

Change in state of stress around Hinagu fault zone through the 2016 Kumamoto earthquake sequence, central Kyushu, Japan

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In order to understand the physical processes of earthquake generation, it is important to evaluate spatial and temporal variations of the stress field around a fault.

The 2016 Kumamoto earthquake sequence occurred at Hinagu and Futagawa fault zones under tectonic stress condition of strike slip or normal fault type. Largest foreshock with Mj6.5 (Mj: magnitude by Japan Metrological Agency) on April 14, 2016 was located Hinagu fault zone. After that, main shock (Mj7.3) occurred on April 16, 2016.

In this study, we estimated the stress field around Hinagu fault zone using focal mechanism data. For discussing temporal change in the field, we divided time sequence into three periods: (1) prior to the sequence (i.e. before occurrence of largest foreshock (Mj 6.5)), (2) between the foreshock and the main shock, and (3) after the main shock. Focal mechanism data were determined from picked first P wave polarity by the HASH program [Hardebeck and Shearer, 2002]. Coseismic stress change due to the fore and main shocks were calculated by Okada model [Okada, 1992]. We adopted results by Asano and Iwata [2016] as coseismic fault slip model.

Comparing the estimated stress field and the seismic activity, we found some earthquakes occurred at the area negatively affected by the coseismic stress changes. The spatial variation of coseismic stress change were not always consistent with the fault slip directions. It is considered the inconsistency could be attributed to the fault geometry.

Here, we modeled the fault planes of the foreshock and the main shock from distribution of hypocenters of the aftershocks. We examined the dip angles of P axes of the earthquakes derived from the focal mechanisms around the Hinagu fault model in this study. Spatial and temporal variations of the focal mechanisms were obtained and reveals some features. Over the period of (2), the earthquakes with similar mechanisms occurred. During all three time periods, (1) to (3), at the north area of the fault, earthquakes occurred as normal faulting and it was the major type of earthquakes located on the hanging wall of the fault. The azimuth of P axes slightly rotate in anticlockwise direction from East-West direction after the main shock. At the south side of the fault, however, most of the events occurred with strike slip motion and these azimuth of P axis were approximately identical.

Keywords: stress field, 2016 Kumamoto earthquake