



# TVS & Resampling Test

## NZ 3D Processing

08 September 2020

[cgg.com](http://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

- **Objective:**

To balance the amplitude and resample to 4ms for later processing.

- **Procedure:**

A time variant scaler is applied reference to Water Bottom two-way Time (WBT):

Time (sec)	WBT	WBT+0.4	WBT+1	WBT+2	WBT+3	WBT+5
Scaler (dB)	0	-5	5	15	25	35

After TVS, we resample the data to 4ms with the anti-aliasing filter (115Hz, 160 dB/octave). And resample back to 2ms for comparison.

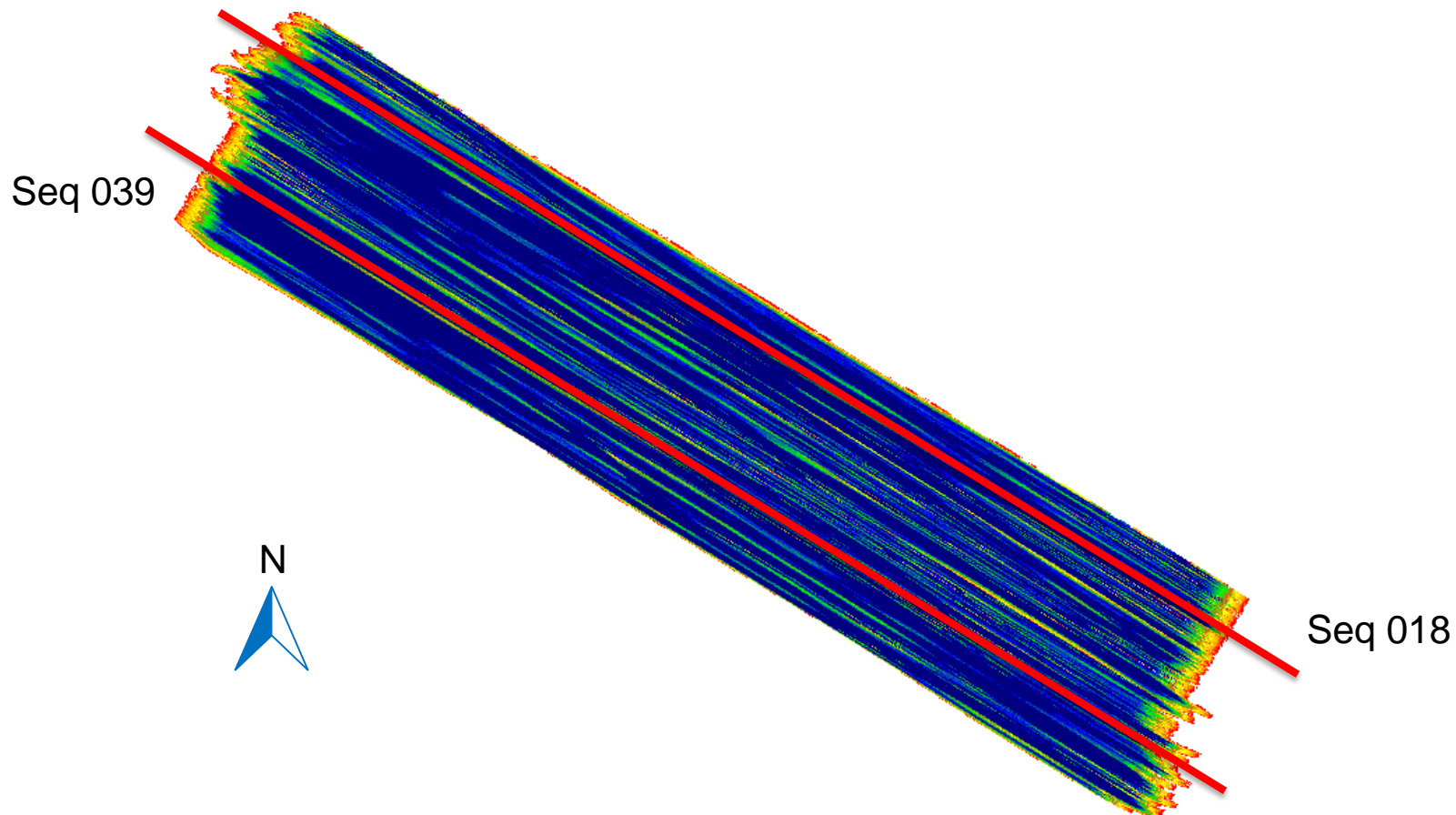
- **Display:**

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

Display: Selected shot gathers and stacks.

- **Observation and Recommendation:**

TVS reasonably balances the amplitude of primary events that helps following processing steps and QC. Resample to 4ms will save processing time with minor loss of high frequency, away from main deep targets. Both processes are recommended for production



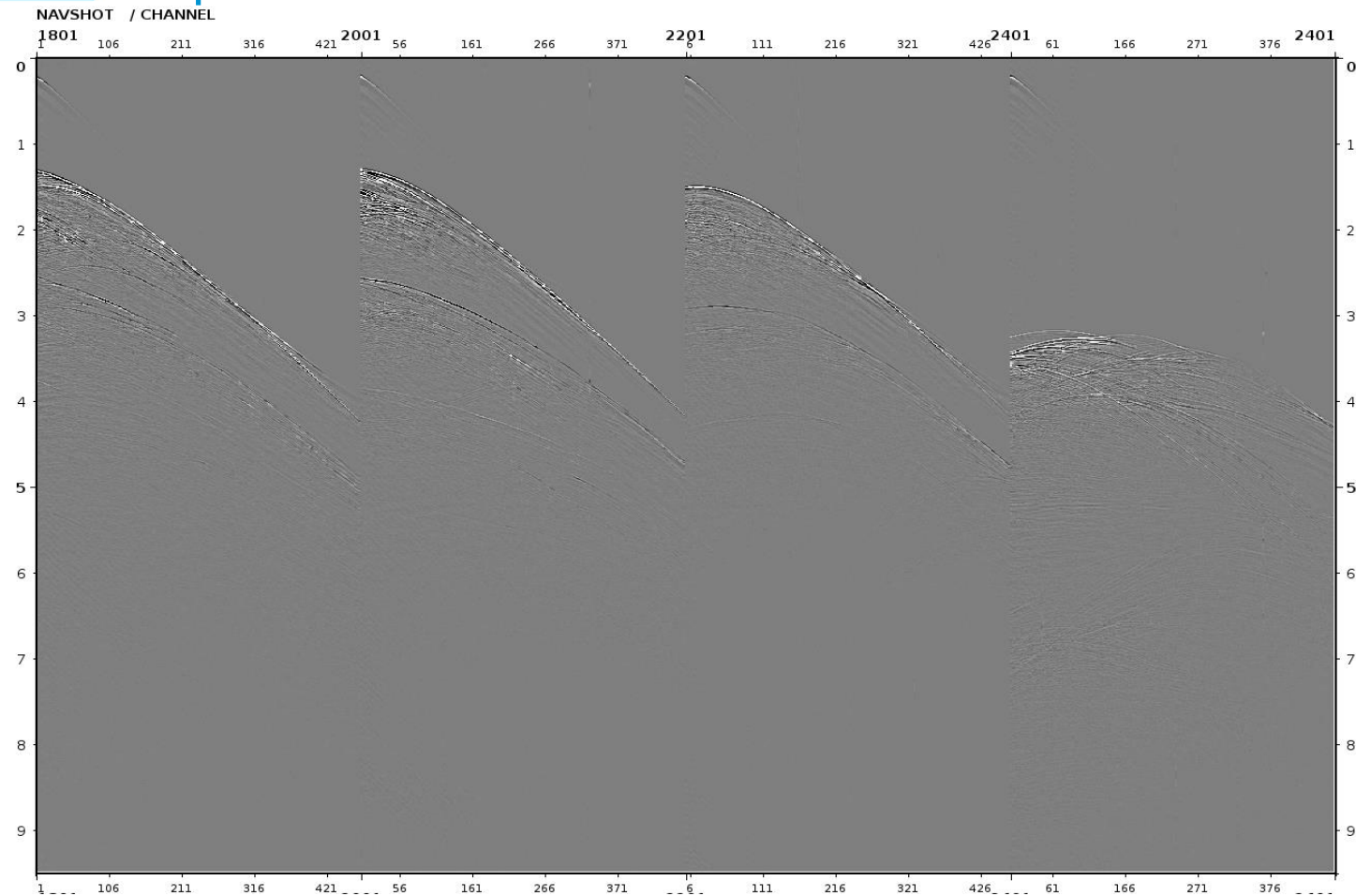


# Time Variant Scaling (TVS)



# Seq 039: Selected Shot Gathers before TVS

6

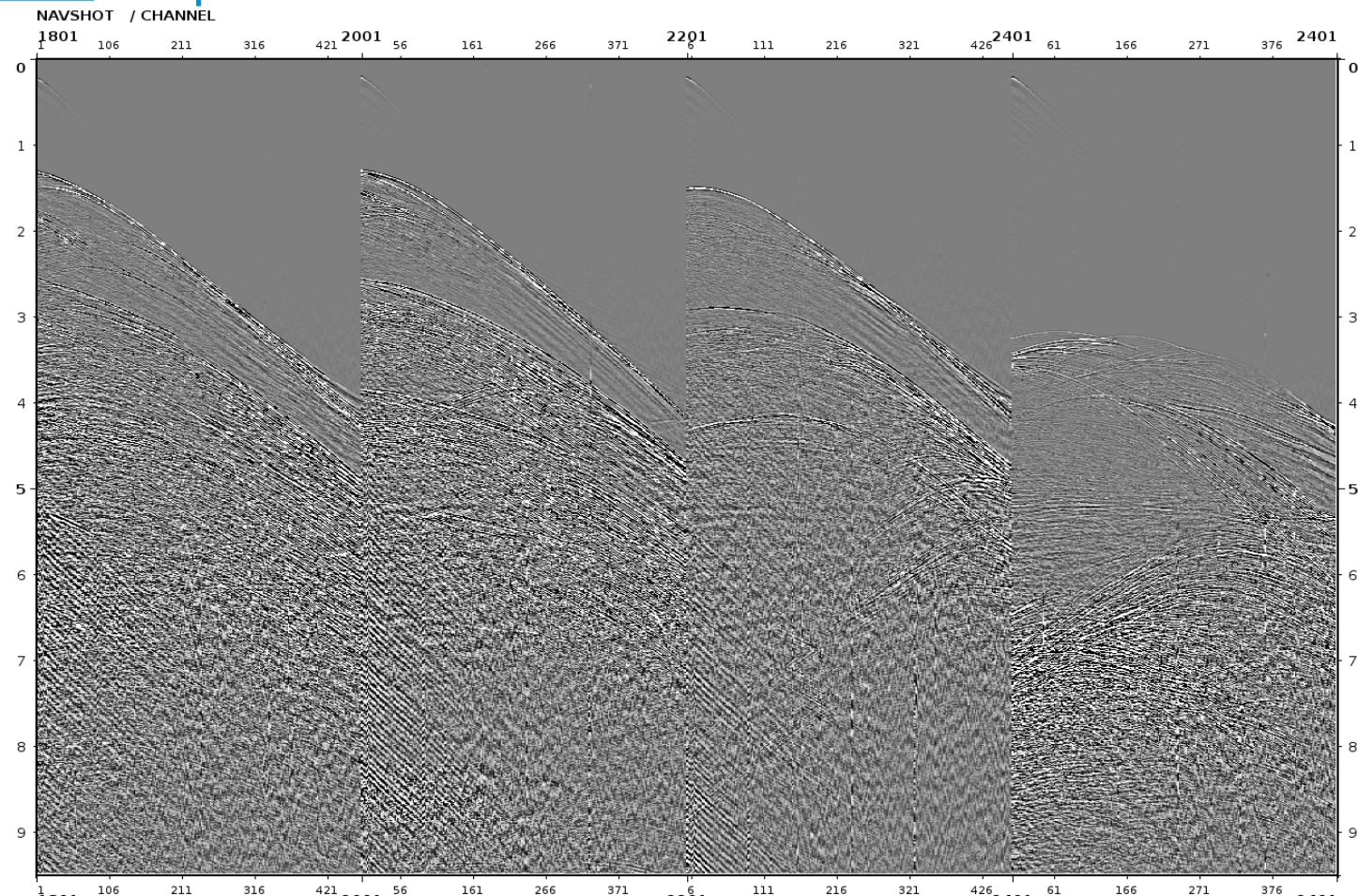


- Deep events are too weak for QC.



# Seq 039: Selected Shot Gathers after TVS

7

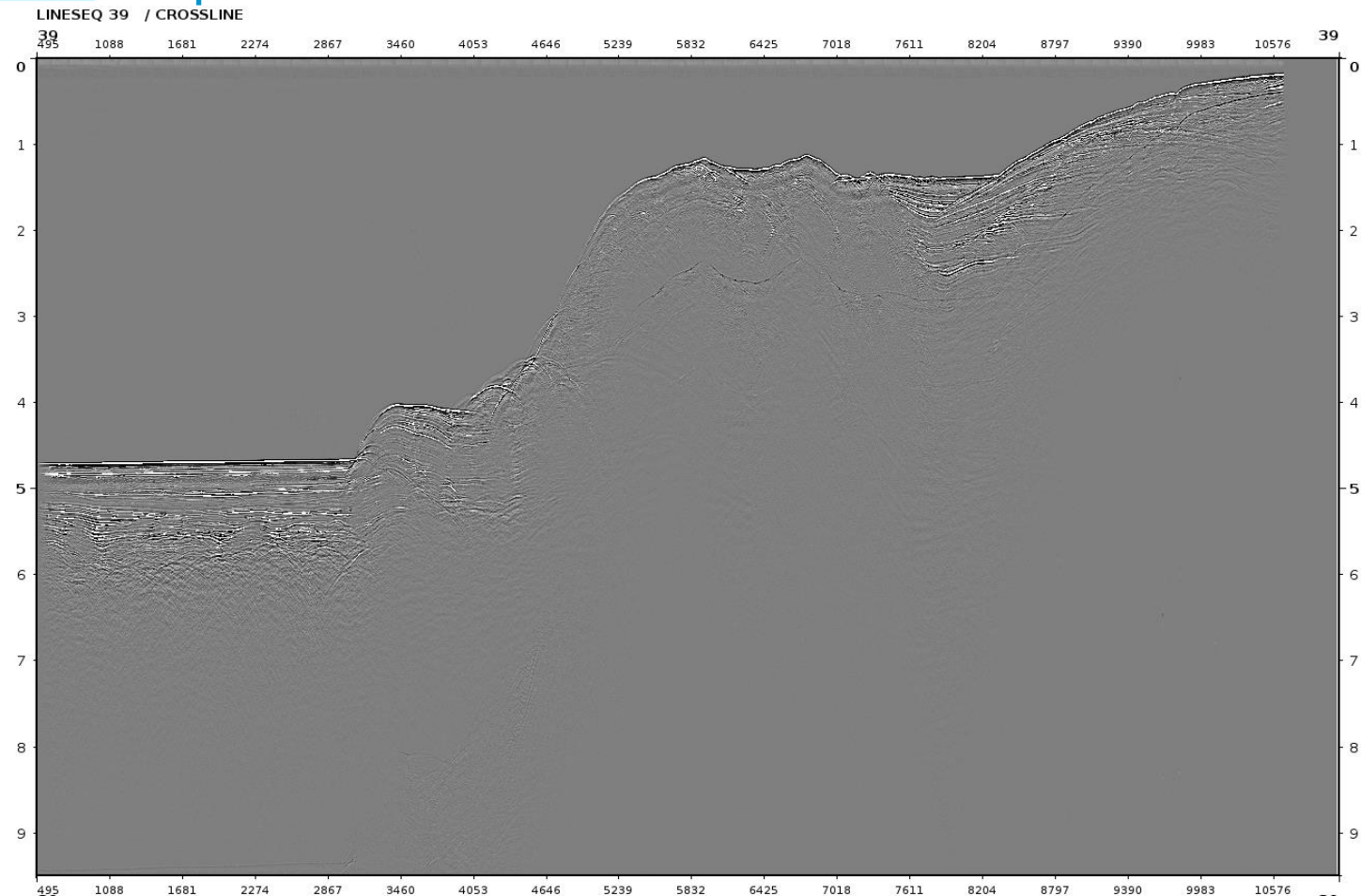


- Amplitudes are well balanced for primaries. High amplitude noises will be remove later.



