Common Reflection Surface theory and worldwide data examples

TEEC

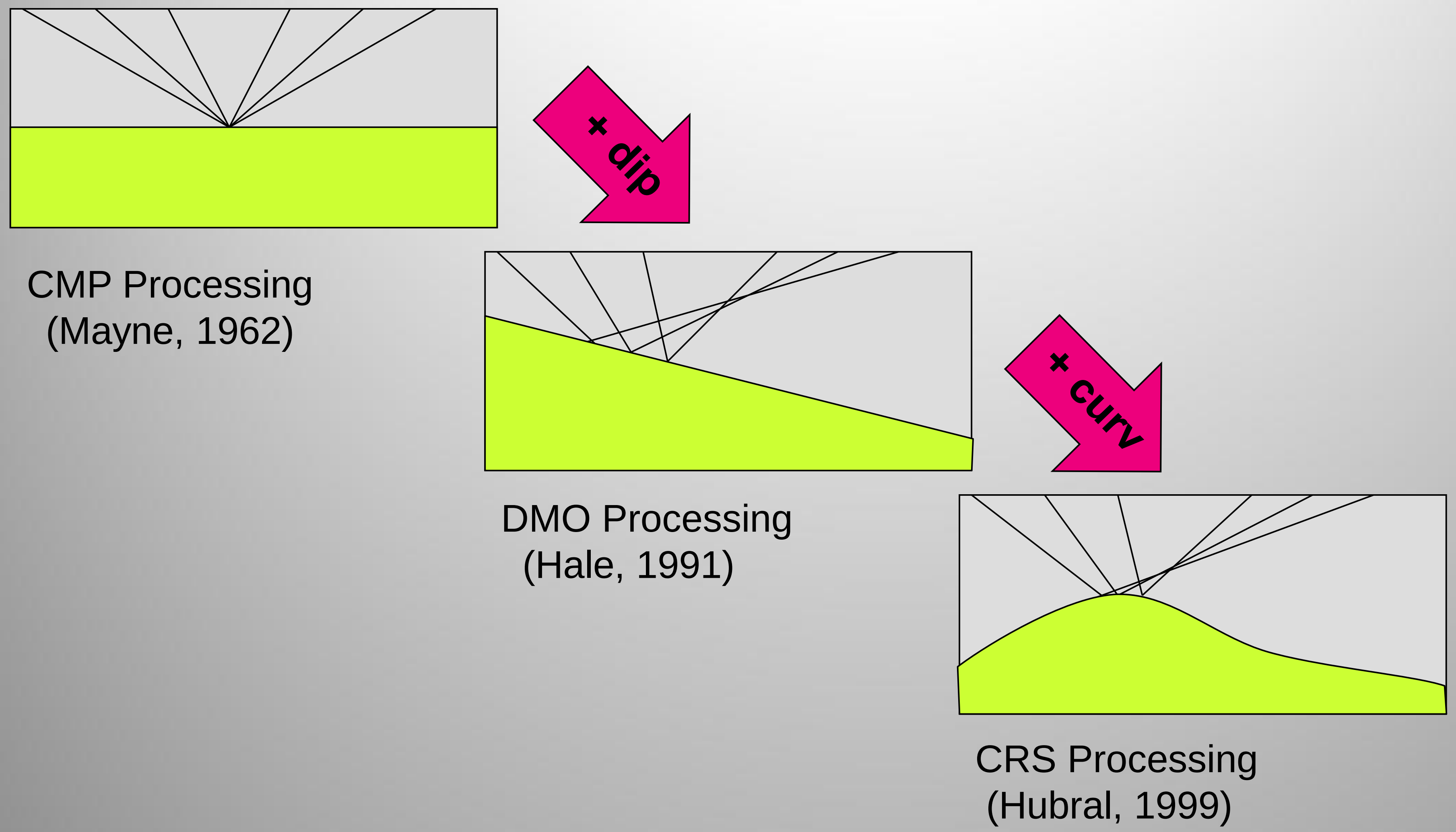
Geophysics

Common Reflection Surface (CRS) processing

Data driven approach

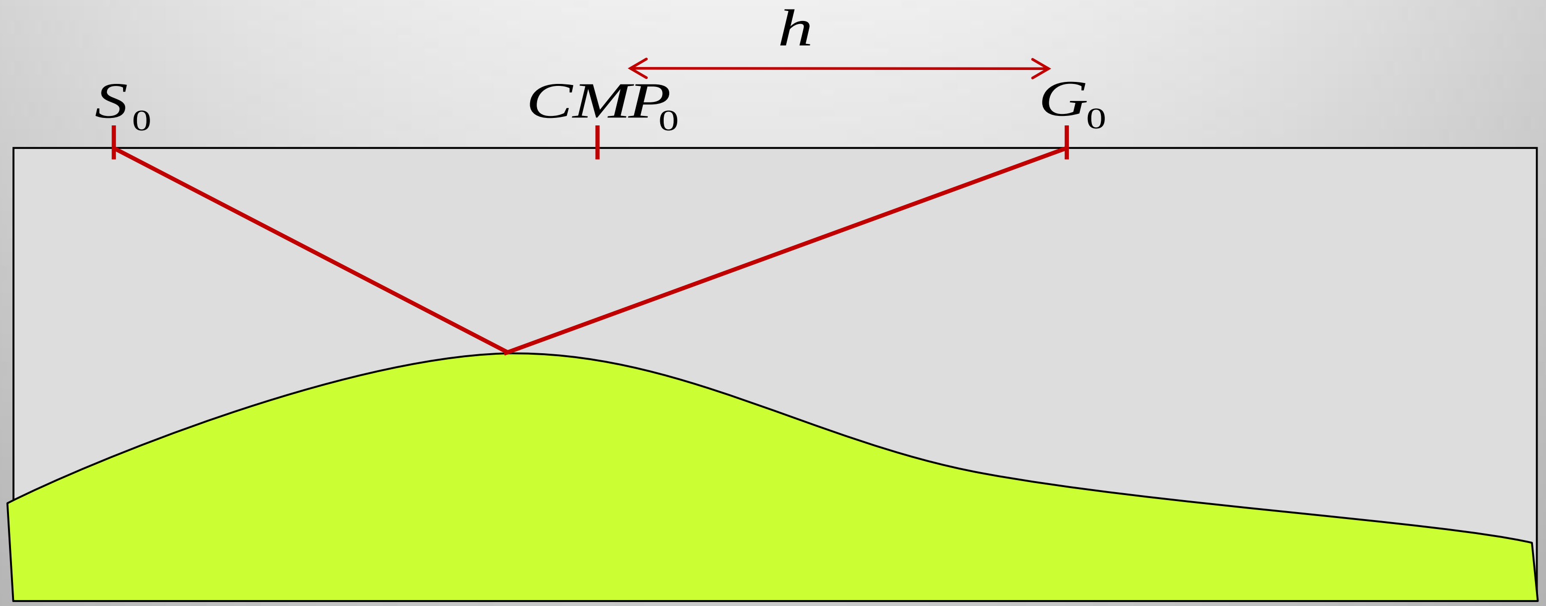
- **stacking parameters are determined from data**
- **local parameter search at each point of stack**
- **selection of parameter by coherency measures along stacking surfaces**

CRS Basics – Generalization of the subsurface model



TEEC Geophysics

CRS Basics – Generalization of the subsurface model

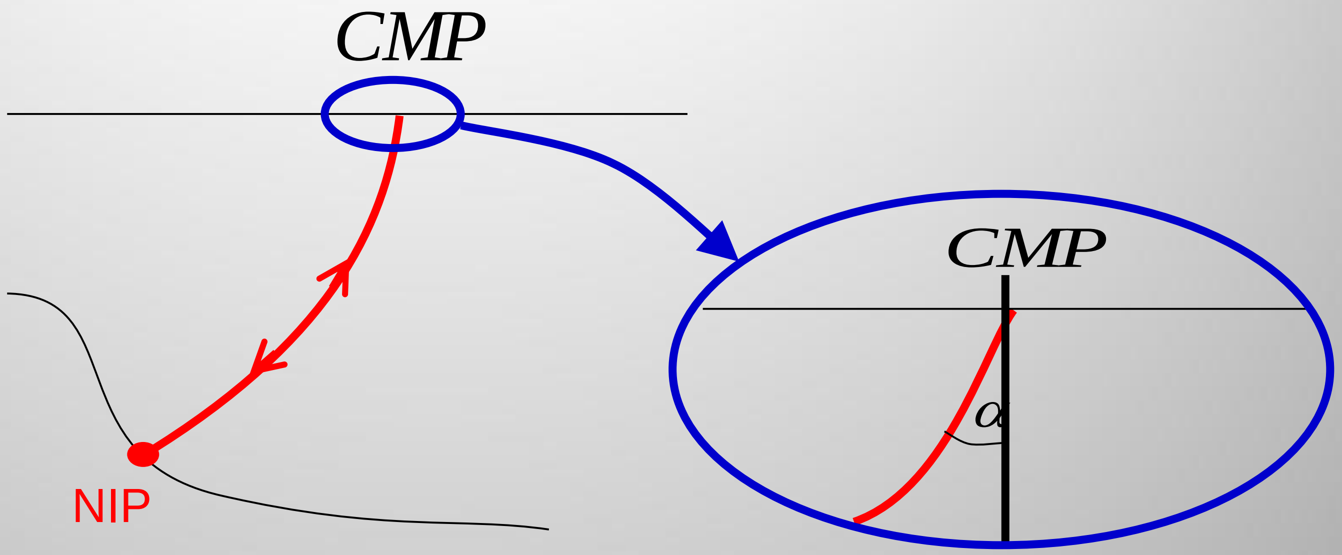


$$t^2(h) = t_0^2 + \frac{4h^2}{v_{NMO}^2}$$

1 Parameter : **V_{NMO}**

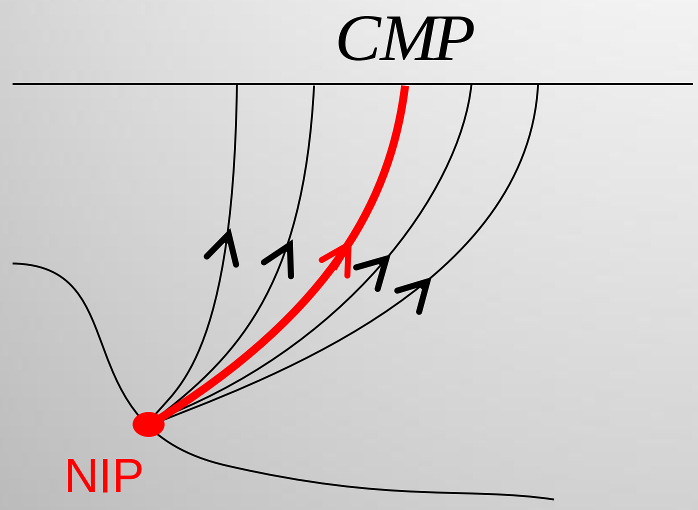
TEEC Geophysics

CRS Basics – Generalization of the subsurface model

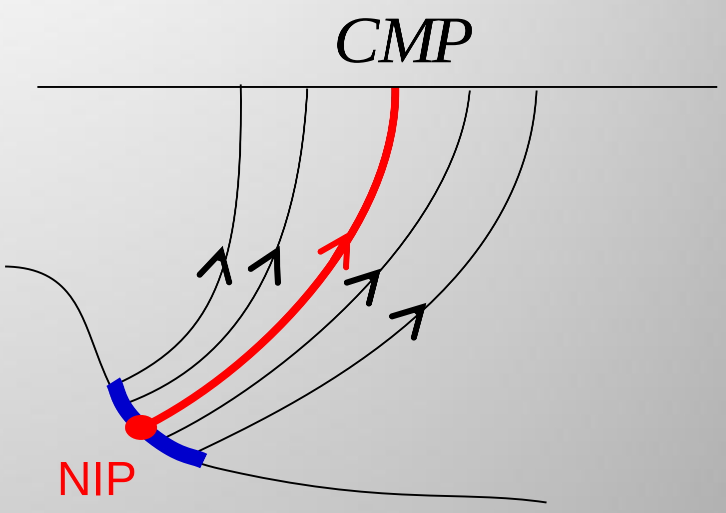


NIP = normal incident point

CRS Basics – Generalization of the subsurface model

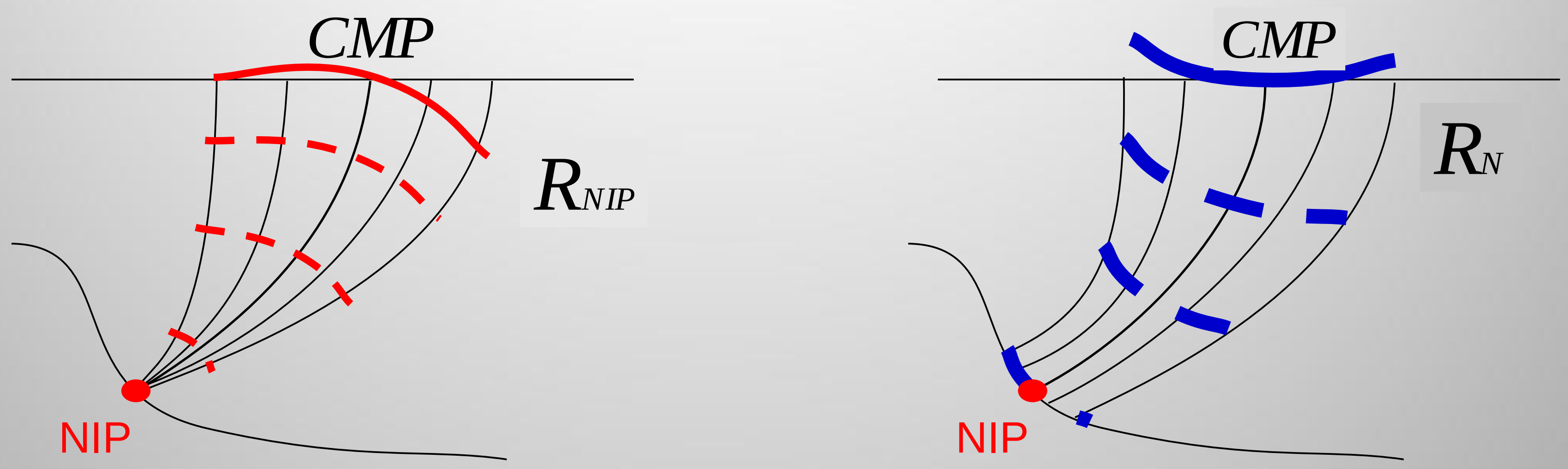


NIP Wave



Normal Wave (or N Wave)

