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基于多道局部复值相关的地震信号边缘检测

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Seismic data edge detection using multichannel local complex-valued correlation

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摘要

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摘要 地震信号边缘检测是利用地震相干属性识别地震地层特征与边界的有效手段, 目前主要利用相关类算法来实现这一目的。与传统的基于实地震信号相关的地震信号边缘检测方法不同, 局部复值相关算法首先将实地震道转换成规范化复地震道, 然后对相邻两规范化复地震道进行滑动时窗的零延迟复值相关运算, 计算简洁, 无需传统相干类算法的相似性扫描、倾角扫描或迭代求解等复杂运算, 能同时提供用于相干分析的相关系数属性和与地层视倾角有关的相移属性, 可以更有效地识别地震信息边缘特征, 并且可对相关系数和相移属性进行对比解释, 增加了边缘检测的准确性和可信度。此外, 针对单道局部复值相关存在的相关系数属性边缘异常不突出和抗噪性较弱的问题, 本文提出了改进的多道方法, 提高了地震信息边缘异常检测和抗噪声的能力, 并将改进的多道算法推广到三维数据, 表明该方法是有效的。

关键词: 局部复值相关 多道 地震信号 边缘检测 相关系数属性 相移属性

Abstract: The edge detection of seismic data is an effective technique to identify the feature and edge of seismic stratigraphy. Currently, it is mainly performed with coherence algorithm. Different from the conventional coherent algorithms based on real-valued signals, the first step of local complex-valued correlation is to transform a real trace into a normalized complex trace, and then the complex-valued correlation of two adjacent ones at zero lag is performed in a sliding time window. The calculation is simple without the semblance scanning, dip scanning or iteration solution which is necessary for conventional coherence algorithms. The local complex-valued correlation can provide both correlation coefficient attributes used for coherence analysis and phase shift attributes related to the apparent dip, which leads to identify the seismic-geology edge more effectively. And the comparison analysis of correlation coefficient attributes and phase shift attributes can improve the accuracy of seismic edge detection. Furthermore, since the edge anomalies shown by correlation coefficient attributes are not highlighted and the anti-noise ability is weak for local complex-valued correlation using single channel, we proposed an improved multi-channel technique called multi-channel complex-valued correlation to enhance the ability of detecting seismic edge anomalies and anti-noise property. And the proposed multi-channel technique is applied to 3D seismic data as an extension. Test results on synthetic data and field data show the validity of the proposed method.

Keywords: local complex-valued correlation multi-channel seismic data edge detection correlation coefficient attributes phase shift attributes

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