

Three-dimensional P and S wave velocity structure around the Suzuka-toen fault zone and the Yoro-Kuwana-Yokkaichi fault zone

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The Headquarters for Earthquake Research Promotion in Japan (HERP; 2000, 2001) evaluated the long-term probability of the large earthquake occurrence on the Suzuka-toen fault zone and on the Yoro-Kuwana-Yokkaichi fault zone. According to the reports, in the case of the Suzuka-toen fault zone, the large earthquake of M7.5 will occur but the probability cannot be evaluated. In the case of the Yoro-Kuwana-Yokkaichi fault zone, the large earthquake of M8 will occur and the probability of the earthquake occurrence in 30 years is from 0 % to 0.6 %, which is slightly higher probabilities compared to those of other active faults.

In this study, we applied the double-difference tomography method proposed by Zhang and Thurber(2003) to the area around the Suzuka-toen fault zone and the Yoro-Kuwana-Yokkaichi fault zone to determine three dimensional (3-D) P- and S-wave velocity structures. Initial velocity structures for the inversion were those of the JMA2001 model (Ueno et al., 2002) used routinely in Japan Meteorological Agency. The grid interval was from 2 km to 5 km horizontally and 3 km vertically.

We used 12,022 P arrival times, 12,292 S ones, 148,508 double differences of P ones and 150,258 those of S ones of 1428 regional earthquakes that occurred from October 1997 to July 2006, observed at 18 permanent stations.

After the inversion, the RMS of travel time residuals and those of double differences was reduced from 0.225 sec. to 0.076 sec. We obtain 3-D P- and S-wave velocity structures around the target area which are more accurate and have higher resolution than previous ones, and are consistent with those by previous studies (e.g. Nakamura et al., 2003). Compared to the JMA2001 model, P-wave velocities are about 1 % slower or same and S-wave ones are about 1 % faster at all depths on the average. Moreover, along the both fault zones, we can see the inhomogeneous velocity structure. Okada et al. (2007) proved that the main rupture zone of the large earthquake exists in the higher velocity zone. This idea can possibly evaluate the main rupture zone of the large earthquakes which will occur in the future. Furthermore, we can see very low velocity zones of P- and S-waves beneath the Yunoyama hot spring shallower than 5 km depth, where is the geothermal field.

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References: HERP, 2000: The long-term probability of the large earthquake occurrence on the Suzuka-toen fault zone.; HERP, 2001: The long-term probability of the large earthquake occurrence on the Yoro-Kuwana-Yokkaichi fault zone.; Nakamura et al., 2003, Abstr. 2003 Japan Earth Planet. Sci. Joint Meeting, S053-P010.; Okada et al., 2007, EPSL, 253, 143-150.; Ueno et al., 2002, Q. J. Seismol., 65, 123-134.; Zhang and Thurber, 2003: BSSA, 93, 1875-1889.