

RELOCATING **ISC** BULLETIN EVENTS WITH **AK135**



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INTRODUCTION

The first workshop on modernizing ISC location procedures was held during the 2005 Santiago IASPEI General Assembly. Using a list of 156 well-located test events (GT0/GT5) selected from the IASPEI collection of Ground-Truth events, a number of prominent seismologists studied the effects of different location algorithms on location accuracies.

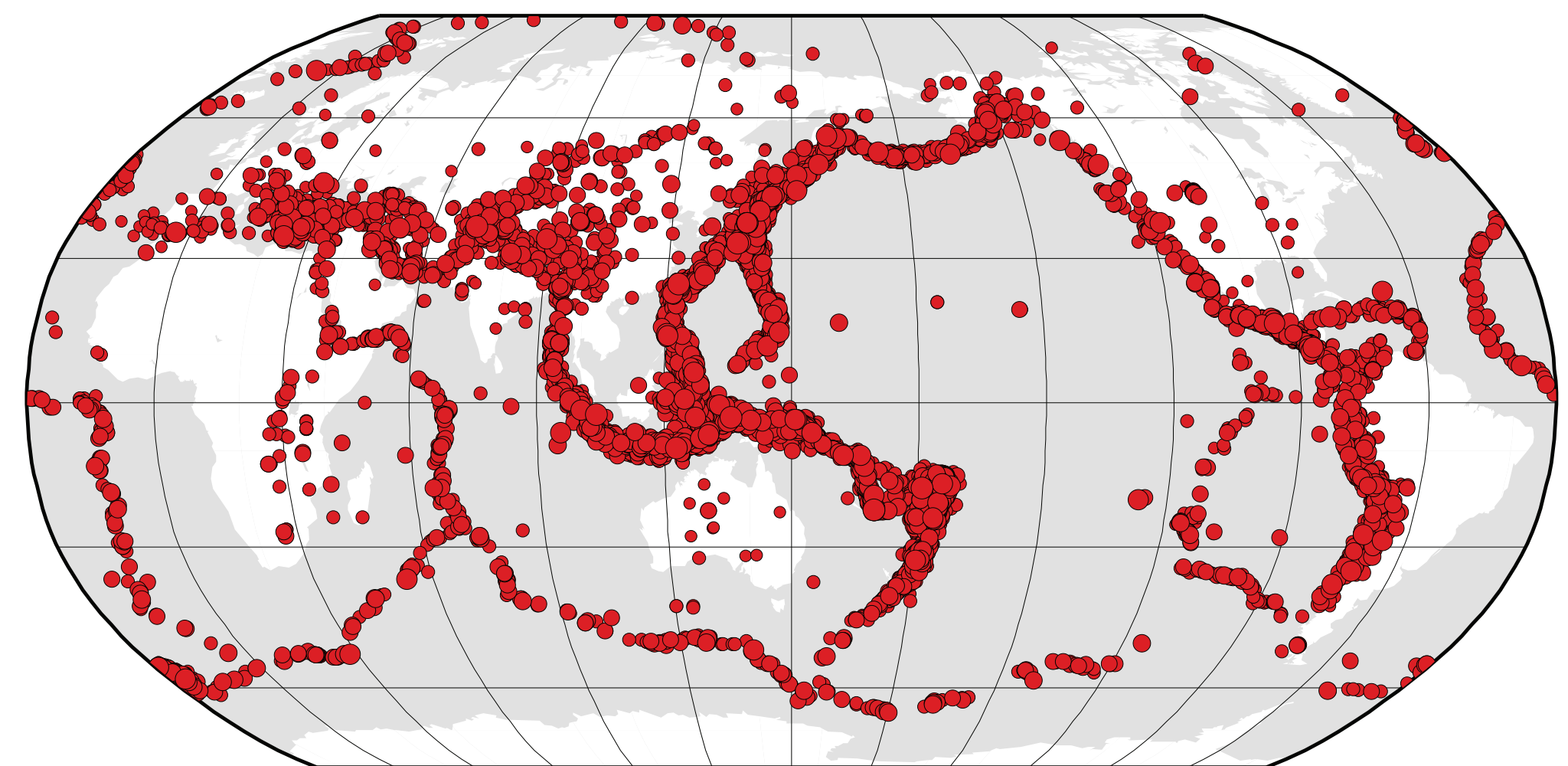
The first workshop participants recommended that the ISC considers changing the Jeffreys-Bullen (JB) velocity model, currently used in operations to locate seismic events, to a modern spherical Earth model with consistent travel-time tables for all major seismic phases. In particular the AK135 velocity model was recommended as the best candidate for this purpose.

