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Strong motion simulation of the 1995 Kobe earthquake considering the shallow velocity structure

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The 1995 Kobe earthquake made a devastating disaster which killed 6434 people and collapsed more than 1 million houses. On the other hand, the earthquake left many data, such as aftershock recording data and geological survey data. As one of the researchers acquainted with the earthquake, the authors have always felt the responsibility to investigate the cause of damage and use the information to mitigate disaster by earthquakes to occur in the near future.
We re-estimated the rupture model of the 1995 Kobe earthquake by using 3-D reciprocal Green's functions and searching for a best fitting case by grid-search technique assuming plural rectangular strong motion generation areas (SMGAs). The final rupture model consists of five SMGAs. The calculated velocity waveforms showed very good fit to the data. Then we take in account of the shallow velocity structure and calculate the PGV distribution in the Kobe area. For the PGV distribution, regions corresponding to the areas of about 90 to 100 cm/s or greater resulting from the 3-D "edge effect" are in good fit compared to the region of the seismic intensity scale VII of Japan Meteorological Agency. Also the damage ratio of wooden houses in the area is calculated and the observed damage ratio is reproduced fairly well. We can conclude that we showed that the damage in Kobe can be simulated only using physical models. This is a large step toward predicting structural damage using a physical model for an earthquake.

Keywords: Kobe earthquake, Strong Motion Generation Area, 3-D Velocity Structure, Edge-Effect, Disaster Belt, Shallow Velocity Structure