# ASSESSMENT OF THE ISC JB AND AK135 LOCATIONS IN THE NW OF SOUTH AMERICA

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## ABSTRACT

We analyzed and compared the JB-AK135 ISC bulletin for January to October 2004 for NW South America, the region between 12N 10S and 60W 85W. The NW of South America is part of the lithospheric boundary between Caribbean, Nazca, South America plates. This complex region comprises subduction, intraplate and nest seismicity.

Using phase arrival-time data reported to the ISC, we select events with P readings recorded at more than 20 degrees, with S and PKP readings because of the AK135 effective representation. In this poster we used two approaches: statistical and seismo-tectonical.

Firstly, to avoid results influenced more by observation than by differences in the model, we relocated the selected group of events using controlled station geometries generated by bootstrap technique. The spatial differences in both depth and latitude-longitude position were statistically analyzed. We also analyzed and compared phase residuals and RMS for both catalogs to understand their uncertainty and relation with the locations.

The second approach is based in the seismo-tectonic local knowledge gained during more than 50 years of studies and observations in the region. This includes operation of local and regional networks (IGP, IGQ, RSNC, OSSO, and others). Using this knowledge, we compared JB and AK135 hypocentre solutions, provided by the ISC, with those recorded and processed by seismic local networks.

## DATA

We selected and analysed ISC's bulletin with Jeffreys-Bullen (JB) and AK135 earthquake locations in the region between 12N 10S and 83W 71W from January until October 2004. We found 290 earthquakes (figure 1b). We select phases from the catalogue with delta higher than 20°, finding 8751 P phases, 1847 PKP and 143 S phases to be analysed.

To compared these data, we used local hypocenters from seismological Centres in South-America : OSSO (Observatorio Sismológico del SurOccidente, Colombia - 591 events), RSNC (Red Sismica Nacional de Colombia – 5275 events), IGQ (Instituto Geofísico de Quito, Ecuador – 46 events) and IGP (Instituto Geofísico del Perú 1402 events). We compared the regional catalogue (figure 1a) and ISC catalogues finding 190 identical events in both catalogs.

