

5 SEISMICITY

Earthquakes with a magnitude greater than 6 in Japan Sea Region are given in Table 5.1. Most earthquakes occurred are of offshore type except Sanjo earthquake (Figure 5.1). However, from time to time shallow earthquakes do occur in the epicentral area. The 1961 Nagaoka earthquake (M5.2) caused 5 deaths (Figure 5.2).

Table 5.1: Past large earthquakes in the vicinity of the epicentral area

Year	Location	Magnitude	Death
1940	Off Cape Kamui	7.5	10
1993	SW of Hokkaido	7.8	202
1983	Japan Sea	7.7	104
1964	Niigata	7.5	26
1828	Sanjo	6.9	1443
1847	Zenkoji	7.4	Several thousands

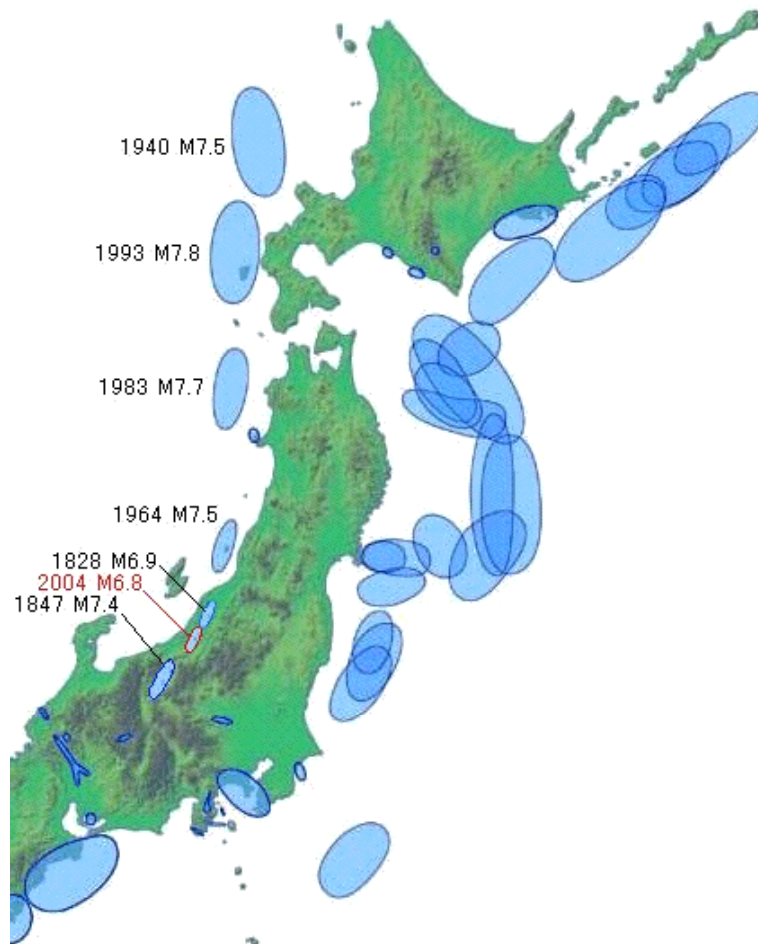


Figure 5.1: Areas and location of historical earthquakes

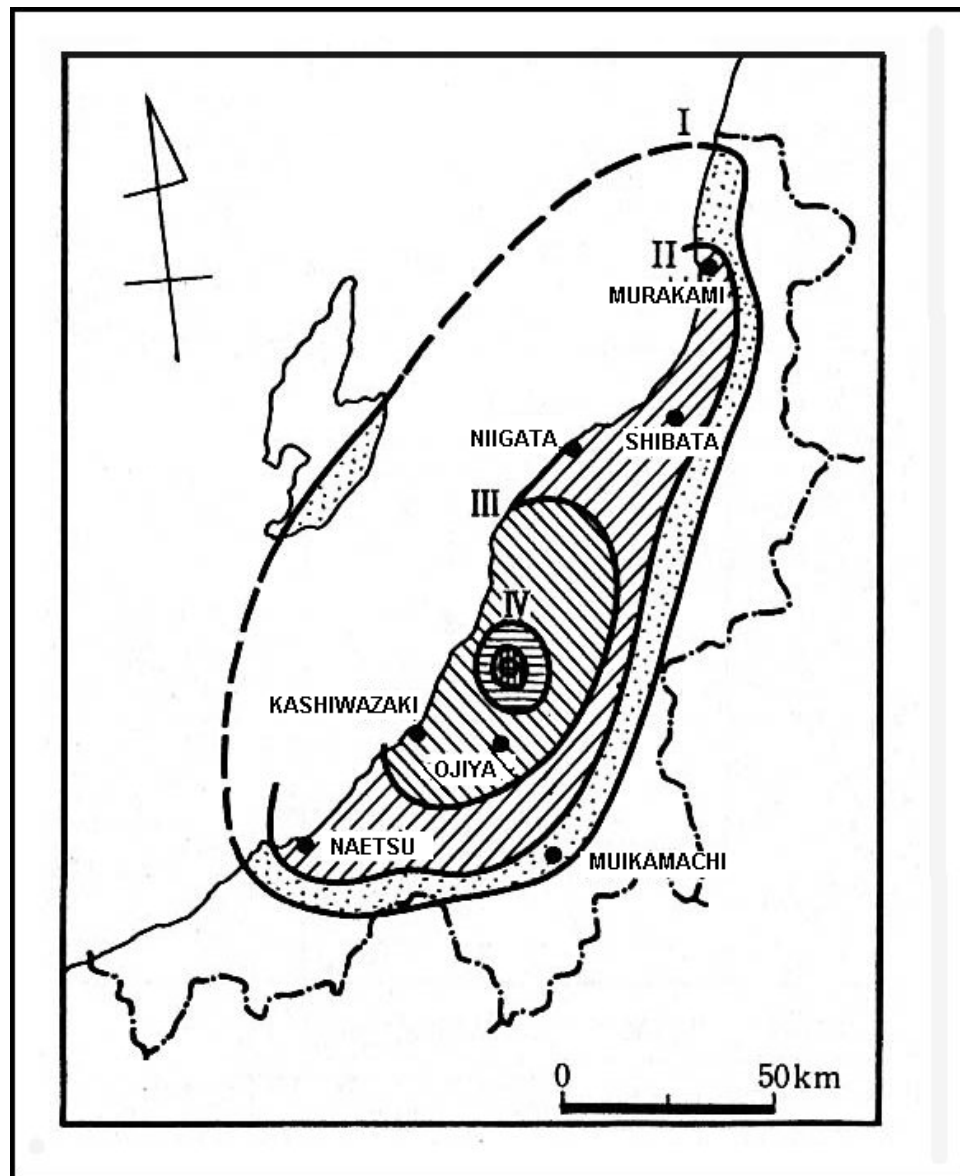


Figure 5.2: Iso-seismal contours of JMA seismic intensities

It is pointed out that there are several seismic gaps along the collision zone between Euro-Asian plate and North American Plate. The 2004 Chuetsu earthquake filled one of these seismic gaps as shown in Figure 5.3.

The author plotted the cumulative magnitude of earthquakes around the epicenter with a radius of 100km between 1973 and Oct. 23, 2004 cataloged by NEIC in Figure 5.4. The following function was fitted to the seism city.

$$\sum M = 0.572(t - 1973)^2$$

It is of great interest that the above functional form is very similar to that of the accelerating creep stage of rocks in laboratory tests. Figure 5.5 shows the epicentral

distributions of the earthquakes. Although two events are seen in the epicentral area, most of earthquakes are far away from the epicenter of the main shock. Following the main-shock many aftershocks took place.

