

Fast hypocenter determination in a three-dimensionally inhomogeneous velocity-structure (2)

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We have been developing a fast hypocenter determination method in a three-dimensionally inhomogeneous velocity structure to be used in interactive processing. It is assumed to be used for quick hypocenter information reports soon after occurrence of earthquakes. We developed programs with a preliminary velocity structure (Katsumata and Yamada, 2002), in which three-dimensional travel-time tables were prepared for individual stations. Required computer resources for calculation of the travel-time tables was no more than an available level. We have improved the velocity structure since then (Katsumata, 2004). We evaluate the calculation time and hypocenter locations with the improved velocity structure.

We assume a velocity structure with discontinuities. The slowness in a layer is expressed with three-dimensional B-spline functions, and depth of discontinuity with two-dimensional B-spline functions. The velocity structure was optimized with tomography technique. The path is calculated with the method by Um and Thurber (1987) in a layer and Snell's law at boundaries.

Travel time tables were made for blocks of [latitude 1(degree) X longitude 1(degree) X depth 50(km)] where arrival times were picked up for the unified seismic catalog in Oct. 1997 – Sep 2005. The selective calculation of blocks reduces calculation time enormously. A total of about 900 million travel times (160 thousands blocks) were prepared. The required calculation times was 17 computers(Pentium 4 3.4GHz) X 35 days.

We used seismic data from the National Research Institute for Earth Science and Disaster Prevention, Hokkaido University, Hiroasaki University, Tohoku University, University of Tokyo, Nagoya University, Kyoto University, Kochi University, Kyushu University, Kagoshima University, the National Institute of Advanced Industrial Science and Technology, Tokyo metropolitan government, Shizuoka prefectural government, Kanagawa prefectural government, the City of Yokohama, the Japan Marine Science and Technology Center, and the Japan Meteorological Agency.