



RELOCATING THE EURO-MED BULLETIN USING THE AK135 VELOCITY MODEL

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From 2008 onward, the EMB is computed using the ak135 global velocity model (Kennett and al., 1995), in agreement with the current IASPEI recommendations. However, from 1998 to 2007 the EMB was calculated using the Jeffreys-Bullen (JB) velocity model (Jeffreys and Bullen, 1940) associated to local velocity models. In order to provide a homogeneous bulletin for the entire period, the EMSC back processes the EMB for years 98-07 containing more than 178 600 events. This effort took five months, including the development and tests of the relocation procedures. Today, the new release of the Euro-Med Bulletin 98-08 with all events computed with the ak135 velocity model is available.

The first issue we encountered while reprocessing the data concerns station coordinates. In the past the rules defined by the International Registry were not strictly followed by all the networks. Consequently station code for several stations have changed. Approximately 50 station codes have been updated in 2010, in collaboration with the ISC and the NEIC.

EMSC computes only a new location for events reported by several network (35% of total events). Indeed, for events reported by a single network (reported events), EMSC does not calculate location, the local network location is reported and time residuals are updated.

The entire processing of the 178 600 events takes 15 days. At the end of the relocation process, events with a difference in location and depth between the JB and ak135 less than 10 km, have been automatically validated (85% of events). For the remaining events (10 000 events) a manual review was required.

The principal corrections made during the manual review concerned depth estimates. Indeed, large variations in location were often associated with large variations in depth, and by fixing the depth to the value reported by the local network or to a default depth for the area, we were able to reduce the discrepancy in location between the JB and ak135 solutions.

Moreover, for events before 2003, larger differences between the JB and ak15 locations were due to misassociation of distant free phases, and because near stations were removed during the original EMB production. These problems were identified in the past but back process was not realized, since then a more accurate review procedure is performed.

Final comparison between the JB and ak135 locations for $M > 2.5$ events recorded by several networks from January, 1998, to December, 2007 (42 760 events) shows that no significant discrepancy is observed between the two models for the Euro-Med region. For 78% of events, differences of less than 10 km are observed between the JB and ak135 solutions (Figure 1- Table 1) and the most significant deviations are observed in southern Greece, Crete, the Strait of Gibraltar, Northern Africa, Northern Ethiopia, and Aqaba Gulf (Figure 2). More generally, the greater differences are observed near the edges of the Euro-Med region where azimuthal coverage is poor. The effect of large azimuthal gaps can be observed in increasing deviations between JB and ak135 locations (Figure 3).

Furthermore, in order to assess the relative performance of the JB and ak135 models, hypocenter solutions from the two models are compared with the authoritative locations when possible, as defined during the 2010 EMSC General Assembly.

Only 7% of locations provided by the local networks are authoritative. Among our set of 42,760 events, 7769 have an authoritative location. Events are located in regions where the seismic networks are the most densely distributed (Figure 5). By comparing JB and AK135 to authoritative locations, we found slightly better performance in the epicenter location from 4.3 km to 4.0 km and an improvement in the depth estimate from 6.0 to 5.8 km when ak135 is used (Figure 4 – Table 2). However, we can not conclude which from ak135 or JB model is the best as each local network uses its own model, Some of them used local or ak135 velocity model. It is obvious that new EMSC solutions computed with the same model as the local solution will be closer to the authoritative location than JB solution.

As a conclusion, no systematic bias is expected for locations in the Euro-Med region with the introduction of the ak135 velocity model.