# Seq 039: 2D Stack before TVS

8



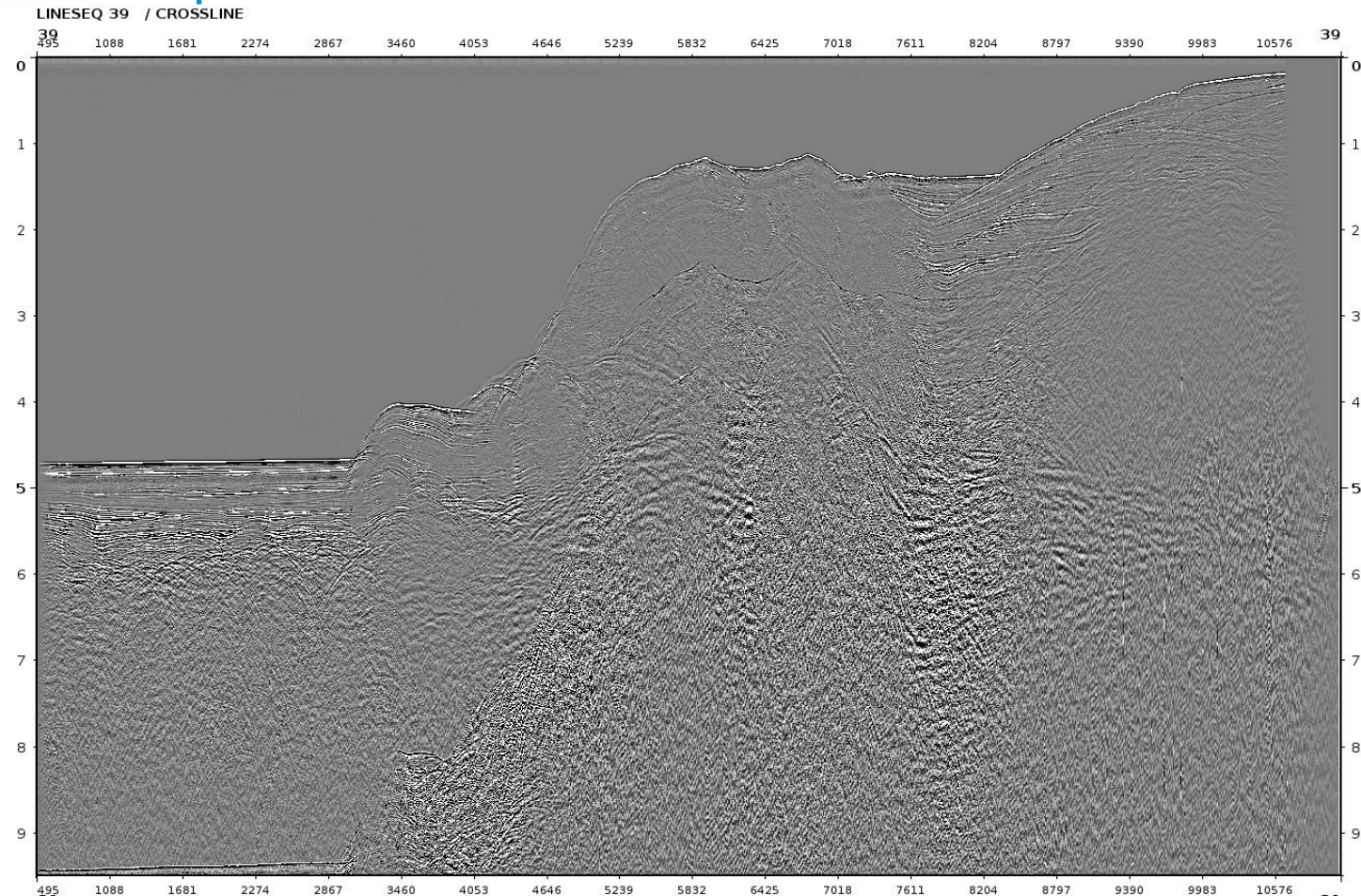
- Deep events are too weak for QC.





# Seq 039: 2D Stack after TVS

9

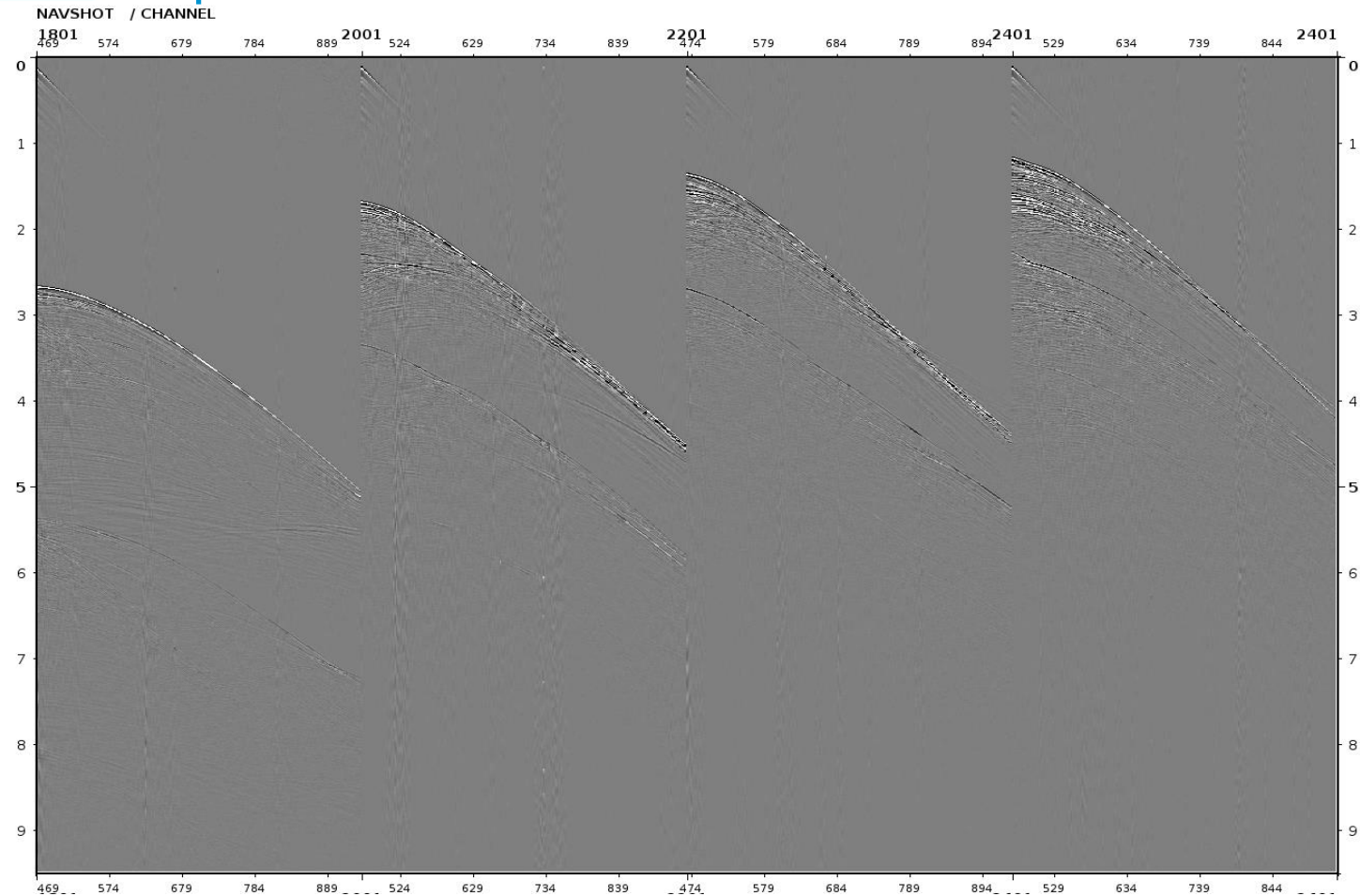


- Amplitudes are well balanced for primaries. High amplitude noises will be remove later.



# Seq 018: Selected Shot Gathers before TVS

10



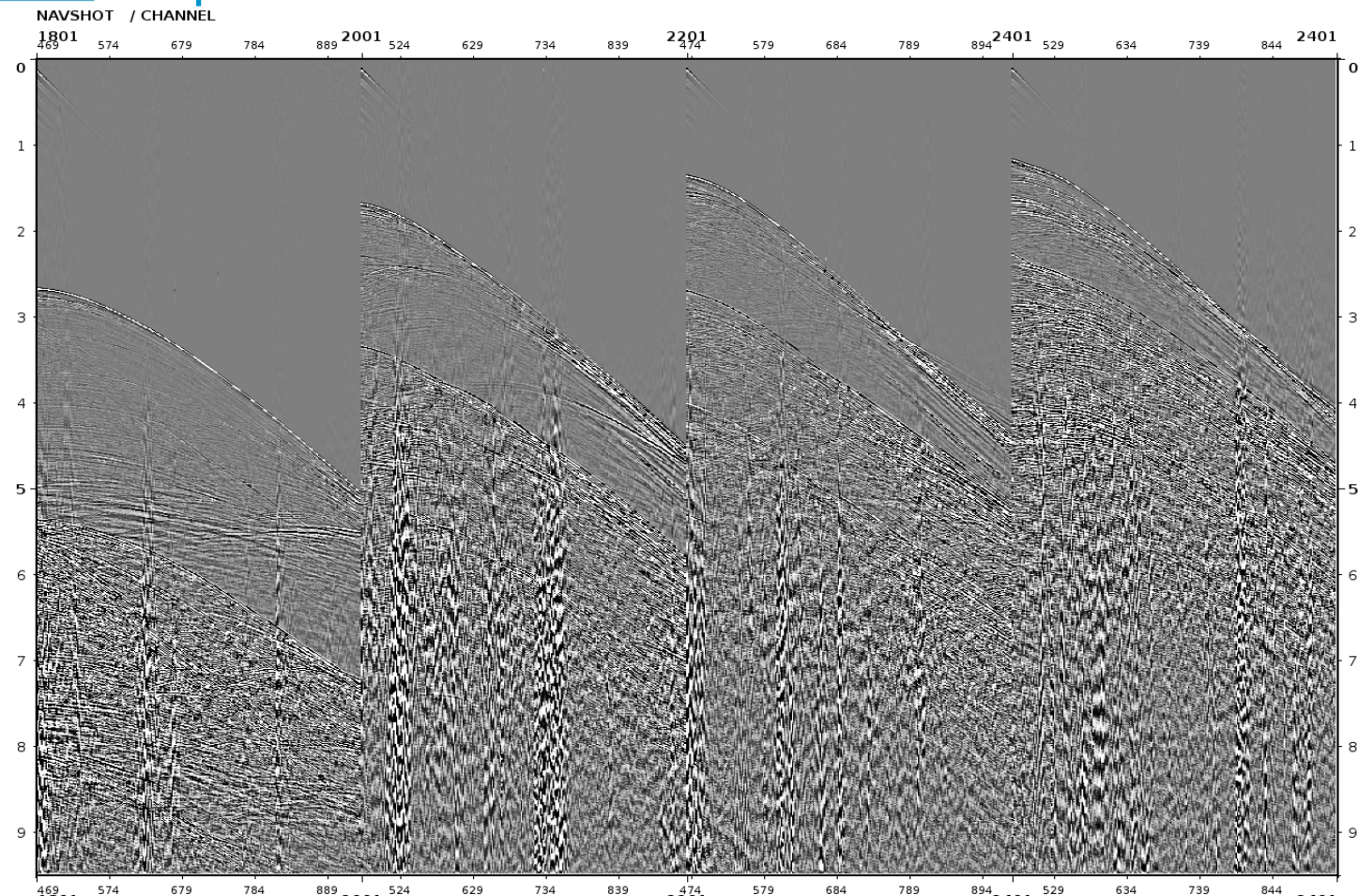
- Deep events are too weak for QC.