CRS Basics – Generalization of the subsurface model



NMO versus CRS

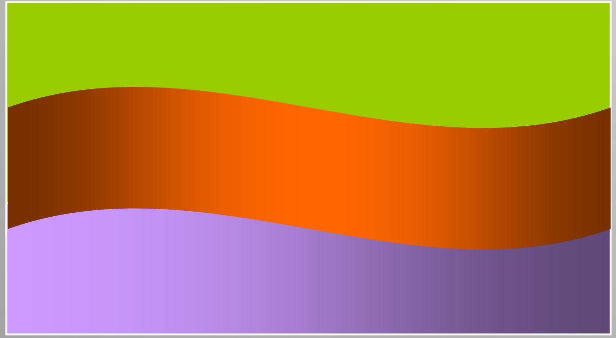
NMO Traveltime

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

1 Parameter : V_{NMO}

NMO Model

CRS Model



CRS Traveltime

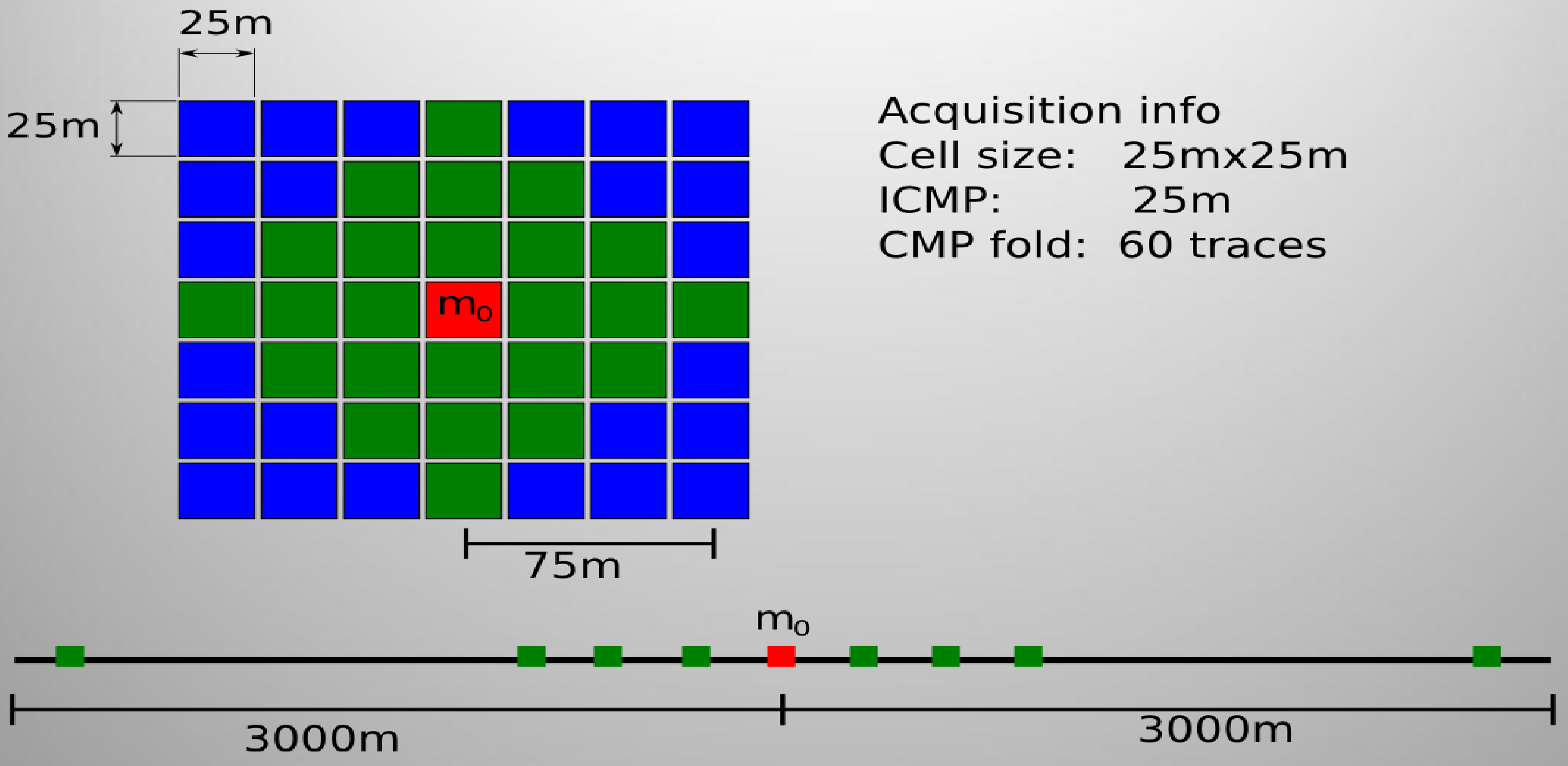
$$t^2 = \left(t_0 + \frac{2\sin\alpha}{v_0}\Delta x\right)^2 + \frac{2t_0\cos^2\alpha}{v_0}\left(\frac{\Delta x^2}{R_N} + \frac{h^2}{R_{NIP}}\right)$$

3 Parameters: α, R_{NIP}, R_N

TEEC Geophysics

CRS Basics – Generalization of the subsurface model

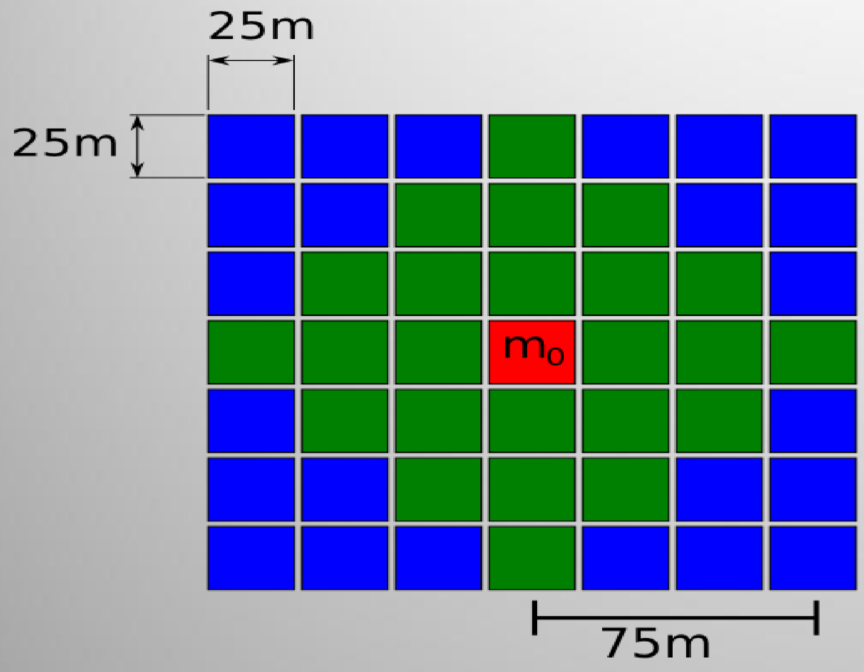
CRS midpoint aperture



Acquisition info
Cell size: 25mx25m
ICMP: 25m
CMP fold: 60 traces

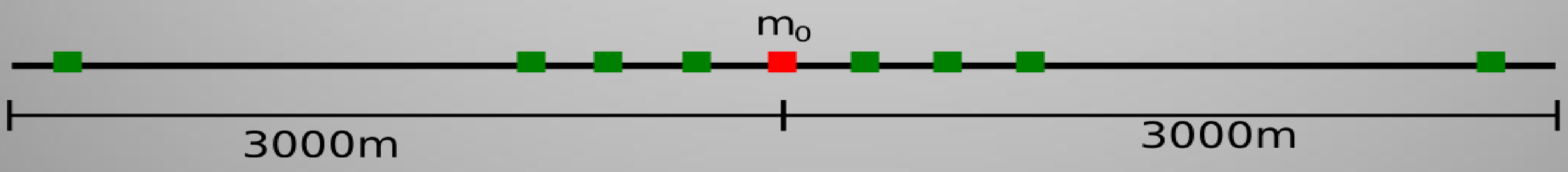
CRS Basics – Generalization of the subsurface model

CRS midpoint aperture



Acquisition info
Cell size: 25mx25m
ICMP: 25m
CMP fold: 60 traces

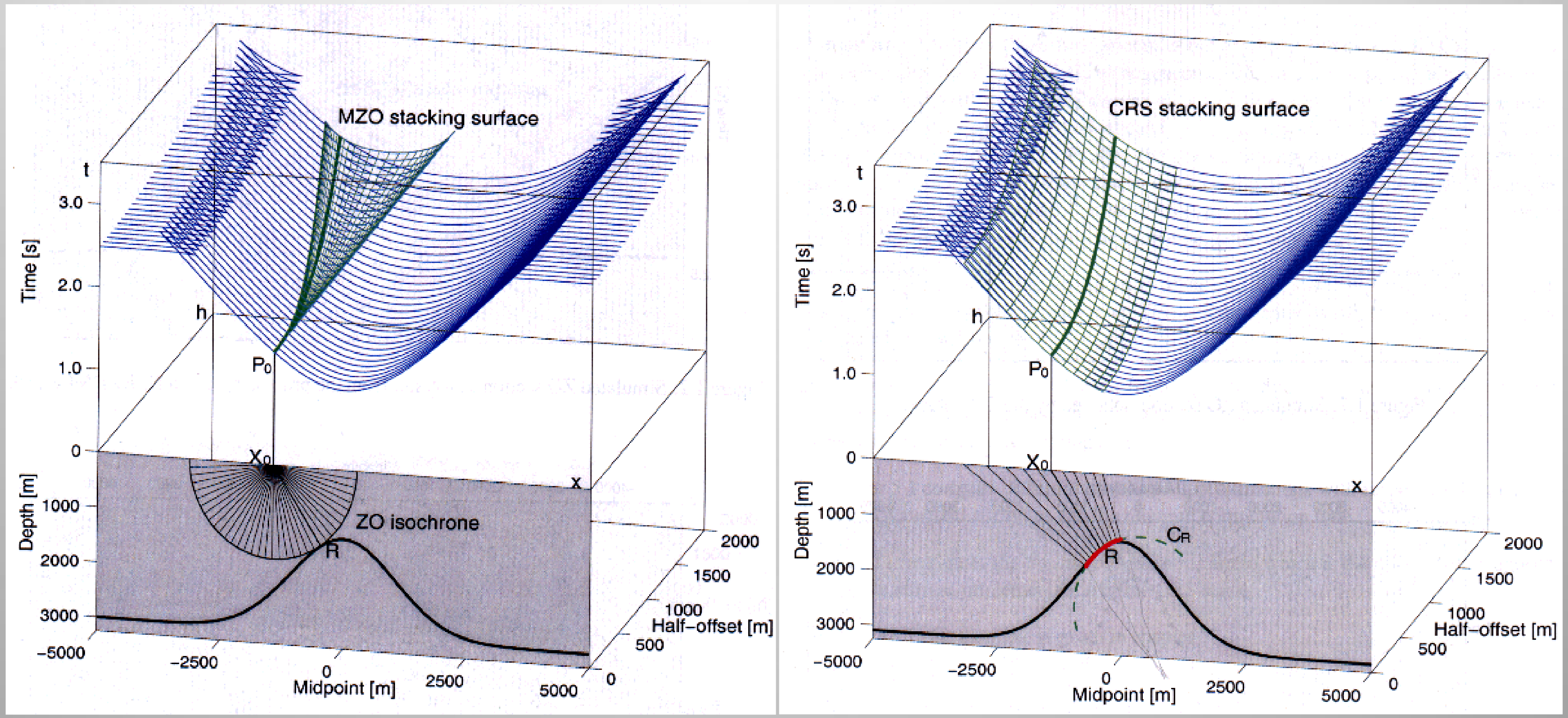
2D: 7 x 60 = 420 traces
3D: 7 x 7 x 60 = 2940 traces



