

Remarkable linear seismicity extending northward from the aftershock area of the 2007 Niigata-ken Chuetsu-oki earthquake

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According to the Japan Meteorological Agency's (JMA) integrated hypocenter database, there exists a remarkable linear seismicity (the depth, mainly, a little less than 20km to around 25km) extending for about 40km in the NNE direction from the aftershock area of the 2007 Niigata-ken Chuetsu-oki earthquake (Mjma 6.8) (Ishibashi, 2008, http://www.pref.niigata.lg.jp/HTML_Article/isibasi2-jisin4,0.pdf).

It spreads along the Eastern-boundary fault of Sado Basin pointed out by Watanabe et al. (2007), and may reflect the tectonic structure in this region. However, we cannot use JMA's integrated hypocenter data directly for geoscientific arguments in this region because their location accuracy is not good enough. Therefore we relocated hypocenters in and around the remarkable linear seismicity and examined its spatial and temporal distribution.

For improving accuracy of relative location, we used double-difference method (DD method; Waldhauser and Ellsworth, 2000). We conducted simultaneous hypocenter relocation in and around the linear seismicity (138.45 to 138.8 degrees east, 37.55 to 38.05 degrees north) and in a wider area around the linear seismicity (138.4 to 139.0 degrees east, 37.4 to 38.3 degrees north). The purpose of the former is to examine the shape of the linear seismicity in detail and that of the latter is to examine the relationship between the linear seismicity and other seismic activity around the linear seismicity. The period for relocation is from October 1, 1997 (the first day of the JMA's integrated hypocenter database) to January 1, 2009. The target hypocenters include aftershocks of the 2004 Niigata-ken Chuetsu earthquake (Mjma 6.8) and the main shock and aftershocks of the 2007 Niigata-ken Chuetsu-oki earthquake. Concerning the velocity structure we referred to Shibutani (2005) and stations within epicentral distances of around 100km were used.

Before the 2007 Chuetsu-oki earthquake the linear seismicity spread along the contour of the water-depth of 200m in the eastern margin of Sado Basin from the 2007 aftershock area. However, there was no event in the 2007 aftershock area. The linear seismic activity remained after the 2007 event. Most hypocenters in the linear seismicity were distributed almost horizontally (about 10km in width). Near the 2007 aftershock area, hypocenters tend to be deepened. Several shallow events (about 10 km in depth) occurred near the center of the linear seismicity. Although they were a few numbers, they showed a tendency of northwesterly-dipping. However, relocated hypocenters in the linear seismicity did not delineate the shape of the Eastern-boundary fault of Sado Basin clearly.

Relocated hypocenters also existed along the contour of the water-depth of 200m in the western margin of Sado Basin. The eastern and western linear seismicity met around the 38.1 degrees N and near the 2007 aftershock area each other. The epicentral distribution corresponds with submarine active faults around Sado Basin that Watanabe et al. (2007) pointed out. The depth of hypocenters in the eastern and western linear seismicity were almost the same and they were distributed approximately horizontally. Shallow events (around 10km in depth) occurred near the Kakuta-Yahiko fault and they looked to be connected to the linear seismicity suggesting gentle northwestward dipping. Therefore, it is possible that the eastern linear seismicity occurs on the deeper part of the Kakuta-Yahiko fault.