

Large earthquakes along the eastern margin of Japan Sea and a study project on historical records and geological traces

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Large (M 7.5 or above) earthquakes have recurred along the eastern margin of Japan Sea and caused damage by ground shaking and tsunami. The 1964 Niigata earthquake (M 7.5) occurred off Murakami coast and caused 26 deaths. It uplifted Awashima Island by about 1 m. A high-angle, westward-dipping fault was first proposed, but a shallow-angle eastward-dipping fault was also proposed. The 1833 Shonai-oki earthquake (M 7.5) caused many casualties in the Shonai plain. The tsunami was recorded from Hokkaido through Noto peninsula, and a fault model based on the tsunami height distribution was proposed. The 1983 Japan Sea (Akita-oki) earthquake (M 7.7) generated tsunami up to 14 m, which is responsible for most of 104 casualties. On the basis of aftershock distribution and other data, many eastward-dipping fault models have been proposed. The 1993 SE Hokkaido earthquake (M 7.8) generated tsunami (the maximum of 30 m on Okushiri Island) and a total of 230 casualties. Okushiri Island had subsided at the time of earthquake. A multiple fault model, an eastward-dipping fault in the north and a westward-dipping fault in the south, has been proposed. The 1940 Shakotan-oki earthquake (M 7.5) caused tsunami damage around the northern tip of Hokkaido. Based on submarine geological and submersible surveys, the source fault is estimated at Oshoro seamounts. In addition to these earthquakes, a large tsunami, up to 13 m, was generated at the time of 1741 eruption of Oshima Oshima by submarine landslide.

The Earthquake Research Committee has compiled past history and announced future probability of large earthquakes along the eastern margin of the Japan Sea. For the earthquakes described above, the lower bound of recurrence interval has been estimated as 500 to 1100 years, hence the probability of next earthquakes in coming 30 years is almost 0 %. The probability and expected earthquake size are: less than 0.1 % and M 7.8 offshore northwestern Hokkaido, 3 to 6 % and M 7.8 off Sado Island, and less than 3% and M 7.5 off Akita. These estimates are focused for only large (M 7.5 or larger) earthquakes and based on very limited number of data, hence we will need to increase geological data such as tsunami deposits and crustal deformation in order to increase the reliability of long-term forecast.

For inland and near-shore earthquake that occurred since Edo period (AD 1600s or later), numerous historical records have been compiled in Collection of Historical Documents (often called Musha Shiryo and Shinshu Jishin Shiryo), and the source area and size of earthquakes have been estimated from damage distribution. Among them, the following earthquakes have left numerous historical records: the 1828 Echigo Sanjo earthquake (about 500 pages of documents), the 1751 Echigo Takada earthquake (about 300 pages), the 1804 Kusakata earthquake (180 pages), the 1766 Tsugaru earthquake (150 pages), and the 1833 Shonai-oki earthquake (150 pages). In addition, the 1694 Noshiro earthquake, the 1704 Ugo earthquake, 1793 Nishi (west) Tsugaru earthquake, the 1802 Sado Ogi earthquake, the 1810 Ugo earthquake, and the 1858 Omachi earthquake also left 40 pages or more documents. More historical records are to be examined and collected.

Regarding Collection of Historical Documents, two issues have been pointed out; no quality control has been made, so that the reliability of each documents varies significantly; because they are not databased, searching particular words is not easy. To overcome these difficulties, we have established database system for Ancient and Medieval ages (Ishibashi, 2009). In the new MEXT project, we plan to collect and evaluate historical records, construct database of these records and emend them with help of historians. We re-estimate the distribution of earthquake damage and seismic intensity, then estimate the source fault.