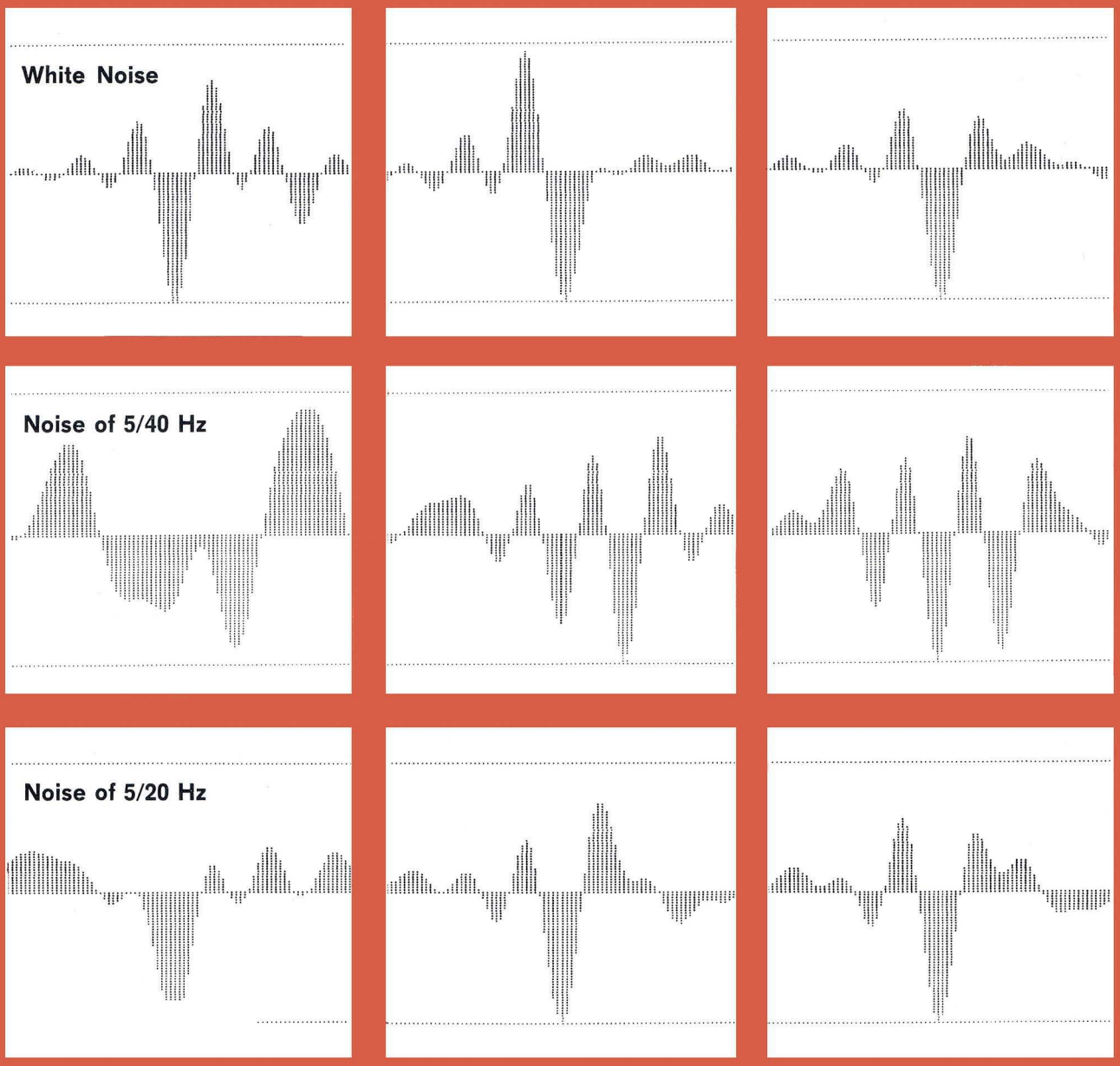
PRAKLA-SEISMOS INFORMATION No.21

Spectrum Filter



Spectrum Filter

Optimal results of conventional deconvolution depend on

- the phase spectrum of the input traces
- the amount of noise present
- a possible correlation of reflection coefficients

Due mainly to the actual seismic noise situation, the deconvolution operator has a phase spectrum which — although being minimum phase — shows a certain phase error. This results in time shifts and distortions in the output traces.