# Seq 018: Selected Shot Gathers after TVS

11



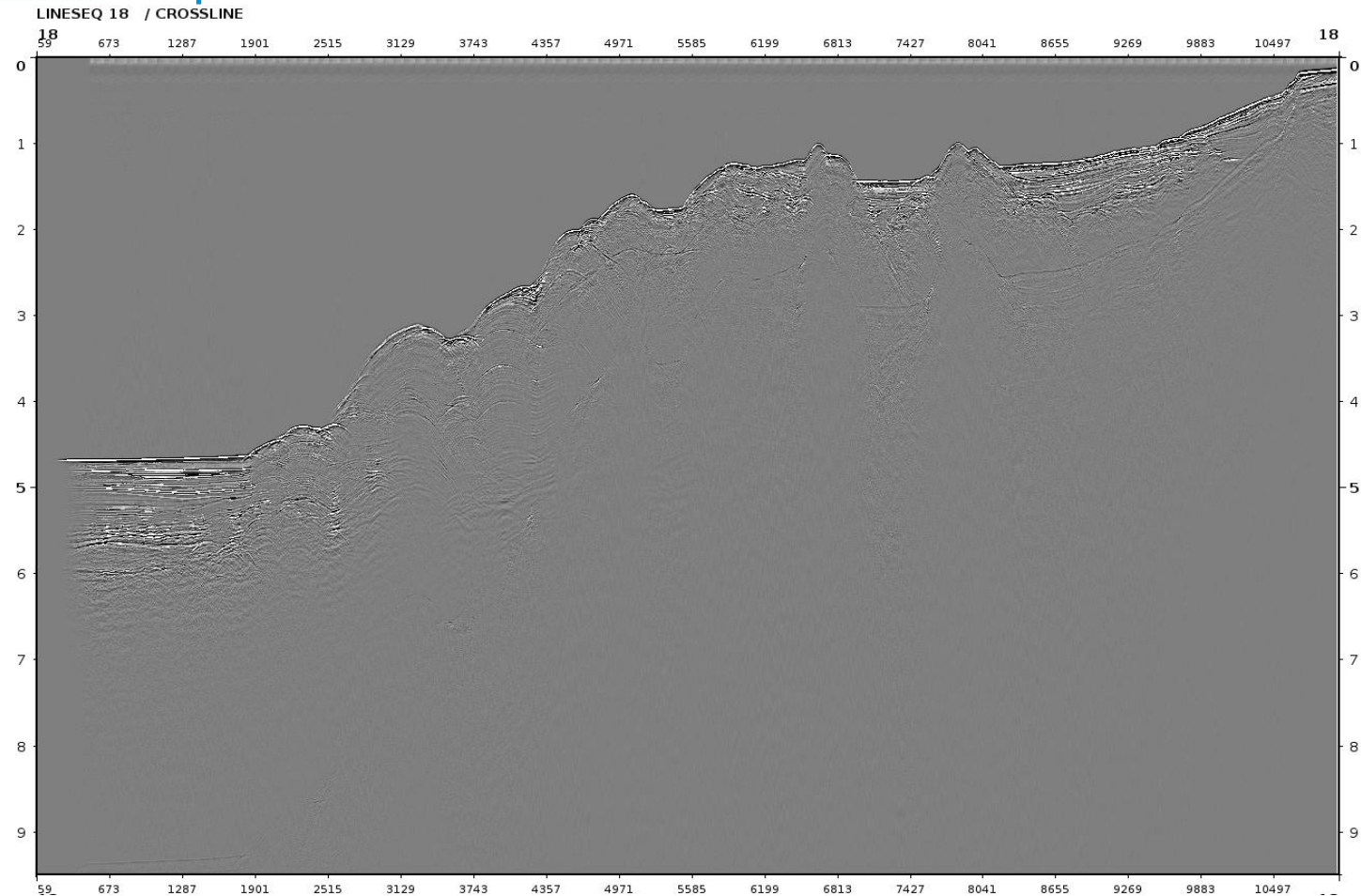
- Amplitudes are well balanced for primaries. High amplitude noises will be remove later.





# Seq 018: 2D Stack before TVS

12

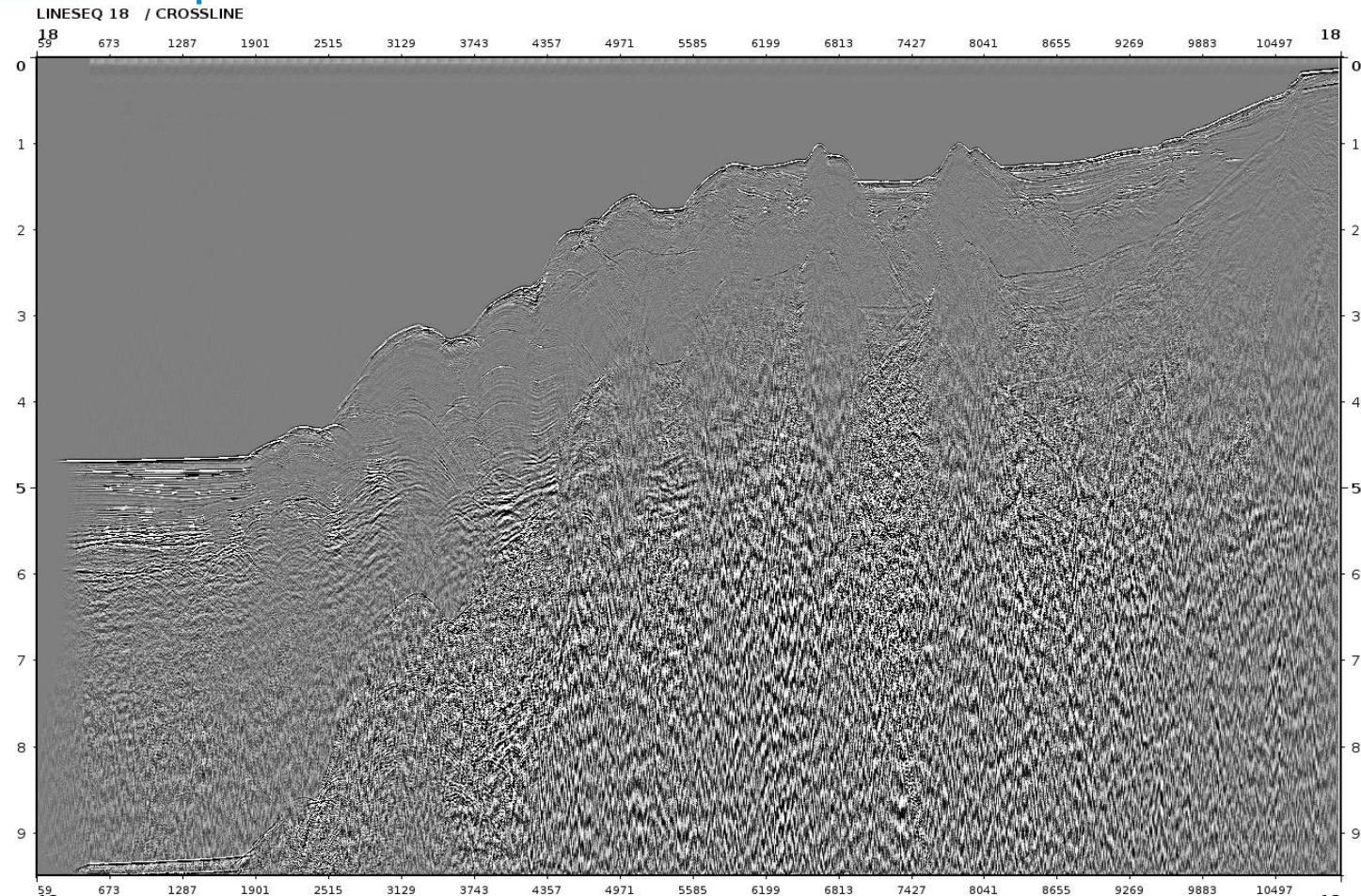


- Deep events are too weak for QC.



# Seq 018: 2D Stack after TVS

13



- Amplitudes are well balanced for primaries. High amplitude noises will be remove later.

