

Near-field strong motion on the hanging wall of low angle thrusting: a case of Hamaoka

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(1) We discuss the near-field strong motion at Hamaoka on hanging wall of low angle thrusting. The key parameter is slip velocity.

(2) The high stress drop of 22 MPa has raised a problem on the evaluation of near-field strong motion. As far as ever documented in Japan, stress drops of subduction zone earthquakes and average slip velocities were estimated to be around 3-5 MPa and 1 m/s, respectively. Following Starr (1928) for dip slip faulting, a stress drop $\Delta\sigma$ is proportional to D_0/W , where D_0 is an average slip and W is a fault width. Following Brune (1970) and Ida and Aki (1972), an average slip velocity D_0/t_0 is proportional to earthquake generating stress σ_e , where t_0 is a risetime. Assuming that σ_e is the same as $\Delta\sigma$, both D_0 and D_0/t_0 are proportional to σ_e , leading to the recognition that velocity and acceleration amplitude of synthetic strong motion are proportional to σ_e in the near-field to the first order.

(3) We move to a discussion of strong motion at Hamaoka. Assuming fault parameters as a fault length 100 km, W 50 km, and bilateral propagation in strike-parallel direction and unilateral propagation upward of rupture front from the center of the lower side, we obtain synthetic strong motion (Fig.1) at Hamaoka for three cases of D_0/t_0 of 1 m/s, 3 m/s and 5 m/s with a common D_0 of 15 m. Numerical computation is done by programs of Kawasaki et al. (1973) and Okada (1980). Velocity and acceleration are roughly proportional to D_0/t_0 . When D_0/t_0 is larger than 3 m/s, the maximum amplitude of acceleration is larger than g .

(4) We can not apply above discussion to shorter period strong motion because far-field term gets relatively predominant and physical attenuation and scattering become effective. However, on the following assumptions (a) and (b)

(a) velocity and acceleration of strong motion are proportional to slip velocity and earthquake generating stress in every scales of multi-scale rupturing phenomena,

(b) stress level of level 2 megathrust earthquake would be far higher than those of level 1 subduction zone earthquakes,

we can postulate that strong motions at Hamaoka during the coming level 2 class Mw9 Nankai trough earthquake would be far larger than those during level 1 class 1944 Tonankai and 1854 Ansei-Tokai earthquakes.

(5) Thus, reliable evaluation of near-field strong motion on the hanging wall of low angle thrusting seems to be not feasible at the present stage of seismology. The evaluation of regional tectonic stress on the hanging wall and the distribution of the strong asperity on the subduction interface are indispensable.

(6) Figure caption

Fig.1 Synthetic strong motions at Hamaoka for three cases of slip velocities of 1 m/s, 3 m/s and 5 m/s with a common slip D_0 of 15 m. Other fault parameters are given in the text. Left, middle and right panels are displacement (U), velocity (V) and acceleration (A), respectively. Upper and lower row panels are those of fault perpendicular motion (subscript x) and vertical motion (z), respectively. A distance from Hamaoka to subduction interface is 10 km.

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