Seismic quiescence before the M=7.3 western Tottori prefecture earthquake

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We investigated the characteristics of the seismic quiescence associated with the M=7.3 western Tottori prefecture earthquake, October 6, 2000 by applying the Region-Time-Length (RTL) algorithm to the earthquake catalog of the Japan Meteorological Agency (JMA).

We estimated the completeness of the JMA earthquake catalog after eliminating aftershocks. The RTL parameters at the epicenter indicated that a seismic quiescence (a decrease of seismicity compared to the preceding background rate) started in 1999 and reached its bottom in May, 2000. The spatial distribution of quiescence during May, 1999 - May, 2000 revealed a significant anomaly in a broad region around the epicenter of the western Tottori prefecture earthquake.

A strong earthquake with M = 7.3 struck the western region of Tottori prefecture on October 6, 2000. This is a kind of inland shallow earthquake with a focal depth of 11 km. In this study, we discuss the seismicity changes before this earthquake based on the Region-Time-Length (RTL) algorithm. The earthquake data are from the earthquake catalog of the Japan Meteorological Agency (JMA).

The RTL algorithm is a kind of statistic method, which can reveal the seismicity changes associated with strong earthquakes. It was developed by Dr. G. A. Sobolev and was initially tested using the earthquake catalog of Kamchatka, Russia (Sobolev and Tyupkin, 1997, 1999). This algorithm takes into account the weighted coefficients associated with all three parameters (time, place and magnitude) of earthquakes. The weight becomes larger as closer to the vicinity of the investigated place or time.

Before applying the RTL algorithm to the JMA earthquake catalog, we first eliminate aftershocks from this catalog and next estimate its completeness. We found that the JMA earthquake catalog is complete for events with M >= 2.5 in the epicentral zone during January, 1975 - January, 2001.

The temporal variation of the RTL parameters at the epicenter showed that a seismic quiescence (a decrease of seismicity compared to the preceding background rate) started in 1999 and reached its bottom in May, 2000, 5 months before the mainshock. A recovery stage from the quiescence pattern to the background seismicity followed.

The spatial distribution of quiescence during May, 1999 - May, 2000 indicated that a significant quiescence anomaly appeared in a broad region around the epicenter of the western Tottori prefecture earthquake. This anomalous zone is several times larger than the rupture dimension of the mainshock.

The evolutions of spatial distributions of seismic quiescence suggested that above anomalies around the epicentral zone would have reasonable correlation with the preparation of the western Tottori prefecture earthquake. The primary characteristics of the seismicity changes prior to this earthquake are similar to those obtained for other large earthquakes in Kamchatka, Kobe, and Hokkaido (Sobolev and Tyupkin, 1997, 1999; Huang and Sobolev, 2001; Huang et al., 2000). Therefore, the seismicity changes revealed in this study may give better understanding of the seismogenic process of the western Tottori prefecture earthquake and provide useful information for seismic risk estimation.

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