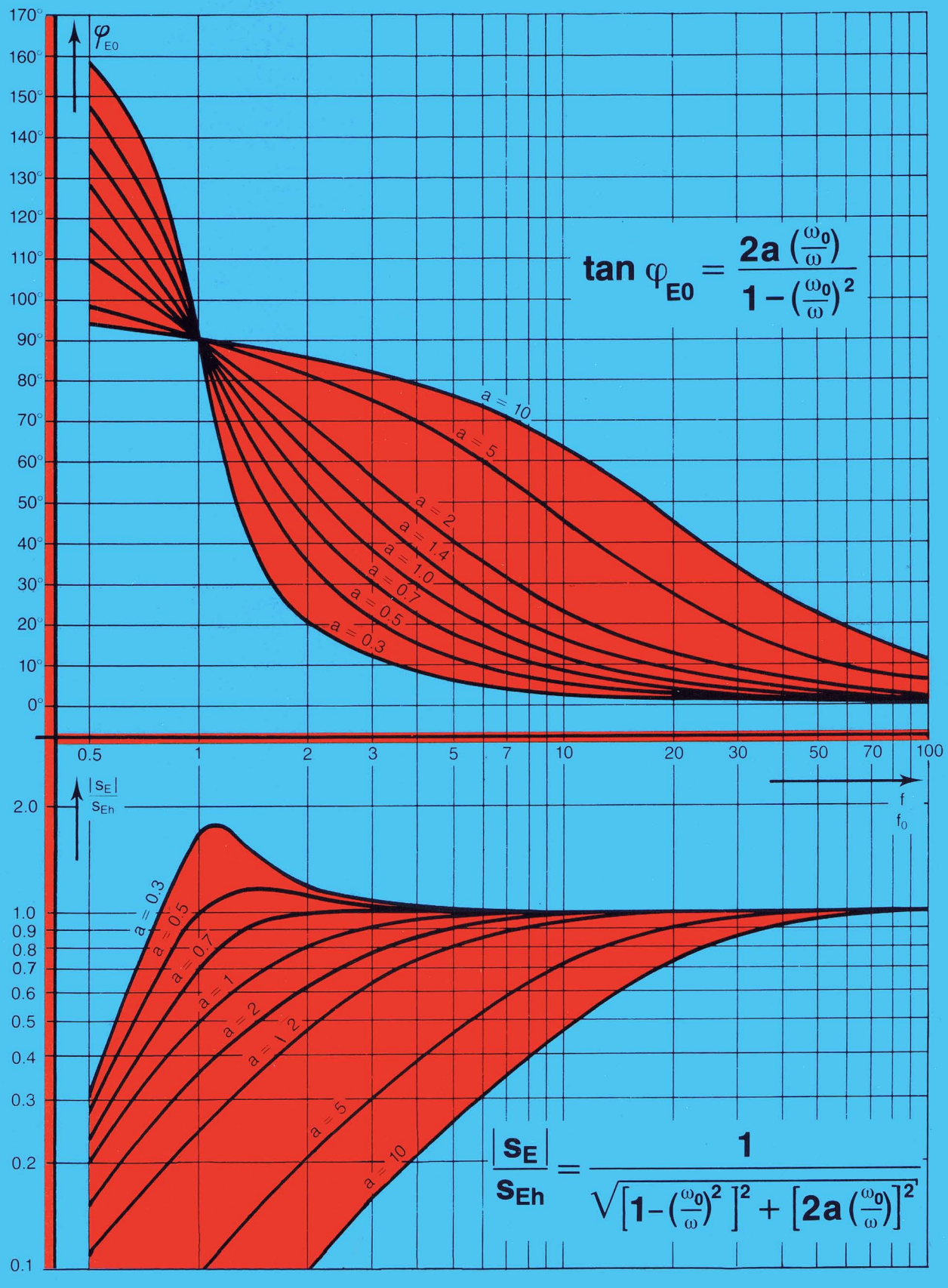
PRAKLA-SEISMOS INFORMATION No.28

TSR - Phase/Amplitude Compensation Techniques



TSR - Phase/Amplitude Compensation Techniques

The main purpose of phase/amplitude compensation filtering is to compensate amplitude distortion and phase shifts induced by the filter responses of sources, geophones and recording instruments.

Phase/amplitude compensation filtering is implemented in the PRAKLA-SEISMOS Data Center by two-sided recursive filters (TSR) for both accuracy and relatively high computational speed.

Phase/amplitude compensation filtering shapes the recorded signals into wave forms more suitable for subsequent processing steps, such as deconvolution, wavelet processing and inversion of seismic traces (pseudo-impedance logs).

