

Hypocenter distribution and source process of the 2016 Kumamoto earthquake

Akio Katsumata¹, Kenichi Fujita¹, *Koji Tamaribuchi¹, Shinobu Ando¹

1.Meteorological Research Institute, Japan Meteorological Agency

An earthquake of M6.5 occurred in Kumamoto Prefecture at 21:26 on April 14, 2016. Following this earthquake, earthquakes occurred at 00:03 on April 15 (M6.4) and at 01:25 on April 16 (M7.3). We report the hypocenter distribution and source processes of these earthquakes including their aftershocks.

The earthquake on April 14 of M6.5 occurred with a focal depth of 11 km, and was strike-slip type with a tension axis of NNW-SSE (JMA). According to a result of relocation by the double difference method with cross-correlated data, the seismic cluster including the one of M6.5 on April 14 is distributed along a nearly-vertical plane with SE-dip. Source process analysis with KiK-net record indicated a large slip area in the NE of the hypocenter. Although source process was analyzed also with assumption of NW-dip, we could get better fitting between observed and synthetic records for the case of SE-dip, especially at nearby stations (KMMH16 and KMMH14) to the assumed fault. In the case of SE-dip, normal fault slip component of SE-side down was estimated.

The earthquake of M6.4 on April 15 occurred with a focal depth of 7 km and with a similar focal mechanism as the one of M6.5 on April 14 (JMA). The epicenter was located in the SE of that of M6.5 event on April 14. The focal depth was estimated at 2 km when a 3D-inhomogeneous velocity structure (3D-vel.) was assumed. The source process analysis indicated a SE-dip fault with a large slip in the SW of the hypocenter, that was a different area of the large slip on April 14. Analysis of interferometric SAR indicated relatively smaller dip angle fault of NW-dip as the total effects of April 14 and April 15 events. In contrast with NE part, the double difference location presented a NW-dipping nearly-vertical plate in the SW part.

The event of M7.3 on April 16 occurred with a focal depth of 11 km and with a NS tension axis (JMA). The CMT solution of JMA had some normal fault component. Double difference locations presented a distribution along a NW-dipping plane. Whereas the focal depth of the event was estimate at 11 km also with the 3D-vel., the focal depth of the cluster was shallower by 2-3 km with the 3D-vel compared with the result with the JMA2001 velocity structure, and hypocenter distributing in the NE of the main cluster was estimated at depths shallower than 5 km by the 3D-vel. After this event, the seismic activity with SE-dip ceased. The result of source process analysis indicated a large slip at the shallow part in the NE of the epicenter. The result of interferometric SAR also indicated crustal deformation distribution up to the area around Mt. Aso that is located in the NE of the epicenter of the M7.3 event.

Seismic activity is observed also in Oita Prefecture. A few clusters were recognized in the activity in Oita Prefecture.

We used data from the National Research Institute for Earth Science and Disaster Prevention, Hokkaido University, Hirosaki University, Tohoku University, the University of Tokyo, Nagoya University, Kyoto University, Kochi University, Kyushu University, Kagoshima University, the National Institute of Advanced Industrial Science and Technology, the Japan Marine Science and Technology Center, Geospatial Information Authority of Japan, the Tokyo metropolitan government, the Shizuoka prefectural government, the Kanagawa prefectural government, and the Japan Meteorological Agency.

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