



# The ISC Datasets and Services

Dmitry A. Storchak, James Harris, Domenico Di Giacomo,

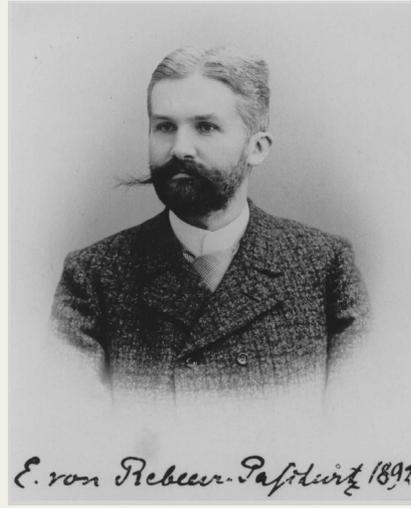
*[www.isc.ac.uk](http://www.isc.ac.uk)*

# Intro: International Seismological Centre (ISC)



*John Milne*

*John Milne*  
(1850-1913)



*E. von Rebeur-Paschwitz 1897.*

*Ernst von Rebeur-Paschwitz*  
(1861 – 1895)

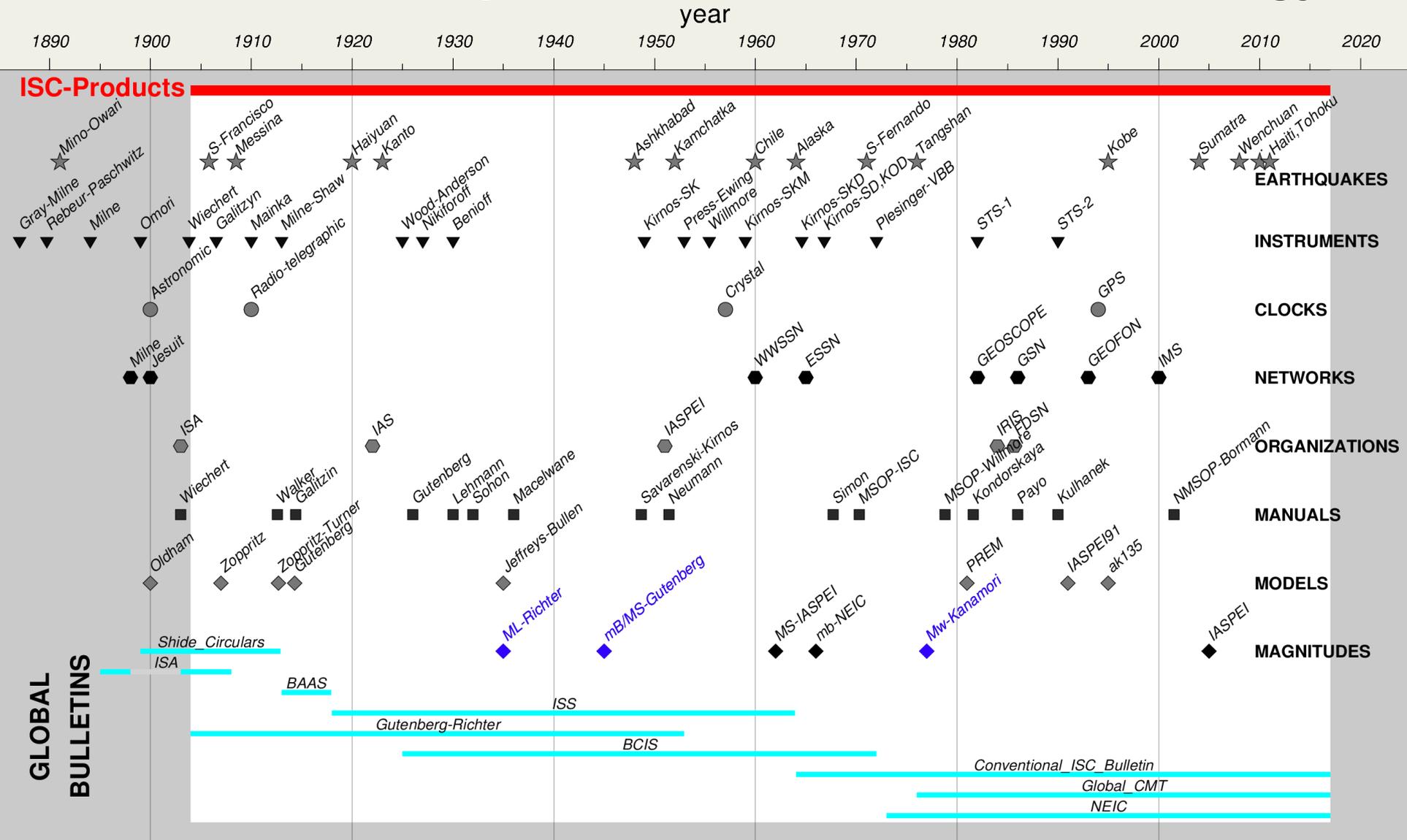
courtesy of Universitätsarchiv Tübingen

The ISC roots go back to **1895** when both **John Milne** (England) and **Rebeur-Paschwitz** (Germany) independently proposed using arrival times of seismic waves at globally distributed seismic stations of similar design to document the earthquakes worldwide.

The ISC datasets are:

- ✓ not in real time
- ✓ aimed at quality, not a speed of delivery
- ✓ long-term
- ✓ continuous
- ✓ most complete and comprehensive
- ✓ open to all
- ✓ designed for use by researchers

# Intro: the entire period of Instrumental Seismology



# Intro: ISC Datasets and Services

*International seismic  
bulletin and  
waveform exchange*

Int'l Station Registry

**Visit the ISC Booth**

*Seismicity, tectonics  
and general studies*

ISC Bulletin  
1904-2015

*Waveform distribution  
Education and Training*

ISC-EHB

GT

CTBTO  
Link

Event  
Bibliography

ISC-GEM  
Catalogue

Int'l Seismo  
Contacts

*Inner Earth's structure*

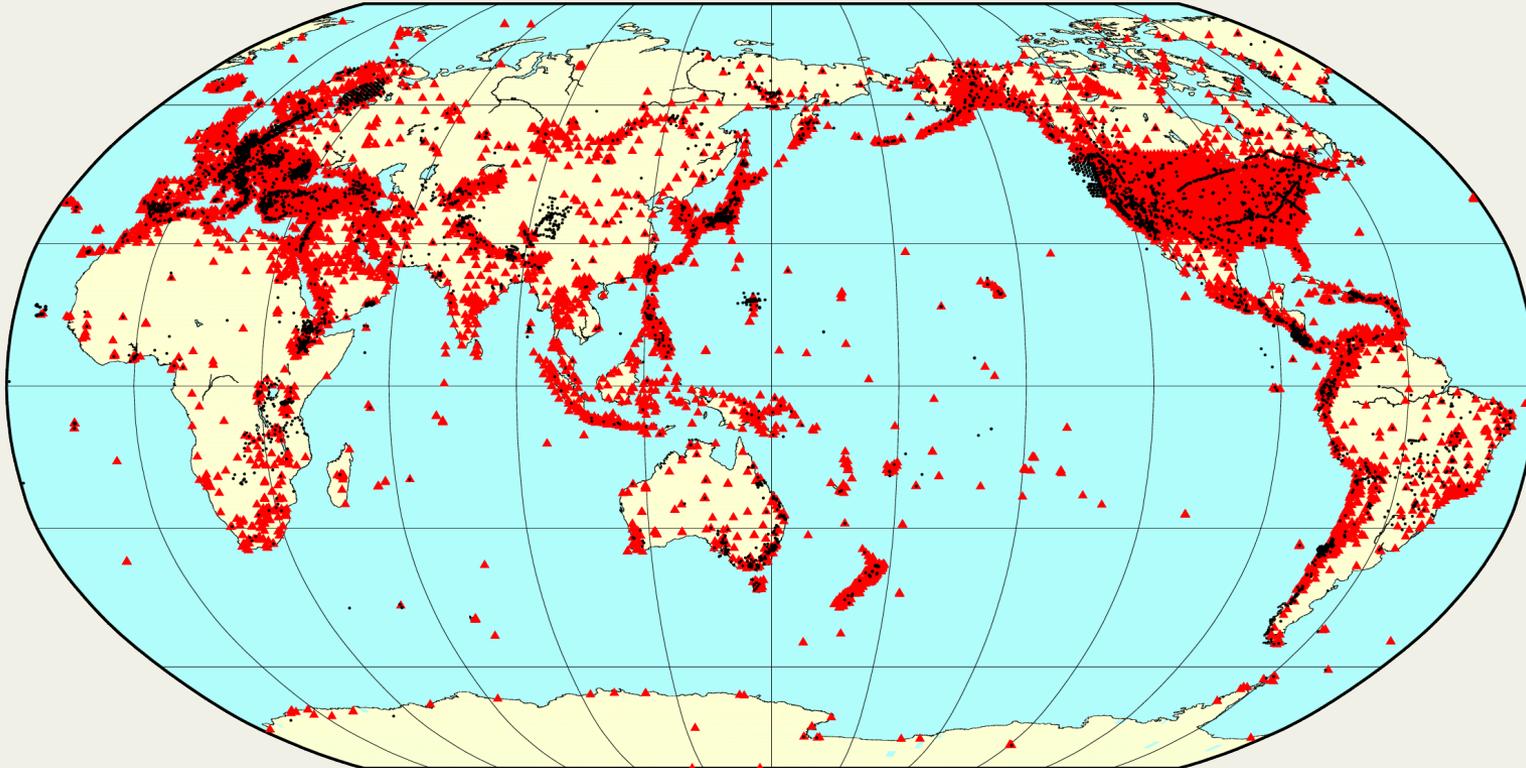
*Seismic Hazard,  
Seismicity, Tectonics*

*Emergency  
situations,  
research*

*Monitoring Nuclear Tests*

# 1. International Registry of Seismograph Stations

International Registry of Seismograph Stations



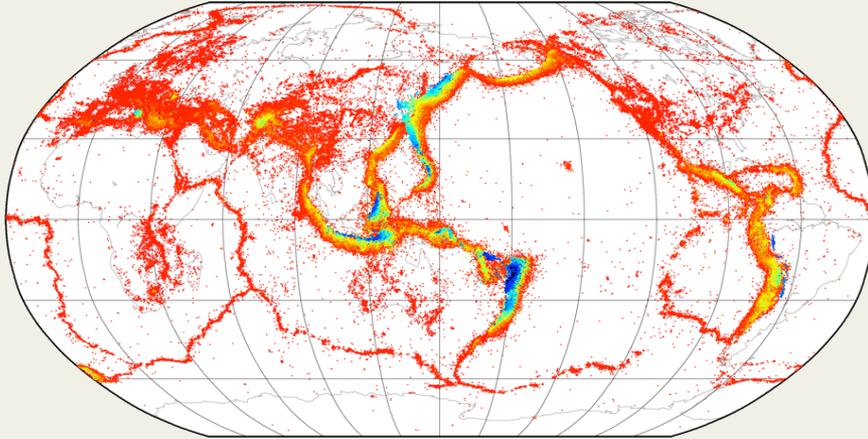
24020 Registered Stations / 16855 contributed data

~**24,000**  
registered;

