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The correlation between the statistical indexes of geoelectric fields and earthquakes

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In rock fracture experiments, electromagnetic emission accompanying fracture is a common physical phenomenon. And in field observations, the anomalies of electromagnetic signals were found before large earthquakes. Taiwan has abundant earthquakes. According Central Weather Bureau of Taiwan, there are averagely 20 ML≥5 earthquakes per year. Since 2012, 20 stations to continuously monitor geoelectric fields have been densely instrumented on Taiwan Island, which is called Geoelectric Monitoring System (GEMS). Hence, GEMS might register variations of geoelectric fields before, during, and after large earthquakes. These registered data could help us to understand whether or not there are conditions of producing large variations of electric charges before large earthquakes in seismogenic zones. After analyzing the data of both geoelectric fields and the earthquake catalogue from 2012 to 2014, we found that the statistical correlation between anomalies of statistical indexes of geoelectric fields and earthquakes with ML≥5. This kind of correlation was examined by the statistical methods of binary classification and C1-F1 analysis. The analyzing procedure is as follow. First, we established the alarm model of time of increased probability (TIP), which can judge that which periods a large earthquakes would be occur in with high probability. Secondly, we calculated the C1 and F1 indexes, and the C1 index and the F1 index can independently explain the portions of true positive (TP) and true negative (TN). Afterwards, we could obtain a best set of TIP model parameters for earthquake prediction based on C1-F1 analysis. The TIP spatiotemporal map was also attained based on the best set of TIP model parameters. According to the TIP spatiotemporal map, we could judge whether or not the future t3 is an earthquake-prone period with ML≥5 on the region of the target station within Rad km and above Dep km. Besides, the other purpose of this project is to conduct significance tests for the best TIP parameters. We generated 10 randomly permuted sets of both geoelectric statistical indexes and the earthquake catalogue, and repeated the same procedure of TIP analysis to find out their best TIP parameters for random cases. According to the random tests, we found that the best TIP parameters from 10 random cases are distinctively different from the best TIP parameters of the real case. This verified the possibility of predicting earthquakes using the TIP model.