



Swell Noise Attenuation Test

NZ 3D Processing

15 September 2020

cgg.com



INSTITUTE FOR GEOPHYSICS



Passion for Geoscience

1. Convert to CGG internal format
2. Nav merge / trace edit
3. Low cut filter
4. Time Variant Scaling (TVS) & Resample to 4ms
5. Swell noise attenuation (SNA)

- **Objective:**

To attenuate swell noise and high amplitude spikes.

- **Procedure:**

Below 20 Hz, swell noise is attenuated using Joint Low-Rank and Sparse Inversion*.

Above 20 Hz, spikes are attenuated using FX deconvolution from designed start time.

- **Display:**

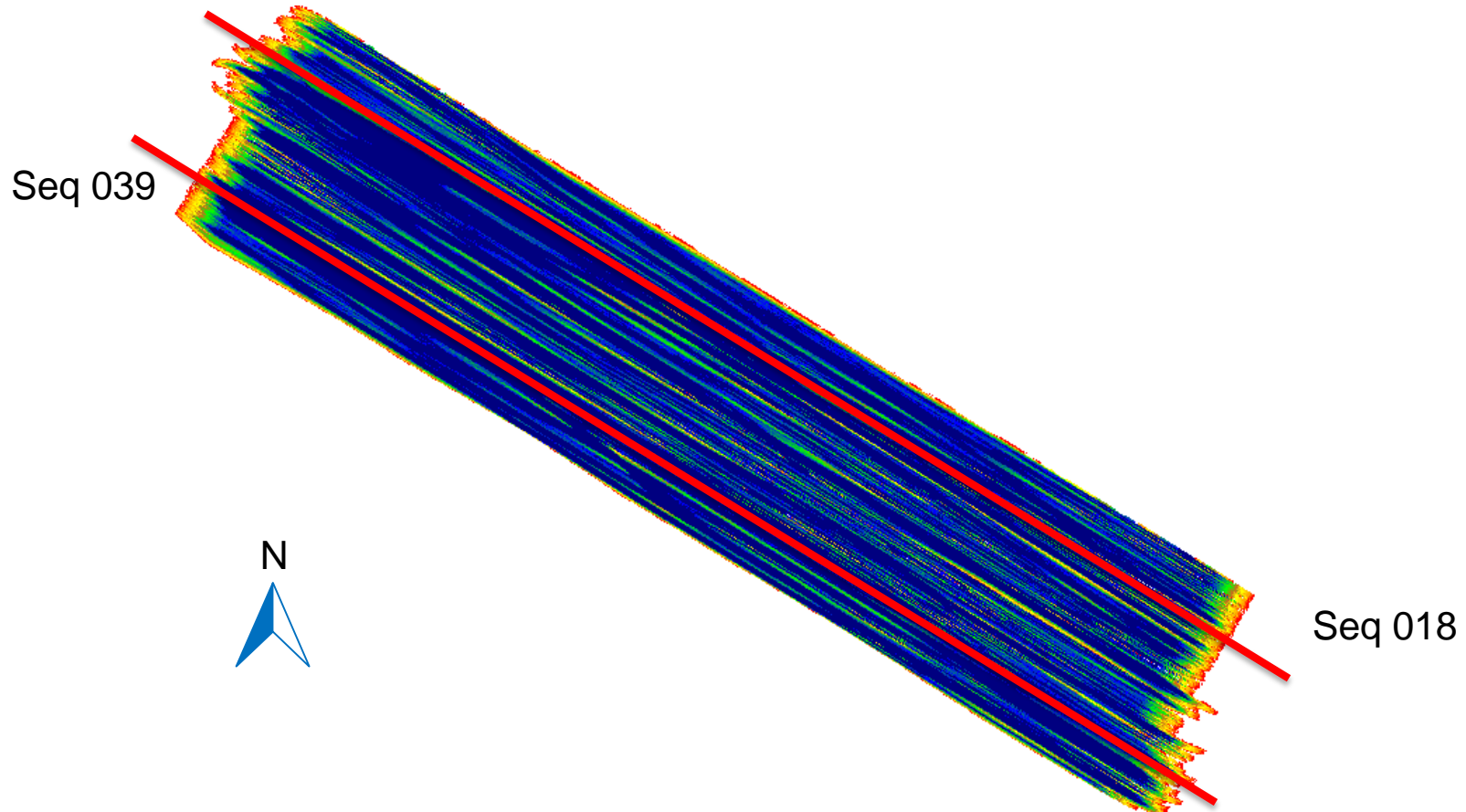
Test line: Seq 018 (Gun 1 Cable 2); Sequence 039 (Gun 2 Cable 1).

Display: Selected shot gathers, stacks, and amplitude maps.

- **Observation and Recommendation:**

Swell noises have been attenuated after joint low-rank and sparse inversion together with FX deconvolution process without hurting primaries. Hence it is recommended to use in production.

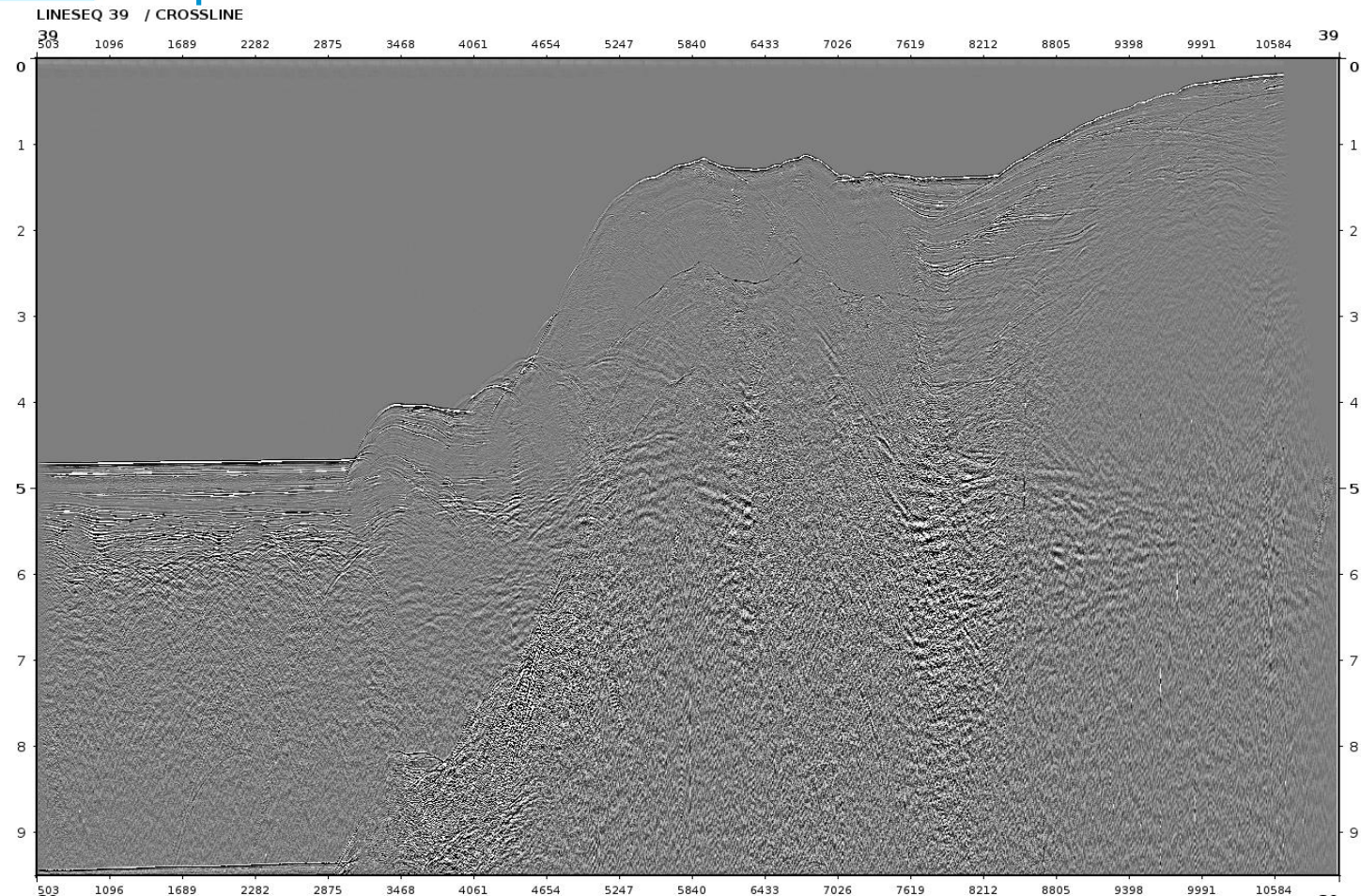
* Sternfels, R., Viguier, G., Gondoin, R. and Le Meur, D, 2015, Multidimensional simultaneous random plus erratic noise attenuation and interpolation for seismic data by joint low-rank and sparse inversion: Geophysics, 80, No 6, WD129-WD141.



Seq 039



Seq 039: 2D Stack before SNA

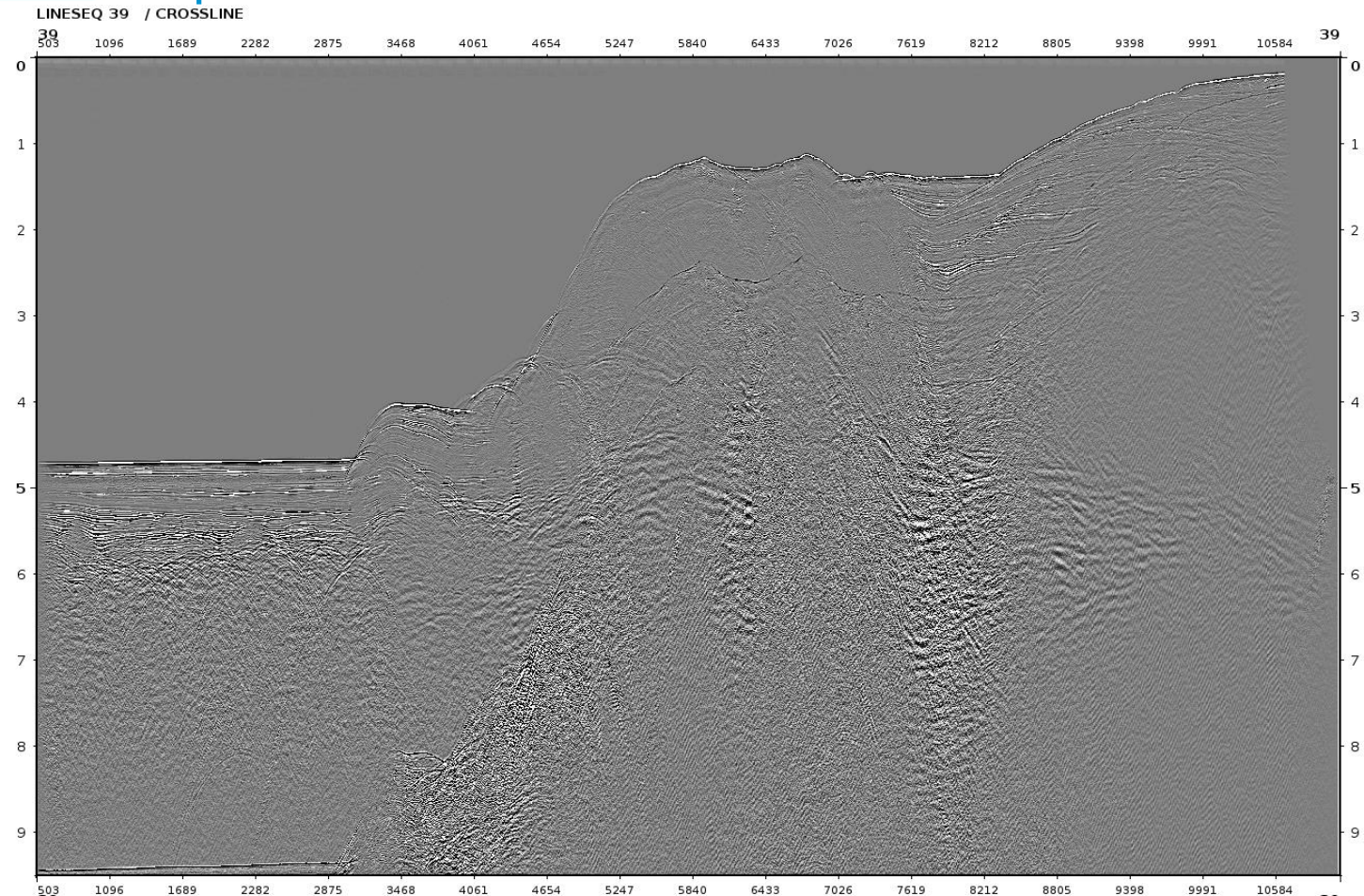


- Mild swell noise and high amplitude spikes on this line.



