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电磁监测台站观测的舒曼谐振背景变化

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Schumann resonances variation observed from Electromagnetic monitoring stations

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摘要

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摘要

舒曼谐振是由闪电激发的电离层与地面之间的全球电磁振荡,在地球与电离层空腔中传播,由于共振作用,其电磁波能量明显高于其他频率电磁波能量.舒曼谐振具有稳定的频域参数和频谱结构,近几年的研究发现,地震发生前会使这些固有参数发生扰动,因此利用舒曼谐振异常来进行地震短临监测可能是一种行之有效的手段.要判断舒曼谐振地震电磁异常,了解舒曼谐振电磁场背景变化规律是前提.本文利用极低频电磁台站观测的天然电磁场数据,处理和分析了各台站观测的舒曼谐振频率电磁场功率谱随时间的变化,得到了舒曼谐振随季节和纬度的背景变化规律.并提出将舒曼谐振背景变化规律应用到地震短临监测预报中,能够为今后辨别地震监测中的舒曼谐振异常提供物理依据.

关键词 舒曼谐振, 电磁场强度, 季节变化, 纬度变化, 数据处理

Abstract:

Schumann resonances(SR) are a set of frequencies of electromagnetic(EM) waves in the natural cavity formed by the earth's surface and its ionosphere, in the extremely low frequency (ELF) range, caused by natural electrical activity of the earth and its atmospheric environment. Because of the resonance interaction, EM energy of SR is stronger than the other frequencies'. In recent years, studies have found that earthquakes would disturb the stable parameters and spectra of SR, so using SR anomaly to implement earthquake monitoring is effective. However, finding out the EM field background variation is the basis of distinguishing the seismic EM anomaly. In this paper, utilizing ELF electromagnetic monitoring stations' natural electromagnetic field data, we processed and analyzed electromagnetic field components' power spectrum curve of SR frequencies, and obtained Schumann resonance background change with season and latitude. Comparing SR' electromagnetic field curves of one station, we can see electromagnetic field intensity changes with seasons obviously. This is weaker in winter and stronger in summer, and the amplitude of sinusoidal variation differs by two orders of magnitude. Comparing the same frequency's graphs of different stations, it is observed that electromagnetic field intensity is enhancing with the decreasing of the latitude. The background variation study will provide physical basis for distinguishing the earthquake electromagnetic anomaly.

Keywords Schumann resonances, Electromagnetic field intensity, Seasonal variation, Latitude variation, Data

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