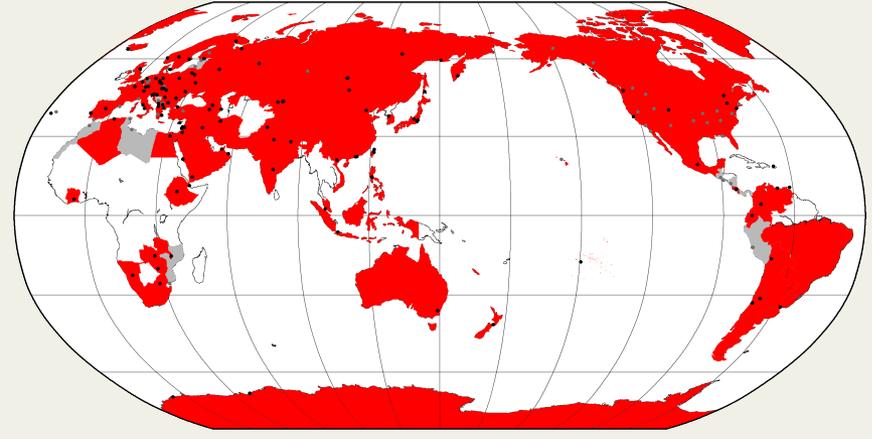
~**17,000** of  
them  
**contributed**  
bulletin data  
to the ISC

run jointly  
with  
USGS

## 2. ISC Bulletin (1904-2017)

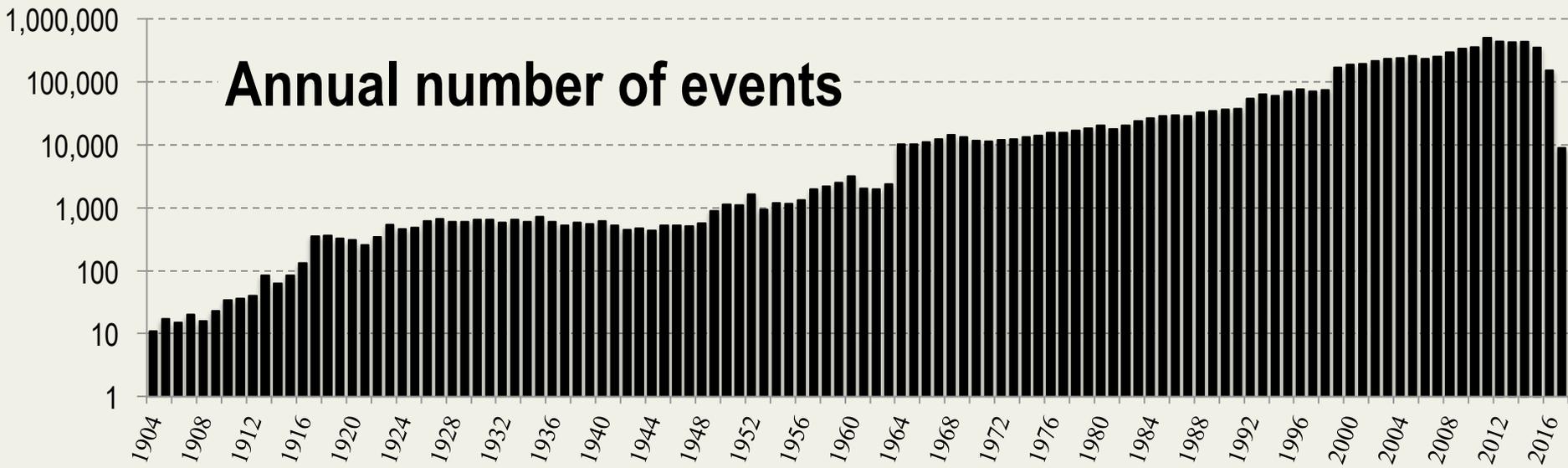


*~6.2 M events, ~171 M seismic arrivals  
based on ~17,000 stations*

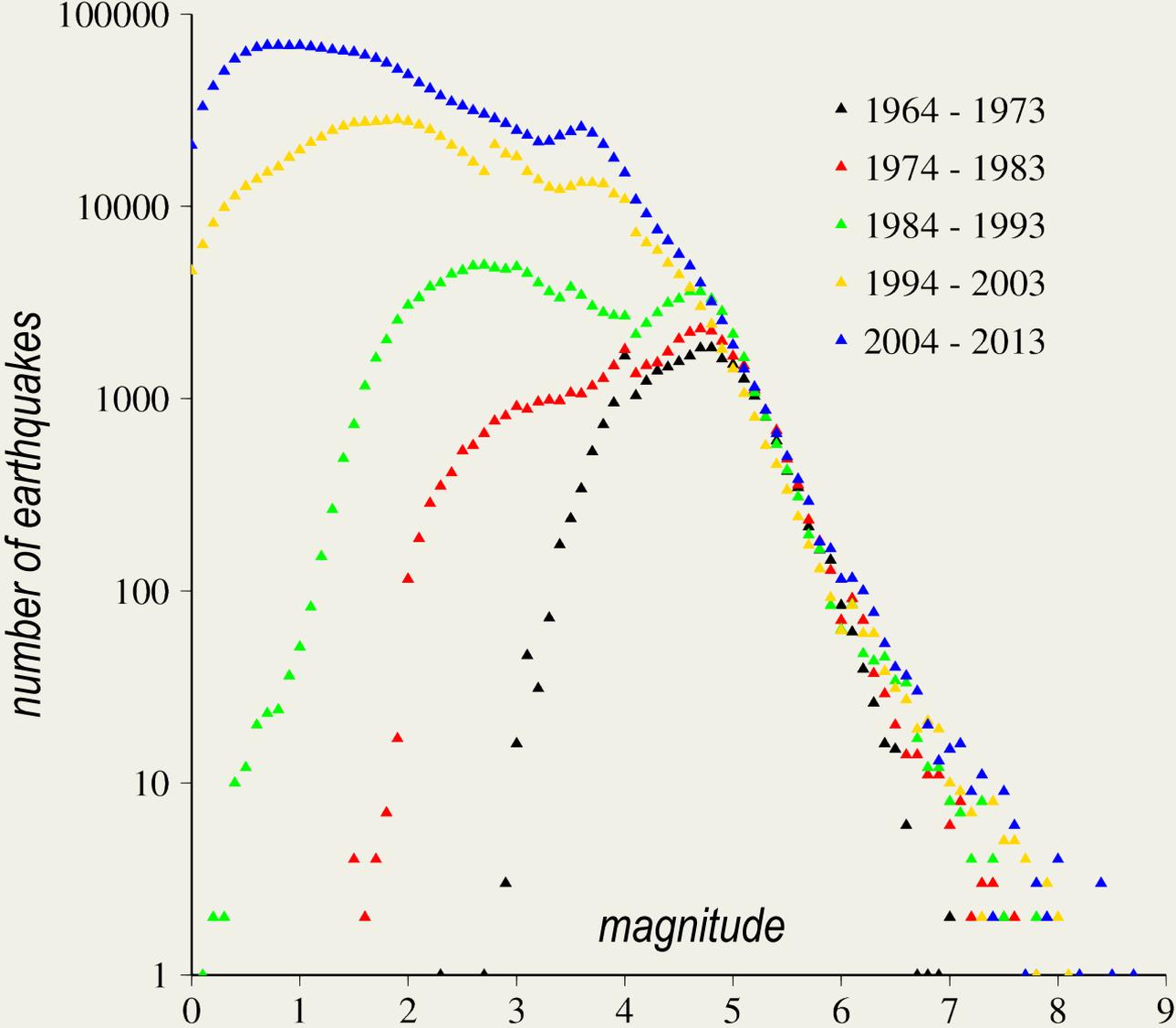


*~130 institutions-contributors  
worldwide*

### Annual number of events

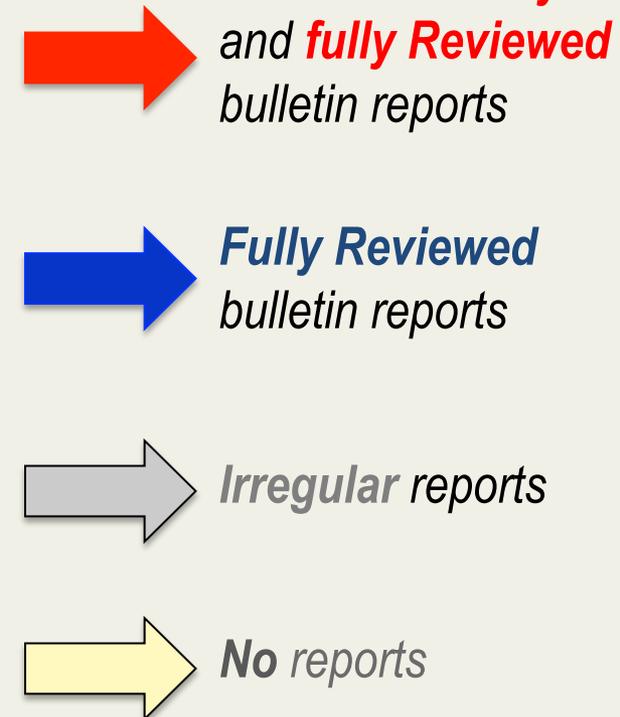
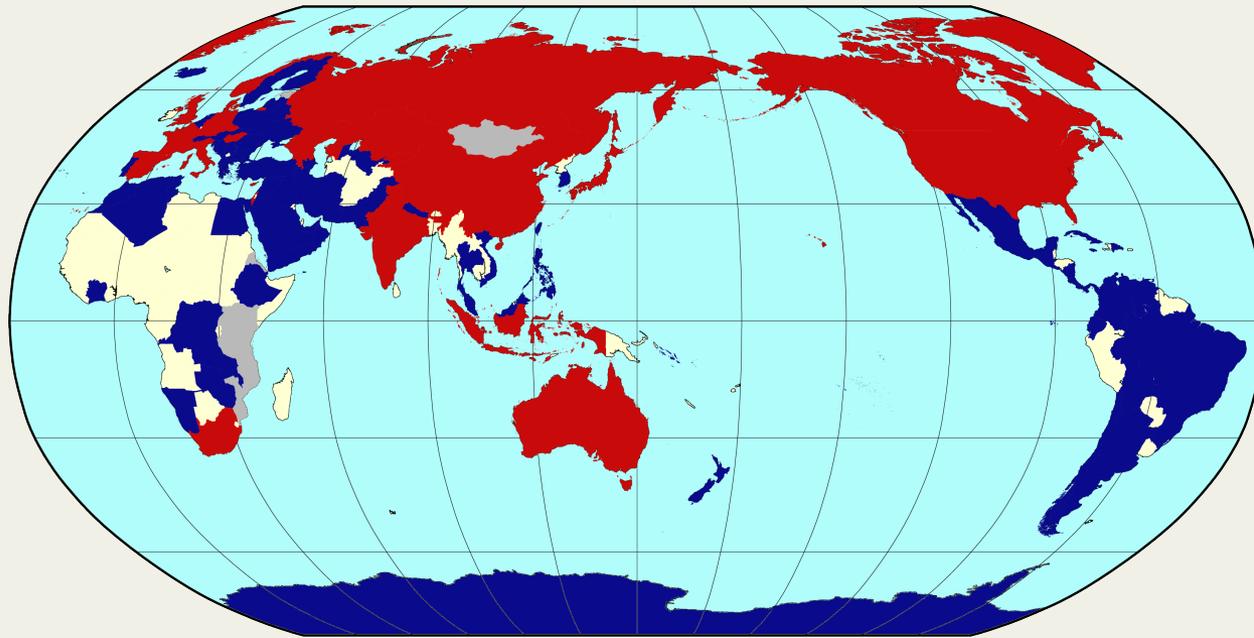


# 2. ISC Bulletin: Improvement in Event Reporting



## 2. ISC Bulletin: Current reporting from networks

~130 institutions in ~100 countries regularly report fully reviewed bulletin data to the ISC; 28 of those also report preliminary information soon after earthquake occurrence.



