

Precise source relocation using Double-Difference (DD) method and 3D velocity structure

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1. Introduction

The earthquake location is one of the most important factors to investigate patterns of seismicity or a wide range of topics in seismotectonics. However the earthquake location or number isn't homogeneous during long period, because of the affectivity of JMA centralization of earthquake information or change of station network. Furthermore, the velocity structure affects the absolute earthquake location (i.e. Engdahl and Lee, 1976; Pavlis and Hokanson, 1985). The purpose of this study is to improve the accuracy of relative and absolute earthquake locations. So we embed 3-D velocity structure in a program named hypoDD. Furthermore we compared the difference of earthquake locations used several velocity structures.

2. Method

The accuracy of absolute hypocenter locations is controlled by several factors, including the network geometry, available phases, arrival-time reading accuracy, the method of determining station corrections (Clear, J. et al., 1966) and knowledge of the detail velocity structure (Pavlis, 1986; Gomberg et al., 1990). In this paper, we combined the double-difference(DD) method (Waldhauser and Ellsworth, 2000) for station corrections and method of estimating the travel times of first arriving seismic waves through 3-D velocity structure, which supposed by J. Vidale 1988.

3. Data

The area of interest in this analysis is from 34.67 to 35.00 degrees in latitude, from 137.30 to 137.83 degrees in longitude and shallower than 50km in depth. Events of magnitude over than 1.2 and less than 4.9 were selected from the JMA seismicity catalog during the period from October 1, 1997 to August 31, 2004. Total number of 886 events was extracted. We weighted for picking quality classes of impulsive (highest accuracy), no-flag (middle), emergent (lowest), to 1.0, 0.5, 0.1 respectively. We used three different velocity structures; 1-D, simple 3-D existing plate model and 3-D of Nakamura (2003).

4. Result

It was found that more clearly earthquake distributions through DD technique than that of originally provided by JMA . Furthermore, we found a few kilometers absolute location difference between simple plate or 3-D velocity structure and 1-D velocity structure. The difference is significance for other studies e.g. interplate coupling.