Seq 039: 2D Stack after SNA

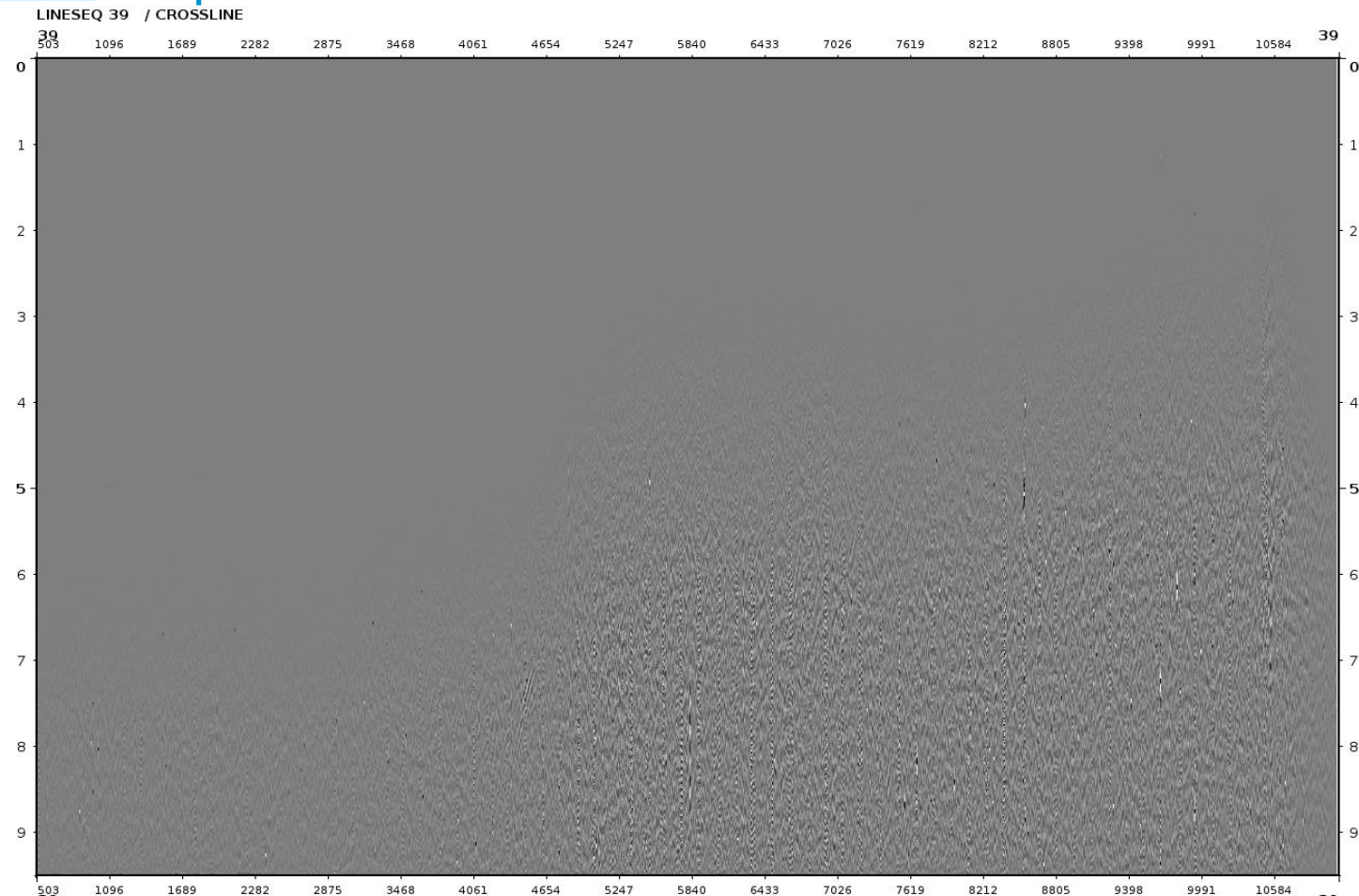
7



- Mild swell noise and high amplitude spikes on this line.

Seq 039: Difference Before - After

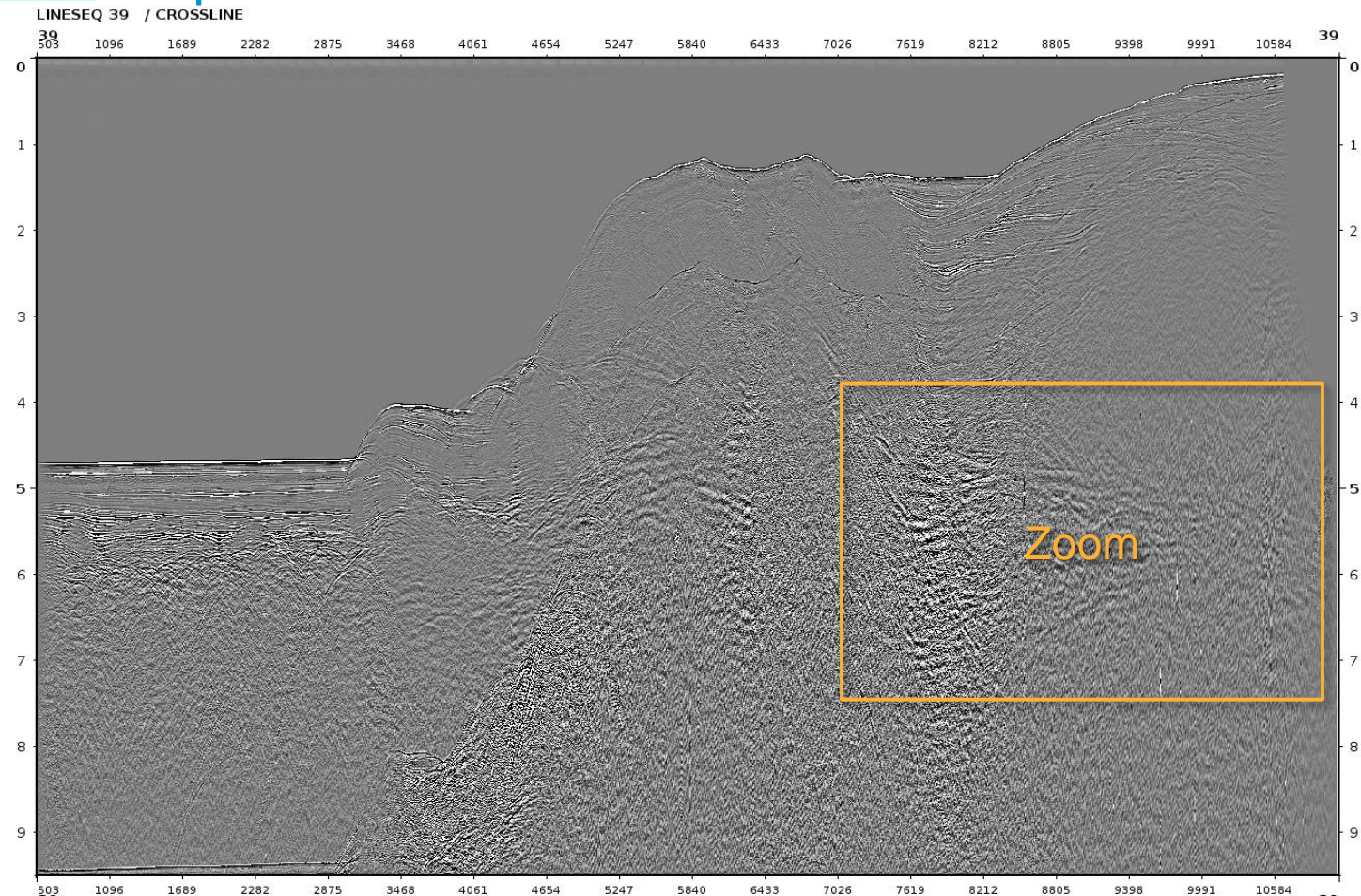
8



- No primary damage is observed on removed noise.

