[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT26]Stress geomechanics integrations: Observations, Modelings and Implications (OMI)

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Stress geomechanics specifies how rocks respond to strain, fluid and heat that provide essential information on understanding seismic behaviors. Thus, some outreach researches address the stress state in the geological structures or along plate boundaries through geophysical, geodetic, geothermal and/or hydrological approaches, especially after recently great earthquakes. Such studies have raised the importance on the stress analysis, including stress evolution by seismic and volcanic activity, in-situ stress measurements, crust heterogeneity, and geodetic modeling for earthquake cycle. This session is to bring the multi-disciplinary studies together on stress geomechanics, including but not limited, to inland/ocean drilling, borehole measurement, focal mechanism of crustal and volcanic earthquakes, subsurface anisotropy analysis and geomechanical model applications. We focus our discussion not only on the observation in association with physical models, but also interdisciplinary cooperation in each research field.

[SIT26-P02]Stress tensor inversion for heterogeneous fault-slip data using fault instability evaluation

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Keywords:stress tensor inversion, fault-slip analysis, fault instability

Stress tensor inversion techniques are based on the Wallace-Bott hypothesis, which assumes that faults slip along shear stress vectors on fault planes. This hypothesis is applicable to faults with high pore fluid pressure and low friction such as preexisting faults in rock masses, since the magnitudes of shear and normal stresses are not constrained. However, in exchange for the wide applicability, the looseness of the assumption sometimes causes low detectability of stresses. In order to improve the detectability, this study proposes to incorporate the estimation of fault instability (Vavrycuk et al, 2013; Sato, 2016) into the stress tensor inversion.

The fault instability of a fault is defined as the nearness of the point representing shear and normal stresses on Mohr diagram to the friction envelope tangent to the Mohr's stress circle. The calculation of fault instability requires the friction coefficient. The new method tries to find the optimal stresses on the basis of grid search. For each candidate of stress solution, the optimal friction coefficient is estimated by the method of Sato (2016) which maximize the fault instability. Then, the weights propotional to the sums of fault instabilities are imposed on the candidates. Finally, the optimal stresses should have larger fault instabilities according to the observed orientation distribution of fault planes.

The new method was applied to meso-scale fault-slip data gathered from the Pleistocene Sekinan Group, Beppu area, southwest Japan. Three normal-faulting stress tensors were detected with NNE-SSW, NNW-SSE and E-W horizontal tension axes. Compared with the conventional stress tensor inversion method

(Sato, 2006) which could detect two tensors at most, it was confirmed that the detectability of stresses were enhanced with the evaluation of fault instability.

References

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Sato, K., 2016, Journal of Structural Geology, 89, 44-53.
Vavrycuk, V., Bouchaala, F. and Fischer, T., 2013, Tectonophysics, 590, 189-195.