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# Estimation of friction coefficient by stress tensor inversion

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Under assumptions that all of the earthquakes occur at a homogeneous stress field and that the slip along a fault occurs in the direction of maximum resolved shear stress, the stress tensor inversion solves for the orientation of the three principal stress axes and the relative magnitude of the principal stresses. In order to understand the earthquake generation process, it is necessary to know absolute stress and strength in the seismogenic zone. Following Yin and Ranalli (1995), we try to estimate average friction coefficient based on the Coulomb failure criterion.

In this study, we further assume that earthquakes occur when the shear and normal stresses on the fault satisfy the Coulomb failure criterion. The procedure to determine the average friction coefficient is as follows: (1) We determine the orientation of the three principal stress axes and the relative magnitude of the principal stresses using a stress tensor inversion (Michael, 1984), (2) For each earthquake, we compute a differential stress normalized by a vertical stress by changing the average friction coefficient, (3) The best estimate for the average friction coefficient is that value which minimizes the variance of differential stresses. Here the basic physical assumption in (3) is that the normalized differential stress at faulting is similar for each earthquake (homogeneous stress field). We applied this method to microearthquakes of Atotsugawa fault and found that the variance of the normalized differential stress is the minimum when the average friction coefficient is about 0.5-0.6.

In this method, we perform a two-step approach to estimate average frictional coefficient; Estimation of stress fields by a stress tensor inversion and search for the best estimate of the average friction coefficient using the result of the stress tensor inversion. This suggests that the result of the stress tensor inversion should be as accurate as possible. Thus, an application of the multiple inverse method (e.g., Otsubo et al., 2008) is important.

References:
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