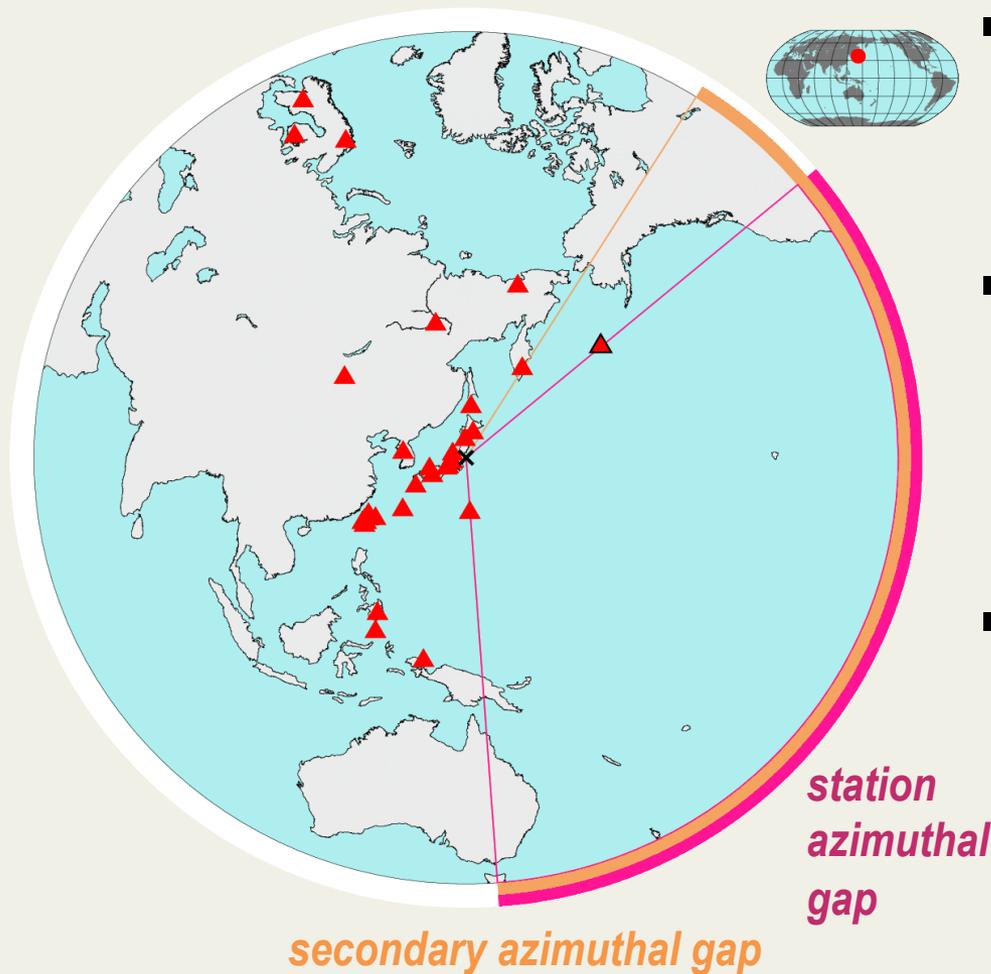
The individual network reports serve as ingredients for the ISC Bulletin.

## 2. ISC Bulletin: incorrect assumptions

There are **two common user assumptions** related to the ISC Bulletin that are **no longer correct:**

1. ISC Bulletin is **2 years behind** real time
2. ISC Bulletin **never changes** once published

## 2. Preliminary ISC Bulletin: 21-11-2016, off Honshu, M6.9

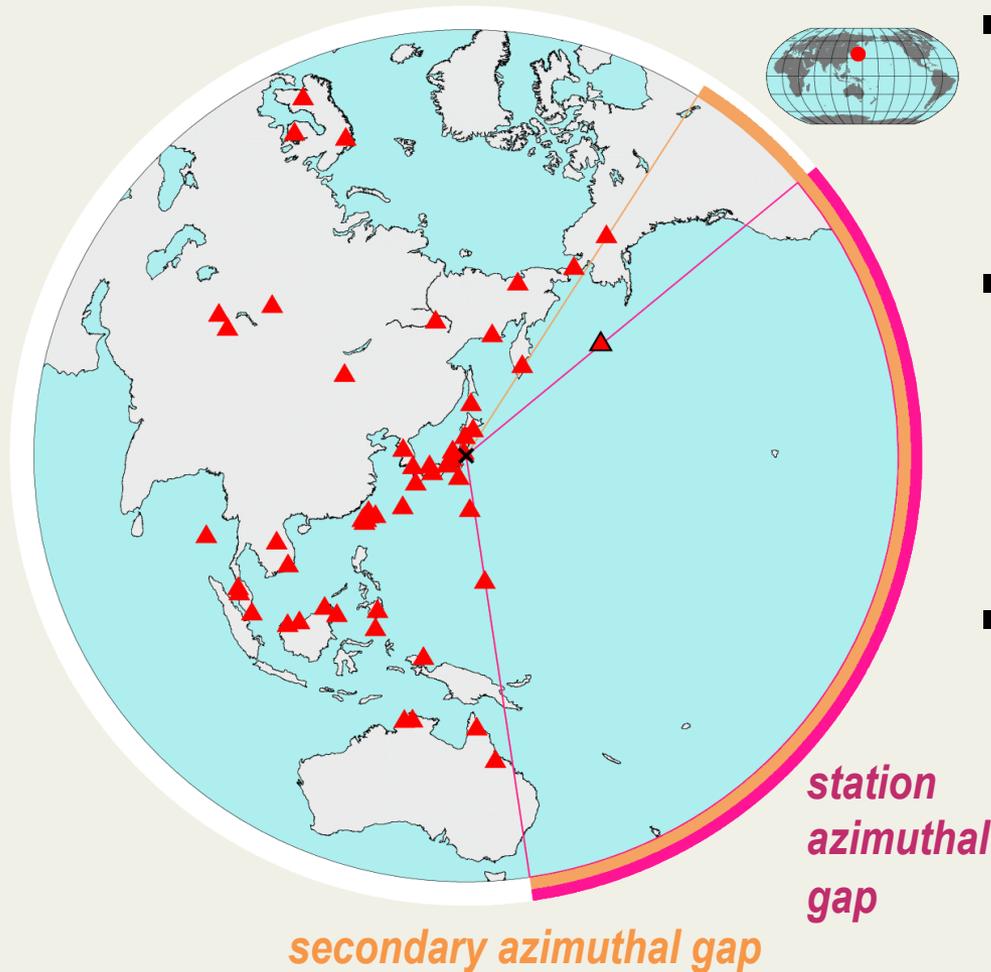


**~10 min** after the earthquake

**32 stations**

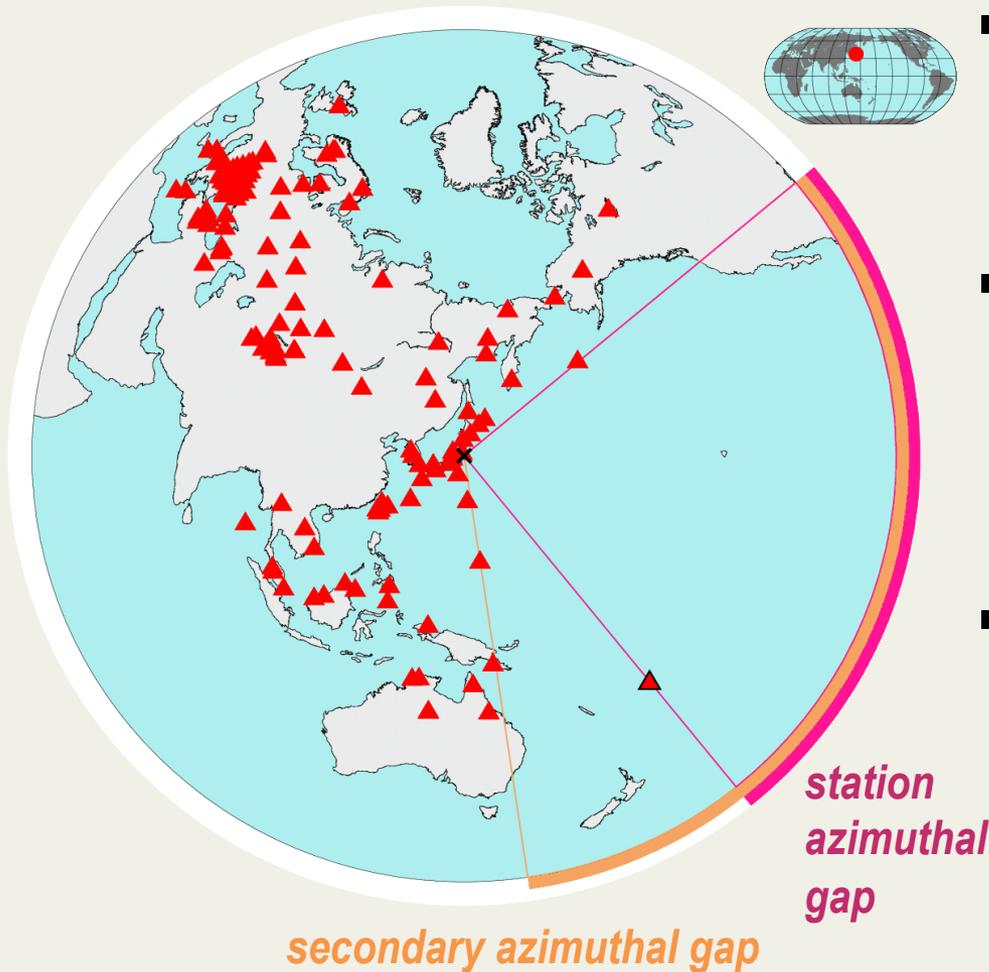
- Whilst the Reviewed ISC Bulletin becomes available 2-3 years behind real time,
- Preliminary (automatic) ISC Bulletin event is formed soon after an earthquake preliminary reports start arriving from agencies;
- Preliminary ISC Bulletin contains a rich collection of station arrival and hypocentre solution data although the ISC's own solution will not be available for several years until all final bulletin reports from networks are received.

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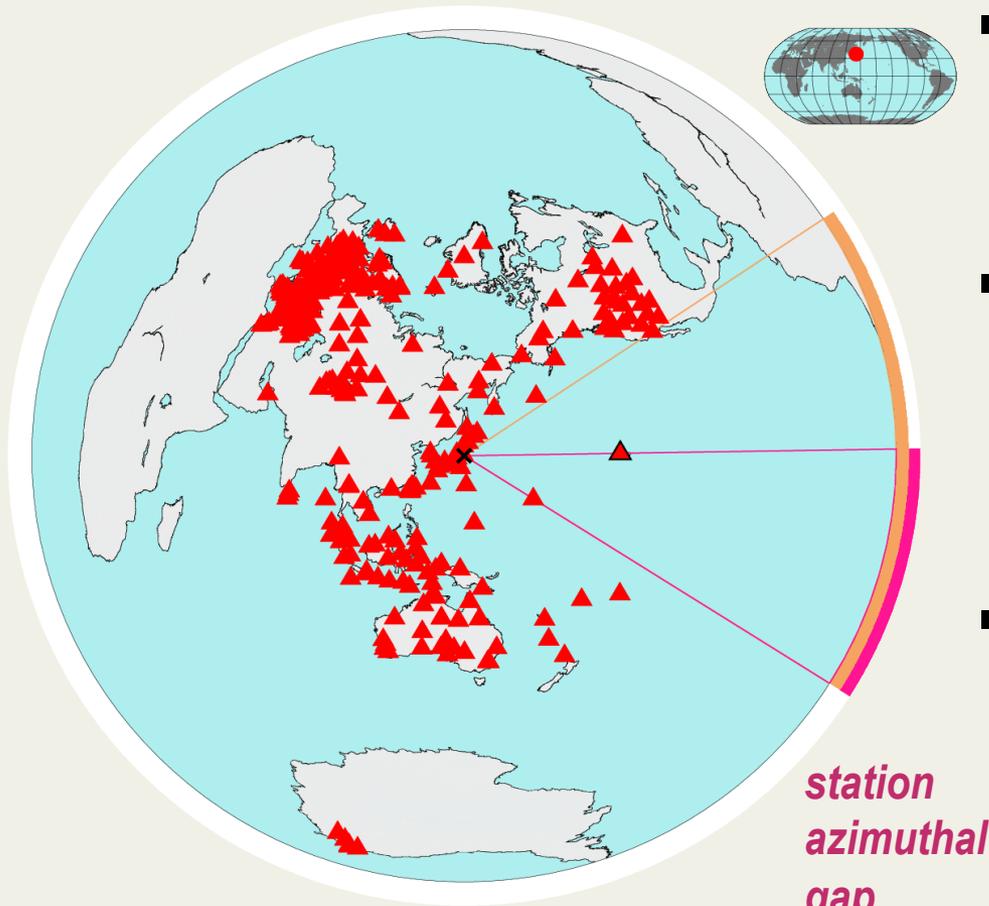


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**~100 min** after the earthquake

