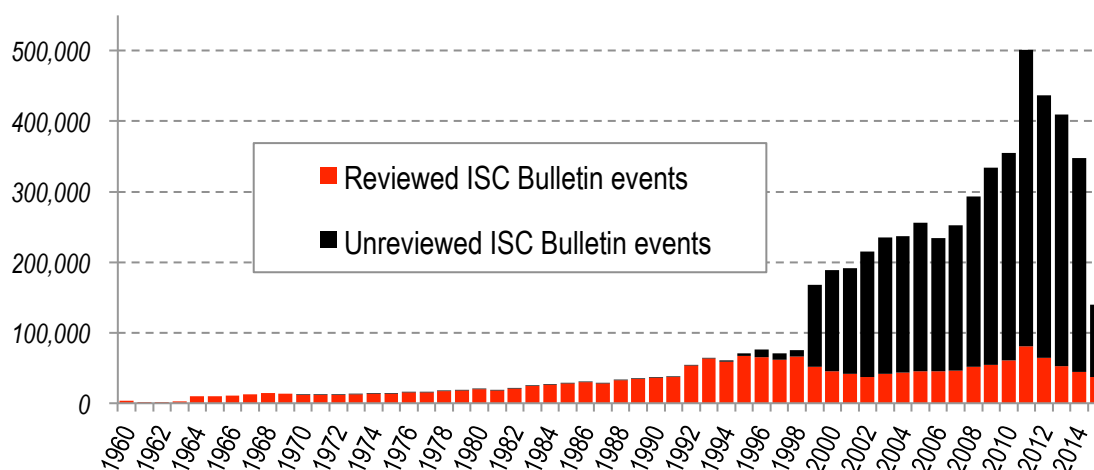


Figure 12a. Timeline of the annual number of reviewed and unreviewed (small) events in the ISC Bulletin. The total height of each column represents the annual number of all seismic events in the ISC Bulletin. Events in June 2013 - Dec 2015 are those intended for review.

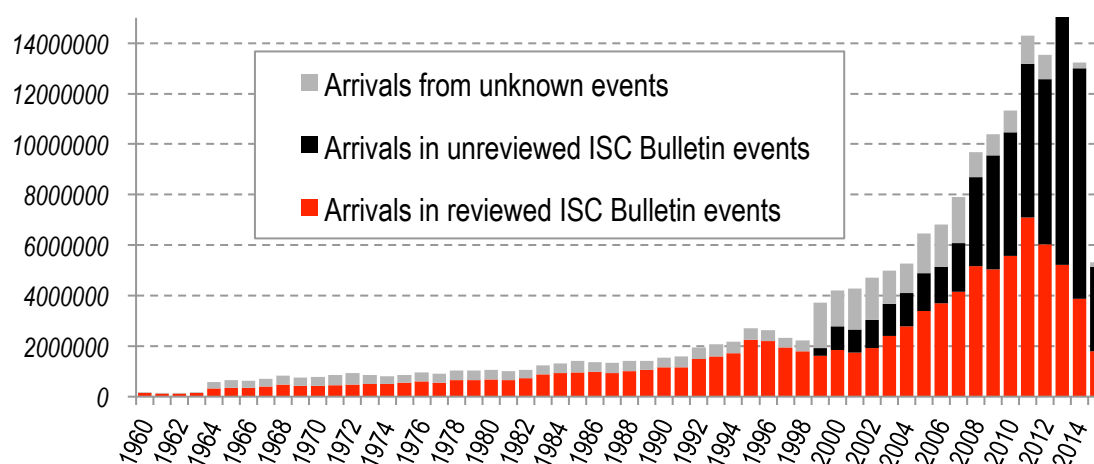


Figure 12b. Timeline of the annual number of seismic arrivals associated with both reviewed (red) and unreviewed (black) events in the ISC Bulletin, as well as those arrivals in the ISC database that are not associated to any known events (grey). The total height of each column represents the annual number of all seismic arrivals in the ISC database. Events in June 2013 – Dec 2015 are those intended for review.

During 2015, we also made another very important advance by parsing the parametric data underlying the ISC-GEM catalogue (1904-1970) into the ISC Bulletin. Hypocentre solutions, surface and body wave magnitudes (but not moment magnitudes) as well as station arrival times, amplitudes and periods have been copied to the main (and rebuild) bulletin database accounts. The effect of this important step can be seen on the Figure 13. Especially important is the inclusion of station arrival times, amplitudes and periods during the 1904-1963 period. In the past, users of the ISC Bulletin had to type these data from the BAAS/ISS bulletin

pages. Amplitudes and period readings were not available to majority of users even in printed version.

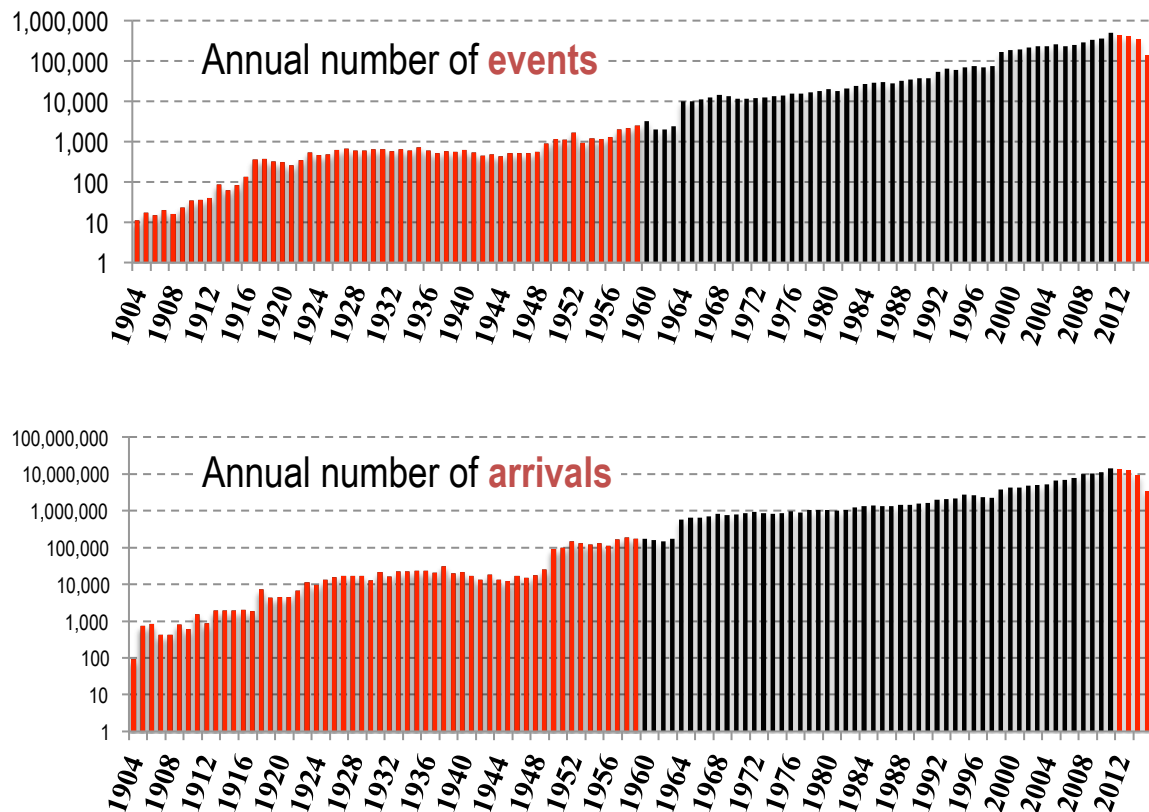


Figure 13. Events and arrivals added to the ISC database during 2015 (in red).

Figure 14 demonstrates the comparative magnitude completeness of the ISC Bulletin and bulletins of the NEIC/USGS and IDC/CTBTO. The ISC and IDC Bulletins appear to be more complete globally than NEIC by at least half a unit of magnitude. The NEIC has adopted its new global magnitude cut-off threshold of 4.5; that means that the ISC Bulletin will always be more complete by definition. The IDC is unlikely to use many more seismic sites/arrays than they use at present due to exact IMS network station positions written in the Comprehensive Test Ban Treaty. Hence, it is likely that there will be even more seismic events in the future that will be unique to the ISC Bulletin. The ISC Bulletin, of course, has a vast number of small events not listed in either IDC or NEIC bulletins.

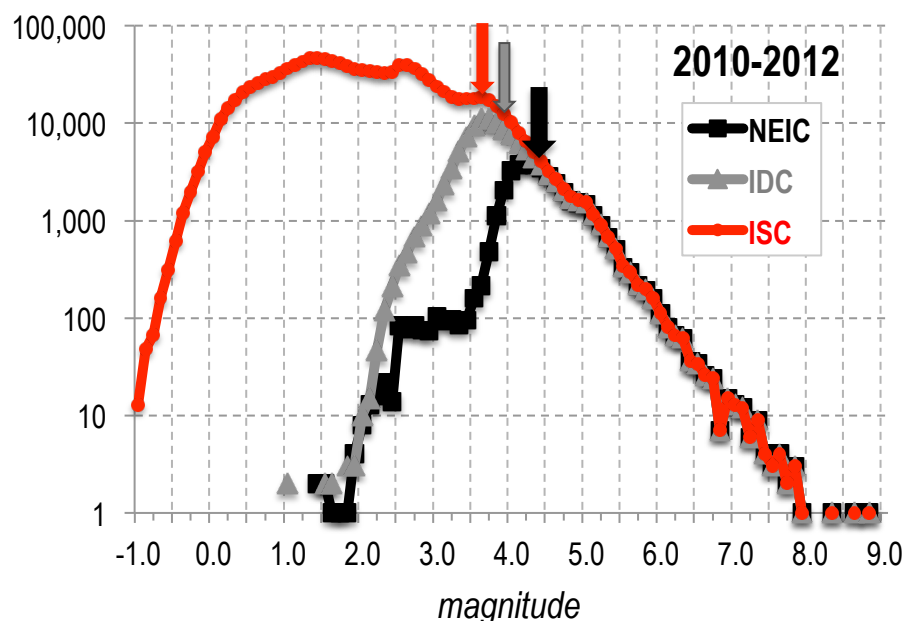


Figure 14. Number of seismic events in the ISC, NEIC/USGS and IDC/CTBTO (REB) bulletins during the 2010-2012 period; vertical arrows indicate an approximate magnitude of completeness.

The ISC Bulletin is still used by a large number of researchers worldwide. Although the number of bulletin web searches decreased in 2015 as compared to previous two years, it is still in the order of **150 searches per hour** (Fig. 15). The results of bibliographic search for scientific articles making use of the ISC data (at the end of this report) also confirm that the ISC Bulletins remains in demand.

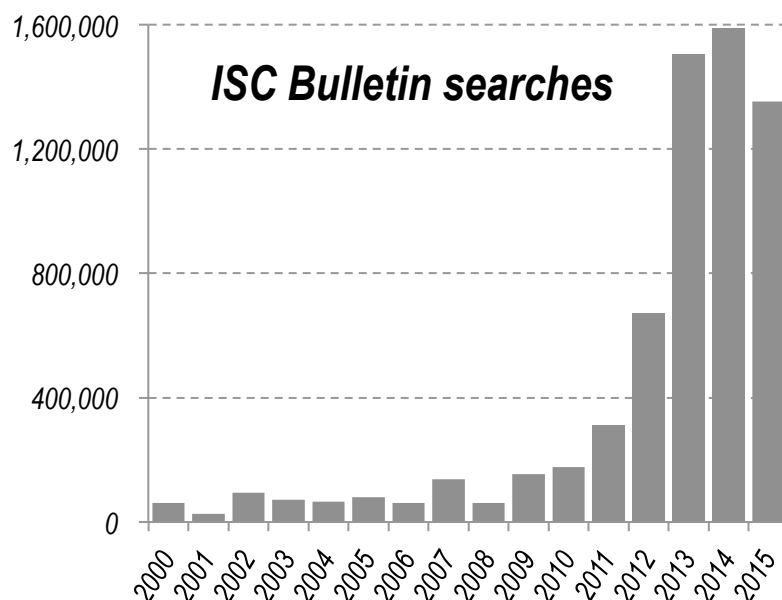


Figure 15. Although the number of the ISC Bulletin searches made by website users during 2015 was down 15% as compared to 2014, the frequency of these searches nevertheless remained at an impressive 150 searches per hour.

Figure 16 shows the multinational character of the ISC Bulletin search users.

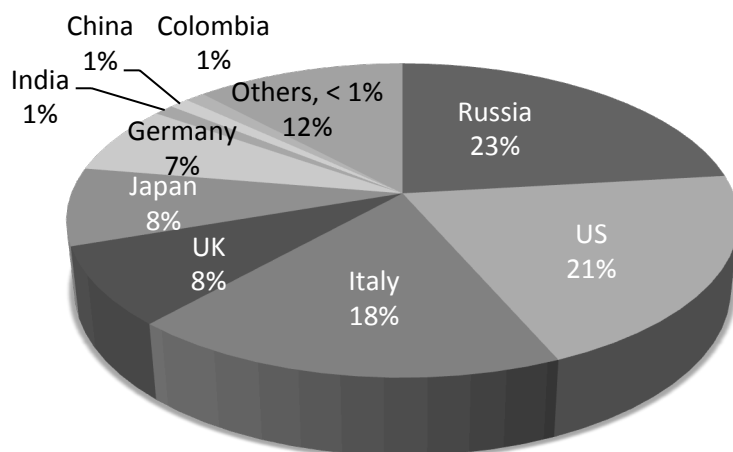


Figure 16. Per country distribution of the ISC Bulletin searches made by ISC website users during 2015.

The above statistics include the use of the ISC mirror website at IRIS DMC, yet it does not include bulletin searches made from mirror-sites at ERI in Tokyo and LLNL in Livermore. Where reliably known, we have removed the numbers related to web crawlers.

Currently, the website searches give output in three major formats: ISF1.0 (International Seismic Format), QML (QuakeML) and CSV (comma separated variables). Figure 17 shows that the total number of searches in QML exceeds those of ISF or CSV. The QuakeML searches, though, are performed by fewer users that tend to run automated queries that take a smaller volume of data. Thus, it is clear that all three formats are popular and need to be maintained in the future.

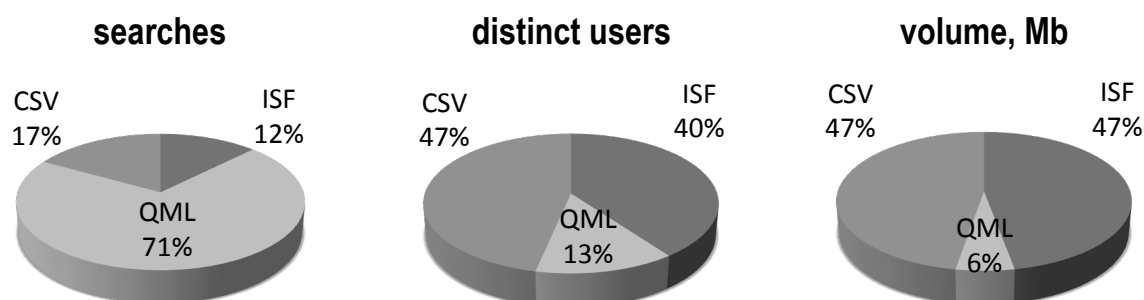
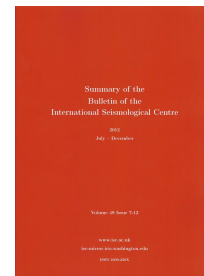
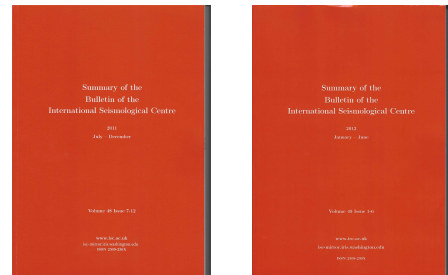


Figure 17. Distributions of the number of the Bulletin searches, distinct users and overall volume of data taken per output format.

PRINTED SUMMARY of the BULLETIN of the ISC

The ISC has ceased publication of the printed *Bulletin of the ISC* with the last data of year 2009. From data year 2010 it was decided to replace this publication with the printed *Summary of the Bulletin of the ISC*, which covers six months of the Bulletin data enclosed on a DVD. The old Bulletin was a listing of individual event hypocentres and magnitudes. Three issues of the Summary that were produced in 2015 (2011-II, 2012-I & 2012-II) included the following topics:

- The ISC (Mandate, History, Evolution of the Bulletin, Member Institutions, Sponsors, Data Contributors, Staff)
- Operational Procedures (data collection, grouping, association, thresholds, location, magnitude determination, review, history of operational changes)
- Availability of the ISC Bulletin
- Citing the ISC
- IASPEI Standards
- Summary of Seismicity (6 months)
- Invited articles on:
 - Notable Events (*Mw*7.8 **Haida Gwaii** and *Mw*6.7 **Jan Mayen** earthquakes)
 - Individual network history, status and procedures (**Canada** and **Brazil**)
- Statistics of Collected Data
- Overview of the ISC Bulletin
- Leading Data Contributors
- Glossary
- Advertisements of the Instrument Producers – Sponsors of the ISC.



Former ISC Senior Seismologist, Wayne Richardson, has kindly served as the Chief-Editor of the Summary on a consultancy basis. Having hired and trained several new PhD staff members in the second half of 2015, we are now in a position to continue editing the Summary using internal resources. We thank Wayne Richardson for his meticulous and dedicated approach to this work.

The invited articles from the Summary are also used on the ISC website. Articles on notable events contribute to the ISC Event Bibliography. Network description articles become associated with general information available for each agency contributing to the ISC Bulletin.

As a book publisher, the ISC charges no Value Added Tax (VAT) on its printed products yet VAT on all goods and services that it buys from other suppliers can be reclaimed.

IASPEI GT LIST

The International Seismological Centre maintains the IASPEI database of Reference Events (earthquakes and explosions, including nuclear) for which epicentre information is known with high confidence (to 5km or better, GT5) with seismic signals recorded at regional and/or teleseismic distances (Fig.18a,b). It should be noted that the depth of these events is not known to the same level of accuracy as the epicentre.

The global effort of collecting and validating GT events is coordinated by the CoSOI/IASPEI working group on Reference Events for Improved Location that includes Bob Engdahl, Eric Bergman, István Bondár and Kostas Lentas.

The GT database of 8,677 reference events (1959-2012) and approximately 886,000 station arrival times facilitates better visualization of the Earth structure, better modelling of velocities of seismic waves, more accurate travel time determinations and increased accuracy of event locations.

The ISC users are able to search this database at the ISC website and receive GT locations and corresponding ISC locations along with station arrival data available for each event. A cross-link to the ISC Bulletin is provided for users to go between ISC and GT databases.

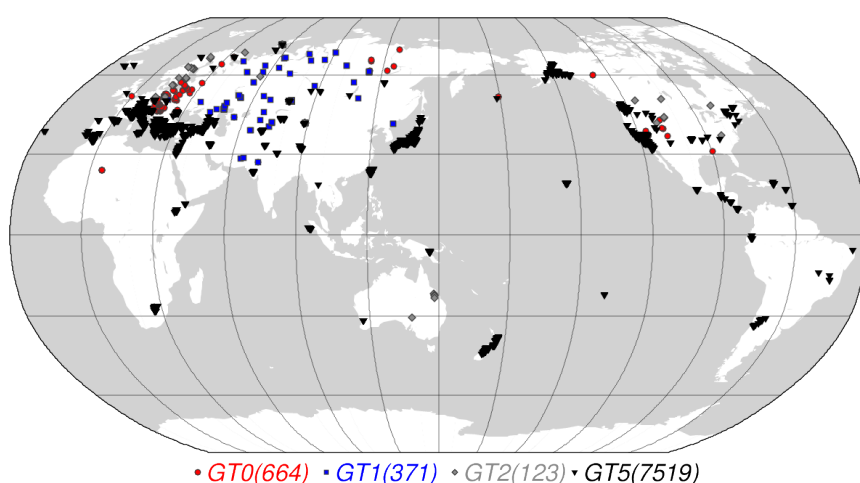


Figure 18a. The IASPEI List contains seismic events during 1959-2012 for which epicentre information is known with high confidence (to 5km or better (GT5))

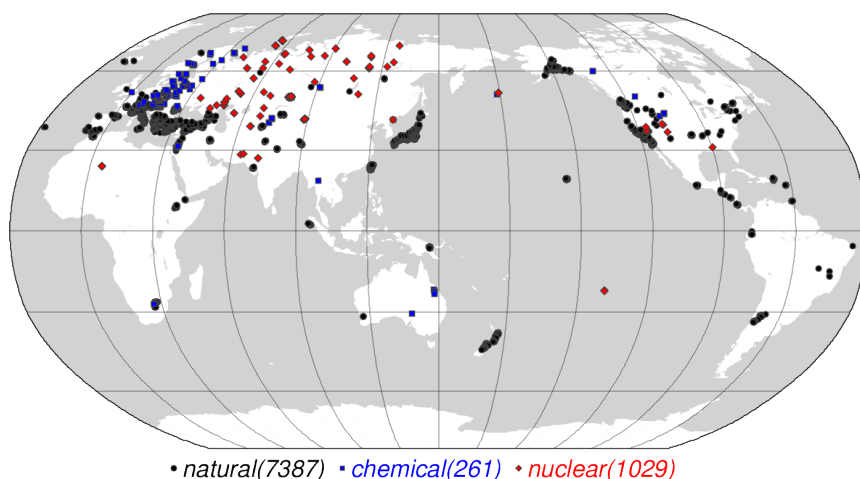


Figure 18b. The IASPEI List contains natural earthquakes as well as chemical and nuclear explosions.

At the end of analysis of each ISC Bulletin data year, we add new events to the Reference Event List. During 2015, 333 events have been added or updated (Fig. 19).