TEEC Geophysics

CRS Basics – Generalization of the subsurface model

Fit of stacking surfaces / reflection time surfaces



NMO/DMO

CRS

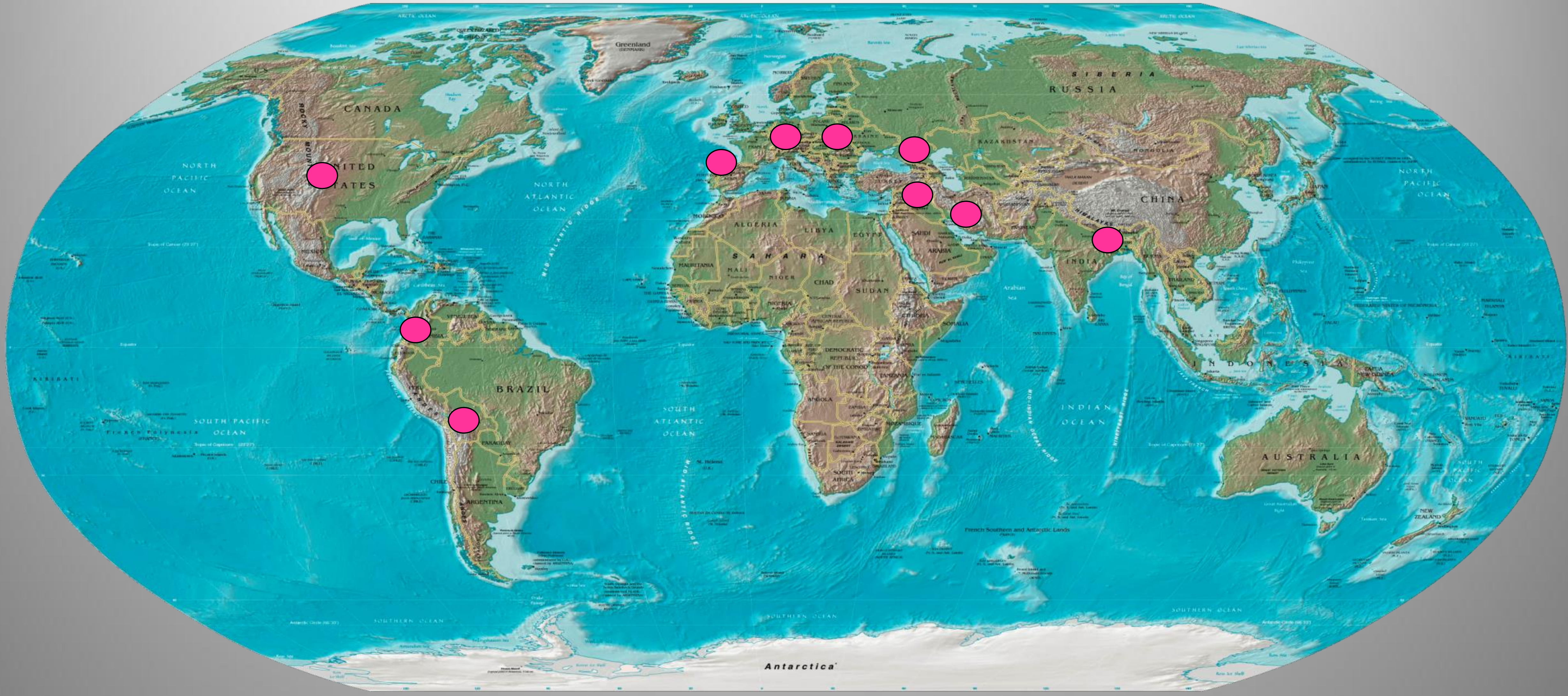
(Hubral et al. 1999)