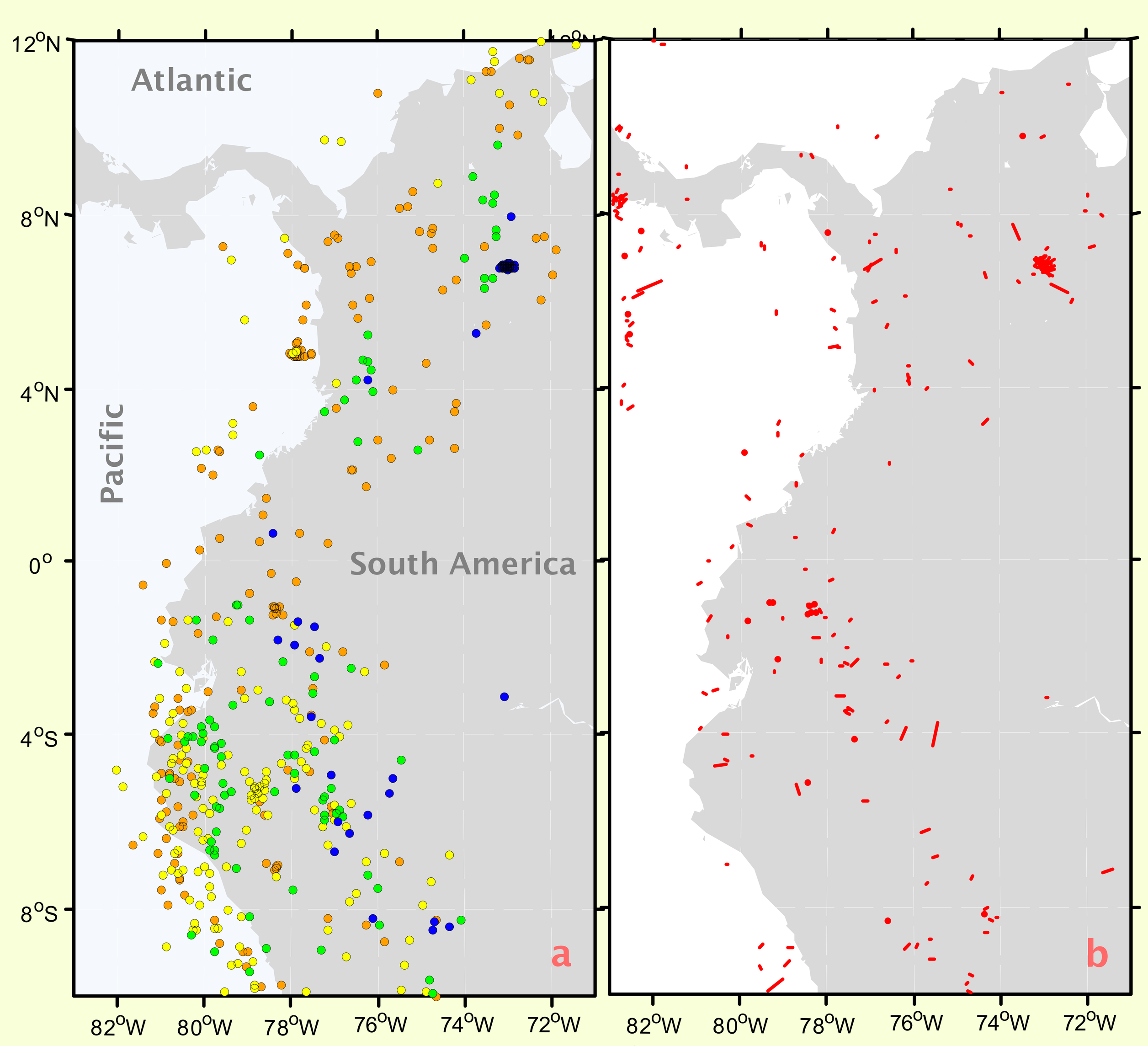



Figure 1. Map of N South America seismicity, January to October 2004, **a.** Regional Network locations, **b.** vectors from JB to AK135 locations