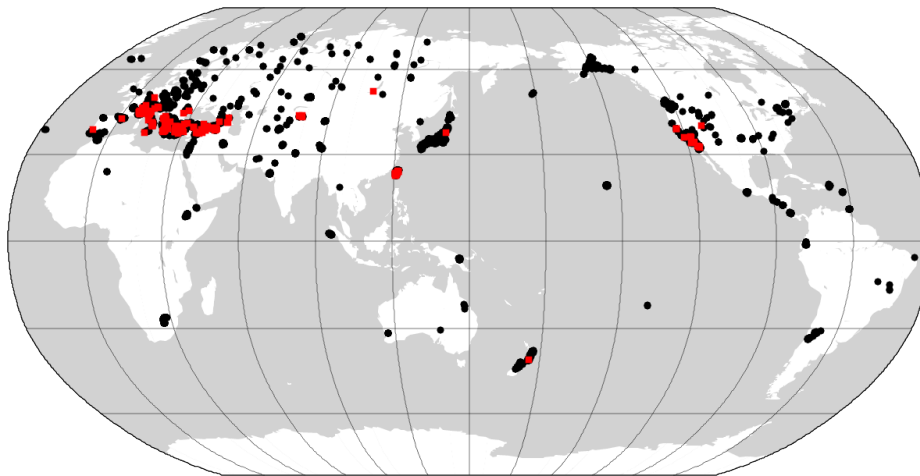


Figure 19.
*During 2015,
333 events (red)
have been either
updated or
added to the
IASPEI list of
Reference
earthquakes and
explosions*

EHB BULLETIN

The EHB (Groomed ISC Bulletin) (Engdahl *et al.*, 1998) contains a set of most accurate seismic event locations regularly used in academic research, especially in seismic tomography. The EHB algorithm has been used to significantly improve routine hypocentre determinations of well-recorded events made by the ISS, ISC and NEIC/PDE in the past.

The EHB algorithm uses:

- the *ak135* 1D global travel-time model with ellipticity and elevation corrections;
- iterative relocation with dynamic phase identification (Kennett *et al.*, 1995);
- first arriving P, S and PKP phases and teleseismic depth phases pP, pwP and sP;
- empirical teleseismic patch corrections (for 5x5 degree patches);
- weighting by distance-dependent phase variance;
- selection criteria for EHB events having 10 or more teleseismic ($\Delta > 28^\circ$) observations with a teleseismic secondary azimuthal gap $< 180^\circ$.

Following the agreement with Bob Engdahl, the EHB is hosted on the ISC website and currently contains 141,478 events between 1960 and 2008 accompanied by ~25 million arrival data. The EHB can be browsed, searched or downloaded from the ISC website. Corresponding events of the ISC and EHB Bulletins are cross-referenced for the convenience of the ISC users.

With the new ISC location algorithm (Bondár and Storchak, 2011) in the ISC routine operations, it is understood that any possible differences between the new style ISC and potential EHB solutions would be mostly in the depth of events. From the beginning of 2016, we shall be working with Bob Engdahl on the recompilation of the EHB dataset initially for the period 2000-2015 to be also re-branded as the ISC-EHB bulletin. As part of this work, we shall be examining a possibility to set up EHB procedures at the ISC and train personnel accordingly.

ISC EVENT BIBLIOGRAPHY

The ISC Event Bibliography (first release in April 2013) facilitates an interactive web search for references to scientific publications linked to both natural and anthropogenic events that have occurred in the geographical region of their interest based on earthquake (location, time, magnitude, etc.) and/or publication parameters (author name, journal, year of publication, etc.). The output is presented in a format accepted by major scientific journals. For most recent publications the results include the DOI that allows direct access to scientific articles from corresponding journal websites.

References are collected and linked to events in the ISC database based on the titles and abstracts of scientific publications that could be found in the ISC Bibliography of Seismology, electronic indexes provided by scientific journals as well as references collected during the work on the ISC-GEM Catalogue.

References to publications are not limited to Seismology. They cover a broad range of

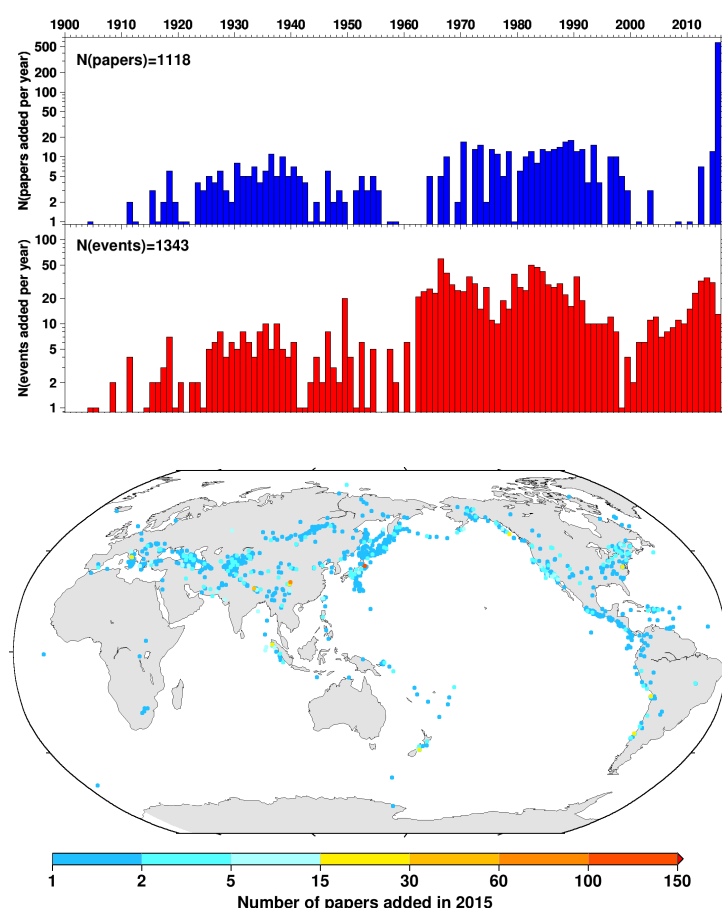


Figure 20. Annual numbers and the map of seismic events and related scientific articles added to the ISC Event Bibliography during 2015.

disciplines including, but not limited to earthquake engineering, tectonics, structural geology, geodesy, remote sensing, nuclear test monitoring, tsunamis, landslides, environmental studies, coastal science, natural disasters, hydrology, geochemistry, atmospheric sciences and geomagnetism. This feature makes the Event Bibliography an attractive tool for multidisciplinary studies and useful for researchers and students from different fields.

At the end of 2015, the Event Bibliography included 17,871 articles from ~500 journal titles related to 14,901 seismic events. Seismic events cover the period from 1904 till present; publications covered the period from 1904 till present. Figure 20 illustrates 1,343 events and 1,118 articles added to the ISC Event Bibliography during 2015.

SEISMOLOGICAL CONTACTS

The objective of this project is to update and maintain up-to-date information on the network of scientific institutions, seismologists and geophysicists in each country willing to serve as scientific points of contact to:

- Seismologists and Geophysicists in other countries;
- Governments;
- Charitable, Response and Relief organizations;
- Media.

Particular care is given to establishing and maintaining contacts in developing countries.

The service benefitted from support in terms of staff time from the Institute of Geophysics and the China Earthquake Networks Center of China Earthquake Administration.

The registry in its current form is readily available for scientific & research institutions, governmental bodies, charitable and relief organizations and media at:

www.isc.ac.uk/projects/seismocontacts (Fig.21).

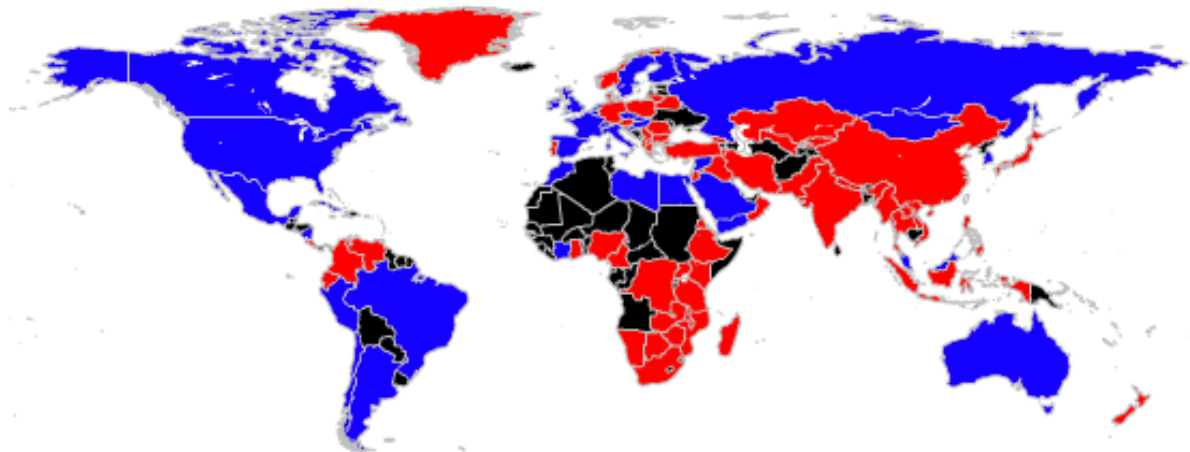


Figure 21. *Seismological Contacts webpage; in red are countries in which institutes and individual staff members are willing to share information and serve as a local point of contact; in blue are countries for which we have information about operating geophysical organisation(s); in black are countries for which we do not hold any information.*

ISC DATABASE

The ISC holds its entire collection of data in the relational Postgre database on a Linux server with a RAID Array. In 2015, this database grew by ~28% (44 Gb) and reached 201Gb, thanks to a steady increase in the number of seismic arrival picks associated to the ever growing number of reported seismic events.

ISC WEB and FTP SITES

The majority of the ISC web data are distributed through the main ISC website as well as the mirror website at IRIS DMC in Seattle. In the past users could choose the IRIS website to get the most quick and efficient service. In early 2015 we installed the load balancer that automatically directs users queries to the least busy server. It substantially improved ISC user web experience, efficiency and speed of queries. At the same time, due to the new enhanced software now used to track robots, web crawlers and other non-human interaction, we are not able to compare meaningfully the numbers of the ISC website hits in the past and during 2015. We know that this year the ISC website experienced ~3.5 million hits.

The use of the ISC ftp site has almost doubled in 2015 compared to previous years. It is used for downloading the pdf copies of the printed ISC Bulletins and Summaries, the ISC Bulletin in FFB and ISF formats, the EHB bulletins and the text version of the IR station list.

Per country usage of the ISC web and ftp services (Fig. 22ab) demonstrates worldwide interest to the ISC data.

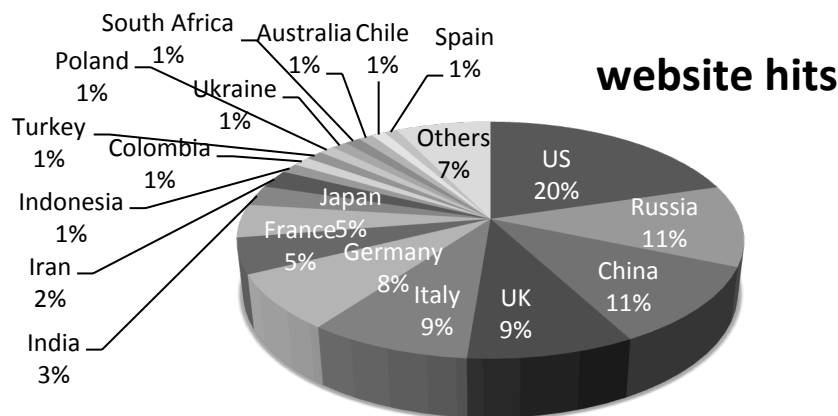


Figure 22 (a). Per country statistics of the ISC website hits

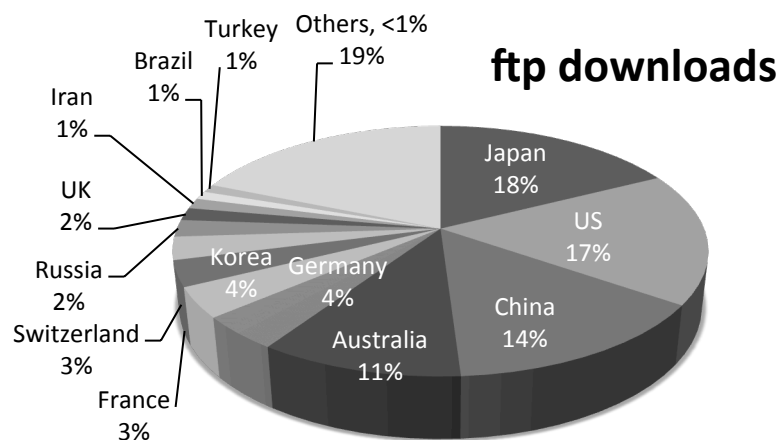


Figure 22 (b). Per country statistics of downloads from the ISC ftp-site

ISC DATABASE and WEBSITE BACKUP and MIRRORS

The ISC continued maintaining one of its servers at the IRIS DMC in Seattle in order to hold a mirror of the ISC database and the ISC website. This was done with assistance from the DMC and US NSF in order to achieve a general ISC data back-up and fall-over facility in case of a breakdown of services at the ISC itself as well as to spread the load on the ISC Internet line and give ISC users faster access to data.

The mirror has been operational since September 2011. The database in Seattle is updated with an hour time lag. During 2015 we introduced the Load Balancer that evenly distributes the load on the ISC website, including the user searches, between the server at the ISC in Thatcham and the server at DMC in Seattle. Users no longer need to know the exact web address in Seattle and are generally no longer aware which server is addressing their request.

In addition, the IRIS DMC is able to use the database on a daily basis to serve the DMC archive users with event-based selection of waveform data.

Other mirrors of the ISC database are maintained by the Earthquake Research Institution (ERI) of University of Tokyo to serve the research community in Japanese universities and by the Lawrence Livermore National Laboratory (LLNL) to serve users from monitoring laboratories in the US. Plans are discussed with China Earthquake Administration (CEA) to have another ISC database and website mirror installed in China with support from CEA. If agreed and implemented, this will help numerous Mandarin speaking seismologists to get better and more intuitive access to the ISC data.

DEVELOPMENT PROJECTS

EXTENSION of the ISC-GEM CATALOGUE

The ISC-GEM Global Instrumental Catalogue is one of the most outstanding global components that was originally funded by the GEM Foundation and now widely used for modelling seismic hazard on a regional and global scale. The catalogue is now also used as both an authoritative reference and a starting point in GEM's regional initiatives in South America, Africa and Asia. The Catalogue also has a multidisciplinary use in a wide range of other areas such as studies of global seismicity, inner structure of the Earth, tectonics, nuclear monitoring research, rapid determination of hazard etc.

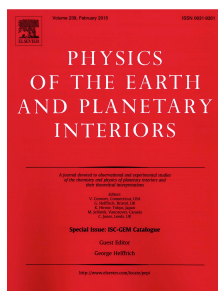
The catalogue is very popular with approximately 10 downloads per day recorded in the last six months. The catalogue is obviously a well known resource and a great credit to both the ISC and the GEM Foundation.

The magnitude cut-off thresholds in the original ISC-GEM catalogue are as follows:

- 1900-1917: $M_S \geq 7.5$ worldwide + smaller shallow events in stable continental areas
- 1918-1959: $M_S \geq 6.25$
- 1960-2009: $M_S \geq 5.5$

We are currently working on extending the ISC-GEM catalogue by decreasing the magnitude cut-off thresholds in the early instrumental period before 1960 as well as adding recent years beyond 2009 (Figure 23). The work began on November 1, 2013, initially with funding from the GEM Foundation and FM Global. At the same time, an extensive fundraising campaign was instigated that has, so far, brought four additional funding commitments from both the private and the commercial sector: Lighthill Risk Network in London (Aon Benfield, Catlin, Guy Carpenter and Lloyd's), United States Geological Survey (USGS), United States National Science Foundation (NSF) and the OYO Corporation in Japan. Our fundraising efforts continue.

The team working on the project includes members of the ISC staff and leading experts from University of Colorado and MTA Research Centre in Hungary. Several institutions internationally have also helped by providing copies of vital historical data.



Six scientific publications explaining details of the project have now been published by the team in a special volume of the Physics of the Earth and Planetary Interior and Seismological Research Letters. References to the ISC-GEM catalogue are becoming progressively more common.

Year 2 of the project ended in October 2015 with data years 1935-1949 and 2012 added to the catalogue. Provided our fundraising campaign is successful, we shall complete the work in the next two years (Figure 24).

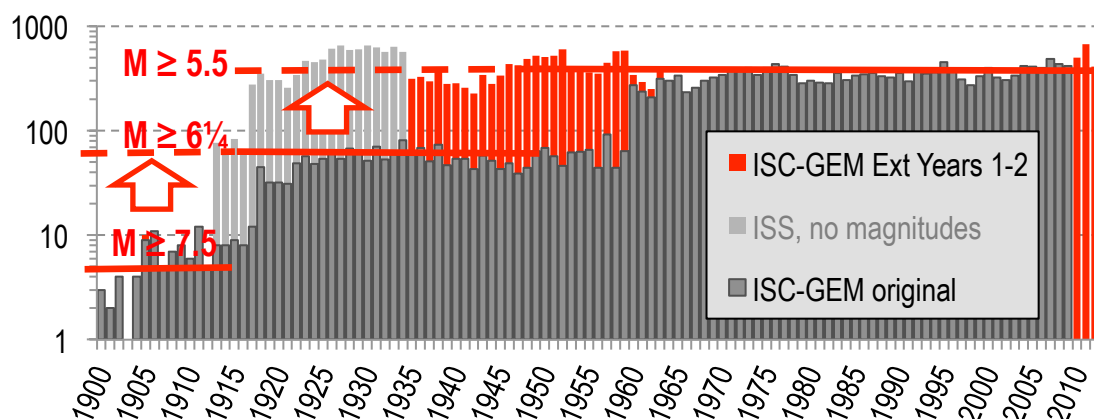


Figure 23. Annual earthquake numbers in the original ISC-GEM catalogue are in dark grey; earthquakes added during the Years 1-2 of the Extension Project are in red and the number of events available in the ISS (the main original source of data prior to 1964) are in light grey. The ISS does not contain magnitudes. Red horizontal lines represent the numbers of earthquakes with magnitude ≥ 5.5 , $6\frac{1}{4}$ and 7.5 , expected to be added during Project Years 3-4, based on the rates of seismicity recorded by modern seismic networks today.

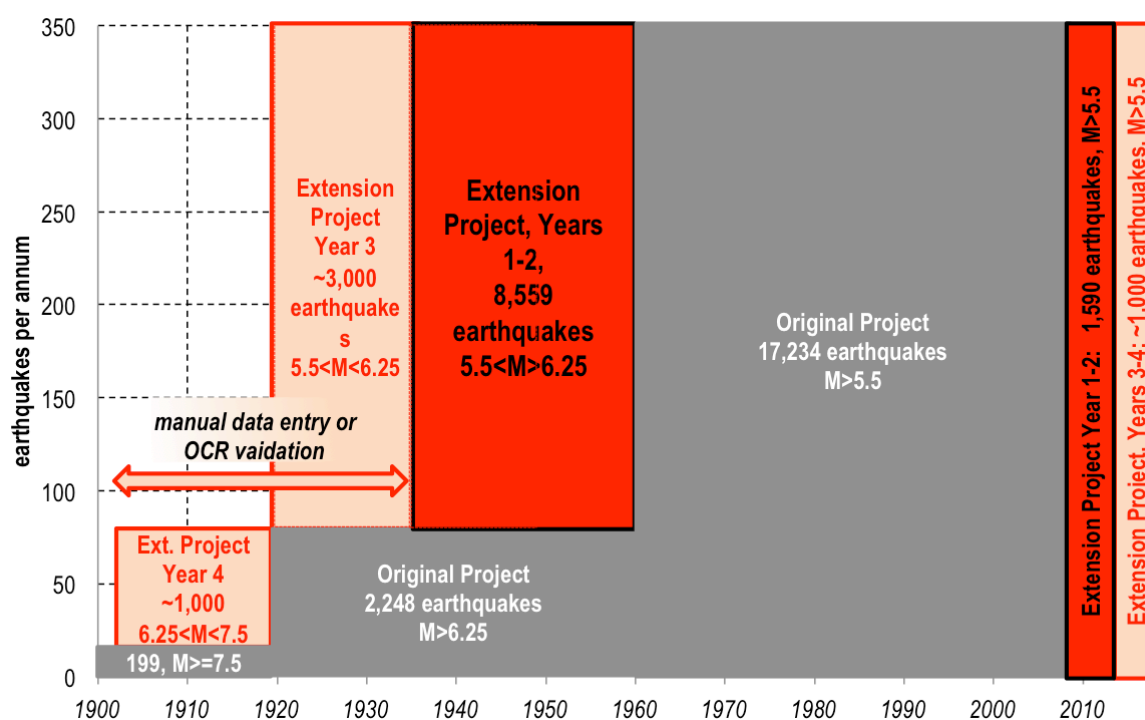


Figure 24. The number of earthquakes for each period of time and magnitude interval in the original and extended (Year 1-2) ISC-GEM catalogue (grey and red) and the approximate number of earthquakes expected to be added to the catalogue (pink cream) during the Years 3-4 of the Extension Project; large effort in the manual data entry and validation of OCR processing of historical paper bulletins is required for years 1904-1934.

CTBTO LINK to the ISC DATABASE

Back in 2008, the UK Foreign and Commonwealth Office (FCO) awarded the ISC with a three year grant to set up a dedicated and secure link to the ISC database for the CTBTO PTS and National Data Centres. The UK FCO provided 90% of the total funding with GEUS (Denmark), NORSAR (Norway), FOI (Sweden) and University of Helsinki (Finland) complementing it with 2.5% each. From April 2011, the funding of the project was taken over by the CTBTO with an intention to continue for three years until March 2015. From April 2015, a new annual contract was signed with four possible annual extensions.

During 2015 we maintained a dedicated server at the ISC that holds a mirror version of the ISC database. The dedicated web-based software package designed and maintained by the ISC for this service allowed users from PTS and National Data Centres for CTBTO to query the ISC database in ways specific to the explosion monitoring community. The software package includes four types of bulletin searches: an area based, an REB event based, GT event based and an IMS station based search through the wealth of the parametric information in the ISC database.

The objective of the project is to provide the capacity for NDCs to perform various types of analysis such as:

- assessing the historical seismicity in a specific region;
- putting an event of interest into context with the seismicity of the surrounding region;
- examination of observations reported by non-IMS stations;
- comparison of hypocentre solutions provided by various agencies;
- relocating an REB event based on the user selected arrival times available for this event in the ISC database;
- investigation of station histories and residual patterns of IMS or IMS surrogate stations.

We also developed an interface for selecting waveforms of non-IMS stations for REB events from the IRIS DMC archive. For each recent REB and GT event, this interface:

- allows selection of stations by distance / azimuth to the REB epicentre;
- shows the number of stations, for which waveforms are available at IRIS DMC;
- exhibits pre-prepared images of selected waveforms, filtered and un-filtered with theoretical first arrivals indicated on top of the waveform images;
- offers a form to request part of waveform, based on absolute or relative theoretical arrival times of required seismic phases or on group velocity of surface waves;
- triggers a request to IRIS DMC; as a result, users receive required waveforms by e-mail in the SEED format.

Figure 25 shows user activity on the Link by both PTS/CTBTO and NDCs.