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

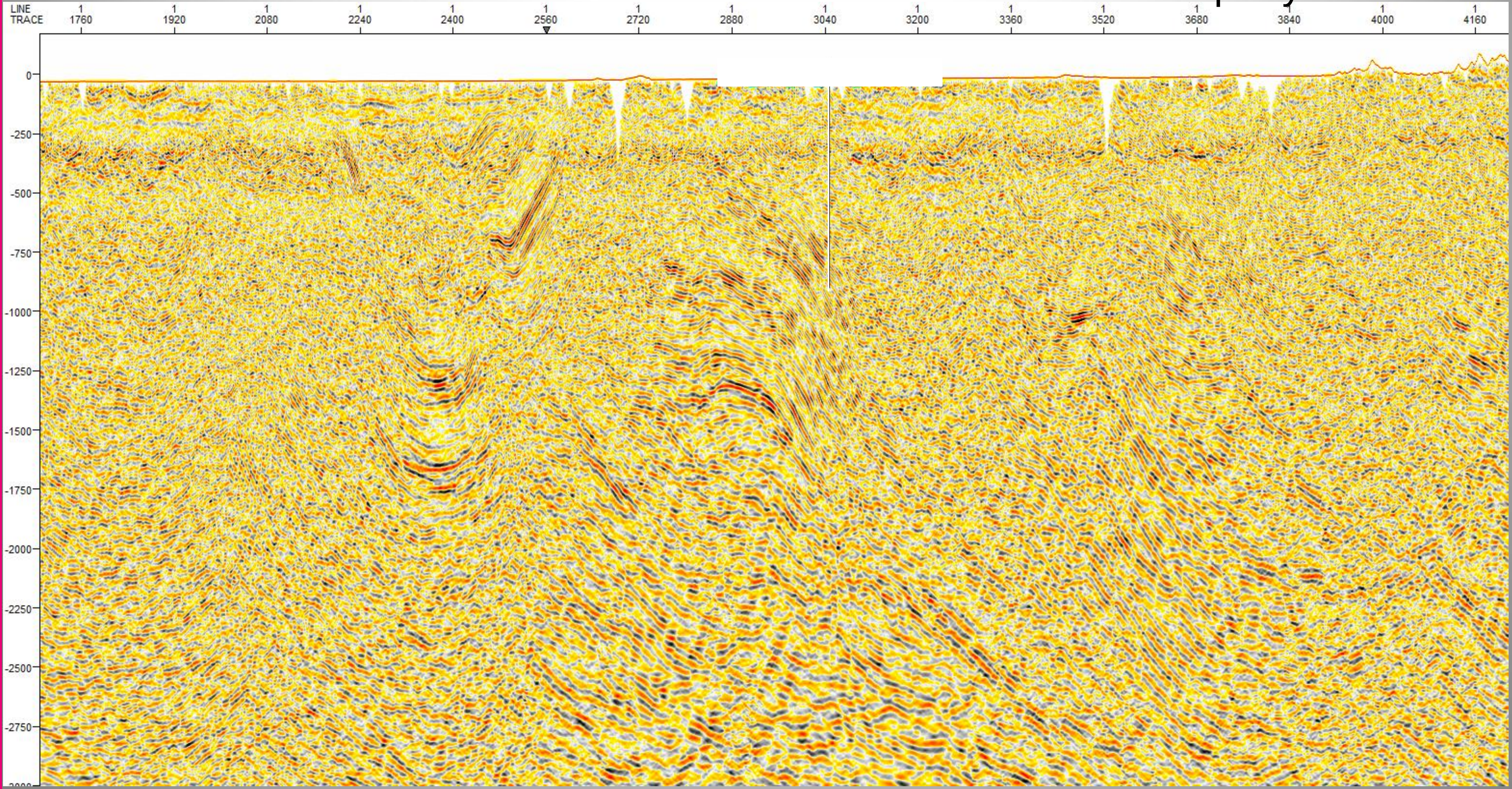
CRS in Complex Tectonic Settings

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



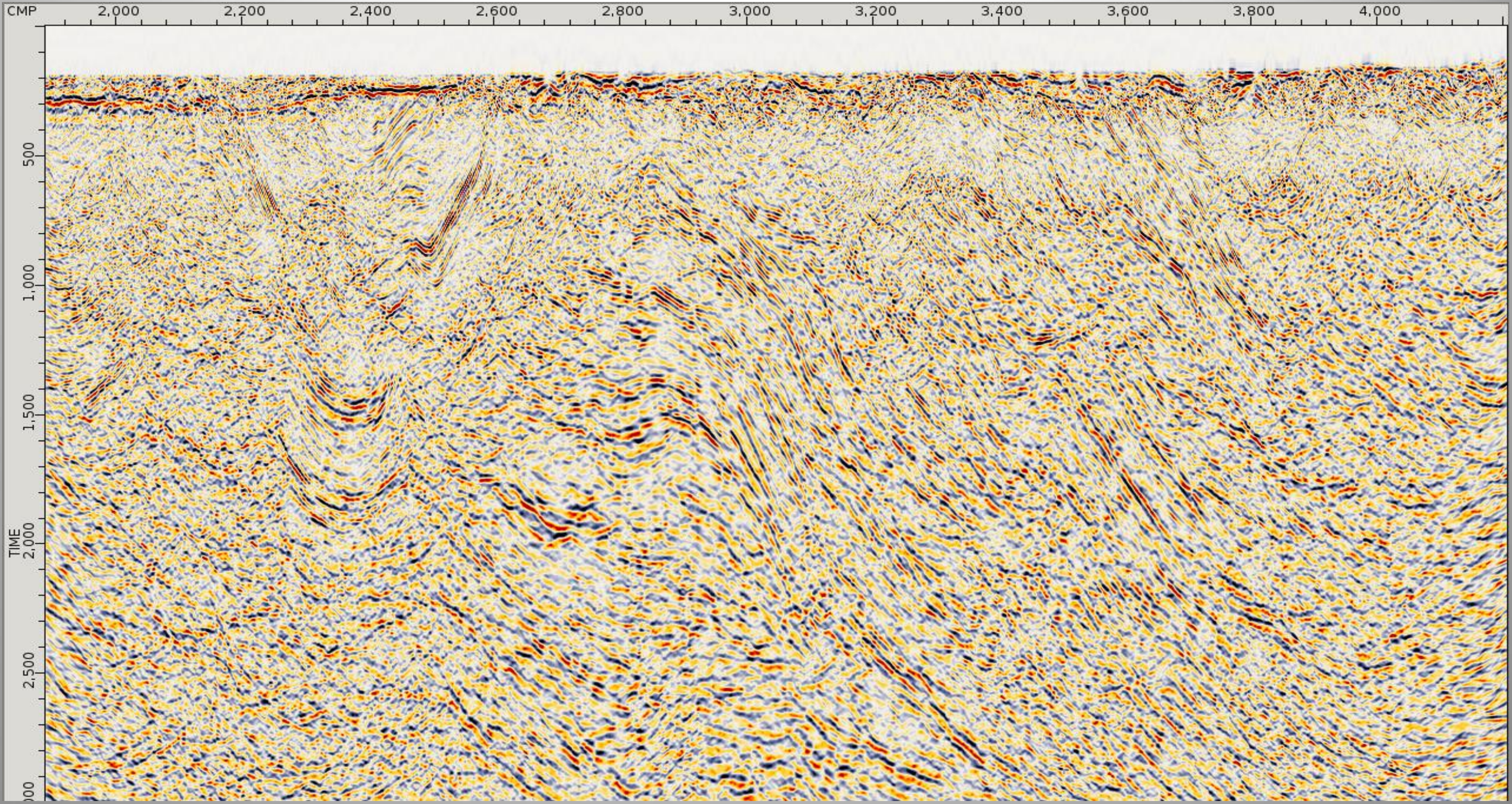
Colombia

3rd party PreSTM



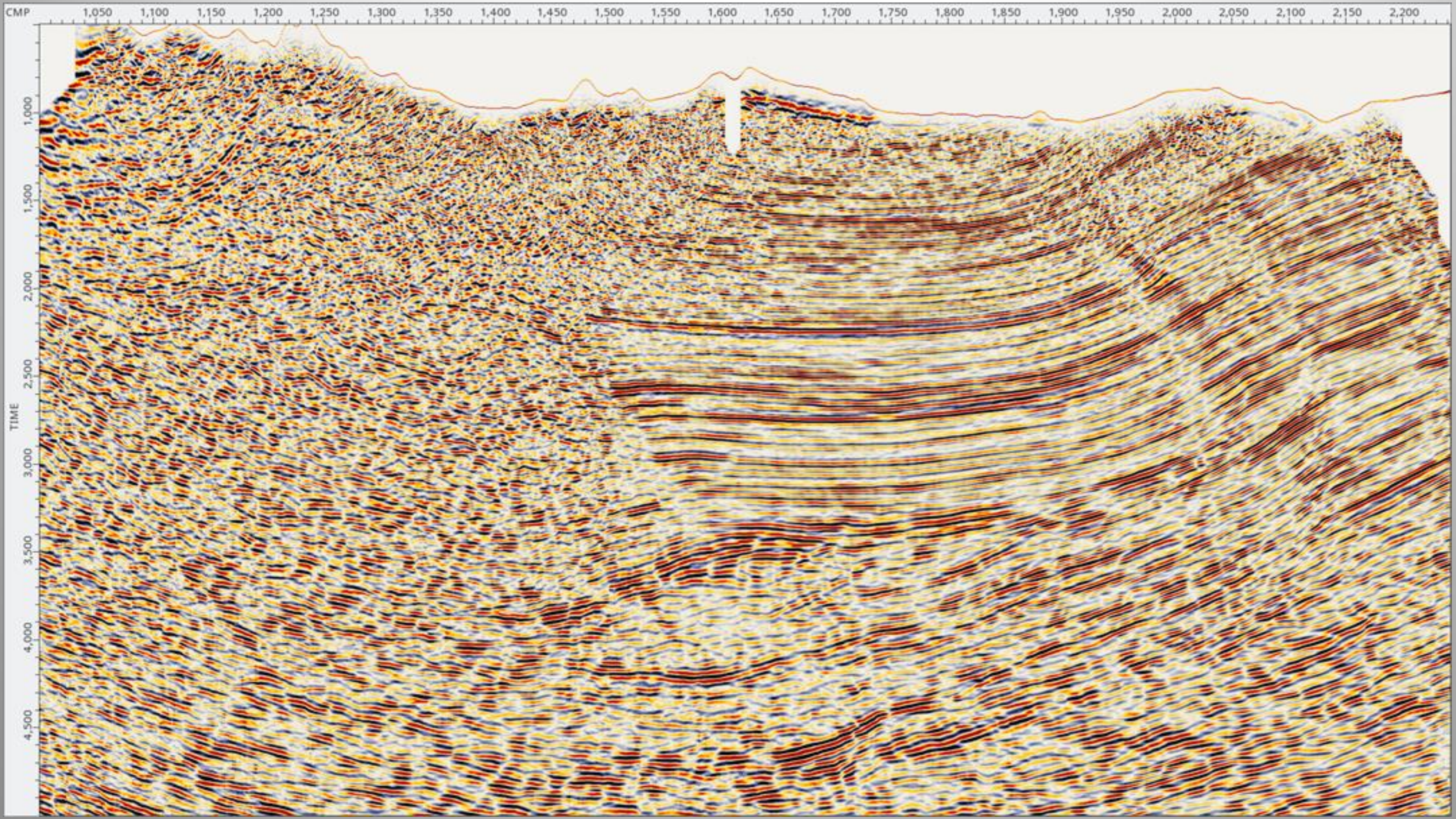
Colombia

CRS PreSTM



Colombia 2D

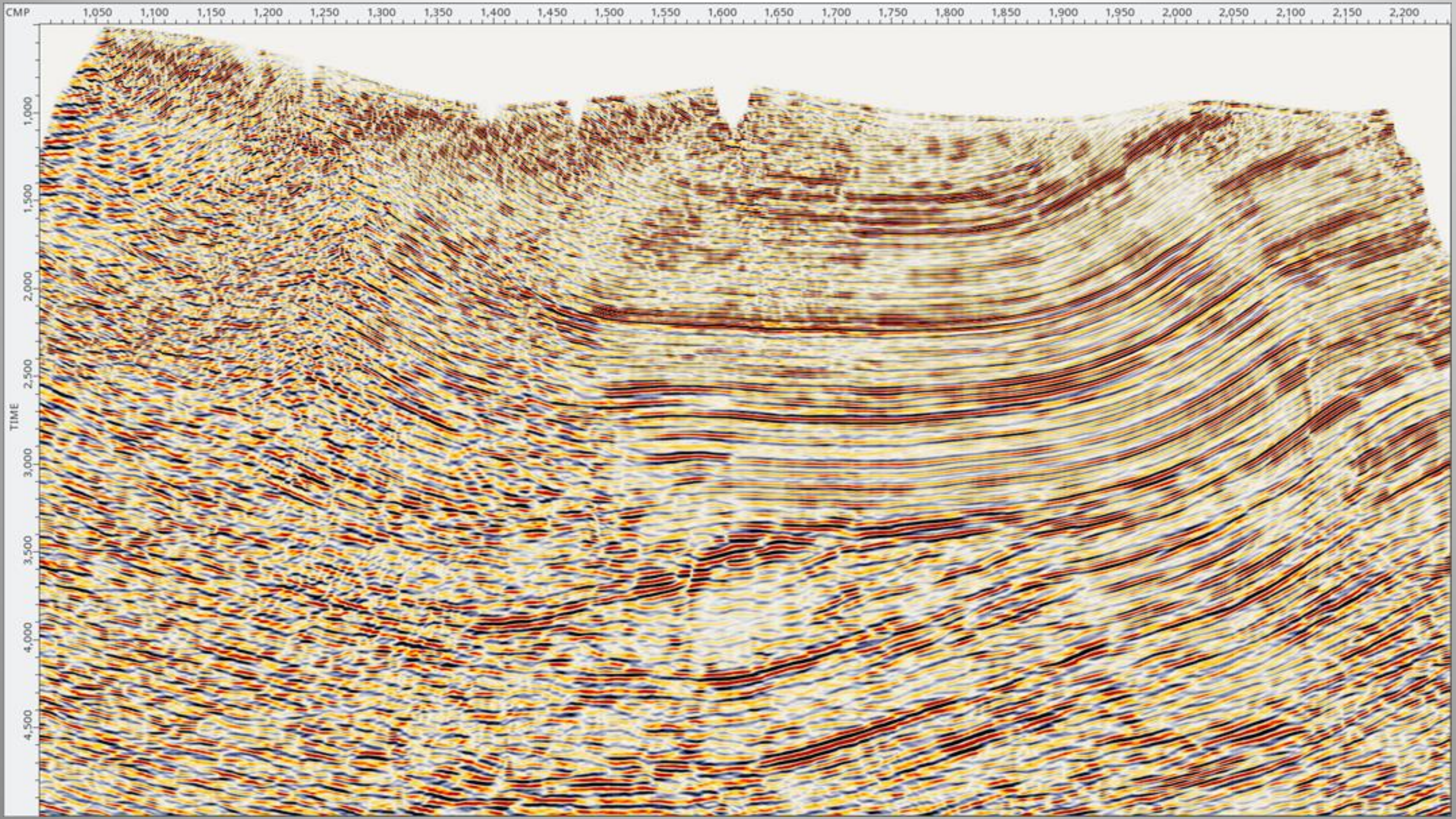
3rd party PreSTM



TEEC Geophysics

