Cable Noise Analysis and Suppression in DAS-VSP Data

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Abstract

The Distributed Acoustic Sensing (DAS) VSP technology for seismic data acquisition has rapidly developed recently. In order to improve the quality of DAS-VSP data, the cable noise has to be suppressed. Firstly, the noise is analyzed, and then a suppression method is presented based on the result of the analysis. At last, the method is tested by a Walkaway-VSP data in Bohai Bay Basin.

Data Analysis

In a single shot record of DAS-VSP data, we can recognize several waves, such as downgoing and upgoing P-wave, but we also find that there are high level noises in the record.

We analyze the noise period of regular cable noise by statistic method. For each seismic trace, the maximum time of recognizable period is read firstly, and then maximum period numbers are counted. Finally, we calculate a single noise period.

In each seismic trace, wavelet extraction includes the following: finding the wavelet in each period, calculating these wavelets to normalization wavelets, and then stacking all wavelets to an average wavelet.

The Cable noise attenuation law is dependent on optical fiber materials and length. According to a lot of testes and researches, we proved that the best fitting method was not exponential fitting, but base fitting.

Suppression Method

According to the analysis result, the cable noise can be fitted by first break time, first break amplitude, noise period, average wavelet and attenuation parameter. The raw wavefield is subtracted by synthetic noise wavefield, and then leaves residual wavefield. By comparison two autocorrelation data of raw wavefield and residual wavefield, the sidelobe of residual wavefield autocorrelation is much less than raw wavefield, the suppression method is proved to be effective and feasible.

Conclusions

As a regular noise, the cable noise can be accurate fitting, and it can be separated from raw wavefield by subtraction method.

Comparing the residual wavefield and raw wavefield, the upgoing wave is clearer. Autocorrelation quality check result shows that the cable noise is effective suppressed.