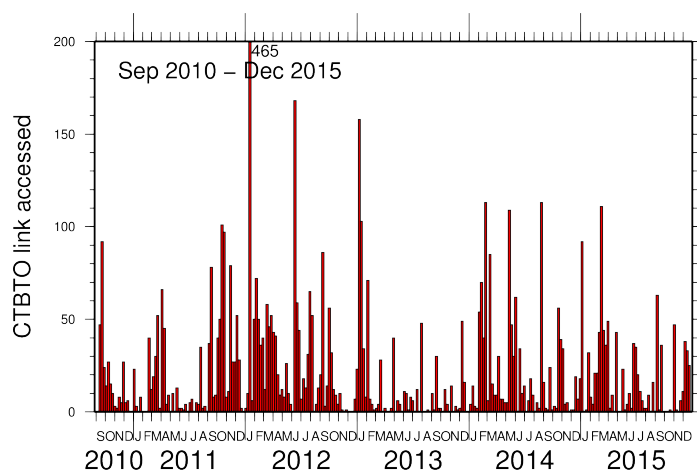


Figure 25. The Link to the ISC database mirror is provided to the NDCs through the IDC secure website. The figure shows the healthy stream of user activity.

It may first appear that this project benefits only CTBTO. This isn't true as the ISC, its Member-Institutions and the ISC product users gain a great deal from the developments on this project:

- The ISC development staff acquired important skills and experience during this project. The advances made under this project are gradually implemented to improve the traditional open ISC web services.
- In particular, experience of downloading, checking quality and processing waveforms on an industrial scale will help the ISC's mid-term plans of making its own automatic waveform measurements to further improve the quality of the ISC Bulletin.
- The ISC and its Bulletin users gained a much speedier access to the REB Bulletin which is now usually available within 20-50 days after event occurrence as opposed to half a year to a year in the past (Fig. 26).
- Many National Data Centres for CTBTO are run by institutions that are either Members of the ISC or reporters of data to the ISC.
- Several NDC's either became ISC Members or increased their financial contributions, based on the added value of the ISC service.

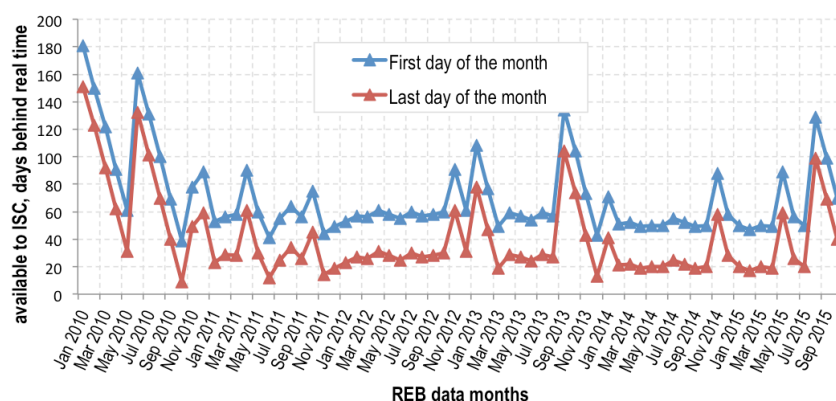


Figure 26. The availability of the IDC REB data to general ISC Bulletin users (days behind real time) has considerably improved with the routine operation of the CTBTO Link. End-of-year glitches are going to be addressed by CTBTO by setting more automated procedures of providing bulletins to the ISC with certain delay.

It also has to be noted that although the software created under this project is open only to the monitoring community, the actual data used by them are exactly the same as used by all ISC users: the ISC Bulletin, GT List, EHB and International Seismograph Station Registry.

ISC BULLETIN REBUILD

The value of the ISC Bulletin is dependent upon adhering to uniform procedures over a long period of time. Nevertheless, essential changes in the ISC procedures have occurred:

- The *ak135* velocity model has been used since 2006 superseding the *JB* travel times.
- A new event Locator based on different approach was introduced from data year 2009.
- Throughout the ISC history different sets of seismic phases were used for location: P & (from 2001) S with other *ak135* phases from 2009.
- Latitude & longitude error estimates were computed before Oct 2002, followed by full error ellipses later on.
- Procedures that determine what reported events require relocation by the ISC were also changed in 1999, 2005 and 2006.

Thus, the ISC Bulletin will benefit from being rebuilt using uniform procedures to guarantee homogeneity through out its entire period.

As part of this project we are:

- Re-computing all ISC hypocentres with uncertainties;
- Re-computing all ISC event magnitudes with uncertainties;
- Soliciting, obtaining and integrating essential additional datasets that were not available at the time of original ISC Bulletin production (Fig.27);
- Performing essential integrity and consistency checks, quality control and correction.

Before 2015, we made a thorough review and clean-up of the contents of the ISC Bulletin in the areas of seismic arrival phase identifications, channel information, first motion information and suspiciously large magnitude estimates.

During 2015 we set up criteria to determine which events warrant the ISC hypocentre. Following these criteria, we relocated all events with the new ISC location procedures and *ak135* velocity model.

Traditionally, all ISC hypocentres are reviewed by the ISC analysts. With the resources available today, we cannot afford to review each event. Thus we had to set up another set of criteria that distinguish the “OK” events from “BAD” events in need of an analyst's attention due to large departures from the old ISC, NEIC or EHB solutions, discrepancy in magnitude or suspicious pattern of arrival time residuals against the new ISC hypocentre. We also decided to review all so called “SEARCH” events that were formed by the ISC alone based on the un-associated reported station readings. The third category of events requiring an analyst's attention, we called it “GAIN”, are those events with no old or an automatic new

ISC hypocentre, yet a set of associated teleseismic arrivals or magnitudes indicate that an event is big enough to warrant an ISC solution. Overall we established that there are ~200,000 events that fall into BAD, SEARCH and GAIN categories.

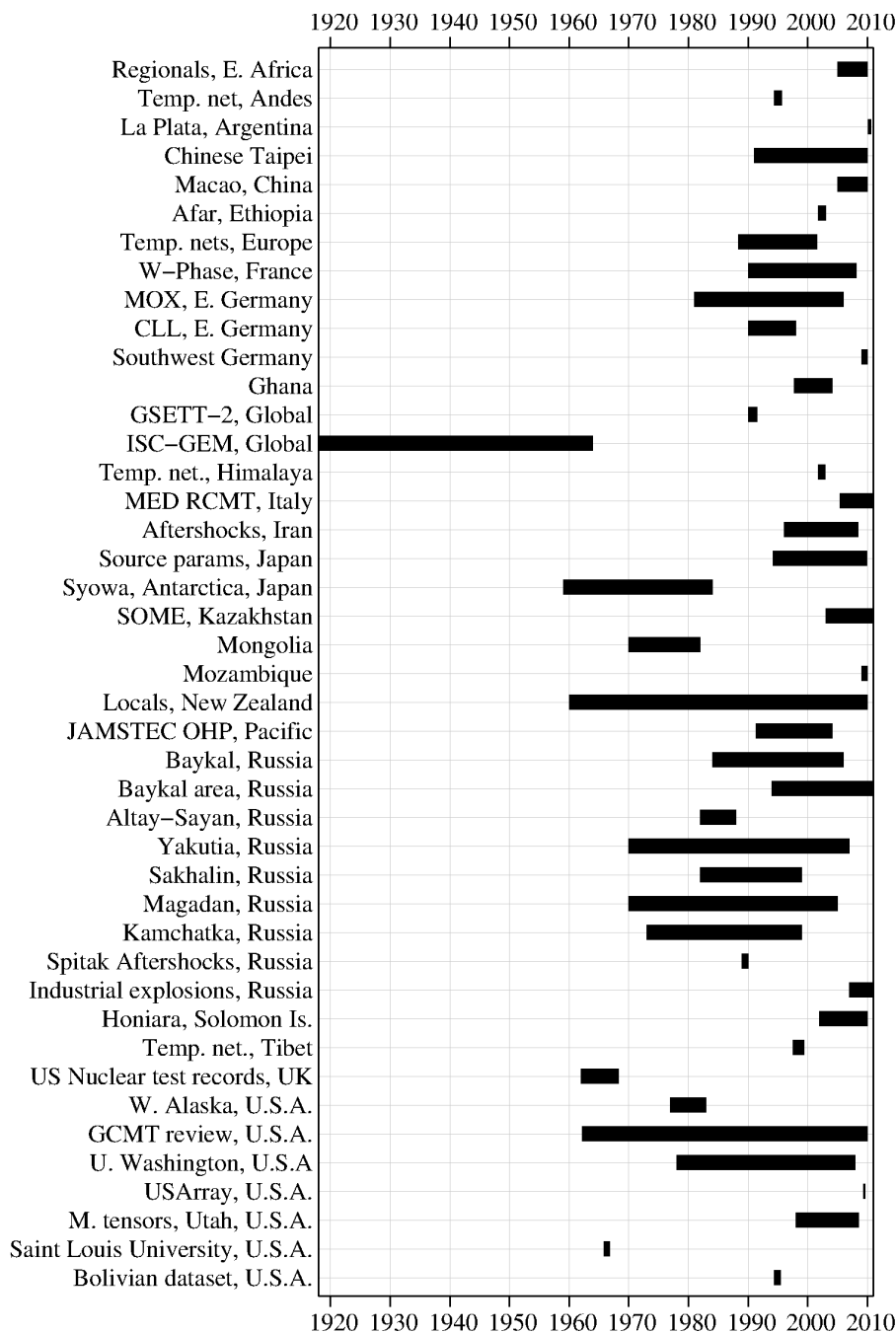


Figure 27.
Previously
unavailable data
to become part of
the Re-built ISC
Bulletin.

At first we aimed at the Bulletin review to be performed by the existing bulletin analysts, yet we soon realised that the current manpower is inadequate for the gigantic task ahead. We therefore identified, hired and trained two additional members of staff. Their training continued till the year's end. As a result, we now have a Rebuild Analyst Team that is an equivalent of 2.7 full time analysts to perform analysis of the three above categories of events.

The ISC Database Administrator and the ISC Director are also heavily involved in this project. They perform initial trial, testing and consulting tasks.

The Web Administrator is also involved in maintaining the interactive editing tool that he specially designed for this project, re-using web browser capabilities.

An employee of the China Earthquake Networks Centre and former ISC Analyst, Mrs Baokun Li have helped on this project at the end of 2015 consulting on the review of earthquakes in China and further afield during 1960s.

Our newly hired ISC Data Seismologist has also been instrumental in bringing additional bulletin datasets from temporary seismic deployments.

At present, a lot of procedures and associated software described above have been settled and we are finishing the analysis of 1960s that, when complete, will be parsed to the main ISC database from the Rebuild database account, ready to be searched by the ISC Bulletin users. The speed of review is highly variable during different periods even within 1960s. We believe that continuous modernization of procedures in the past led to previously undetected and currently observed problems in the data that we have to rectify. Any estimates of the likely end of the project are highly uncertain. We nevertheless try to speed up the review as much as possible aiming to end the project whilst we have the analyst resources available.

The ISC FDSNWS WEB-SERVICE

Based on the funding provided by IRIS, the ISC has designed its first web-service, compliant with FDSN rules (<http://www.fdsn.org/webservices/FDSN-WS-Specifications-1.1.pdf>). This service allows a common method of querying a data source and returns data in a standard format. The ISC service currently produces data in QuakeML or ISF formats. This will be expanded to include the FDSN standard text format once our prime event magnitudes are in place.

The ISC implementation of the service (<http://www.isc.ac.uk/fdsnws/event/1/>) went live after a final round of testing by IRIS in March 2015. The ISC service was placed on the official FDSN Web Services list (<http://www.fdsn.org/webservices/datacenters/>) in June 2015. Though the event service is the least common service it can also be found at USGS (NEIC), Northern California Earthquake Data Center, ETHZ and INGV.

The event service at IRIS (<http://service.iris.edu/fdsnws/event/1/>) is now directing users to go to the ISC or USGS services. We added links to this web service to the list of methods of searching the ISC Bulletin on the ISC website. Almost a thousand searches have been made using the ISC FDSNWB web-service in 2015.

FINANCE

The detailed financial statements of the ISC for 2015 were audited by Griffins, Chartered Accountants (Newbury, UK) and approved by Prof. John Woodhouse of the ISC Executive Committee. These statements present the state of ISC's financial affairs as at 31 December 2015.

INCOME

In 2015, the ISC had a total income of £853,732 from 65 Member contributions (new: USP & ICGC), grants for special projects and general sponsorship. The grants and sponsorship are listed as Other Income and amount to almost 27% of the total income. The providers of these funds are itemised on page 7 of the accounts. Interest on ISC bank accounts is included in the Other Income. NSF funds and some other grants, where work has yet to start, have been split between 2015 and 2016.

The exchange rate between the UK £ and USA \$ veered between the opening rate of £1=\$1.56 at the start of the year, to £1=\$1.58 and then finishing the year at £1=\$1.48 at the end of December.

At the year-end £63,745 had yet to be paid by members but at the time of writing this report some £42,065 had been received. The total of bad debts written off was £2,005 following our policy to write off funds where nothing has been received for three years or when we have been informed that the member has resigned.

EXPENDITURE

About 77% of ISC expenditure was committed to personnel costs, £13,296 more than the amount spent in 2014. During the year we saw the arrival of five new members of staff. The staff costs include salaries, pension contributions, and recruitment and repatriation of new and departing staff. The ISC salaries follow the newly adopted ISC salaries scales approved by the Executive Committee and based on the CPI (inflation index) published annually by the UK Office of National Statistics.

Building expenses were less than the previous years' costs even though a new telephone system was installed and many of the offices were redecorated, many for the first time since 1986. Computing costs slightly increased following purchase of workstations to be used by newly hired analysts. The total staff travel costs rose reflecting the costs of sending extra members of staff to attend the IUGG, ISC-50, NEIC-ISC-EMSC Coordination, the ExecCom and the Governing Council meetings in Prague. As in previous years, staff travelled to several countries to attend meetings to increase the profile of the ISC, take part in project meetings and also to seek new data and future funding.

RESERVES

The gain in income over expenditure in 2015 was £76,760. At the same time we are aware of the extensive roof repairs urgently required with an estimated cost of £50,000. The ISC total reserves, comprising the cash in the bank, value of building and land, money owed to ISC (debtors) minus the money ISC owes (creditors) increased during 2015 to £839,277; this includes money earmarked for on-going projects. The Contingency Fund stands at £30,000 in accordance with the wishes of the ISC Governing Council. The ISC General Reserve of £809,277 is equivalent to around 12 months future operation of the ISC. This is within British guidelines for charitable organizations.

CASH FLOW

The cash flow in Fig. 28 shows receipts and outlays using dates when transactions were recorded at the bank and the bank balances where US Dollars and Euros are converted to Sterling using the exchange rate as of the end of each month.

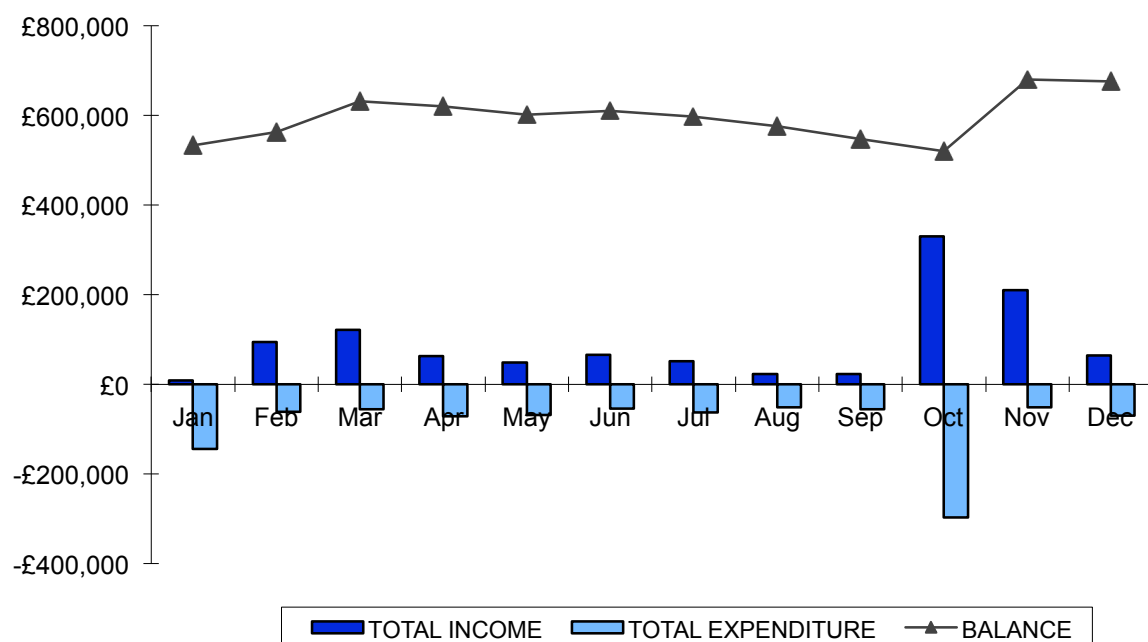


Figure 28. Income/Expenditure cash flow and cash balance 2015

In 2015, the ISC was fortunate not to experience problems with the cash flow and wishes to thank its Members and Sponsors for their continuing support. We also would like to thank those organizations that make their payment promptly and accurately when invoices are sent during their year.

SCIENTIFIC LIAISONS

VISITORS to the ISC

The following geophysicists visited ISC premises in Thatcham during the year:

- Cho Hee Young, Busan Regional Meteorological Administration, *South Korea*
- Lee Bong Soo, Korean Meteorological Administration, *South Korea*
- Park Sang Mi, Korean Meteorological Administration, *South Korea*
- Kim Byung Chel, EMT, *South Korea*
- Miugu Kang, EMT, *South Korea*
- Marcelo Assumpção, University of Sao Paulo, *Brazil*
- Philip Usher, University of Bristol, *UK*
- Kathrin Lieser, GEOMAR, Kiel, *Germany*
- Ron Smith, retired, *Australia*
- Bob Engdahl, University of Colorado, Boulder, *United States*
- Baokun Li, CENC, CEA, *China*
- David Pugh, Cambridge University, *UK*
- Min Chen, OeRC, Oxford University, *UK*
- Simon Walton, OeRC, Oxford University, *UK*

CONFERENCES, MEETINGS, WORKSHOPS, TRAINING COURSES

Members of the ISC staff presented at the following conferences, meetings and workshops:

- EGU Meeting, Vienna, *Austria*
- CTBTO Science & Technology Conference, Vienna, *Austria*
- GS RAS International Seismology School, Novkhany, *Azerbaijan*
- CTBTO Capacity Building and RSTT Workshop, San Jose, *Costa Rica*
- IUGG Assembly, Prague, *Czech Republic*
- NEIC-ISC-EMSC Coordination meeting, Prague, *Czech Republic*
- Nordic Seismology Seminar, Bornholm, *Denmark*
- International Training Course on Seismology, Seismic Data Analysis, Hazard Assessment and Risk Mitigation, Potsdam, *Germany*
- GEM Open-Quake Launch meeting, Pavia, *Italy*
- Complex Geophysical Monitoring of the Far East, Petropavlovsk-Kamchatskij, *Russia*
- Africa Array Meeting, Johannesburg, *South Africa*
- SECED Conference, Cambridge, *UK*

ISC STAFF VISITING OTHER INSTITUTIONS

Often with the help of the hosting institution, members of the ISC staff visited and, where appropriate, gave a presentation to the staff of:

- IDC CTBTO, Vienna, *Austria*
- Guangdong Provincial Earthquake Administration, Guangzhou, China
- UNA-OVSICORI, Heredia, *Costa Rica*
- University of Costa Rica (UCR), San Jose, *Costa Rica*
- Geophysical Institute, Czech Academy of Sciences, Prague, Czech Republic
- GFZ, Potsdam, *Germany*
- GEM Secretariat, Pavia, *Italy*
- Kamchatka Branch, Geophysical Survey RAS, Petropavlovsk-Kamchatskij, *Russia*
- Institute of Volcanology and Seismology, Petropavlovsk-Kamchatskij, *Russia*
- Pretoria University, Pretoria, South Africa
- Council for Geosciences, Pretoria, South Africa
- Oxford University, Earth Science Department, Oxford, *UK*
- Oxford e-Research Centre, Oxford, *UK*

ISC PRIZE for OXFORD UNIVERSITY STUDENTS

A few years ago the ISC established a small annual Prize in Mathematics and Geophysics (£200 and the annual ISC DVD-ROM) for a best first year student at the Earth Science Department of its home institution – the University of Oxford. In 2015, the prize was delivered by the ISC's Honorary Seismologist, Robin Adams to Mr Andrew Orkney, the student with the best exam results in geophysics and mathematics. By awarding this prize the ISC hopes to attract Oxford University students to take note of the ISC services right from their first year, support the ISC in the future and perhaps even help the ISC in fulfilling its mission.

USGS ComCat TELECALLS

As part of its long and established cooperation with USGS, the ISC staff took part in a series of late night (in UK) telephone conferences run by the USGS headquarters in Reston and aimed to observe, discuss and advise formation of the USGS Comprehensive Catalog (ComCat). ComCat is to be widely used by the US and other researchers. The ComCat combines together the NEIC catalogues with bulletins of local US networks. The historical part of the ComCat will benefit from the data in the ISC-GEM Catalogue.

SCIENTIFIC PAPERS PUBLISHED by the ISC STAFF

Storchak, D.A., D. Di Giacomo, E.R. Engdahl, J. Harris, I. Bondár, W.H.K. Lee, P. Bormann and A. Villaseñor, 2015. The ISC-GEM Global Instrumental Earthquake Catalogue (1900-2009): Introduction, *Phys. Earth Planet. Int.*, 239, 48-63, doi: [10.1016/j.pepi.2014.06.009](https://doi.org/10.1016/j.pepi.2014.06.009).

Di Giacomo, D., J. Harris, A. Villaseñor, D.A. Storchak, E.R. Engdahl, W.H.K. Lee and the Data Entry Team, 2015. ISC-GEM: Global Instrumental Earthquake Catalogue (1900-2009), I. Data collection from early instrumental seismological bulletins, *Phys. Earth Planet. Int.*, 239, 14-24, doi: [10.1016/j.pepi.2014.06.003](https://doi.org/10.1016/j.pepi.2014.06.003).

Bondár, I., E.R. Engdahl, A. Villaseñor, J. Harris and D.A. Storchak, 2015. ISC-GEM: Global Instrumental Earthquake Catalogue (1900-2009): II. Location and seismicity patterns, *Phys. Earth Planet. Int.*, 239, 2-13, doi: [10.1016/j.pepi.2014.06.002](https://doi.org/10.1016/j.pepi.2014.06.002).