Figures on the title page illustrate such effects. Each of the three traces in the left hand column has the same reflectivity and the same wavelet, only the noise varies in frequency and strength from trace to trace. The application of simple deconvolution produces completely different results (middle column).

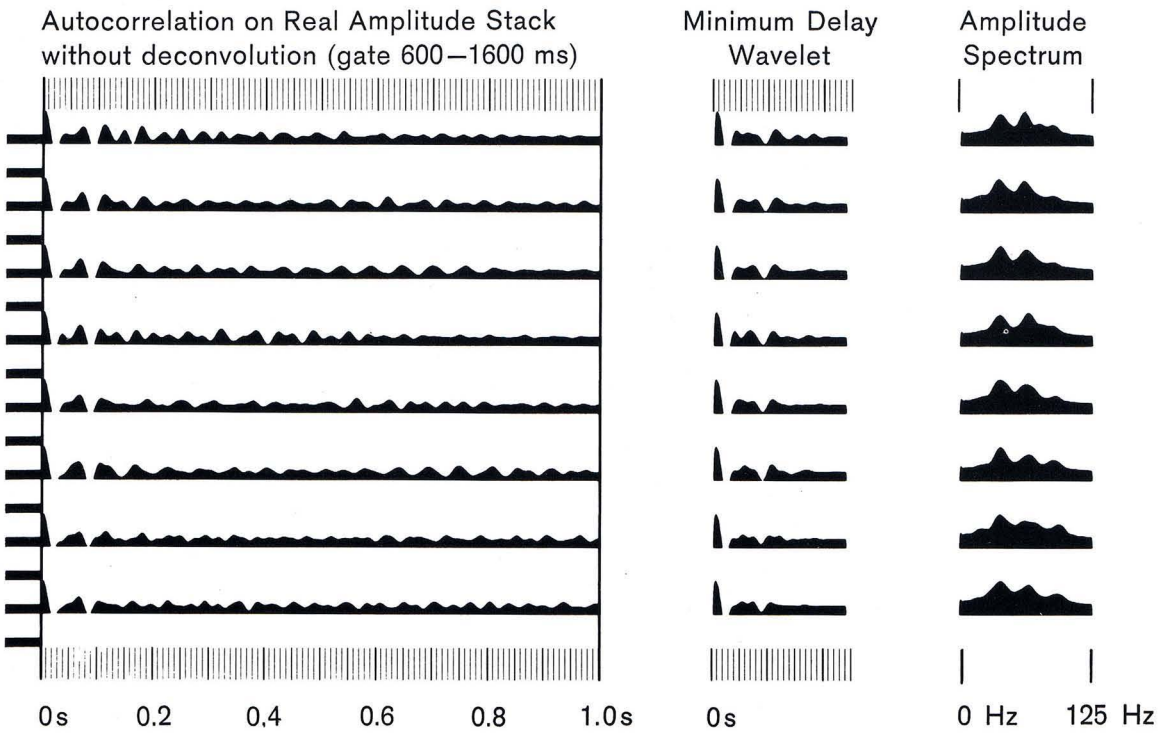
The idea of PRAKLA-SEISMOS' spectrum filter is to establish a uniform minimum delay wavelet, including a uniform noise-situation, prior to any deconvolution process. Thus it may be concluded that the wavelet spectrum will also be uniform.