**176** stations

## 2. Preliminary ISC Bulletin: 21-11-2016, off Honshu, M6.9



*secondary azimuthal gap*

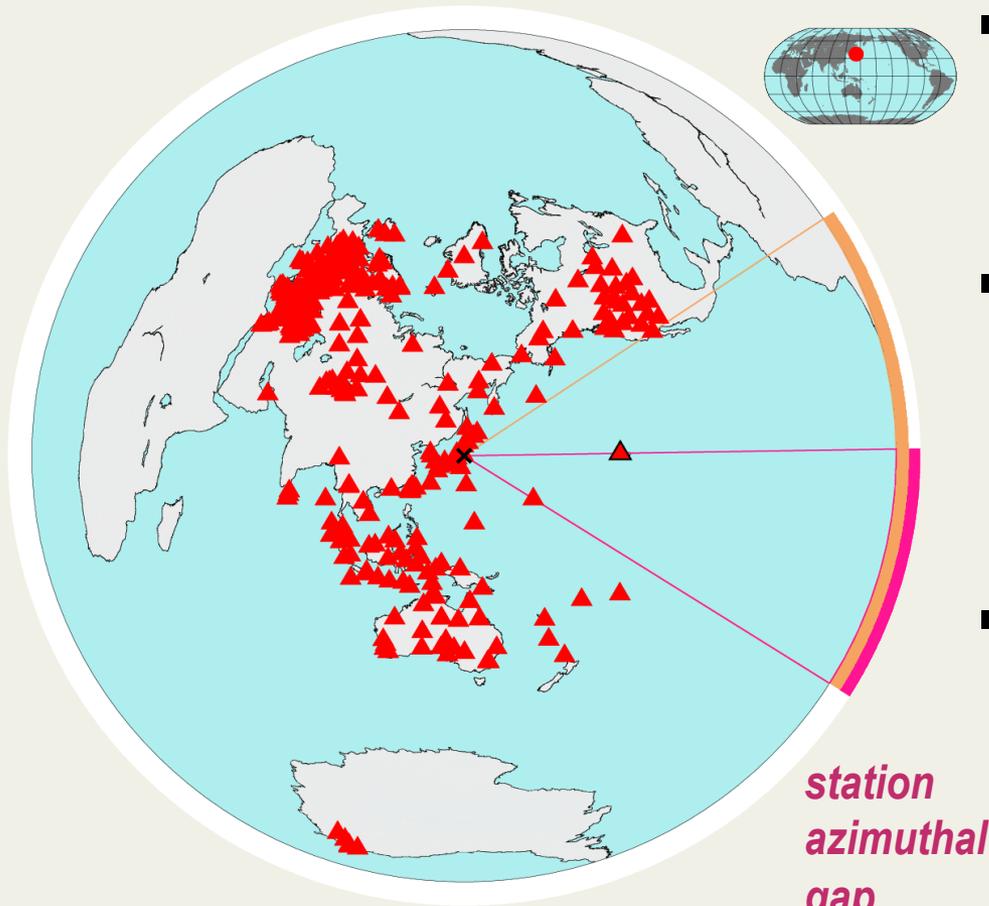
*station azimuthal gap*

**~14 hr** after the earthquake

**406 stations**

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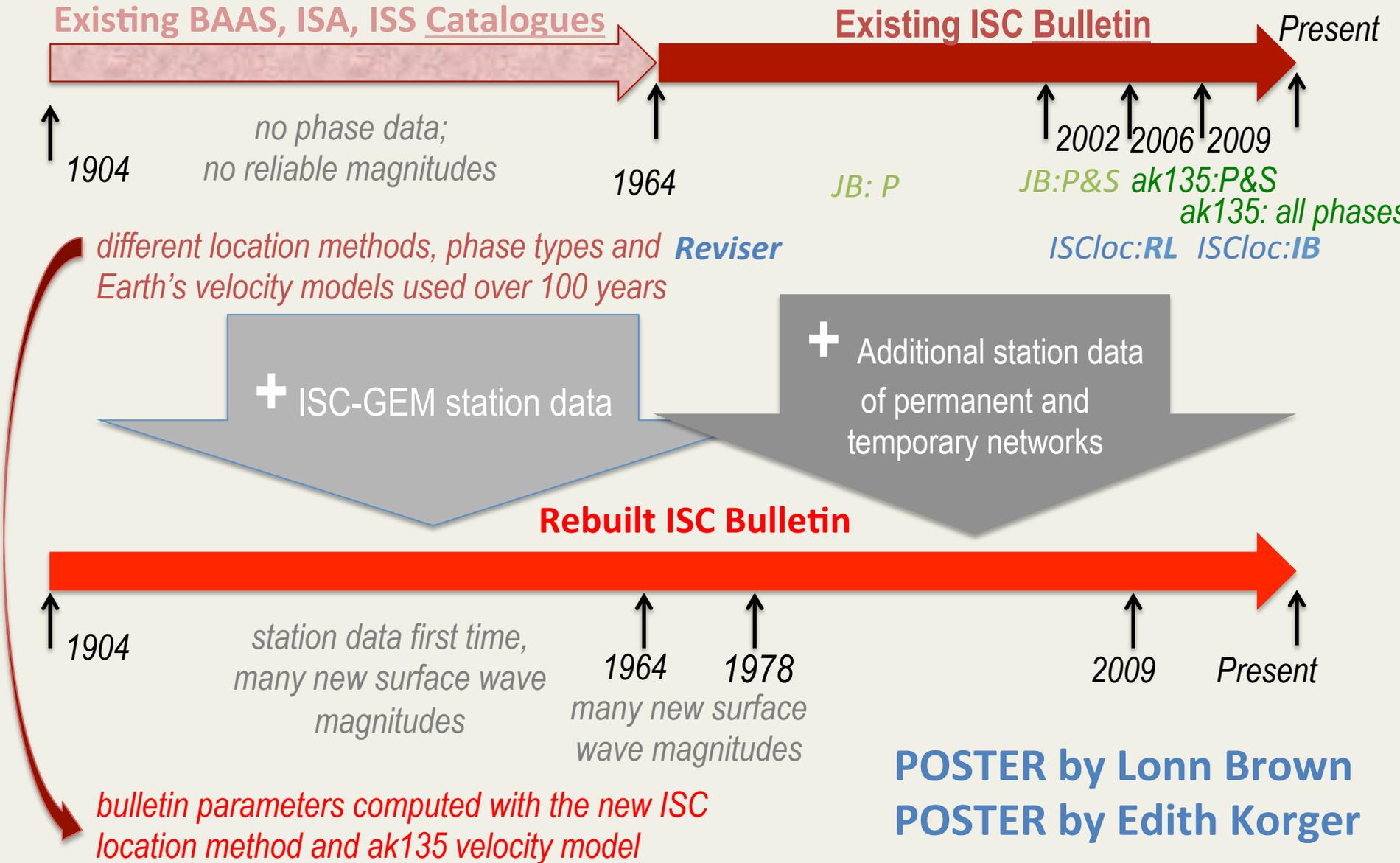
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*secondary azimuthal gap*

**~65 hr** after the earthquake

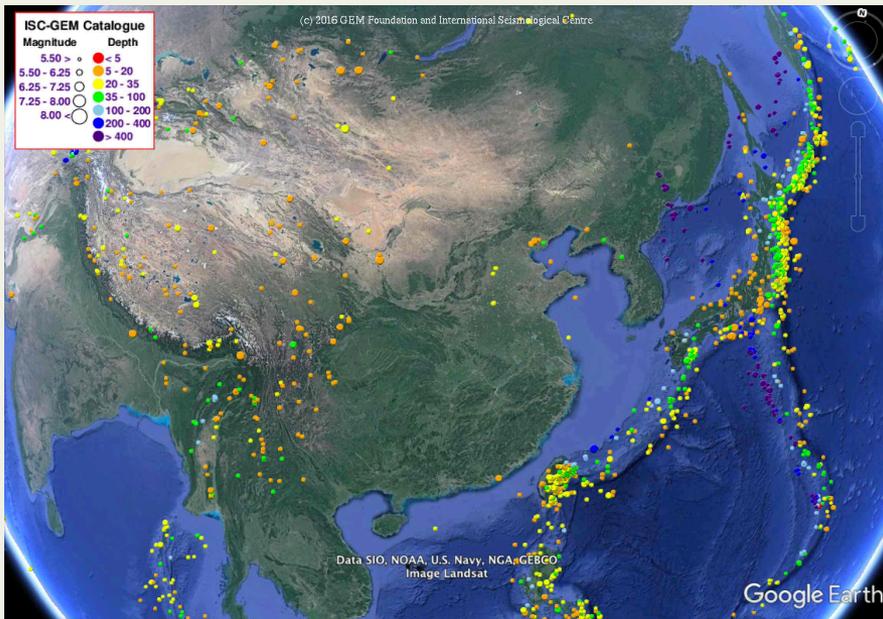
**417** stations

# 2. ISC Bulletin: Rebuild



**POSTER by Lonn Brown**  
**POSTER by Edith Korger**

# 3. ISC-GEM Catalogue (1904-2013)



The ISC-GEM Global Instrumental Earthquake Catalogue is built for the purpose of seismic hazard and risk assessment:

- ~24,500 homogeneous hypocentre locations and  $M_W$  estimates
- with the estimates of uncertainty
- covering ~110 years period
- prepared using uniform location and magnitude determination techniques,
- using original seismogram measurements

**1904-1917:**  $M_W \geq 7.5$  worldwide + smaller shallow events in stable continental areas

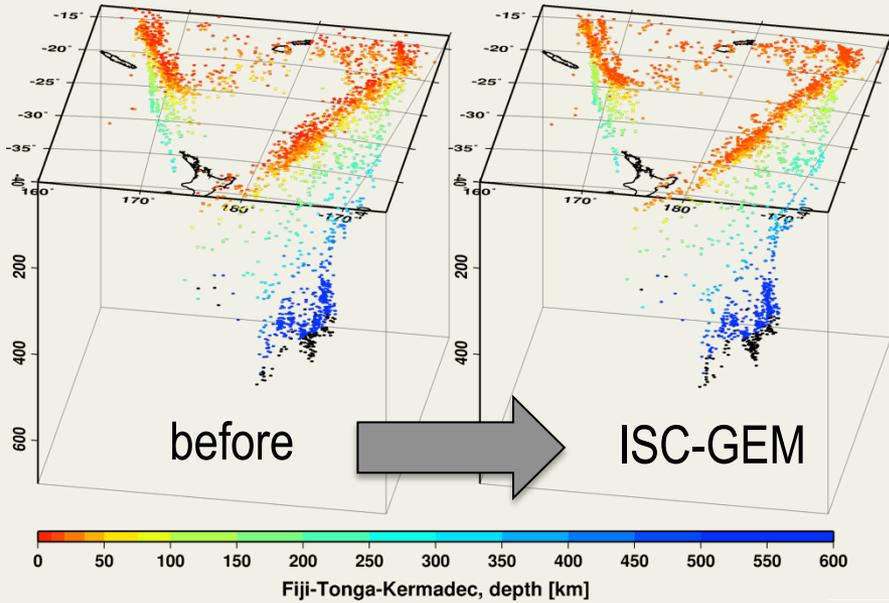
**1918-1934:**  $M_W \geq 6\frac{1}{4}$

**1935-2012:**  $M_W \geq 5.5$

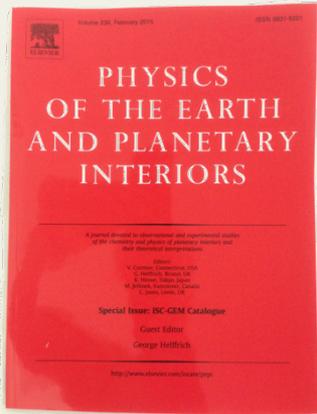
# 3. ISC-GEM: Homogeneity

All hypocentres and their uncertainties recomputed using a combination of **EHB** and **ISC** location techniques

