

Seismic changes beneath the Nikkou-Ashio area associated with the 2011 Tohoku-Oki earthquake

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The 11 March 2011 Mw9.0 Tohoku-Oki megathrust earthquake induced many in-land earthquakes in Japan. Obvious changes in seismic activity are observed in the Nikkou-Ashio area located in the southern Tohoku. The seismicity rate was three to four times more active than usual. I have investigated the behavior of seismicity before and after the megathrust from 2000 to 2012, observed by Earthquake Research institute, University of Tokyo and report its changes, the relationship between hypocenters and the velocity structures and the b-value changes.

1) Seismicity.

After three hours later from the Tohoku-Oki earthquake, shallow micro earthquakes began to occur in the region. The induced earthquakes are characterized by locating very shallow depths of 1-2 km. They located at two different places in character. The one is near and around volcanic bodies such as Mt. Nantai-san and Mt. Shirane-san, where usual earthquakes seldom occur. The other is along the Uchinokomori faults. The place is the most seismically active zone in Ashio, where the local earthquakes always occur at depths of 7-8 km. The seismic activity around volcanoes is rapidly decreasing from June 2011, while the shallow earthquakes along the Uchinokomori faults still continue with usual activity.

2) Relationship between the seismicity and the velocity structure

Beneath the volcanoes, anomalous low velocity zones at depths of 5-8 km widely spread, which indicates the existence of magma or fluid. The induced shallow earthquakes are locating just above the low velocity zones. The shakes and the stress changes due to the significant earthquakes and fluid derived from under low velocity zones result in shallow earthquakes. The decreasing of normal stress for the Uchinokomori faults and the upwelling flow of fluid also may result in very shallow earthquakes along the faults.

3) Change in b-value

B-value in the Nikkou-Ashio region changed immediately concerned to the 2011 Tohoku-Oki earthquake. Before eight months b-value was 0.8, then gradually it increased up to 0.98 until just before the earthquake and after the Tohoku-Oki earthquake, it decreased down to 0.75. Until now the fluctuation of the b-value is related to the occurrence of low-frequency earthquakes. Low-frequency earthquakes in the Ashio region have occurred with a recurrence interval of about three years at the point of b-value reversal. When the b-value is relatively low, low-frequency earthquakes occur and after that b-value become high with promoted seismic activity. In this time, low-frequency earthquakes occur almost the same period associated with the reversal of b-value. The change of b-value is also caused by the 2011 Tohoku-Oki earthquake. We need a more study to understand the relation between them.

Keywords: seismicity change, b-value, low velocity zone, Nikkou-Ashio