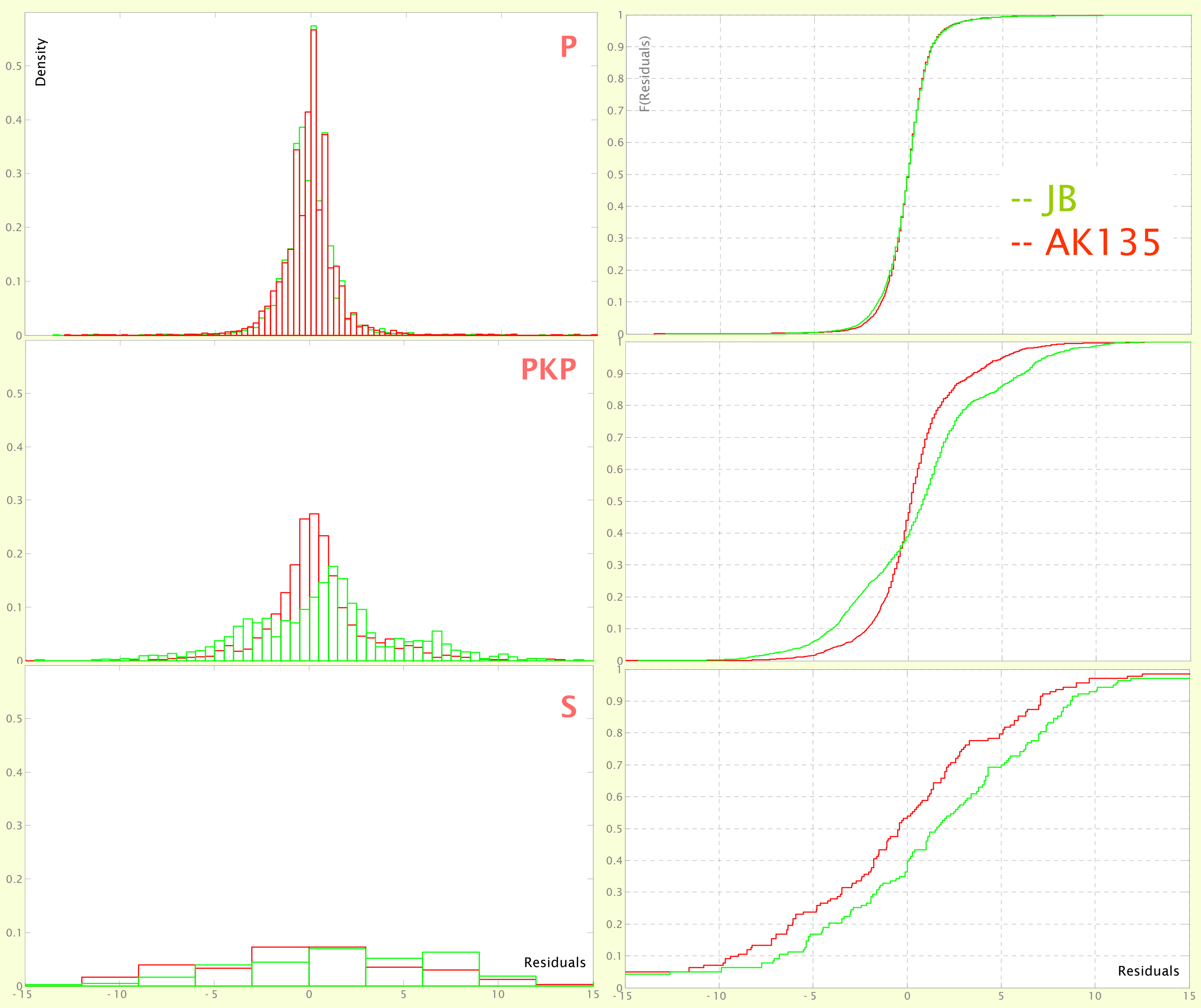
## METHOD

We relocated events using the same algorithms and weighting scheme been used by ISC, but we had restricted only to phases with delta higher than 20°. We applied the bootstrap technique to station (removing all phases for a particular station at time), and then calculated the average values for epicentral location, depth, RMS and phase residuals for all the estimations.

A quantitative comparison was done using a probabilistic approach: the empirical cumulative distribution function (ECDF, F(x)). Both samples (JB & AK135) with parameters of epicentral location, depth, location RMS and phase residuals were compared with local and regional network's locations.

The Kolmogorov–Smirnov (K-S) test was used to compared the difference between the distributions of 1) phase residuals, 2) RMS location and 3) differences between epicentral location of the samples. We used this statistics because it is a distribution-free, so it is valid for any continuous population distribution (Willemann, 2003).

## TRAVEL TIME RESIDUAL ANALYSIS




The graphic shows the density of samples (left) and empirical cumulative distribution (right) for the different analysed phases (P, PKP, and S) for both JB (green) and AK135 (red).

Almost all hypocenters solutions were controlled by the P readings, because those are more than 80% picked and reported phases.

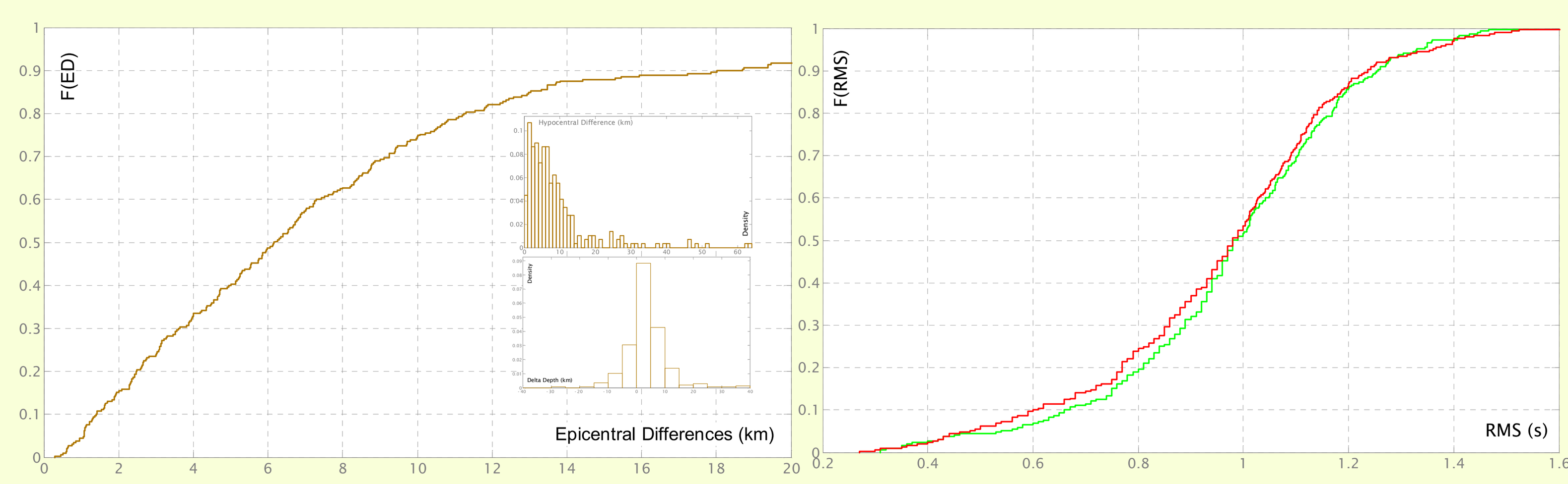
For P, PKP and S phases the difference between their distributions were significant at 5% level of confidence. The Kolmogorov Smirnof statistic is 0.02, 0.17 and 0.8 for each phase respectively.