Seq 039: 2D Stack Zoomed In Location

9

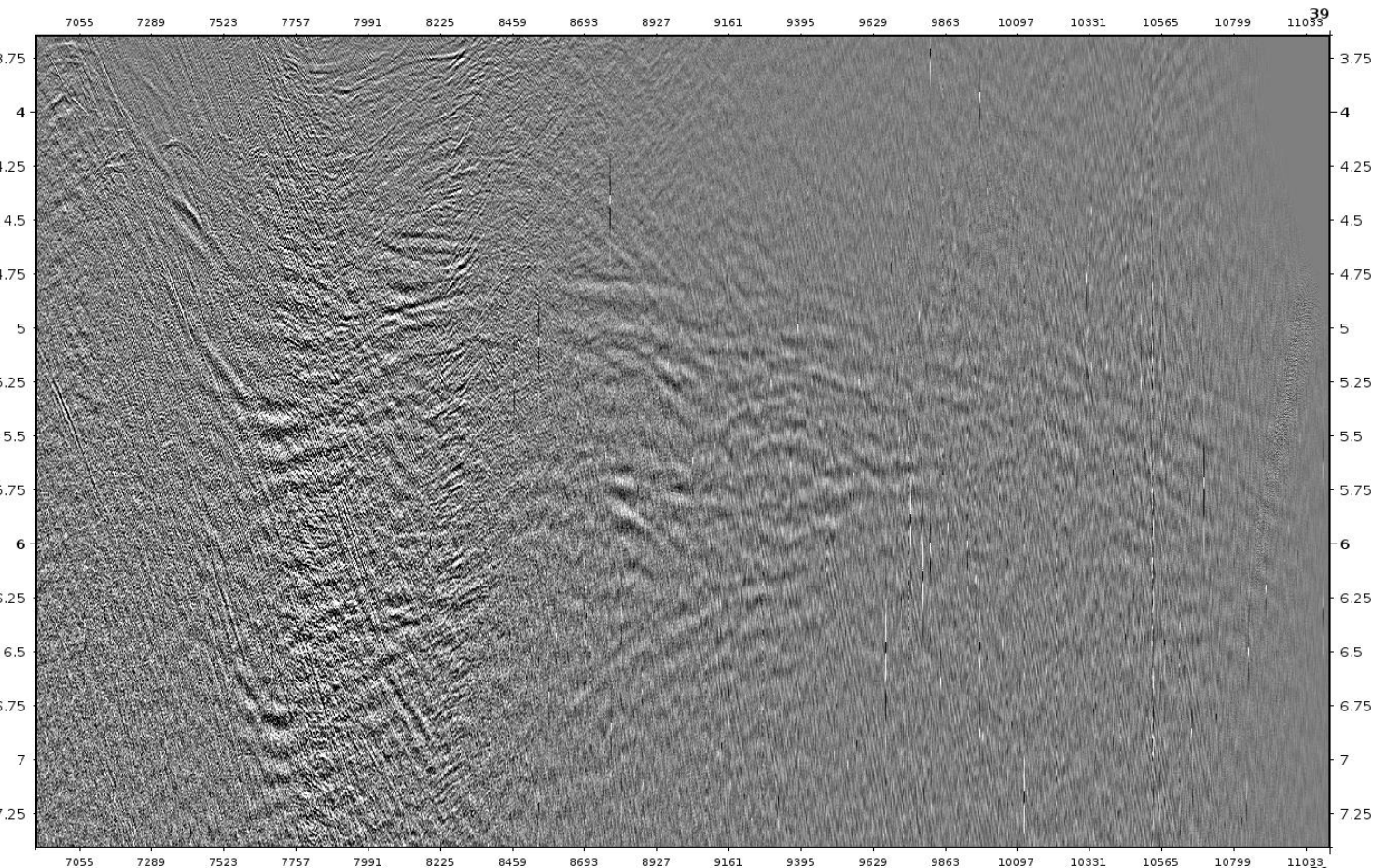




Seq 039: Zoomed 2D Stack before SNA

10

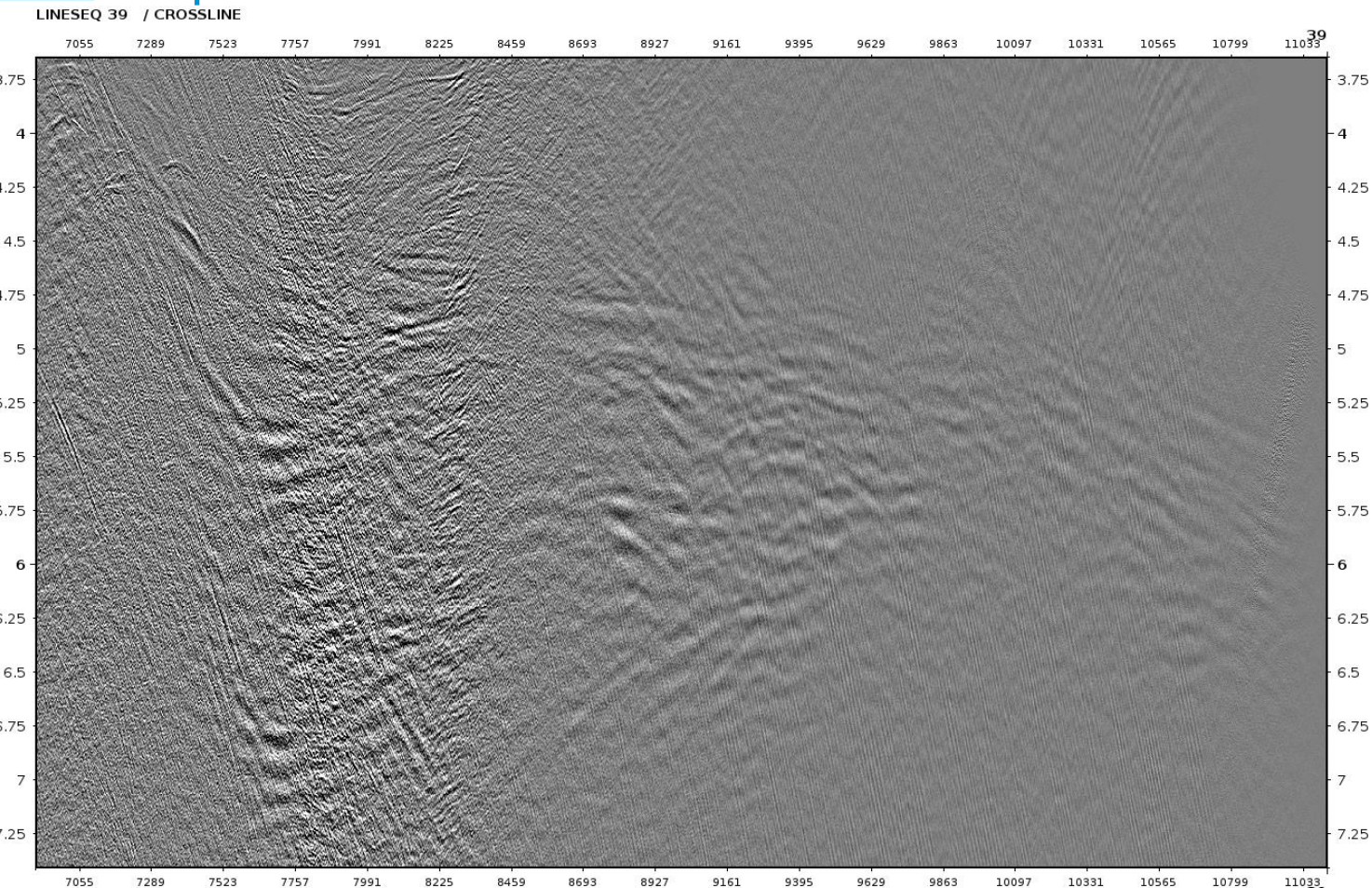
LINESEQ 39 / CROSSLINE



- Primaries are masked by swell noise and high amplitude spikes.

Seq 039: Zoomed 2D Stack after SNA

11

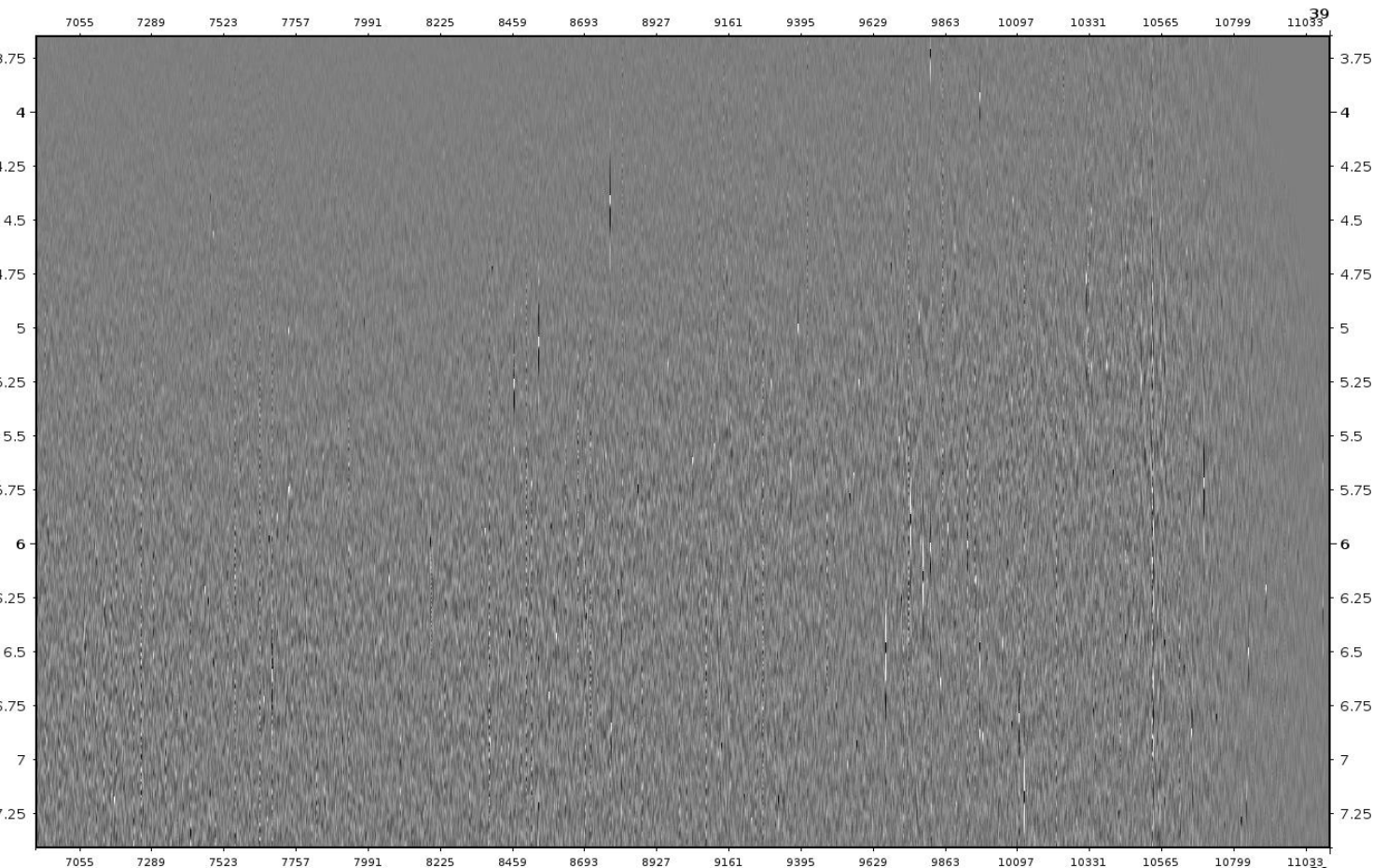


- Removing swell noise and high amplitude spikes reveals primaries underneath, with linear noise.

