

## Application of GPR to a near-surface structure study for damaged zones of the 2011 Naganoken-Hokubu earthquake

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After the Tohoku-off Pacific Ocean earthquake, the Naganoken-Hokubu earthquake occurred along the active fault zone in an area bordered between Nagano and Niigata Prefecures. In Aokura and Mori areas, many houses were damaged by this induced earthquake, while in Kamigo area, Tsunan Town, surface breakages took place along a pre-existence flexure of the Miyanohara active fault. Accordingly, we investigated subsurface structures in the three areas using the ground-penetrating radar (GPR) unit and two 100 MHz antennas on August of 2011. The GPR data were processed to accentuate geologic features by high pass filtering, low pass filtering. The time profile changed to a depth profile by the wide-angle measurement. Judging from the GPR results and observation, we conclude that a soft ground with saturated water exists in Mori area, because there is a layer of weak reflected signals on the GPR section. The distribution of the soft ground is almost consistent with that of the remarkable house damages in Mori area. Secondary, in Aokura area, there is also a water-saturated soft ground, based on an analysis of the GPR data. The soft ground layer is bounded by strong reflected signals on the GPR section. This boundary is assumed to be a fault. Thirdly, in Kamigo area, Tsunan Town, anomalous detection, showing a discontinuity of reflected signals, was found on the GPR section. This discontinuity on the GPR section is considered to be the Miyanohara active fault.

Keywords: Naganoken-Hokubu earthquake, ground-penetrating radar (GPR), flexure scarp, Miyanohara fault