ECDF shows that for P phases their residual's distributions are almost the same, but for PKP phases the ECDF shows an improvement in the AK135 residuals as they are concentrated around 0.

## SPATIAL VARIATIONS OF HYPOCENTERS

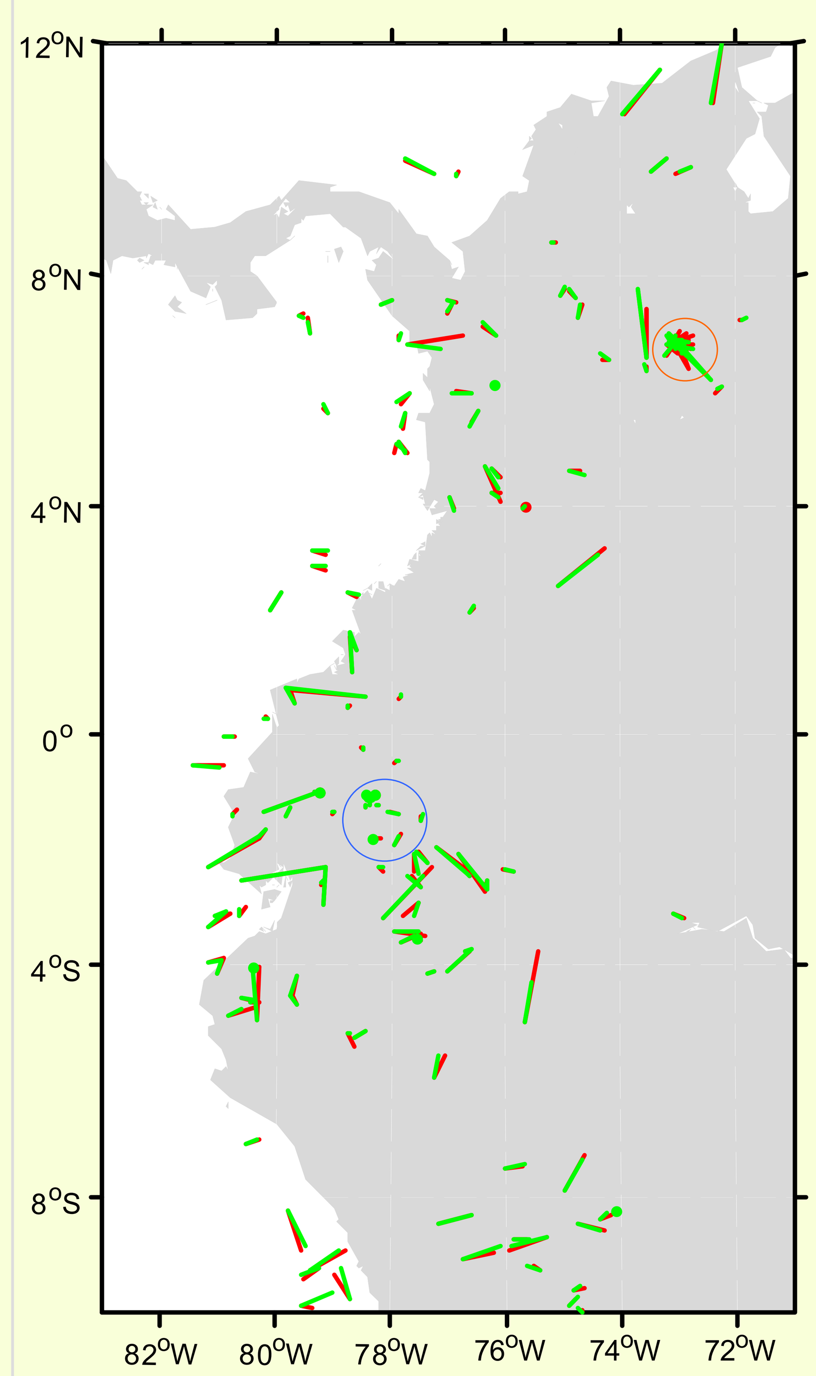
Analysis of RMS for JB and AK135 locations yields almost the same results.