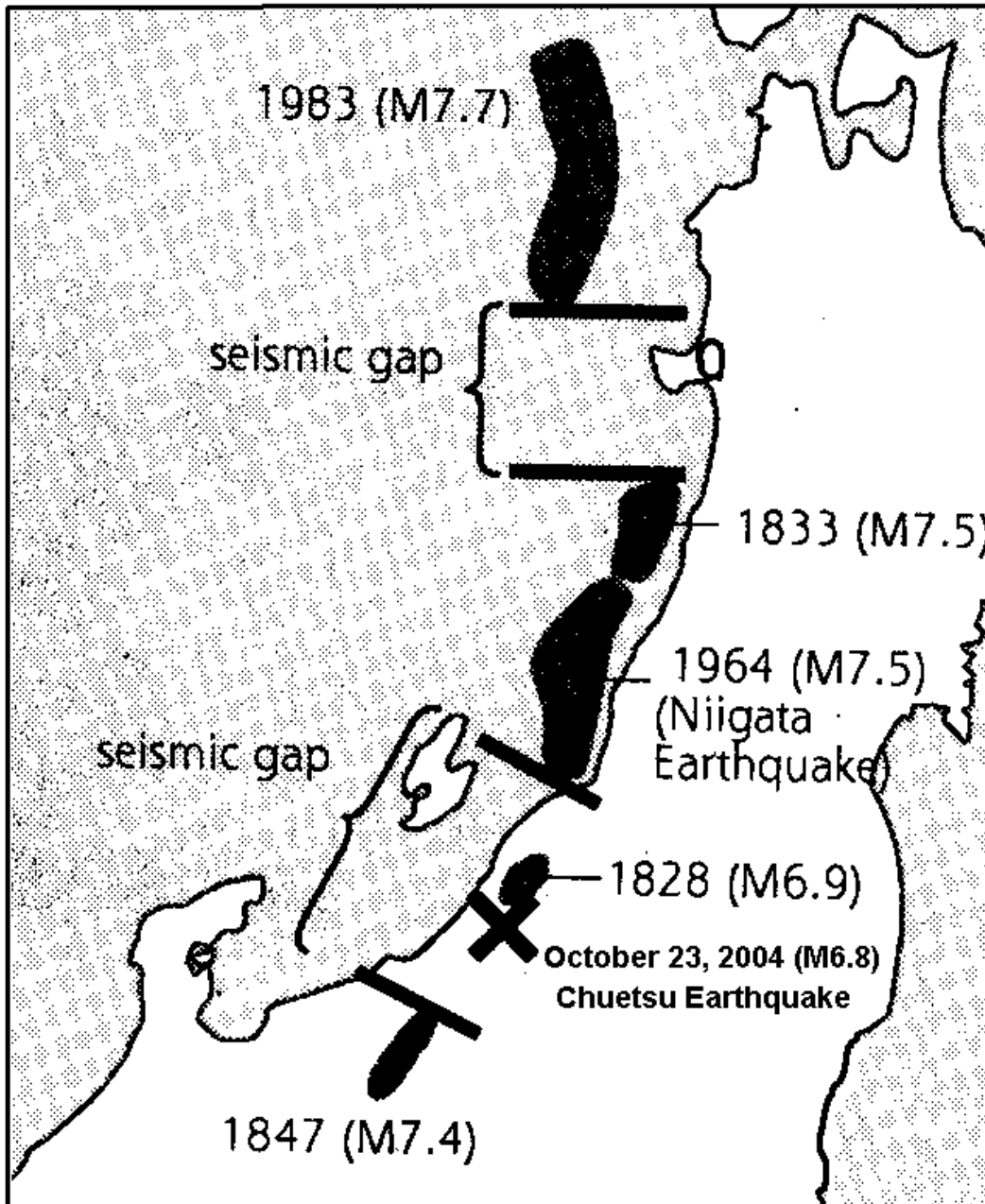


Figure 5.3: Seismic gaps in the vicinity of epicentral area (modified from Yomiuri Newspaper)