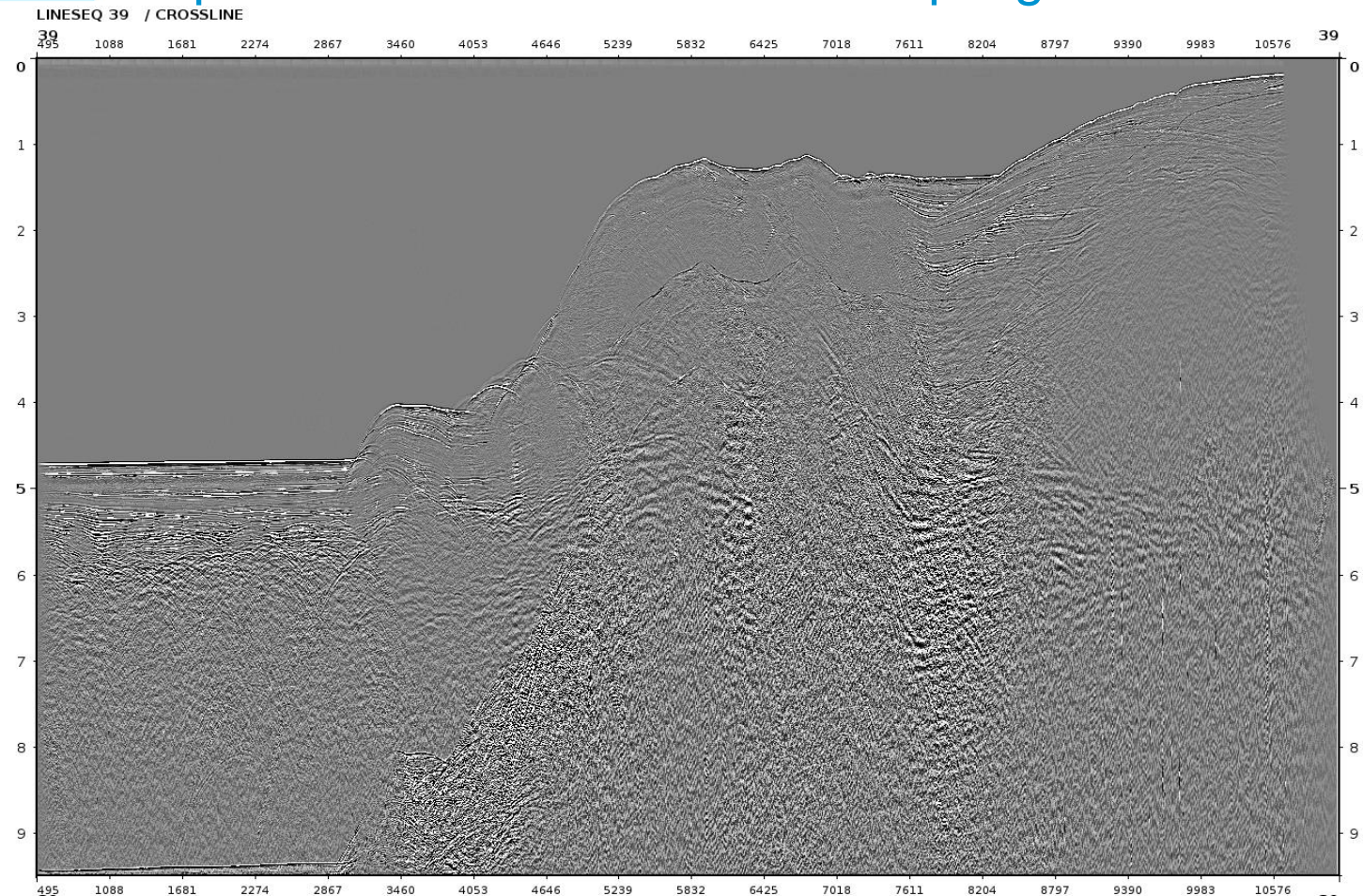
# Resample to 4ms

## Seq 039



# Seq 039: 2D Stack before Resampling

15



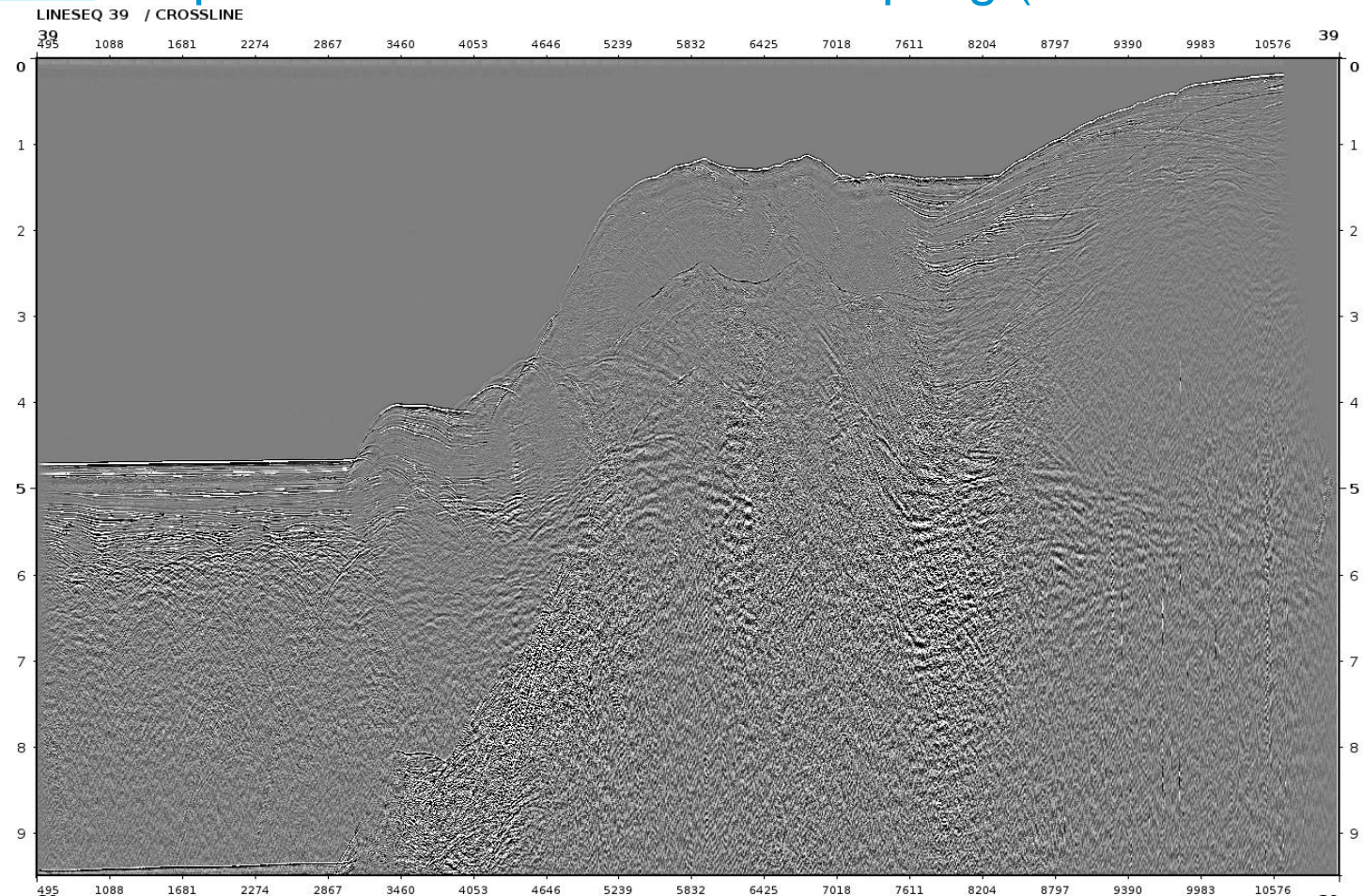
- TVS applied for display





# Seq 039: 2D Stack **after** Resampling (and back to 2ms)

16

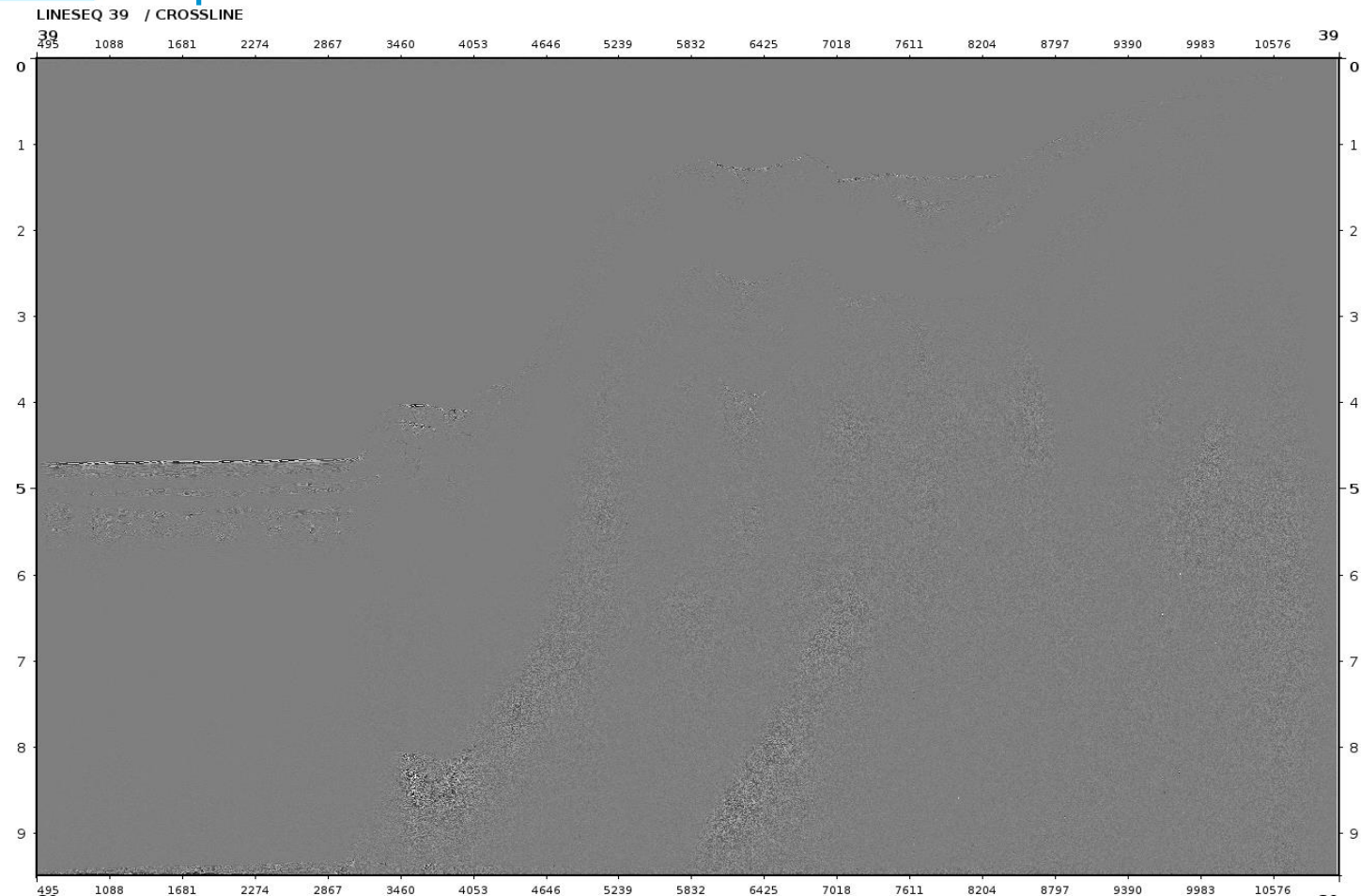


- TVS applied for display



# Seq 039: 2D Stack Difference Before - After

17

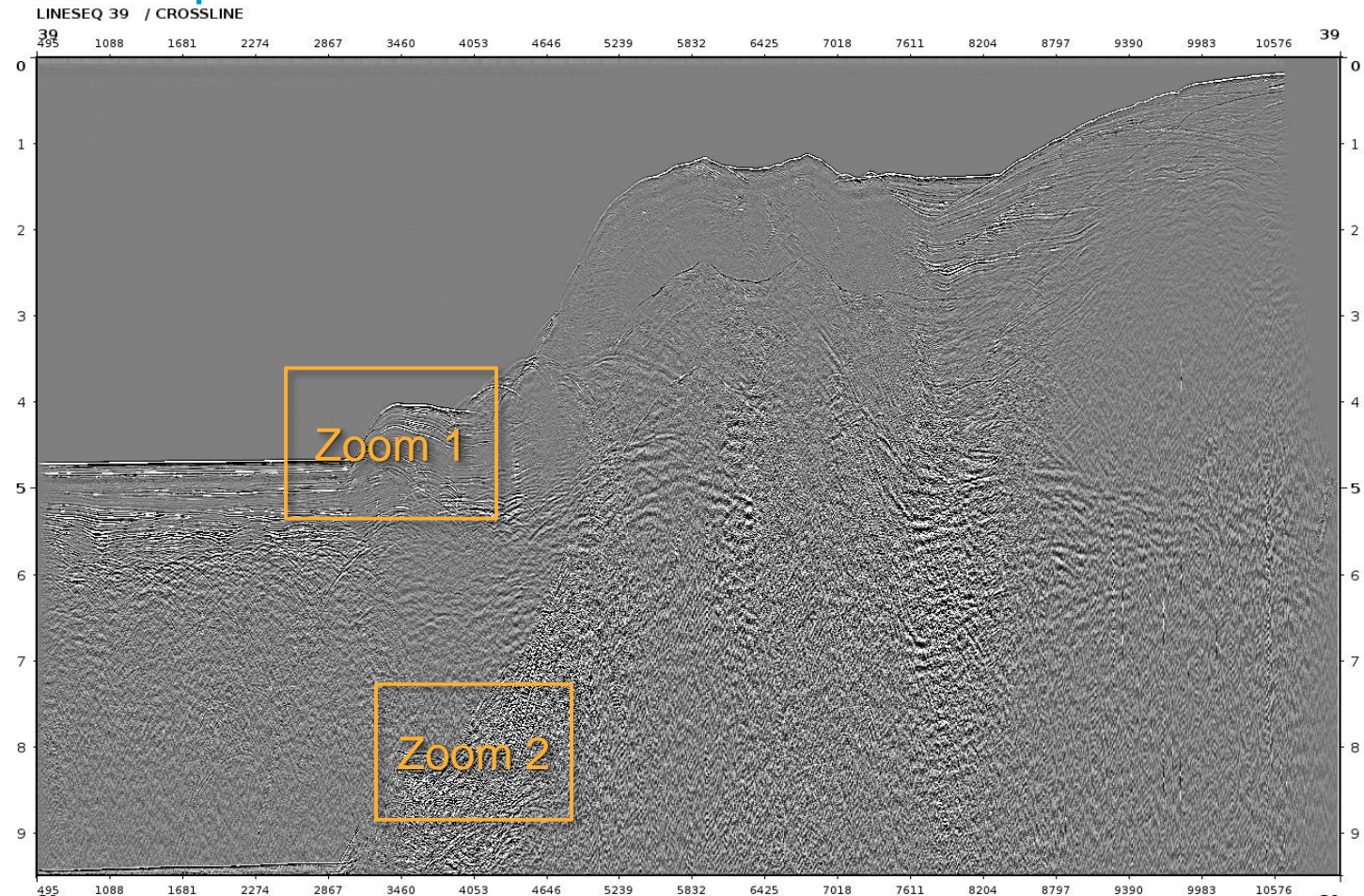


- TVS applied for display



# Seq 039: 2D Stack Zoomed In Location

18



- TVS applied for display

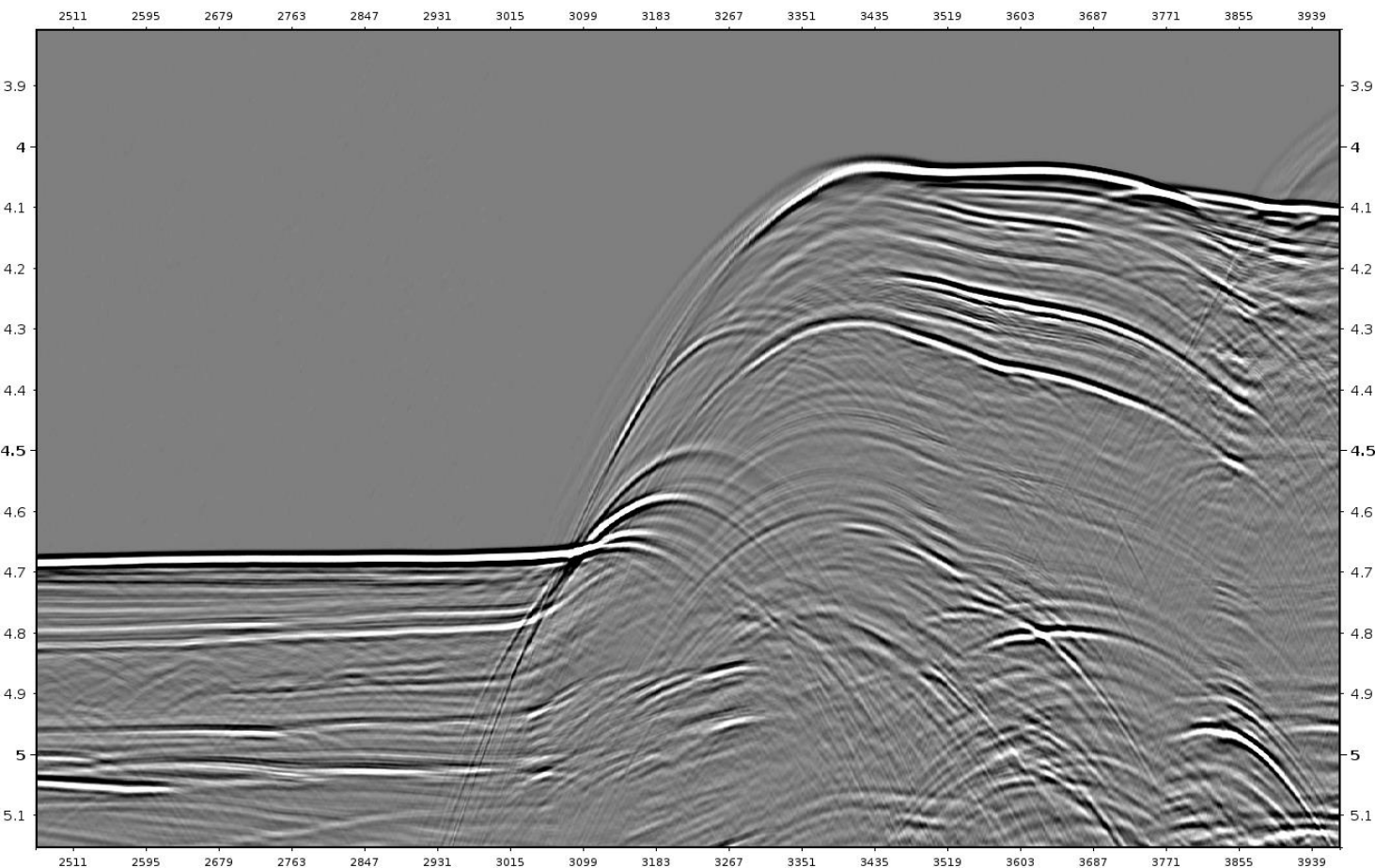




# Seq 039 Zoomed: 2D Stack before Resampling

19

LINESEQ 39 / CROSSLINE



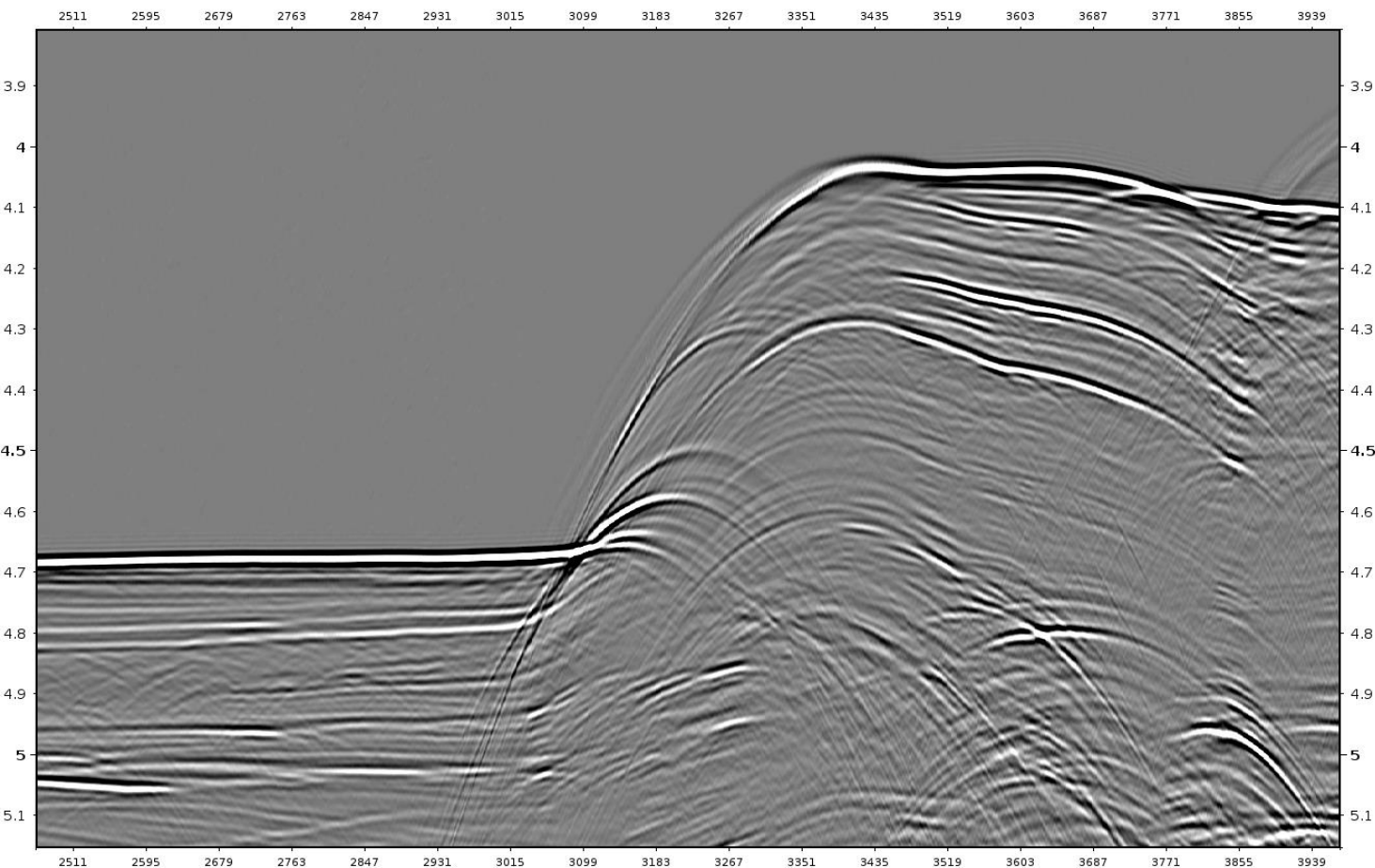
- Around water bottom.