Seq 039: Difference Before - After

12

LINESEQ 39 / CROSSLINE

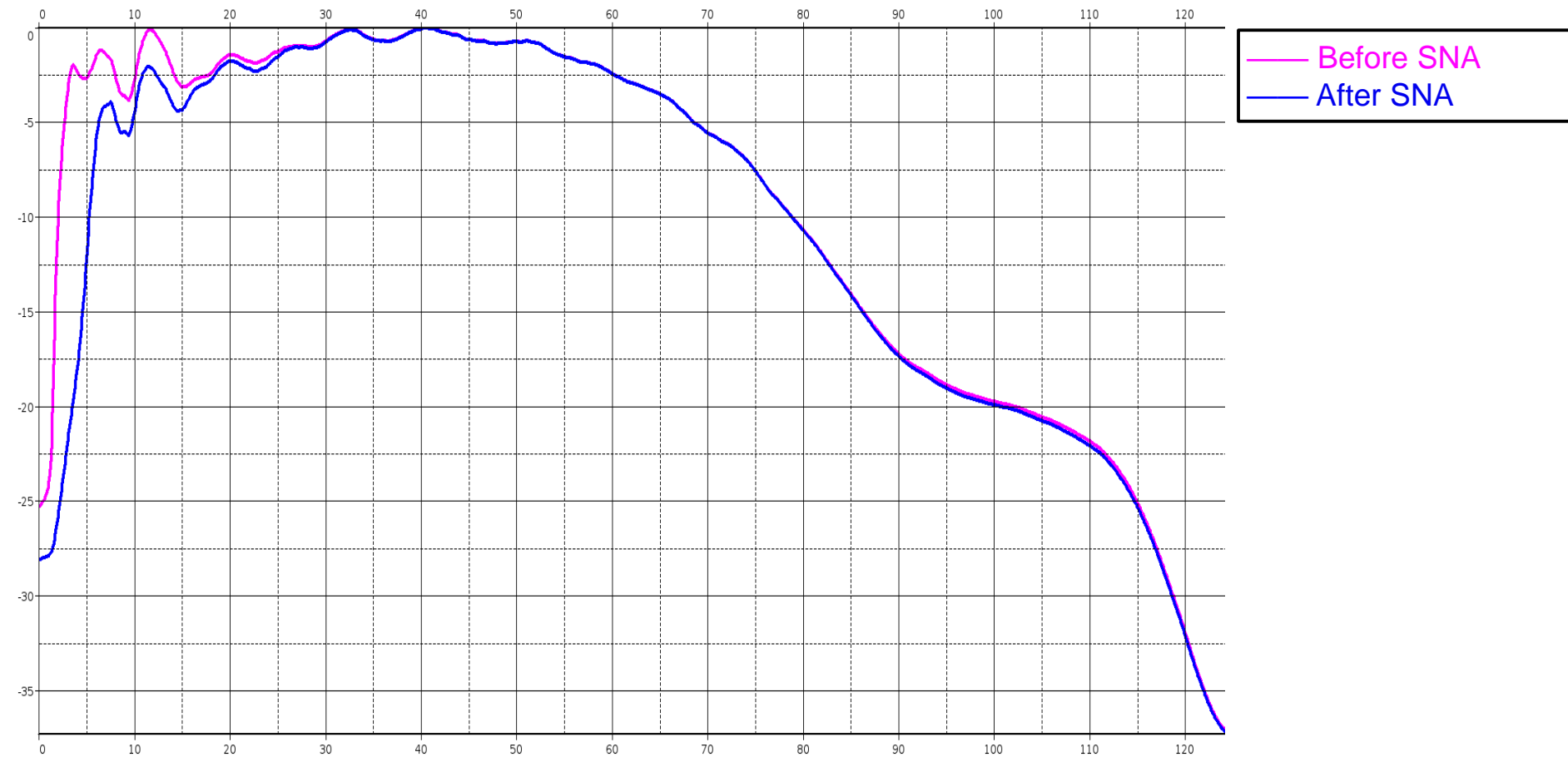


■ No primary damage is observed on removed noise.



