Multi-methods Combined Analysis of the Future Earthquake Potential

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Large earthquakes usually occur in fault zones, which are mostly generated deep within the earth's crust. Prior to an earthquake, natural seismicity is correlated across multiple spatial and temporal scales. Many studies have indicated that earthquake is hard to be accurately predicted by a single time-dependent earthquake forecast model. In this study, we attempt to combine 4 earthquake precursory methods, i.e. the Pattern Informatics (PI), Load Unload Response Ratio (LURR), State Vector (SV), and Accelerate Moment Release methods (AMR) to investigate the potential of the future large earthquake. The PI technique is founded on the premise that changes in the seismicity rate are a proxy for changes in the underlying stress. We first use the PI method to quantify localized changes surrounding the epicenters of large earthquakes in Chinese mainland to objectively quantify the anomalous areas (hot spots) of the upcoming events. Then we can delineate the seismogenic regions of the ensuing large events by integrating with associated active fault zones. Finally, we evaluate the earthquake potential in the regions using 3 other short-to-intermediate-term earthquake prediction methods. As a retrospective study, we examine the large earthquakes ($M_L > 6.5$) occurred in western China over the past 3 years. It is clearly that the LURR and SV time series usually climb to an anomalously high peak prior to occurrence of a large earthquake. And, the asymptote time, t_c, predicted by the AMR method correspond to the time of the actual event. The results may suggest that the multi-methods algorithm can be a useful tool to provide stronger constraints on forecasts of the time and location of future large events.