Moreover, specific field recording and interpretation problems can be solved by phase/amplitude compensation processing.

The following filters are available:

Source-Signature Filters

a) Source-Signature Correction or Compression (see fig. 1)

- for debubbling, deghosting, decoupling
- for dephasing sweep distortion
- for removal of the source-array response

b) Source-Signature Adjustment

- for matching of VIBROSEIS* and dynamite data or airgun and dynamite data.

Receiver Filters

c) Geophone Response Corrections (see fig. 4)

- For the adjustment of records or sections recorded with different geophone types
- for compensation of geophone phase shifts especially where broadband data had been recorded with high-frequency geophones (to avoid harmonic distortion by excessive low-frequency noise).

* Trademark of Conoco Inc.

d) Compensation of Geophone Pattern Response

- In the case of dipping reflection events: to make up for the attenuation of high frequency components caused by destructive interference in the geophone pattern.

e) Corrections for Variations in Instrument Input Voltage

- Effects due to variations in the resistance of the recording cable or streamer; this problem can be crucial when super-long cable spreads are used in CDP roll-along techniques.

f) Instrument Filter Corrections

- for adjustment of different filter settings (phase and amplitude distortions, see fig. 3)
- for compensation of recording filter phase shifts (dephasing) (notch filters in particular have a highly undesirable phase spectrum, as do low-cut filters with steep flanks; see fig. 2).

