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Identification of Earthquakes and Explosions by Decision-making Method

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It is well-known that as a quick decision method, the matrix-decision can not only make decision on a few studying samples, but also adapt to specialist experiences, and has been extensively applied in various fields. Based on the features of matrix-decision method, we designed a matrix decision algorithm to discriminate explosion and earthquake, and applied it to those explosions and earthquakes occurred in Beijing and its adjacent area. We collected total 661 records from 33 earthquakes with Ml ranging from 1.3 to 3.2 occurred between 2003 and 2007, and 29 industry explosions with Ml between 1.0 and 2.1 detonated from 2002 to 2010, to do a discriminate experiment, among which 185 explosive records and 476 earthquake seismograms were observed by 59 stations. We firstly measured the first motion direction of P wave, the amplitude ratio of P wave to S wave, Pc/Sm and Pm/Sm, the ratio of maximum amplitude of P and S wave to the duration of code wave, Pm/Tc and Sm/Tc, and used the measured values as the preliminarily independent discrimination criteria. It shows that the first motion direction of P wave and the amplitude ration are more effective among the 5 independent discrimination criteria, and it also states that Pm/Sm is more effective than Pc/Sm. Then we used the matrix-decision algorithm to do discrimination and U test. Our results demonstrate that if the total 5 independent discrimination criteria are used together in the matrix-decision algorithm, the correct discrimination probability can reach more than 97% with U test being 93%. If 4 of 5 independent discrimination criteria are arbitrarily selected and applied in the matrix-decision algorithm, among 10 discrimination results there are 7 with the correct discrimination probability more than 93.3% . Our studying results show that the designed matrix-decision algorithm is effective for the 5 selected independent discrimination criteria and can be applied to the earthquake and explosion discrimination.