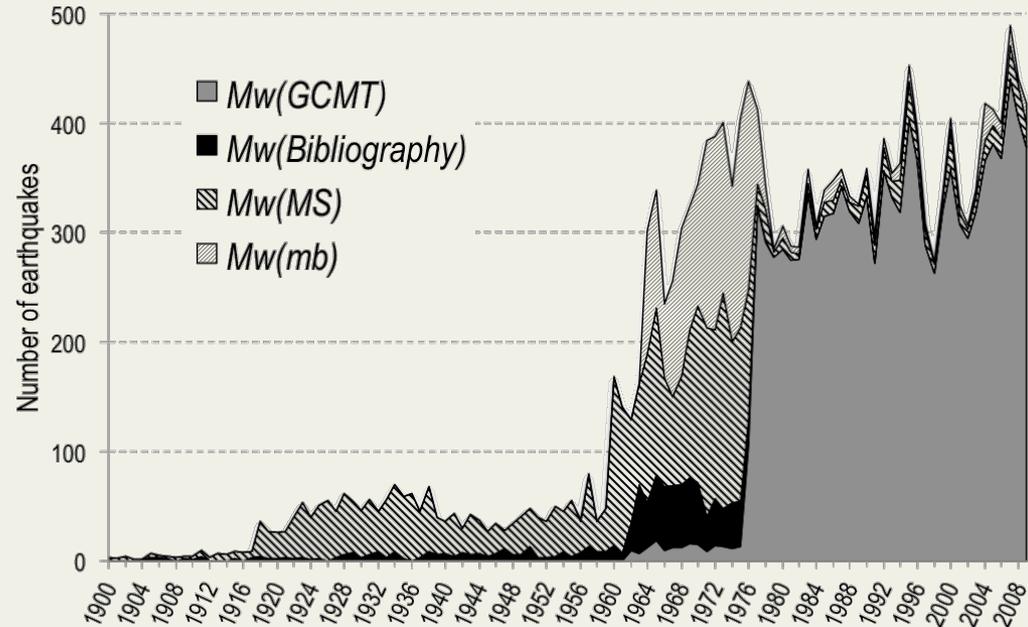
*(Bondár et al., 2015)*



All magnitudes are expressed in  $M_W$  scale with uncertainties  
*(Di Giacomo et al., 2015)*



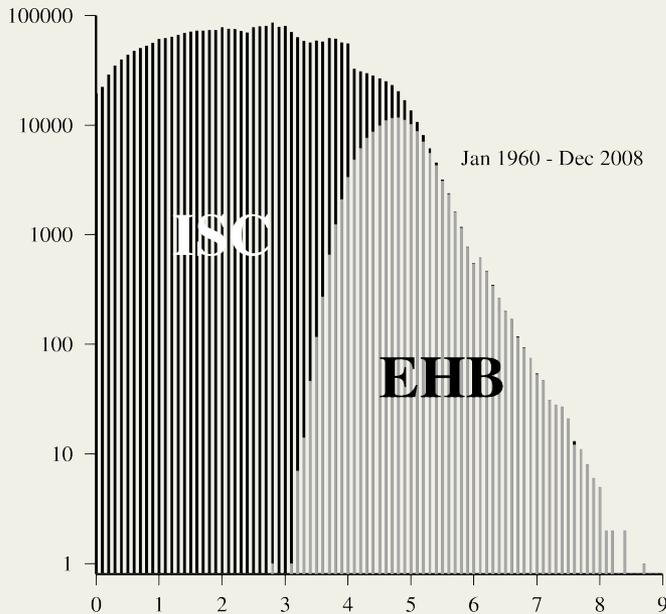
TALK by Domenico Di Giacomo



## 4. ISC-EHB (1960-2008)

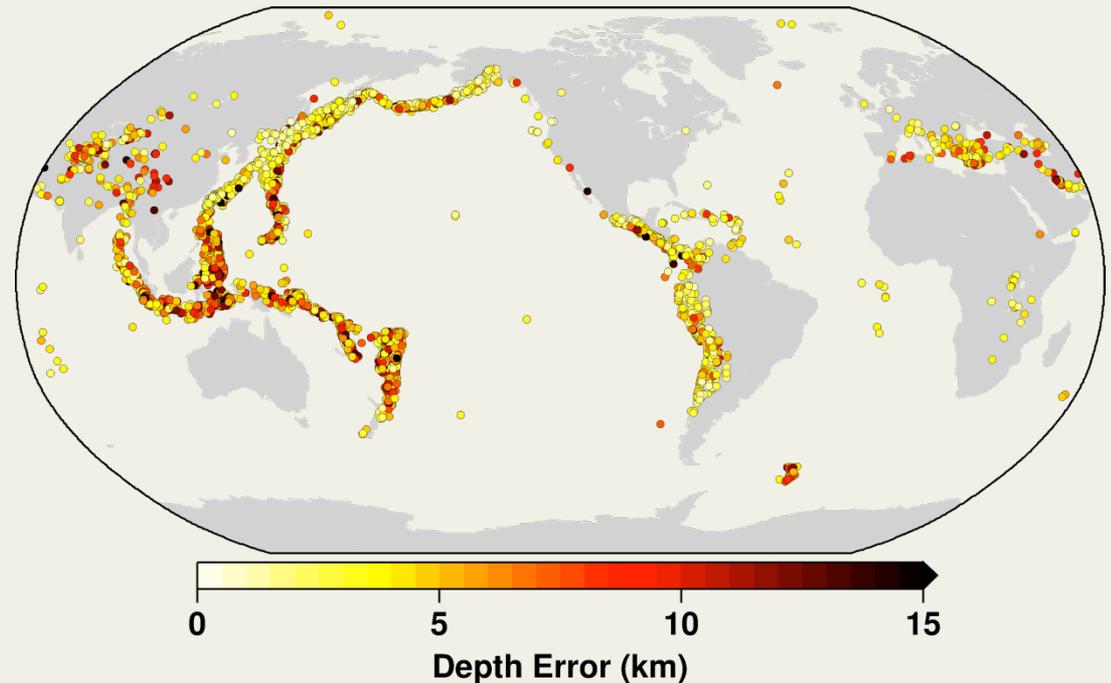
The EHB dataset was a groomed subset of the ISC Bulletin with well recorded seismic events relocated using (*Engdahl et al, 1998*) technique.

Together with Engdahl, we are preparing the **ISC-EHB** dataset that will benefit from EHB and new ISC location techniques and more rigorous and structured analysis.

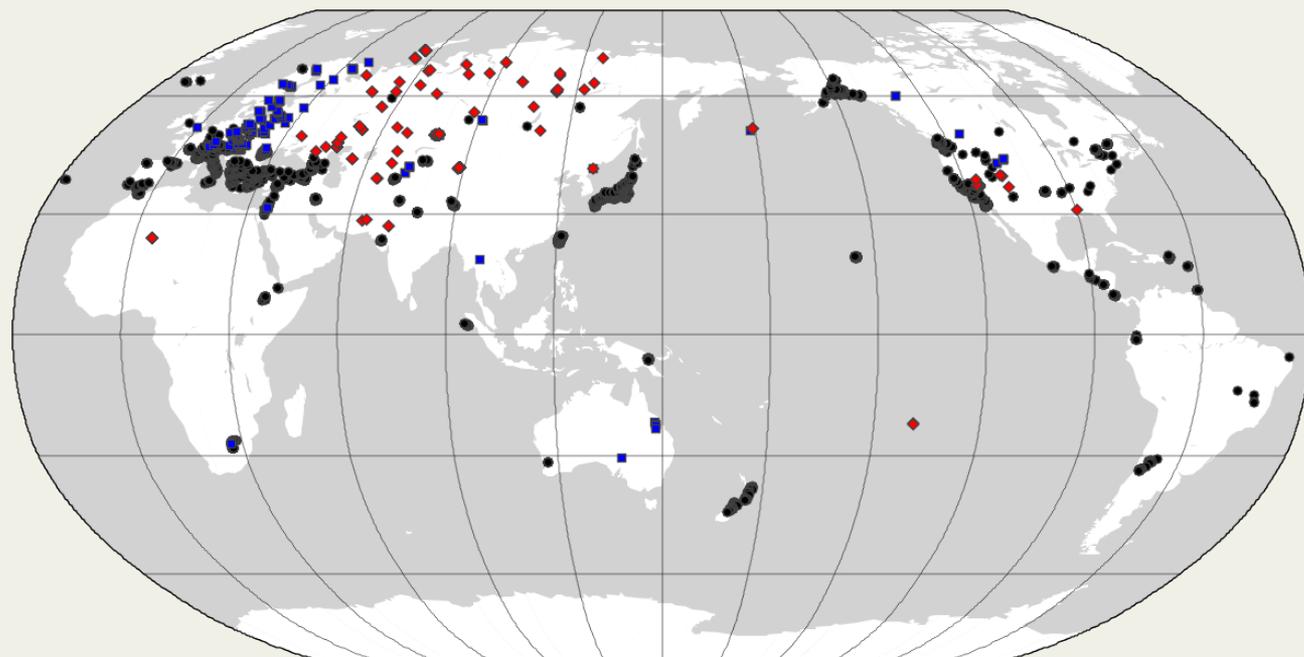


The main advantage of this dataset is that the event depths are generally better constrained as a result of a special analysis.

**TALK by Jen Weston**



## 5. IASPEI Reference Event List, **GT** (1959-2012)



• natural(7283) ■ chemical(261) ◆ nuclear(1029)

**8,573** GT(0-10)  
events with locations  
known with 95%  
confidence level:  
✓ natural  
✓ anthropogenic  
accompanied by  
**~870,000**  
associated seismic  
arrivals

The list is maintained by the ISC under the supervision of IASPEI

**TALK by Kostas Lentas**

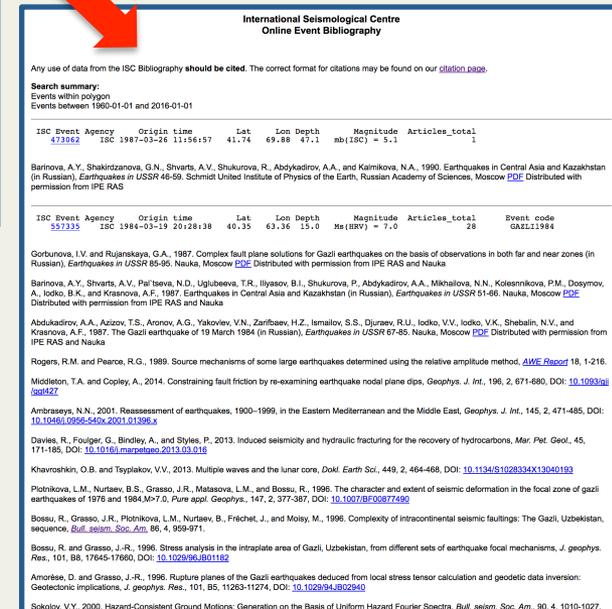
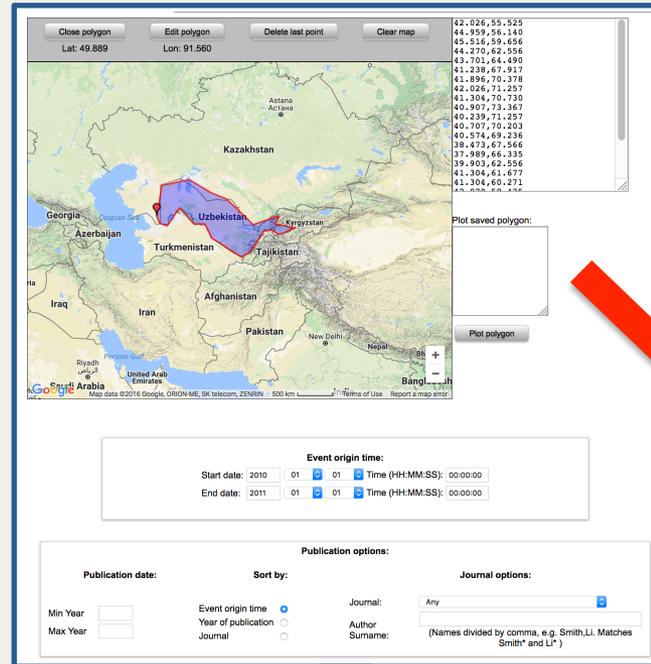
# 6. ISC Event Bibliography (1904-2016)

An interactive web-search for references to scientific articles related to seismic events in a particular region and period of occurrence/publication; includes articles in many fields of Geosciences;

