

Checkerboard resolution test for natural earthquake tomography of volcanic islands in Tokyo

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Grasping the underground velocity structure of volcanoes to estimate the activity of the volcanoes, which not only increase the possibility of estimating the presence or absence and location of magma but also the accuracy of determining the hypocenter of volcanic earthquakes, is very important. As an effective method to grasp the velocity structure of the volcanoes, there is natural earthquake tomography. In natural earthquake tomography targeting a single volcano, in order to improve resolution, temporary seismic observation is carried out in general. However, since the number of observation points and observation period are limited, it is important to grasp the presumable resolution in advance. The purpose of this study, therefore, is to examine, by numerical experiments, how much resolution we can estimate the underground velocity structure by performing temporary seismic observation with how many observation points and observation period, when carrying out natural earthquake tomography on Hachijojima, Kozushima and Niijima of volcanic islands in Tokyo.

In order to evaluate the resolution of the velocity structure using natural earthquake tomography, We have employed a checkerboard resolution test (CRT). In this study, we conducted a parametric study in which the number of observation points and the number of earthquakes were changed, in order to evaluate the influence of parameters with good resolution (pair of observation points and number of earthquakes) on the resolution.

As the results of parametric study using CRT, we have found that in Hachijojima, when setting a pair of grid 1 km, number of observation points 20, observation period 6 months, it was possible to image with a resolution of some degree down to 4 km in depth, in Kozujima, when setting a pair of grid 1 km, number of observation points 30, observation period 6 months, it was possible to image with a resolution of some degree down to 4 km in depth and in Niijima, when setting a pair of grid 1 km, number of observation points 30, observation period 6 months, it was possible to image with a resolution of some degree down to 6 km in depth.

Keywords: natural earthquake tomography, checkerboard resolution test (CRT)