Di Giacomo, D., I. Bondár, D.A. Storchak, E.R. Engdahl, P. Bormann and J. Harris, 2015. ISC-GEM: Global Instrumental Earthquake Catalogue (1900-2009): III. Re-computed MS and mb, proxy MW, final magnitude composition and completeness assessment, *Phys. Earth Planet. Int.*, 239, 33-47, doi: [10.1016/j.pepi.2014.06.005](https://doi.org/10.1016/j.pepi.2014.06.005).

Storchak, D.A., M. Kanao, E. Delahaye, J. Harris, 2015. Long-term accumulation and improvements in seismic event data for the polar regions by the International Seismological Centre. *Polar Science*, 9(1), 5-16, doi: [10.1016/j.polar.2014.08.002](https://doi.org/10.1016/j.polar.2014.08.002)

Macheyeki, A.S., Mdala, H., Chapola, L.S., Manhiça, V.J., Chisambi, J., Feitio, P., Ayele, A., Barongo, J., Ferdinand, R.W., Ghebrebrhan, O., Goitom, B., Hlatywayo, J.D., Kianji, G.K., Marobhe, I., Mulowezi, A., Mutamina, D., Mwano, J.M., Shumba, B. and Tumwikirize, I., 2015. Active Fault Mapping in Karonga-Malawi after the December 19, 2009 Ms 6.2 Seismic Event, *J. African Earth Sciences*, 102, 233-246, doi: [10.1016/j.jafrearsci.2014.10.010](https://doi.org/10.1016/j.jafrearsci.2014.10.010)

OTHER REFERENCES USED IN THIS REPORT

BAAS, 1900-1912. British Association for the Advancement of Science, Circulars 1-27 issued by the Seismological Committee of the British Association for the Advancement of Science (*Shide Circulars*).

BAAS, 1913-1917. British Association for the Advancement of Science, Seismological Committee, monthly bulletins.

Bondár, I., and D. Storchak, Improved location procedures at the International Seismological Centre, 2011. *Geophys. J. Int.*, 186, 1220-1244.

Ekström, G., Nettles, M., and Dziewonski, A.M., 2012. The global CMT project 2004–2010: Centroid-moment tensors for 13,017 earthquakes, *Phys. Earth Planet. Int.*, 200-201, 1-9.

Engdahl, E.R., van der Hilst, R. and Buland, R., 1998. Global teleseismic earthquake relocation with improved travel times and procedures for depth determination, *Bull. Seism. Soc. Am.*, 88, 722-743.

ISS, 1918-1963. International Seismological Summary, annual volumes.

Kennett, B. L. N., Engdahl, E. R., and Buland, R., 1995. Constraints on seismic velocities in the Earth from traveltimes, *Geophys. J. Int.*, 122, 108-124.

SCIENTIFIC PAPERS PUBLISHED in 2015 that USED the ISC DATA

This list is a result of a special effort to put together a collection of scientific papers that used ISC or EHB data and published in 2015. The list is by no means complete. The ISC has become such a familiar name that many researchers unfortunately fail to reference the ISC when using the ISC data.

We have searched Google Scholar for scientific papers that refer to the ISC data. We used the exact phrases “International Seismological Centre”, “International Seismological Center”, “ISC-GEM” and “EHB”+ “seismic” for papers appearing in 2015. No doubt many more references can be found by using different search phrases.

[Long-term accumulation and improvements in seismic event data for the polar regions by the International Seismological Centre](#) DA Storchak, M Kanao, E Delahaye, J Harris - *Polar Science*, 2015 – Elsevier Abstract The **International Seismological Centre** (ISC) is a non-governmental non-profit making organization funded by 62 research and operational institutions around the world and charged with the production of the ISC Bulletin, the definitive summary...

[Central Asia earthquake catalogue from ancient time to 2009](#) NN Mikhailova, AS Mukambayev 2015 - [annalsofgeophysics.eu](#)... The main international centers considered are: ISC bulletin; - Reviewed Event Bulletin of the IDC of the CTBTO (REB; <http://www...>

[Volcanic eruptions in the southern Red Sea during 2007–2013](#) S Jónsson, W Xu - *The Red Sea*, 2015 – Springer ... Verlag Berlin Heidelberg 2015 175 Page 2. regional networks provide limited information, although they show increased seismicity associated with the eruptions ... (**International Seismological Centre** 2013)...

[Ice melting and earthquake suppression in Greenland](#) M Olivieri, G Spada - *Polar Science*, 2015 – Elsevier ... Spada et al., 2012). 3. Observed seismicity. Fig. 1b shows the distribution of seismicity in Greenland during the last 60 years according to the ISC catalogue. The spatial distr...

[Rapid Characterization of the 2015 Mw 7.8 Gorkha, Nepal, Earthquake Sequence and Its Seismotectonic Context](#) GP Hayes, RW Briggs, WD Barnhart... - *Seismological ...*, 2015 - srl.geoscienceworld.org ... It is also clear that the 2015 rupture is predominantly adjacent to, and west of, the 1934 M 8.0–8.4 earthquake (eg, Chen and Molnar, 1977; Molnar and Qidong, 1984; Bollinger et al., 2014; **International Seismological Centre**, see Data and Resources) that produced surface ...

[Complex deformation pattern of the Pamir–Hindu Kush region inferred from multi-scale double-difference earthquake relocations](#) L Bai, T Zhang - *Tectonophysics*, 2015 – Elsevier ... The existence of intermediate-depth earthquakes beneath the Pamir–Hindu Kush region has long been recognized. The ISC catalog includes nearly 4000 earthquakes of $M \geq 4.5$ recorded over the past fifty years...

[Seismicity of the Arctic mid-ocean Ridge system](#) V Schlindwein, A Demuth, E Korger, C Läderach... - *Polar*

Science, 2015 – Elsevier ... We present here a comprehensive seismicity analysis that compares the teleseismic earthquake record of 35 years drawn from the catalogue of the **International Seismological Centre** with reconnaissance-style local earthquake records at six locations along the ridge that were ...

[Enhanced Earthquake Monitoring in the European Arctic](#) G Antonovskaya, Y Konechnaya, EO Kremenetskaya... - *Polar Science*, 2015 – Elsevier ... A probabilistic seismic model for the European Arctic. *J. Geophys. Res.*, 116 (B01303) (2011) <http://dx.doi.org/10.1029/2010JB007889>. **International Seismological Centre**, 2010; **ISC**; On-line Bulletin ...

[Two deep earthquakes in Wyoming](#) C Frohlich, W Gan... - *Seismological Research ...*, 2015 - srl.geoscienceworld.org ... range of station distances. For the Wyoming deep earthquake of 21 September 2013 13:16 UTC (event g), (pP–P) intervals reported by the **ISC** support a depth of 70–80 km (Fig. 6)...

[Presumption of large-scale heterogeneity at the top of the outer core basal layer](#) A Souriau - *Earth and Planetary Science Letters*, 2015 – Elsevier ... its turning point in the lower third of the outer core. The large PKPbc data set of the EHB catalog distributed by the **ISC** is analyzed. In order to compensate for the uneven distribution ...

[Can We Consider the 1951 Caviaga \(Northern Italy\) Earthquakes as Noninduced Events?](#) M Caciagli, R Camassi, S Danesi... - *Seismological ...*, 2015 - srl.geoscienceworld.org ... town of Caviaga. They were recorded by several observatories worldwide, as reported by the International Seismological Summary (ISS) On-Line Bulletin (ISS, 1951; **ISC**[ISC], 2011). ..

[Equalized Plot Scales for Exploring Seismicity Data](#) DC Agnew - *Seismological Research Letters*, 2015 - srl.geoscienceworld.org ... Although the EVC catalog has been partly superseded by the ISC–GEM Global Instrumental Earthquake Catalogue (Storchak et al., 2013; Michael, 2014; DiGiacomo et al., 2015), the composite nature of the EVC ...

[A Long-Term Seismic Quiescence before the 2004 Sumatra \(Mw 9.1\) Earthquake](#) K Katsumata - *Bulletin of the Seismological Society of America*, 2015 - bssaonline.org

.. An earthquake catalog created by the **International Seismological Centre** is analyzed in the study area, 80°–110° E, 10° S–20° N, between 1964 and 2004, including 1153 earthquakes shallower than 100 km with body–wave magnitude of $5.0 \leq m_b \leq 6.7$

Comparative analysis of regression methods used for seismic magnitude conversions P Gasperini, B Lolli, S Castellaro - *Bulletin of the Seismological ...*, 2015 - bssaonline.org ... Das et al. (2014) obtain instead very different values ($c_0 = 1.992$ and $c_1 = 0.623$) from the empirical fit of a global set of 19,466 m_b and M_w taken from the bulletin of the **International Seismological Centre** (ISC) and from the catalog of the Global Centroid Moment Tensor (CMT) ...

Seismicity, structure and tectonics in the Arctic region M Kanao, VD Suvorov, S Toda, S Tsuboi - *Geoscience Frontiers*, 2015 – Elsevier ... Figure 1. Distribution of tectonic provinces, seismicity and volcanoes in Eurasian continent and surrounding regions (after database of Cornell University; the world geology map, seismicity is after the **International Seismological Centre** (ISC) ...

Probabilistic Models for Forecasting Earthquakes in the Northeast Region of India A Sil, TG Sitharam, ST Haider - *Bulletin of the Seismological Society ...*, 2015 - bssaonline.org ... seismicological agencies. The national agencies are the IMD, BARC, and NGRI. International seismicological agencies are the ISC, USGS, and COSMOS Virtual Data Center ...

A new, improved and fully automatic method for teleseismic depth estimation of moderate earthquakes ($4.5 < M < 5.5$): application to the Guerrero subduction zone (... J Letort, J Guilbert, F Cotton, I Bondár... - *Geophysical ...*, 2015 - gji.oxfordjournals.org ... Moreover, we have also validated our method through relocation of the same events using the new **International Seismological Centre** (ISC)-locator algorithm, as well as comparing our cepstral depths with the available Harvard–Centroid Moment Tensor (CMT) solutions

Evolution of the oceanic lithosphere inferred from Po/So waves traveling in the Philippine Sea Plate A Shito, D Suetsugu, T Furumura - *Journal of Geophysical ...*, 2015 - Wiley Online Library ... The source parameters provided by the Bulletin of the **International Seismological Centre** [ISC, 2012] are listed in Table 1, and the locations of these events and the BBOBSs are shown in Figure 1. We divide the Philippine Sea Plate into three regions ...

Lithosphere formation at the ultraslow-spreading Gakkel Ridge: From reconnaissance seismicity studies towards passive seismology with under-ice ocean bottom ... V Schlindwein, F Schmid - 2015 - epic.awi.de ... We present here a comprehensive seismicity analysis that compares the teleseismic earthquake record of 35 years drawn from the catalogue of the **ISC** with reconnaissance-style local earthquake records at five locations along the ridge ...

Recent advance in polar seismology: Global impact of the International Polar Year M Kanao, D Zhao, DA Wiens, É Stutzmann - *Polar Science*, 2015 - Elsevier ... Storchak et al.

(2015) demonstrate the recent products and services (Bulletin, IASPEI reference event list, event bibliography, etc.) of the **International Seismological Centre** (ISC), including the characteristics of seismicity in both the Arctic and Antarctic regions. ...

Seismological Segmentation of Halmahera Thrust, Molucca Sea Region, based on Large Earthquake Sequences H Shiddiqi - 2015 AGU Fall Meeting, 2015 - agu.confex.com ... We employed teleseismic double-difference relocation using P- and S-wave arrival times from the Meteorological, Climatological, and Geophysical Agency of Indonesia (BMKG) and the **ISC** catalog. ...

Determination of Earthquake Hazard Parameters Using Different Earthquake Catalogues in İzmir, Turkey NCA Kılıç - 8th Congress of the Balkan Geophysical Society, 2015 - earthdoc.org ... For this purpose, the data obtained from international databases (ie, **International Seismological Centre**, ISC and National Earthquake Information Centre, NEIC) and a national database (ie, Kandilli Observatory and Earthquake Research Institute, KOERI) were used. ...

iLoc: New Developments on the ISC Locator I Bondár - ctbto.org ... Abstract The new location algorithm developed for the **International Seismological Centre** (ISC) has been operational since January 2011. ... Let., 80, 465–472. Bondár, I., and D. Storchak, Improved location procedures at the **International Seismological Centre**, 2011, *Geophys. ...*

Integer and fractional-order entropy analysis of earthquake data series AM Lopes, JAT Machado - *Nonlinear Dynamics*, 2015 – Springer ... This paper studies the statistical distributions of worldwide earthquakes over the time period from year 1963 up to 2012. The data are from the Bulletin of the **International Seismological Centre** (ISC), freely available at <http://www.isc.ac.uk/iscbulletin/>. ...

Seismic Hazard Assessment of Kavre Valley Municipalities HR Parajuli - *Proceedings of IOE Graduate Conference*, 2015 - conference.ioe.edu.np ... has been identified as 'seismic gap' [2] and stands as a potential site for future great earthquake(s). Instrumentally recorded seismicity data for earthquakes having magnitude greater than or equal to 4.0 after 1964 AD are available from **ISC**, UK. ...

The Wood–Anderson of Trieste (Northeast Italy): One of the Last Operating Torsion Seismometers D Sandron, GF Gentile, S Gentili... - *Seismological ...*, 2015 - srl.geoscienceworld.org ... we took into account the catalog of the Istituto Nazionale di Geofisica e Vulcanologia (ISIDe Working Group, 2010) and the online bulletins of the EMSC (2010; Euro–Med Bulletin) and of the ISC, 2013 ...

Seismicity Pattern Analysis in and around Shillong Great Earthquake of 1897 A Panthi, J Bhattarai - *Himalayan Physics*, 2015 - nepjol.info ... 2. DATA ANALYSIS Seismicity data were compiled using almost all the available earthquake catalogues such as ISC, NEIC- USGS, Page 2. 37 The Himalayan Physics, Vol.4, No.4, July 2013 ...

An Earthquake Classification Scheme Adapted for Japan Determined by the Goodness of Fit for Ground–Motion Prediction Equations JX Zhao, S Zhou, P Gao, T Long, Y

Zhang... - Bulletin of the ..., 2015 - bssaonline.org ... In the present study, we compared the hypocentral locations published in the catalogs of the International Seismological Centre /Engdahl–van der Hilst–Buland (ISC–EHB; Engdahl et al., 98), the Japan Meteorological Agency (JMA), and the National Earthquake Information ...

Evolution of b-values before large earthquakes of $m_b \geq 6.0$ in Andaman region S Prasad, C Singh - *Geologica acta*, 2015 - revistes.ub.edu ... 206 Data and Methodology. The study area includes the Andaman region of latitude 8° – 15° N and longitude 91° – 95° E (Fig 1). We have used the data reported by the **International Seismological Centre** catalogue from January 2000 to December 2012. ...

Role of tectonic stress in seepage evolution along the gas hydrate-charged Vestnesa Ridge, Fram Strait A Plaza-Faverola, S Bünz, JE Johnson... - *Geophysical ...*, 2015 - Wiley Online Library ... Seismic results were analyzed in conjunction with high-resolution bathymetry data (50×50 m) [Hustoft et al., 2009; Vanneste et al., 2005], seismological data (**International Seismological Centre** (ISC) database <http://www.isc.ac.uk>), and updated gravimetric maps (Scripps ...

Rupture process of the 2012 Mw 7.8 Haida Gwaii earthquake from an empirical Green's function method TE Hobbs, JF Cassidy, SE Dosso - *Bulletin of the Seismological ...*, 2015 - bssaonline.org ... 1). It should be noted that although the Canadian National Seismograph Network catalog lists this event as M_w 6.3, it is also listed in the Geological Survey of Canada (Pacific) moment tensor catalog as M_w 6.1, in the **ISC** Bulletin as M_w 6.0 ...

Marine seismogenic-tsunamigenic prone areas: The Gulf of Cadiz JM Miranda, L Matias, P Terrinha, N Zitellini... - *SEAFLOOR ...*, 2015 – Springer ... In Figure 6.1, we plot the epicenters of earthquakes with magnitude greater than 2, from the ISC catalog, for the period 1970-2000. Focal mechanisms (Borges et al., 2001, Buforn et al., 2004) indicate right lateral and reverse faulting ...

An evaluation of earthquake hazard parameters in the Iranian Plateau based on the Gumbel III distribution H Mohammadi, Y Bayrak - *Journal of Seismology*, 2015 – Springer ... is shown in Fig. 2. The database utilized in this survey is taken from Ambraseys and Melville (1982), Berberian(1994), **International Seismological Centre** (ISC), and US Geological Survey (USGS).

Evaluation of Ground Motion Prediction Equations (GMPEs) for Chile Subduction Zone. N BASTÍAS, AM Gonzalo, F LEYTON, E SAEZ, F RUZD... - *researchgate.net* ... The moment magnitudes (M_w) were obtained from the Harvard Centroid Moment Tensor (CMT), for events that are not available by CMT we used other magnitude scales (eg M_s) reported by CSN or by ISC, and use conversion equations ...

Pervasive deformation of an oceanic plate and relationship to large $> M_w$ 8 intraplate earthquakes: The northern Wharton Basin, Indian Ocean J Geersen, JM Bull, LC McNeill, TJ Henstock... - ..., 2015 - *geology.gsapubs.org* ... Focal mechanisms: red are main shocks of the 11 April

2012 intraplate earthquakes; black are aftershocks (until 31 April 2012) (both from **ISC** catalogue, www.isc.ac.uk/iscgem/); green are historic events (AD 1897–2005) from Delescluse and ...

A unified M_w -based earthquake catalogue and seismic source zones for the Red Sea region N Babiker, AHG Mula - *Journal of African Earth Sciences*, 2015 – Elsevier An earthquake catalogue for the Red Sea region with unified moment magnitude (M_w) is presented herein. The catalogue was compiled from various sources between 2.

The frequency dependence and locations of short-period microseisms generated in the Southern Ocean and West Pacific M Gal, AM Reading, SP Ellingsen... - *Journal of ...*, 2015 - Wiley Online Library ... microseisms. For this purpose we consider earthquakes with a magnitude of 3.5 m_b or higher from the **International Seismological Centre** (ISC)catalog

Seismogenic faulting of the sedimentary sequence and laterally variable material properties in the Zagros Mountains (Iran) revealed by the August 2014 Murmuri (E. ... A Copley, E Karasozen, B Oveisi... - *Geophysical ...*, 2015 - gji.oxfordjournals.org ... 2008; Nissen et al. 2010; Copley et al. 2012 for recent applications of this technique). We used teleseismic P and S phase arrival times reported by the ISC, fixed all hypocentre depths, and solved for the hypocentre latitude and longitude. ...

Bibliographical search for reliable seismic moments of large earthquakes during 1900–1979 to compute M_W in the ISC-GEM Global Instrumental Reference ... WHK Lee, ER Engdahl - *Physics of the Earth and Planetary Interiors*, 2015 – Elsevier ... 2002). The ISC was funded by the GEM Foundation to deliver a reliable instrumental global earthquake catalogue (from 1900 to 2009) with relocated hypocenters and moment magnitudes. ...

The Varzaghan-Ahar, Iran, Earthquake Doublet (M_w 6.4, 6.2): implications for the geodynamics of northwest Iran A Ghods, E Shabanian, E Bergman... - *Geophysical ...*, 2015 - gji.oxfordjournals.org ... Turkey (Fig. 6). We have also used arrival time data collected by the ISC. The two national Iranian permanent networks are discussed in Ghods & Sobouti (2005) and Ghods et al. (2012). We ...

An enigmatic earthquake in the continental mantle lithosphere of stable North America TJ Craig, R Heyburn - *Earth and Planetary Science Letters*, 2015 – Elsevier ... remains uncertain. Occasional other earthquakes at mantle depths in continental areas are reported in routine earthquake catalogues (eg **International Seismological Centre**, 2012 and Engdahl et al., 1998).

Origin and significance of deep earthquake clusters surrounding a pronounced seismic gap in northeast China W Gan, C Frohlich, Z Jin - *Journal of Asian Earth Sciences*, 2015 – Elsevier ... We thus relocated all G1 earthquakes in latitude range 40 – 45° N, longitude range 125 – 137° E and compared these relocations to locations reported in other catalogs, including the **ISC** bulletin and the EHB catalog (Engdahl et al., 1998). ...

[The M w 7.9 2014 intraplate intermediate-depth Rat Islands earthquake and its relation to regional tectonics C Twardzik, C Ji - Earth and Planetary Science Letters, 2015 – Elsevier ...](#) We use for the JHD relocation analysis the arrival times of seismic phases (P, S, pP, sP, PcP, and ScP) reported by the ISC, **EHB Bulletin**, <http://www.isc.ac.uk>

[Independent estimate of velocity structure of Earth's lowermost outer core beneath the northeast Pacific from PKiKP – PKPbc differential traveltimes and dispersion in ... T Ohtaki, S Kaneshima - Journal of Geophysical Research: ..., 2015 - Wiley Online Library ...](#) b EHB: from the EHB Bulletin [Engdahl et al., 1998 **International Seismological Centre**, 2011b], ISC: from the ISC Bulletin [International Seismological Centre, 2011a], and PDE: from the Preliminary Determination of Epicenters Bulletin by the National Earthquake Information ...

[Multifractality in seismic sequences of NW Himalaya A Chamoli, RBS Yadav - Natural Hazards, 2015 – Springer ...](#) The first data is compiled from different seismological sources such as International Seismological Summary (ISS), **International Seismological Centre** (ISC), NEIC of USGS, HRVD CMT catalogue and other local catalogues of Oldham (1883), Tandon and Srivastava (1974) ...

[Probabilistic seismic hazard assessment of NW and central Himalayas and the adjoining region MM Rout, J Das, R Das - Journal of Earth System Science, 2015 – Springer ...](#) Acknowledgements. Earthquake data from India Meteorological Department, India, US Geological Survey, USA and **International Seismological Centre**, On-line Bulletin, United Kingdom catalogs have been used in this study and the authors remain grateful for their support...

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[Tomography of core-mantle boundary and lowermost mantle coupled by geodynamics: joint models of shear and compressional velocity G Soldati, L Boschi, S Della Mora... - Annals of ..., 2015 - annalsofgeophysics.eu ...](#) (2009) and shown in their Figure 3. We employ a database of ~630,000 summary rays travel times of P waves and ~63,000 of PcP waves extracted from the **International Seismological Centre** (ISC) bulletin, as corrected by Antolik et al. (2001)...

[A summary of hazard datasets and guidelines supported by the Global Earthquake Model during the first implementation phase M Pagani, J Garcia, D Monelli... - Annals of ..., 2015 - annalsofgeophysics.eu ...](#) Global instrumental catalogue (ISC-GEM) The scientific project dedicated to the construction of a global uniform instrumental catalogue was led by the **International Seismological Centre** and saw the participation of a numerous and highly qualified group of international experts ...