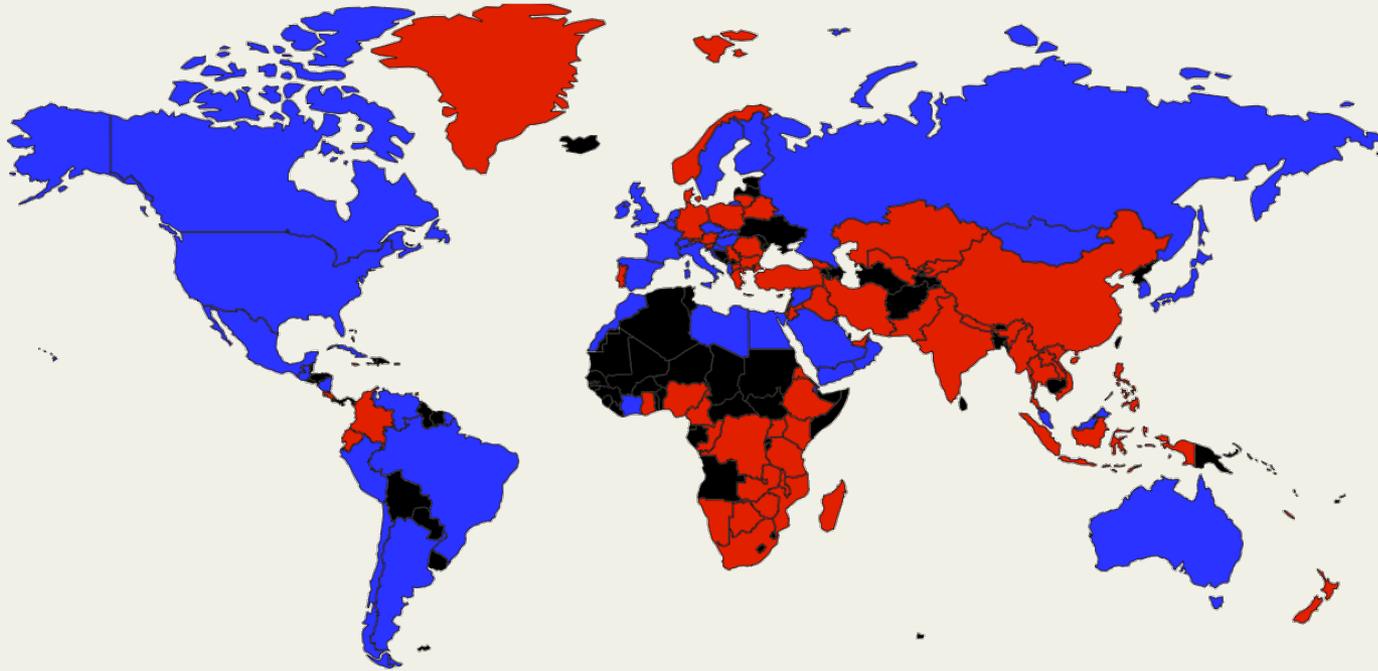
POSTER by D. Di Giacomo

Convenient web-search with immediate results

Events Bibliography includes both earthquakes and anthropogenic events.



# 7. Seismological Contacts



*Development of this database was assisted by:*

- IUGG
- CEA (China)

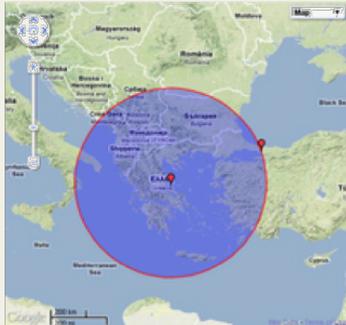
**RED** – institutes and individual members of staff are willing to share information and serve as a local point of contact.

**BLUE** – geophysical organisation(s) known, no specific individuals.

**BLACK** – no information.

# 8. CTBTO Link: Overview of searches

Four groups of searches:



Area based search



Station based search



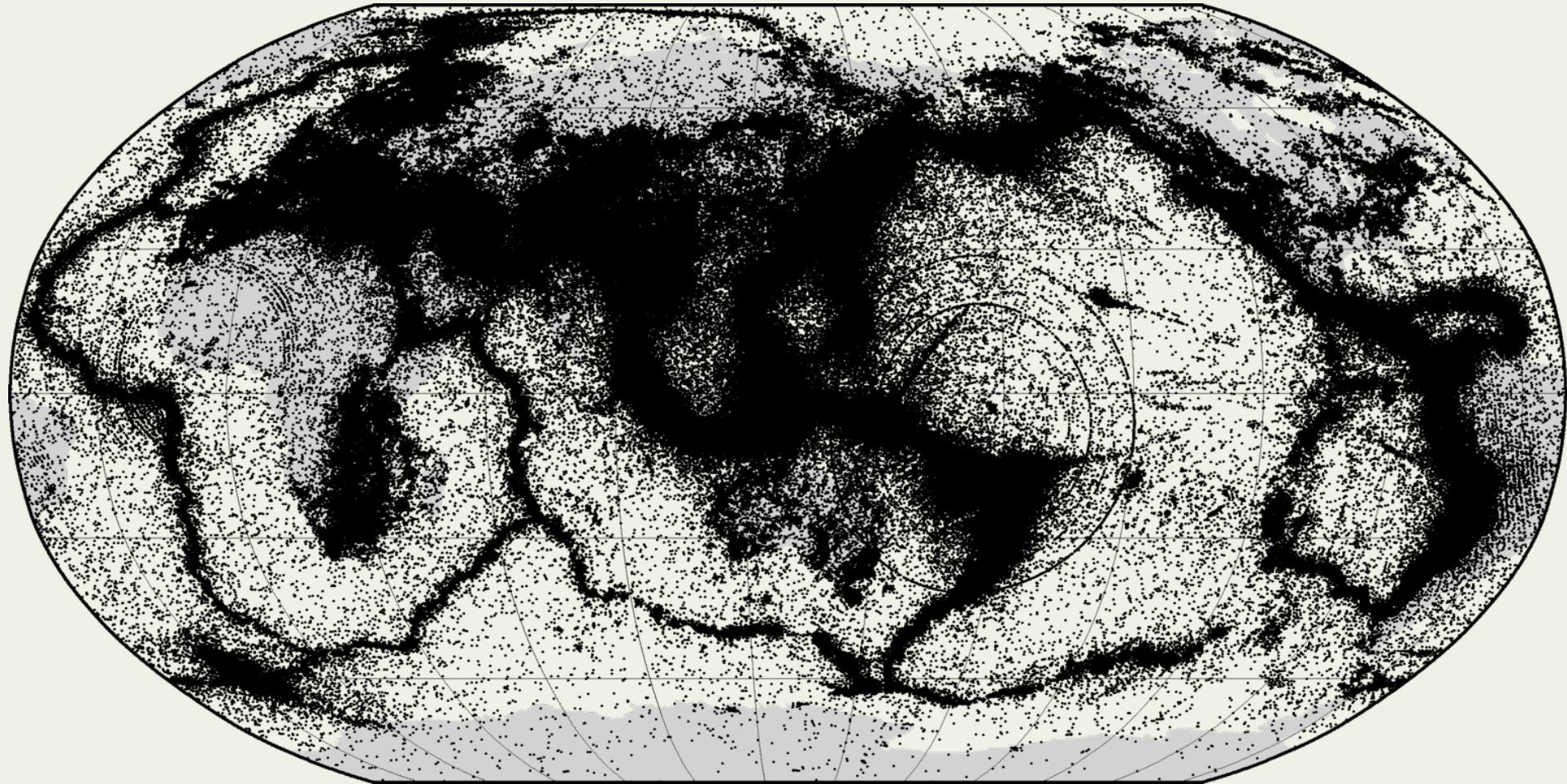
IDC Reviewed Event Bulletin (REB) search  
Waveforms of non-IMS stations for North Korea event are available [here](#)



GT search  
Waveforms of the Borovoye archive from nuclear explosions (1967 - 1995) are now available under the GT search. For more information click [here](#).

- **Area based** – spatio-temporal searches within the ISC Bulletin;
- **REB event based** – spatio-temporal searches based on specific events within the IDC Reviewed Event Bulletin; waveform previews and download assistance
- **IMS station based** – searches of station data proximate to a particular IMS seismic station.
- **GT event based** – searches for GT event waveform records.

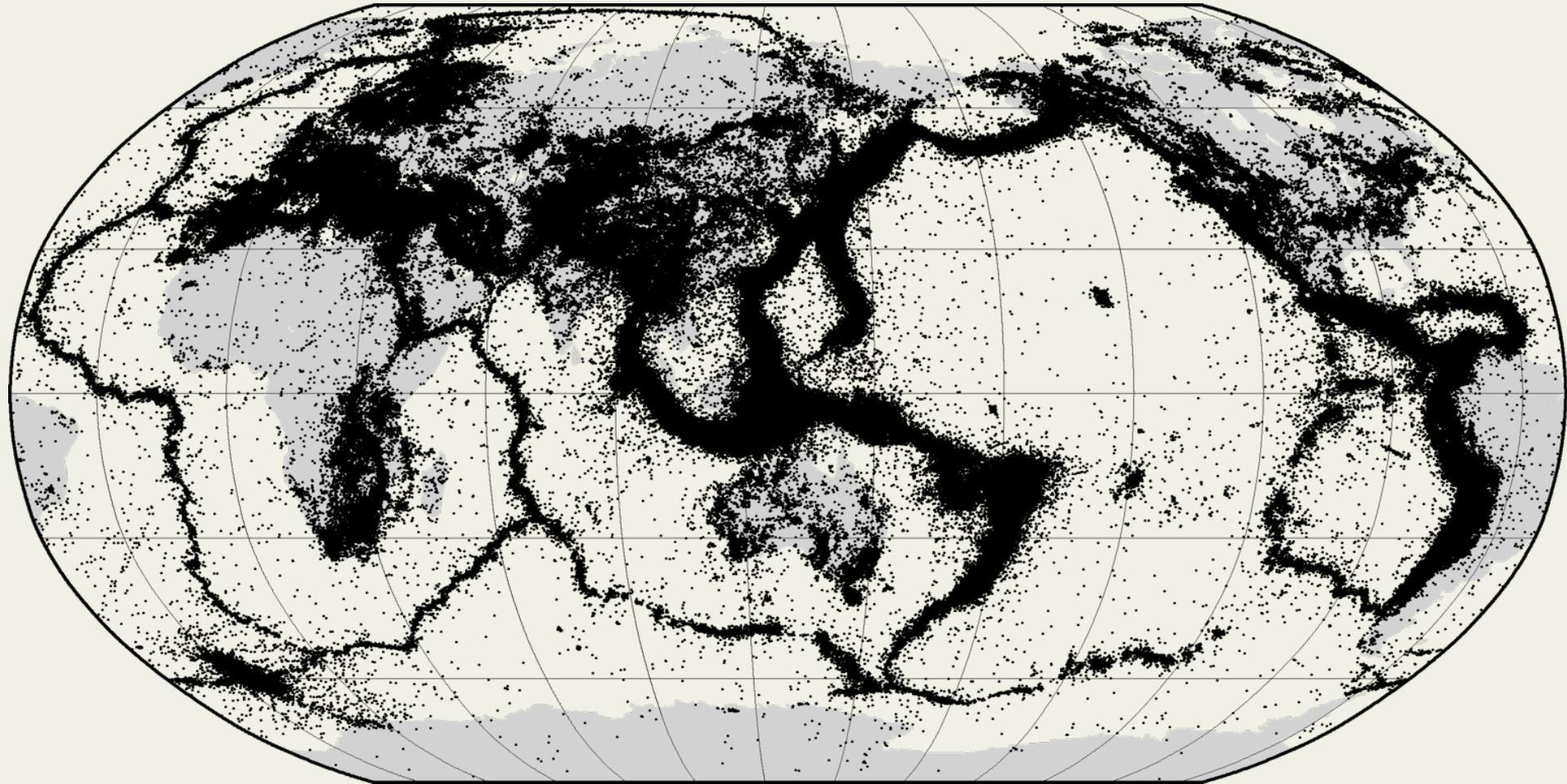
# All **hypocentres** reported to ISC by **other agencies**



