

Microtremor and Earthquake Damage Survey in and around Kathmandu, Nepal

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In response to the occurrence and severe damage of the April 25, 2015 Gorkha Earthquake (Mw7.8) in Nepal, the Japan Science and Technology Agency (JST) started research support funds “Japan-Nepal Urgent Collaborative Projects (J-RAPID Program)”. As a member of a research project “Investigation of Ground-motion to Damage Relationship in the Kathmandu Valley from Aftershock and Microtremor Observations (Principal investigators: Prof. Kazuki Koketsu at the University of Tokyo and Dr. Soma Nath Sapkota, Deputy Director General at the Department of Mines and Geology, Ministry of Industry, Nepal)” under the J- RAPID program, I visited Nepal from September 17 to 26 for field survey with Dr. Masumi Yamada, Prof. Jim Mori (Kyoto Univ.) and Dr. Walter D. Mooney (USGS). Our research team conducted single-point microtremor observations^{*1} in the Kathmandu valley (city center and historical areas, including mainshock observation sites) and surrounding damaged areas (e.g Chautara, Bahrabise, and Dunche), and damaged school buildings (Sankhu area) using a portable microtremor observation system^{*2}, to investigate the relationship between natural periods of ground and building damage. The observation period was seven days and it was a very short time for the survey in a wide range of areas, but we could obtain microtremor data at more than 70 sites. Our observed data in the Kathmandu valley show dominant peaks of microtremors in the long period range, indicating deep sediment layers. Many local people were interested in our observations and provided us valuable information such as damages caused by just after the mainshock. We also investigated the earthquake damage of buildings along with the microtremor observations in detail. Many low-rised buildings were collapsed in the areas northwest – northeast of Kathmandu and the sights left an impression on me.

We also visited the National Society for Earthquake Technology (NSET) and the National Seismological Centre, Department of Mines and Geology (NSC-DMG) and had a discussion on earthquake damage and research trends in some running international projects. In NSC-DMG, we met ex-participants of IISEE training course [Mr. Mukunda Bhattarai (2004-2005 and 2013-2014 Seismology courses), Mr. Lok Bijaya Adhikari (2002-2003 Seismology course; 2013 Global course), Mr. Umesh Prasad Gautam (2010 Global course)].

The detailed results of our damage and microtremor surveys were published in *Earth, Planets and Space* (see <https://earth-planets-space.springeropen.com/articles/10.1186/s40623-016-0483-4>).



Photo 1: Kathmandu basin



Photo 2: Microtremor observation
(at Patan Durbar Square)



Photo 3: Discussion at NSET



Photo 4: Discussion at NSC-DMG

*1: The ground is always vibrating with very-small amplitude due to natural phenomena such as ocean waves and wind, and human activities (we call the phenomena microtremor, ambient vibration or seismic noise). The microtremor data have information about underground soil structure and ground motion properties of the site.

*2: We used a portable microtremor observation system with three-component accelerometer DATAMARK JU-310 (Hakusan corporation) for our microtremor observations. The sensor is sometimes used for lectures of Regular (S and E) and Global courses. Dr. Hisatoshi Kahiwa at the National Institute for Land and Infrastructure Management provided us the instrument for this survey.