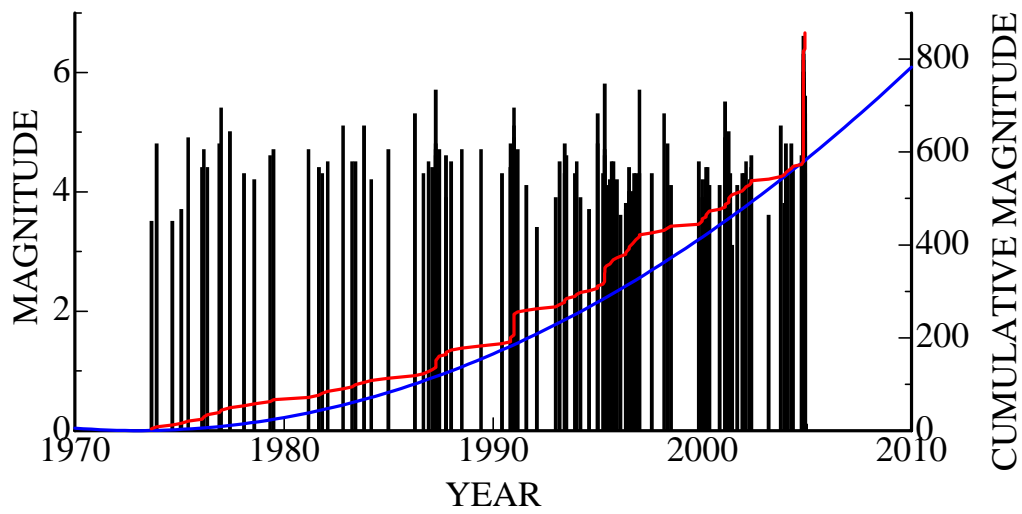
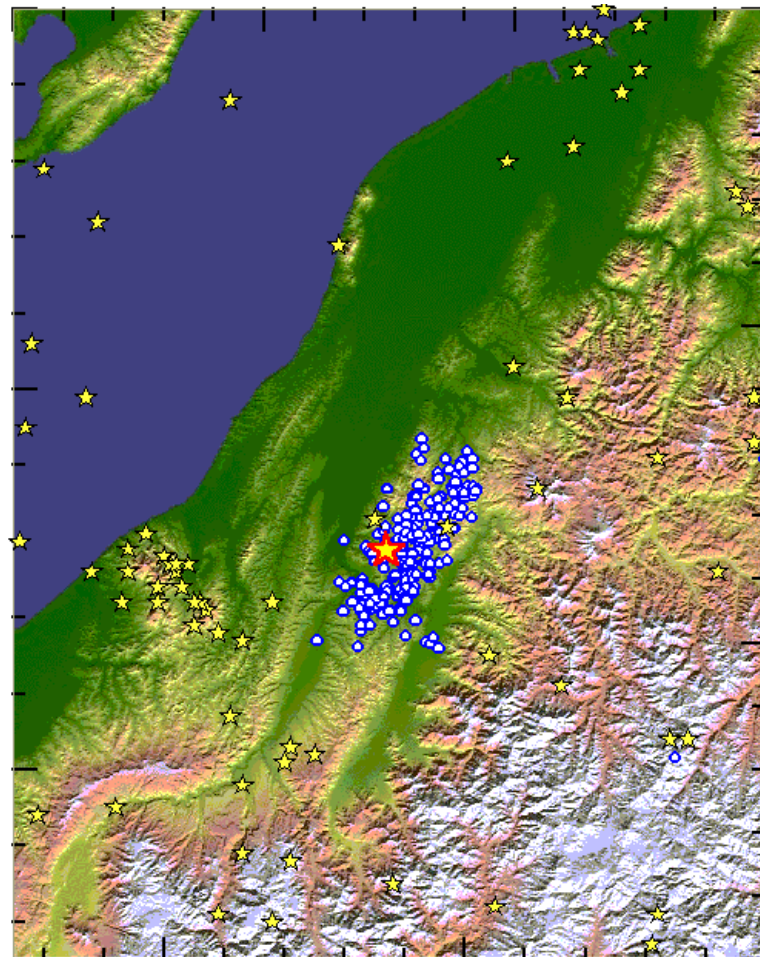


Figure 5.4: Variation of magnitude and cumulative magnitude with time



★ Main Shock ○ After-shocks (JMA) ☆ 1973-2004 (NEIC)

Figure 5.5: Pre-seismicity in the epicentral area and aftershock distributions (base map NASA)