Objective evaluationof precursory seismic quiescence and activation phenomenon in wide area

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The 1995 Kobe earthquake of M7.3 is an earthquake known to have observed abnormal changes in seismic activity accompanied by various changes such as crustal deformation, groundwater and electromagnetism before the main shock. Especially Mogi (1995) pointed out the seismicity gap and the quiescent phenomenon of the seismic activity with a long-term and wide-area perspective. Yoshida (1995) pointed out the wide range of the preceding phenomena of seismic activity and showed that the area wider than the epicenter area is involved in the earthquake occurrence process. Therefore, if any prediction method is supposed, it is a problem how much accuracy it is possible to know based on such a preceding phenomenon in wide area.

eMAP is a tool to evaluate the appearance probability of seismic activity by Poisson's probability (Yoshikawa et al., 2017). In this method a region is set for each individual epicenter and the degree of abnormality is displayed in all regions. In order to consider the above problem, we examined the possibility of diagnosis of wide area seismic activity by this method.

By analysis of the quiescence and activation phenomenon in wide area during the Kobe earthquake, mainly in the Kinki, Chugoku and Shikoku districts, the following features were found. At that time, in the JMA seismic catalog before the unification, the magnitude threshold is considered to be around M 2.0 since 1988. The spatial distribution of the seismic activity has changed in a relatively short time scale and a stable pattern is not seen until 5 to 6 years before the main shock, but about 2 years before, a quiet phenomenon is confirmed in the area with the range of 50 km in the eastern part of Hyogo Prefecture. About a year before to the main shock, we can see activation in the epicenter area and a wide area surrounding it. This seems to be due to the small foreshock activity occurred along various active faults and geological lineaments. Based on this seismic sequence, it is possible to suppose a forecasting tactics as follows. First of all, by grasping the location and extent of the quiescence phenomenon, we assume the location and the scale of the main shock (Yoshikawa, 2015), and then estimate the urgency of earthquake occurrence by detecting the simultaneity of temporal changes.

Keywords: Kobe eq, Seismic quiescence and activation

