



Retrospective performance investigation of the predictive models of statistical seismology for the May 12, 2008, Wenchuan earthquake: PI, RI, AMR, and quiescence

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To explore whether there were some indications of the increase of strong earthquake probabilities before the May 12, 2008, Wenchuan earthquake, we conducted retrospective forecast test of some of the predictive models of statistical seismology. Earthquake catalogue down to M_L 3.0 from 01/01/1977 to 15/06/2008 in the Sichuan-Yunnan region is used. For the investigation of the Pattern Informatics (PI) algorithm and the Relative Intensity (RI) algorithm, we consider a 15-year long ‘sliding time window’, with ‘anomaly training time window’ and ‘forecast time window’ being both 5 years. Grid size is taken as 0.2 degrees. Pre-shock PI ‘hotspots’ can be seen along the northern Longmenshan fault which is responsible for the Wenchuan earthquake. On the other hand, when considering bigger grid size and higher cutoff magnitude, such ‘hotspots’ disappeared and there was almost no indication of the approaching of this great event. In the perspective of the newly proposed migration pattern, however, there seem to be clues to the preparation of the earthquake. To systematically analyze the precursory moment release, considering the special characteristics of this great inland thrust event, we took four upgraded approaches. We propose a BIC criterion as a development of the curvature parameter of Bowman et al. (1998) to identify the statistically significant acceleration or quiescence behavior as compared to linear increase. We use an ‘eclipse method’ as a development of the ‘interfering event consideration’ to eliminate the interference from the nearby seismically active fault zones. We consider the distribution of m -coefficient in the (T, R, M_C) space, to explore the variation of moment release behavior with temporal window length T and spatial window radius R centered at the nucleation point, and cutoff magnitude M_C of the catalogue in use. We use not only circular windows but also ‘crack-like’ windows to investigate the overall behavior of the moment release associated with the Wenchuan earthquake. It is observed that moment release before the Wenchuan earthquake did show accelerating moment release (AMR) and quiescence behavior for different spatio-temporal ranges, respectively, with robustness to some extent against the changing of parameters. However, for this earthquake, to constrain the failure time in a forward forecasting mode is shown to be difficult.