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庐枞矿集区大地电磁测深强噪声的影响规律

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Effect rules of strong noise on magnetotelluric (MT) sounding in the Luzong ore cluster area

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摘要

天然大地电磁场信号微弱,极化方向随机,极易受电磁噪声污染.张量阻抗分析、远参考技术、Robust估计等对随机噪声和不相关噪声有比较好的压制效果,但对强的相关噪声目前还没有有效的压制方法.庐枞矿集区人烟稠密、工业发达,是我国著名的铁、铜、硫等矿产基地之一,区内强烈的工业、通讯、矿山、民用等电磁干扰严重污染了大地电磁测深数据.本文首先根据实测的电磁场时间域波形和卡尼亚电阻率测深曲线形态,挑选出基本未受噪声污染的测点(Y1650).然后利用数学形态学从受严重污染的电磁场时间序列中提取出类方波、三角波、阶跃、脉冲和充放电5种典型噪声的波形,并以不同的方式将这些噪声波形与Y1650的电磁场波形叠加,对比分析加噪后Y1650点电阻率和相位测深曲线的变化,进而归纳出典型强噪声对庐枞大地电磁测深资料的影响规律,为进一步压制强噪声和资料处理提供依据.

关键词 大地电磁测深, 矿集区, 强噪声, 波形, 相干度, 信噪比

Abstract:

Natural earth electromagnetic field signal is weak, with random polarization directions, highly susceptible to electromagnetic noise. Tensor impedance analysis, the remote reference technology, and Robust estimation can suppress the effect of random noise and uncorrelated noise, but currently no effective methods can suppress strong noise. The Luzong ore concentration area is densely populated, with highly developed industry, also one of China's famous bases of iron, copper, sulfur and other minerals. In this region, strong noise for industry, communication, mining, civil and other electromagnetic interference is a serious pollution to magnetotelluric sounding data. Firstly, according to the measured electromagnetic field time domain waveform and Cagniard resistivity sounding curve shape, we pick out the basic non-noise pollution measurement points (Y1650). Then we use mathematical morphology to extract the class of square wave, triangle wave, step, impulse, and charging and discharging of five kinds of typical noise waveforms. And we stack these noise waveforms in a different way and Y1650 of the electromagnetic field waveform from the electromagnetic field time series of highly contaminated, and make contrast analysis added noise Y1650 point resistivity and phase sounding curve changes. Finally we summarize the effect rules of the typical strong noises on magnetotelluric sounding data in Luzong, and provide the basis for the further suppression of strong noise and data processing.

Keywords Magnetotelluric sounding, Ore concentration area, Strong noise, Waveform, Coherence, Signal-to-noise ration (SNR)

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