平成 28 年（2016 年）熊本地震調査報告

気　象　庁

Report on The 2016 Kumamoto Earthquake

Japan Meteorological Agency

Abstract

Seismicity

At 21:26 on April 14 2016 (JST), an earthquake with a magnitude (M) of 6.5 in the Kumamoto area of Kumamoto Prefecture caused strong shaking with a seismic intensity of 7 in the local town of Mashiki. Just 28 hours later (at 01:25. on April 16), a quake with an even bigger main-shock magnitude of 7.3 struck the same area, with seismic intensities of 7 recorded in Mashiki and the local village of Nishihara. This was the first time the Japan Meteorological Agency (JMA) had recorded two quakes with a seismic intensity of 7 within two days.

After the M6.5 earthquake of April 14 2016, particularly high levels of seismic activity were observed in and around the Kumamoto area. After the main shock, numerous quakes were also recorded in the Aso area of Kumamoto Prefecture and central Oita Prefecture with an area of seismic activity covering around 150 km in length. JMA collectively named this seismic activity “the 2016 Kumamoto Earthquake” (referred to here simply as “the Kumamoto Earthquake”). There were over 4,000 quakes with seismic intensities of 1 or more within six months of the first tremor, exceeding even the figure for the active 2004 Mid-Niigata Prefecture Earthquake period. Aftershock activity from the Kumamoto Earthquake continues, although a trend of decay is observed.

The focal mechanism of the first earthquake (M6.5, April 14) exhibited strike-slip faulting with a north-south tension axis, and that of the M6.4 earthquake on April 15 showed faulting with a NNW-SSE tension axis. The focal mechanism of the main shock exhibited strike-slip faulting with a NW-SE tension axis. The Headquarters for Earthquake Research Promotion judged that the April 14 M6.5 earthquake and the April 15 M6.4 earthquake occurred along the Hinagu fault zone (Takano-Shirahata section), while the main shock occurred along the Futagawa fault zone (Futagawa section).

Strong motion and damage

In relation to the M6.5 earthquake of April 14, recorded seismic intensities were 7 for Mashiki, 6-lower for Kumamoto, Tamana, Uki, Nishihara and Kashima, and between 5-upper and 1 from Kyushu to Chubu. The main shock was recorded with a seismic intensity of 7 in Mashiki and Nishihara, 6-upper values were recorded

in Kumamoto, Minamiaso, Kikuchi, Uto, Otsu, Kashima, Uki and Koshi, and values from 6-lower to 1 were observed between Kyushu and parts of Tohoku. The tremors caused 251 direct and indirect fatalities, 2,792 injuries and 205,897 instances of residential damage, including 8,677 total collapses, in Kumamoto and the prefectures of Yamaguchi, Fukuoka, Saga, Nagasaki, Oita and Miyazaki and elsewhere (as of November 13 2017; Fire and Disaster Management Agency, Ministry of Internal Affairs and Communications). Evacuee numbers were as high as 183,883 in Kumamoto Prefecture and 12,443 in Oita Prefecture (as of April 13 2017; Cabinet Office). A total of 190 sediment-related incidents (e.g., slippage of sand and stone slopes or landslides) were also reported (as of October 16 2017; Ministry of Land, Infrastructure and Transport and Tourism).

Action taken by JMA

As of November 30 2017, JMA had issued 19 Earthquake Early Warnings for Kumamoto Prefecture and nearby areas. After a seismic intensity of 7 was observed in association with the M6.5 earthquake on April 14, the JMA Seismology and Volcanology Department, the Meteorological Research Institute, Fukuoka Regional Headquarters and the Kumamoto, Shimonoseki, Saga, Nagasaki, Oita, Miyazaki and Kagoshima Local Meteorological Offices dispatched JMA Mobile Observation Team (JMA-MOT) members tasked with field surveying to determine the condition of seismic intensity meter stations and damage caused by earthquake-related ground shaking in areas where seismic intensity values of 5-upper or more were observed.

JMA held press conferences on earthquake situations and provided information on related disaster prevention and seismic activity. A special page on the Kumamoto Earthquake was also published on the JMA website for enhanced information provision, including numbers of quakes and their seismic intensities, maps of epicenters, space-time graphs of seismic activity, meteorological support materials and information on weather warnings, advisories, weather forecasts and precipitation. JMA lowered its trigger criteria for heavy rain warnings/ advisories and sediment-related incident alerts issued in collaboration with prefectural governments for areas where the observed seismic intensity was 5-upper or more based on consideration of ground instability caused by seismic motion. JMA also lowered its criteria for flood warnings, advisories and forecasts for areas where river management structures such as embankments might have been affected by earthquakes.

JMA established the Disaster Management Headquarters immediately after the M6.5 earthquake that struck at 21:26 on April 14 2016 and strengthened its information collection functions. The Response Office of the Prime Minister's Office was opened at 21:31 on the same day. JMA's Emergency Response Team was dispatched to the Crisis Management Center of the Prime Minister's Office to support rescue and emergency relief activities via the provision of information on earthquakes and weather.

JMA also dispatched one staff member, one liaison and two supporters from the Fukuoka Regional Headquarters and other offices to the local governmental emergency response headquarters at the Kumamoto prefectural office. JMA staff attended conferences and meetings at local response headquarters as well as sessions at the Kumamoto Prefecture emergency response headquarters, providing information on seismic activity, weather nowcasts and forecasts and engaging in discussions with related institutions.