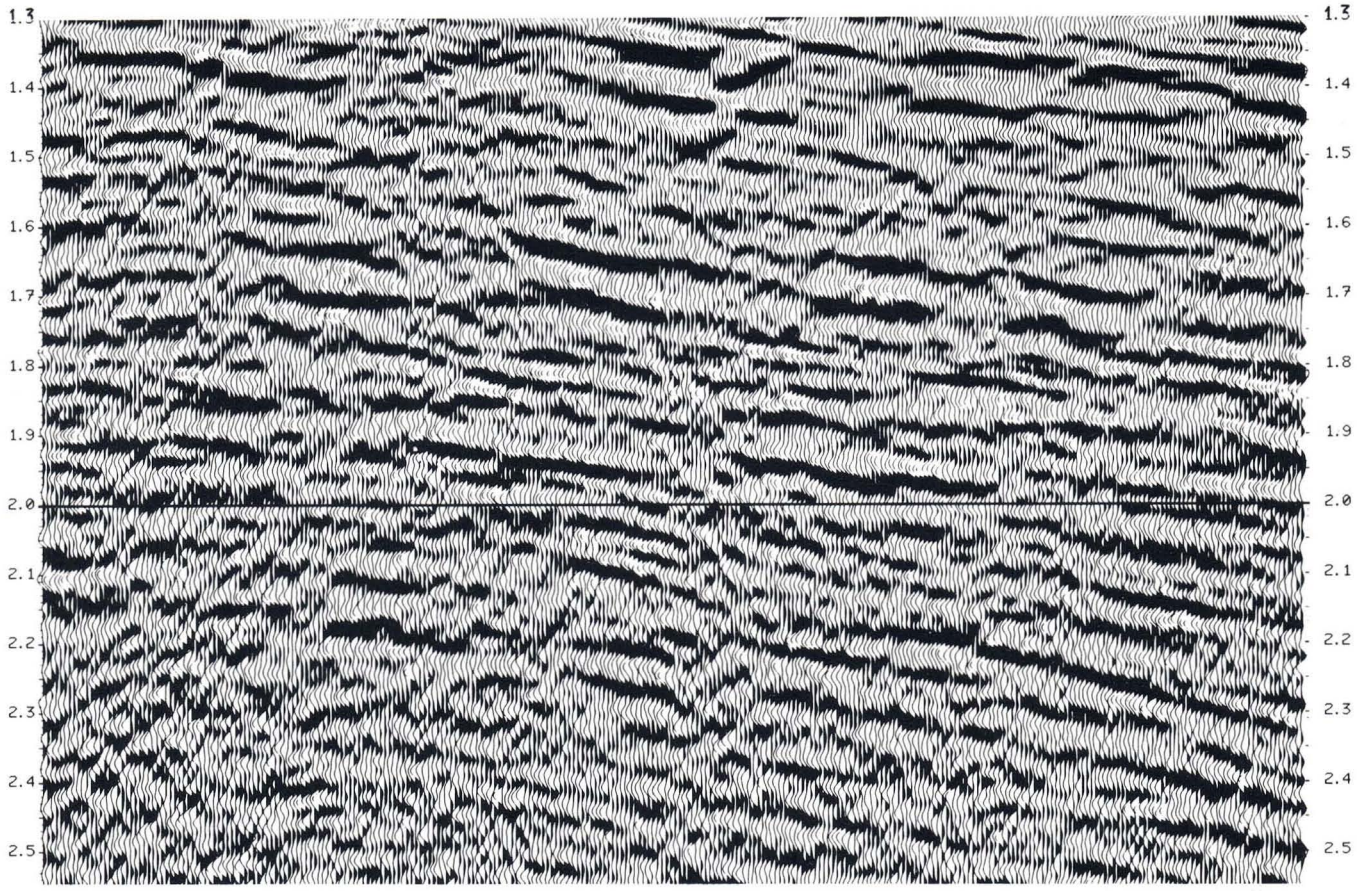
The spectrum filter is the ideal process to be used prior to deconvolution when the actual wavelet is unknown.* In principle, it may be described as a trace-adaptive zerophase whitening filter followed by a constant minimum delay filter. The appropriate choice of the minimum delay filter is made by selecting the optimum operator from the line of interest, resulting in a spectrum which is as close as possible to the actual wavelet spectrum. Parameter-selection is carried out by means of the "Parameter Evaluation Sheet", valid for a certain recording configuration.