[Relationships Between M w and Other Earthquake Size Parameters in the Spanish IGN Seismic Catalog L Cabañas, A Rivas-Medina... - Pure and Applied ..., 2015 – Springer ...](#) from specific studies. These include Udías and López Arroyo (1970), López Arroyo and Udías (1972), Fukao (1973), Pondrelli et al. (1999) and from the **International Seismological Centre** catalog (ISC 2010). In particular ...

[Hydrogeochemical and seismological exploration for geothermal resources in South Sinai, Egypt utilizing GIS and remote sensing AE EL-Rayes, MO Arnous, HA Aboulela - Arabian Journal of Geosciences, 2015 – Springer ...](#) A catalogue of micro to moderate earthquake that affects the study area has been compiled for the mentioned period as revealed from the National Earthquake Information Centre (NEIS), the **International Seismological Centre** (ISC), the Egyptian National Seismic Network ...

[Relocation of Earthquakes by Source-Specific Station Corrections in Iran V Materni, A Giuntini, S Chiappini... - Bulletin of the ..., 2015 - bssaonline.org ...](#) 2011). Improved location procedures at the **International Seismological Centre**, *Geophys. J. Int.* 186, 1220–1244, doi: 10.1111/j.1365–246X.2011.05107.x. Abstract/FREE Full Text. ↵: Cagnetti, V., and; R. Console. (1978). *European ...*

[Tectonic inversion in the Caribbean–South American plate boundary: GPS geodesy, seismology, and tectonics of the Mw 6.7 22 April 1997 Tobago earthquake JC Weber, H Geirsson, JL Latchman, K Shaw... - ..., 2015 - Wiley Online Library...](#) magnitude, and moment release and those determined independently through the inversion of seismic data that we obtained from the following: (1) the US Geological Survey's National Earthquake Information Center (NEIC), (2) the **International Seismological Centre** (ISC), (3 ...

[Assessment of the Potential for Induced Seismicity at the Cavone Oilfield: Analysis of Structural and Geophysical Data, and Geomechanical Modeling R Juanes, BH Hager, B Jha, JH Shaw... - Offshore ..., 2015 - onepetro.org ...](#) been published previously. For background information about regional seismicity since 1964 and the Emilia-Romagna 2012 sequence, we rely on epicenters reported by the **International Seismological Centre** (ISC).

[Crustal and upper mantle seismic structure of the Svalbard Archipelago from the receiver function analysis I Geofizyki - Pol. Polar Res, 2015 - degruyter.com...](#) to each seismic station. See Table 1 for details. Table 1 Location of seismic broadband stations from **ISC** and time range of used data set for receiver function analysis. Station's code Latitude ...

[The Unusual Bay of Bengal Earthquake of 21 May 2014 \(Mw 6.1\) SK Singh, V Hjörleifsdóttir, G Suresh... - Seismological ..., 2015 - srl.geoscienceworld.org ...](#) Other earthquakes in the Bay of Bengal (gray circles) are taken from the ISC catalog, and those with focal mechanisms plotted at their epicenters (compressional quadrants in gray) are from the Global Centroid Moment Tensor (CMT) catalog. ...

[Site specific design response spectrum proposed for the capital city of Agartala, Tripura](#) A Sil, TG Sitharam - [Geomatics, Natural Hazards and Risk](#), 2015 - Taylor & Francis ... The event data were collected from various national and international seismological agencies such as IMD, Geological Survey of India (GSI), United State Geological Survey (USGS), and the **International Seismological Centre** (ISC). ...

[Recalibration of the distance correction term for local magnitude \(ML\) computations in Italy](#) B Lolli, P Gasperini, FM Mele... - [Seismological ...](#), 2015 - [srl.geoscienceworld.org](#) ... CSTI Working Group, 2004) from 1981 to 1989. For some earthquakes missed by Italian catalogs, they also considered the Bulletin of the **International Seismological Centre**. Based on the epicentral distance reported on the ...

[Probabilistic analysis of the seismic activity and hazard in northern Thailand](#) S Pailoplee, P Charusiri - [Geosciences Journal](#), 2015 – Springer ... For the instrumental records, the earthquake catalogues of the (i) **International Seismological Centre**, (ii) National Earthquake Information Center, (iii) Thai Meteorological Department, (iv) China Digital Seismic Network, Beijing, China, (v) International Data Center ...

[Modelling Southeast Asian subduction zones for seismic hazard assessments using global tectonics and GIS techniques](#) VA Dimas, AM Kaynia, G Gibson - [ich.no](#)

... and GIS techniques. It is defined using an amalgamation of the **International Seismological Centre** (ISC) earthquake data and other source data to define the subduction slabs motion as it descends into the mantle.

[Tomographic evidence for a slab tear induced by fossil ridge subduction at Manila Trench, South China Sea](#) J Fan, S Wu, G Spence - [International Geology Review](#), 2015 - Taylor & Francis ... Manila Trench. The dataset, taken from the **International Seismological Centre** (1960–2008), is composed of 13,087 P-wave arrival times from 1401 regional earthquakes and 8834 from 1350 teleseismic events. The results ... The data used in this study are P-wave arrival times, which are an edited version (EHB bulletin) from the International Seismological Centre (ISC) (Engdahl et al. 1998). ... Figure 3 shows the distribution of the earthquakes and the 51 **seismic** stations used in this study. ...

[Seismicity in the southwestern Gulf of Mexico: evidence of active back arc deformation](#) G Suárez, A López - [Revista Mexicana de Ciencias ...](#), 2015 ... The size of the symbols is proportional to the magnitude of the earthquakes (source: **International Seismological Centre** and the Servicio Sismológico Nacional). Page 3. 79 Seismicity in the southwestern Gulf of Mexico: evidence of active back arc ...

[Source model of the 16 September 2015 Illapel, Chile Mw 8.4 earthquake based on teleseismic and tsunami data](#) M Heidarzadeh, S Murotani, K Satake... - [Geophysical ...](#), 2015 - Wiley Online Library ... Earthquake catalogs by the USGS National Earthquake Information Center (<http://earthquake.usgs.gov/earthquakes/search/>) and Global

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[Maximum magnitude estimation considering the regional rupture character](#) P Anbazhagan, K Bajaj, SSR Moustafa... - [Journal of ...](#), 2015 – Springer ... from the Bhabha Atomic Research Centre (BARC), Indian Meteorological Department (IMD), Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam and National Geophysical Research Institute (NGRI), Hyderabad, **International Seismological Centre**

[GEAR1: A global earthquake activity rate model constructed from geodetic strain rates and smoothed seismicity](#) P Bird, DD Jackson, YY Kagan, C Kreemer... - [Bulletin of the ...](#), 2015 - [bssaonline.org](#) ... forecast outperforms its seismicity and strain–rate parents; the chance that this improvement stems from random seismicity fluctuations is less than 1%. The preferred hybrid is also tested against the independent parts of the **ISC-GEM** Retrospective Testing against Earthquakes of 1918–1976. Storchak et al. (2012) released the International Seismological Centre–Global Earthquake Model (**ISC–GEM**) catalog, which is a comprehensive revision of the longstanding ISC catalog. ...

[Beringia: Seismic hazard and fundamental problems of geotectonics](#) El Gordeev, TK Pinegina, AV Lander... - [Izvestiya, Physics of the ...](#), 2015 – Springer ... 3–4, pp. 449–463. [Bulletin of the ISC](#), 1964–2003. <http://www.isc.ac.uk> Cross, RS and Freymueller, JT, Evidence for and implications of a Bering Plate based on geodetic measurements from the Aleutians and western Alaska, J. Geophys. ...

[Twentieth century seismicity of the Koffiefontein region \(Free State, South Africa\): consistent determination of earthquake catalogue parameters from mixed data types](#) FO Strasser, P Albini, NS Flint, C Beauval - [Journal of Seismology](#), 2015 – Springer ... Thus, the issue of combining multiple source determinations only concerns events large enough to also have teleseismic determinations by international agencies such as the **International Seismological Centre** (ISC) or the USGS National Earthquake Information Center (NEIC).

[An updated seismic source model for Egypt](#) R Sawires, JA Peláez, RE Fat-Helbary... - [... seismology to optimal ...](#), 2015 - [researchgate.net](#) ... The solutions of the Global Catalogue of CMT Harvard [65], the **International Seismological Centre** (ISC) [66], the National Earthquake Information Centre (NEIC) [67], the Regional CMT catalogues (RCMT) in the Mediterranean region [68], as well as ZUR-RMT catalogue of the ...

[Probing the core–mantle boundary beneath Europe and Western Eurasia: A detailed study using PcP](#) A Gassner, C Thomas, F Krüger, M Weber - [Physics of the Earth and ...](#), 2015 – Elsevier ... eastern Norway (Fig. 2). The long recording times of these arrays allow the analysis of 84 earthquakes (**ISC**, 2011) and nuclear explosions within a maximum of 50° distance (Table S1). The PcP ...

[Possible seasonality in large deep–focus earthquakes](#) Z Zhan, PM Shearer - [Geophysical Research Letters](#), 2015 - Wiley Online Library ... The earthquake catalog used in this

study is the **International Seismological Centre**-Global Earthquake Model (**ISC-GEM**) Global Instrumental Earthquake Catalogue from 1900 to 2009 [Storchak et al., 2013], complemented by the Global Centroid Moment Tensor (CMT) catalog ...

[A detailed seismic zonation model for shallow earthquakes in the broader Aegean area](#) [DA Vamvakaris](#), [CB Papazachos](#), [C Papaioannou](#)... - 2015 - [researchgate.net](#) ... The Global CMT project, EMSC-CSEM and ISC are the main sources of this data type, as they collect and publish information from numerous international ...

[GPR scan assessment at Mekaad Radwan Ottoman–Cairo, Egypt](#) [AM Abbas](#), [H Salah](#), [U Massoud](#), [M Fouad](#)... - [NRIAG Journal of ...](#), 2015 - Elsevier... Case Studies, Geological Society, London (2002). Fitzner et al., 2002b; Fitzner, B., Heinrichs, K., La Bouchardiere, D., 2002b. Damage index for stone monuments, **ISC**, On-line Bulletin,.

[The flat to normal subduction transition study to obtain the Nazca plate morphology using high resolution seismicity data from the Nazca plate in Central Chile](#) [S Nacif](#), [EG Triep](#), [SL Spagnotto](#), [E Aragon](#), [R Furlani](#)... - [Tectonophysics](#), 2015 – Elsevier ... Seismicity of a period of time of ~48years (1960–2008) from International ... Fig. 2. Seismicity of a period of time of ~ 48 years (1960–2008) from **International Seismological Centre**, EHB Bulletin, <http://www.isc.ac.uk>, Internatl. Seis. Cent., UK, 2009. ...

[Modeling of Kashmir Aftershock Decay Based on Static Coulomb Stress Changes and Laboratory-Derived Rate-and-State Dependent Friction Law](#) [F Javed](#), [S Hainzl](#), [A Aoudia](#), [M Qaisar](#) - [Pure and Applied Geophysics](#), 2015 – Springer ... aftershock sequence. 2.4 Aftershock Data. We analyzed the aftershock events, provided by the ISC that occurred between 330 N and 360 N latitude and 720E and 750E long..

[Fuzzy—probabilistic seismic hazard assessment, case study: Tehran region, Iran](#) [E Boostan](#), [N Tahernia](#), [A Shafiee](#) - [Natural Hazards](#), 2015 – Springer ... It contains basic parameters of earthquakes in Iran including historical and instrumental data. ISC catalog (<http://www.isc.ac.uk>) was also used for earthquakes occurred during 2001 to 2011

[Spatio-temporal and hazard mapping of Earthquake in UAE \(1984–2012\): Remote sensing and GIS application](#) [MM Yagoub](#) - [Geoenvironmental Disasters](#), 2015 – Springer ... region. Data Used Earthquake data used in this study was obtained from the Bulletin of the ISC event catalog which contains data from 1904 to 2013...

[Analysis of natural and artificial phenomena using signal processing and fractional calculus](#) [JA Machado](#), [AM Lopes](#) - [Fractional Calculus and Applied Analysis](#), 2015 - [degruyter.com](#) ... magnitude of the earthquakes. The Bulletin of the **International Seismological Centre** (ISC), available online at <http://www.isc.ac.uk/>, is used. The data catalog covers the period P = 1904 – 2013 years. Each record contains information ...

[Did the 1983 Charazeh earthquake trigger the destructive 1990 Rudbar earthquake?](#) [K Sarkarinejad](#), [S Ansari](#) - [International Journal of Earth Sciences](#), 2015 – Springer

... Consequently, the 1983 main shock, unlike the 1990 Rudbar earthquake, did not affect the seismicity. Data and resources. The **International Seismological Centre** (ISC) database was searched using www.isc.ac.uk (last accessed on April, 2013). ...

[PMTec: A new MATLAB toolbox for absolute plate motion reconstructions from paleomagnetism](#) [L Wu](#), [VA Kravchinsky](#), [DK Potter](#) - [Computers & Geosciences](#), 2015 – Elsevier ... 1981). Derived from 7.4 million first arrivals reported to the **International Seismological Centre** (Obayashi et al., 2006), model GAP-P1 is recommended in PMTec because of its good resolution for large scale mantle features.

[CSMAP: Cross Section Selector and Tomogram Generator](#) [T Kim](#), [Y Fukao](#), [M Obayashi](#) - [jamstec.go.jp](#) ... Earthquake hypocenters within a band 50 km wide on both sides of the section plane are extracted from the EHB (Engdahl-Hilst-Buland) Bulletins published from the **International Seismological Centre** (Engdahl et al., 1998) to plot hypocentral distribution. ...

[Giant Seismites and Megablock Uplift in the East African Rift: Evidence for Late Pleistocene Large Magnitude Earthquakes](#) [HL Hilbert-Wolf](#), [EM Roberts](#) - [PloS one](#), 2015 - [journals.plos.org](#)

[The 3 May 2006 \(Mw 8.0\) and 19 March 2009 \(Mw 7.6\) Tonga earthquakes: Intralab compressional faulting below the megathrust](#) [Q Meng](#), [DS Heeszel](#), [L Ye](#), [T Lay](#)... - [Journal of ...](#), 2015 - [Wiley Online Library](#) ... The locations of major and great earthquakes (magnitudes ≥ 7.0) along Tonga in the **International Seismological Centre**-Global Earthquake Model (ISC-GEM) Global Instrumental Earthquake Catalog (<http://www.isc.ac.uk/iscgem/>) [Storchak et al., 2013], which extends back to ...

[Active fault mapping in Karonga-Malawi after the December 19, 2009 Ms 6.2 seismic event](#) [AS Macheyeki](#), [H Mdala](#), [LS Chapola](#)... - [Journal of African Earth ...](#), 2015 – Elsevier ... n The **International Seismological Centre**, Thatcham, UK. Received 25 July 2014, Revised 8 October 2014, Accepted 20 October 2014, Available online 1 November 2014. Highlights. • We map and characterize surface fractures after an earthquake in Karonga Malawi.

[Gaussian Process Random Fields](#) [D Moore](#), [SJ Russell](#) - [Advances in Neural Information Processing ...](#), 2015 - [papers.nips.cc](#) ... Distributed variational inference in sparse Gaussian process regression and latent variable models In [Advances in Neural Information Processing Systems \(NIPS\)](#), 2014. [26] **International Seismological Centre**. On-line Bulletin. Int. Seis. Cent., Thatcham, UK, 2015. ...

[Assessment of the ground motion levels for the Vrancea \(Romania\) November 1940 earthquake](#) [F Pavel](#), [R Vacareanu](#) - [Natural Hazards](#), 2015 – Springer ... N and 26.93° long. E. The **International Seismological Centre** provides two depth values of 96 km and 150 km, respectively, and three epicenter positions: 45.7° lat. N and 26.8° long. E, 45.9° lat. N and 26.6° long. E and 45.75° lat. N and 26.5° long. ...

[Assessing infrequent large earthquakes using geomorphology and geodesy: the Malawi Rift](#) M Hodge, J Biggs, K Goda, W Aspinall - *Natural Hazards*, 2015 - Springer... We use the Malawi Rift system as an example region, and two major information sources of regional seismicity are consulted, they are as follows: (1) instrumental earthquake catalogue compiled by the ISC, and (2) geomorphological ...

[Hydrous state of the subducting Philippine Sea plate inferred from receiver function image using onshore and offshore data](#) T Akihara, K Mochizuki - *Journal of Geophysical Research*: ..., 2015 - Wiley Online Library ... We extracted event records from the continuous waveform data based on two earthquake catalogs: the **ISC-GEM** catalog, compiled by the ISC and the JMA catalog (Figure 2 ...

[The persistence of memory](#) JAT Machado, AM Lopes - *Nonlinear Dynamics*, 2015 - Springer... laws [13, 46]. The Bulletin of the **International Seismological Centre** (ISC), available online at (<http://www.isc.ac.uk/>), is used in this study. The data catalog covers the period of years $\backslash(P)$ = 1904–2013. Each record contains ...

[The 2008 Nura Mw6. 7 earthquake: A shallow rupture on the Main Pamir Thrust revealed by GPS and InSAR](#) X Qiao, Q Wang, S Yang, J Li, R Zou, K Ding - *Geodesy and Geodynamics*, 2015 – Elsevier ... Green and blue circles show respectively the seismicity of shallow (<50 km) and intermediate(>50 km) earthquakes from 1960 to 2008 from the **International Seismological Centre's** (ISC) catalog [15]. Dashed green lines denote national boundaries. ...

[IUGG-1851](#) R Quintero - iaspei.org ... The ISC, thanks to a unique international cooperation in the seismological community, collects, integrates and finally processes seismological bulletins (location parameters, seismic station data, moment tensor solutions, felt reports, etc .

[Joint analysis of the 2014 Kangding, southwest China, earthquake sequence with seismicity relocation and InSAR inversion](#) G Jiang, Y Wen, Y Liu, X Xu, L Fang... - *Geophysical ...*, 2015 - Wiley Online Library ... the focal parameters of the two events reported by Global Centroid Moment Tensor (GCMT), Institute of Geology of China Earthquake Administration (IGLCEA), Institute of Geophysics of China Earthquake Administration (IGPCEA), **International Seismological Centre** (ISC)...

[Interaction of reactivated faults within a restraining bend: Neotectonic deformation of southwest Jamaica](#) B Benford, B Tikoff, C DeMets - *Lithosphere*, 2015 - lithosphere.geoscienceworld.org ... Faults are overlain on a geologic map of Jamaica modified from Hastie et al. (2008). (C) Earthquakes from (ISC; 2001) for the period 2000–2010 (June); magnitudes range from 2.0 to 5.9. ...

[Himalayan hazard study on the basis of stress and strain state of 1991 Uttarkashi earthquake using Coulomb stress transfer model](#) DK Gupta, D Bhowmick, PNS Roy - *Geomatics, Natural Hazards ...*, 2015 - Taylor & Francis ... this region. According to the online bulletin of **International Seismological Centre** (ISC), the Uttarkashi

main shock was accompanied by many minor earthquakes of $M_b > 3.5$ that occurred for the next four months...

[Deep Earth Seismology: An Introduction and Overview](#) AM Dziewonski - *Treatise on Geophysics*, 2015 - books.google.com ... The data used by Jeffreys were extracted from the ISS, the precursor of the **International Seismological Centre** (ISC), which (with international financial support and governance) resumed the ISS role in 1964 and continues until today. Page 17. ...

[Upper mantle structure around the Trans-European Suture Zone obtained by teleseismic tomography](#) I Janutyte, M Majdanski, PH Voss, E Kozlovskaya - *Solid Earth*, 2015 - search.proquest.com... From the seismological bulletins of the **International Seismological Centre** (ISC), we selected 101 teleseismic earthquakes (EQs) with a magnitude range of 5.5 to 7.2 and an epicentral distance of 30 to 92 degrees with respect to the point at the Lithuanian Polish border...

[Stress adjustment revealed by seismicity and earthquake focal mechanisms in northeast China before and after the 2011 Tohoku-Oki earthquake](#) H Yu, L Zhao, Y Liu, J Ning, QF Chen, J Lin - *Tectonophysics*, 2015 – Elsevier ... For catalog analysis, we collect 3606 crustal-depth events (< 35 km, $M_L \geq 1.0$) reported by the China Earthquake Network Center (CENC) between 1970 and 2014, and 644 mantle-depth events (> 350 km, $M_b \geq 2.2$) reported by the **International Seismological Centre** (ISC) in ...

[Anomalous fluoride and warm water wells may indicate blind geothermal systems in Cenozoic basins of Northwestern Thailand](#) FS Singharajwarapan, SH Wood... - *Proceedings World ...*, 2015 - researchgate.net ... Since the year 2000 least 16 earthquakes greater than $M_b = 3.5$ and up to 4.6 have occurred in the Chiang Mai basin area (**International Seismological Centre**, 2014), and some have occurred near the Mae Tha fault, and also near the arc of fluoride-anomalous groundwater. ...

[Seismic hazard maps and spectrum for Patna considering region-specific seismotectonic parameters](#) P Anbazhagan, K Bajaj, S Patel - *Natural Hazards*, 2015 – Springer ... The earthquake event details within 500 km radius around the Patna district compiled from several resources like National Earthquake Information Centre (NEIC) **International Seismological Centre**, Indian Meteorological Department (IMD), United State Geological Survey ...

[Earthquake Prediction with Radio Techniques](#) M Hayakawa - 2015 - books.google.com... depth ≥ 150 km) during the period of 1964–2010. Reproduced with permission from <https://www.eic.eri.utokyo.ac.jp/db/isc/index.html>, **International Seismological Centre** Page 15. 3 Earthquakes and EQ Prediction 1.1.1 Naturally ...

[Satellite-derived geoid for the estimation of lithospheric cooling and basal heat flux anomalies over the northern Indian Ocean lithosphere](#) S Rajesh, TJ Majumdar - *Journal of Earth System Science*, 2015 – Springer ... (1997). Seismicity data as hypo-central distribution over the active mid-oceanic spreading centres of the Carlsberg Ridge were obtained from the reviewed catalogues

of **International Seismological Centre** (ISC-GEM catalogue, Storchak et al. 2013) for the period 1985–2009. ...

High-resolution lithospheric structure beneath Mainland China from ambient noise and earthquake surface-wave tomography X Bao, X Song, J Li - *Earth and Planetary Science Letters*, 2015 – Elsevier ... In the meantime, we selected shallow teleseismic Rayleigh waves with magnitudes larger than 5.0 and with distances greater than 1400 km from **International Seismological Centre** Bulletin in the region -20°N to 55°N , and 65°E to 150°E

Complex inner core of the Earth: The last frontier of global seismology H Tkalić - *Reviews of Geophysics*, 2015 - Wiley Online Library ... It should be mentioned here that large collections of traveltimes data sensitive to the Earth's core exist and are available to researchers. For example, one such collection is the phase arrival data of the Bulletin of the **International Seismological Centre**. ...