To ensure that introducing new travel times into the ISC operation does not cause unwanted or unforeseen biases, the ISC was asked to

produce its Bulletin for several data months using the AK135 model as well as JB. The version of ISC Bulletin with JB and AK135 solutions, covering the period of Jan-Oct 2004, is now available to the seismological community from the ISC web-site.

We encouraged seismologists from different countries to use their local knowledge of geographic and tectonic regions to conduct critical comparisons of the ISC JB and the experimental ISC AK135 locations.

Approximately 15,000 events in Jan-Oct 2004 were located by the ISC using both JB and AK135 velocity models



We recomputed locations of seismic events of 10 most recent (at the time) months of Published ISC Bulletin, covering the period from Jan to Oct 2004, using the AK135 velocity model. Below we briefly describe the details necessary to understand the contents of this new bulletin.

Selection of events for relocation

There is no point comparing the results of ISC location of small events. Neither JB nor AK135 ISC solutions are likely to be as accurate as a solution of well-established local network. There is also no point producing an AK135 location in the case where JB solution is either not possible or where ISC editors have chosen not to publish an ISC solution. Based on this we have only considered the following events:

- Period of time: Jan-Oct 2004
- Strictly from Published (Reviewed) bulletin
- No data, received after the original analysis was completed, were to be used
- Only events with ISC JB estimates available
- Magnitude ≥ 3.5 .

We used ISC magnitude estimate if available. If not, we used an average of all reliable magnitude estimates reported for the event. If no reliable magnitude was available, events with at least one

station associated at 10 or more degrees were considered at least as large as 3.5.

Setting relocation options

At the ISC we try to get a free depth estimate where possible. Often, due to lack of appropriate data, the ISC has to fix the depth to a particular value. This value is one of:

- depth reported by local network with close stations and good azimuthal coverage;
- depth based on pP-P time intervals;
- default depth for the area.

For the purpose of our comparison, for each event we had to use the same way of dealing with depth for AK135 relocation as was used in JB location. Otherwise, the same location procedures - least squares with uniform reduction and the same set of determining phases:

