AOGS 2005

Evaluation of the Effects of the Earth's Lateral Heterogeneities on Hypocenter Location along the Southern Kuril Trench

TOMOYA HARADA

Graduate School of Science and Technology, Kobe University

The spatial and temporal recurrence patterns of large/great interplate earthquakes at subduction zones have been investigated by mainly examining their main-shock and aftershock distributions. Harada and Ishibashi (2003), for example, made this kind of study along the southern Kurile trench by relocating hypocenters of earthquakes during 1950-2003. However, because hypocenter determination is usually done by using 1-D radial earth models, locations of earthquakes in subduction zones seem to have considerable errors due to the effects of lateral heterogeneities in the earth. The effects depend on the hypocenter location, magnitude, and station distribution, because they provide the number, length, and path of rays from hypocenters. In order to evaluate the errors in the Kurile subduction zone due to the lateral heterogeneity of the earth, I made a numerical simulation. First, I put 5 (across the trench) times 14 (along the trench) times 7 (downward) imaginary hypocenters along the southern Kurile trench at horizontal and vertical intervals of 50km and 30 km, respectively, and prepared 20 patterns of global station distribution depending on magnitudes and ages. Then, I calculated P-wave travel times for all combinations of hypocenters and stations by assuming Zhao's (2004) 3-D P-wave velocity model and using 3-D ray tracing procedure developed by Harada (2005). Next, I relocated imaginary hypocenters for iasp91 radial earth model (Kennett and Engdahl, 1991) by grid-search method, and compared initial and relocated hypocenter locations. Corrections of the earth's ellipticity and station elevations were ignored in the present simulation. As the results, most of relocated hypocenters moved horizontally in systematic manners and became deeper by 5 to 10 km. It was found that different station distributions gave different errors of relocated hypocenters.

Keywords: 3-D, global velocity structure, hypocenter determination, subduction zone, ray tracing, numerical simulation, southern Kurile

References

[1] T. Harada and K. Ishibashi, *Abstracts, IUGG2003*, JS01/30A/D-037 (2003).
[2] D. Zhao, *Phys. Earth Planet. Interiors,* **146**, 3-34 (2004).
[3] T. Harada, *Abstracts, 2005 Japan Earth and Planetary Science Joint Meeting* (2005).
[4] B. Kennet and E. Engdahl, *Geophys. J. Int.*, **105**, 429-465 (1991).