

相控震源定向地震波信号分析

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摘要 应用可控震源地震勘探, 当环境噪声很强, 采用组合震源工作仍不能满足信噪比要求时, 引入能形成定向地震波的相控震源. 由相控震源定向照明地震理论分析, 主波束方向上3单元相控震源产生的反射地震波信号信噪比比单震源高6.53~9.54 dB, 比组合震源高1.76~4.77dB. 为研究相控地震实际效果, 在同一测区进行了三种震源地震对比实验. 由单炮地震记录和水平叠加时间剖面可知, 相控震源反射波信号信噪比明显高于单震源情况, 略高于组合震源情况. 进一步对反射波信号功率谱特性做定量分析, 得到如下结果: 与单震源情况相比, 相控震源使各道反射波信号信噪比提高了0.75~8.15 dB, 平均提高3.65 dB; 与组合震源情况相比, 各道信噪比提高了0.93~3.17 dB, 平均提高2.02 dB, 实验结果与理论分析吻合. 综上所述可知, 基于相控震源的定向照明地震技术是可行的, 可以有效提高地震信号的信噪比.

关键词 [相控震源](#) [定向地震波](#) [地震照明](#) [信噪比](#)

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Analysis of directional seismic signal based on phased-array vibrator system

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Abstract When ambient noise is strong, seismic data signal-to-noise ratio (SNR) might still be low even if combination vibrators are used. To solve this problem we proposed to apply a phased-array vibrator system (PAVS), which can form a directional seismic wave. In theory, 3-unit PAVS can make SNR of reflected waves increasing 6.53~9.54 dB than single vibrator, and 1.76~4.77dB than combination sources. In practice, field experiments were done with different sources in the same test field. The results show that a significant SNR improvement can be seen in reflected signals of PAVS than single source according to single shot records and horizontal stacking time sections. Of course, we also noticed that there is a little difference in time domain signals between seismic signals of PAVS and combination source. Furthermore, power spectrums of reflected wave signals are analyzed and we get some quantitative results: PAVS make SNR of reflected waves increasing 0.75~8.15 dB and 0.93~3.17dB at different traces respectively than single and combination sources. Mean SNR increases are 3.65dB and 2.02dB. It shows that the results from experiments are consistent with theoretical analysis. To evaluate PAVS and its effect on seismic signals, time sections from different sources were shown. It can be seen that directional illumination technology of PAVS is effective and superior to boost SNR of seismic signals than other routine sources.

Key words [Phased-array vibrator system \(PAVS\)](#); [Directional seismic wave](#); [Seismic illumination](#); [Signal-to-noise ratio \(SNR\)](#)

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