

Space- temporal stability of the seismic quiescence (4) -Relation of seismic quiescence area and the main shock

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We have been continuing investigation of seismic quiescence phenomena for the purpose of application to earthquake prediction. As a result of re-investigation of the cases for the earthquakes of M7 class in Japan, we found that the distance between the hypocenter of the main shock and the center of seismic quiescence area becomes large with the earthquake magnitude to occur in the detected cases. Based on this scaling law, detectable cases could be newly found in the non-detected ones in the previous investigation.

We applied the method of 'eMAP' which was developed by Aketagawa and Ito (2008) and Hayashimoto and Aketagawa (2010) for detection of the seismic quiescence. For the study we picked up 26 earthquakes that occurred from 1987 to 2011 with the magnitude larger than or equal to 6.7 and the intensity larger than or equal to five in Japan. There were 11 detected cases and 15 non-detected cases in the past investigation (Ota et al.(2009) and Yoshikawa (2012)). In the case of the 1995 Kobe earthquake, where seismic quiescence could not be detected by 'eMAP' in the past investigation, a clear seismic quiescence has been reported by the DPRI of Kyoto University (1995) and the Japan Meteorological Agency (1995). As a result of re-investigation of this case, it became possible to treat it as a detectable case if the following things were considered. Though we have considered as the necessary condition for the precursor that the phenomenon appears in and around the focal area before occurrence of the main shock, we could not recognize as a phenomenon to be connected directly with the main shock because a seismic quiescence appeared in Tamba region approximately 30km distant from the epicenter near the Akashi Channel. And any remarkable quiescence was not detected in the epicenter, since the average seismic activity before the earthquake was too low. It is necessary to make clear the condition to treat the quiescence as a precursor. Then as we re-examined the detected cases, we found that the distance between the epicenter of the main shock and the center of the quiescence area became large with the magnitude of the earthquake to occur. We have reported that there are scaling laws in the size of the quiescence area and the duration of quiescence against the magnitude (Yoshikawa et al., 2013). As the quiescence is supposed to occur in the stress reduction area caused by aseismic slip, the main shock should occur in the periphery of the quiescence area and it is quite natural that the distance between the epicenter and the center of the quiescent area becomes larger obeying the scaling law.

We re-examined other non-detection cases and found that the precursory seismic quiescence can be detected also in the 1987 eastern off Chiba earthquake, the 1994 far-off Sanriku earthquake, the 2000 western Tottori earthquake, and the 2004 south-east off Kii peninsula earthquakes. As a result of this, 16 cases can be considered as detected and 10 cases as not- detected for 26 cases in total.

Keywords: earthquake, quiescence, hypocenter