The CTBTO Link to the ISC Database

Gaspà O., Bondár I,. Harris J. Aspinwall M. and Storchak D.
International Seismological Centre
email: oriol@isc.ac.uk

ABSTRACT:

The CTBTO Link to the International Seismological Centre (ISC) Database is a collection of interactive tools for manipulating seismological data sets provided by the ISC. The Link is open to National Data Centres (NDC) and the Provisional Technical Secretariat (PTS). By means of a graphical interface and queries tailored for the monitoring community, the users are given access to a multitude of products. These include historical seismicity since 1904, nuclear and chemical explosions, Engdahl, van der Hilst and Buland (EHB) bulletins, Ground Truth (GT) events and the IDC Reviewed Event Bulletin (REB) amongst others.

The searches are divided into three main categories: The Area Based Search (a spatio-temporal search based on the ISC Bulletin), the REB search (a spatio-temporal search based on specific events in the REB) and the IMS Station Based Search (a search for historical patterns in the reports of seismic stations close to a particular IMS seismic station).

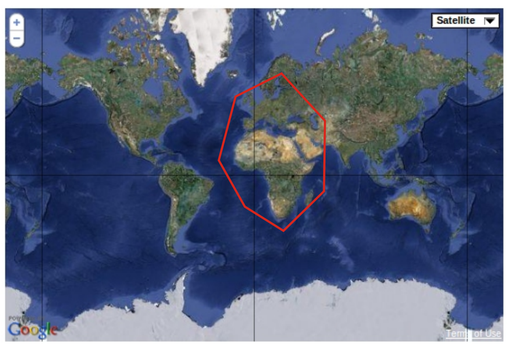
The outputs are a simplified version of the ISC Bulletin showing the most relevant parameters in HTML with access to ISC, GT, EHB and REB Bulletins in IMS1.0 format for single or multiple events. This is a user-friendly interface we hope will help NDCs to put REB events in context within the historical seismicity.

The CTBTO Link to the ISC Database has been developed and maintained by the ISC and is supported by the UK Foreign and Commonwealth Office (90%) and four Scandinavian Research Institutions (10%):

* NORSAR,
* The Geological Survey of Denmark and Greenland (GEUS),
* The Swedish National Defense Research Establishment (FOI)
* The University of Helsinki.

Access to Data and Outputs

Interactive Search



This graphical interface allows the users to select a geographic zone with a simple click.

The other requirements are the time period and the type of search to be done:

* Area
* REB
* Station

1) Google Map Interface
2) Capable of Drawing Polygons
3) Simple Spatio/Temporal Searches
4) User-Friendly

Area Based Search

REB

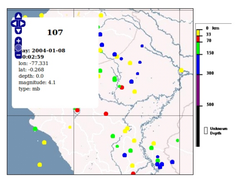
REB Based Search

IMS Based Station Search

Uses the ISC database as a complementary tool to put in context a user-selected REB event:

* Search through the REB or specify event
* Select an event of interest
* Find information from the ISC Bulletin around this event

REB event selection



		REB Hypocentre					Magnitude		
Index ↑	Author	Date - Time	Lon	Lat	Depth	nsta	mb	MS	Select event
109	IDC	2004-01-02 05:49:18	-74.288	-8.037	145.2		3.70	2.90	○
108	IDC	2004-01-04 16:13:55	-77.453	-3.527	0.0		4.50	3.80	○
107	IDC	2004-01-08 00:02:59	-77.331	-0.268	0.0		4.10		◉

Radius around REB epicentre + REB event + Search option

Search options

- Event map
  Select specific event categories if required:
  - Nuclear Explosions
  - Ground Truth Events
  - EHB Events
  - REB Events

  Add different types of events to your search if required:
  Check All / Choose clear
  - Rock Bursts
  - Induced Event
  - Mining Explosions
  - Chemical Explosions

Search options

- Networks reporting hypocentres in the area
- Compare network hypocentre solutions

  AAB vs AAB

  Looking for an agency?
- Magnitude Distribution

Search options

IMS/Registered networks performance

0.5 | Magnitude tolerance

Search options are very similar to the *Area Based Search* but reduced to the REB event area of influence.

