Vintage Data Reprocessing – Sweetest Smoke May Come From Old Pipes – A 2D Onshore Case

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OUTLINE

• Rationale

• Processing flow

• Imagery enhancement

• Conclusion
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Rationale

The E&P cycle?

Alternative route

Usual process

* Return on capital employed

*Explo. Roce* (%)

2D explo  3D explo  3D Delin  Well

2D explo  2D repro  3D Delin  Well

Return on capital employed
Case study background
Processing workflow

Raw shot gather (SG)  
SG after denoising  
SG after deconvolution  
SG after full pre-stack seq.

Reconstruction of navigation & Trace edit
Wavelet standardization
Refraction statics + IRSC + calibration
Non-invasive de-noise
Wavelet processing
Amplitude scaling
Initial (VA + Residual Statics)
2D ML Mistie Correction
Multi-factor analysis and correction:
  statics, velocities, S/N enhancement, reinterpretation
  2D ML Mistie Correction
  Enhanced Coherency Processing
  2D Multiline Mistie Correction
  PreSTM + MVA (time domain)
  Attenuation of multiples
  Amplitude balance
  Stack
  Post-mig processing
Processing workflow

- Vintage final stack!
- Raw stack
- Stack after denoising
- Stack after deconvolution
Processing workflow

Stack after refraction statics  
Stack after residual statics  
Final reprocessed stack  
Vintage final stack !

Reconstruction of navigation & Trace edit
  Wavelet standardization
  Refraction statics + IRSC + calibration
  Non-invasive de-noise
  Wavelet processing
  Amplitude scaling

Initial (VA + Residual Statics)
2D ML Mistie Correction

Multi-factor analysis and correction:  
statics, velocities, S/N enhancement, reinterpretation
  2D ML Mistie Correction
Enhanced Coherency Processing
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PreSTM + MVA (time domain)
Attenuation of multiples
Amplitude balance
Stack
Post-mig processing
Processing workflow - multifactor separation

Generalization of basic iterations: (VA – resid. stat.):

Separation of more factors:
- (v) velocities,
- (s) residual statics,
- (p) phase rotation,
- (c) static cycle skips,
- (n) noise elimination,
- (r) reinterpretation,

Advanced workflow is considered:

- e.g.: v, s, p, v, s, c, r, v, s, r, ...
Processing workflow - multifactor separation

Principle:

• Introduce geophysicist skills and experience in a multi-loop flow

• Adopt a cycling approach to bring benefit of high-end technologies (e.g. Enhanced Coherency Processing, looking for coherency within the 1st Fresnel zone to improve S/N) to converge to a cleaner dataset

• Increase geophysicist added-value through processing flow key-step reassessment (velocities-statics, etc)

Generalization of basic iterations: (VA – resid. stat.):

Separation of more factors:
- (v) velocities,
- (s) residual statics,
- (p) phase rotation,
- (c) static cycle skips,
- (n) noise elimination,
- (r) reinterpretation,
- (m) migration

Advanced workflow is considered:

e.g.: v, s, p, v, s, c, r, t, v, s, r, n, t,...
Multifactor separation at work

Note: not all modules are applied to every line. Notation as defined in the previous slide.
Several wavefront attributes are automatically estimated locally, within defined percentage of the 1st Fresnel zone, to characterize wavefront and ensure the best local stack: \( R_{\text{NIP}} \), local dip, emergence angle, coherency. Then, interactive attributes’ analysis follows. Coherency of attributes in space is steered via interpretive, interactive editing.
Processing workflow - multiline set

Stripe map of an attribute of 2D multiline project

Sample panel of the Interactive Residual Static Correction

Examination of seismic misties in ML 2D project

Examin. and correction of velocity misties at intersections
Multiline set – more about IRSC

Two correlations are defined:

- **Blue line** (blue arrow) – present shape
- **Red line** (red arrow) - trial interpretation.

That procedure is repeated for two sections:
- **CSP** – Common Shot Point stack,
- **CRP** – Common Receiver Point stack

Both, CSP and CRP are limited-offset, and usually band-limited stacks.

Sample panel of the Interactive Residual Static Correction (IRSC).

Geophysicist experience is essential. Order of shot – receiver statics separation is decided interactively, supported by QC CDP stack.

Several loops are possible, with application of fractions of estimated statics.
Imagery enhancement

Vintage processing

Reprocessing

Line A

Line B

Line A

Line B

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Messages (conclusion)

• To the contractors: do your best to maintain your knowledge and know-how in this difficult environment: push-button algo may not be the future...

• To decision-maker: do not engage in cost-intensive seismic surveys without extracting the maximum value of existing datasets

• To the audience: how much value is still hidden in the seismic archived databases?...
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References