# Seq 039 Zoomed: 2D Stack **after** Resampling (and back to 2ms)

20

LINESEQ 39 / CROSSLINE



- Resampling removes some extreme high frequency which has minor effect on overall structure.



# Seq 039 Zoomed: 2D Stack Difference Before - After

21

LINESEQ 39 / CROSSLINE



- Removed high frequency component.

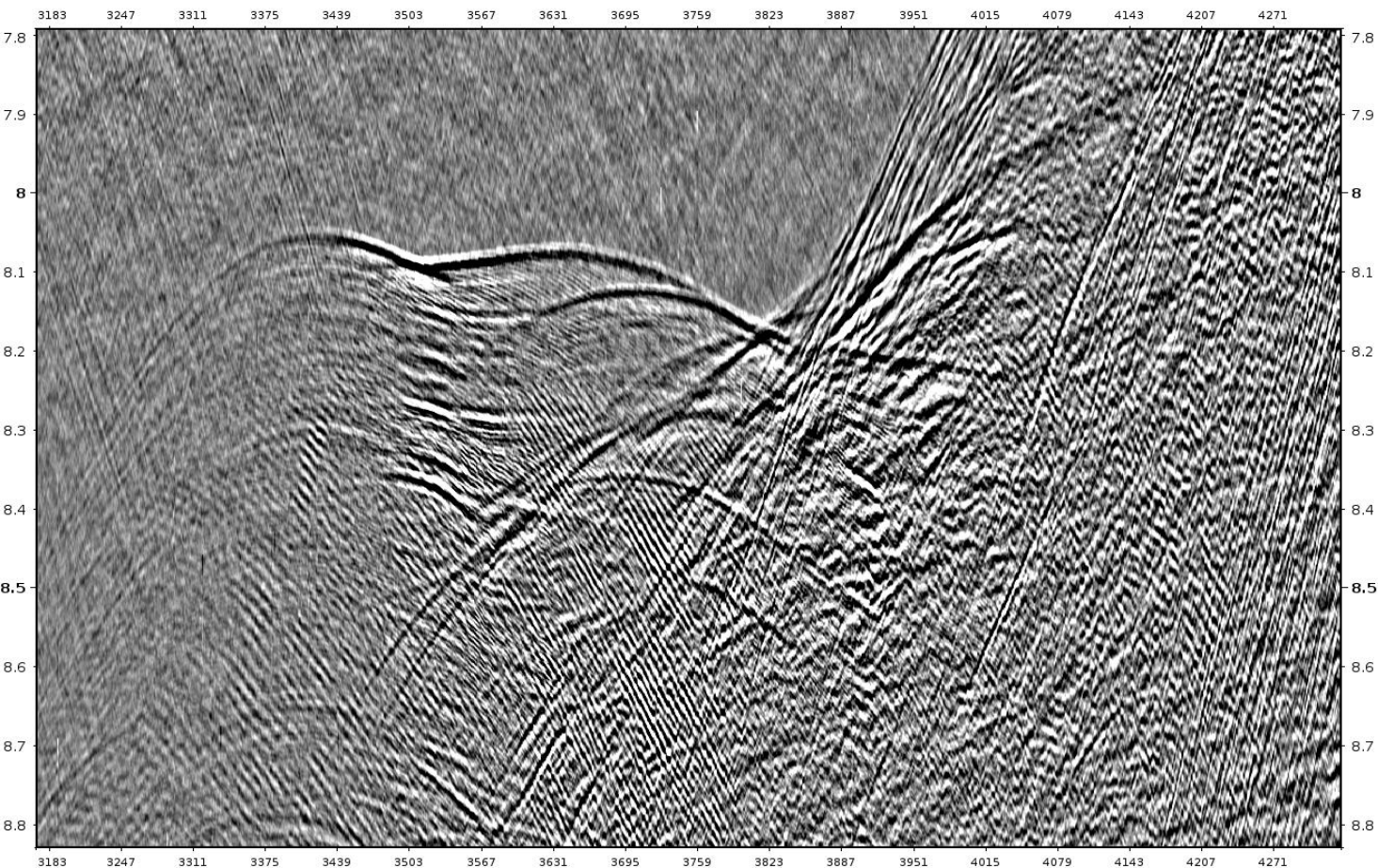




# Seq 039 Zoomed: 2D Stack before Resampling

22

LINESEQ 39 / CROSSLINE



- Water layer related multiples show high frequency energy which does not belong to the primaries in the deep section, due to earth absorption.

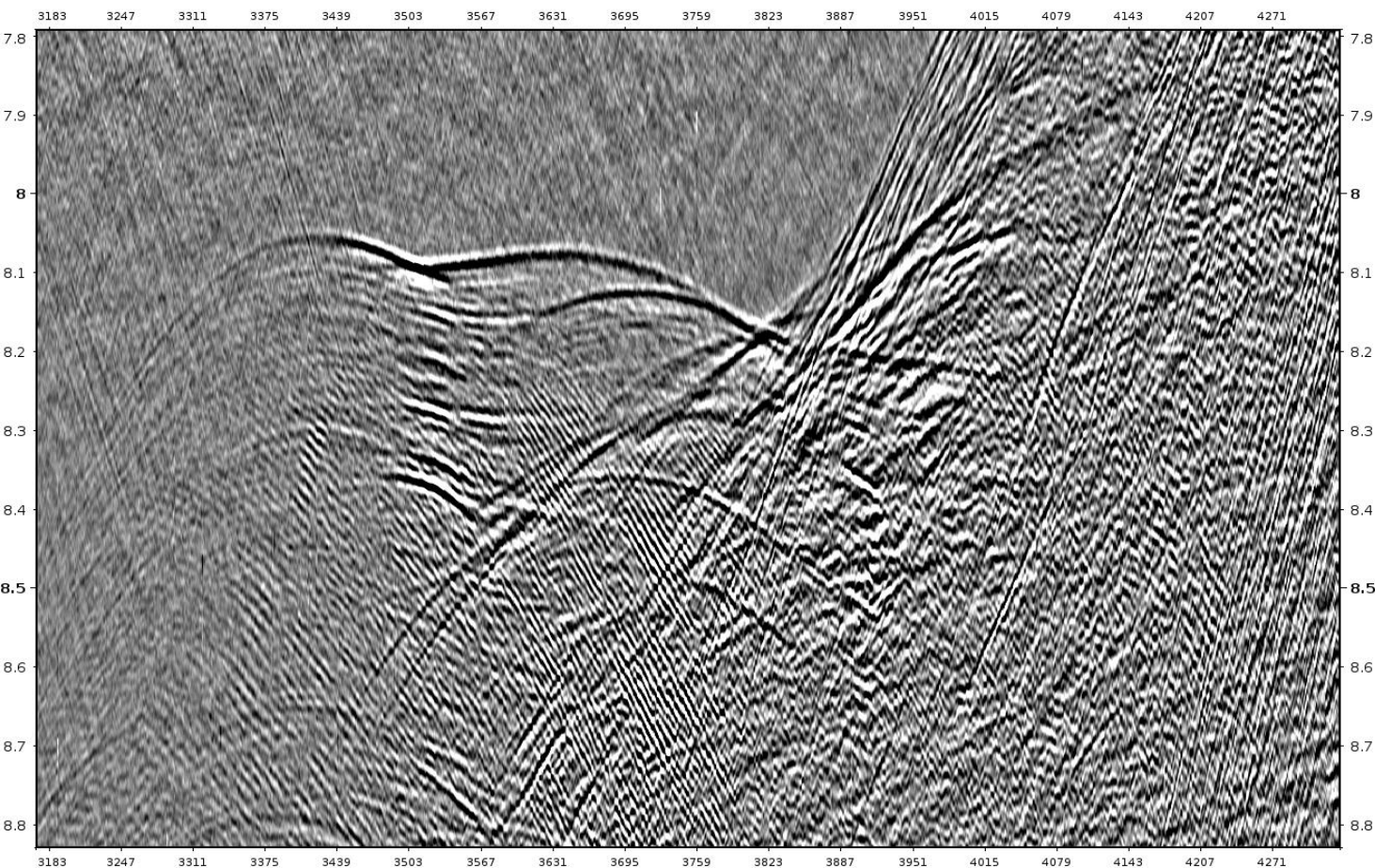




# Seq 039 Zoomed: 2D Stack **after** Resampling (and back to 2ms)

23

LINESEQ 39 / CROSSLINE



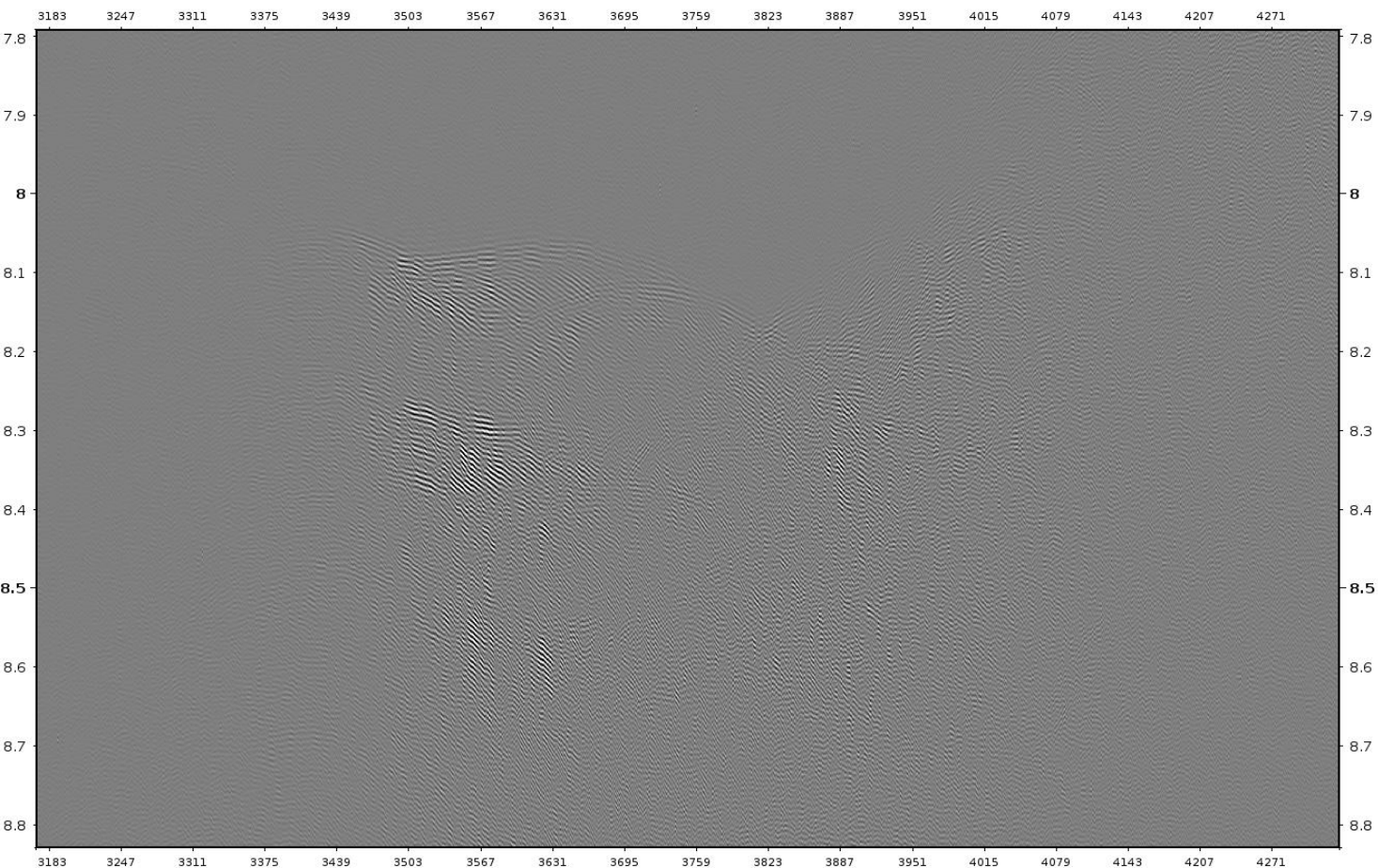
- High cut filter during resampling removes part of the high frequency multiples.



# Seq 039 Zoomed: 2D Stack Difference Before - After

24

LINESEQ 39 / CROSSLINE



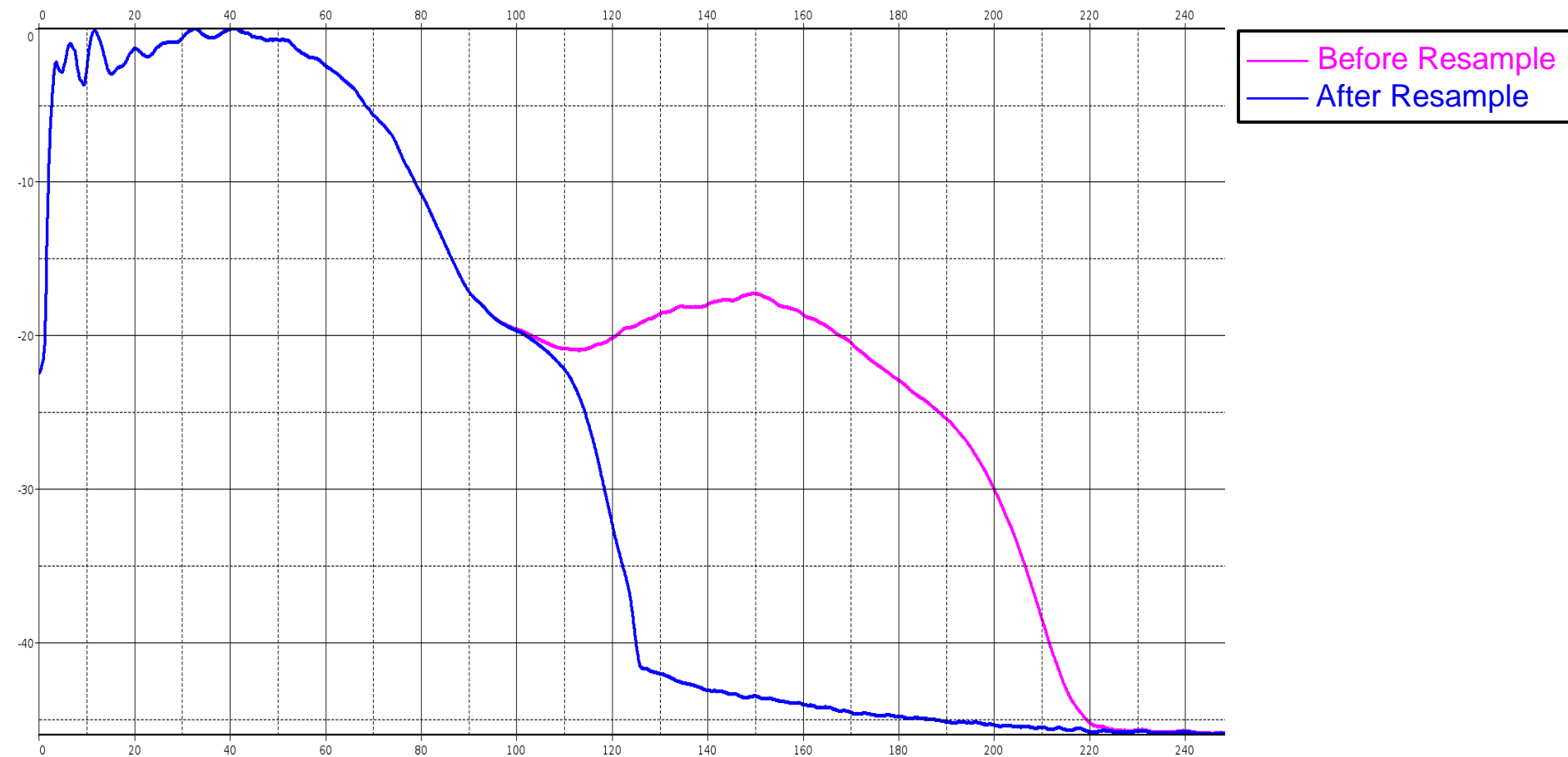
■ Removed high frequency component.