Resembling outputs to the Area Based Search

Event Map

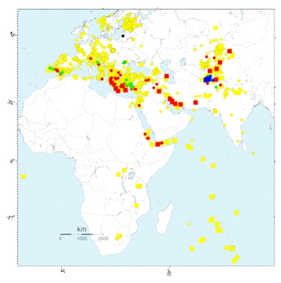
Hypocentral solutions Comparison

IMS/Registered Networks performance

Network Information

Magnitude Distribution

Event Map

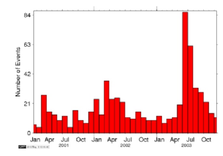


Shows ISC historical seismicity and also specific ISC categories and types of events

- Events:
  - Nuclear Explosions
  - EHB Events (depth accuracy)
  - GT Events (location accuracy)
  - REB events
  - Explosions (chemical, experimental …)
- List of sortable events with main location parameters.
- Access to the ISC Bulletin in IMS1.0 for the whole collection or for individual events.

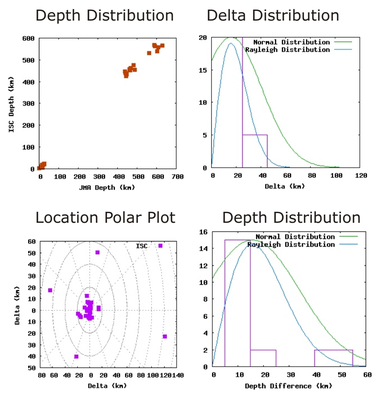
Network Information

Presents a summary of information reported by networks to the ISC (more than 120).



- Contact information
- Timeline of events
- Frequency-Magnitude distribution
- Accessible xy data

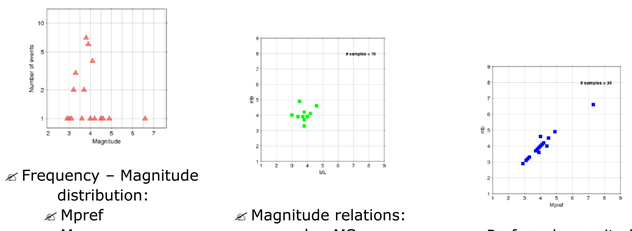
Agency Comparison



Presents the differences between the same hypocentral solutions reported by two user-selected networks

- Listing
  - Summary of location and differences
  - Access to ISC Bulletin
- Additional Statistics
  - Statistics of events reported
  - Outliers
  - Delta and Depth differences plots
  - Polar distribution
  - Depth distribution

Frequency Magnitude Distributions



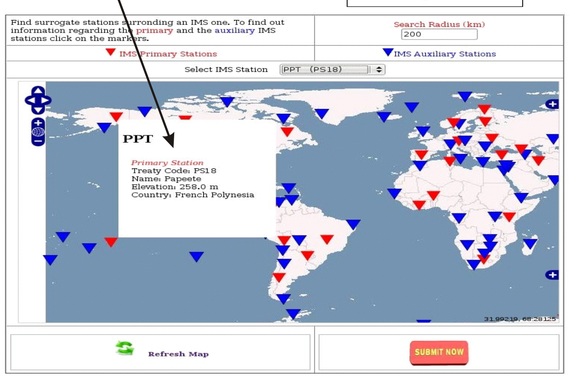
- Frequency – Magnitude distribution:
  - Mpref
  - Mw
  - MS
  - mb
  - ML
- Magnitude relations:
  - mb v MS
  - mb v Mw
  - mb v ML
  - MS v Mw
- Preferred magnitude relations:
  - Mpref v Mw
  - Mpref v MS
  - Mpref v mb
  - Mpref v ML

Summary of reported magnitudes

Interactive Map

Treaty and Seismic code

Surrogate station defining distance

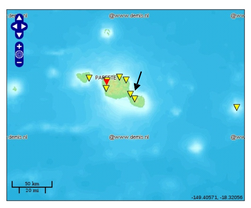


This is another interactive map which allows to examine the IMS station network and identify a particular station.