Incoming Plate Variations along the Northern Manila Trench: Implications for Seafloor Morphology and Seismicity C Chen, S Wu, J Qian, C Zhao... - ... *Dynamics: From Mantle ...*, 2015 - books.google.com ... Sea region. The resolution at the upper slope is lower due to the lack of data. The seismicity data shown in Figure 4.4 a is extracted from the **International Seismological Centre** (ISC) catalogue (<http://www.isc.ac.uk/iscbulletin> ...

Revisiting Earth's radial seismic structure using a Bayesian neural network approach RWL de Wit - 2015 - *dspace.library.uu.nl* ... hand panel). ak135 (Kennett et al., 1995) were constructed to explain the extensive catalogue of travel times documented by the **ISC**. More recently, Cammarano et al. (2005) combined ...

15 Ground Deformation at Piton de la Fournaise, of GNSS Monitoring T Staudacher, A Peltier - ... of the Southwest Indian Ocean: Piton de ..., 2015 - books.google.com ... 15.6) shortened faster and faster reaching up to 13.5 cm at 20: 48: 30. Between 20: 48: 30 and 20: 49: 00, the baseline increased suddenly by 22 cm, simultaneously with a 4.8 Ms seismic event (at 20: 48: 48.40, **International Seismological Centre**, On-line Bulletin, <http://www.> ...

High-quality lowest-frequency normal mode strain observations at the Black Forest Observatory (SW-Germany) and comparison with horizontal broad-band ... W Zürn, AMG Ferreira... - *Geophysical ...*, 2015 - *gji.oxfordjournals.org* ... Lisbon, Portugal;

4 **International Seismological Centre**, Pipers Lane, Thatcham, Berkshire, United Kingdom; 5 Institut de Physique du Globe de Strasbourg, CNRS/University of Strasbourg, UMR 7516, Strasbourg, France; 6 Institut ...

Regional level forecasting of seismic energy release B Kavitha, STG Raghukanth - *Acta Geodaetica et Geophysica*, 2015 – Springer ... of period. In the year 2013, the **International Seismological Centre** (<http://www.isc.ac.uk/>) has released the ISC–GEM Global Instrumental Reference Earthquake Catalogue spanning from 1900 to 2009. This catalogue ...

Modeling the Crust and Upper Mantle in Northern Beata Ridge (CARIBE NORTE Project) D Núñez, D Córdoba, MO Cotilla, A Pazos - *Pure and Applied Geophysics*, 2015 – Springer ... Only few shallow earthquakes have been recently located in the northern part of this structure (see **INTERNATIONAL SEISMOLOGICAL CENTRE**, ON-LINE BULLETIN 2001), but in the past there have been some large earthquakes, such as the one that took place in 1673 with a ...

Mantle plume–subduction zone interactions over the past 60Ma M Fletcher, DA Wyman - *Lithos*, 2015 – Elsevier ... Zhao (2007) utilized a P-wave model developed from a grid parameterization approach that was applied to a large dataset of **International Seismological Centre** (ISC) travel times to determine a whole mantle P-wave model, but it was noted that conclusive evidence for the ...

P and S wave tomography and anisotropy in Northwest Pacific and East Asia: Constraints on stagnant slab and intraplate volcanism W Wei, D Zhao, J Xu, F Wei... - *Journal of Geophysical ...*, 2015 - Wiley Online Library ... Liu et al., 2013]. 2 Data and Method. 2.1 Data. In this study, we used two sets of P and S wave arrival time data, including the reprocessed **International Seismological Centre** (ISC) data set by Engdahl et al. [1998] and ...

Moment tensor solutions for the Iberian-Maghreb region during the IberArray deployment (2009–2013) R Martín, D Stich, J Morales, F Mancilla - *Tectonophysics*, 2015 – Elsevier ... Maghreb region, covering the Iberian Peninsula, NW-Africa, and nearby offshore regions (modified from Mancilla and Díaz, 2015a); b) map with the seismicity (magnitude > 3) in the Iberia-Maghreb region from ISC on-line bulletin (**International Seismological Centre**, www.isc.ac ...

Structural geology of active tectonic areas and volcanic regions A Tibaldi, F Pasquarà - 2015 - books.google.com ... oceanic ridges. 3 Page 19. Figure 1.1. Distribution of earthquakes in the years 1975–1994. Only earthquakes with magnitude (M) ≥ 4 and depth ≤ 100 km are represented (from **International Seismological Centre**).

Mid–mantle anisotropy in subduction zones and deep water transport A Nowacki, J Kendall, J Wookey... - *Geochemistry, ...*, 2015 - Wiley Online Library... Locations are taken from the **ISC** where locations exist, and otherwise the National Earthquake Information Center (NEIC) of the US Geological Survey (USGS) ...

Statistical tests on clustered global earthquake synthetic data sets EG Daub, DT Trugman... - *Journal of Geophysical ...*, 2015 - Wiley Online Library ... method [Aki, 1965]. However, an analysis of the more recent **International Seismological Centre** Global Earthquake Model catalog [Storchak et al., 2013] shows that for events in that catalog since 1917, $b \approx 1$ [Michael, 2014]. For the ...

Seismotectonics of Mindoro, Philippines PF Chen, EA Olavere, CW Wang, BC Bautista... - *Tectonophysics*, 2015 – Elsevier ... Central University, Jhongli, Taiwan; b Philippine

Institute of Volcanology and **Seismology**, Quezon City ... 1). The **seismically** active PMB and the aseismic PCB together constitute the ... Coupled with the transition, **EHB seismic** distributions exhibit a southeasterly trend of steepening ...

Automatic picking based on an AR-AIC-costfunction approach applied on tele-, regional-and induced **seismic** datasets K Olbert, T Meier, L Cristiano - EGU General Assembly ..., 2015 - adsabs.harvard.edu ... A quick picking procedure is an important tool to process large datasets in **seismology**. ... at seismological stations is essential not just for localization procedures but also for **seismic** body-wave ... PP- and S-phases event source times and locations are taken from the **EHB** catalogue ...

Seismic Hazard in Iran N Saloor, A Salaree - earth.northwestern.edu ... Topography data are from ETOPT2 (Amante and Eakins, 2009) and the seismicity data is from **EHB** (2008) for the period of 1900-2008. Page 5. ... Iranian Seismological Center (IRSC) has currently 124 **seismic** ... This has led many of other **seismically** important regions ...

Differences and similarities in the Cocos–North America and Cocos–Caribbean convergence, as revealed by **seismic** moment tensors M Guzmán-Speziale, FR Zúñiga - Journal of South American Earth ..., 2015 – Elsevier ... Both plate margins are **seismically** active (eg, Burbach et al., 1984, LeFevre and McNally, 1985, Singh ... We also use the combined **EHB-ISC** catalog to determine a new geometric model of ... We do so by obtaining 19 contiguous **seismic** cross-sections perpendicular to the trench. ...

Initial global **seismic** cross–correlation results: Implications for empirical signal detectors DA Dodge, WR Walter - Bulletin of the Seismological Society of ..., 2015 - bssaonline.org ... estimates used in this study can be obtained from the International **Seismic** Centre (ISC ... php), the **EHB** catalog (<ftp://ciei.colorado.edu/pub/user/engdahl/EHB>), and the ... waveform data were obtained through the Incorporated Research Institutes in **Seismology** ..

Seismic structure in southern Peru: evidence for a smooth contortion between flat and normal subduction of the Nazca Plate SL Dougherty, RW Clayton - Geophysical Journal International, 2015 - gji.oxfordjournals.org ... We find a mean location difference of 9.5 km, with 97 per cent of the ISC event locations within 25 km of their respective **EHB** epicentre (85 per cent ≤ 15 km apart). ... Grey dots are **seismic** stations (see Figs 1 and 2); other symbols as in Fig. ...

Origin and significance of deep earthquake clusters surrounding a pronounced **seismic** gap in northeast China W Gan, C Frohlich, Z Jin - Journal of Asian Earth Sciences, 2015 – Elsevier ... the hinge zone of the subducting slab and directly beneath the **seismic** gap; (2) Its ... catalogs, including the International Seismological Centre (ISC) bulletin and the **EHB** catalog (Engdahl ...

The Great 2006 and 2007 Kuril Earthquakes, Forearc Segmentation and **Seismic** Activity of the Central Kuril Islands Region BV Baranov, AI Ivashchenko, KA Dozorova - Pure and Applied ..., 2015 – Springer ... and 1971–1974, suggesting their relation, at least, to the great 1952 and 1963 **seismic** events. To examine the background seismicity, we choose the 30-year time period from 1977 to the occurrence of the great November 15, 2006 Kuril earthquake and use the **EHB** catalog for ... Seismic activity of the Central Kuril Islands region is investigated using the following earthquake catalogues (see references): New Catalog (through 1977); **ISC-GEM** (1913–2009); **EHB** (1960–2008), **ISC** (2009–2014); **ANSS** ComCat (1973–2014); and **CMT** (1976–2014), with ...

RV POSEIDON Fahrtbericht/Cruise Report POS430, POS440, POS460 & POS467-**Seismic** hazards to the southwest of Portugal; POS430-Le-Seyne-sur-Mer- ... I Grevenmeyer - 2015 - eprints.uni-kiel.de ... with large errors, indicate that most events occur in the mantle and hence favour a **seismically**-driven mantle ... Location map of the **seismic** network in the Horseshoe Abyssal Plain. Red dots are earthquakes reported in the **EHB** catalogue and yellow star marks the Mw=6.0 2007 ...

A review of **seismic** hazard assessment studies and hazard description in the building codes for Egypt R Sawires, JA Peláez, RE Fat-Helbary, HA Ibrahim - Acta Geodaetica et ... - Springer ... Badawy (2005) mentioned that, with the improvement of the ENSN, new **seismically** active zones have been discovered across and ... 1994), **EHB**, **ISC** (2011), **NEIC**, **CMT**, Abou Elenean (1997), **ENSN** (1998 – 2010) and Aswan bulletin. 24 shallow (area) **seismic** sources. ...

Regional **seismic** variations in the inner core under the North Pacific JCE Irving, A Deuss - Geophysical Journal International, 2015 - gji.oxfordjournals.org ... it has been discovered that the inner core contains two **seismically** distinct hemispheres ... core's hemispherical structure is enigmatic; most proposed mechanisms to explain the **seismic** observations fall ... Where possible, the **EHB** catalogue of earthquake hypocentres (Engdahl et al ...

Seismic hazard assessments at Islamic Cairo, Egypt AE Khalil, A Deif, HEA Hafeez - Journal of African Earth Sciences, 2015 – Elsevier ... In addition, the updated catalog of **EHB** (Engdahl et al., 1998) the International Seismological Center ... Their works were carried out to define the **seismically** active zones in and around the ... the valuable information it provides, especially in defining new areas of **seismic** activity that ...

Global scale observations of scattered energy near the inner-core boundary: **Seismic** constraints on the base of the outer-core JMC Adam, B Romanowicz - Physics of the Earth and Planetary Interiors, 2015 – Elsevier ... Scattering in **seismic** wave codas is usually very complex and expected to be due to short wavelength structure (Vidale and Earle, 2000). ... Event parameters are from the relocated **EHB** catalog (Engdahl et al., 1998 and Bondár and

Storchak, 2011), or from the ISC bulletin ... Table 2. Parameters (date, coordinates and magnitude) from the **ISC-GEM** catalog (2012) of the earthquakes used for the PWS and beamforming analysis.

Seismic hazard assessment of Kashmir and Kangra valley region, Western Himalaya, India B Mukhopadhyay, S Dasgupta - *Geomatics, Natural Hazards and ...*, 2015 - Taylor & Francis ... is characterized by active uplifted dome with flanks deformed by **seismically** active shear ... **Seismic hazard assessment of Kashmir and Kangra valley region, Western Himalaya, India.** ... The Centennial Catalogue and **EHB** event data [ER Engdahl ...

Rate of lateral magma transport in the Earth's crust beneath submarine volcanic arcs derived from earthquake swarm analysis A Spicak - 2015 AGU Fall Meeting, 2015 - agu.confex.com ... 5) in space and time in shallow earthquake swarms; (ii) rapid migration of **seismic** activity during ... zones of the swarms with distinct seamounts and submarine ridges (current **seismically** active intrusions ... as ISC and NEIC USGS, and the usefulness of the **EHB** relocation procedure ...

The Effects of Stagnant Slabs on the Topography of 410 km Discontinuity Beneath the Pamir-Hindu Kush Region SUI Yi, Z Yuan-Ze, W Xiao-Ran - *Chinese Journal of ...*, 2015 - Wiley Online Library ... seen in Fig.1 and the relative parameters are listed in Table 1. The **seismic** waveform data ... Japan (<http://www.hinet.bosai.go.jp>) and the Incorporated Research Institutions for **Seismology**, USA (IRIS ... in Table 1 were selected from the events before 2009 in the **EHB** database (<http://www.ehb.org> ...

Link between plate fabric, hydration and subduction zone seismicity in Alaska DJ Shillington, A B  cel, MR Nedimovi  , H Kuehn... - *Nature ...*, 2015 - nature.com ... All ALEUT **seismic** and bathymetric data are available through the Marine Geoscience Data System ... online for the AEIC (<http://www.aeic.alaska.edu>) and **EHB** (<http://www.ehb.org> ... the temporary local network are available from Incorporated Research Institutions for **Seismology** (<http://ds.ehb.org> ...

Presumption of large-scale heterogeneity at the top of the outer core basal layer A Souriau - *Earth and Planetary Science Letters*, 2015 - Elsevier ... Highlights. • The **seismic** phase PKPbc is used to find the structure at the base of the liquid core. • PKPbc residuals from the **EHB** file are binned in latitude, longitude, depth, azimuth. • A hemispherical heterogeneity in the liquid core is found at the top of the F-layer. • ...

Ambient noise surface wave tomography of the Makran subduction zone, south-east Iran: Implications for crustal and uppermost mantle structures M Abdetedal, ZH Shomali, MR Gheitanchi - *Earthquake Science*, 2015 - Springer ... Seismicity of each period map is plotted from **EHB** catalog (Engdahl et al. ... Network (<http://www.iris.edu/hq/programs/gsn>), the Virtual European Broadband **seismic** Network (VEBSN) and international Institute of Earthquake Engineering and **Seismology** (IIEES). ...

Probabilistic earthquake hazard analysis for Cairo, Egypt A Badawy, I Korrat, M El-Hadidy, H Gaber - *Journal of Seismology*, 2015 - Springer the purpose of characterizing the activity rates of the identified **seismic** sources, a ... NEIC); & The International Seismological Center (ISC) online bulletin; & **EHB** (Engdahl et ...

Pn anisotropic tomography under the entire Tianshan orogenic belt Z Zhou, J Lei - *Journal of Asian Earth Sciences*, 2015 - Elsevier ... The blue triangles denote the Chinese provincial **seismic** stations and **EHB** stations (Engdahl et al., 1998) that recorded events with white circles, whereas the green triangles and the yellow diamonds represent portable stations (www.iris.edu) that recorded the events with the ...

A summary of hazard datasets and guidelines supported by the Global Earthquake Model during the first implementation phase M Pagani, J Garcia, D Monelli... - *Annals of ...*, 2015 - annalsofgeophysics.eu and **EHB** [Engdahl and Villase  or 2002]. Pollitz et al. [2014] use the ISC-GEM catalogue to investigate global **seismic** quiescence periods in the framework of a study aimed at assessing the short- and long-term triggering of seismicity by the M 8.6 Indian Ocean ...

Geomorphological features of active tectonics and ongoing seismicity of northeastern Kumaun Himalaya, Uttarakhand, India V Pathak, CC Pant, GS Darmwal - *Journal of Earth System Science*, 2015 - Springer ... of the study area as recorded by the network along with **EHB** events, seismicity ... The Uttarakhand Himalaya is **seismically** very active and is drained by many perennial rivers ... So, detailed seismicity information would be very important in planning **seismic** risk mitigation measures ...

The flat to normal subduction transition study to obtain the Nazca plate morphology using high resolution seismicity data from the Nazca plate in Central Chile S Nacif, EG Triep, SL Spagnotto, E Aragon, R Furlani... - *Tectonophysics*, 2015 - Elsevier ... The subducted Nazca plate is **seismically** active from the trench to depths of ~ 150–200 km ... We selected the seismicity for the study region and surrounding areas from **EHB** Bulletin (<http://www.ehb.org> ... From North to South the Nazca plate becomes less **seismic** in accordance ...

Subduction tractions and vertical axis rotations in the Zagros-Makran transition zone, SE Iran: the 2013 May 11 Mw 6.1 Minab earthquake C Penney, A Copley, B Oveisi - *Geophysical Journal ...*, 2015 - gji.oxfordjournals.org... part of the accretionary wedge built above the subduction interface can be **seismically** active and ... 2012) catalogue and are located at **EHB** epicentres until 2009 and NEIC epicentres for ... orientation (strike, dip and rake), source-time function, centroid depth and **seismic** moment. ...

Field survey and modelling of the Caspian Sea tsunami of 1990 June 20 A Salaree, EA Okal - *Geophysical Journal International*, 2015 - gji.oxfordjournals.org ... 1999), **seismic** sources with the potential of generating tsunamis in the Caspian Sea include the ... Red circles are epicentres of earthquakes (1900–2014) from

the **EHB** catalogue ... clearly the largest event recorded in northern Iran during the era of instrumental **seismology** ...

The Varzaghan–Ahar, Iran, Earthquake Doublet (Mw 6.4, 6.2): implications for the geodynamics of northwest Iran [A Ghods, E Shabanian, E Bergman...](#) - *Geophysical ...*, 2015 - [gji.oxfordjournals.org...](#) Yellow circles are epicentres of earthquakes with magnitude larger than 4.5 from the ISC–**EHB** Bulletin (International ... The standard crustal model used in the broad-band **seismic** network run by International Institute of Earthquake Engineering and **Seismology** ([iiees.ac.ir](#)). ...

Incoming Plate Variations along the Northern Manila Trench: Implications for Seafloor Morphology and Seismicity [C Chen, S Wu, J Qian, C Zhao...](#) - ... *Dynamics: From Mantle ...*, 2015 - [books.google.com](#) ... location error of the ISC catalogue is slightly larger than the **EHB** catalogue [Engdahl et al ... the tectonic features beneath the accretionary prism are difficult to observe **seismically**, especially by ... In this paper, we related accretionary prism deformation and **seismic** activity

Seafloor seismicity, Antarctic ice-sounds, cetacean vocalizations and long-term ambient sound in the Indian Ocean basin [JY Royer, R Chateau, RP Dziak...](#) - *Geophysical Journal ...*, 2015 - [gji.oxfordjournals.org](#) ... Note that the **EHB** catalogue adopts the ISC's m b values, whereas the ISC, NEIC and ... Among unusual events, on 2007 April 5, our array detected **seismic** activity associated with the eruption and ... and over the Wharton Basin; all these areas are known to be **seismically** active...

Along-strike variations in crustal seismicity and modern lithospheric structure of the central Andean forearc [K Metcalf, P Kapp](#) - *Geological Society of America Memoirs*, 2015 - [memoirs.gsapubs.org](#) ... Hypocenters **EHB** Bulletin Global 697 1960–2007 Yes Yes Green ... the observed aseismicity in the Bolivian thrust belt is interpreted to indicate an interseismic cycle longer than the **seismic** record. ... 6C), the entire orogen is more **seismically** active than farther north and south. ...

Application of time-and magnitude-predictable model for long-term earthquake prediction in Iran [H Zafarani, SMM Ghafoori, MR Adlparvar, P Rajaeian...](#) - *Natural Hazards*, 2015 – Springer ... One of the most **seismically** active regions in the world is the Iranian ... are mainly geographical or imaginary boundaries which are neither tectonic nor **seismic** (Berberian 1979 ... Earthquake Information Center (NEIC), **International Seismological Center** (ISC) and **EHB** Bulletin, and ...

New evidences of rupture of crust and mantle in the subducted Nazca plate at intermediate-depth [SL Spagnotto, EG Triep, LB Giambiagi, SV Nacif...](#) - *Journal of South ...*, 2015 – Elsevier ... b) AB Cross-section: **EHB** catalog seismicity: black and White circles correspond to Nazca ... The subduction area is **seismically** and tectonically characterized by along-strike variations in ... values of isotropic and CLVD percentages suggest that during these **seismic** events ...

Relocalizing a historical earthquake using recent methods: The 10 November 1935 Earthquake near Montserrat, Lesser Antilles [P Niemz, D Amorèse](#) - *Journal of South American Earth Sciences*, 2015 – Elsevier ... for localization (>7). Events exceeding M4.6 were extracted from the **EHB** catalog (International ... This is a general problem of early **seismology** when stations were more unevenly distributed ... regions of the northern hemisphere already had a high density of **seismic** stations, mainly ...

Spatial distribution of the contemporary stress field in the Kurile Wadati-Benioff zone by inversion of earthquake focal mechanisms [CV Christova](#) - *Journal of Geodynamics*, 2015 – Elsevier ... spatial distribution of the overall seismicity along the arc (hypocenters from the **EHB** catalog Engdahl ... Deep-seated **seismic** gaps and clusters of earthquakes below them, as in the Kurile WBZ ... or remnants of paleo-plates buried in the upper mantle and **seismically** reactivated by ...

Receiver function images of the Hellenic subduction zone and comparison to microseismicity [F Sodoudi, A Brüstle, T Meier, R Kind...](#) - *Solid Earth*, 2015 - [search.proquest.com](#) ... We combine our results with hypocentre locations of the **EHB**-ISC catalogue (Engdahl et al., 1998 ... about 20 and 40 km depth of the plate interface is currently **seismically** active in ... the seismogenic zone in the southeastern Aegean may indicate either a low **seism**

An Earthquake Classification Scheme Adapted for Japan Determined by the Goodness of Fit for Ground–Motion Prediction Equations [JX Zhao, S Zhou, P Gao, T Long, Y Zhang...](#) - *Bulletin of the ...*, 2015 - [bssaonline.org](#) ... For example, the ISC–**EHB** catalog was considered to be more accurate than those from the other organizations (Zhao, Zhang, et al ... earthquakes using regional network arrival times recorded at onland stations, because of the inadequate distribution of **seismic** stations (Gamage ...