# Seq 039: Full Window Amplitude Spectrum of 2D Stack

25

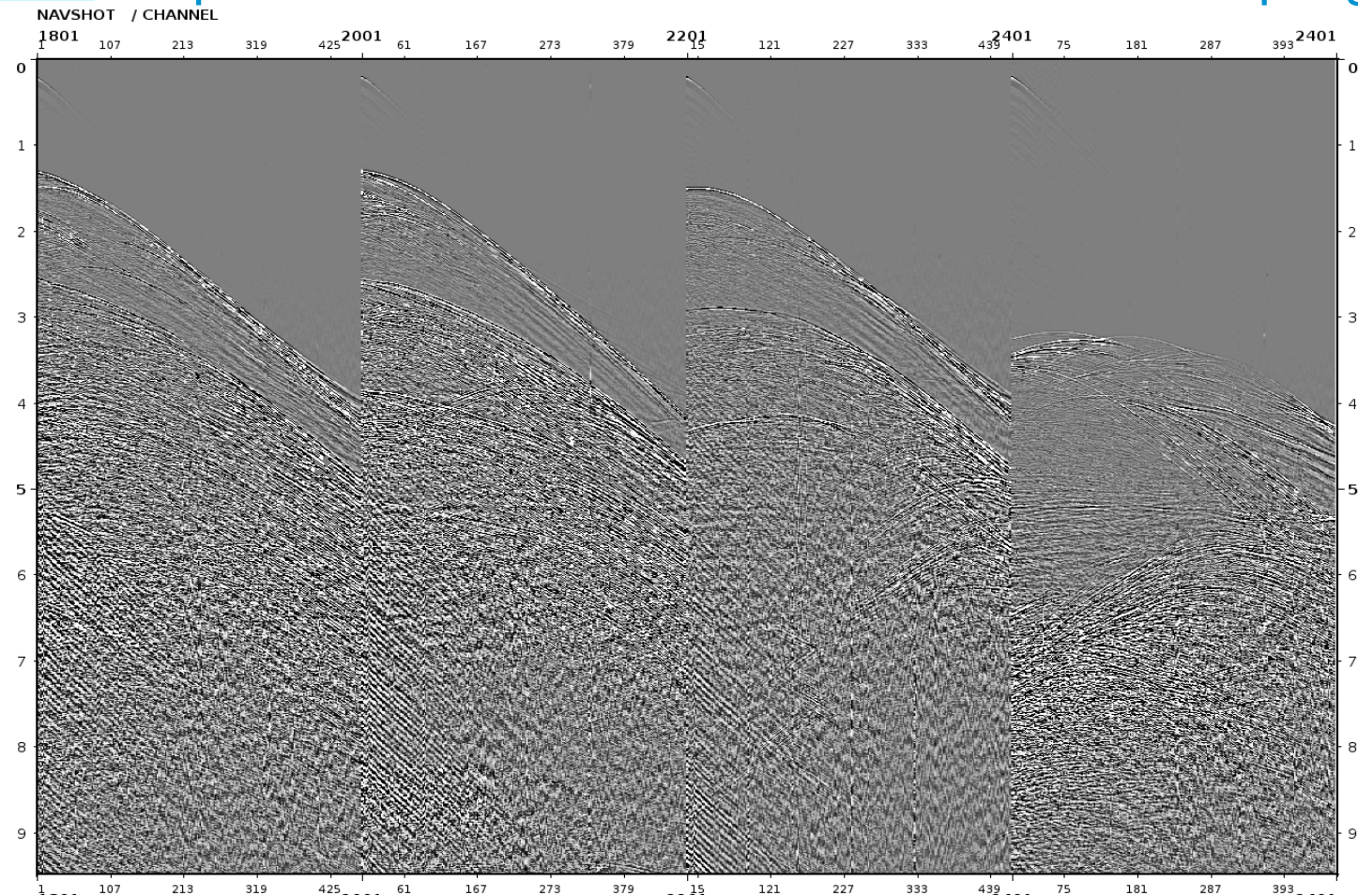






# Seq 039: Selected Shot Gathers before Resampling

26



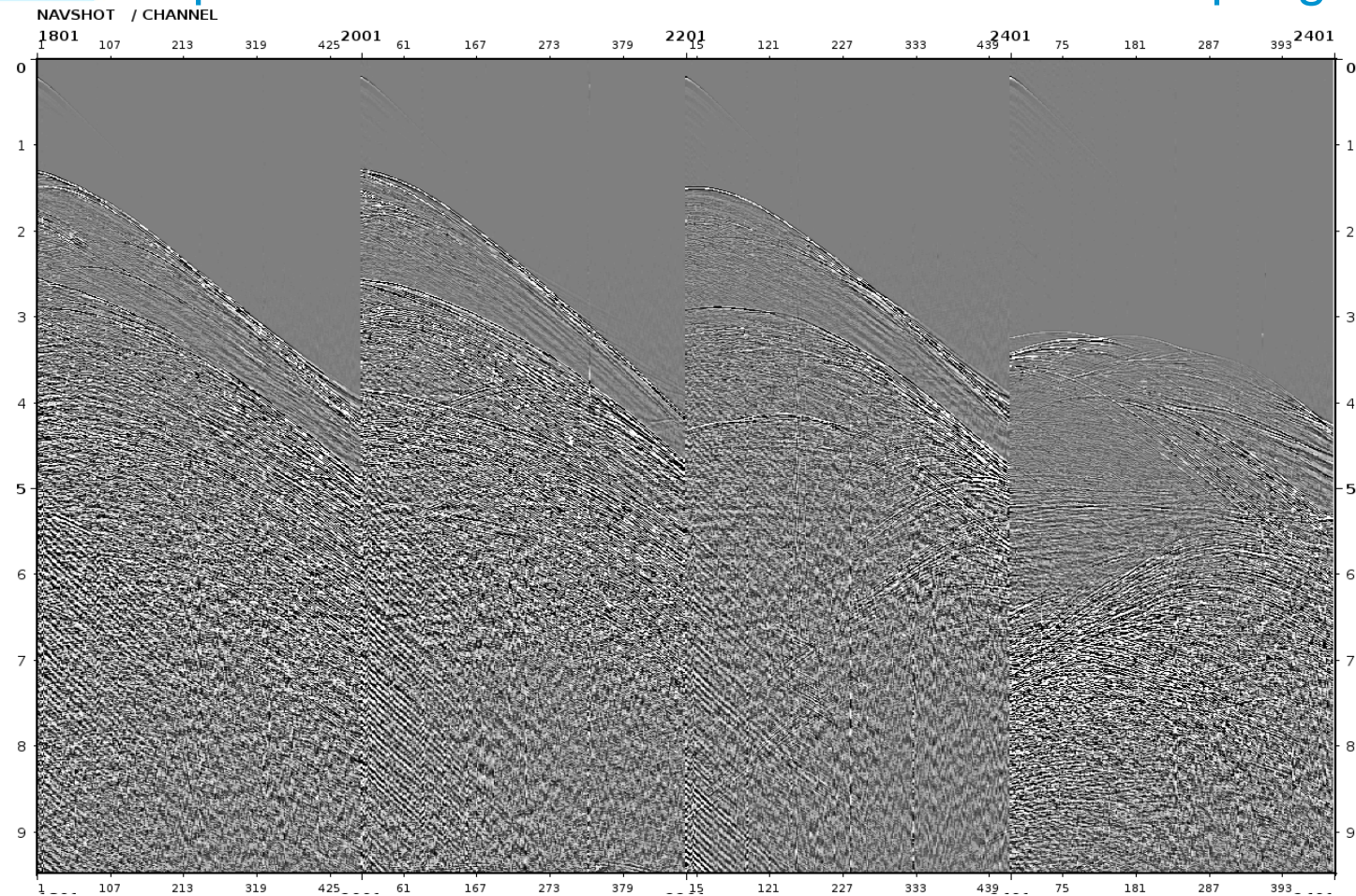
- TVS applied for display





# Seq 039: Selected Shot Gathers after Resampling

27

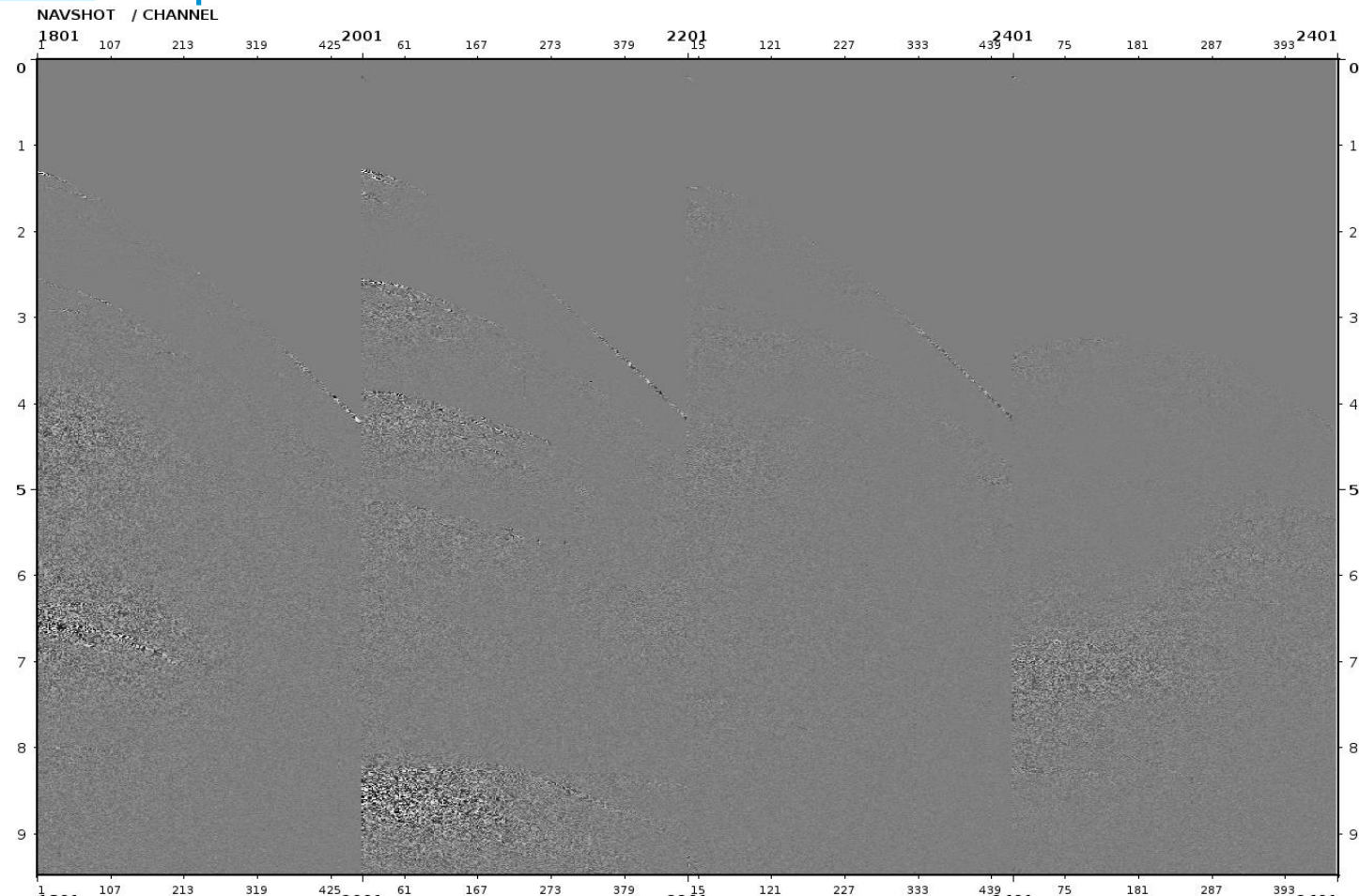


- TVS applied for display



# Seq 039: Selected Shot Gathers Difference Before - After

28



- TVS applied for display

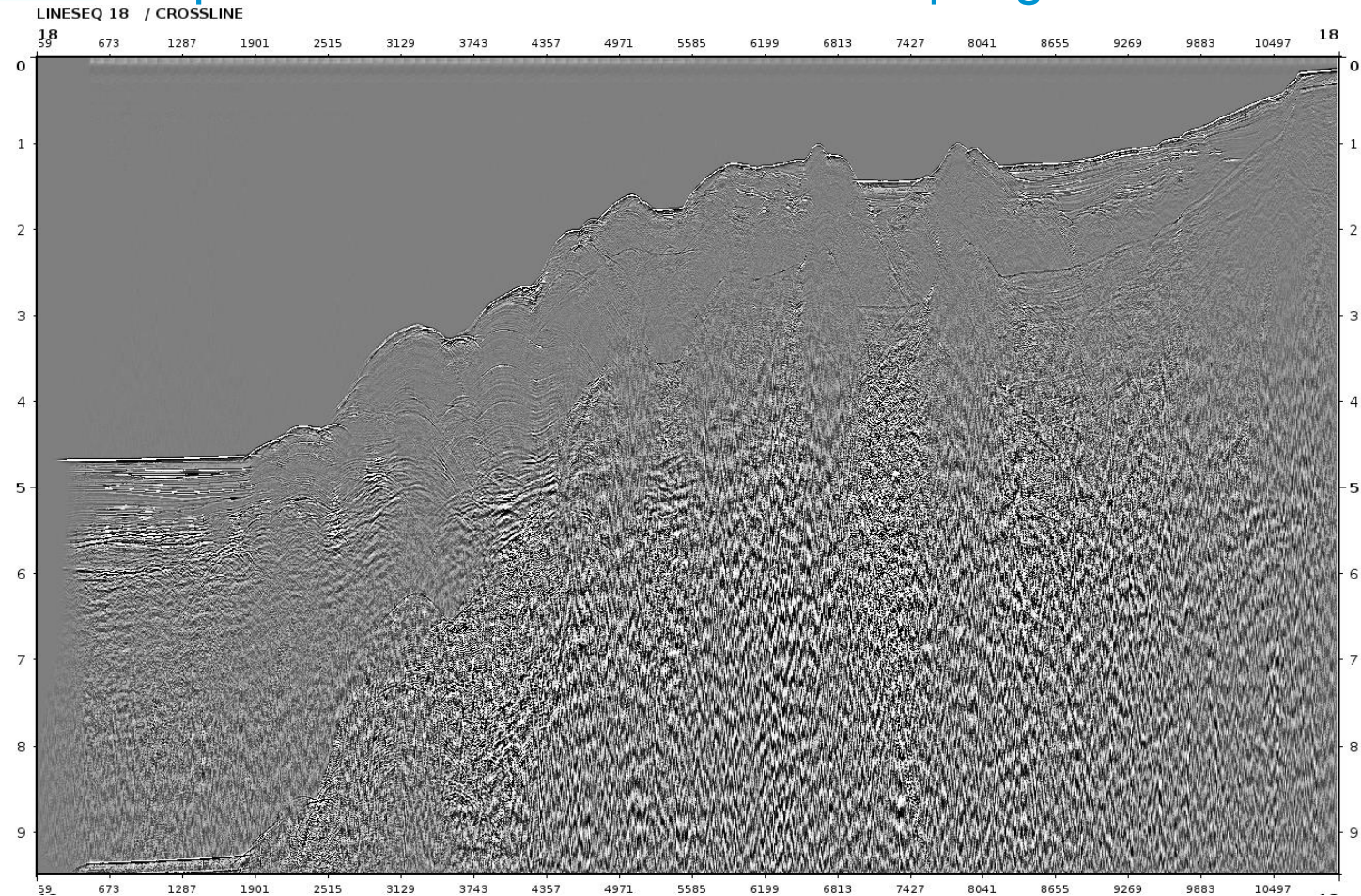
# Resample to 4ms

## Seq 018



# Seq 018: 2D Stack before Resampling

30



- Line with strong swell noise.