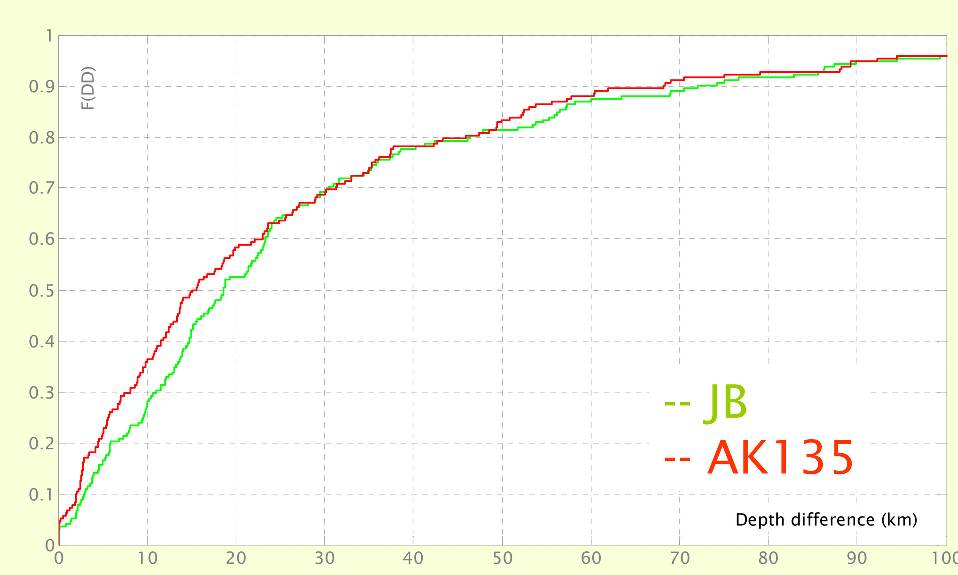
The ECDF (right) shows a small difference for this parameter (K-S statistic is 0.05) been AK135 slightly better than JB.

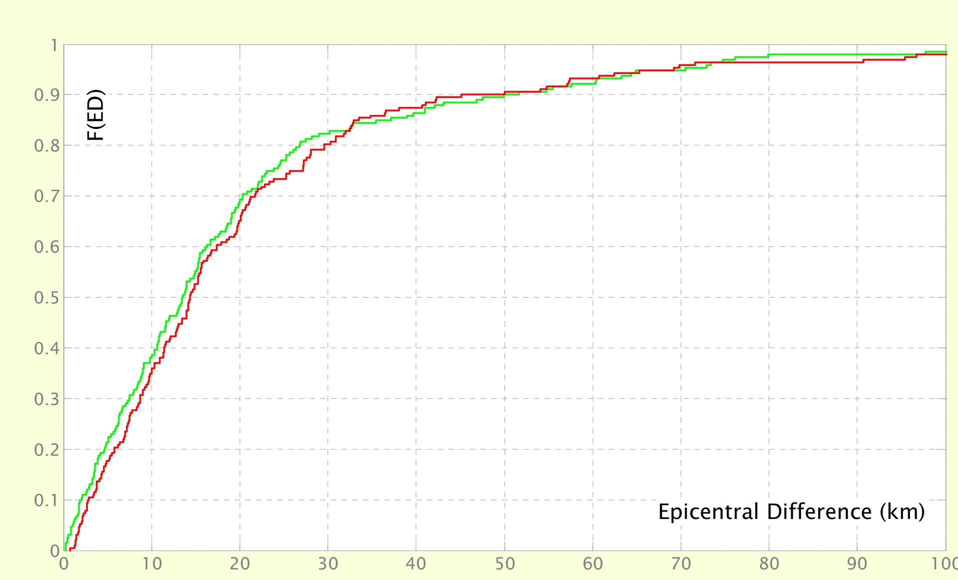



Distance between both locations (JB & AK135) are concentrated between 0 and 10 km.

## COMPARISSON WITH HYPOCENTERS FROM LOCAL – REGIONAL NETWORKS






Epicentral differences between JB & AK135 hypocenters and regional-local locations were analysed. Earthquake displacement vectors (left), show that JB has larger displacements than AK135, particularly in Bucaramanga nest.

Differences in location were small when a regional agency reports hypocenters to ISC. A closest hypocenter's seed for the location algorithm (i.e.. IGQ reports)

The epicentral difference's ECDF shows that epicentral solutions using JB are slightly closer to local solutions than using AK135, K-S statistic is 0.7.

Depth is better determinate with AK135 than JB compared whit local-regional locations.

## CONCLUSIONS

In general, the information analyzed shows a small improvement using AK135.

PKP could improve earthquake location, since it is better predicted when AK135 is used.

We observed smaller RMS location values with AK135.

By comparing earthquakes located by regional-local networks for N South America with JB & AK135 models we found slightly better performance in the epicenter when JB is used, but an improvement in the depth estimation when AK135 is used.

## REFERENCES

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