Fig. 1: Source-signature correction

VIBROSEIS* application: correction of sweep distortion

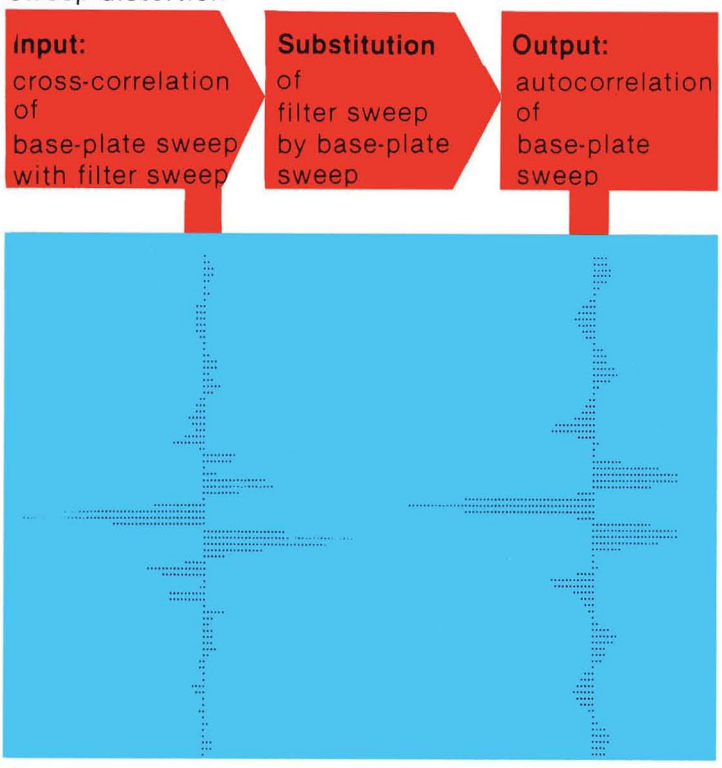


Fig. 2: Dephasing of recording filters

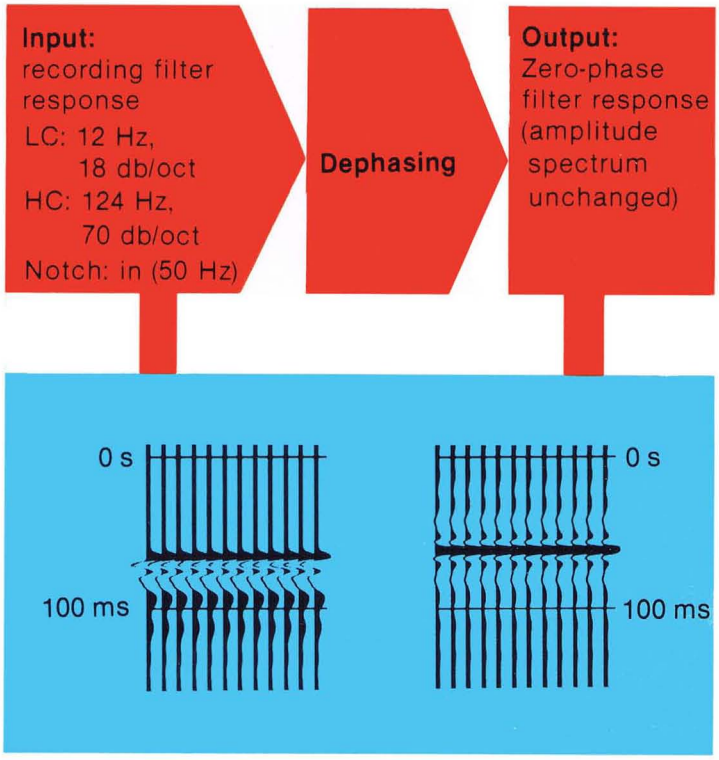
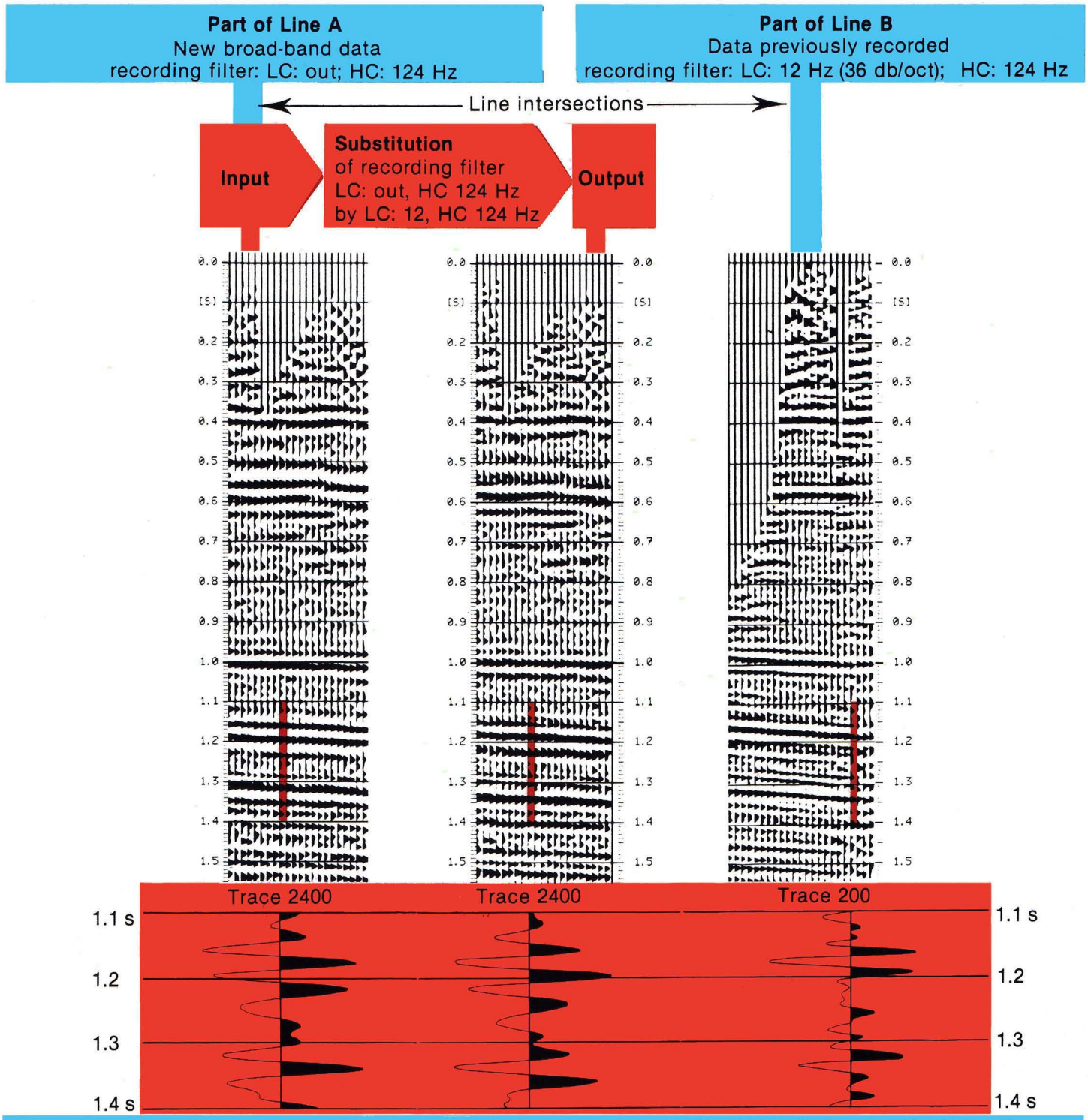


Fig. 3: Instrument filter corrections



Details of the traces shown: Travel time 1100—1400 ms, Trace 2400 of Line A, Trace 200 of Line B

Which processing sequence should be selected for Phase/Amplitude Compensation Filtering?

