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汶川M_S8.0级地震前后ULF电磁辐射频谱特征研究

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A study on the characteristics of ULF electromagnetic spectrum before and after the Wenchuan M_S8.0 earthquake

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摘要

本文基于电磁波频谱理论研究方法,对2008年四川汶川M_S8.0地震前后金河、剑阁及郑州二砂三个电磁波台站的观测资料进行FFT和小波变换分析,研究了电磁辐射数据快速傅里叶频谱变化特征和在不同尺度下小波变化的分解,发现在汶川地震前确实有异常信息存在.结果表明:(1) FFT动态谱图像说明,地震前电磁波频谱变化特征较明显,在时间、频段上均显示了阶段性进程特征,且随着震中距的增大,辐射能量越小,异常出现的时间越晚;(2) 小波分解显示了地震前电磁波异常信号低频部分出现的时间较早;距震中较近的台站,异常信息在高频部分相对明显;距震中稍远的台站,异常信息在低频部分相对明显.

关键词 汶川地震, 电磁辐射, ULF频段, 快速傅里叶变换(FFT), 小波变换

Abstract:

Based on the theory of electromagnetic spectrum, we analyzed the observation data of electromagnetic radiation with FFT and wavelet transform method. The data were recorded at Jinhe and Jiange stations in Sichuan province, and at Ersha station in Zhengzhou of Henan province before and after the Wenchuan earthquake. After studying the variation of the electromagnetic spectrum from FFT transform and the wavelet decomposition at different scales, it is found that there is anomalous information before the earthquake. The results show that, first, the dynamic FFT spectrum image shows obvious variations of the electromagnetic spectrum before the earthquake, with characteristic progressive stages in both time and frequency band, and with the increase of epicentral distance, the radiation energy is smaller and the anomaly appears later. Secondly, the detailed wavelet decomposition shows that abnormal low-frequency signals appear earlier than the high-frequency anomaly; at the station near to the epicenter, the high-frequency anomaly is more apparent, while at the far station, the low-frequency anomaly is relatively more apparent.

Keywords Wenchuan earthquake, Electromagnetic radiation, ULF band, Fast Fourier transform(FFT), Wavelet transform

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