Spatio-temporal evolution of intraplate strike-slip faulting: The Neogene–Quaternary Kuh-e-Faghan Fault, central Iran [G Calzolari, F Rossetti, M Della Seta...](#) - ... *Society of America ...*, 2015 - [gsabulletin.gsapubs.org](#) ... Epicenters are from the International **Seismic** Centre **EHB** Bulletin (International **Seismic** Centre, Thatcham, UK, 2009, ([http://www.isc.ac.uk](#)) and earthquake catalogue at Iranian Institute of Earthquake Engineering and **Seismology**

Gravity anomalies, crustal structure, and seismicity at subduction zones: 2. Interrelationships between fore–arc structure and seismogenic behavior [D Bassett, AB Watts](#) - *Geochemistry, Geophysics, Geosystems*, 2015 - Wiley Online Library... [2012]. Earthquakes from the GCMT catalog (all event classes) are projected from **EHB** hypocenters along strike with the maximum projection ... This geometry is consistent with **seismic** velocity constraints on the location of the Tonga Ridge, which is **seismically** defined by ...

Palaeotsunamis and tsunami hazards in the Eastern Mediterranean [P England, A Howell, J Jackson...](#) - *Phil. Trans. R. ...*, 2015 - [rsta.royalsocietypublishing.org](#) ... of shallow (depth < 30 km) earthquakes for 1960–2010 from

the EHB catalogue [26 ... Studies of the release of seismic moment in the region over the instrumental ...

Focal depths and mechanisms of shallow earthquakes in the Himalayan–Tibetan region L Bai, G Li, NG Khan, J Zhao, L Ding - *Gondwana Research*, 2015 - Elsevier... China Earthquake Network Center (CENC) relies on arrival times of regional **seismic** network which ... this study and those listed in CENC, USGS PDE, gCMT, and **EHB** catalogs. ... region with waveforms available at the Incorporated Research Institutions for Seismology (IRIS) Data ...

Waveform inversion and focal mechanisms of two weak earthquakes in Cordillera Principal (Argentina) between 35° and 35.5° S R Villegas, J Zahradnik, S Nacif, S Spagnotto... - *Journal of South ...*, 2015 – Elsevier ... Principal takes an important role, focusing the major **seismic** activity in the upper plate. Also, the higher percentage of crustal seismicity is located on the western flank of the Andean mountain chain as documented by the international catalog (NEIC-USGS or **EHB**-ISS), regional ...

Lithospheric mantle heterogeneities beneath the Zagros Mountains and the Iranian Plateau: a petrological-geophysical study L Tunini, I Jiménez-Munt, M Fernandez... - *Geophysical ...*, 2015 - gji.oxfordjournals.org ... 4.4 Mantle **seismic** velocities. Fig. ... (1998), incorporating additional earthquakes from 1995 to 2002 and arrival times (Villaseñor et al. 2003). In total, more than 14 million arrival times from 300 000 earthquakes were reprocessed using the **EHB** methodology (Engdahl et al. 1998). ...

Mixtures of ground-motion prediction equations as backbone models for a logic tree: an application to the subduction zone in Northern Chile A Haendel, S Specht, NM Kuehn... - *Bulletin of Earthquake ...*, 2015 – Springer ... In fact, on the 1st of April, during the review process of this manuscript, this **seismic** gap was partially ruptured by an Mw ... We plotted vertical cross sections perpendicular to the trench using reported **EHB** events (Centennial Earthquake Catalog, see Online Resource 1) between ...

Source of the 6 February 2013 M_w = 8.0 Santa Cruz Islands Tsunami F Romano, I Molinari, S Lorito... - ... *Hazards and Earth ...*, 2015 - nat-hazards-earth-syst-sci.net ... shock. Orange beach balls indicate the regional historical **seismic**-ity (from 1976 to present; GCMT catalogue, <http://www.globalcmt.org> ... 2003). In particular, we selected from the **EHB** global relocation earthquake cat

Propagation of back-arc extension into the arc lithosphere in the southern New Hebrides volcanic arc M Patriat, J Collot, L Danyushevsky... - *Geochemistry, ...*, 2015 - Wiley Online Library ... Hebrides subduction southern termination is not characterized by such a subduction-to-transform transition (Figure 2). Unlike the **seismic** events distribution ... Intermediate hypocenters (50 km < z < 150 km) from the ISC **EHB** bulletin [Engdahl et al., 1998] are reported as color ...

Effects of errors and biases on the scaling of earthquake spatial pattern: application to the 2004 Sumatra–Andaman

sequence S Padhy, OP Mishra, N Subhadra, VP Dimri, OP Singh... - *Natural Hazards*, 2015 – Springer ... (2010) studied the relocated **EHB** events (Engdahl et al. ... in five blocks of the 2004 Sumatra earthquake source region and their relations with clustering or diffuse **seismic** activity is ... The Andaman–Sumatra region is one of the **seismically** most active subduction zones in the world

Gravity anomalies, crustal structure, and seismicity at subduction zones: 1. Seafloor roughness and subducting relief D Bassett, AB Watts - *Geochemistry, Geophysics, Geosystems*, 2015 - Wiley Online Library ... Centroid Moment Tensor (GCMT) [Dziewonski et al., 1981; Ekström et al., 2012], Engdahl, van der Hilst, and Buland (**EHB**) [Engdahl et al. ... A large magnitude earthquake catalog compiled for this study containing the epicenters, **seismic** asperities, and slip distributions ...

Rheology of the lithosphere beneath the central and western Tien Shan P England, P Molnar - *Journal of Geophysical Research: Solid ...*, 2015 - Wiley Online Library... **Seismic** tomography shows variations in P and S wave speeds that imply large lateral temperature variations in crust and upper mantle of the ... show epicenters of earthquakes in the interval 1960 to 2010 with hypocenters shallower than 50 km from the **EHB** Bulletin [International ...

Differential contraction of subducted lithosphere layers generates deep earthquakes L Liu, JS Zhang - *Earth and Planetary Science Letters*, 2015 - Elsevier... Earthquakes with magnitudes greater than 5 in the **EHB** catalog (Engdahl et al., 1998) for the period from 1964 to 2004 are ... Deep earthquakes usually have lower **seismic** radiation efficiencies (as small as <0.1) compared to shallower events (Houston, 2007) ...

Evolution and dynamics of a fold-thrust belt: the Sulaiman Range of Pakistan K Reynolds, A Copley... - *Geophysical Journal ...*, 2015 - gji.oxfordjournals.org ... Instrumental and historical evidence shows that the Sulaiman Range and surrounding area exhibits a high level of **seismic** activity, though events with a magnitude ≥M_w 6 ... Events from the Global CMT catalogue occurring prior to 2010 are shown at the relocated **EHB** epicentres ...

New insights into the Andean crustal structure between 32 and 34 S from GOCE satellite gravity data and EGM2008 model O Alvarez, ME Gimenez, MP Martinez... - *Geological Society, ...*, 2015 - sp.lyellcollection.org ... The Bouguer anomaly field used for the gravity inverse calculations was obtained from the Calculation Service of the **International Centre** for Global ... On-shore basins were modelled using depths to top basement from gravimetric studies and the **seismic** lines of Yacimientos ...

Along-strike variations in crustal seismicity and modern lithospheric structure of the central Andean forearc K Metcalf, P Kapp - *Geological Society of America Memoirs*, 2015 - memoirs.gsapubs.org ... of cross sections B–E. CMT—Centroid-Moment-Tensor; ISC—

International Seismological Center; SA—Salar ... best constrained in our study area where the density of

published **seismology** studies is ... belt is interpreted to indicate an interseismic cycle longer than the **seismic** record ...

Seismic monitoring in the oceans by autonomous floats A Sukhovich, S Bonniex, Y Hello, JO Irissou... - *Nature* ..., 2015 - *nature.com* ... Using only delay times reported by the **International Seismological Center** (ISC) from existing **seismic** networks, the ... This allowed us to improve the detection of **seismic** signals in the Indian ...

Testing the Basic Assumption for Probabilistic Seismic-Hazard Assessment: 11 Failures M

Wyss **Seismological Research Letters**, 2015 ... This example is exceptional in which the earthquake catalogs available (**International Seismological Center** [ISC] and ... Shake-up time for Japanese **seismology**, *Nature* 472, 407–409, doi: 10.1038 ... The Global **Seismic Hazard Assessment Program** (GSHAP)—1992/1999, *Ann.* ...

Probabilistic Seismic Hazard Assessment of the Chiapas State (SE Mexico) AG Rodríguez-Lomeli... - *EGU General Assembly* ..., 2015 - *adsabs.harvard.edu* ... The PSHA was based on a composited **seismic** catalogue homogenized to Mw and was used a logic tree procedure for the ... The earthquake catalogue was compiled from the **International Seismological Center** and the Servicio Sismológico Nacional de México sources. ...

A unified M w-based earthquake catalogue and seismic source zones for the Red Sea region N Babiker, AHG Mula - *Journal of African Earth Sciences*, 2015 – Elsevier .. (1994) and Ambraseys (2001), **International Seismological Center** (ISC), National Earthquake Information Center (NEIC) and ... The **seismic** activity is high within this zone due to the extensional tectonics related to the Red Sea rifting and tectonic activity associated with ...

Seismic Tomography Imaging beneath the Arabian Peninsula and Red Sea S El Khrepy, I Koulakov, E Burov... - *EGU General* ..., 2015 - *adsabs.harvard.edu* ... **Seismic** tomography model of the body waves velocity in the upper mantle beneath the Arabian Peninsula, Red Sea and surrounding ... is computed using the P-and S-waves travel times provided by the earthquake catalogue of the **International Seismological Center** (ISC) 1980 ...

RETREAT seismic data analysis: from records to 3D velocity model RB Raykova - *researchgate.net* ... IRIS, 2010, Incorporated Research Institutions for **Seismology**, *www.iris.edu*. ISC, 2010,

International seismological center, *www.isc.ac.uk*. Kennett, BLN, Engdahl, ER, Buland, R., 1995, Constraints on **seismic** velocities in the Earth from traveltimes. ...

Investigating the Effect of Spatial Distribution of Seismicity on Probabilistic Seismic Hazard Results LR Pattanur, ID Gupta - *researchgate.net*... Possible **seismic** sources in and around CITZ are identified by analyzing the correlation of ... other important **international** sources like **International Seismological Summary**(ISS), **Internatio**

nal Seismological Center (ISC), National Earthquake Information Center (NEIC) of ...

Assessment of the efficiency of seismicological equipment in extreme weather conditions in Bulgaria-first stage of Livingston Island seismicity study L Dimitrova, G Georgieva, R Raykova, V Gurev... - *bggs.eu* ... *Compt. Ren. de l'Acad. Bul. des Sc.*, 66, 5, 725-732. ISC, 2015, **International Seismological Center**, *www.isc.ac.uk*. Peterson, J., 1993. Observation and modeling of **seismic** background noise, USGS Tech. Rept., 93-322, 1-95. Rangelov, 2002. ...

Structure of the Yanbu suture zone in Northwest Saudi Arabia inferred from aeromagnetic and seismicological data M Al-Harbi, E Ibrahim, A Al-Amri... - *Arabian Journal of* ..., 2015 – Springer ... K.

Abdelrahman **Seismology** Department, National Research Institute of Astronomy & Geophysics, Helwan, Cairo ... 1994), (2) the **Seismic Studies Center** (SSC) of King Saud University, (3) the Saudi ... as fol- lows: (1) on-line bulletin of the ISC ...

Complex faulting in the Quetta Syntax: fault source modeling of the October 28, 2008 earthquake sequence in Baluchistan, Pakistan, based on ALOS/PALSAR ... M Usman, M Furuya - *Earth, Planets and Space*, 2015 – Springer ... *Geology* 25:23–26

CrossRef. **International Seismological Centre** (2012) On-line Bulletin, *http://www.isc* ... Guevara E (2008) Hole-filled seamless SRTM data V4, **International Centre** for Tropical ... InSAR data inversion for the 2008 Baluchistan (Western Pakistan) **seismic** sequence ...

Seismic hazard assessments at Islamic Cairo, Egypt AE Khalil, A Deif, HEA Hafez - *Journal of African Earth Sciences*, 2015 – Elsevier ... the updated catalog of EHB (Engdahl et al., 1998) the **International Seismological Center** (ISC) online

Subduction or delamination beneath the Apennines? Evidence from regional tomography I Koulakov, A Jakovlev, I Zabelina, F Roure... - *Solid* ..., 2015 - *search.proquest.com* ... we use P and S travel times from the **International Seismological Centre** (ISC) catalogue ... study is based on freely available data catalogue provided by the ISC. ... and remnant subducted slabs beneath Italy: evidence from **seismic** tomography, *Ann.* ...

Services for cloud computing and seismic data processing for geomechanically and geodynamically active coal mining areas in Kuzbass VP Potapov, VN Oparin, OL Giniyatullina... - *Journal of Mining* ..., 2015 – Springer ... in particular [1–5]. In general, to solve this problem the **seismologists** register and ... The new-developed service was used to analyze a system of **seismic** events in ... Man-Made Situations (Kemerovo, *www.spasko.ru*) and web-site of **International Seismological Center** (ISC, *www.isc* ...

Deterministic seismic hazard assessment close to a gas field in northern Oman I El-Hussain, A Deif, AME Mohamed, K Al-Jabri... - *Arabian Journal of* ..., 2015 –

Springer ... On March 3, 1971, the **International Seismological Center** catalogues published an earthquake of magnitude 5.2 at the most east part of ... Induced seismicity by gas exploitation is mostly observed at the **center** of the field ...

Relocalizing a historical earthquake using recent methods: The 10 November 1935 Earthquake near Montserrat, Lesser Antilles P Niemz, D Amorèse - *Journal of South American Earth Sciences*, 2015 – Elsevier ... the common horizontal error for teleseismic locations provided by the **International Seismological Center** (ISC) and ... This is a general problem of early **seismology** when stations were more unevenly ...

On the possibility of imminent regional **seismic** activity forecasting using geomagnetic monitoring and Sun-Moon tide code data SC Mavrodiev, L Pekevski, G Kikuashvili, E Botev... - *theo.inrne.bas.bg* ... TideDay is the diurnal mean value in time calculated in analogy of mass **center** formulae 360 ... Contadakis, M., Biagi, P., and Zschau, J.: **Seismic** hazard evaluation, precursory phenomena and reliability of prediction, **International Seismological Center**

Nepal earthquake 2015: Its aftermath S Sud, M Thapa, A Sachdev - *Journal of Research: THE BEDE* ..., 2015 - indianjournals.com ... ISBN 978-0-313-08747-9. "In India, J&K, HP, Uttarakhand fall under most active **seismic** zone". ISC (19 January 2015), ISC-GEM Global Instrumental Earthquake Catalogue (1900-2009), Version2.0, **International Seismological Center**.

Seismicity and Seismotectonics of Jeddah-Makkah Region, West-Central Saudi Arabia M Fnais, A Al-Amri, K Abdelrahman... - *Journal of Earth* ..., 2015 - Springer... different sources as follows; Saudi Geological Survey (SGS); **Seismic Studies Center** ... global sources of earthquake data like the **International Seismological Center** (ISC);

Investigating the Effect of Probabilistic Se LR Pattanur, ID Gupta - *Journal of Earthquake Science and Engineering - joes.org.in* ... Possible **seismic** sources in and around CITZ are identified by analyzing the correlation of ... other important **international** sources like **International Seismological Summary** (ISS), **International Seismological Center** (ISC), National Earthquake Information **Center** (NEIC) of ...

Seismic Hazard Analysis for the Albertine Region, Uganda– A Probabilistic Approach B Bwambale, U Bagampadde, A Gidudu... - *South African Journal of* ..., 2015 - GSSA... results from Eastern and Southern Africa Regional **Seismology** workshop – January ... by the National Earthquake Information **Center** (NEIC), **International Seismological Center** (ISC), and ... The traditional probabilistic **seismic** hazard assessment (Cornell, 1968)...

Multi-seismotectonic models, present-day seismicity and **seismic** hazard assessment for Suez Canal and its surrounding area, Egypt MA El-Eraki, SI Mostafa - *Bulletin of Engineering Geology and the Environment – Springer* ... The **seismic** data used in this study includes updated

earthquake catalogues. ... The instrumental earthquake data were gathered from the **International Seismological Center** Bulletin ...

Insights into the Aftershocks and Inter-Seismicity for Some Large Persian Earthquakes M Nemati - *Journal of Sciences, Islamic Republic of Iran*, 2015 - journals.ut.ac.ir ... of Geophysics the University of Tehran (IGUT) and **International Seismological Center** (ISC) catalogs. ... Aftershocks spatial distribution demonstrated that the causative co-**seismic** fault have had ... Following a precisely aftershock surveying with a dense **seismological** network (IIIES ...

Evidence for anomalous mantle upwelling beneath the Arabian Platform from travel time tomography inversion I Koulakov, E Burov, S Cloetingh, S El Khrepy, N Al-Arifi... - *Tectonophysics*, 2015 – Elsevier ... considerably different from the tholeiitic basalts observed in the Red Sea spreading **center**. ... The distribution of **seismic** attenuation based on the analysis of waveform data recorded by ... the entire African realm based on the data of the **International Seismological Center** (ISC) ...

Intermediate-term variations in 200 years seismicity of south of Iran M Nemati - *Geomatics, Natural Hazards and Risk*, 2015 - Taylor & Francis ... The available **seismic** database of the IIIES is much more complete than other databases in Iran like of the Institute of Geophysics, the ... 2012. Geomorphology and **seismology** of Mw 5.8 Koodian earthquake, Southeast Zagros [in Persian]. ... ISC

Seismic Hazard Analysis and Obtaining Uniform Hazard Spectra for Esfahan Region, Iran SAR Amrei, GG Amiri, E Khodadadi - *civiljournal.semnan.ac.ir* ... moreover, there are other catalogues for the studied region such as "The National Earthquake Information **Center** (NEIC)" and "**International Seismological Center** (ISC ... Generally, when calculating **seismic** hazard analysis, Ms or mb is used as a magnitude scale, but because of ...

P Wave Tomography of the Western Mediterranean Region and the Gulf of Cadiz. Constraints on Regional Geodynamic Models MN Beghoul - 8th Congress of the Balkan Geophysical Society, 2015 - earthdoc.org ... P arrival times of the ISC from 1964 to present at distances less than 19° and located in the Mediterranean Basin; are used. Very strict criteria are applied to the data, and only earthquakes located by at least hundred **seismic** stations...

Between–Event Variance for Large Repeating Earthquakes G Yagoda–Biran, JG Anderson, H Miyake... of the **Seismological** ..., 2015 - bssaonline.org ... Hypocentral depth for this earthquake as determined by the **International Seismological Center** was 35 km ... the 2005 event was about 3–4.5 times smaller in **seismic** moment than ...

Probabilistic earthquake hazard analysis for Cairo, Egypt A Badawy, I Korrat, M El-Hadidy, H Gaber - *Journal of Seismology*, 2015 – Springer ... A. Badawy (*) .M. El-Hadidy .H. Gaber **Seismology** Department, National Research Institute ...purpose of characterizing the activity

rates of the identified **seismic** sources, a ... the National Earthquake Information **Center** (NEIC); & The **International Seismological Center** (ISC) online ...

The M w 7.9 2014 intraplate intermediate-depth Rat Islands earthquake and its relation to regional tectonics [C Twardzik, C Ji - Earth and Planetary Science Letters, 2015 – Elsevier](#) ... the aftershocks from Preliminary Determination of Earthquake National Earthquake Information **Center** reported by the ISC;

Seismicity and seismotectonics of the Red Sea Region [ZH El-Isa - Arabian Journal of Geosciences, 2015 – Springer](#) ... The catalogues of the ISC, the National Earthquake Information **Center** ... a shows magnitude versus time, while b shows the **seismic** moment variation ...

Extensional Seismotectonic Motion and its Dynamics in the Eastern Margin of the Tibetan Plateau and its Surroundings [J Xu, Z Zhao - J Geol Geophys, 2015 - omicsgroup.org](#) ... data from the Chinese **Seismic** Net and the Bulletin of the **International Seismological Center** (ISC) using P ... Tibetan plateau: recent normal faulting measured by InSAR and body wave **seismology**. ...

Relations between source parameters for large Persian earthquakes [M Nemati, M Tatar - Annals of Geophysics, 2015 - annalsofgeophysics.eu](#) ... 2. Data and error analysis The database used in this study was gathered from various **seismic** catalogues. We used catalogues of the **International Seismological Center** (ISC as a main structure), the **International** Institute of Earthquake Engineering and **Seismology** of Iran (IIEES ...

Precursory seismicity changes prior to major earthquakes along the Sumatra-Andaman subduction zone: a region-time-length algorithm approach [S Sukrungsri, S Pailoplee - Earth, Planets and Space, 2015 – Springer](#) ... Using statistical **seismology**, the possibility of applying the frequency-magnitude distribution ... However, up to 2014, all the **seismic** risk areas mentioned above are still ... The seismicity data compiled by the (i) **International Seismological Center**, (ii) US NEIC

Seismicity characterization around the Farnsworth field site for combined large-scale CO 2 storage and EOR [T Chen, L Huang - International Journal of Greenhouse Gas Control, 2015 – Elsevier](#) ... ANSS (Advanced National **Seismic** System). 2. OKGS (Oklahoma Geological Survey). 3. IRIS (Incorporated Research Institutions for **Seismology**). 4. ISC (**International Seismological Center**). 5. NCEER (National **Center** for Earthquake Engineering Research).

Tomographic imaging of the Cascadia subduction zone: Constraints on the Juan de Fuca slab [C Chen, D Zhao, S Wu - Tectonophysics, 2015 - Elsevier](#)... Catalog and phase data compiled by the Northern California Earthquake Data **Center** from January 2010 to May 2013; and (3) the **International Seismological Center** (ISC) bulletins from June 2001 to February 2011, which include data contributed by several **seismic** networks in ...

Receiver function analysis-**Seismic** imaging of the crust beneath TROLL **seismic** station in Queen Maud Land, Antarctica [A Torsvik - 2015 - duo.uio.no](#) ... (Moho), named after the Croatian **seismologist** who discovered it (Mohorovičić, 1909). The ... distances between 30° and 95° from a **seismic** station, were considered suitable events. The **International Seismological Center** (ISC) provides the public with full access to data within ...

Source mechanism of the 1998 M w 7.4 intraplate strike-slip earthquake in the West Philippine Basin revealed by Coulomb stress changes [YC Lin, JY Lin - Tectonophysics, 2015 – Elsevier](#) ... Hypocenters and magnitudes extracted from the **International Seismological Center** (ISC) catalog (<http://www.isc.ac.uk/iscbulletin/search/catalogue/>), which contains ... At the end of January 1999, two **seismic** stations, IRIOM2 and HATERU, were added around Ishigaki Island by ...

Extraction of weak PcP phases using the slant-stacklet transform-II: constraints on lateral variations of structure near the core-mantle boundary [S Ventosa, B Romanowicz - Geophysical Journal International, 2015 - gji.oxfordjournals.org](#) ... In **seismology**, these methods are regularly used to obtain slowness slant stacks (also vespagrams) that ... due to (1) the wide dynamic range of energy of **seismic** signals, hindering the ... The **International Seismological Center** (ISC) Bulletin provides high-quality hypocentre reports. ...