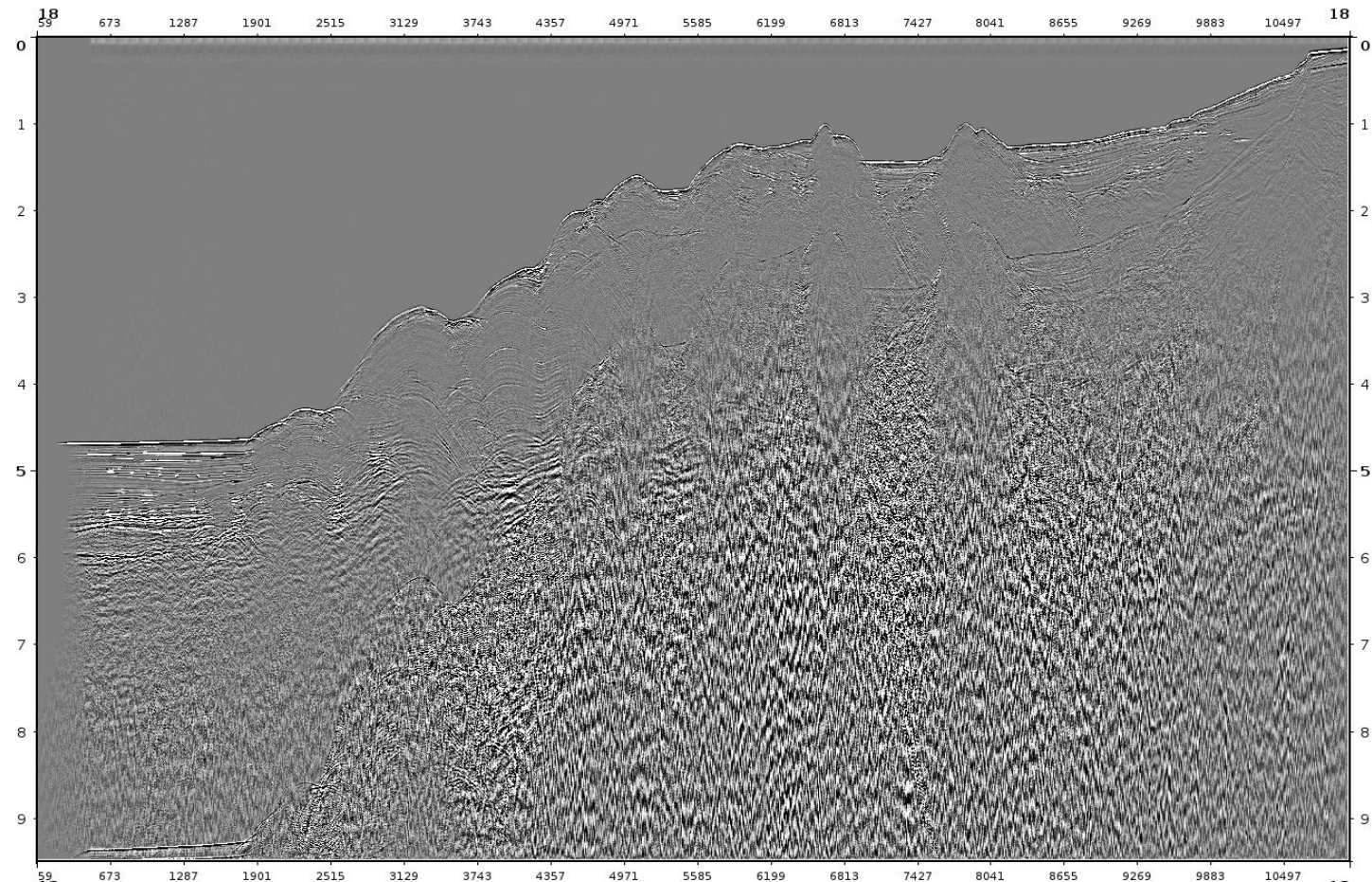




# Seq 018: 2D Stack **after** Resampling (and back to 2ms)

31

LINESEQ 18 / CROSSLINE

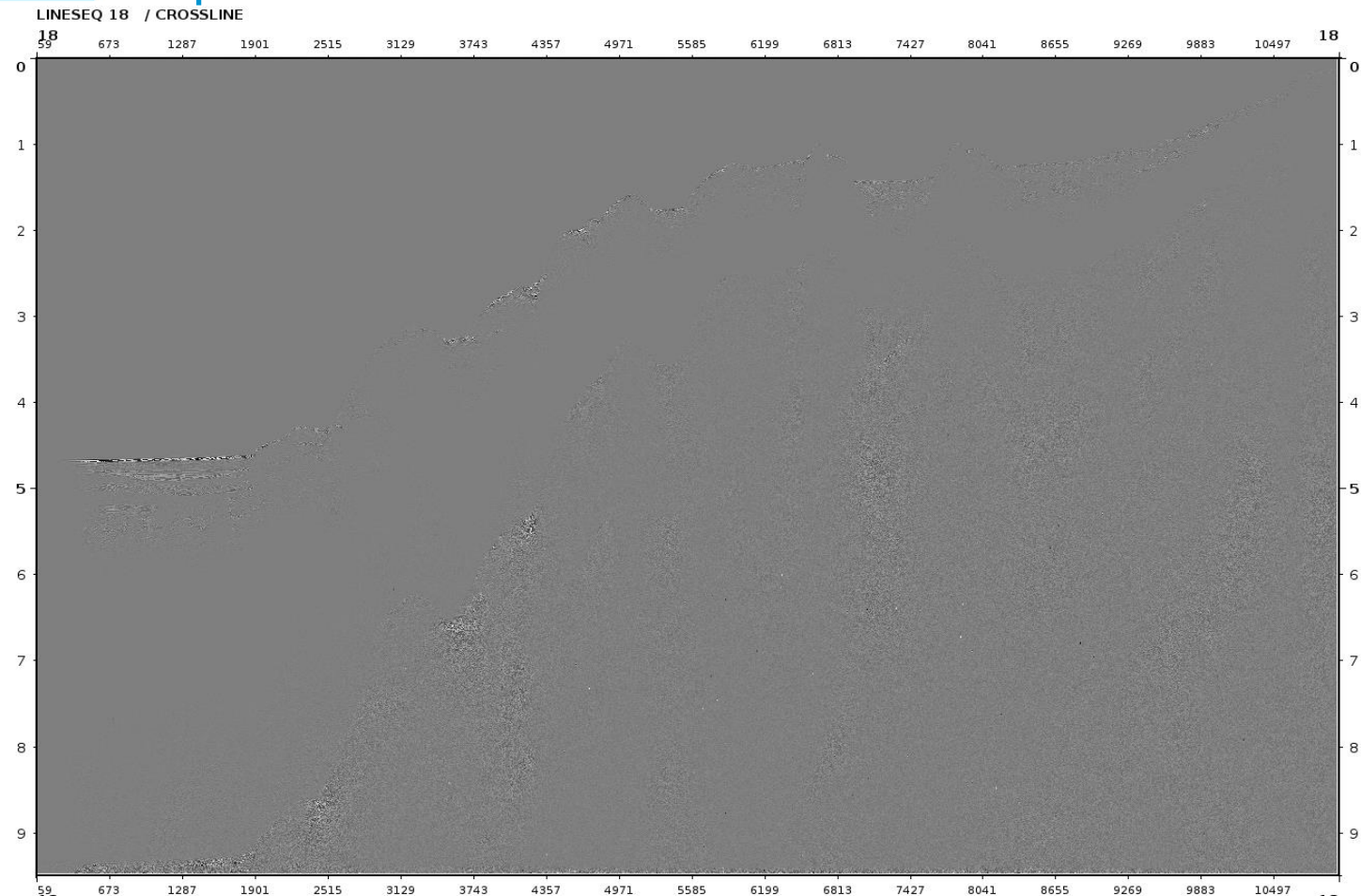


- Line with strong swell noise.



# Seq 018: 2D Stack Difference Before - After

32



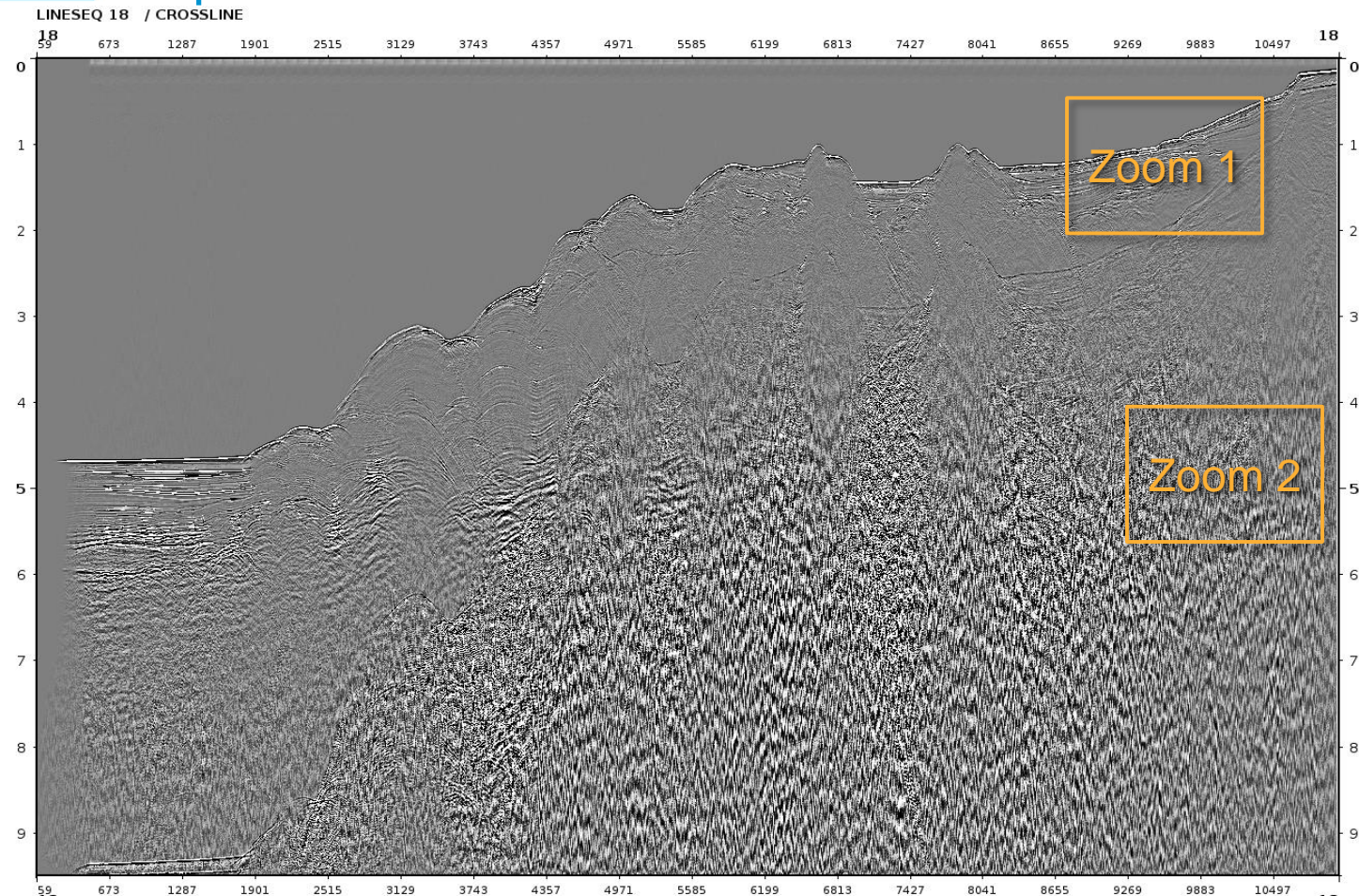
- Line with strong swell noise.





