Landform around the source area of the 2007 Off Mid-Niigata Earthquake revealed by an airborne LiDAR

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It was observed by InSAR measuring and leveling that Nishiyama hill in northern part of the source area of the 2007 Off Mid-Niigata Earthquake uplifted 20 and several centimeters with the earthquake. The correspondence of topographic high and uplifted area shows a possibility that Nishiyama hill has been formed by the same fault movements. We carried out an airborne LiDAR to elucidate topographic feature of the source area. The measurement range is a rectangle of 25 x 10 km parallel to the coastline. It covers whole part of Nishiyama hill from the northern tip to Sabaishi river in Kashiwazaki plain, and extends its landside margin to the eastern wing of Higashi-kubiki hill. The flight was carried out in late September of 2007, and made a DEM (Digital Elevation Model) of the whole measured area with 2 m grid. The work from the airborne measurement to making a DEM was outsourced to Nakanihon Koukuu Co.Ltd. We discuss on the acquired topographic feature of Nishiyama hill in this study.

Nishiyama hill has relatively gentle slopes with about 120 m high. Seaside of the watershed which locates eastern part of the terrain is eroded well by rivers, and there are relative wide lowlands along the valleys. Except for the southern part of the hill, the rivers flow almost westward directly in their lower streams. Ridges and valleys distribute mutually in this direction. The peak of every ridge is located its northern tips, consequently a cuesta is formed in total. This fact is clearly shown by distribution of relative heights from its highest to lowest in 5 x 5 pixels. The higher score distributes in the southern side of the rivers (northern side of the ridges). Each ridge reaches to shoreline with the asymmetric profile, consequently it makes triangle cape. The representative example is Kannonzaki cape. On the other hand, upper stream of each river curves left at the valley head. The relative height increases at the curving valley head, consequently its higher zone distributes along the watershed range.

The topographic features correspond well with the geological structure. Two echelon anticlines are formed in Nishiyama hill. In the northern part, Amaze anticline is partially found around the shoreline in Izumozaki, but no the other anticlines are found on land. Teradomari formation distributes along the shoreline just around Amaze anticline, which is surrounded by Shiiya formation in the eastern and southern part. The curve of rivers in this area corresponds well with the change of the strikes of Shiiya formation. Although dips of the formation are gentle around the center of the anticlines, those of the east margin are steep in Nishiyama formation. The large relative height zone recognized in DEM distributes boundary between Shiiya formation and Nishiyama formation.

Based on the above, it is interpreted that Nishiyama hill was uplifted with deformation center of its east side. It is mentioned that the off Mid-Niigata Earthquake was generated mainly by SE dipping thrust fault, but partially by NW dipping one in the northern part. The landform features of Nishiyama hill shows a correspondence with the latter faulting.