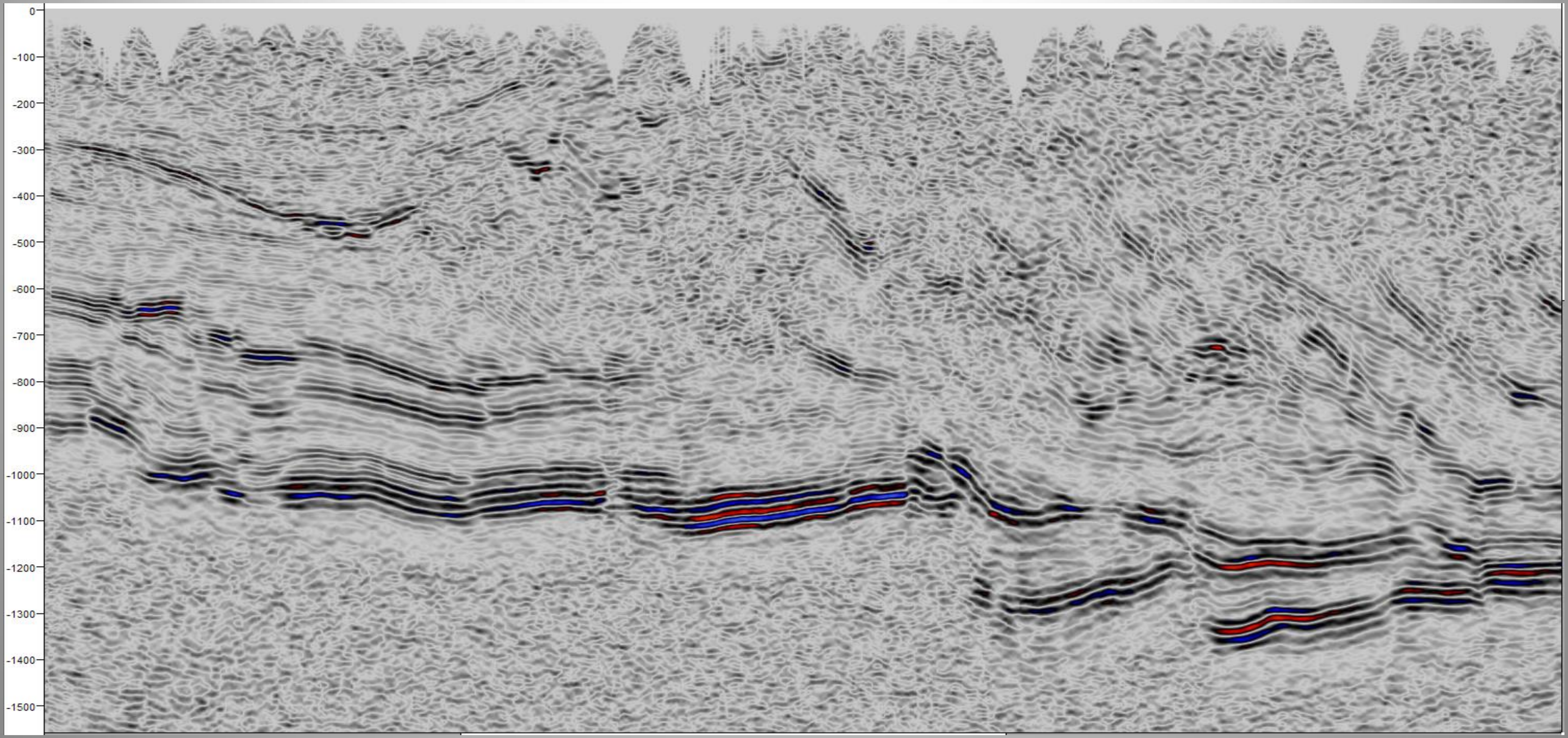
Colombia 2D

TEEC CRS PreSTM



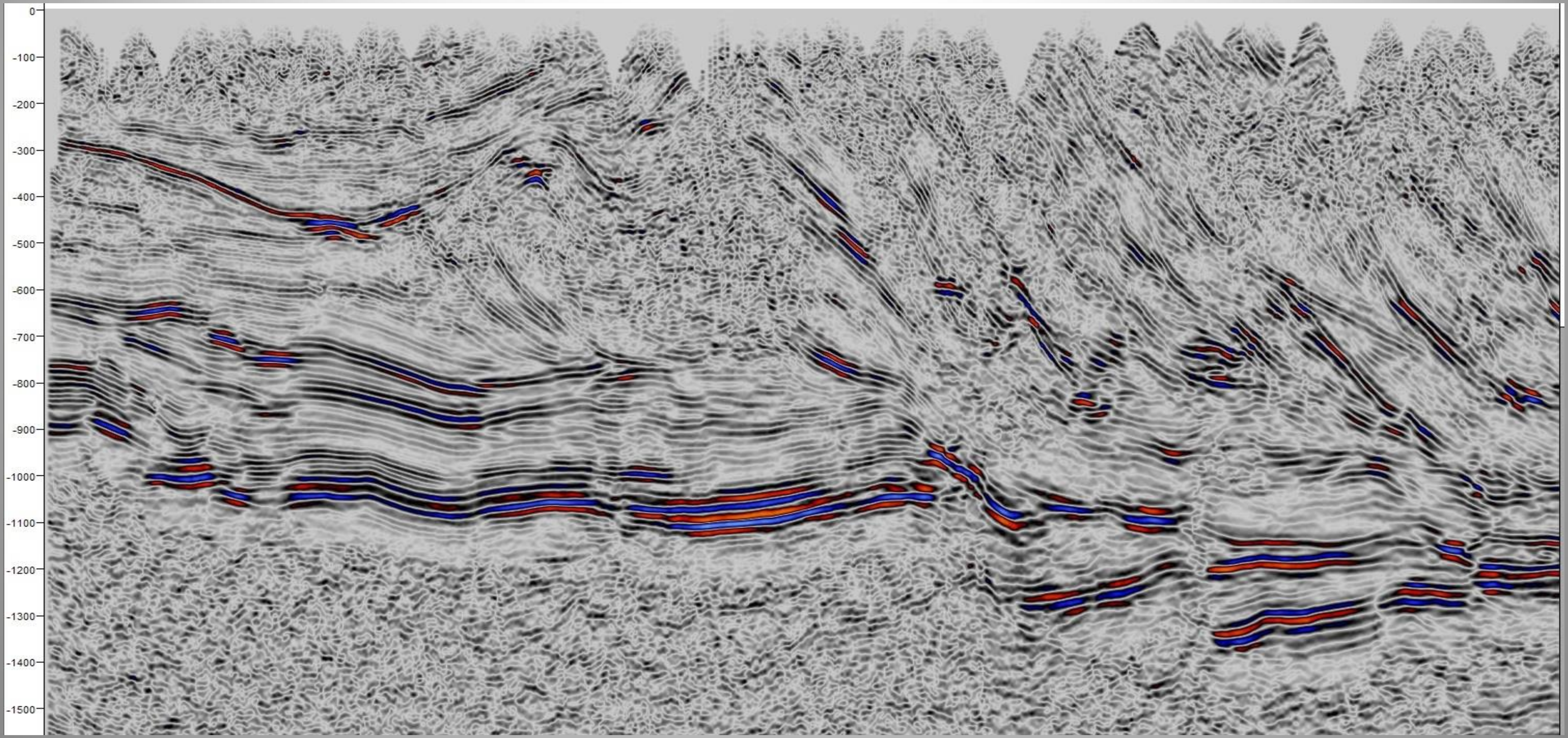
TEEC Geophysics

Northern Calcareous Alps



Client Time Migration with conventional processing

Northern Calcareous Alps



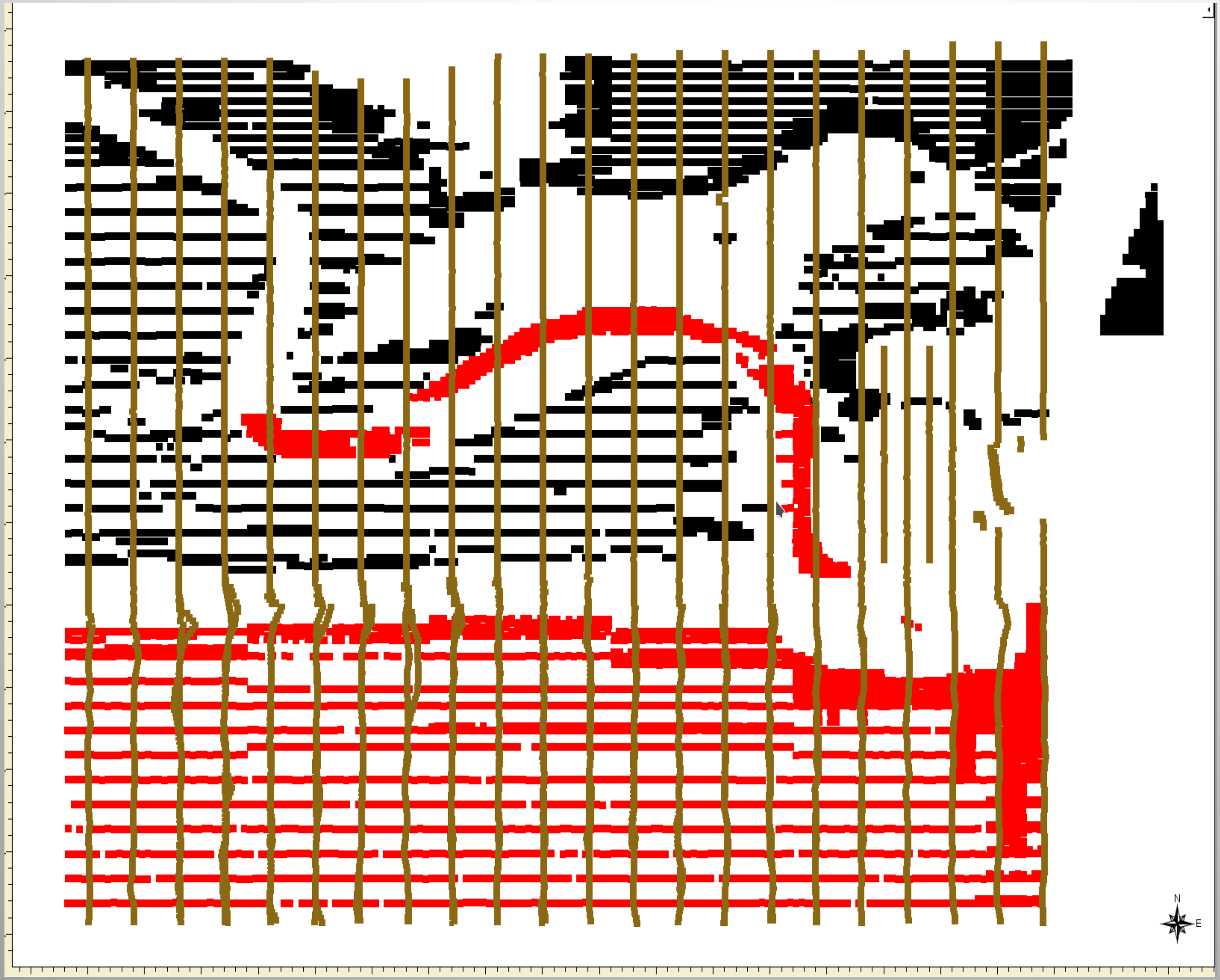
TEEC Time Migration with CRS processing

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

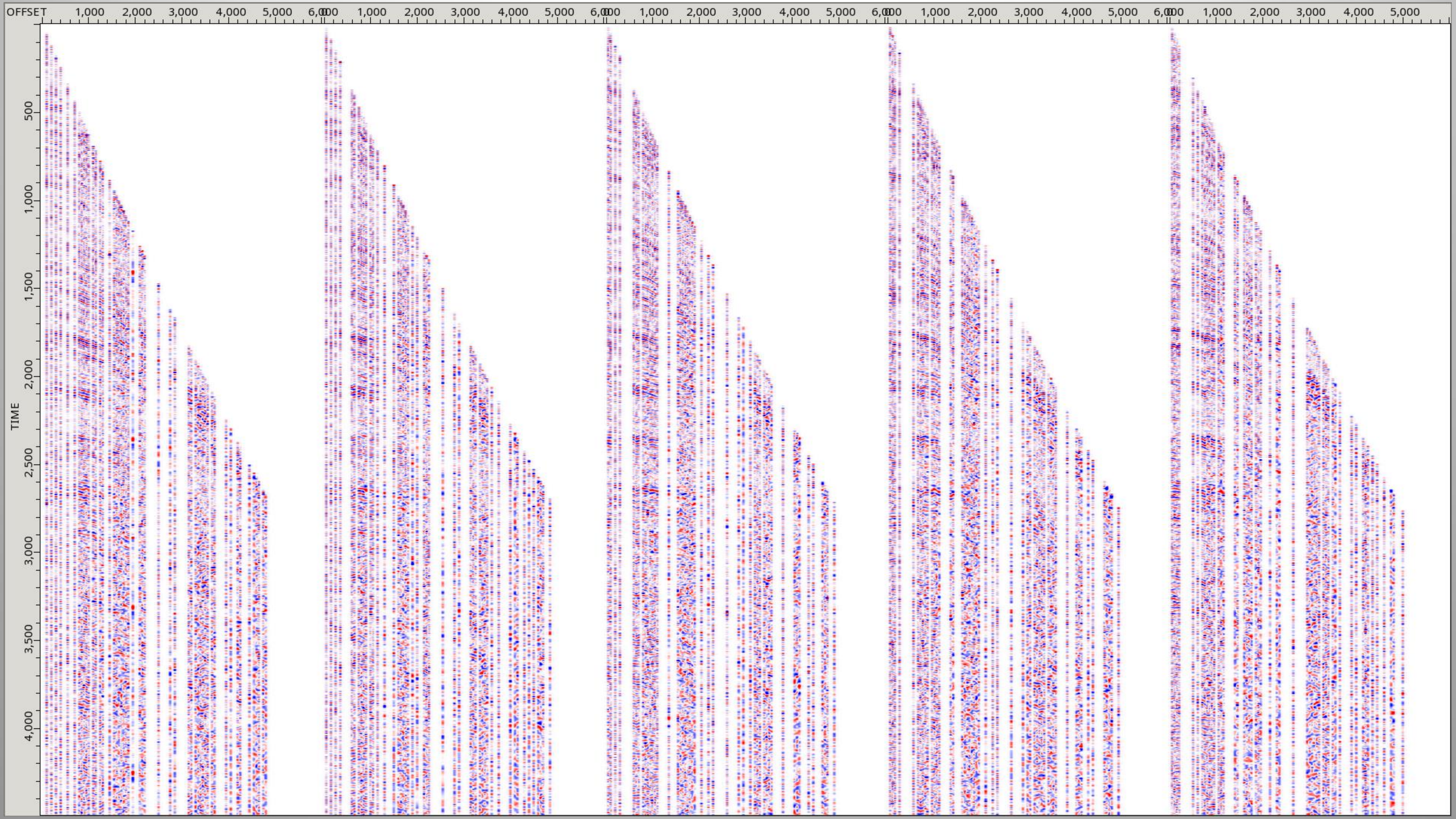


