Statistical study on correlation between AETA electromagnetic signals and earthquakes

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The seismic electromagnetic precursor has been considered as an effective means of the impending and imminent earthquake prediction. Our team developed a multi-component seismic monitoring system, which is named as AETA. Since the end of 2016, AETA has successively installed more than 200 sets in China. In previous studies, researchers used different methods to detect anomalies in AETA electromagnetic disturbance data and found pre-seismic anomalies in retrospective studies of the 2017 Jiuzhaigou Ms7.0 earthquake.
In order to further verify the correlation between AETA electromagnetic disturbance anomalies and local seismicity, we conducted statistical analysis on 20 AETA stations with installation periods more than two and a half years and abundant earthquake cases. Only earthquake events with epicenter distances within 500km and Es exceed 10^7 were considered. First, we used a modified sliding PCA method to obtain the abnormal values of AETA electromagnetic disturbances, and performed 0/1 encoding based on whether the abnormal values exceed median+2IQR to obtain a sequence reflecting the electromagnetic abnormal signals. And then, Superposed Epoch Analysis (SEA) has been applied to test seismic electromagnetic anomalies at 20 stations. Statistical results have indicated that the ratio of stations showing statistically significant correlation between electromagnetic disturbance anomalies and earthquakes reached 75%. For 65% of stations, their anomalies were more likely to appear before earthquakes rather than after them. The periods when statistical result of 5 day counts was significant varied from station to station. The above results have illustrated that the electromagnetic observation with AETA is useful and has a possibility of improving local earthquake forecasting.
From a large number of earthquake cases around the world, the asynchronous phenomenon of electromagnetic signals exists. That is to say, some stations can’ t receive abnormal signals and the time when the abnormal signals were received by different stations from the same earthquake was not synchronized. In future, we will work to fully excavate the seismic anomaly pattern of each station. How to comprehensively consider anomalies of multiple stations to make a more accurate estimation of three seismic factors is another focus of future research. With the accumulation of earthquake cases, we believe that more clearly anomalous patterns at each station will be found and more accurate prediction will be made.

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