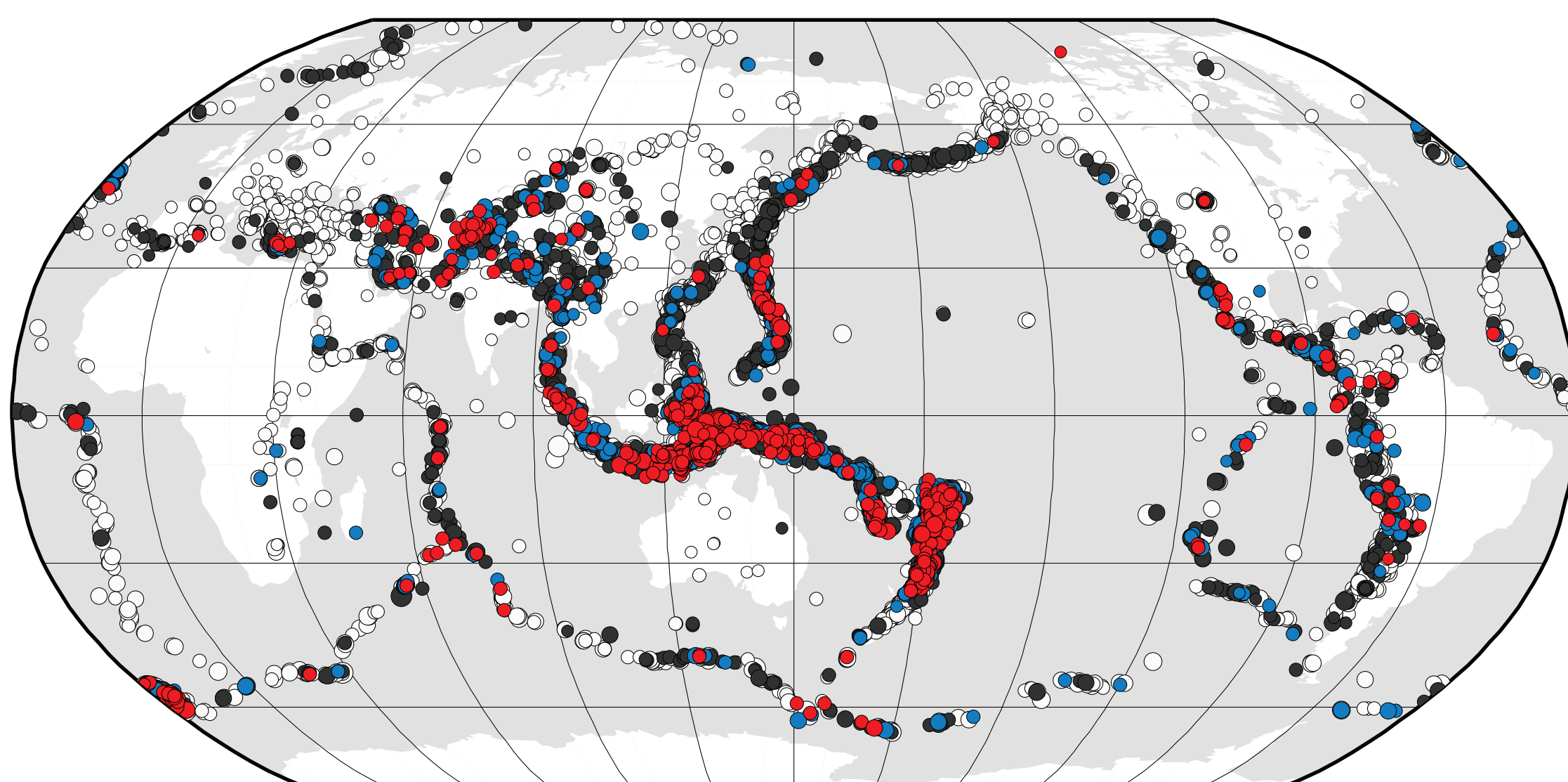
- P,
 - Pn, Pg, Pb,
 - S[weight factor 0.5 beyond 20 degrees],
 - Sn, Sg, Sb)
- were used for both JB and AK135 solutions.

Manual review

A great deal of time was spent on tuning the relocation procedures, where an ISC seismologist was making iterative spot checks of the results of relocation. This was done only for two months of data in order to come up with the final relocation procedure. There are still issues with some secondary phase identification and network magnitude computation that are not related to relocation process and therefore were not yet addressed to our complete satisfaction.

It should be everyone's understanding that AK135 relocations were not examined by the ISC seismologists as thoroughly as JB ones. Nevertheless, we hope that the great effort originally made by the ISC seismologists in editing the JB bulletin benefited AK135 bulletin enormously.

Discrepancy in event position between JB and AK bulletins



- 0-10km, 68%
- 10-20km, 21%
- 20-30km, 5%
- >30km, 6%

The following regions are analysed by the workshop participants:

Alaska
British Columbia
Central America
Andes
Fennoscandia
Poland
Mediterranean
Turkey
Iran
Caucasus
Siberia
Kamchatka
China
Island of Taiwan
Japan