SIT39-P03 Room:Convention Hall Time:May 24 16:15-17:30

Geometry of subducted slab: three-dimensional visualization of seismic tomographic model

Yasuko Yamagishi[1*], Yoshio Fukao[1], Masayuki Obayashi[1]

[1]IFREE/JAMSTEC

It is well known that the style of slab subducion in the mantle has a wide variation. Subducted slabs form convective downwelling of the Earth's lithosphere, which play a role in thermal and material transport from the surface into the Earth's interior, therefore describing the style of slab subduction is important to understand mantle dynamics and thermal evolution in the Earth. Seismic tomographic models have been developed to provide clear images of subducted slabs. Most of these images have been presented based on two-dimensional visualization of the models. Subducted slabs are marked by the region of positive values of seismic velocity perturbation continuing from trenches, but their profile cannot be defined quantitatively by a certain value of seismic velocity perturbation, in part because of the intrinsic nature of subducting slab and in part because of uncertainties and errors involved in tomographic model. Two-dimensional view of tomographic model does not depict the slab by a certain value of anomaly but shows spatial variation of seismic velocity, through which one may extract image of the subducted slab. However, it is difficult to understand the three-dimensional geometry of the subducted slab from the two-dimensional view of tomographic model, even if successive slices of the model are provided. This is because the cross-sectional image of a slab depends on the direction and the position of the cross-section, and some subducted slabs continue to each other in very complicated geometry. Seismic tomographic model is originally a three-dimensional scalar field. Three-dimensional visualization of the tomographic model should be more appropriate to illustrate precisely the geometry of the subducted slabs. Most of the previous methods for three-dimensional visualization display the iso-surface of seismic velocity perturbation, which, however, does not give in general natural image of the subducted slab because the slab cannot be delineated by a fixed value of the seismic velocity perturbation as mentioned above. In this study, we propose a new method for visualizing three-dimensionally seismic tomographic model to express the geometry of the subducted slabs. This method is an extension of the two-dimensional contour image in a sense that it can show variation of the seismic velocity perturbations. The mantle domain is divided into small blocks, and by rendering these blocks the three-dimensional tomographic image is obtained. Surfaces of a block are colored with their transparency dependent on the velocity perturbation in the block. The subducted slab is imaged as an assembly of blocks with various degree transparency by this new method, which is a most faithful representation of the slab image contained in the original tomographic model because no interpolation, extrapolation or smoothing is involved in the method. Hence, this method provides a slab image consistent with that obtained from two-dimensional cross-sections. We visualize here some subducted slabs around the Circum Pacific by using the new method to demonstrate that the complicated structures of the slabs difficult to interpret by two-dimensional images are figured out based on the three-dimensional view. The simple visualization proposed here will be useful to describe the geometry of subducted slabs and to clarify the evolutional processes of them.

Keywords: seismic tomographic model, subducted slab, three-dimensional visualization