One cause of the strong ground motion characteristics in Mukawa town during the 2018 Hokkaido eastern Iburi earthquake

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The Hidaka mountain range, central Hokkaido, Japan, formed by the Hidaka arc-arc collision zone, with the Ishikari eastern fault zone on the west side and the Tokachi plain fault zone on the east side. The 2018 Hokkaido eastern Iburi earthquake (Mw 6.6) occurred on September 6, 03:08 JST at this arc-arc collision zone. The Japan Meteorological Agency (JMA) magnitude (Mj) was 6.7 and hypocentral depth was 37 km. The maximum seismic intensity (JMA-scale) 7 was observed in Atsuma town. During this earthquake, 41 people died mainly by a widespread large landslide in Atsuma town. The many building damages by strong ground motion were concentrated around HKD126 site. At K-NET HKD126 and JMA Atsuma Shikanuma stations, strong motion records had strong power to destroy the timber frame buildings. It is an important examination to know the cause of the generation of this destructive strong motion in spite of a low magnitude and deep focus.

We have conducted observations (2018 September 10- December 16) of earthquake ground motion due to aftershocks of this earthquake at near hillside station (MKW01). The target stations' underground shear wave velocity structures were estimated by microtremor array observation and multichannel analysis of surface waves method (Shigefuji et al 2019 Jpgu). We calculated theoretical amplification factor of the SH wave with the estimated shear wave velocity structure. The amplification factor of HKD126 is 5 times larger than the one of the MKW01 at a frequency around 1 Hz. Cause of this tendency are affected by low shear wave velocity in shallow part in HKD126; the engineering bedrock of HKD126 is deeper than the MKW01. We carried out the strong ground motion high-density line array observation (2018 December 01-16) along the line of HKD126 to MKW01 in Mukawa town, to know the changing of the ground motion amplitude by underground structures. We choose the earthquake records which were not affected by the nonlinear effect of soft soil. In these observed spectra, we can also understand the different amplitude as same as the theoretical ones. However, the predominant periods during mainshock is longer than this predominant period of theoretical and weak motion records. Generally, the strong ground motions are affected by the nonlinear response of surface soft soil. The strong motion record of HKD126 was examined the nonlinear effects by the DNL (degree of nonlinear effect) methods. The DNL value is 14.7; this value means large nonlinearity occurred (Noguchi et al. 2013) and the predominant period of the 1-2 s might be moved from the short-period side by this large nonlinearity. The strong ground motion power of 1-2 s during the main shock at HKD126 site was mainly amplified by this shallow underground velocity structure and this predominant range was conceivable changed for long periods side with nonlinear effect moreover.

A further step for studying this earthquake, we will examine the nonlinear effect for HKD126 in detail and we will spread the target area to examine the strong ground motion spatial distribution and discuss the 3-D underground structure.

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