Phase/amplitude corrections should be carried out before prestack deconvolution or stacking when broad-band data is required for high-resolution projects or stratigraphic modelling and for interpretation.

However, relative phase/amplitude adjustments or simple changes of phase/amplitude characteristics can, for reasons of economy, in many cases be carried out after stacking if e.g. different sets of data are to be matched or compared (applications b, c and f).

Which data can be treated with Phase/Amplitude Compensation Filters?

All recorded data, old and new.

Which parameters are needed for the application of Phase/Amplitude Compensation Filters?

Considering the problem in question:

Pattern response (for both source and receivers)

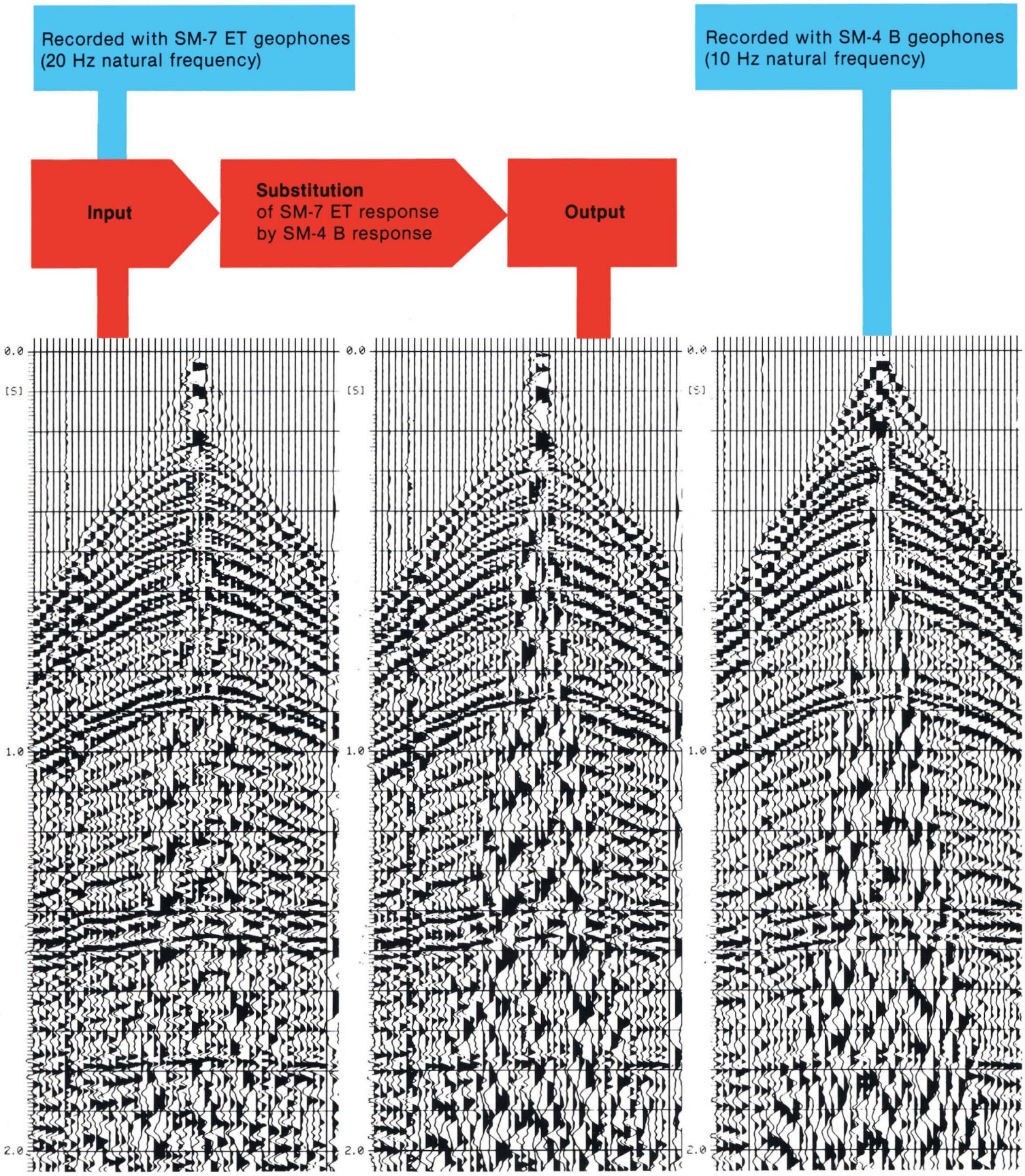
Source-signature

Damping characteristics and phase/amplitude response of geophones

Filter response of recording instrument

etc.....

Fig. 4: Correction for different geophone responses



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