Figures

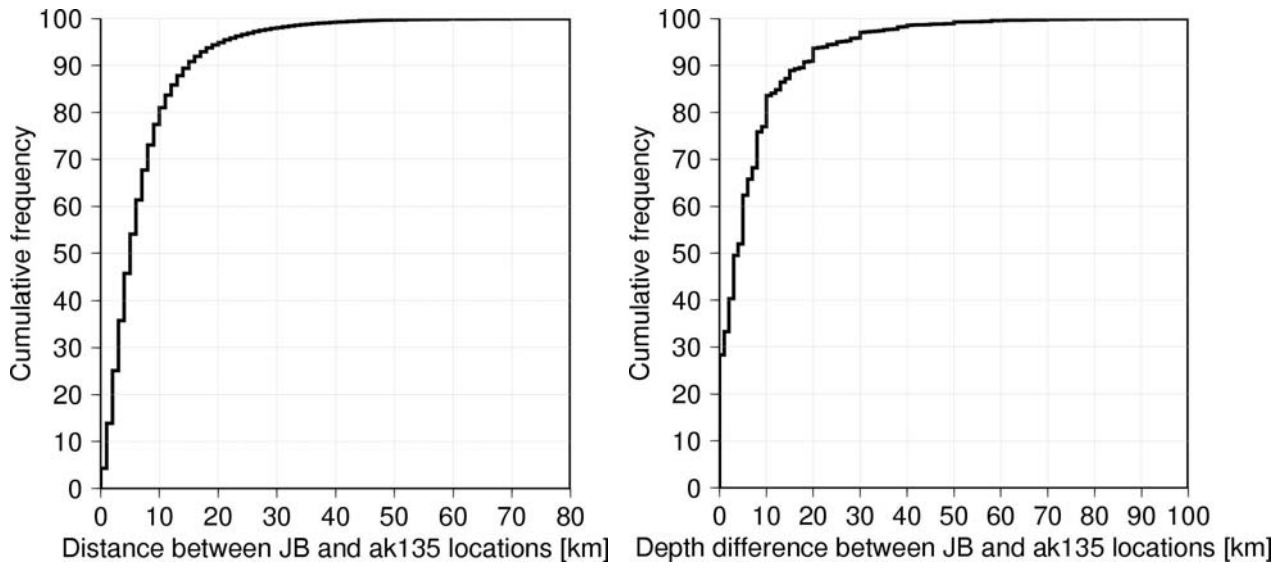


Figure 1: Cumulative distribution of location and depth differences between the JB and ak135 locations for $M > 2.5$ events recorded by several networks from Jan 1998 to Dec 2007.

	Dloc [km]	Abs(Depth) [km]
Maximum	227	112
Average	6.9	6.05
Median	5.4	4.0
95%	21	30

Table 1: Statistics on location and depth differences for $M > 2.5$ events recorded by several networks from Jan 1998 to Dec 2007.