The effectiveness of this technique is demonstrated in some examples. The improvement of the synthetic data is clearly shown in the right-hand column on the title page. Real examples of offshore and onshore data are presented on page 3 and the back page: S/N-ratio, resolution and correlation of faults have been improved; regarding the onshore data on the back page, the spectrum filter has created improved conditions for the application of automatic residual static corrections.

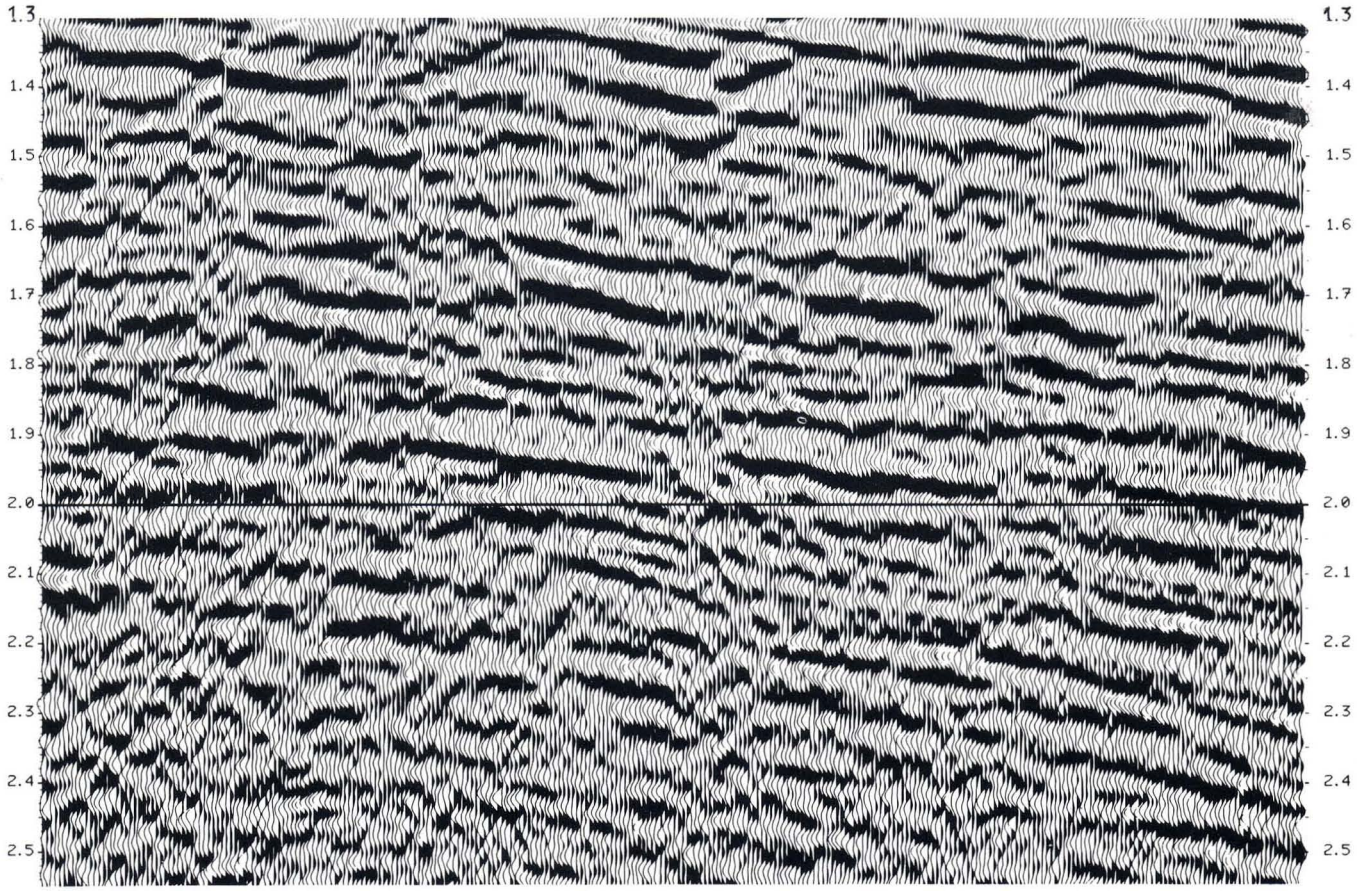
* In case of known wavelets, PRAKLA-SEISMOS' Wavelet Processing should be applied (see PRAKLA-SEISMOS Information No. 8).

