

## Precursory seismic activity surrounding the source region of the 1968 Tokachi-oki earthquake

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The 1968 Tokachi-oki earthquake (Mw8.2) occurred off the Pacific coast of Aomori prefecture and ruptured northern and southern asperities. 26 years later, the 1994 Sanriku-haruka-oki earthquake (Mw7.7) occurred near the epicenter of 1968 event and ruptured only its southern asperity [Nagai et al. (2001)]. According to Sato et al. (1996), the rupture process of the 1994 event was very similar to the earlier stage rupture process of the 1968 event. The question arises, "Why did the 1994 event not rupture the northern asperity of 1968 event"? In order to address this question, we investigated the long-term seismicity pattern with reference to the slip distribution of the 1968 Tokachi-oki (Mw8.2) and 1994 Sanriku-haruka-oki (Mw7.7) earthquakes. We used the earthquake catalogue compiled by the Japan Meteorological Agency (JMA) for the past 90 years since 1923.

There are two major clusters that are considered to be important for characterizing the spatio-temporal seismicity pattern in and around the source region of the 1968 event. The one is a cluster of events located off the Pacific coast of Iwate prefecture between the Japan Trench and the southern asperity of the 1968 event. We call this cluster the "east-west trending seismic activity", because it is distributed along the east-west direction. The other is a cluster of events located off the Pacific coast of Iwate prefecture between the 10 and 20km depth contours of the upper interface of the subducted Pacific plate. We call this cluster the "southern seismic activity", because it is located southern side of the southern asperity of the 1968 event. The epicentral area of the southern seismic activity include the rupture zone of the 1989 and 1992 Sanriku-oki earthquakes, which are regarded as the ultra-slow earthquake by Kawasaki et al. (1995, 1998, 2001).

The 1931 Iwate-oki earthquake (M7.2) occurred off the Pacific coast of Sanriku and ruptured the southern asperity of the 1968 event [Yamanaka and Kikuchi (2004)]. The 1931 event was preceded three years earlier by a M7.0 event that occurred about 30km to the west. 4 years later, a M6.9 earthquake occurred very close to the epicenter of the M7.0 event in 1935. The 1933 activity in the zone of east-west trending seismic activity consists of nine large earthquakes (M>6.0) with the largest of M7.1. Three of the events initially occurred in the eastern part of the zone, then expanded into the west. The 1933 Sanriku-oki earthquake (M8.1) occurred in the outer-rise region off the Pacific coast of Iwate prefecture. The 1941 activity in the zone of southern seismic activity consists of four large earthquakes (M>6.0). Two of the events occurred in the eastern part of the zone, then the other two events occurred in the western part of the zone. A strong swarm activity (including eight M>6.0 earthquakes) occurred in the zone in 1952. The 1960 Iwate-oki earthquake (M7.2) occurred off the Pacific coast of Sanriku and ruptured the southern periphery of the southern asperity of the 1968 event. The rupture propagated to the deep direction from the hypocenter [Yamanaka and Kikuchi (2004)]. A 1945 event (M7.1) occurred off the Pacific coast of Aomori prefecture and ruptured the northern asperity of the 1968 event. The 1945 event was preceded two years earlier by a M7.1 event that occurred about 40km to the east. On March 22, 1944, M6.1 event occurred in the region sandwiched by the northern and southern asperities of the 1968 event. This event may contribute to weaken the strength of this region and allowed to propagate the rupture from the southern to northern asperities when main shock of the 1968 event occurred.

### References:

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