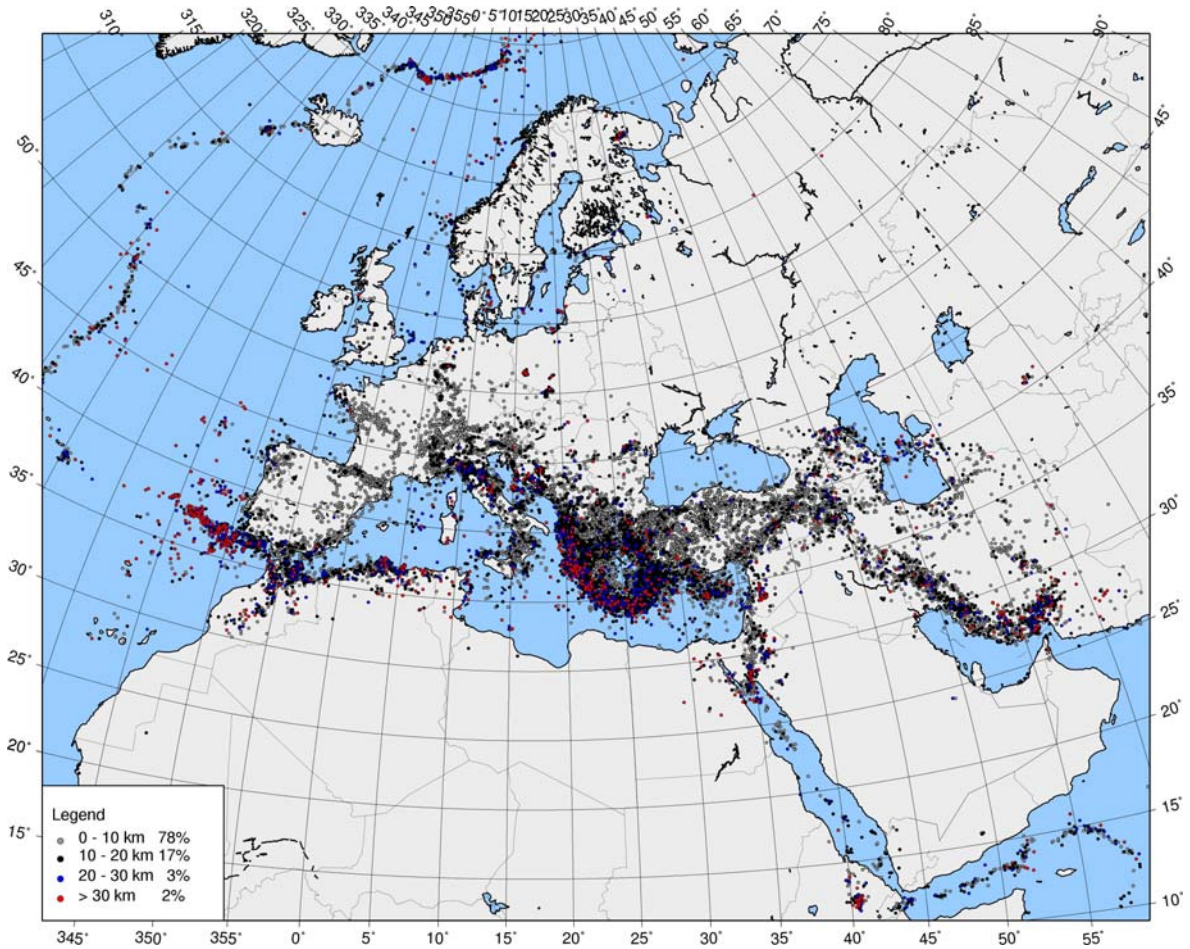


Figure 2: Discrepancy in event locations between JB and ak135 for $M > 2.5$ events recorded by several networks from Jan 1998 to Dec 2007.

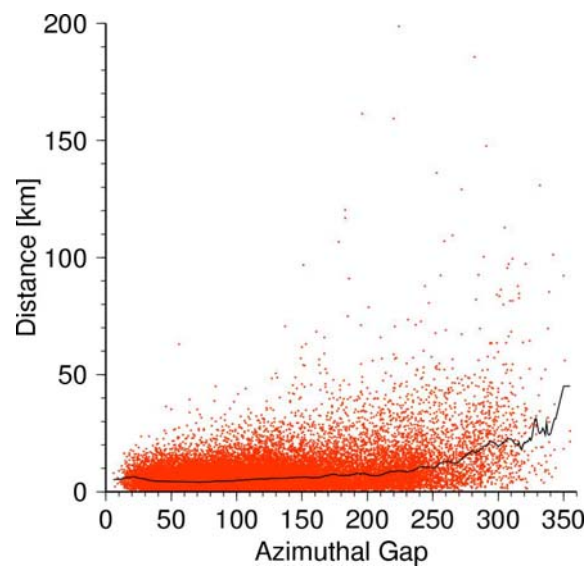


Figure 3: Distance between the JB and ak135 locations as a function of ak135 azimuthal gap for $M > 2.5$ events recorded by several networks from Jan 1998 to Dec 2007, blue dots are all measurements and black line is a smooth trend of mean distance between the two locations.

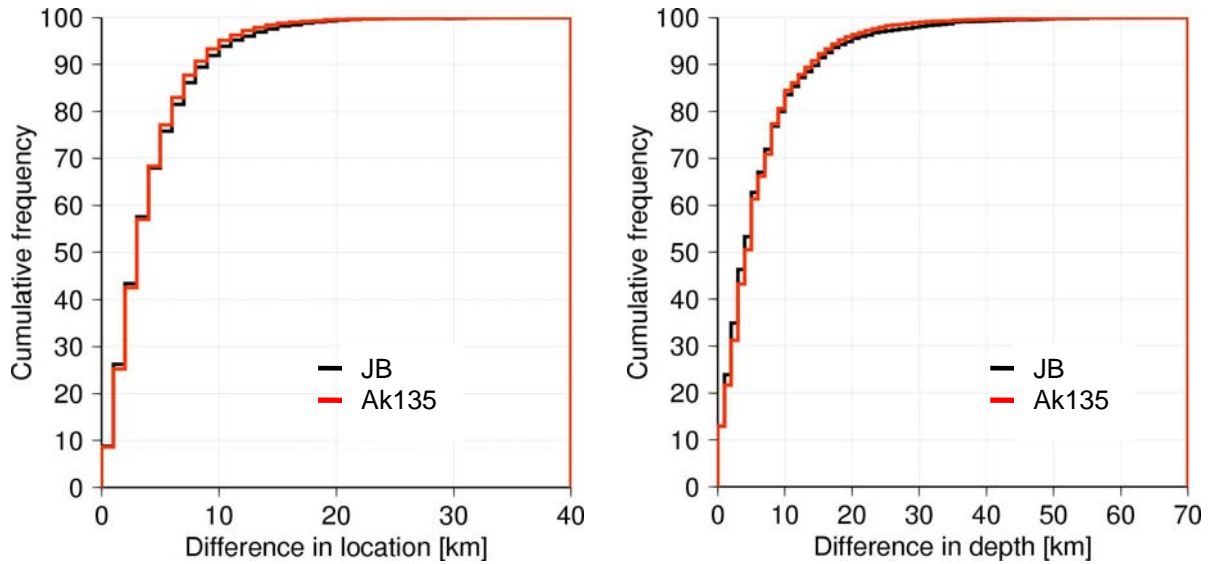


Figure 4: Cumulative distribution of location difference between JB and ak135 hypocenters and authoritative location.

