

Detection of the blast frequent areas based on the NIED Hi-net hypocenter catalog

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One of the important matters for constructing a daily hypocenter catalog is excluding information about artificial earthquakes and blasts. Automatic hypocenter determination system operated by NIED has the master database of blast frequent areas. By using this database, the system automatically determines that a detected event is whether a natural earthquake or artificial one. On the other hand, blast points sometimes move by changes of social activities (Okada, 1996). In this study, we extracted new blast frequent areas based on the NIED Hi-net hypocenter catalog for eight years (from April 2008 to March 2016). Then, we apply the same method to two years before and after the 2011 Tohoku earthquake, and check the time and spatial variation of the blast frequent areas in the Tohoku district.

Seismograms by blasts at quarries and construction areas are generally observed in the daytime (Okada, 1996; Taira and Tsumura, 2001). First, we extracted the manually confirmed blast events from the eight-year Hi-net catalog and confirmed that 99.5 % of the blast events were observed for 12 hours from 7:00 to 19:00. Thus, we set this time range as blast frequent time zone. As a basic unit for the blast frequent region evaluation, we defined small cells with the width of 0.025-degree. Based on the Hi-net hypocenter catalog for recent three years (April 2013 ~ March 2016), we extracted shallow (< 10km) events and counted the number within each cell. Cells where more than 90% events occurred during the blast frequent time zone were selected and named as **EVT**. We also labeled the cells as **MAN** where several blast events detected manually. The cells already selected in the Hi-net master DB were labeled as **MAS**. Comparing these cells, we confirmed that all **MAN** cells were included in **EVT** cells. Although more than 700 cells were only selected as **MAS**, 240 cells were newly extracted as **EVT**. Checking the event activity of each cell for the eight years' catalog, we confirmed that the former cells were two cases: the area where the detection of blast events was stopped and both the blasts and natural earthquakes were observed. In order to check the transition of the blast area before and after the 2011 Tohoku Earthquake, we prepared the Hi-net hypocenter catalog for three periods: Before the earthquake (Mar. 2009 to Feb. 2011), just after the earthquake (Apr. 2011 to Mar. 2013), and recent two years (Apr. 2014 to Mar. 2016). Using each catalog, cells where more than 90% events occurred concentrated within the blast frequent time zone were extracted. Although there were many active blast area along the Kitakami River in Iwate and Miyagi, Hama-dori district in Fukushima and Hitachi city in Ibaraki before the earthquake, few blast events were detected just after the earthquake. The activity of blasts was obviously reduced at not only the Pacific coast but also the inland area. In recent years, the activity has resumed at these areas and seemed to expand to the surroundings. This result shows that the progress of reconstructions from the earthquake damage.

Keywords: NIED Hi-net, Blast, Tohoku-Oki Earthquake, Hypocenter Catalog