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Seismicity Pattern Changes Prior to Large Earthquakes -An Approach of the RTL Algorithm

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ABSTRACT

A statistical method, which is called the Region-Time-Length (RTL) algorithm and takes into account information such as magnitude, occurrence time and place of earthquakes, was applied to earthquake data to investigate seismicity pattern changes prior to large earthquakes. Based on the RTL algorithm and some newly developed parameters such as the *Q*-parameter (average of the RTL values over some time window) and *S*-parameter (an index of seismic activation), I quantified both the temporal and spatial characteristics of seismicity pattern changes in various tectonic regions. The results indicated that seismic quiescence anomalies generally started a few years before the occurrence of the earthquakes and lasted from 1 to 2.5 years. The duration of the subsequent stage of seismic activation generally lasted several months. The linear dimension of the quiescence zone reached a few hundred kilometers (several times the rupture dimension of the mainshock), while the activation zone was generally in order of several tens of kilometers (comparable to the rupture dimension). An earthquake is most likely to occur once the relevant source region has passed through the quiescence and activation stages. Close investigation of possible artifacts due to the selection of model parameters and the changes of seismological networks are important in identifying real seismicity changes from man-made ones. Further stochastic testing using random earthquake catalogs was also done and it supports that the anomalies revealed in my works are significant. Besides studying on seismicity changes before large earthquakes, I also performed the first test of the above statistical method for investigating seismicity changes of earthquake swarms. It indicated that an increased RTL parameter would be a new potentially useful index for the risk alarm of earthquake swarms.

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