Seq 039: Full Window Amplitude Spectrum of 2D Stack

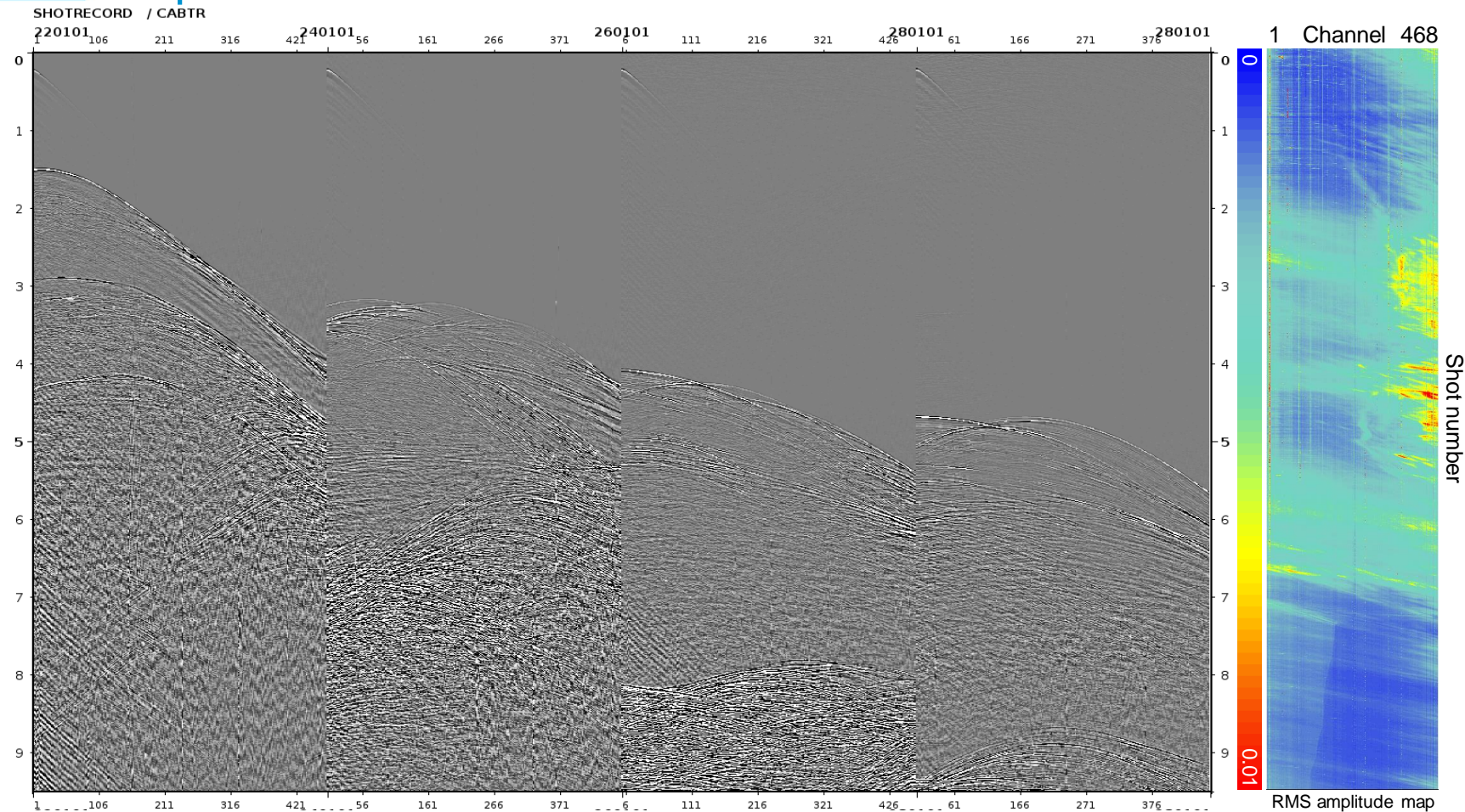
13





Seq 039: Selected Shot Gathers before SNA

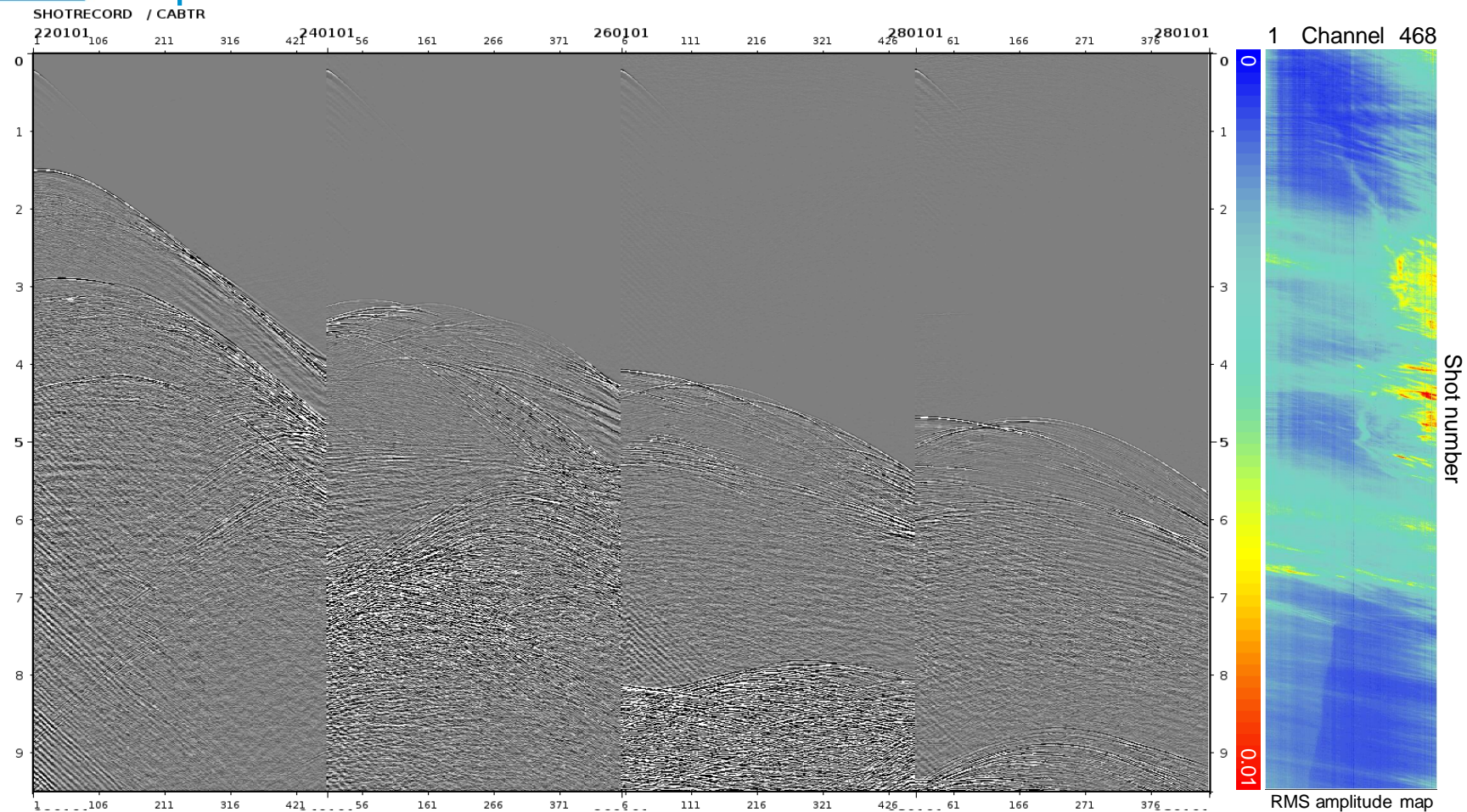
14





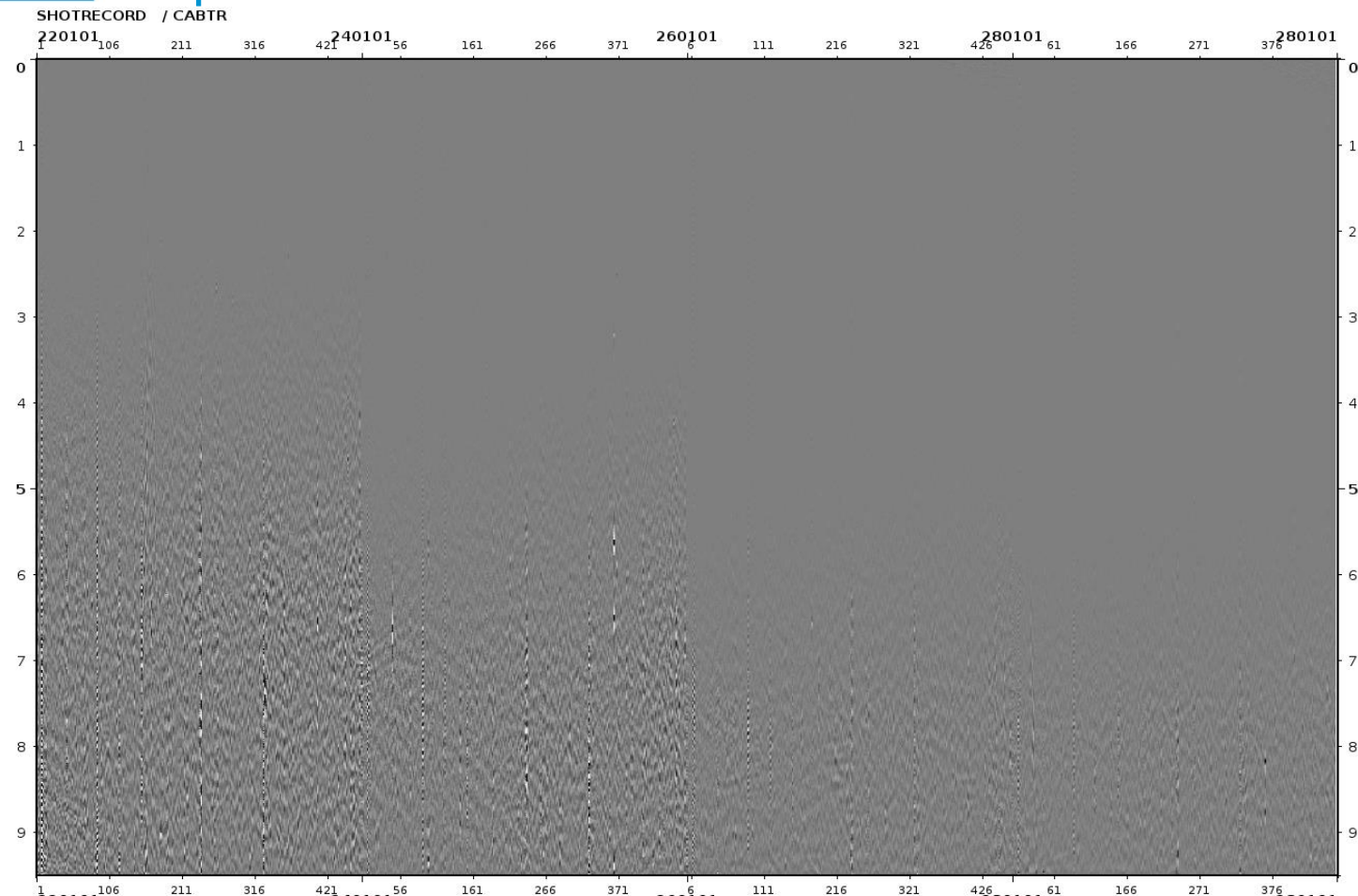
Seq 039: Selected Shot Gathers after SNA

15



Seq 039: Difference Before - After

16



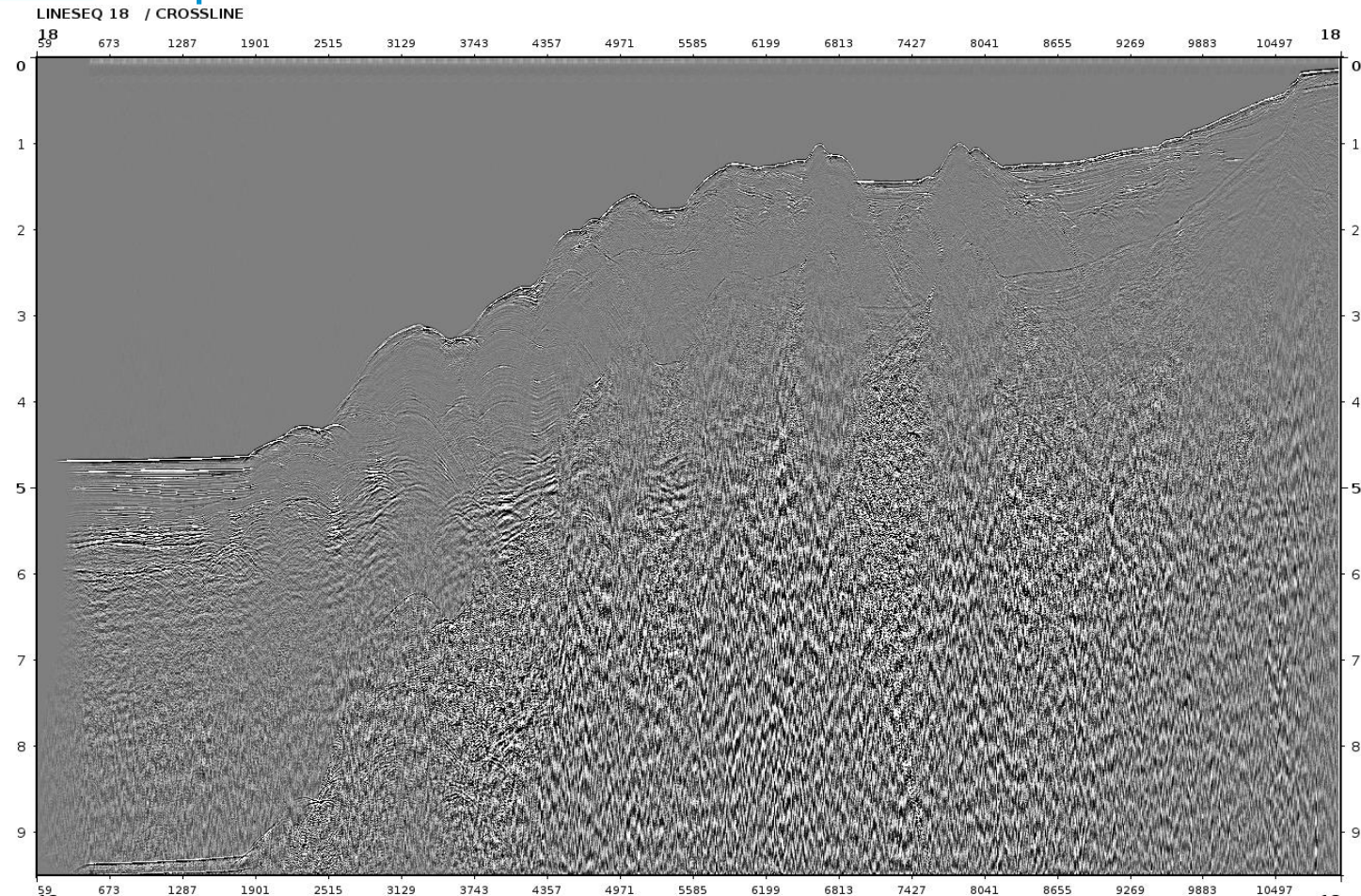
- No primary damage is observed on removed noise.

Seq 018



Seq 018: 2D Stack before SNA

18

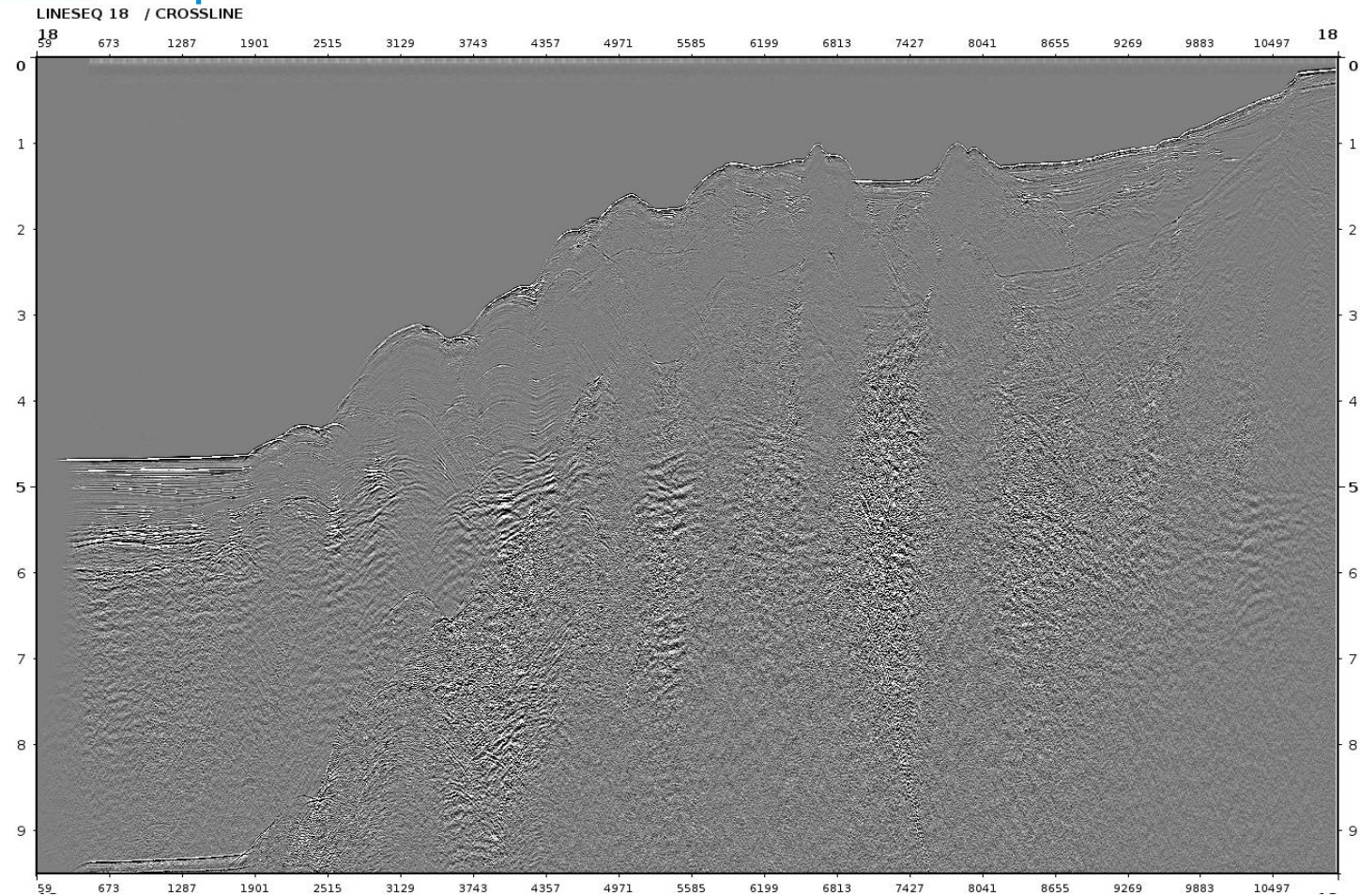


- Heavy swell noise and high amplitude spikes on this line.