- **Sources:**
- **Explosives in black**
- **Airguns in red**

- **Receiver:**
- **Receiver in brown**

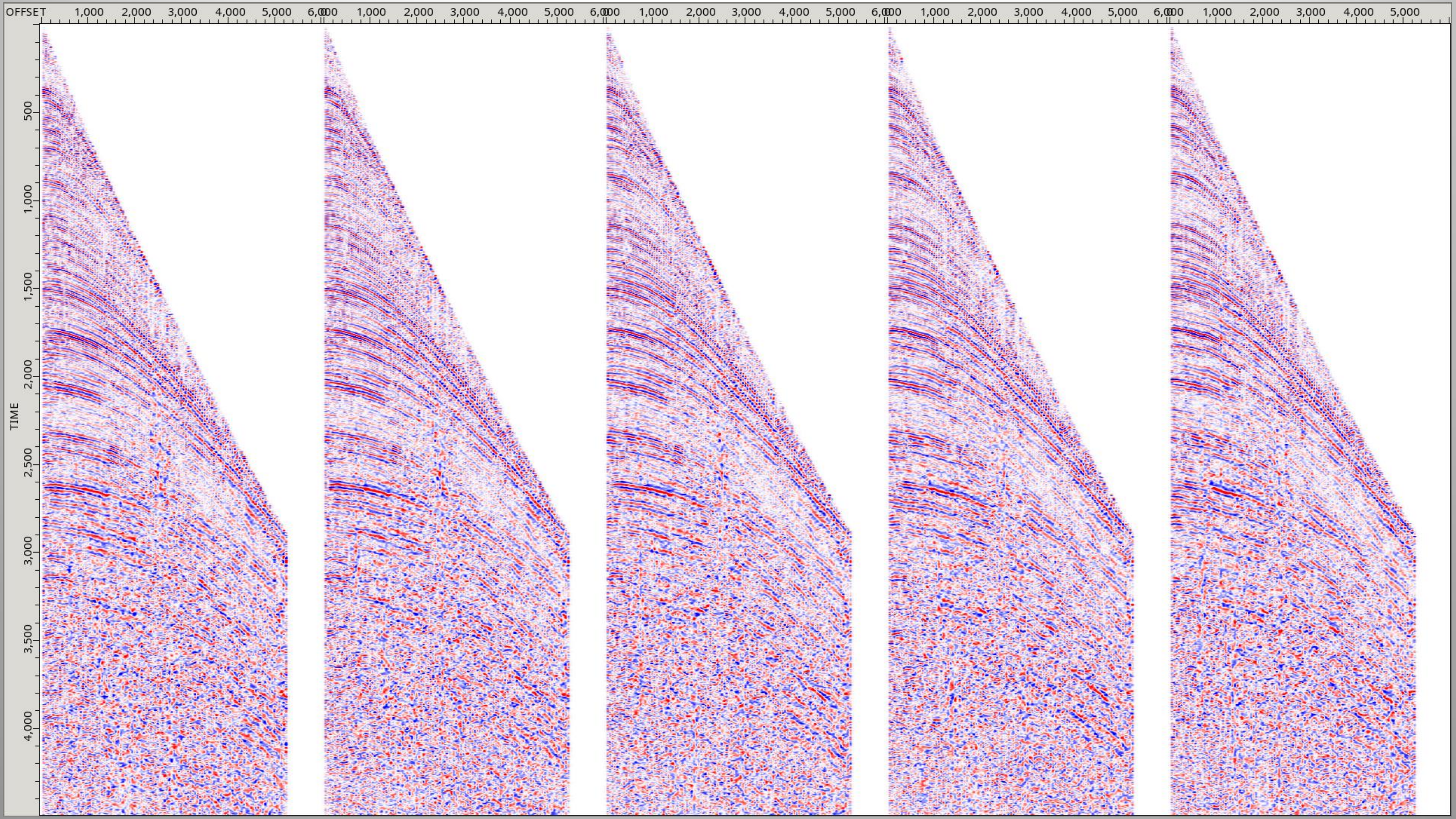
TEEC Geophysics

CMP gathers before CRS processing



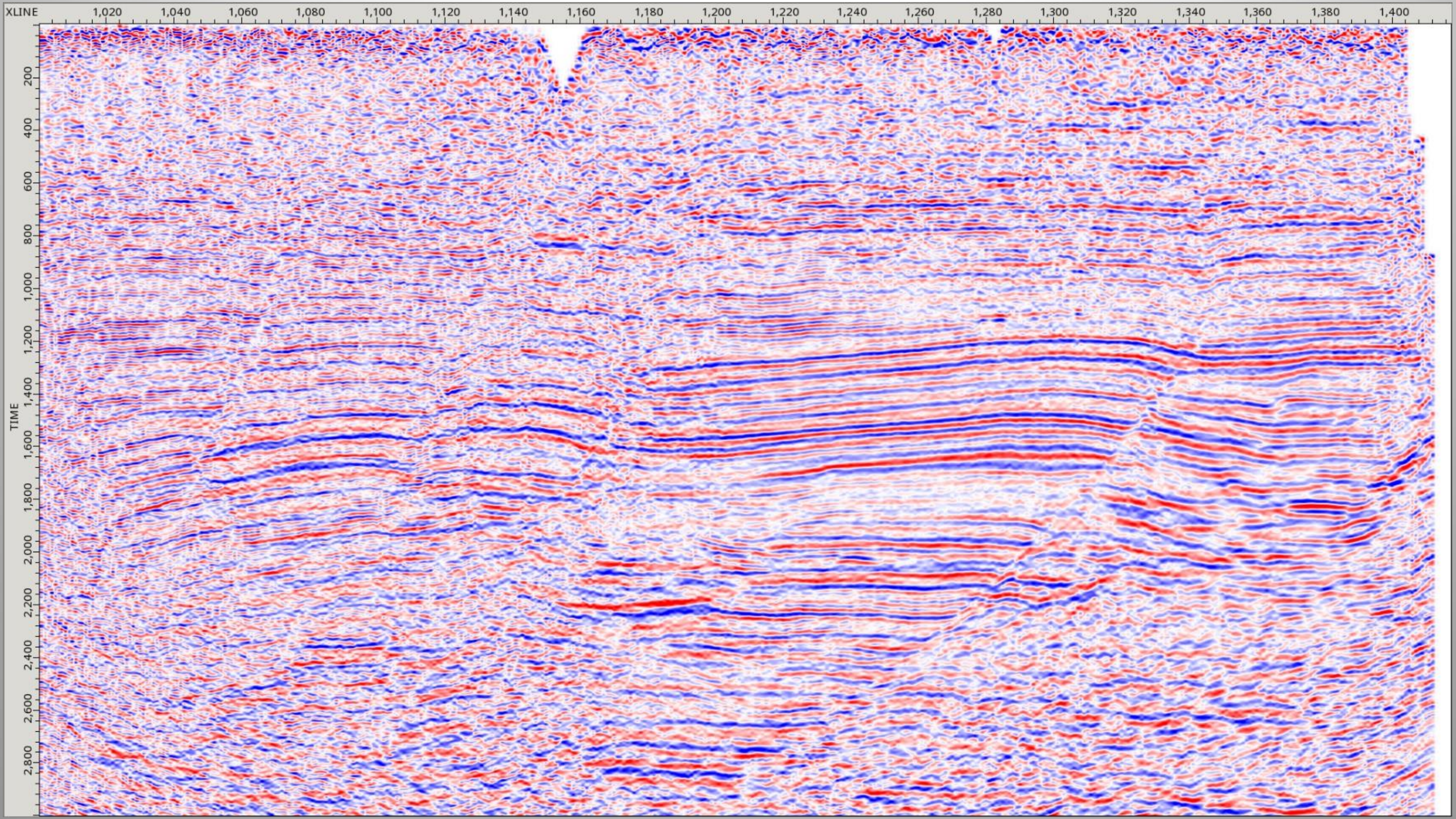
TEEC Geophysics

CRS gathers



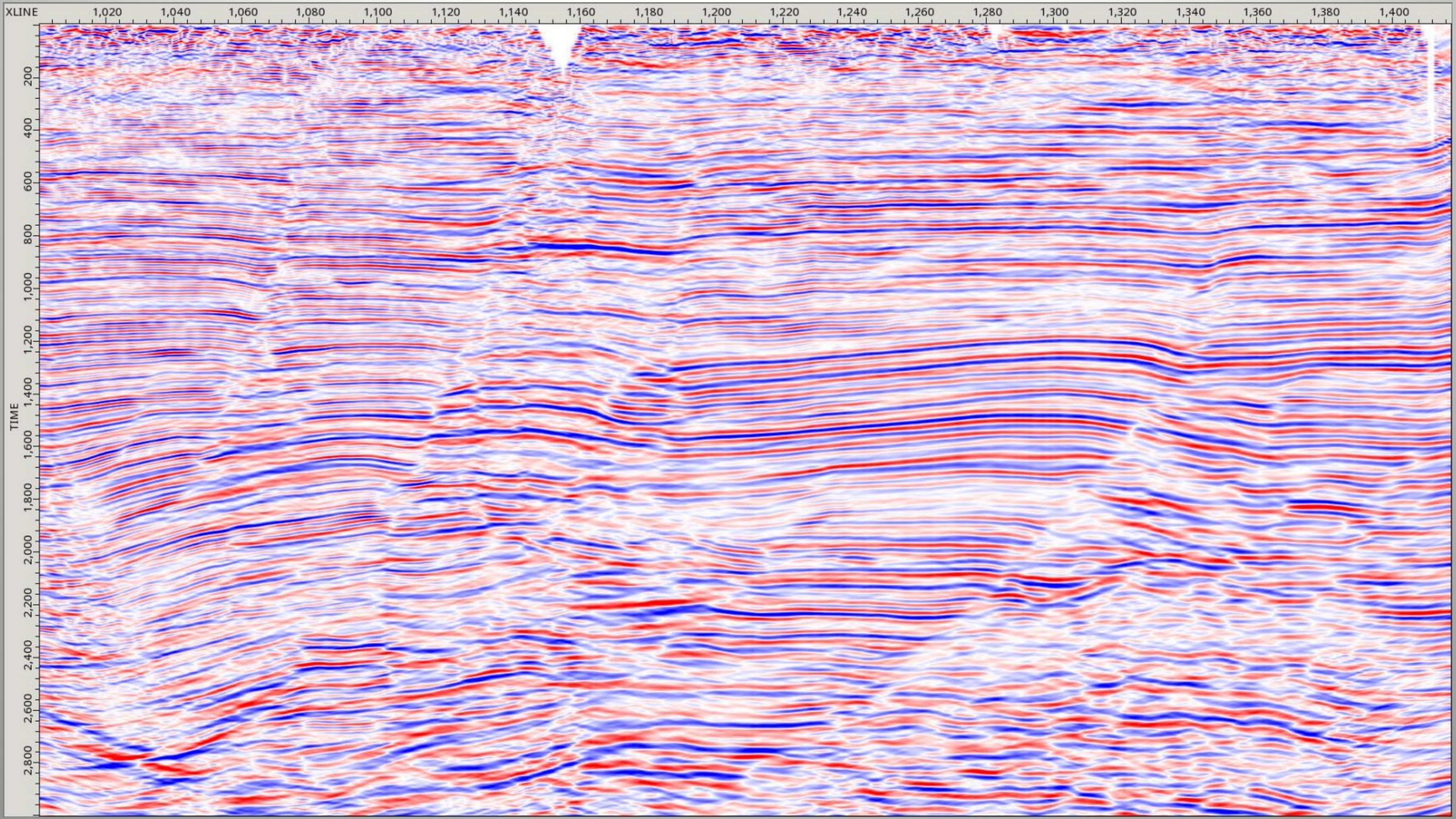
OFFSET
1,000
2,000
3,000
4,000
5,000
6,000
TIME
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000

