Geophysical Research Abstracts
Vol. 18, EGU2016-5316, 2016
EGU General Assembly 2016

Inelastic strain in the seismogenic zone, Kyushu, Japan inferred from focal mechanism of earthquakes

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Strain in the seismogenic zone of the crust is a key parameter to understand crustal dynamics. GNSS data provide us with great information about deformation rate at the surface, which have been investigated by many researches and modeled kinematic behavior as elastic medium. Generally, strain in the earth's medium consists with elastic and inelastic ones. The two kinds of strain result different effects on the stress field. Therefore, detecting inelastic strain is important to know state of stress in the crust as well as elastic one. Inelastic strain is caused by such as fault creep, viscoelastic response, and earthquakes. Here, we showed the inelastic strain in the seismogenic zone of Kyushu, Japan from seismic moments and focal mechanisms data by counting Kostrov's sum in the spatial bins. Seismic moment tensors about 9000 earthquakes with magnitude greater than 2 for 13.5 years were obtained from seismic network data in Kyushu Island and F-net catalog. Total released moment at every spatial bin with 0.15 x 0.15 degree in latitude and longitude was estimated and then strain rate was calculated from the moment, compliance of the medium, and volume of the bin. The estimated maximum strain rate achieves 10^{-7} strain/year. This strain rate is comparable with that from GNSS data. However, the strain rate mainly revealed the different principal direction from the one of GNSS. On the other hand, the directions were similar to the behavior of active faults in Kyushu. The result in this study showed that inelastic strain due to earthquakes is enough large, suggesting that the effect should be considered for modeling crustal dynamics.