Seq 018: 2D Stack after SNA

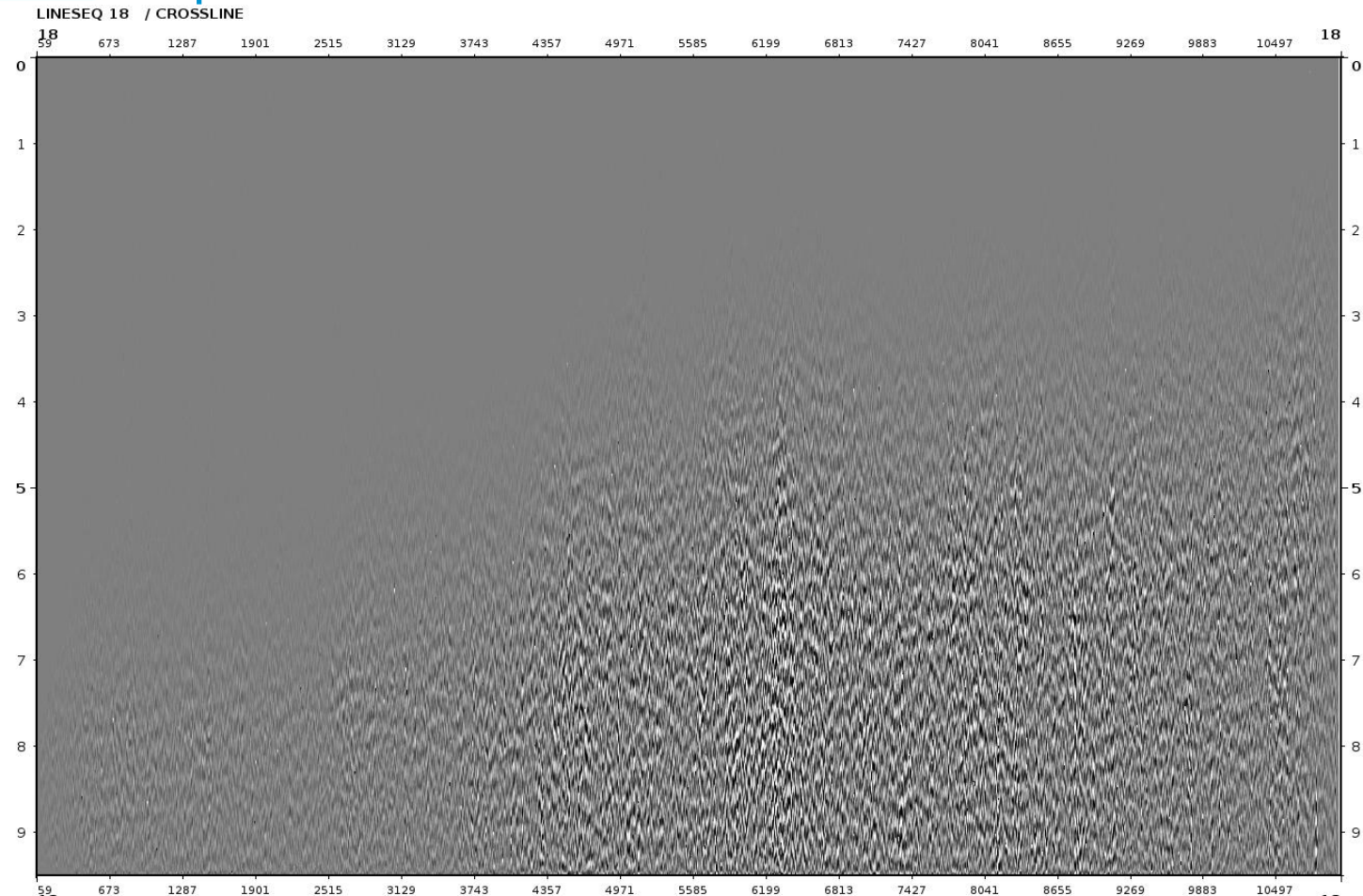
19



- Heavy swell noise and high amplitude spikes on this line.

Seq 018: Difference Before - After

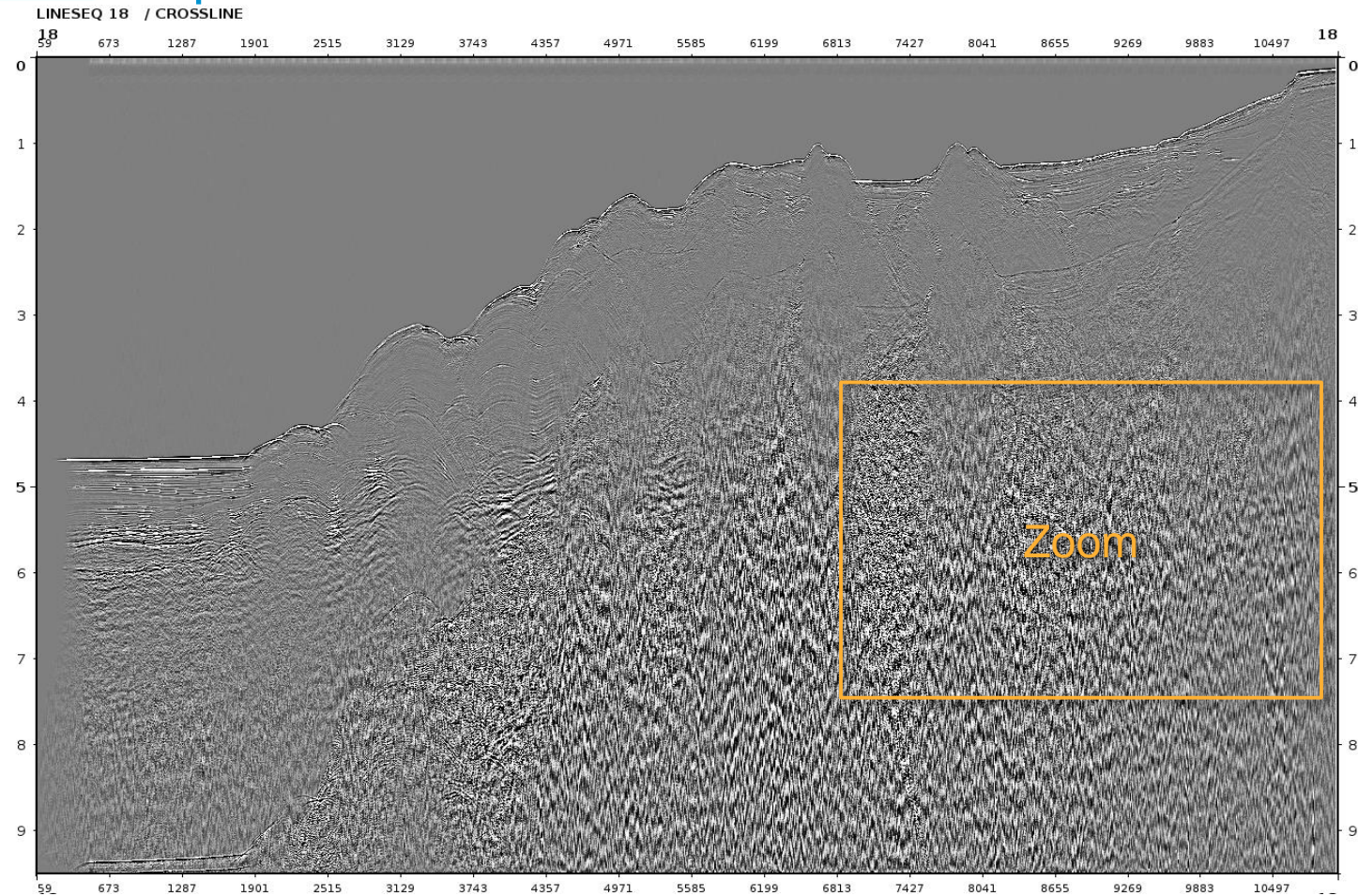
20



- No primary damage is observed on removed noise.