Seismotectonics of the eastern Himalayan and indo-burman plate boundary systems [A Kumar, S Mitra, G Suresh - Tectonics, 2015 - Wiley Online Library](#) ... (a) Plot of earthquake epicenters (circles) taken from the **International Seismological Center** (ISC) reviewed ... we use broadband teleseismic data from Global Digital **Seismic** Network (GDSN) ... stations, obtained from the Incorporated Research Institutions in **Seismology** (IRIS) Data ...

Intrinsic versus extrinsic **seismic** anisotropy: Surface wave phase velocity inversion [N Wang, JP Montagner, G Burgos, Y Capdeville... - Comptes Rendus ..., 2015 – Elsevier](#) ... 3, France; d First Crust Monitoring and Application **Center**, China Earthquake ... model (PREM; Dziewonski and Anderson, 1981) with several **seismic** discontinuities, we ... in California, USA (latitude, 32.889°; longitude, -117.105°; from the **International Seismological Center** website ...

Active transverse faulting within underthrust Indian crust beneath the Sikkim Himalaya [H Paul, S Mitra, SN Bhattacharya... - Journal International, 2015 - gji.oxfordjournals.org](#) ... GDSN) stations, obtained from the Incorporated Research Institutions in **Seismology** (IRIS) Data ... Using the **seismic** scalar moment (M 0) obtained from waveform inversion and ... by our local network of broadband stations, and using **ISC** phase data ...

Historical seismicity of the Jordan Dead Sea Transform region and seismotectonic implications [H Zuhair, S McKnight, D Eaton - Arabian Journal of Geosciences, 2015 – Springer](#) ... including the USGS (NEIC), the **International**

Seismological Center (ISC), and the National Geophysical Data **Center**/World Data ... felt earthquake in some of the above mentioned cities is associated with **seismic** activity along ...

Teleseismic shear wave tomography of the Japan subduction zone K Asamori, D Zhao - *Geophysical Journal International*, 2015 - gji.oxfordjournals.org ... 2004) and the database of Research **Center** for Prediction of Earthquakes and Volcanic Eruptions, Tohoku ... Kennett & Engdahl 1991) and the hypocentral parameters released in the Bulletin of the **International Seismological Center**. ... 2009) beneath the Hi-net **seismic** stations. ...

Isolated cases of remote dynamic triggering in Canada detected using cataloged earthquakes combined with a matched-filter approach B Wang, RM Harrington, Y Liu, H Yu... - *Geophysical ...*, 2015 - Wiley Online Library ... earthquake catalog data, followed by a more detailed search in Alberta, where denser **seismic** station coverage monitors **seismic** activity associated ... 2004 and 2014 with depths < 100 km and surface wave magnitude $M_S > 6$ in the **International Seismological Center** catalog (ISC ...

Crustal and uppermost mantle structure beneath the continental rifting area of the Gulf of Suez from earthquake tomography S El Khrepy, I Koulakov, N Al-Arifi - *Tectonophysics*, 2015 - Elsevier ... that was formed through extension associated with a dispersed system of spreading **centers**. ... from local and regional seismicity recorded by permanent and temporary **seismic** stations in ... the ENSN and regional station data provided by the **International Seismological Center** (ISC ...

A seismotectonic study of the 21 May 2014 Bay of Bengal intraplate earthquake: evidence of onshore-offshore tectonic linkage and fracture zone reactivation in the ... GS Rao, M Radhakrishna, KSR Murthy - *Natural Hazards*, 2015 - Springer ... (2) Regional **Centre**, CSIR-National ... Furthermore, the close proximity of the Burmese arc has implications for the **seismic** hazard of the Bengal basin ... For the 1963–2011 period, the events >Mb 4.0 are considered from the ISC) bulletin; events ...

Seismic hazard assessment for Yanbu metropolitan area, western Saudi Arabia S Almadani, A Al-Amri, M Fnais, K Abdelrahman... - *Arabian Journal of ...*, 2015 - Springer ... Geophysics Department, College of Science, King Saud University, Riyadh, Saudi Arabia **Seismology** ... offshore continuation of such faults is confirmed from the magnetic and **seismic** data (Coleman ... (1994), **ISC** ...

Thickness of the lithosphere beneath Turkey and surroundings from S-receiver functions R Kind, T Eken, F Tilmann, F Sodoudi, T Taymaz... - *Solid ...*, 2015 - search.proquest.com ... of earthquakes between 1998 and 2014 (catalogue of **ISC**). ... eldin the deforming Aegean region determined from **seismic** moment tensors ... northern European lithosphereasthenosphere boundary from comparing **seismological** and electromagnetic ...

P wave tomography and anisotropy beneath Southeast Asia: Insight into mantle dynamics Z Huang, D Zhao, L Wang - *Journal of Geophysical Research: ...*, 2015 - Wiley Online Library ... **Seismic** anisotropy, which describes directional dependence of the speed of **seismic** waves, provides important ... SE Asia using P wave arrival-time data compiled by the ISC and the data **center** of the Chinese **Seismological** Network (CSN ...

Developments in Ground Motion Predictive Models and Accelerometric Data Archiving in the Broader European Region S Akkar, Ö Kale - ... on *European Earthquake Engineering and Seismology*, 2015 - Springer ... Ansal (ed.), *Perspectives on European Earthquake Engineering and Seismology*, Geotechnical, Geological ... published in peer-reviewed journals) or ISC bulletin ... information was taken from local or national **seismic** networks whenever ...

A probabilistic approach toward earthquake hazard assessment using two first-order Markov models in Northeastern India WK Mohanty, AK Mohapatra, AK Verma - *Natural Hazards*, 2015 - Springer ... 1996), where cutoff magnitude is estimated at 4. The sources for earthquake catalog include United States Geological Survey (USGS), **International Seismological Center** (ISC)....

P-wave tomography and anisotropy beneath Southeast Asia: Insight Z Huang, D Zhao, L Wang - 2015 - researchgate.net ... using P-wave arrival-time data compiled by the ISC and ... Although **seismic** stations are located sparsely on the islands surrounding SE Asia, the ... above the slab, which is a common **seismological** feature revealed in most subduction zones all .

The Effects of Stagnant Slabs on the Topography of 410 km Discontinuity Beneath the Pamir–Hindu Kush Region SUI Yi, Z Yuan–Ze, W Xiao–Ran - *Chinese Journal of ...*, 2015 - Wiley Online Library ... Fig.1 and the relative parameters are listed in Table 1. The **seismic** waveform data ... <http://www.hinet.bosai.go.jp>) and the Incorporated Research Institutions for **Seismology**, USA (IRIS ... ac.uk/EHB/index.html) and from the database of the **International Seismological Center**, ...

Analysis of geomorphic indices in the southern Central Andes (23°–28° S): Evidence for pervasive Quaternary to Recent deformation in the Puna Plateau H Daxberger, U Riller - *Geomorphology*, 2015 - Elsevier ... Earthquake Information **Center** (NEIC:<http://earthquake.usgs.gov/region/al/neic/>) and ISC (<http://www.isc.ac.uk/>) indicates earthquakes with moment magnitudes up to M6 within crust of the southern Central Andes. ...

Gravity anomalies, crustal structure, and seismicity at subduction zones: 1. Seafloor roughness and subducting relief D Bassett, AB Watts - *Geochemistry, Geophysics, Geosystems*, 2015 - Wiley Online Library ... der Hilst, and Buland (EHB) [Engdahl et al., 1998], and ISC (<http://www.isc.ac.uk/>) earthquake catalog compiled for this study containing the epicenters, **seismic** asperities, and ... km), centered landward of the trench approximately above the slab **center** of mass ...

Gravity anomalies, crustal structure, and seismicity at subduction zones: 2. Interrelationships between fore-arc structure and seismogenic behavior [D Bassett, AB Watts - Geochemistry, Geophysics, Geosystems, 2015 - Wiley Online Library](#) ... Dziewonski et al., 1981; Ekström et al., 2012], Engdahl, van der Hilst, and Buland (EHB) [Engdahl et al., 1998], and reviewed ISC (<http://www.isc.ac.uk/>, accessed January 2015) earthquake bulletins; and a catalog of seismic tremor occurring ...

The long-wavelength mantle structure and dynamics and their implications for large-scale tectonics and volcanism in the Phanerozoic [S Zhong, X Liu - Gondwana Res, 2015 - researchgate.net](#)... **International Seismological Center** (ISC) bulletins were used to construct a 3-D P wave ..seismograms from **International** Deployment of Accelerometers (IDA) and Global Digital ...

ISC-GEM: Global Instrumental Earthquake Catalogue (1900–2009), III. Re-computed MS and mb, proxy MW, final magnitude composition and completeness [D Di Giacomo, I Bondár, DA Storchak...](#) - *Physics of the Earth and ...*, 2015 – Elsevier Abstract This paper outlines the re-computation and compilation of the magnitudes now contained in the final **ISC-GEM** Reference Global Instrumental Earthquake Catalogue (1900–2009). The catalogue is available via the ISC website (www.isc.ac.uk/iscgem/) and lists ...

ISC-GEM: global instrumental earthquake catalogue (1900–2009), II. Location and seismicity patterns [I Bondár, ER Engdahl, A Villaseñor, J Harris...](#) - *Physics of the Earth and ...*, 2015 – Elsevier Abstract We present the final results of a two-year project sponsored by the Global Earthquake Model (GEM) Foundation. The **ISC-GEM** global catalogue consists of some 19 thousand instrumentally recorded, moderate to large earthquakes, spanning 110 years of ...

The ISC-GEM global instrumental earthquake catalogue (1900–2009): introduction [DA Storchak, D Di Giacomo, ER Engdahl...](#) - *Physics of the Earth and ...*, 2015 – Elsevier Abstract In this introductory article we give a general description of the **ISC-GEM** Global Instrumental Earthquake Catalogue (1900–2009). We also provide the background for four further articles that describe the effort in collecting and digitizing parametric earthquake ...

Bibliographical search for reliable seismic moments of large earthquakes during 1900–1979 to compute MW in the **ISC-GEM** Global Instrumental Reference ... [WHK Lee, ER Engdahl - Physics of the Earth and Planetary Interiors, 2015 – Elsevier](#) Abstract Moment magnitude (MW) determinations from the online GCMT Catalogue of seismic moment tensor solutions (GCMT Catalog, 2011) have provided the bulk of MW values in the **ISC-GEM** Global Instrumental Reference Earthquake Catalogue (1900–2009 ...

ISC-GEM: Global Instrumental Earthquake Catalogue (1900–2009), I. Data collection from early instrumental seismological bulletins [D Di Giacomo, J Harris, A Villaseñor...](#) - *Physics of the Earth and ...*, 2015 – Elsevier Abstract In order to produce a new global reference

earthquake catalogue based on instrumental data covering the last 100+ years of global earthquakes, we collected, digitized and processed an unprecedented amount of printed early instrumental seismological ...

A summary of hazard datasets and guidelines supported by the Global Earthquake Model during the first implementation phase [M Pagani, J Garcia, D Monelli...](#) - *Annals of ...*, 2015 - annalsofgeophysics.eu ... Global instrumental catalogue (**ISC-GEM**) The scientific project dedicated to the construction of a global uniform instrumental catalogue was led by the International Seismological Centre and saw the participation of a numerous and highly qualified group of international...

2b... or not 2b? Interpreting magnitude distributions from microseismic catalogs [DW Eaton, S Maghsoudi - First Break, 2015 - earthdoc.org](#)... Figure 1a exemplifies this relationship, based on the cumulative magnitude distribution from the **ISC-GEM** Global Instrumental Earthquake Catalogue, for the period 1980-2011. ... The **ISC-GEM** catalogue was used here under the terms of open access licence CC-BY-SA 3.0. ...

Extending the ISC-GEM Global Earthquake Instrumental Catalogue [D Di Giacomo, B Engdhal, D Storchak...](#) - *EGU General ...*, 2015 - adsabs.harvard.edu Abstract After a 27-month project funded by the GEM Foundation (www.globalquakemodel.org), in January 2013 we released the **ISC-GEM** Global Instrumental Earthquake Catalogue (1900-2009) (www.isc.ac.uk/iscgem/index.php) as a special product to use for seismic ...

An M W-based Historical Earthquake Catalog for Mainland China [J Cheng - 2015 AGU Fall Meeting, 2015 - agu.confex.com](#) ... We started from an M S-based Chinese catalog spanning from 780 BC to present. We compared M S from the catalog with Mw for common earthquakes in the **ISC-GEM** and GCMT catalogs, and derived M S - M W regression relationships using orthogonal least square ...

Regression Relations for Conversion of Various Magnitude Types and Catalogs for the Earthquakes of Turkey and Vicinity [B Çıvgın - Seismological Research Letters, 2015 - srl.geoscienceworld.org](#) ... In addition to the bulletin, ISC reports moment magnitude data in partnership with GEM Foundation within the **ISC-GEM** (Storchak et al., 2013). The catalog contains data for the period of 1900-2009. ... These are **ISC-GEM**, Global CMT, and USGS...

Seismic hazard assessment for Myanmar: Earthquake model database, ground-motion scenarios, and probabilistic assessments [CH Chan - 2015 AGU Fall Meeting, 2015 - agu.confex.com](#) ... Our earthquake database integrates the ISC, **ISC-GEM** and global ANSS Comprehensive Catalogues, and includes harmonized magnitude scales without duplicate events. Our active fault database includes active fault data from previous studies...

Evaluation of strain accumulation in global subduction zones from seismicity data [R Ikuta, Y Mitsui, Y Kurokawa, M Ando - Earth, Planets and Space, 2015 – Springer](#) ... 2012). We then trace the slip history of these stick-slip patches using the **ISC-GEM** Global Instrumental Earthquake Catalogue

(**ISC-GEM** catalog; Storchak et al. ... Slip accumulation and slip-deficit rate on stick-slip patches deduced from the GCMT and **ISC GEM** catalogs...

Rapidly Estimated Seismic Source Parameters for the 16 September 2015 Illapel, Chile M w 8.3 Earthquake L Ye, T Lay, H Kanamori, KD Koper - *Pure and Applied Geophysics* – Springer ... The region just to the south (32°S to 34.5°S) ruptured most recently in the 9 July 1971 [M S 7.9, M W 7.8, (**ISC-GEM**)] and 3 March 1985 [M S 7.8, M W 7.9 (CMT)] Valparaíso earthquakes as well as previously in the great 17 August 1906 (M S 8.4) earthquake (eg, Comte et al. ...

Estimation of Seismic Intensity at Lalitpur, Nepal HR PARAJULI - *nset.org.np* ... New Technologies for Urban Safety of Mega Cities in Asia ISC, 2015, **ISC-GEM** Global Instrumental Earthquake Catalogue (1900-2009), Version 2.0, International Seismological Centre Japanese International Cooperation Agency (JICA). 2002. ...

Regional level forecasting of seismic energy release B Kavitha, STG Raghukanth - *Acta Geodaetica et Geophysica*, 2015 – Springer ... The **ISC-GEM** Global Instrumental Reference Earthquake Catalogue (<http://www.isc.ac.uk/iscgem/index.php>) has been utilized in the present study. A total of 41 active seismogenic zones are identified from tectonic plate boundaries using of past ...

Ambient seismic noise tomography of the southern East Sea (Japan Sea) and the Korea Strait SJ Lee, J Rhie, S Kim, TS Kang, GB Kim - *Geosciences Journal*, 2015 – Springer ... Fig. 7. Group velocity map for the 5 s period and earthquake ($2 \leq M \leq 6$) epicenter locations from 1994 to 2013 (**ISC-GEM** Catalog; Storchak et al., *Seismological Research Letters*, 2013). Clearly, seismicity inside the UB

The 3 May 2006 (Mw 8.0) and 19 March 2009 (Mw 7.6) Tonga earthquakes: Intralab compressional faulting below the megathrust Q Meng, DS Heeszel, L Ye, T Lay... - *Journal of ...*, 2015 - Wiley Online Library ... Large (magnitude ≥ 7) shallow (≤ 70 km deep) earthquakes in the Tonga subduction zone since 1900 (circles) from the **ISC-GEM** catalog. Mechanisms for the northern 1975 (-16.3°) and 1948 events are from Okal et al. [2011]. ...

Relocalizing a historical earthquake using recent methods: The 10 November 1935 Earthquake near Montserrat, Lesser Antilles P Niemz, D Amorèse - *Journal of South American Earth Sciences*, 2015 – Elsevier ... A similar approach in regard to the global seismicity is underway at the International Seismological Centre (ISC) which produces and maintains the **ISC-GEM** Catalog as an authoritative source for global earthquake locations. ...

Are new data suggesting a revision of the current M w and M e scaling formulas? P Bormann - *Journal of Seismology*, 2015 – Springer ... With this in view, we have first to acknowledge what remains valid and what has changed since the 1970s. According to the **ISC-GEM** Global Instrumental Earthquake Catalogue (1900–2009), the M S (20) type of magnitude is the longest available and most complete long-period ...

IUGG-1851 R Quintero - iaspei.org ... The **ISC-GEM** Catalogue is another ISC dataset that was designed to be used for global and regional studies of seismic hazard and risk. ... IUGG-1116 Extension of the **ISC-GEM** Global Earthquake Instrumental Catalogue, an update ...

Global Seismic Hazard Assessment Program-GSHAP legacy L Danciu, D Giardini - *Annals of Geophysics*, 2015 - annalsofgeophysics.eu ... Villaseñor and P. Bormann (2013). Public Release of the **ISC-GEM** Global Instrumental Earthquake Catalogue (1900-2009), *Seismol. Res. Lett.*, 84 (5), 810-815; doi:10.1785/022 0130034. Stucchi, M., A. Rovida, AA Gomez ...

Satellite-derived geoid for the estimation of lithospheric cooling and basal heat flux anomalies over the northern Indian Ocean lithosphere S Rajesh, TJ Majumdar - *Journal of Earth System Science*, 2015 – Springer ... (1997). Seismicity data as hypo-central distribution over the active mid-oceanic spreading centres of the Carlsberg Ridge were obtained from the reviewed catalogues of International Seismological Centre (**ISC-GEM** catalogue, Storchak et al. ... **ISC-GEM** catalogue) of seismicity. ...

Development and operation of a regional moment tensor analysis system in the Philippines: contributions to the understanding of recent damaging earthquakes BJT Punongbayan, H Kumagai, N Pulido... - *J Disaster ...*, 2015 - researchgate.net... *Journal of Disaster Research* Vol.10 No.1, 2015 25 Page 2. Punongbayan, BJT et al. Fig. 1. Significant earthquakes in the Philippines ($M \geq 7.0$, 1900-2009, **ISC-GEM** Catalogue). Expected to contribute to a better characterization of earthquake sources ...

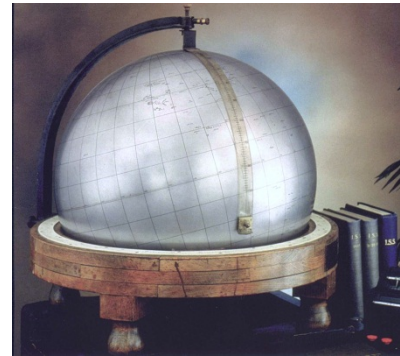
Total Probability Theorem Versus Shakeability: A Comparison between Two Seismic-Hazard Approaches Used in Central Asia D Bindi, S Parolai - *Seismological Research Letters*, 2015 - srl.geoscienceworld.org ... New York, 473–488. Google Scholar. ←: Di Giacomo, D.; Bondár, I.; Storchak, DA.; Engdahl, ER.; Bormann, P., and; Harris, J. (2015). **ISC-GEM**: Global Instrumental Earthquake Catalogue (1900–2009): III. Re-computed MS

Source process of the 1911 M8.0 Chon-Kemin earthquake: investigation results by analogue seismic records G Kulikova, F Krüger - *Geophysical Journal International*, 2015 - gji.oxfordjournals.org ... Fig. 5; Kondorskaya & Shebalin (1977). In January 2013 **ISC-GEM** Global Instrumental Earthquake Catalogue (Storchak et al. 2013) was issued and the Chon-Kemin earthquake epicentre was relocated more to the east (Fig. ...

Evaluation of Intensity of Recent Seismogenic Tsunamis in the World Ocean from 2000 to 2014 VK Gusiakov - *Pure and Applied Geophysics*, 2015 - Springer... calculations. Earthquake parameters (origin time and magnitude Mw) are taken from the **ISC-GEM** catalog (STORCHAK et al. 2015) Vol. 172, (2015) Evaluation of Intensity of Recent Seismogenic Tsunamis... 3275 Page 6. table ..

SUMMARY OF ACHIEVEMENTS

- The ISC marked its 50th Anniversary with a dedicated symposium at IUGG.
- We gratefully acknowledge the support from 65 Member-Institutions (2 new), development grants from CTBTO, GEM Foundation, USGS, US NSF, FM Global, Lighthill Risk Network, OYO, UK KTP, IRIS as well as sponsorship from Reftek.
- 13-17 staff members, 6 consultants and 2 members of Oxford University worked at the ISC improving and extending the ISC products and services; 6 new members of staff have been trained/re-trained during the year.
- 547 stations have been registered and modified in the International Station Registry.
- Preliminary bulletin data are collected from 28 networks and data centres worldwide.
- Revised bulletins are collected from 122 networks worldwide.
- During 2015, ~46,000 events with ~4.25 million of associated phases have been added to the Reviewed ISC Bulletin.
- The ISC database size has increased by ~28% and reached 201Gb in total.
- The ISC-GEM catalogue has been extended to include known events with moment magnitudes above 5.5 during 1935-1949 and 2012.
- The ISC Event Bibliography reached ~17,900 articles related to ~14,900 seismic events.
- Other ISC development projects included:
 - The CTBTO Link to the ISC database;
 - The ISC Bulletin Rebuild;
 - The Visual Bulletin Analysis System
- We continued to maintain the IASPEI Reference (GT) Event List, the EHB Bulletin and the List of International Contacts in Seismology.
- The FDSN-compliant web-service has been put into action.
- The introduction of the load balancer between the ISC web servers installed at the ISC and IRIS DMC has helped to improve the experience of web users of the ISC data.
- The ISC database mirrors were operated at IRIS DMC in Seattle, ERI in Tokyo and LLNL in Livermore; this also improved the speed of access to the ISC data.
- The ISC staff participated in a large number of meetings and conferences and received good publicity throughout the year.
- Several scientific articles describing new ISC products were submitted and/or published.
- The large number of scientific articles published worldwide in 2015 indicates a wide-range use of the ISC Bulletin data by many researchers.



Signed, May 15, 2015

Dr. Dmitry A. Storchak
Director