Global P-wave travel-time tomography using 3D ray tracing

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New inversion method used three-dimensional ray tracing was applied to the global P-wave arrival time data in order to obtain whole mantle tomographic images. Obtained tomographic images are more sharp than those estimated from one-dimensional ray tracing. Although the method is time consuming, it could be a powerful tool for the global studies of the Earth's structure.

Tomographic inversions of the body-wave travel-times become a powerful tool in the study of Earth's structure and understanding of global tectonic processes. Therefore, the improving of precision, clarity and reliability of tomographic images is an important goal. Most tomographic studies try to refine the data used in the inversion in order to solve this problem. However, the improving of the final results also could be reached by applying advanced algorithm for the ray tracing.

Therefore, an inversion technique using 3D ray tracing based on the "pseudo-bending method" (Koketsu and Sekine, 1998) has been applied to the ISC P-wave travel times in this study. Comparisons of results obtained from 1D and 3D ray tracing, applied to the same data set, shows that the new 3D technique gives sharper images than those based on 1D method. In particular, the high-velocity zones are more pronounced and are clearly revealed. However, the general pattern of the velocity anomalies is the same.The 3D ray tracing is somewhat time consuming.Therefore, the generation of data kernel takes several days depending on the number of rays.