Geophysical Research Abstracts
Vol. 19, EGU2017-5838-4, 2017
EGU General Assembly 2017

Pre-state of stress on the fault of the 2016 Kumamoto earthquake (Mj7.3) inferred from moment tensor data of micro-earthquakes before the mainshock

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The 2016 Kumamoto earthquake (Mj7.3, Mj: magnitude scale by Japan Metrological Agency) occurred on 16 April 2016 in Kumamoto prefecture, middle part of Kyushu Island, Japan. Several earthquakes over Mj 6 also occurred before and after the mainshock. The earthquake killed resident people and heavily damaged the cities around the hypocentral area. The seismic activity in and around the area was highest in the Kyushu Island before the earthquake occurrence. Surface breaks appeared along the active faults called Hinagu and Futagawa faults during the sequence of the Kumamoto earthquake. Dense seismic observation carried out in the area enable us to estimate high precision focal mechanism solutions. Here we analyzed the focal mechanisms before and after the occurrence of the sequence as seismic moment tensors and estimated stress field in the hypocentral area. As general tendency, dominated minimum principal stress (sigma 3) in the N-S direction obtained and the maximum principal stress takes value close to the moderate one. The stress field reveals spatial heterogeneous feature, which varies from southern to northern part of the area. We calculate maximum shear stress direction on the fault of the mainshock from the heterogeneous stress field. Comparing the direction with co-seismic rupture direction estimated from the strong motion records around the hypocentral area, we found that co-seismic fault slip mainly controlled by pre-state of stress on the fault. This result from the seismic observation provides an evidence to confirm the hypothesis based on laboratory experiments for fault behavior. This suggests a possibility that the fault behavior can be estimated from the stress field inferred from fault plane solutions.