

Thickness of seismogenic layer within the crust on the Japan Sea side

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1. Introduction

We investigate the depth of the seismogenic layer in order to estimate the lower limit of the seismogenic fault plane since this depth is related to the size of the earthquake caused by the active fault. We have index D10 and D90 as the upper and lower limit of seismogenic layer, respectively. D10 is defined as the depth above which 10 % of the whole crustal earthquakes occurred from the surface. D90 is the depth above which 90 % of the crustal earthquakes occurred from the surface. The difference between the D10 and D90 is the thickness of the seismogenic layer.

2. Data and method

NIED Hi-net has a catalog of hypocenters determined with one-dimensional velocity (1D) structure (Ukawa et al., 1984). We construct the system to relocate the hypocenters from 2001 to 2013 with magnitude greater than 1.5 on the Japan Sea side shallower than 50 km depth with three-dimensional velocity (3D) structure (Matsubara and Obara, 2011). We estimate the D10 and D90 from the hypocenter catalog with 3D structure.

3. Result

The many earthquakes determined shallower than the 5 km with 1D structure are relocated to deeper with 3D structure and the earthquakes deeper than 15 km are relocated to about 5 km shallower. D10 becomes deeper and D90 becomes shallower with 3D structure.

From Akita to Niigata prefecture, D90 is deeper than the other area and D90 beneath the Japan Sea is much deeper than the inland area. The thickness of the seismogenic layer in this area is also thick from 8-16 km. On the west side of the area, D90 is very shallow as 11-16 km and the thickness of the seismogenic layer is also thin as 2-7 km from Toyama to Tottori.

4. Discussion

Omuralieva et al. (2012) relocated the JMA unified hypocenters with 3D structure. D90 became shallower than that from the JMA catalog. Very deep D90 beneath the northern Hokkaido and from Akita to Niigata is consistent with our result.

5. Conclusion

Using 3D structure, the depth of shallow earthquakes is relocated to deeper and that of the deep earthquakes is relocated to shallower then D10 deepens, D90 shallow, and the thickness of the seismogenic layer becomes thinner. The thickness of the seismogenic layer is thick beneath the region from the Akita to Niigata prefecture on the northeastern Japan Sea side, however, that is very thin beneath the region from Toyama to Tottori prefecture on the west side of the Japan Sea coastal area.

Keywords: seismogenic layer, D90, D10, seismic fault