- JB/authoritative location

	Dloc [km]	Depth [km]
Average	4.3	6.0
95%	11.8	20

- Ak/authoritative location

	Dloc [km]	Depth [km]
Average	4.0	5.8
95%	10.9	18.6

Table 2: Statistics on location differences between JB (top) and ak135 hypocenters (bottom) and authoritative location.

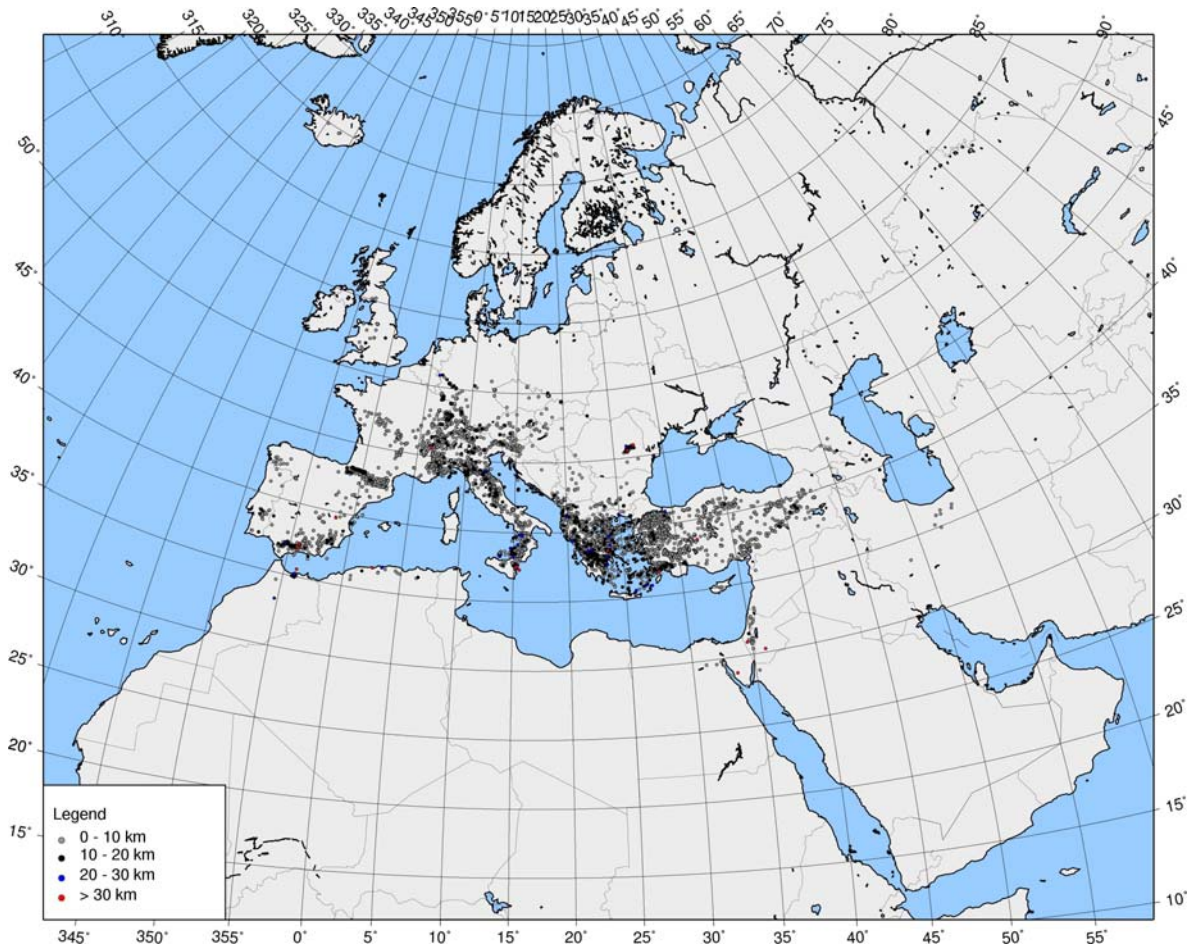


Figure 5: Map of discrepancy in event locations between ak135 and authoritative locations of $M > 2.5$ events recorded by several networks from Jan 1998 to Dec 2007 computed for the 7769 events with an authoritative location provided by a local network. Similar map when comparing JB and authoritative locations.

References

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