Seq 018: 2D Stack Zoomed In Location

21

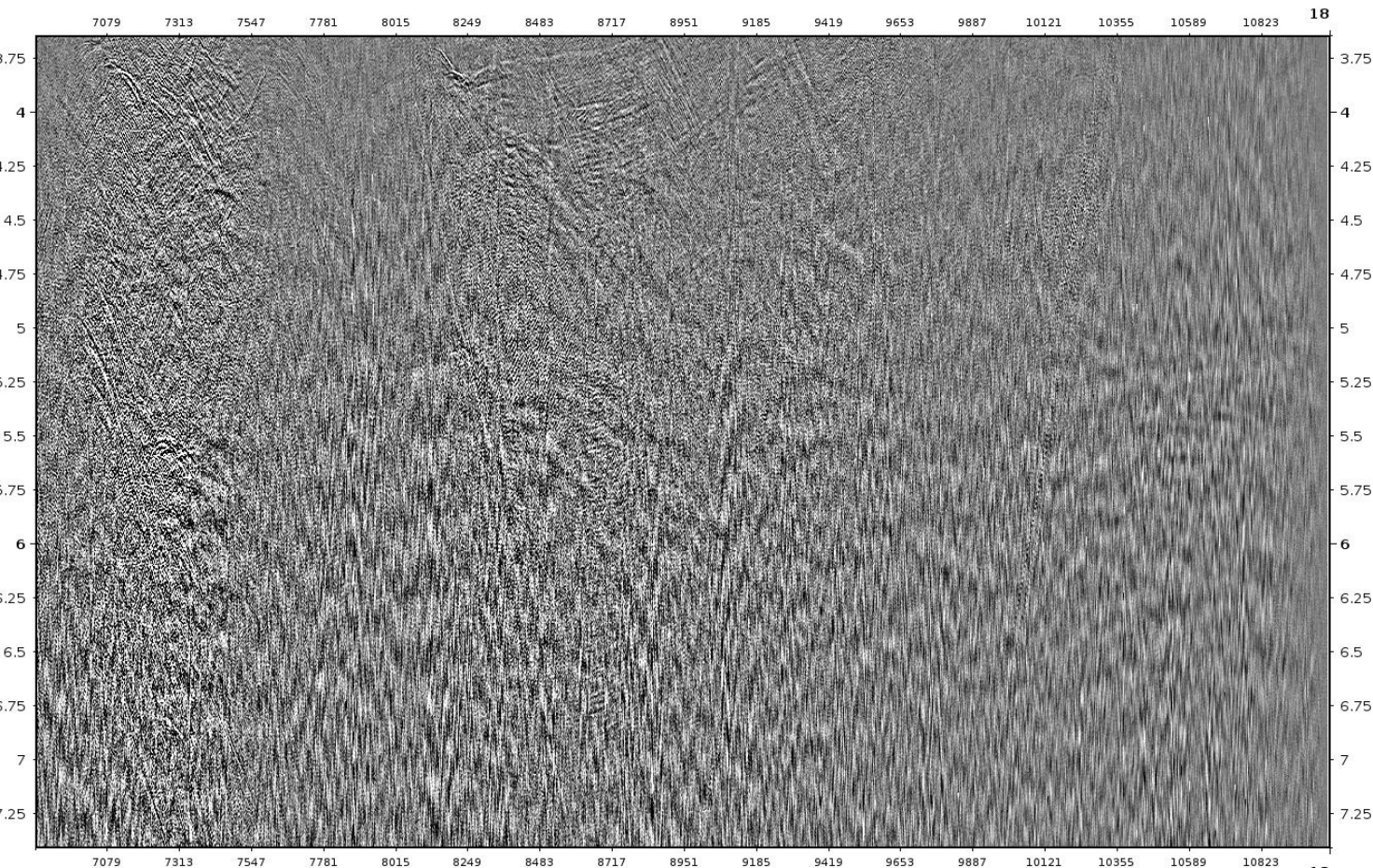




Seq 018: Zoomed 2D Stack before SNA

22

LINESEQ 18 / CROSSLINE

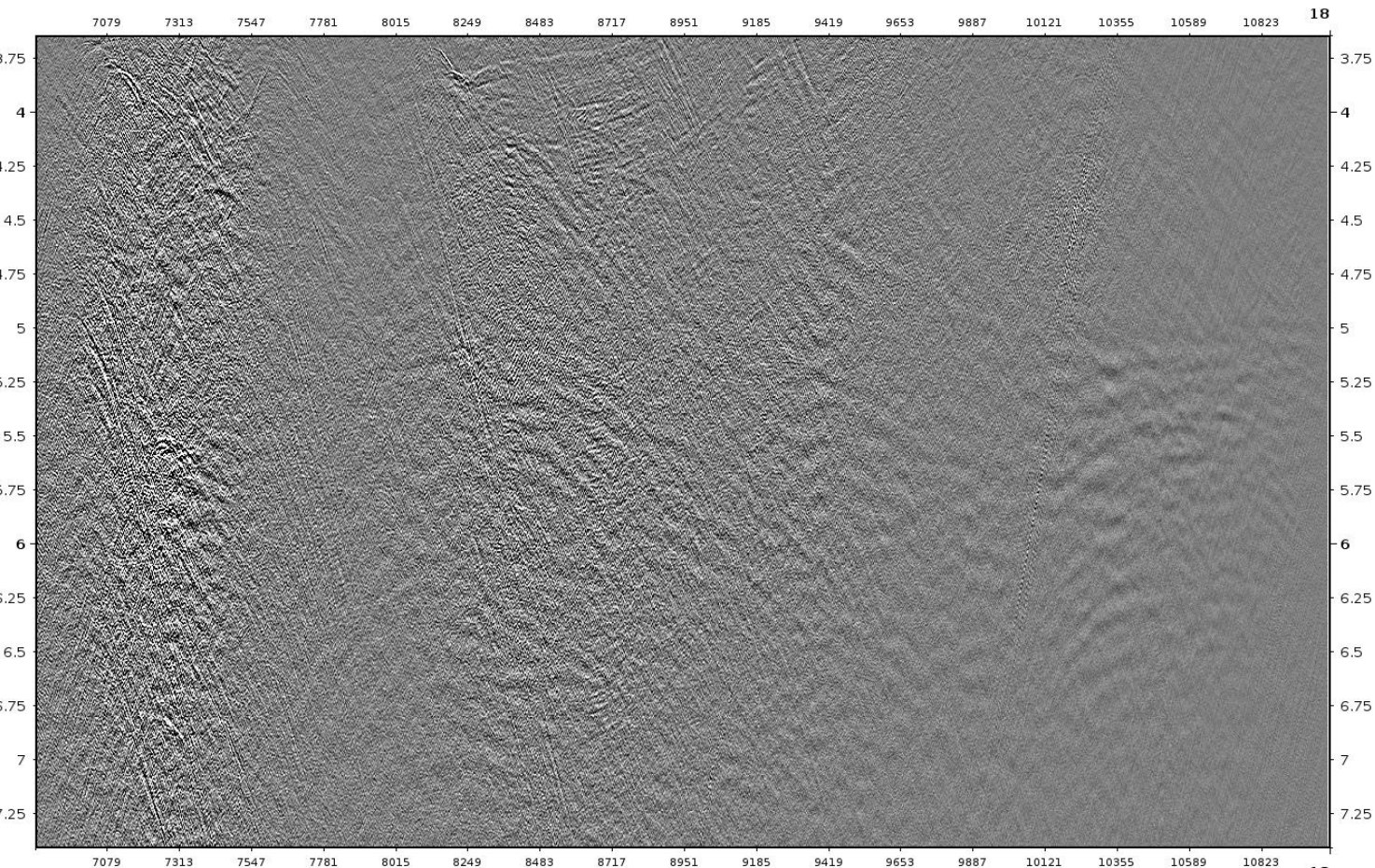


- Primaries are masked by swell noise and high amplitude spikes.

Seq 018: Zoomed 2D Stack after SNA

23

LINESEQ 18 / CROSSLINE

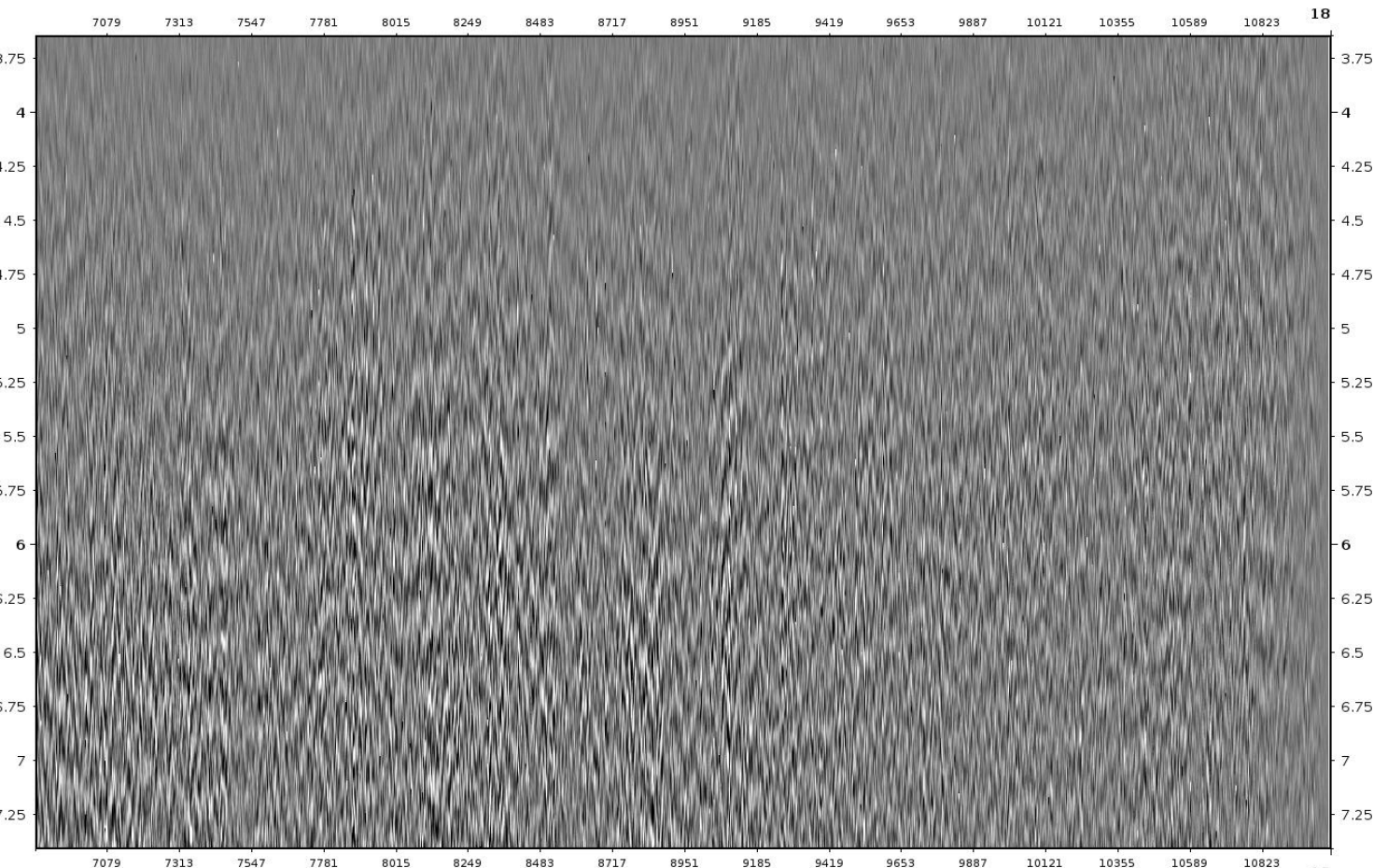


- Removing swell noise and high amplitude spikes reveals primaries underneath, with linear noise.

Seq 018: Difference Before - After

24

LINESEQ 18 / CROSSLINE

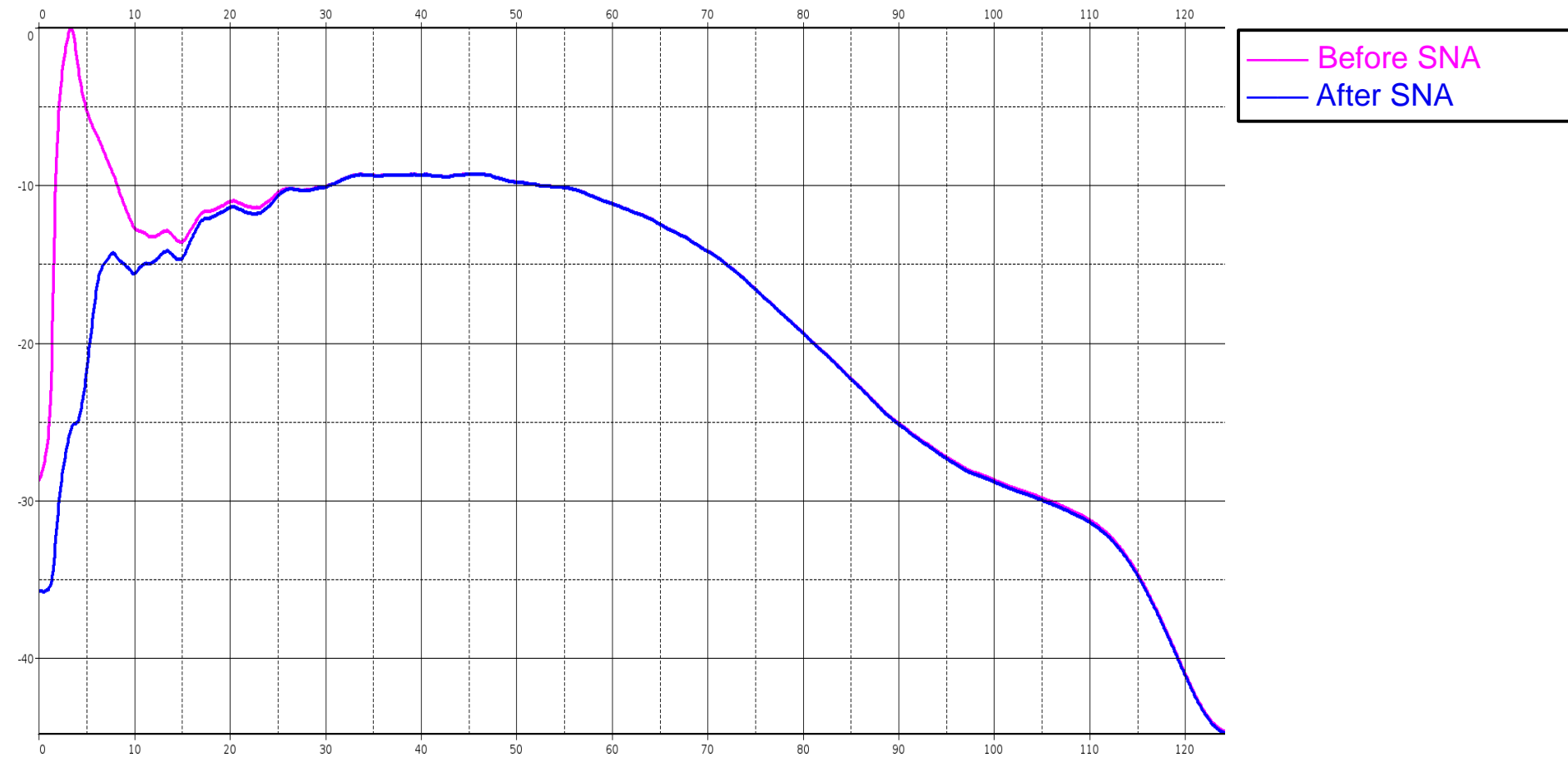


■ No primary damage is observed on removed noise.



