

Source parameters of foreshocks and aftershocks of 2014 Northern Nagano earthquake

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The 2014 M6.7 Northern Nagano earthquake occurred on 22 November, 2014, which broke a part of Kamishiro fault. In order to reveal the generation mechanism of the mainshock, we determined hypocenters and source parameters of foreshock sequence from four days before the mainshock, as well as aftershocks.

We assumed two different one-dimensional crustal velocity structures to account for heterogeneous velocity structure in the studied area. Hypocenters are shifted by the relocation to the east at about 2 km and shallower at most 5 km, compared with the JMA catalogue. Although the aftershock distribution basically defines an eastward dipping plane, vertical and westward dipping planes are also identified at the middle to the northern part of the source region. The foreshocks located at about 3 km depth and distributed on NNW dipping plane, which is clearly distinct from the aftershock distribution. It is noted that the foreshock sequence started at the deeper part, then migrated to the shallower part and finally approached to the mainshock nucleation point.

We then determined focal mechanisms from P-wave polarity data as well as body wave amplitude, which enabled us to obtain well-determined solutions down to M0.5. Most of aftershocks exhibit a large strike-slip component, while aftershocks occurring at the southern part of the source region show reverse faulting type of mechanisms. This feature is consistent with the aftershock distribution. As for the foreshock sequence, we obtained a number of events with a large strike-slip component having a nodal plane dipping to the NNW, which is also consistent with the foreshock distribution. Interestingly, we found that the foreshock focal mechanisms slightly change with time and finally resemble to the P-wave first-motion mechanism of the mainshock. We detected more than 400 new events based on visual inspection of running spectra and S-P time at the station closest to the foreshock sequence (Hi-net Hakuba station). Hypocenter and focal mechanism determination of these events will further contribute to elucidate the relation between the foreshock sequence and the mainshock occurrence.

We will also present the stress drop estimations and discuss the spatial distribution of stress drops as well as the difference in source properties between the foreshocks and aftershocks.

Acknowledgements: Seismograph stations used in this study include permanent stations operated by NIED (Hi-net), JMA, ERI, and DPRI.

Keywords: Northern Nagano earthquake, source parameter, foreshock, aftershock