PreSTM using CMP gathers



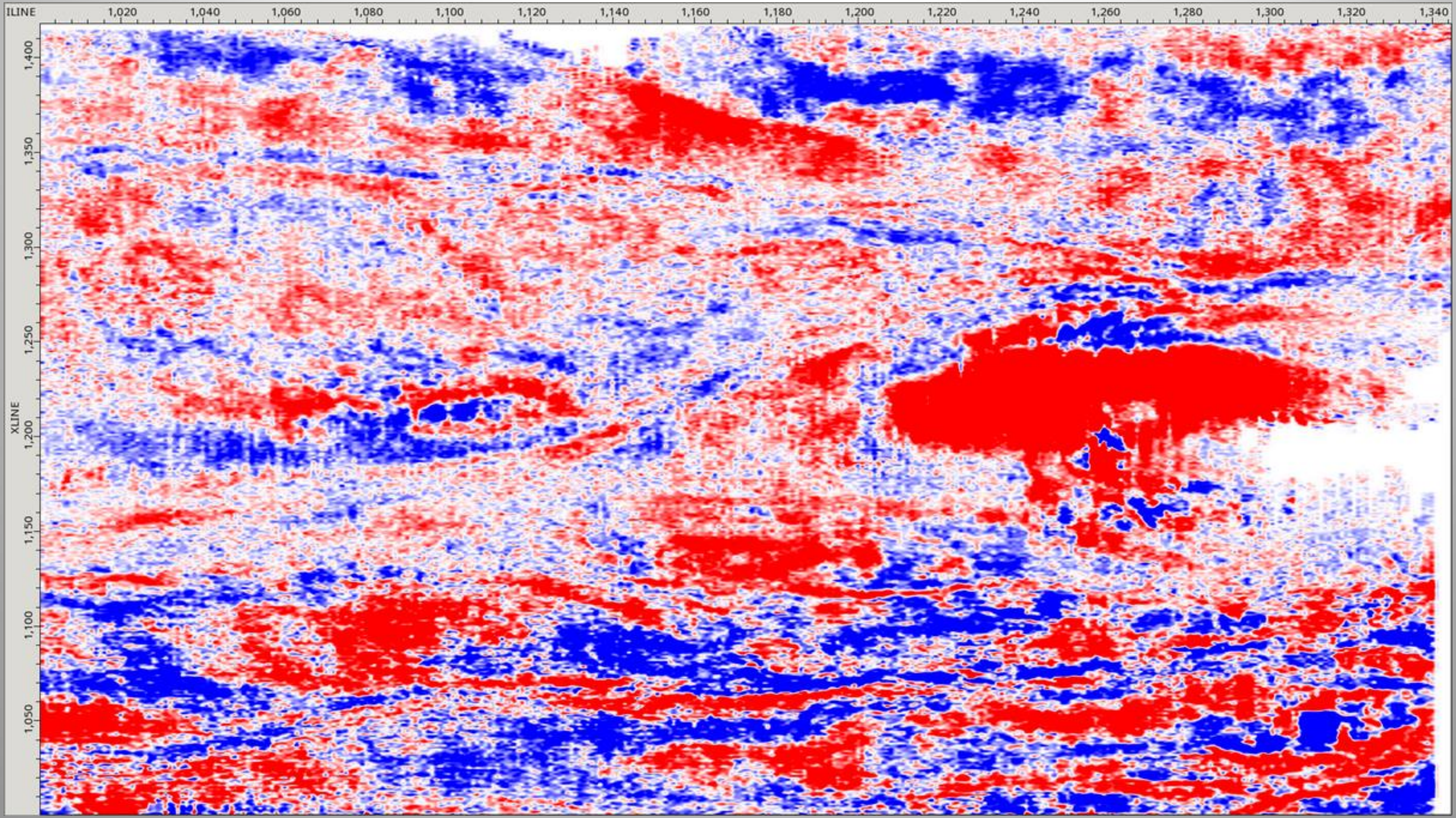
TEEC Geophysics

PreSTM using CRS gather

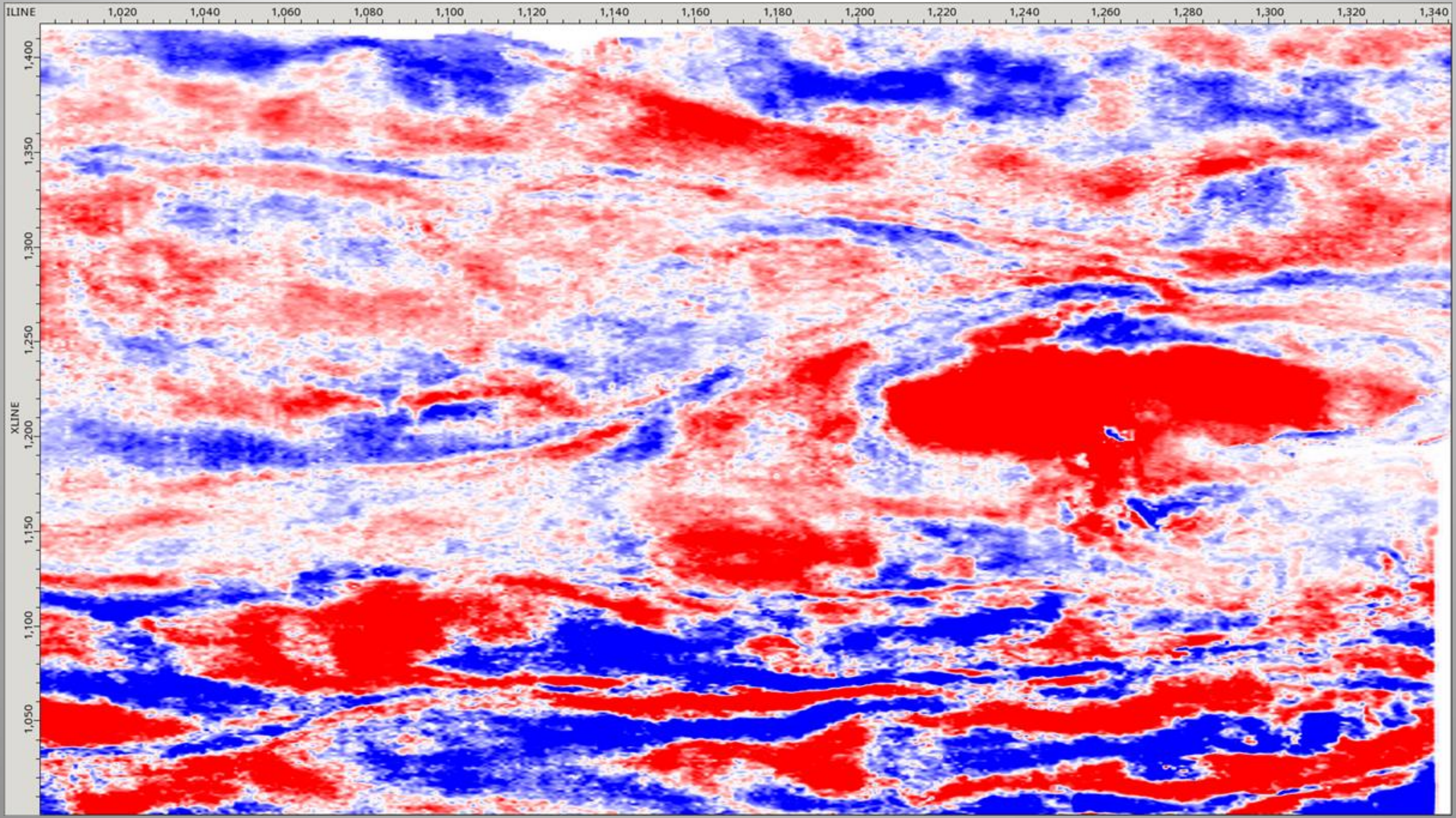


TEEC Geophysics

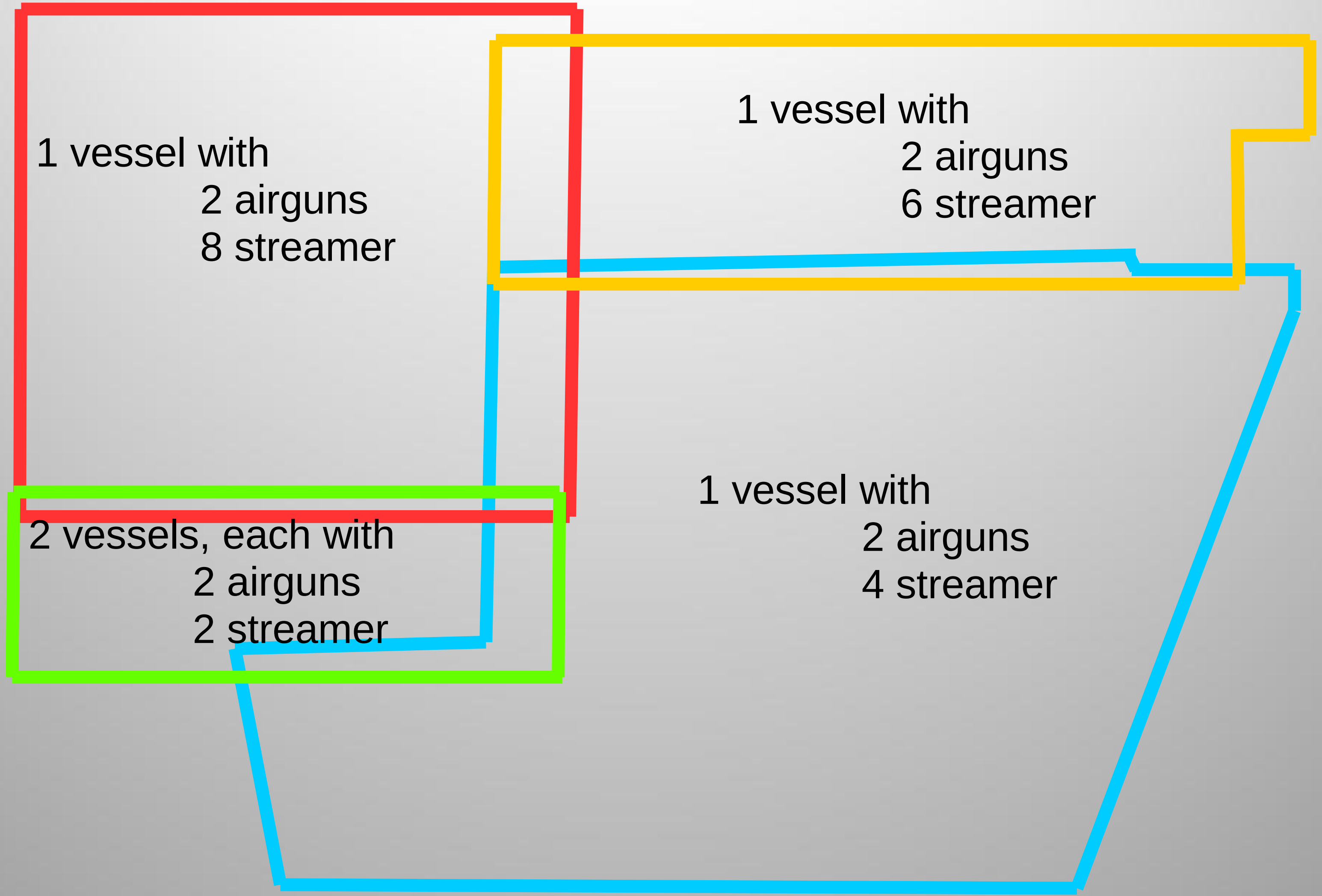
Timeslice 1032 ms of PreSTM



TZ 1032 ms of CRS PreSTM

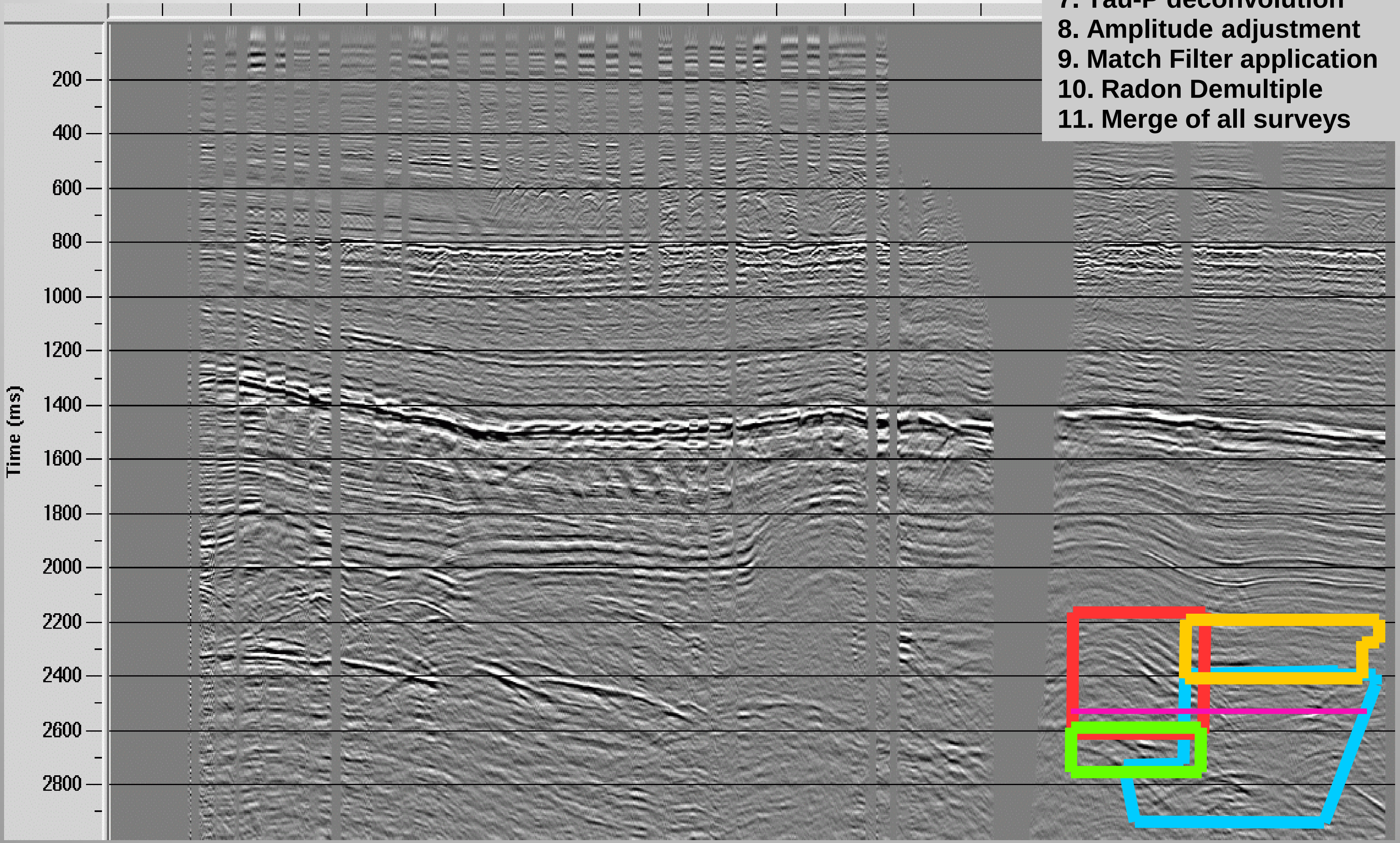


North Sea merge of 4 different acquisition geometries



TEEC Geophysics

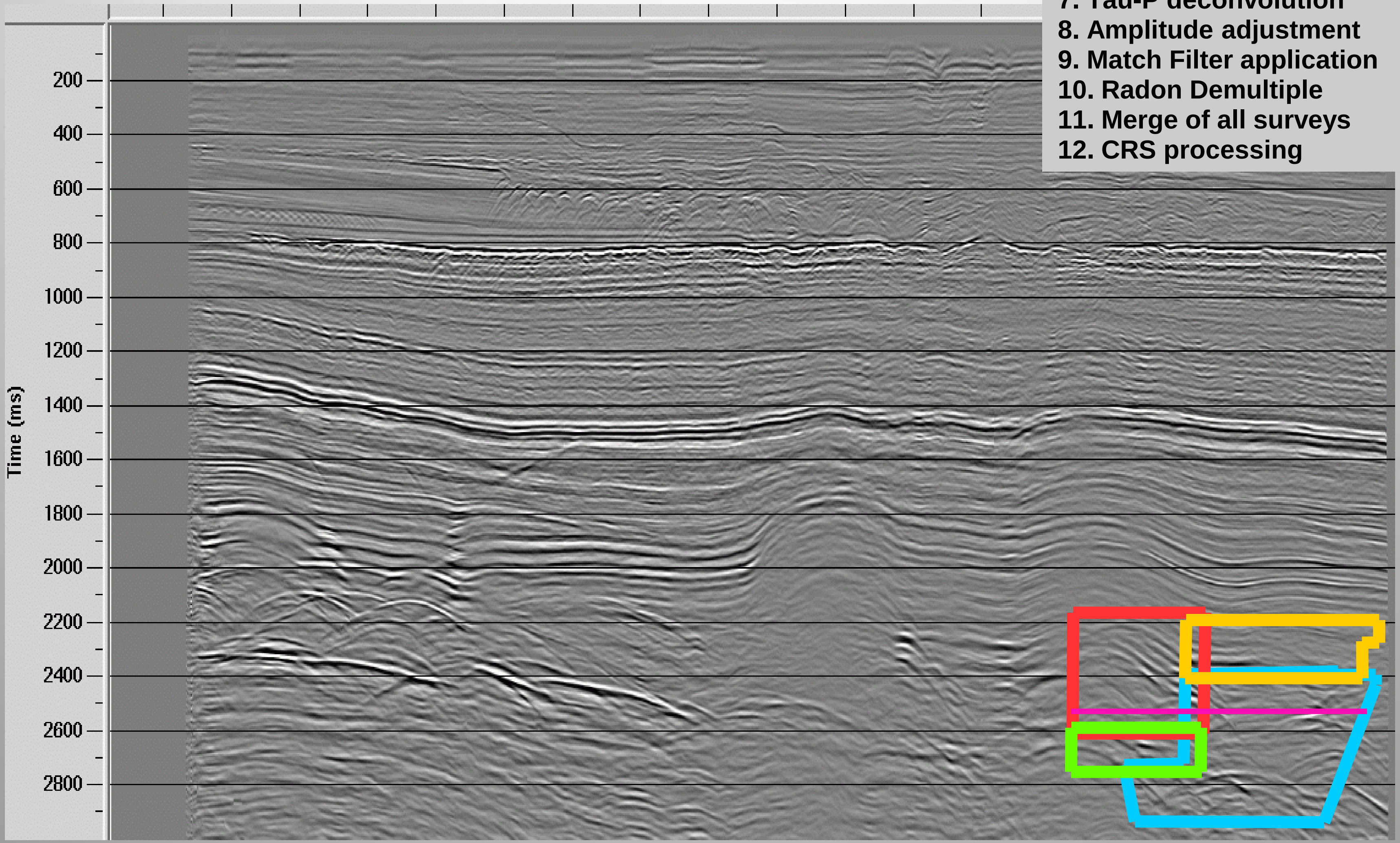
Inline of CMP stack



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

Inline of CRS stack

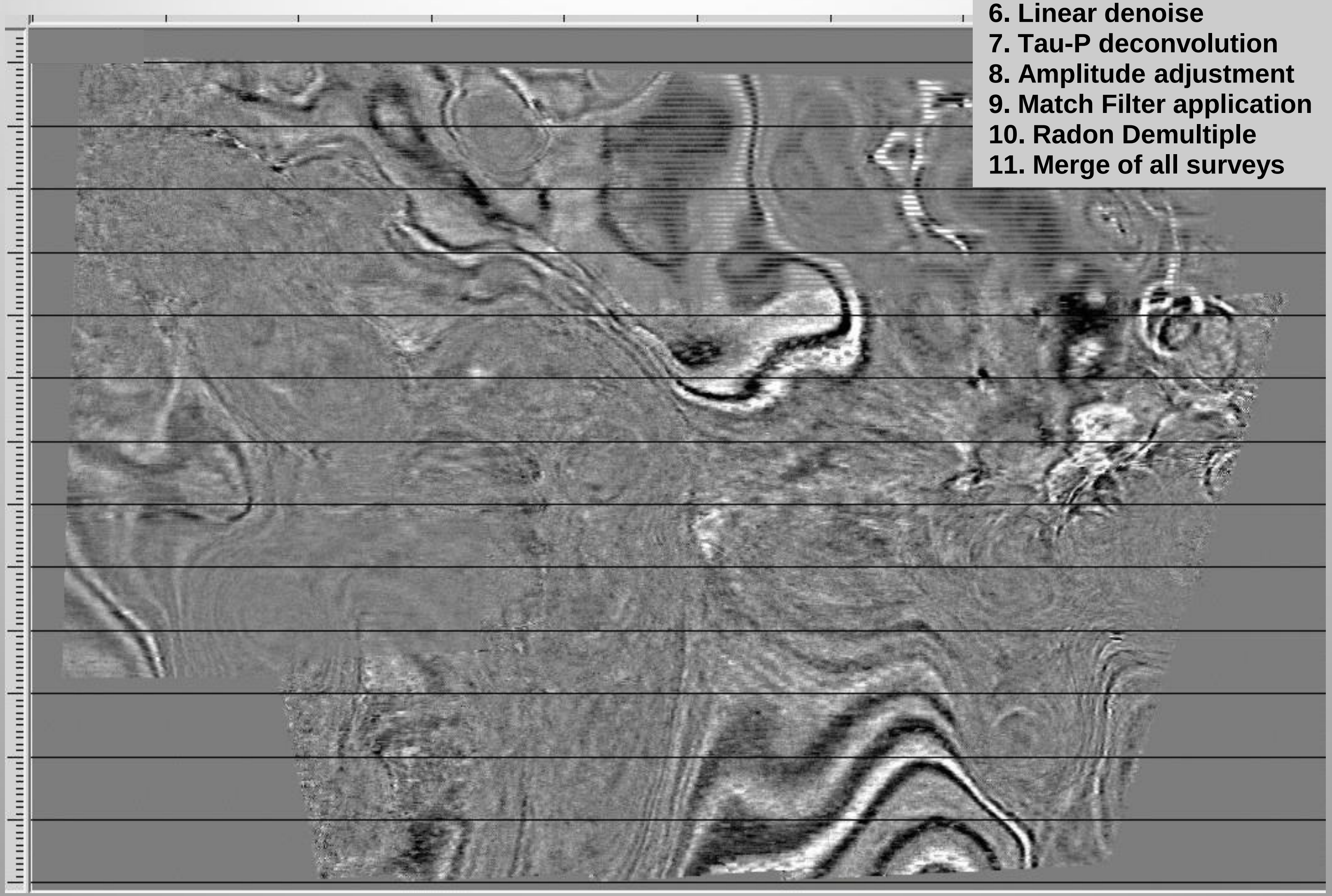
1. source/receiver static applied
2. True amplitude recovery
3. Low cut filter
4. Source signature deconvolution
5. Debubble
6. Linear denoise
7. Tau-P deconvolution
8. Amplitude adjustment
9. Match Filter application
10. Radon Demultiple
11. Merge of all surveys
12. CRS processing