Seq 018: Full Window Amplitude Spectrum of 2D Stack

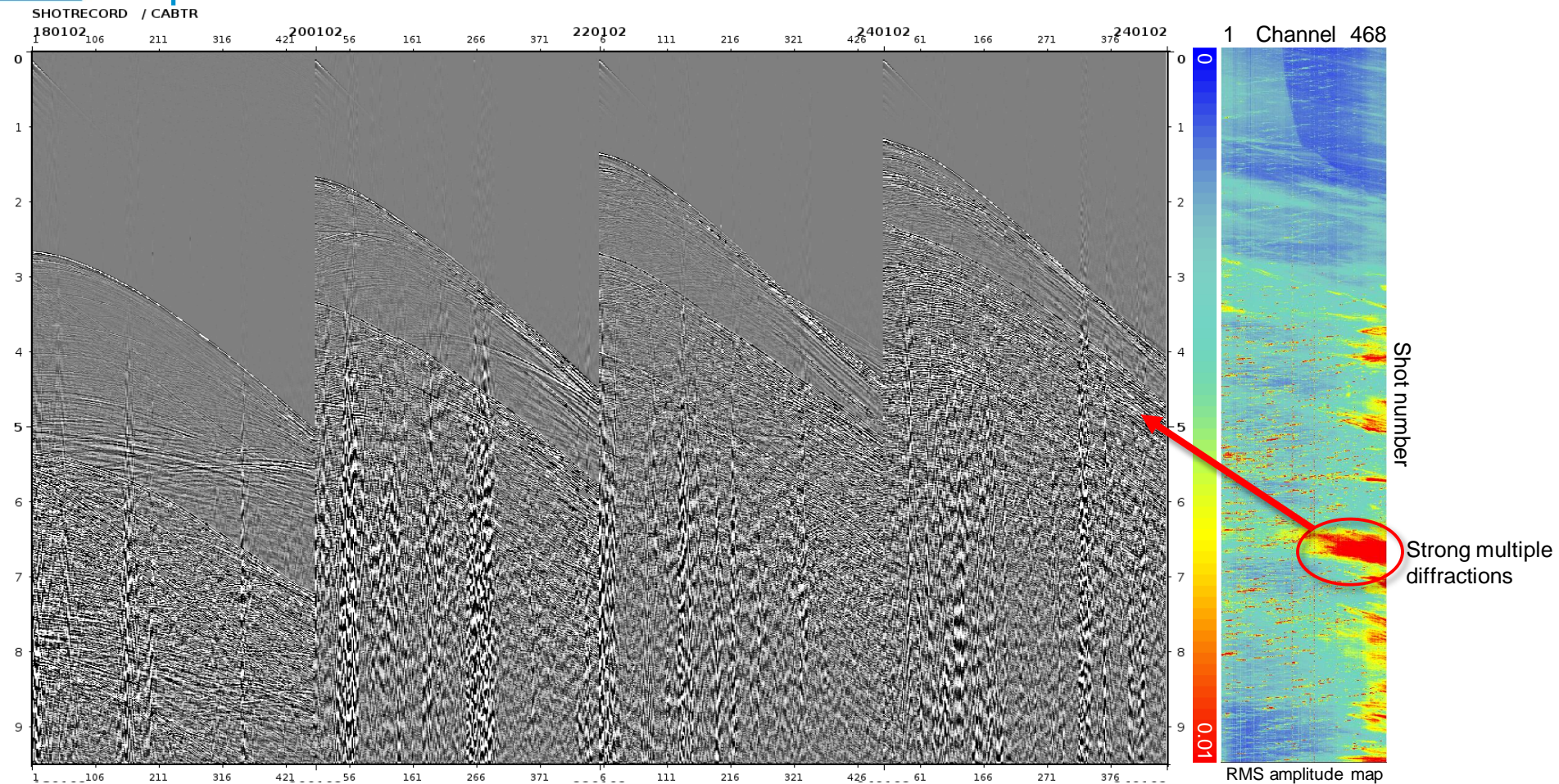
25





Seq 018: Selected Shot Gathers before SNA

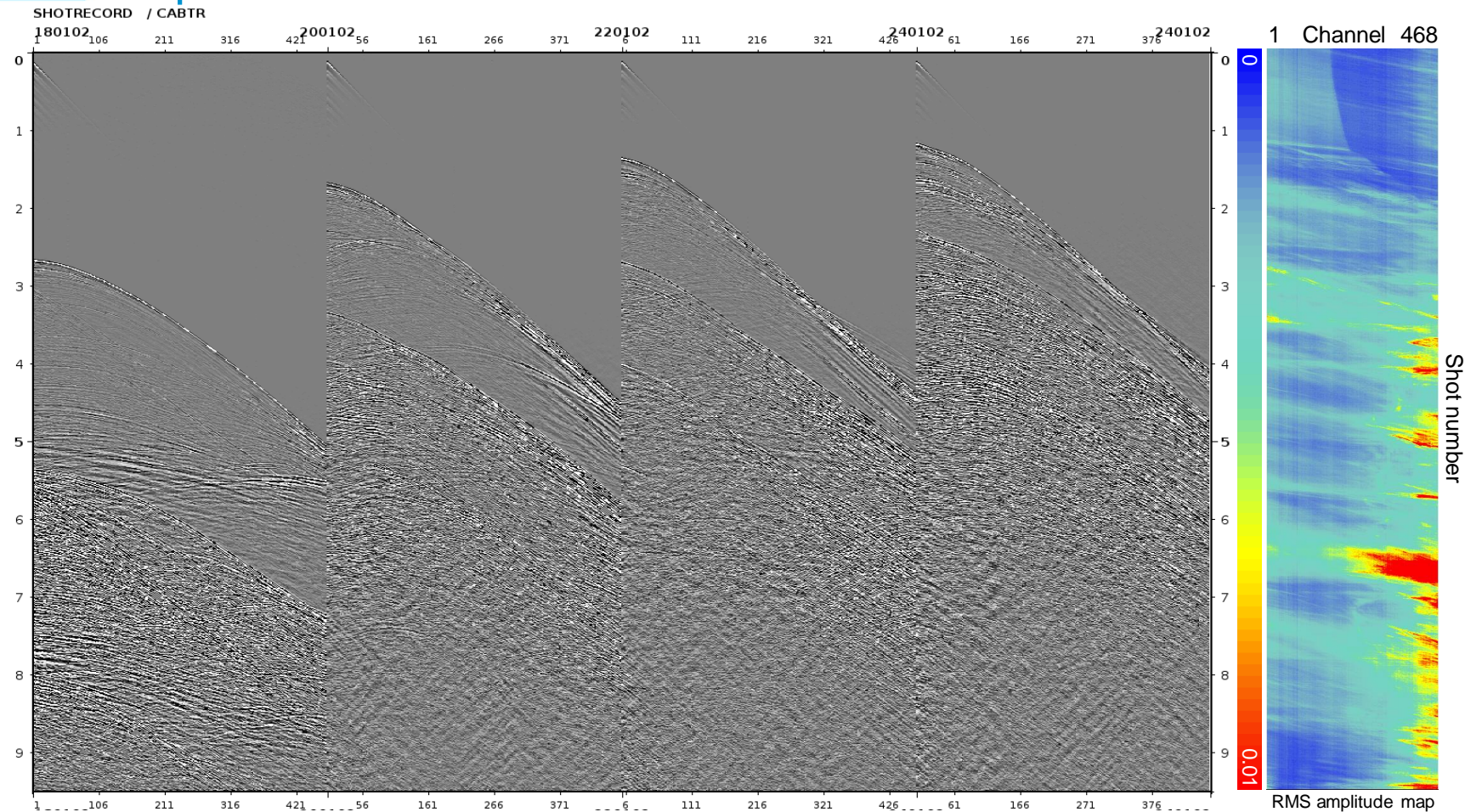
26





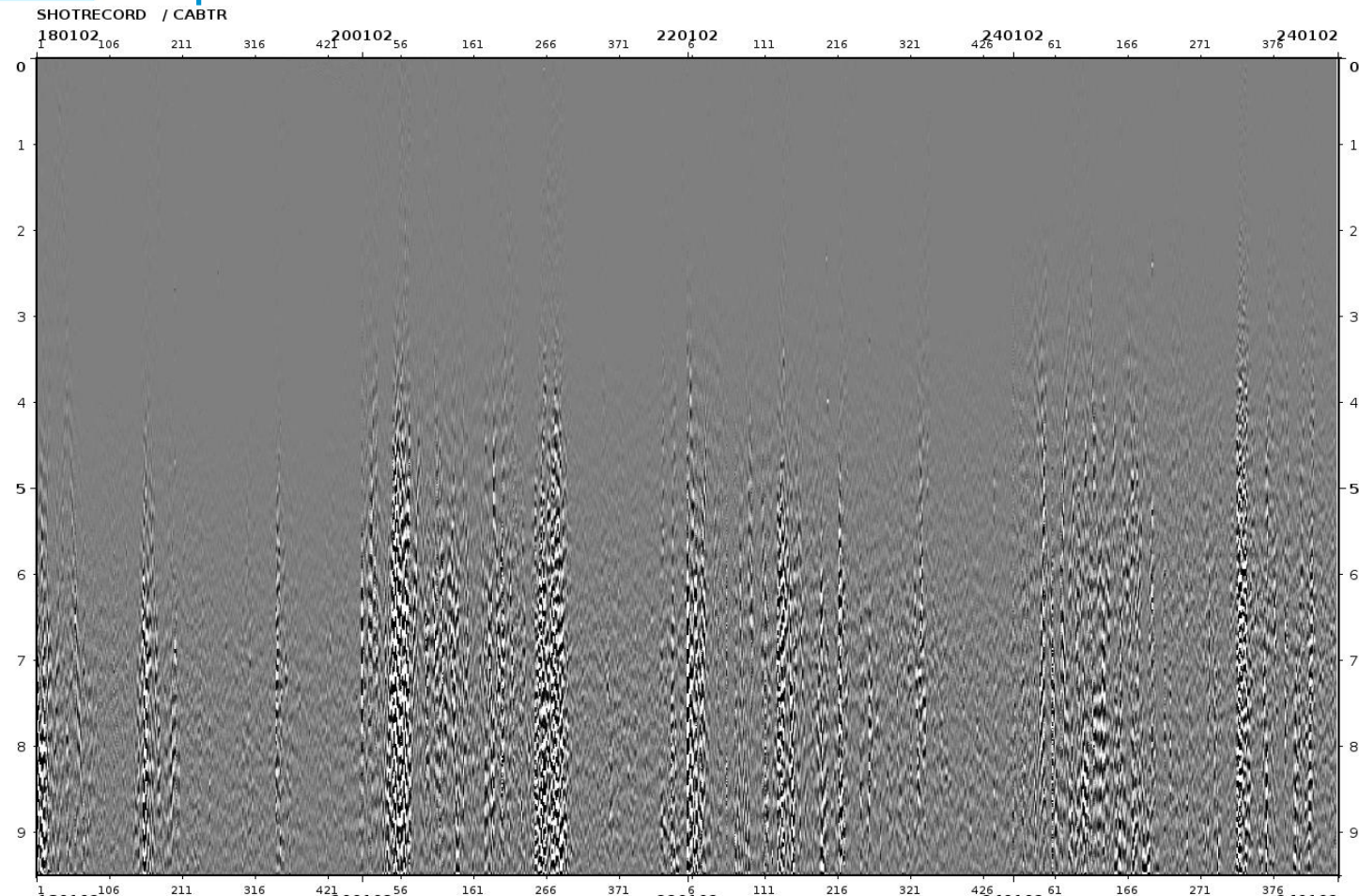
Seq 018: Selected Shot Gathers after SNA

27



Seq 018: Difference Before - After

28



- No primary damage is observed on removed noise.