



## **Detection of Abnormal Phenomena Observed from SCM Boarded on ZH-1**

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The Search Coil Magnetometer(SCM) on China Seismo-Electromagnetism Satellite(CSES) , on the basis of Faraday's law of electromagnetic induction, can obtain ULF/ELF/VLF information from variable magnetic field in the ionosphere. The information is used to study anomaly phenomena such as seismic activities, magnetic storm and unknown signals etc.

This study is aimed at detecting abnormal phenomena from VLF power spectrum data in SCM ranging from 12.5hz to 25.6khz. VLF signals radiated by artificial VLF transmitters and magnetic storm are defined as abnormal phenomena. Constructing a detection model contributes to search abnormal phenomena in big data quickly and accurately.

Firstly, in specific frequency, building training and testing samples, based on the acquired data from both the areas above artificial VLF transmitters (termed as positive samples) and other observed areas (termed as negative samples) respectively, needs to use fixed time window in each orbit to create two-dimensional images through Mel Frequency Cepstrum Coefficient (MFCC). Secondly, deep learning methods used as a detection model, such as CNN, is to detect abnormal phenomena from those samples. Finally, we can use this method to detect each time window in all of the VLF power spectrum data in order to fast find some interesting phenomena. In our experiments, we collect 440 samples including positive samples and negative samples. And we use 110 samples for each class as training data, and the others as testing data. The results show that testing precision of our method reaches 86%. If more data is added to CNN, our method can detect abnormal phenomena more efficiently.