Overview of The 2016 Kumamoto Earthquake

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1.Japan Meteorological Agency

1. Introduction

A big earthquake of M6.5 occurred at 21:26 on 14 April, 2016 in Kumamoto region of Kumamoto Prefecture. Its focal depth was estimated at 11km, and the maximum JMA seismic intensity scale was 7, which is the strongest of the scale. After 28 hours of the earthquake, a rather bigger earthquake of M7.3 occurred in the same region, and the seismically active area was spread up to about 150km long, from Kumamoto Prefecture to Oita Prefecture. Just after the latter biggest earthquake (M7.3), another earthquake of M5.7 occurred in the central region of Oita Prefecture (The M5.7 is a reference value. JMA Seismic intensity of this earthquake is unknown because of overlapping seismic waves from M7.3 event.), and one and a half hour after the biggest earthquake (M7.3), another earthquake of M5.9 occurred in Aso region of Kumamoto Prefecture (maximum JMA seismic intensity is 6+). Seismic intensities were over 5- for 18 big earthquakes (as of 11 May). JMA named the sequence of this seismic activity “The 2016 Kumamoto Earthquake”. This seismic activity occurred in crust, and Earthquake Research Committee of Headquarters of Earthquake Research Promotion evaluated that this seismic activity is caused by parts of Futagawa Fault and Hinagu Fault.

2. Distribution of hypocenters and Mechanisms of the earthquakes

Hypocenters are distributed along a belt area from Northeast to Southwest direction within Beppu-Shimabara Graben in central Kyushu. Detailed analysis of the distribution of hypocenters by using Double-Difference method suggests vertical or steeply dipping fault planes inclining toward Northwest. In addition, it shows that there are complex planes around the junction of the Futakaga Fault and the Hinagu Fault. In the central Oita Prefecture, the hypocenters of the new seismic activity are distributed in the areas where seismicity had been inactive.
The mechanisms of the earthquakes are mainly strike slip type with North-South Tension axis. Some Normal fault type earthquakes occur around Futagawa Fault.

3. Analysis of Source Process and Source Scanning Algorithm

Source process analysis on the biggest earthquake (M7.3) in Kumamoto region of Kumamoto Prefecture by using strong-motion seismic records of near seismometers shows that the fault slip propagated from the hypocenter toward Northeast and finally reached around Mt. Aso.
Source Scanning Algorithm on the same earthquake (M7.3) shows that emission of energy started around the Futagawa Fault, and spread to the Hinagu Fault.

4. Earthquake information issued by JMA

After the first big earthquake (M6.5) in Kumamoto Prefecture on 14 April, Japan Meteorological Agency (JMA) issued Early Earthquake Warning (EEW) for 19 earthquakes of this seismic activity. Regarding to Intensity Scale for Long-period Ground Motion, the maximum intensities of 3 and 4 were observed at following earthquakes.
M6.5 on 14 April: Intensity 3 in Kumamoto region of Kumamoto Prefecture.

M6.4 on 15 April: Intensity 4 in Kumamoto region of Kumamoto Prefecture.
M7.3 on 16 April: Intensity 4 in Kumamoto region and Aso region of Kumamoto Prefecture.
It was the first time to observe the intensity 4 which is the strongest intensity in the Intensity Scale for Long-period Ground Motion since the start of issuance of this information by JMA in March 2013.
JMA issued information about aftershock probability after the first big earthquake of M6.5, however, JMA stopped issuance of following information because this seismic activity is not considered to be a simple mainshock -aftershock series after the occurrence of the bigger earthquake (M7.3) on 16 April. Instead of issuance of information about aftershock probability, JMA called attention to people to prepare high seismicity in this region from a point of view of disaster prevention.

Keywords: Kumamoto Earthquake, Double-Difference Method, Seismic Source Process Analysis, Source Scanning Algorithm, Long-period Earthquake Ground Motion, Earthquake Information