Parameter Evaluation Sheet for Spectrum Filter

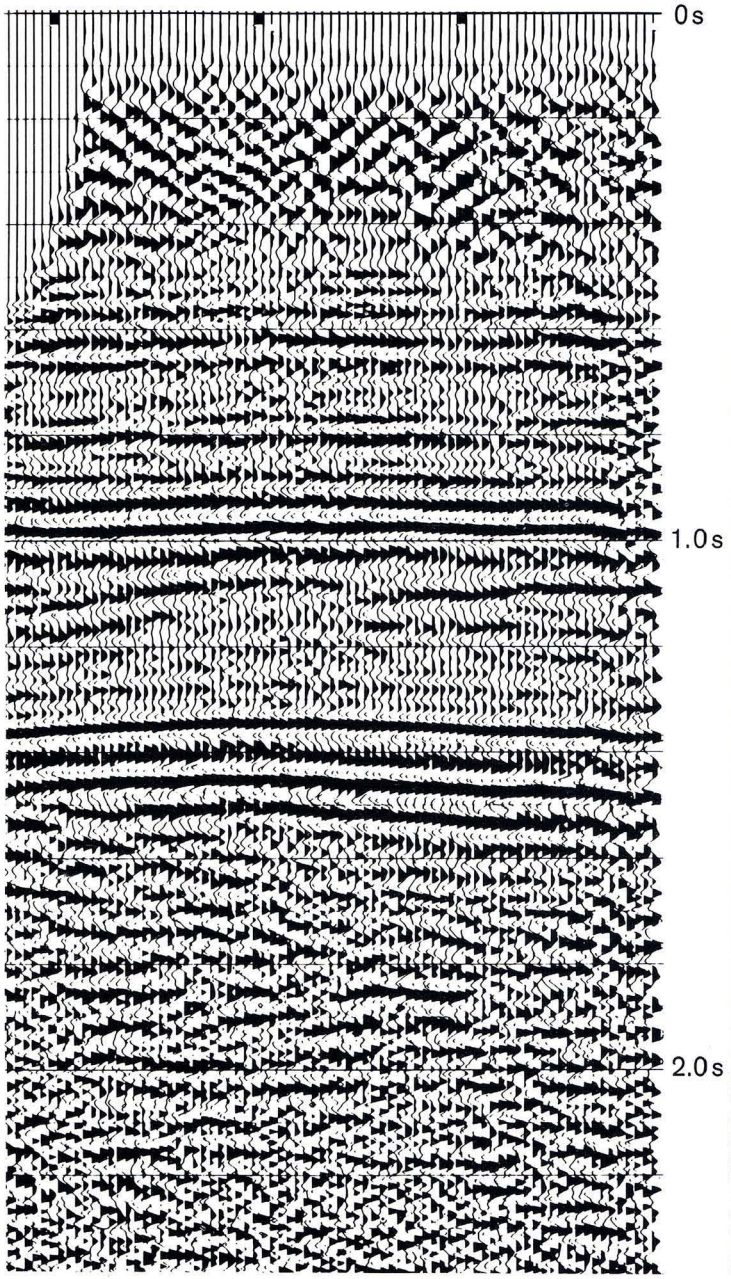




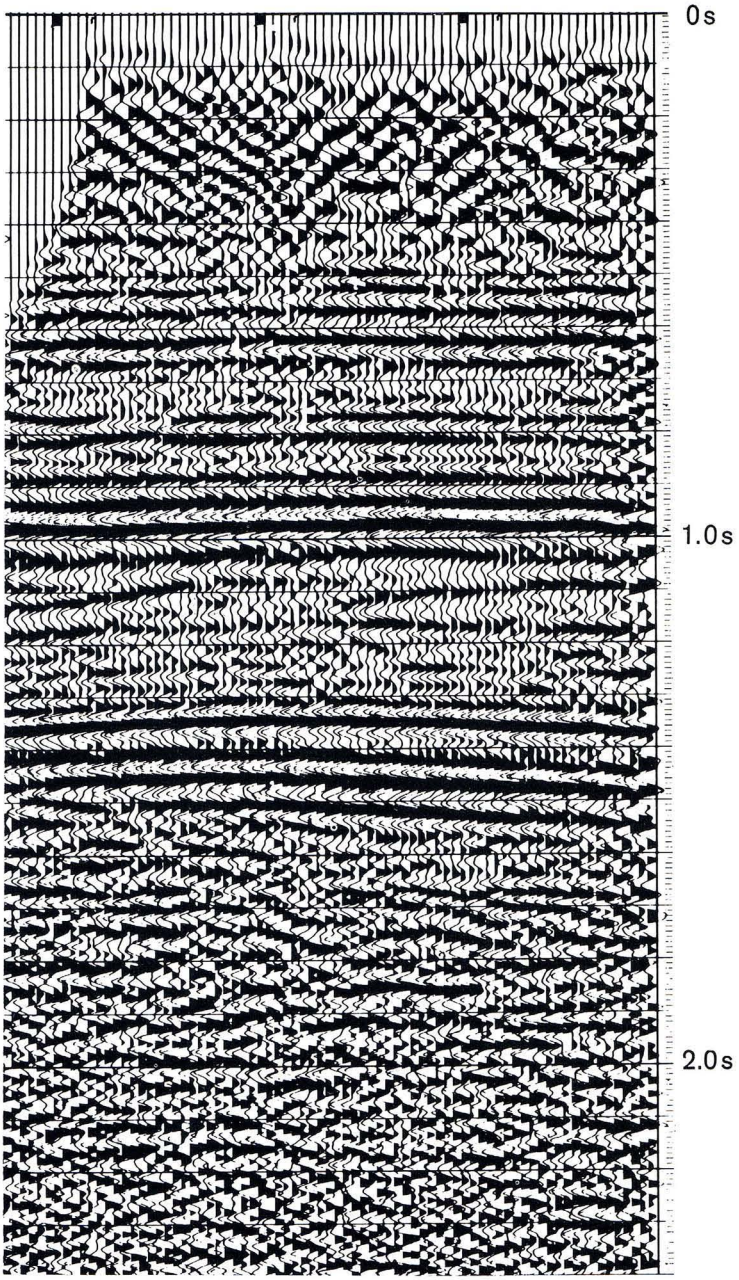
Part of an Offshore-Line: Deconvolution Before Stack



Same Line: Spectrum Filter + Deconvolution Before Stack



Part of an Onshore-Line:
Deconvolution Before Stack



Same Line:
Spectrum Filter + Deconvolution Before Stack

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PRAKLA-SEISMOS GMBH · HAARSTRASSE 5 · P.O.B. 4767 · D-3000 HANNOVER 1
PHONE: 8 07 21 · TELEX: 9 22 847 · CABLE: PRAKLA · GERMANY

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