Station Selection

List of Registered Surrogate Stations

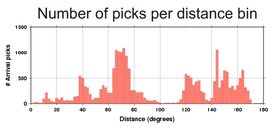
Station Information				Reporting Period to the ISC	
CODE	Station Name	Latitude	Longitude	Started	Last
AFR	Afareaitu	-17,538	-149,778	1970-05-01	1996-08-01
MEH	Mehetia	-17,875	-148,066	2004-02-01	2007-10-01
PAE	Paea	-17,662	-149,580	1970-05-01	2007-10-01
PPN	Papenoo	-17,531	-149,432	1967-08-01	1996-03-01
PPT	Papeete	-17,568	-149,576	2002-01-01	2007-10-01
TAH	Tahiti	-17,733	-149,300	1964-09-01	1964-11-01
THT	Papeete	-17,569	-149,574	1968-01-01	1971-08-01
TRE	Tiarei	-17,558	-149,346	2002-01-01	2007-10-01
TVO	Taravao	-17,782	-149,252	1970-05-01	2007-10-01



Find surrogate seismic stations close to an IMS seismic station and provide relevant information in the ISC Bulletin regarding arrival picks.

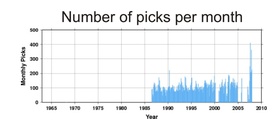
Arrival Picks Statistics

Number of picks per distance bin



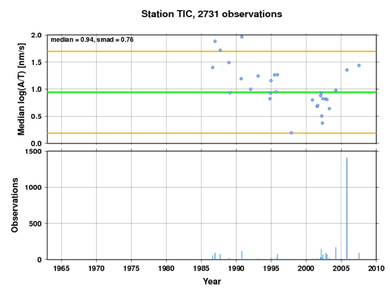
Number of time defining arrival picks per distance bin (2 degrees) reported by a station to the ISC Bulletin

Number of picks per month



Number of arrival picks per month reported by a station to the ISC Bulletin

Amplitude Analysis



Median residual per month worth of data

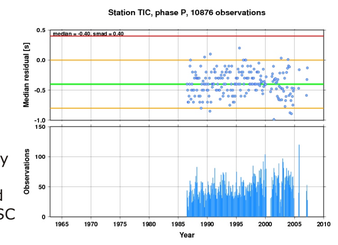
number of monthly arrival picks since the station started reporting to the ISC

The green line is the median, the orange line shows the one time variance (smad) boundary and the red line 2·smad boundary. The red columns match those monthly median residuals with a 2·smad discrepancy compared to the median (also red dots).

Propagation Effects

A HTML page with all the information regarding arrival picks gathered from the ISC Bulletin about the user-selected registered seismic station.

Time residual history



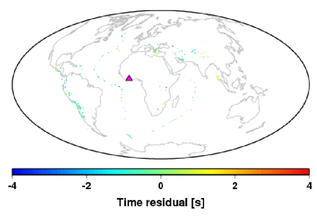
Median residual per month worth of data

number of monthly arrival picks since the station started reporting to the ISC

The green line is the median, the orange line shows the one time variance (smad) boundary and the red line 2·smad boundary. The red columns match those monthly mean residuals with a 2·smad discrepancy compared to the median (also red dots).

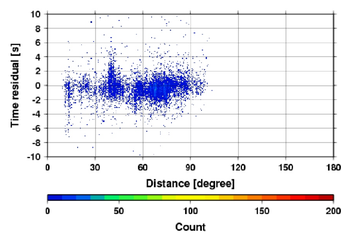
Observations for first arrival picks

DBIC, 1134 first arriving P observations



Time residual map of first arrival picks, based on azimuth and distance to the epicentre with 1 x 1 degree binning grid. The purple triangle pinpoints the location of the station.

TIC, 12205 first arriving P observations



Time residual of first arrival pick as a function of epicentral distance. No binning has been used.

CONCLUSIONS:

- User-friendly interfaces to facilitate the search of ISC data to National Data Centres (NDC's).
- Implementation of complex and tailored queries with the aim of helping the monitoring community.
- Exclusive access to ISC data for NDC's.
- Use of up-to-date seismological data as well as historical from the ISC data servers.
- Successful test at the IDC in Vienna (December 2009) and at the NCD workshop in Nairobi (May 2010).
- The CTBTO Link will be included as a tool in the next NDC Preparedness Exercise (NPE 2011).

REFERENCES:

- OpenLayers: Free Maps for the Web, http://openlayers.org/
- Generic Mapping Tools, GMT Version 4.5.0 Released, http://gmt.soest.hawaii.edu/
- Wolfram Mathworld, http://mathworld.wolfram.com/