

Focal depth of aftershocks of the 2004 off-shore Kii Peninsula earthquake estimated from sP phase

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(1) Off-shore southeast of Kii Peninsula earthquake

A major earthquake with a magnitude of 7.4 occurred at 23:57:16 (local time) on September 5, 2004 at the off-shore southeast of Kii Peninsular, Japan. Since the seismic stations are mostly located in continental areas the poor azimuthal coverage can easily induce earthquake mislocations.

(2) Relocations

Distinct later phases were observed at small epicentral distance of about 200km. We interpret this phase as sP phase, an upgoing S phase from the focus which is then converted to a P wave at the plate boundary at a point relatively near the hypocenter, diffracted along the plate boundary, and finally reaching the observation stations. This phase is sensitive to focal depth for its travel time changes slowly with distance but rapidly with depth. The sP follows the P wave by a time interval (sP-P) has been studied to constrain the focal depth (Umino N., et al., 1995). The goal of this procedure is to eliminate the effect of original time on location determination. However, it does not take the advantage of recent development of accurate location. Many of those developments are aimed at improving relative and/or absolute location accuracy. For example, double-difference (DD) earthquake location method (Waldhauser F., and W. L. Ellsworth, 2000).

Our strategy is to combine the advantage of both sP depth phase and DD method. We have developed DD to include sP phase for improving focal depth accuracy. The sp phase identification and the calculations of the takeoff angle are the critical central parts of the earthquake location method.

(3) Tomographic images

We investigated velocity structure by using double-difference tomography. We obtained more accuracy images of the rapture area of the 2004 off-shore Kii Peninsula earthquake.

(4) Results and discussion

From the relocated hypocenters and the accuracy tomographic images, we may infer that strong lateral heterogeneities exist along plate boundary, which would have impacts on the initiation and rupture process of the earthquakes.

References

- Umino, N., Hasegawa A., and Matsuzawa T., sP depth phase at small epicentral distances and estimated subduction plate boundary, *Geophys. J. Int.*, 120, 356-366, 1995.
- Waldhauser F., and W. L. Ellsworth, A double-difference earthquake location algorithm: Method and application to the Northern Hayward Fault, California, *Bull. Seism. Soc. Amer.*, 90, 1 353-1 368, 2000.
- Zhang, H. J., and Clifford H. Thurber, Double-difference tomography: the method and its application to the Hayward fault, California, *Bull. Seismol. Soc. Am.*, 93(5), 1875-1889, 2003.