A method for monitoring the tectonic stress in the Earth

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It is important to monitor the regional tectonic stress that causes earthquakes. Katsumata (2005) proposed a method for estimating the regional tectonic stress by using a stress tensor inversion method and microearthquake seismicity. In this study I investigated two unknown parameters by using a grid search method. Analyzing procedure is as follows.

1. The stress tensor inversion method provides stress parameters including the direction of principal stresses and R. R is defined by,

$R = (S1 - S2)/(S1 - S3)$ (1),

where S1, S2 and S3 are principal stresses.

2. I assumed that,

$aP = (S1+S2+S3)/3$ (2),

where P is a lithostatic pressure and a is a constant.

3. Coulomb Stress Function (CSF) is defined by,

$CSF(b)=(S1-S3)(\sin 2b - u \cos 2b)/2 - u (S1+S3)/2$ (3),

where b is an angle between the S1 and the failure plane and u is a coefficient of friction. The equation (3) as a function of b takes the maximum when $u = -\tan(bm)$. I assumed that CSF(bm) is proportional to the microearthquake seismicity rate.

4. S1, S2, and S3 are obtained if the two parameters, a and u, are given. The a and u are searched by a grid search method.

5. In the grid search method I selected the parameters that are consistent at most with the equation of equilibrium.