

# **Improvement Test of Global Event Locations Using Three Dimensional Earth Models**

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The revised locations in the ISC Bulletin are traditionally based on P-wave travel timetables derived from the radially stratified Jeffreys-Bullen (JB) earth model with traditional Geiger 1910's linear method. Over the last 20 years, however, three-dimensional models of earth structure have been developed that are now generally in agreement at long wavelengths. We investigate the ability of lateral heterogeneous 3-dimensional earth models (S&P12/WM13, KH07) of P wave velocity to accurately locate global events. The ellipticity and elevation corrections, and related to model crustal correction are also incorporated.

For our tests, we use a globally distributed selection of events from pIDC ground-truth database (Yang and Romney, 1999; <http://www.pidc.org>), EHB catalogue (Engdahl, Van der Hilst and Buland, BSSA, 1998), 26 explosions tabulated by Smith and Ekstrom (BSSA, 1996), 82 earthquakes compiled by Kennett and Engdahl (GJI, 1991) for the IASP91 model.

Our 3-D location study demonstrates statistically significant improvement in event locations over any of the 1-D models (JB, PREM, ak135), even though our technique is limited to P waves and to linear perturbation of travel times from the 1-D model. The tests suggest that use of regional and local data remains very important in computing accurate hypocenters. Our KH07 3-D result demonstrates clear improvement in defining the subduction zone (especially deep events) with selected EHB South American 1964-1995 data, although use of depth phases would offer further improvement. For worldwide events from an actual one-month Bulletin, we find large geographical variations in differences between KH07 and ISC Bulletin locations.