Statistical confirmation and evaluation of a relationship between excitation of the ultra-low frequency ground electric signals and magnitude M ≥ 4 earthquakes in a 300 km radius region around Beijing

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Signals from 4 stations monitoring the ultra-low frequency components electric field in the vicinity of Beijing are used as explanatory variables in forecasting the occurrence of events with M ≥ 4 within a 300 km circle centered on Beijing. The model used is a version of Ogata's LIN-LIN algorithm for examining the influence of an explanatory signal on the occurrence of events in a stochastic point process. The explanatory effect is shown to be highly significant, and greatly superior to the explanatory effect of the same signals applied to a randomized version of the earthquake data. All four stations show significant explanatory power, although in combination the two most effective tend to dominate the forecasts.
The results are stable against perturbations in the time period or region of observation. The predictions appear to be most effective for events with M ≥ 5 , and for events closer to the observing stations, although some of the smaller events appear to produce detectable signals at distances of over 100 km from the source. Probability gains over the simple Poisson process are in the region up to 3 -- 4 for the events of magnitudes 5 or larger. A special study is made of predicted and unpredicted events in the region around the M_S = 7.8 Tangshan earthquake of 1976, to reveal the common spatial pattern of the classified events corresponding to all indiviual stations.