Common Reflection Surface theory and worldwide data examples
Common Reflection Surface (CRS) processing

Data driven approach

• stacking parameters are determined from data
• local parameter search at each point of stack
• selection of parameter by coherency measures along stacking surfaces
CRS Basics – Generalization of the subsurface model

CMP Processing
(Mayne, 1962)

* dip

DMO Processing
(Hale, 1991)

* curv

CRS Processing
(Hubral, 1999)
CRS Basics – Generalization of the subsurface model

\[ t^2(h) = t_0^2 + \frac{4h^2}{v_{NMO}^2} \]

1 Parameter: \( v_{NMO} \)
NIP = normal incident point
CRS Basics – Generalization of the subsurface model

NIP

NIP Wave

Normal Wave (or N Wave)
CRS Basics – Generalization of the subsurface model
NMO versus CRS

NMO Traveltime

\[ t^2(h) = t_0^2 + \frac{4h^2}{v_{NMO}^2} \]

1 Parameter: \( v_{NMO} \)

NMO Model

CRS Model

CRS Traveltime

\[ t^2 = \left( t_0 + \frac{2\sin \alpha}{v_0} \Delta x \right)^2 + \frac{2t_0 \cos^2 \alpha \Delta x^2}{R_N} + \frac{h^2}{R_{NIP}} \]

3 Parameters: \( \alpha, R_{NIP}, R_N \)
CRS Basics – Generalization of the subsurface model

CRS midpoint aperture

Acquisition info
- Cell size: 25m x 25m
- ICMP: 25m
- CMP fold: 60 traces
CRS Basics – Generalization of the subsurface model

CRS midpoint aperture

Acquisition info
Cell size: 25m x 25m
ICMP: 25m
CMP fold: 60 traces

2D: \(7 \times 60 = 420\) traces
3D: \(7 \times 7 \times 60 = 2940\) traces
CRS Basics – Generalization of the subsurface model

Fit of stacking surfaces / reflection time surfaces

NMO/DMO

CRS

(Hubral et al. 1999)
Expected advantages of CRS stacking

- Improved signal-to-noise ratio
- Improved imaging of dipping reflections
- Improved imaging in low fold zones
- More detailed velocity model information
CRS in Complex Tectonic Settings

- Alps/Germany
- Andes Foreland/Bolivia
- Carpathian Mountains/Poland
- Caucasus Mountains/Russia
- Kurdistan/Irak
- Himalaya Foreland/India
- Pyrenees/Spain
- Rockies/USA
- Zagros Mountains/Iran
Colombia

3rd party PreSTM
Northern Calcareous Alps

Client Time Migration with conventional processing
Northern Calcareous Alps

TEEC Time Migration with CRS processing
CRS on marine data

North Sea
Gulf of Mexico
Persian Gulf
South China Sea
Carribean Sea

Barent Sea
Black Sea
Offshore West Africa
Offshore Nova Scotia
Brasil
Land/TZ/offshore

- Sources:
  - Explosives in black
  - Airguns in red

- Receiver:
  - Receiver in brown
CMP gathers before CRS processing
CRS gathers
PreSTM using CMP gathers
PreSTM using CRS gather
Timeslice 1032 ms of PreSTM
TZ 1032 ms of CRS PreSTM
North Sea merge of 4 different acquisition geometries

1 vessel with
  2 airguns
  8 streamer

2 vessels, each with
  2 airguns
  2 streamer

1 vessel with
  2 airguns
  6 streamer

1 vessel with
  2 airguns
  4 streamer
1. Source/receiver static applied
2. True amplitude recovery
3. Low cut filter
4. Source signature deconvolution
5. Debubble
6. Linear denoise
7. Tau-P deconvolution
8. Amplitude adjustment
9. Match Filter application
10. Radon Demultiple
11. Merge of all surveys
1. source/receiver static applied
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10. Radon Demultiple
11. Merge of all surveys
12. CRS processing

Inline of CRS stack
Time slice at 2100 ms of CMP stack

1. source/receiver static applied
2. True amplitude recovery
3. Low cut filter
4. Source signature deconvolution
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9. Match Filter application
10. Radon Demultiple
11. Merge of all surveys
Time slice at 2100 ms of CRS stack
Inline of vintage PreSTM result
Inline of CRS PreSTM
Please contact us for further questions or any comments at

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