

Aftershock distribution and crustal structure in and around the source area of the 2014 northern Nagano Pref. earthquake

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A shallow earthquake occurred in the northern Nagano Prefecture, at 10:8 PM Japan standard time on November 22, 2014, with the Japan Meteorological Agency (JMA) magnitude (M_{JMA}) of 6.7. The focal mechanism showed a reverse fault with a compression axis in a WNW-ESE direction. Aftershock area is located near the Kamishiro fault, which is a part of the Itoigawa-Shizuoka Tectonic Line. Revealing the relation between an active fault system and aftershock distribution is important to study long-term behavior of active faults. Precise aftershock distribution and detailed crustal structure in and around the source region of this earthquake is important to constrain the process of earthquake occurrence. To investigate aftershock distribution and crustal structure, we conducted a high-density seismic array observation in and around focal area. One hundred sixty-three seismic stations, approximately 1 km apart, were deployed during the period from December 3, 2014 to December 21, 2014. Each seismograph consisted of a 4.5 Hz 3-component seismometer and a digital data recorder (GSX-3). Waveforms were continuously recorded at a sampling rate of 250 Hz. The continuously recorded data were divided into event files, starting from an origin time determined by the JMA. In order to obtain a high-resolution velocity model, a well-controlled hypocenter is essential. Due to this, we combined the seismic array data with permanent seismic station data. We used 40 telemetered seismic stations in the present study. During the seismic array observation, the JMA located 977 earthquakes in a latitude range of 35.5-37.1N and a longitude range of 136.7-139.0E. We selected 100 local crustal events so that they were distributed uniformly in the study area. To investigate the aftershock distribution and the crustal structure, a tomography code simul2000 (Thurber and Eberhart-Phillips, 1999) was applied to the P- and S-wave arrival time data obtained from 100 local earthquakes. The hypocentral distribution of aftershocks shows a concentration on a plane dipping eastward in the vicinity of the mainshock hypocenter. The depth section of Vp structure shows that an eastward-dipping low-Vp zone exists along the estimated deeper extension of the Kamishiro fault.

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Keywords: dense seismic array observation, seismic tomography, Kamishiro fault, aftershock distribution