1904-2016

**12M** hypocentres

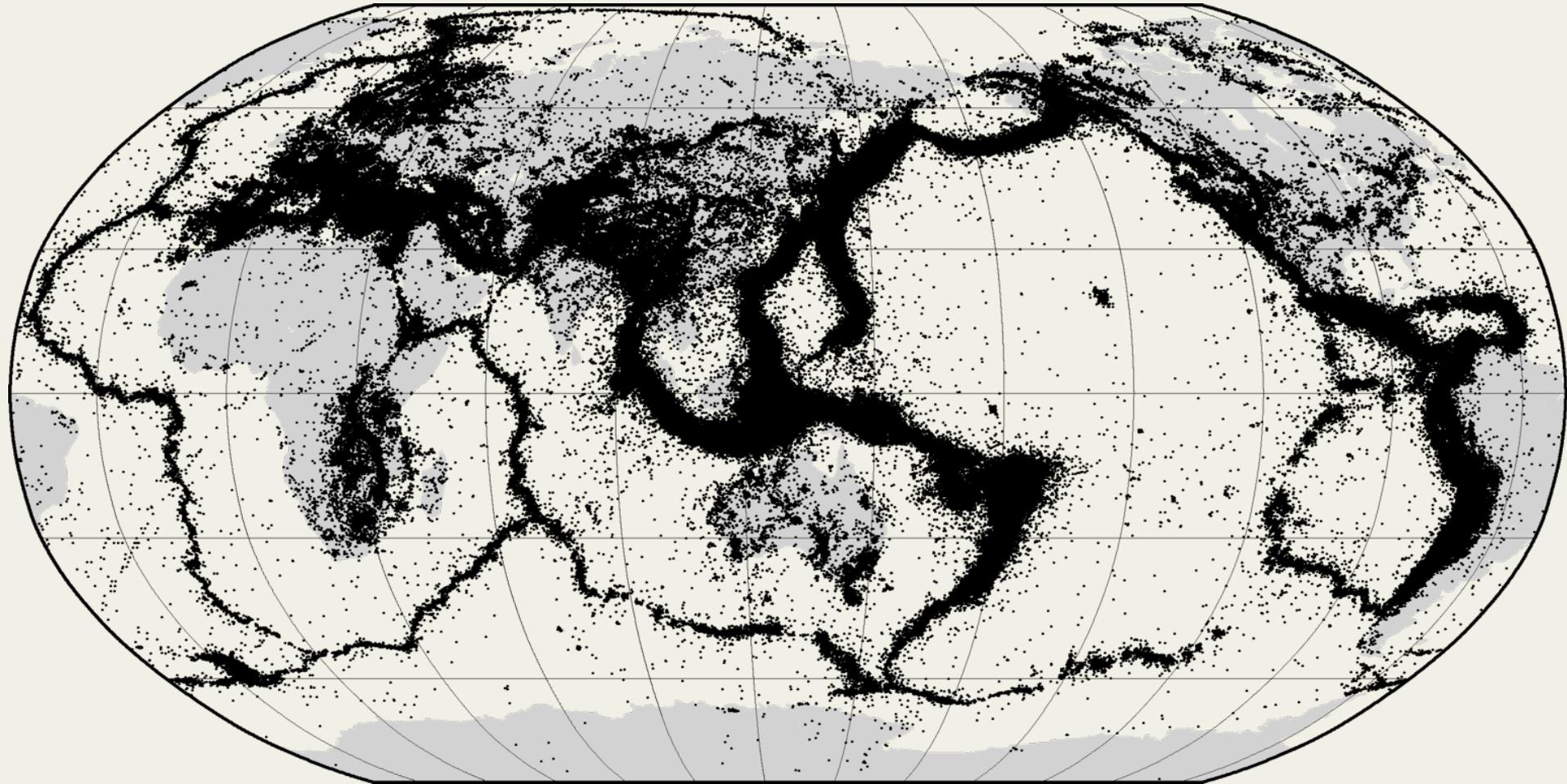
# Merged per event



1904-2016

6M events

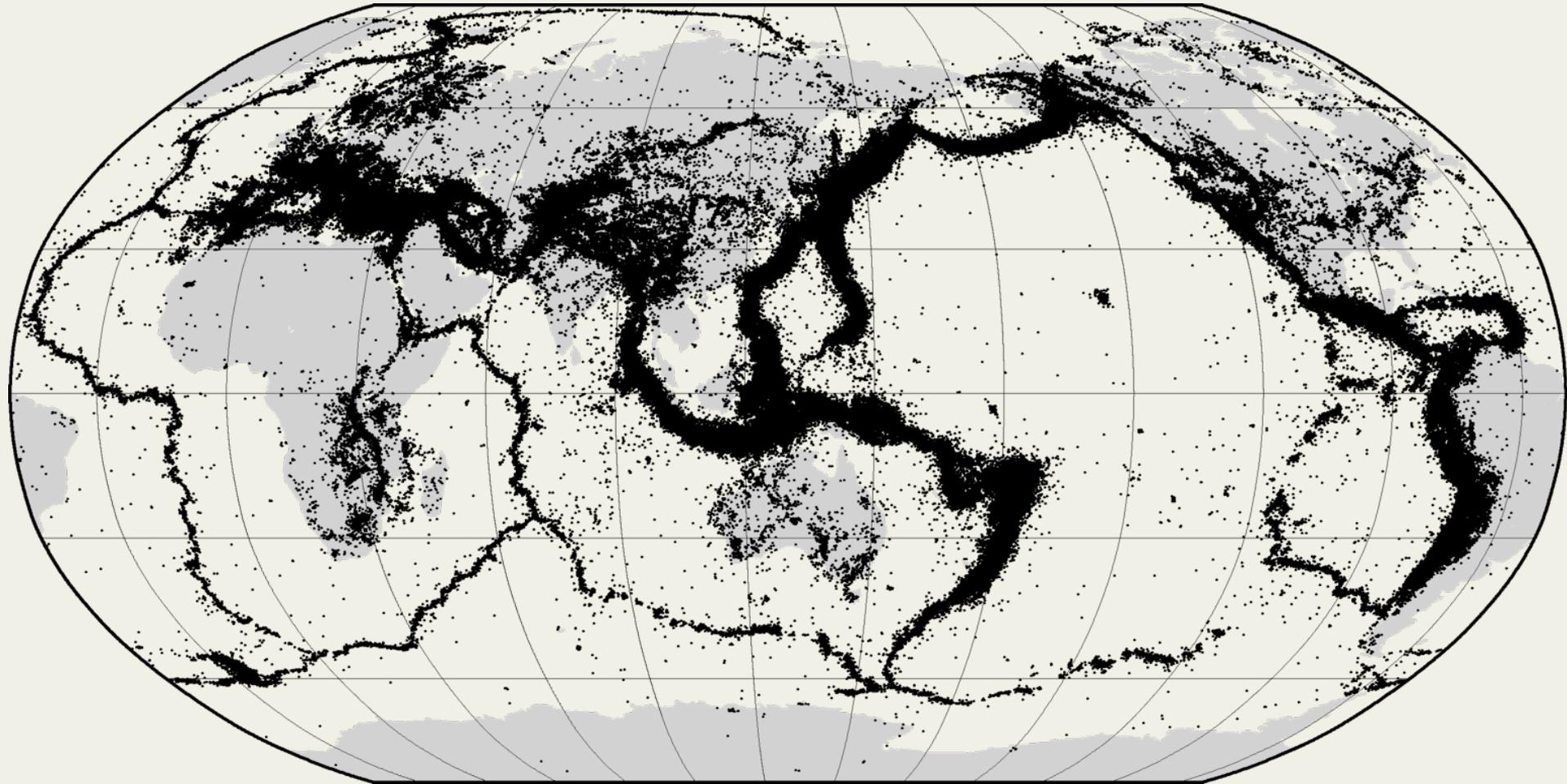
# Events **reviewed** by the ISC



1904-2016

**1.9M** events

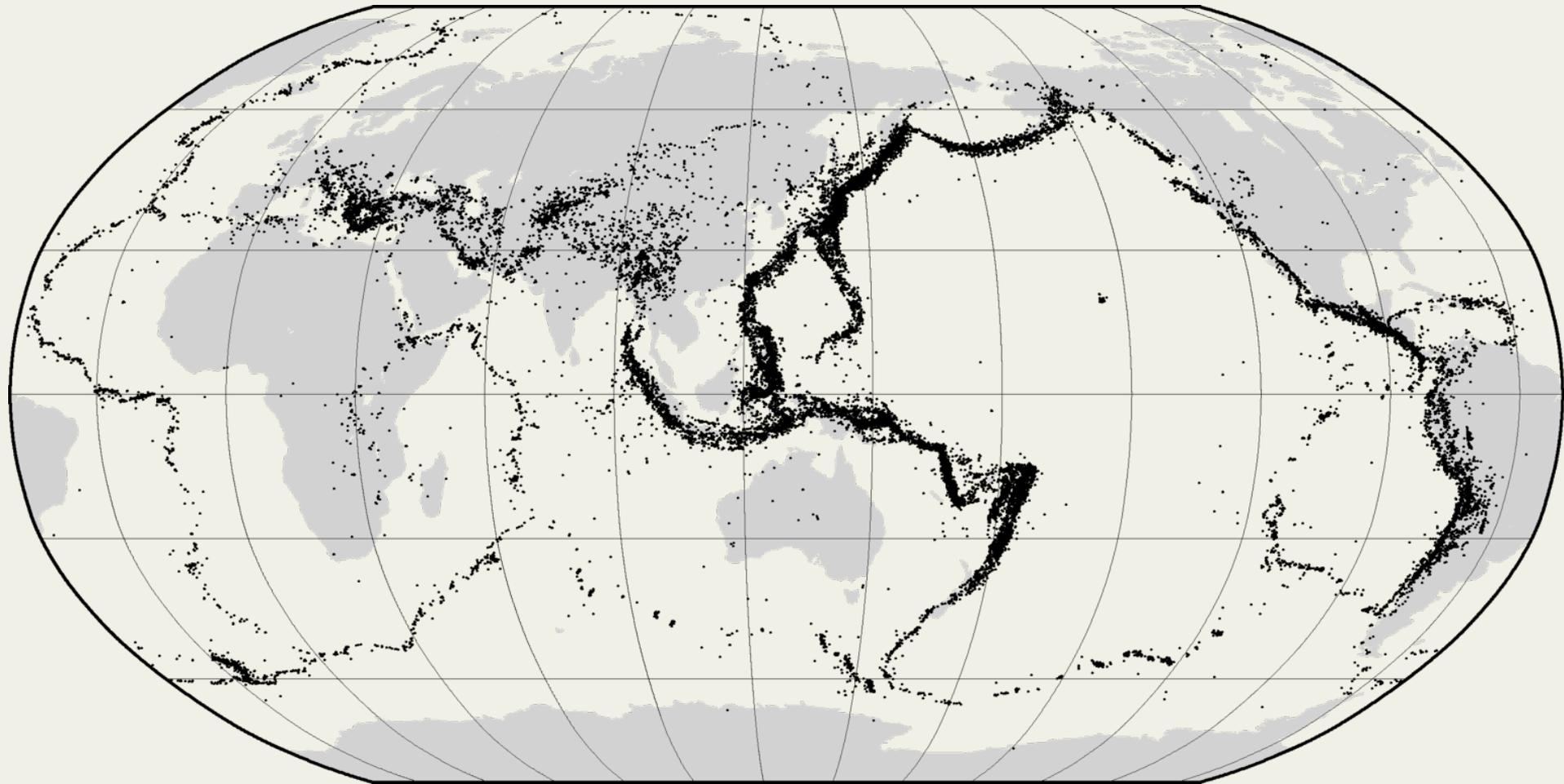
# ISC hypocentres



1904-2014

1.2M hypocentres

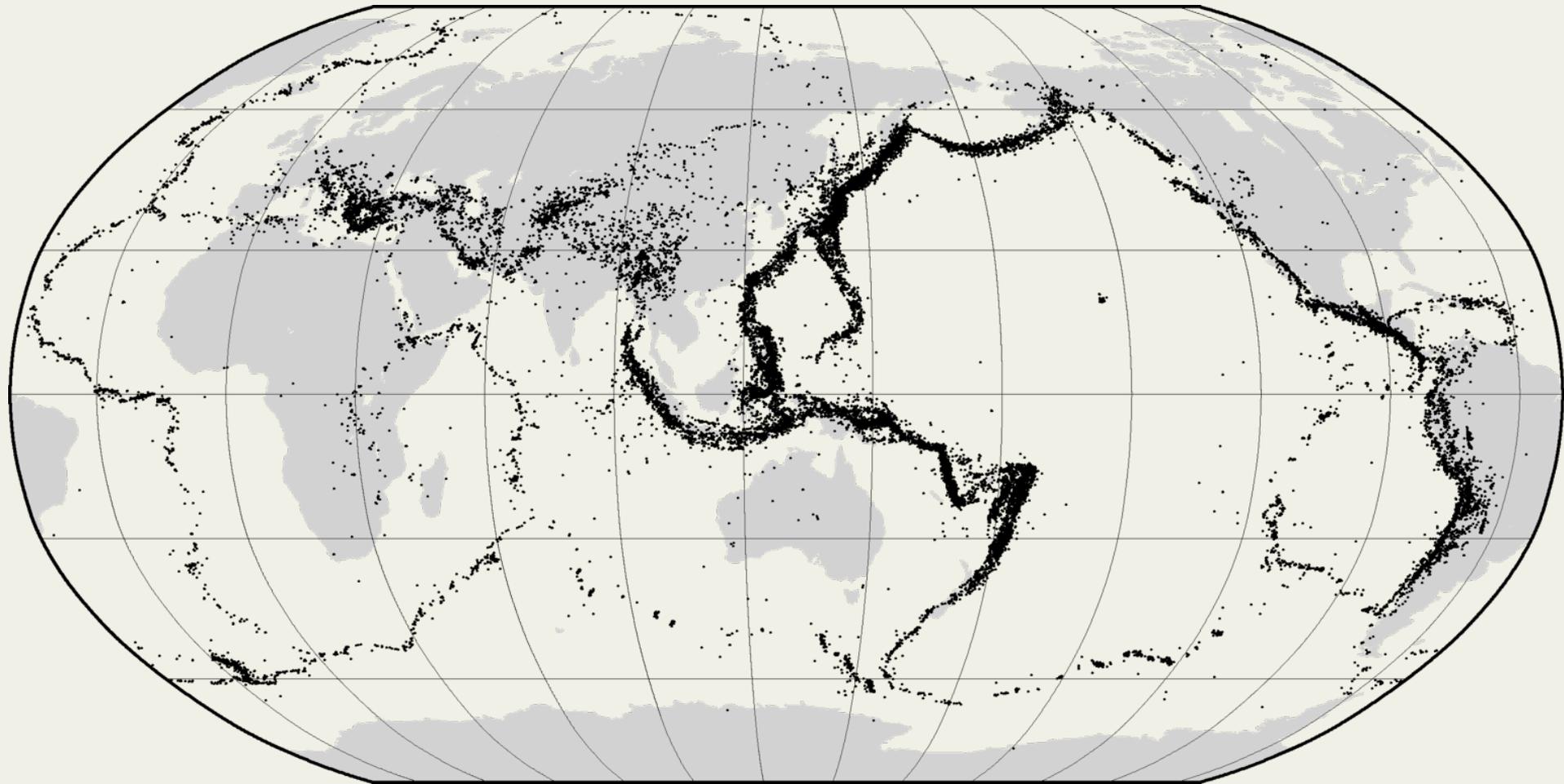
# ISC-EHB events



1960-2008

136K events

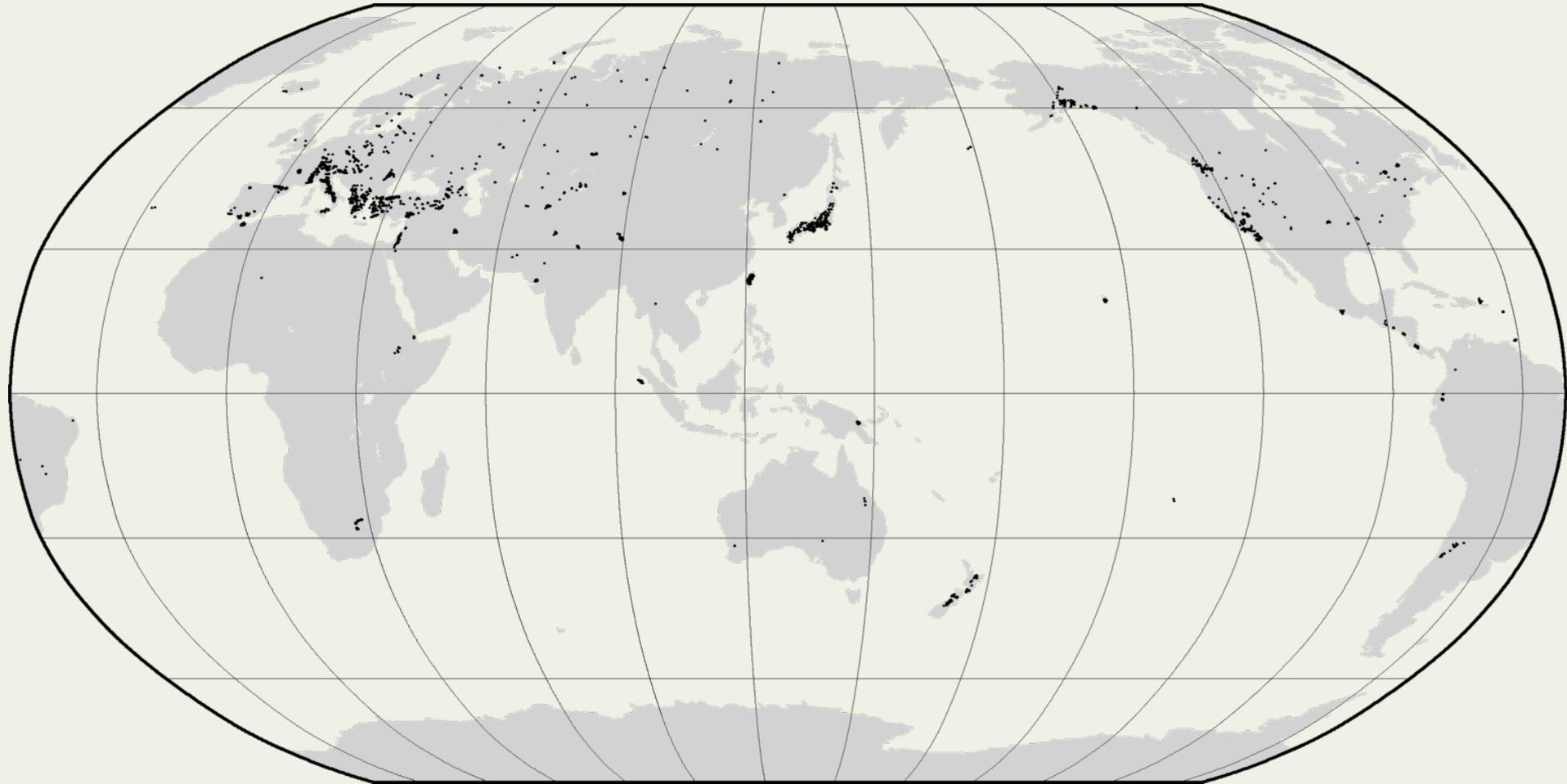
# ISC-GEM earthquakes



1904-2013

34K earthquakes

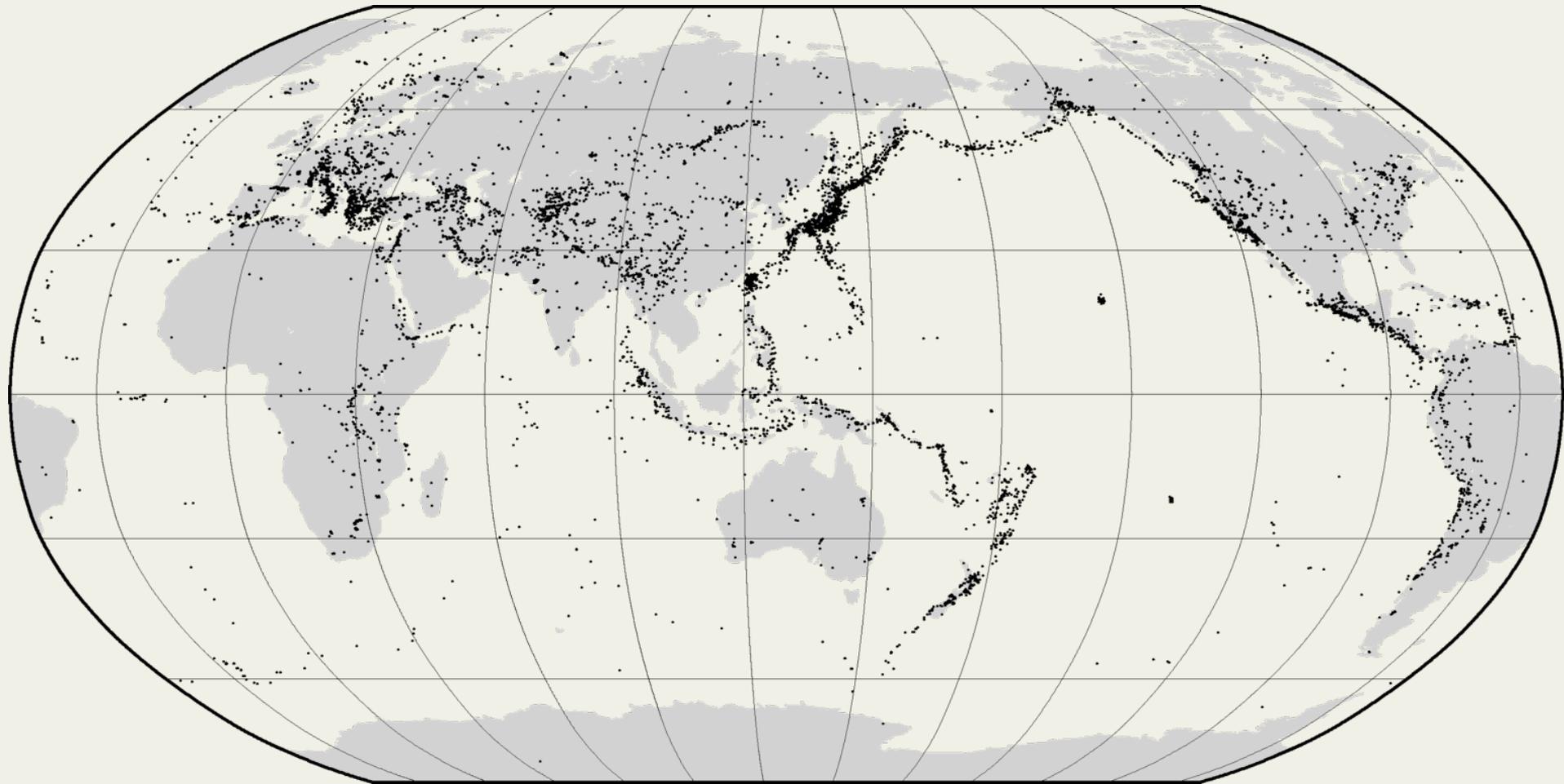
# GT events



1959-2015

9K events

# Event **Bibliography**



1904-2016

**15K** events

# Summary

- ISC continues its unique long-term international mission collecting and integrating seismic bulletins from **~130** agencies worldwide.
- The following ISC datasets and services are openly available:
  - ISC **Bulletin** (1904-2017),
  - **ISC-GEM** Catalogue (1900-2013),
  - **ISC-EHB** (1964-2008),
  - **GT** (1959-2013),
  - ISC **Event Bibliography** (1904-2017),
  - International **Station Registry** (1904 – 2017)
  - Seismological **Contacts**.
- The CTBTO Link to the ISC db is open to personnel of nuclear test monitoring institutions cooperating under the umbrella of CTBTO.

# Acknowledgements

**64** Institutions in **48** countries, including the **Royal Society**, **BGS** and **Blacknest** in UK, make the annual **membership** subscriptions to the ISC.

**14** international, public or commercial entities sponsor individual ISC **projects**:



PREPARATORY COMMISSION

*CTBTO Link to ISC database*



*International Station Registry*



*ISC Event Bibliography*



*Aon Benfield,  
Lloyd's,  
Guy Carpenter,  
Catlin.*

*ISC-GEM Catalogue*