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Inhomogeneous structure and seismicity in and around the high strain rate zones in the central part of NE Japan

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In the central part of Japan, the inhomogeneous distribution of strain rate distribution was reported (e.g. Miura et al., 2004). High strain rate is observed along the backbone range, the forearc region of Miyagi prefecture, and near coast line of the Japan Sea. To understand the origin of these high strain rate zones, we estimate seismic velocity structure of the crust in the central part of Tohoku, NE Japan, and discuss on its relation with seismic activity.

We determined three- dimensional seismic velocity structure and relocated hypocenters simultaneously using the tomography method (Zhao et al., 1991; Zhang and Thurber, 2003). Travel time data used are obtained from the dense seismic network by the temporary seismic stations installed for ”Multidisciplinary research project for high strain rate zone” promoted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. and the Group for the aftershock observations of the Iwate-Miyagi Nairiku Earthquake in 2008 (GIMNE) and the Japan Nuclear Energy Safety Organization (JNES). We also used P- and S-wave data from networks of Tohoku University, JMA, Hi-net and other temporary stations during the period from 1997 to 2010.

In the upper crust, distinct low-velocity regions are distributed in the Osaki-plain, Kitakami low-land, Shinjo basin and Shonai plain. In some areas (e.g., in the source region of the 2003 northern Miyagi earthquake), these low-velocity zone are seems to be distributed in the hanging wall of the fault. We also found some low-velocity regions near the active volcanoes (e.g., Kurikoma, Chokai). High seismicity area in the upper crust corresponds with higher velocity areas.

In the lower crust, we found some distinct low velocity areas. These low velocity zones are located just beneath the volcanoes and these high strain rate zones. High seismicity includes the moderate-sized and large earthquakes (e.g., the 2003 northern Miyagi earthquake (M6.4), the 2008 M7.2 Iwate Miyagi Nairiku earthquake, the 1894 M7.0 Shonai earthquake) in the upper crust is just above these low velocity zones. These low-velocity zones in the lower crust are imaged to continuously distributed from the uppermost mantle.

We used data from temporary seismic stations installed for ”Multidisciplinary research project for high strain rate zone” promoted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. We also used data from the Japan Nuclear Energy Safety Organization (JNES), JMA, Hi-net.