Forecast of Earthquake Swarm Activities in the Eastern Izu Region, Central Japan

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A Subcommittee for exploration of Earthquake Activity Forecast methods was set up in the Earthquake Research Committee of the Headquarters for Earthquake Research Promotion of Japan in 2009. The aim of the subcommittee is to explore and propose methods of earthquake activity forecast in short-term range to reduce earthquake disasters.

Although earthquake prediction is generally quite difficult, there are some cases we can prospect seismic activities by the current dense crustal and seismological observation and the progress of seismology (Fig.1). An example is aftershock activity after a big earthquake occurs. JMA issues Aftershock Information to provide the aftershock prospect. Another case we think predictable is an earthquake swarm activity in the eastern Izu region, central Japan (Fig.2).

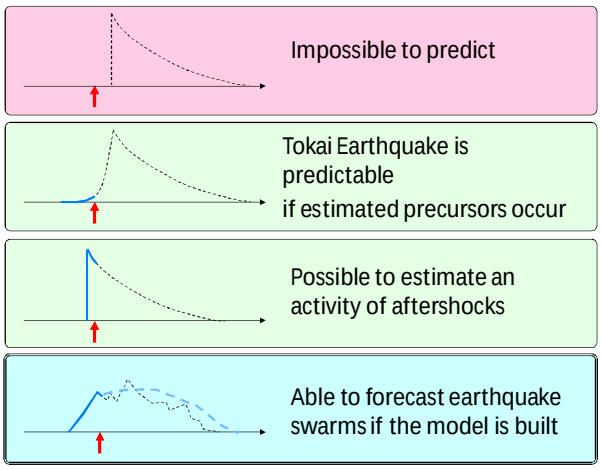

Fig.1 Predictability of earthquakes

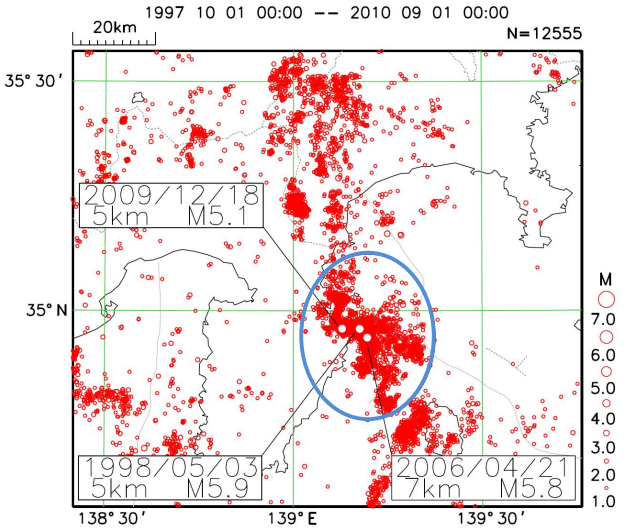

Fig.2 Hypocenter distribution in Izu region
Earthquake swarm has occurred in blue circle
(1997/10/1- 2010/8/31, depth≦20km)

Earthquake swarms have occurred repeatedly since 1978 in the eastern Izu region and sometimes brought earthquakes with magnitude of 5 (Fig.2,3). The average occurrence frequency of earthquake swarms is 1.5 times a year. As these activities were located close to Ito city, an M5 scale earthquake caused damage in the past. During the activity on December 2009, seven people were injured and 278 houses were damaged. Not only residents but also many people in other areas were concerned with earthquake swarm activities because Izu is a popular resort area with natural beauty and hot springs.

These seismic activities are thought to be related to volcanic activities of Izu-Tobu Volcanoes. In fact, the swarm activity in 1989 resulted in a submarine volcanic eruption east off Ito city (Fig.4). These volcanic activities with dike intrusion cause crustal deformation in surrounding area which precedes earthquake swarm activity in many cases. On the other hand, the strain variation rate at the beginning at Higashiizu observation site is proportional to the total volume of intruding magma which has a good correlation with swarm activity. Accordingly, we can prospect earthquake swarm activities after strain changes at Higasiizu are observed (Fig.5).

This method was approved by the Earthquake Research Committee this September and JMA has begun discussions with local government about the proper announcement way of this forecast information to the public to avoid confusions. JMA expects to start the operation of the information provision in next year.

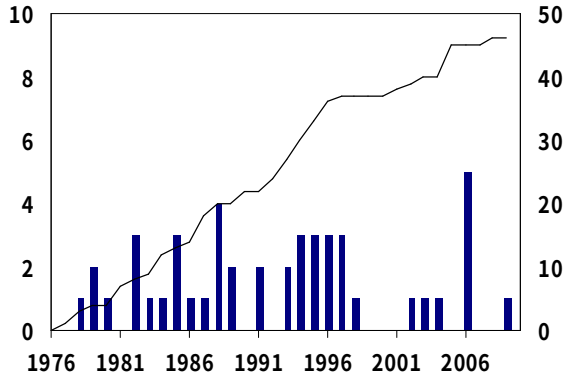

Fig.3 Histogram of earthquake swarm number (left axis)
Accumulated numbers of earthquake swarms number (right axis)

Fig.4 Volcanic eruption on July 13 1989
(Photographed by Japan Coast Guard)

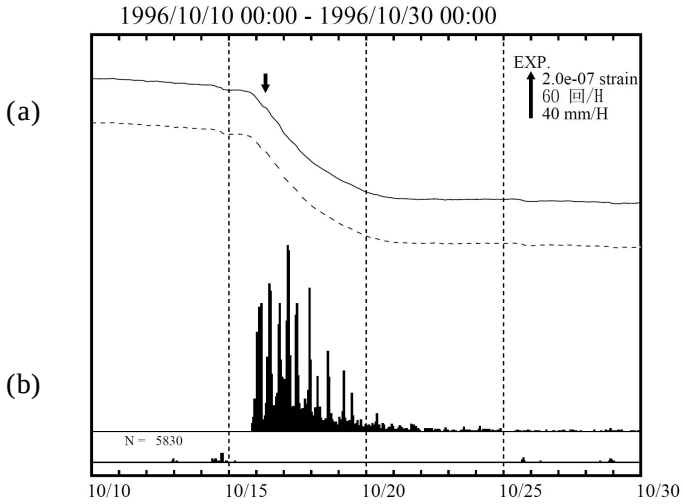

Fig.5 Crustal movement in Higashiizu (a)
Histogram of earthquake number at Kamata (b)