TEEC Geophysics

Time slice at 2100 ms of CMP stack

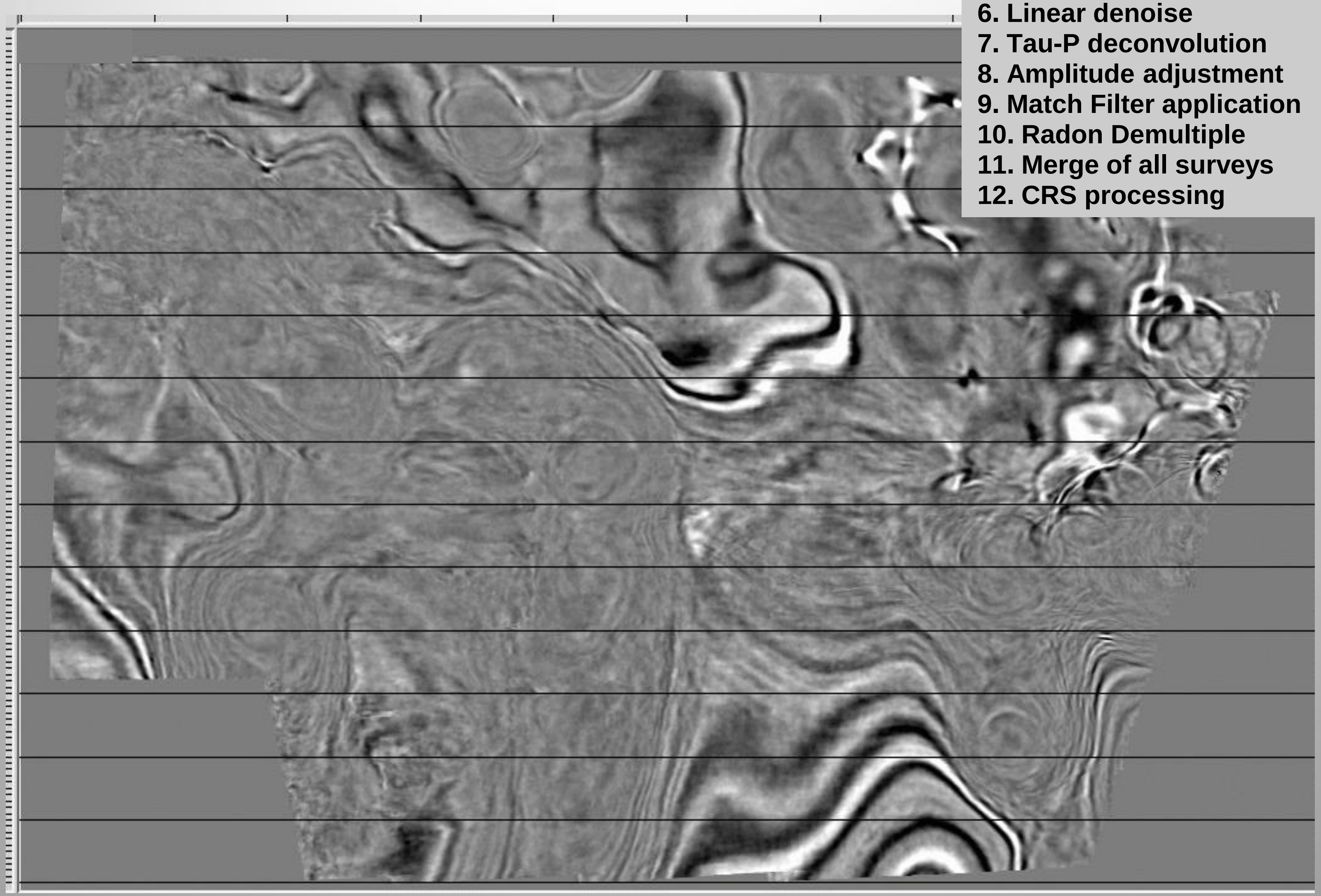
1. source/receiver static applied
2. True amplitude recovery
3. Low cut filter
4. Source signature deconvolution
5. Debubble
6. Linear denoise
7. Tau-P deconvolution
8. Amplitude adjustment
9. Match Filter application
10. Radon Demultiple
11. Merge of all surveys



TEEC Geophysics

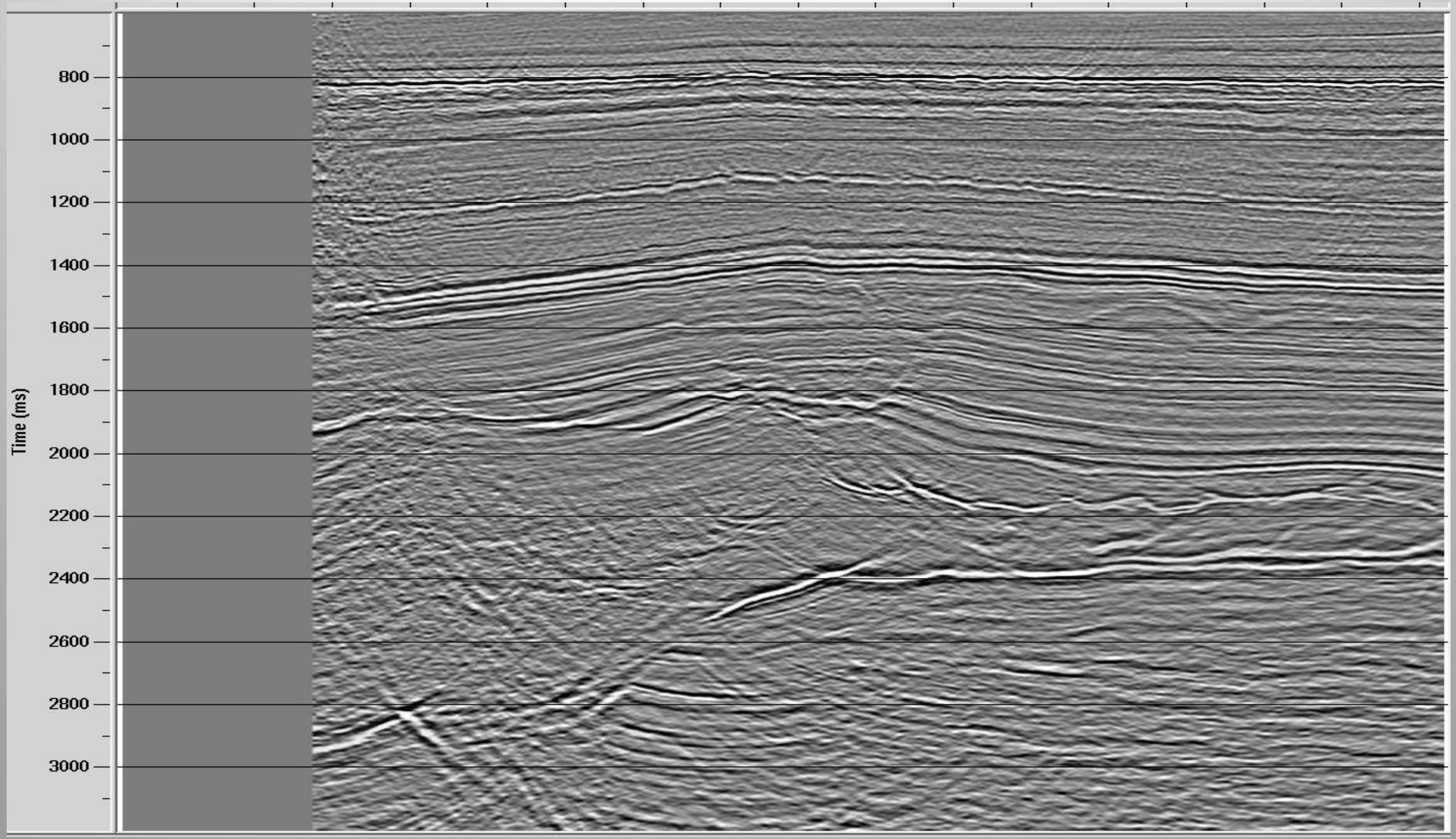
Time slice at 2100 ms of CRS stack

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
12. CRS processing



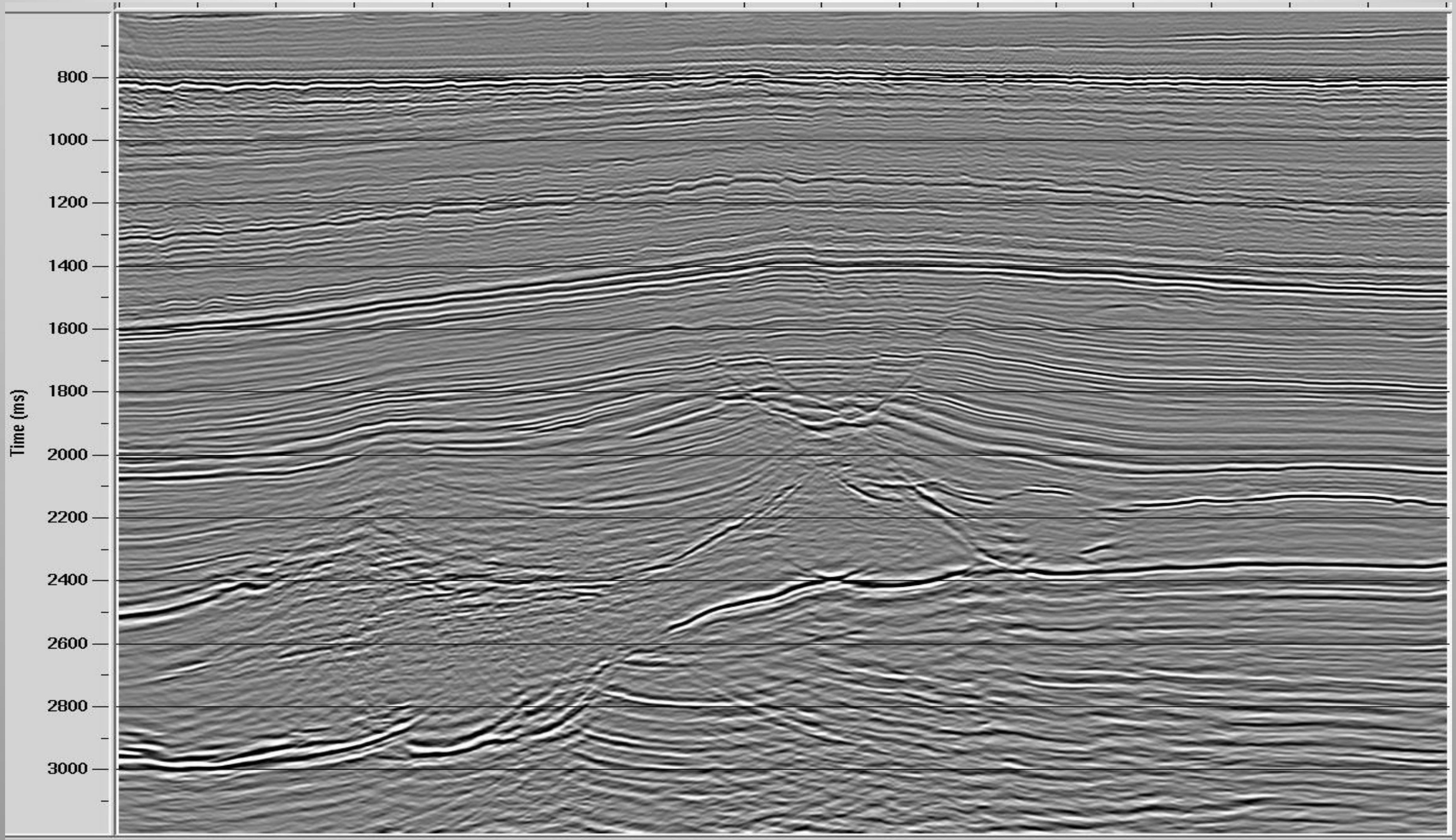
TEEC Geophysics

Inline of vintage PreSTM result



TEEC Geophysics

Inline of CRS PreSTM



TEEC Geophysics

Please contact us for further questions or any comments at

info@teec.de

TEEC Geophysics