# Seq 018: 2D Stack Zoomed In Locations

33



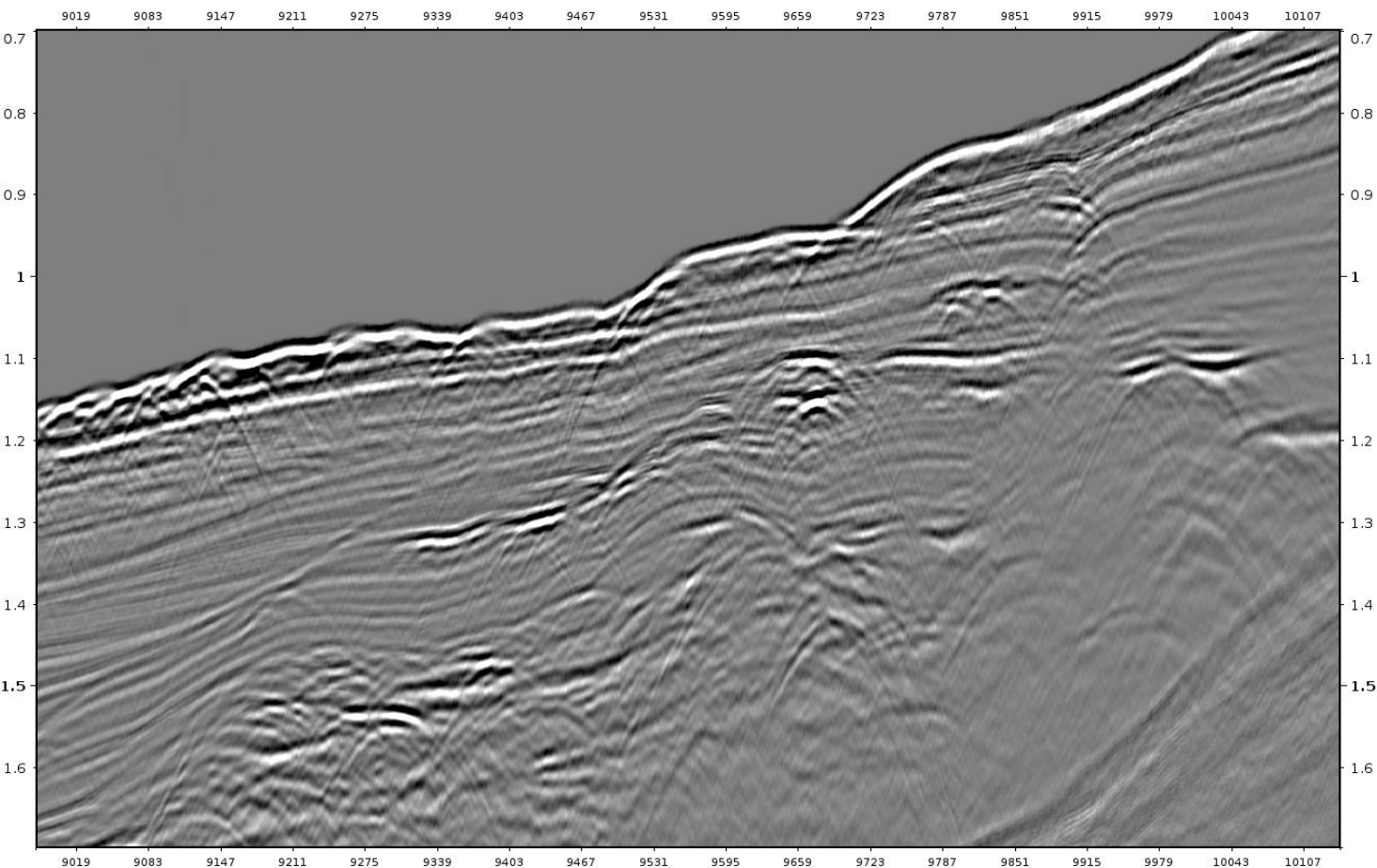
- Line with strong swell noise.



# Seq 018 Zoomed: 2D Stack **before** Resampling

34

LINESEQ 18 / CROSSLINE



■ Around water bottom.

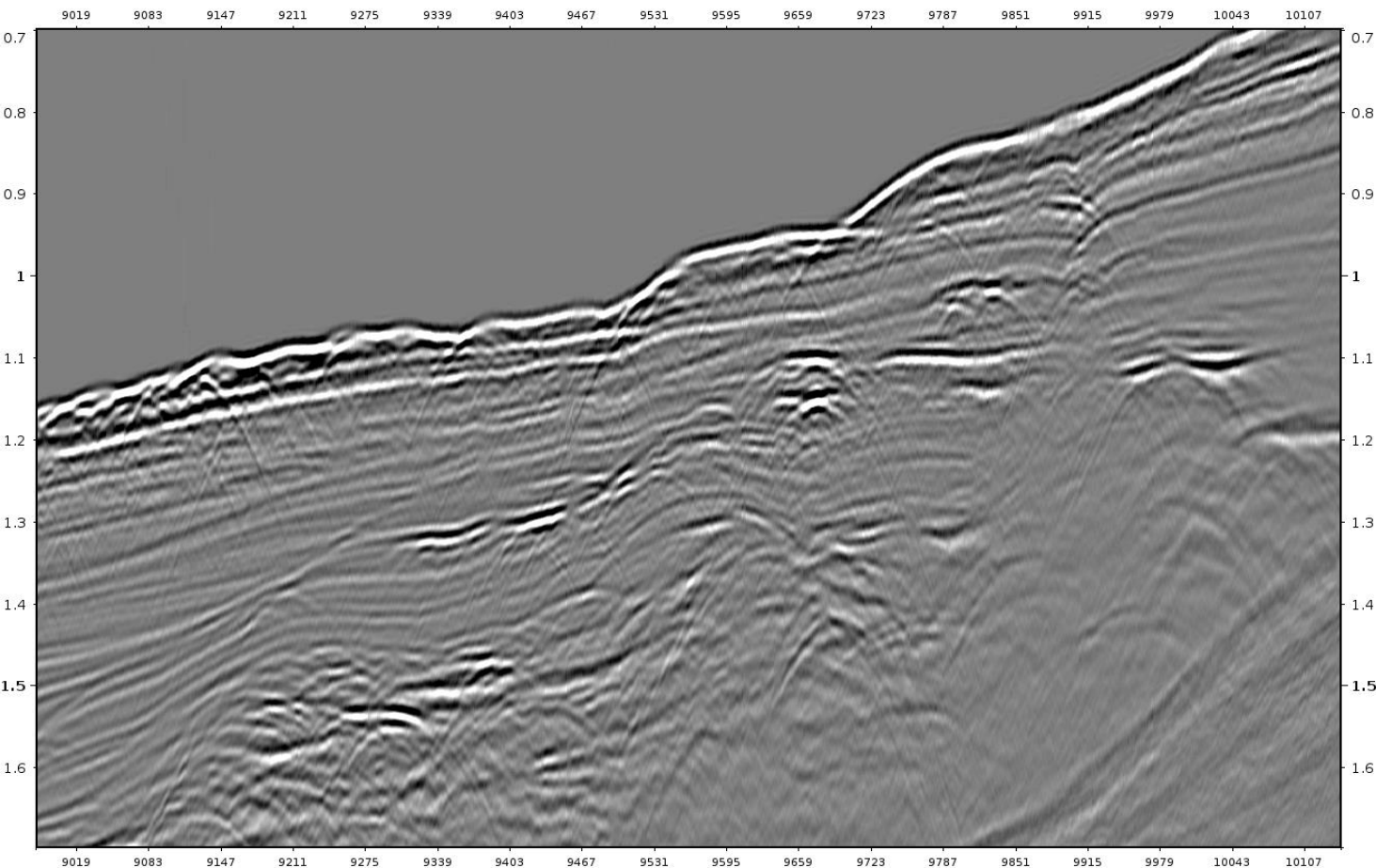




# Seq 018 Zoomed: 2D Stack **after** Resampling (and back to 2ms)

35

LINESEQ 18 / CROSSLINE



- Resampling removes some extreme high frequency which has minor effect on overall structure.

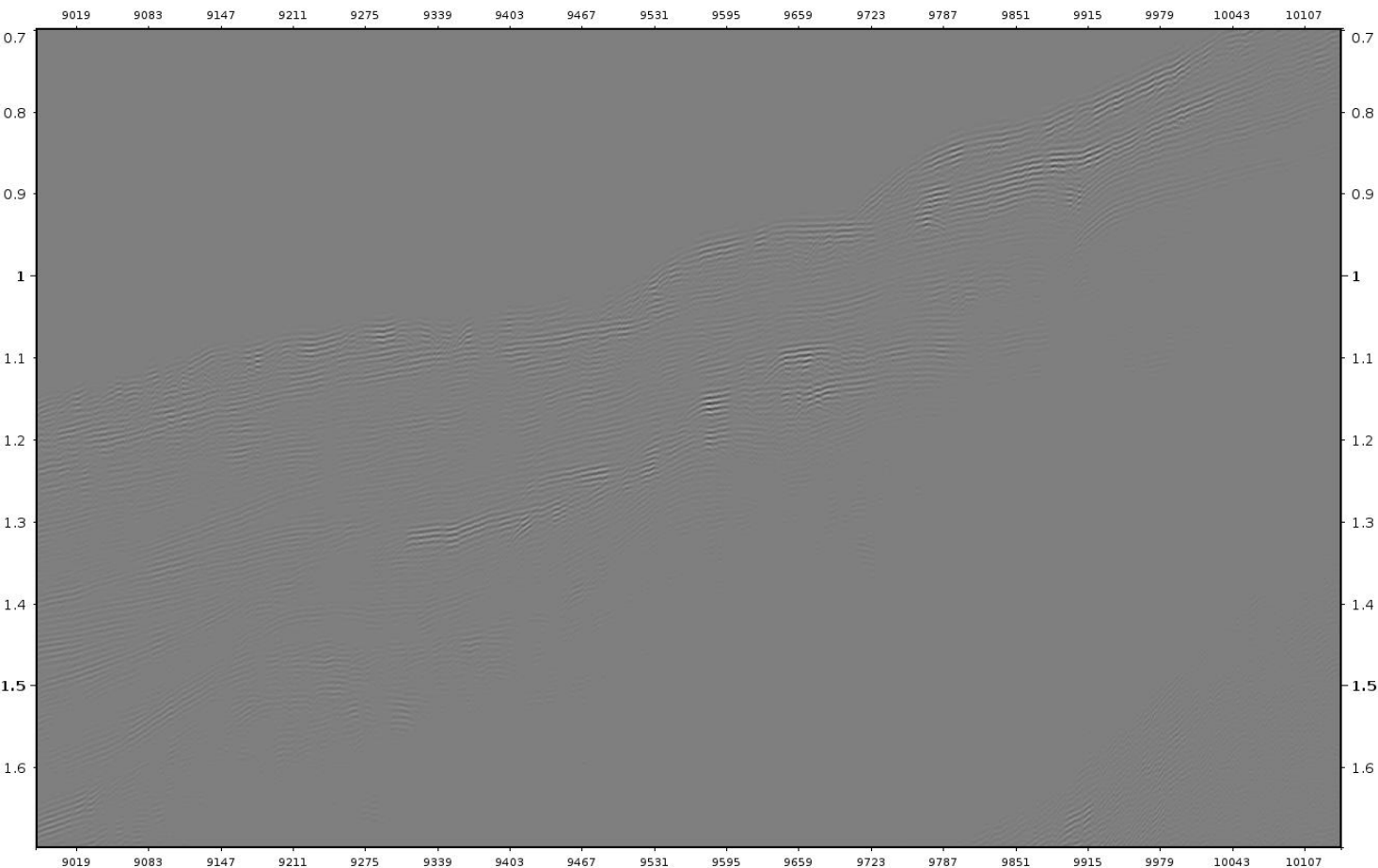




# Seq 018 Zoomed: 2D Stack Difference Before - After

36

LINESEQ 18 / CROSSLINE



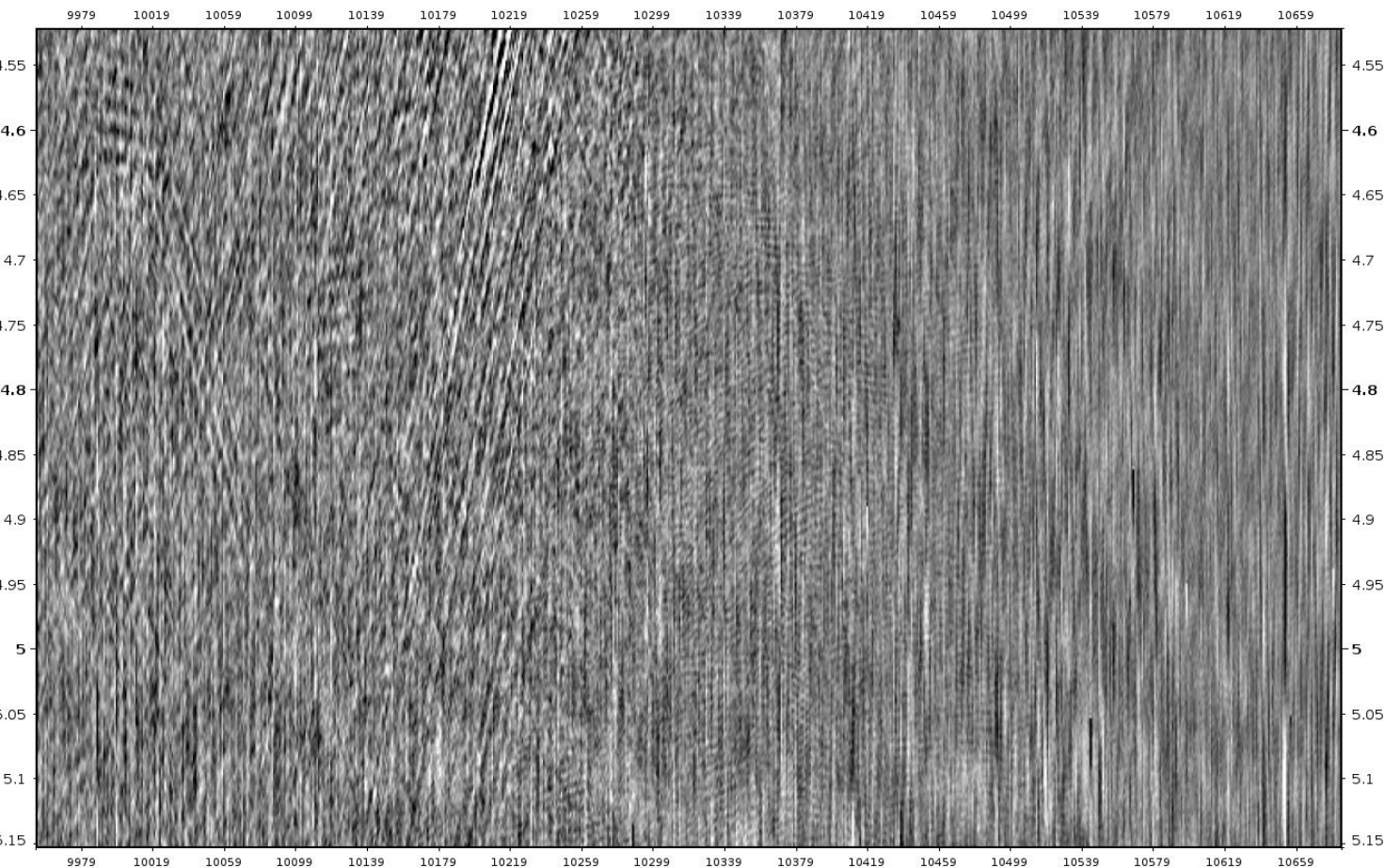
■ Removed high frequency component.



# Seq 018 Zoomed: 2D Stack **before** Resampling

37

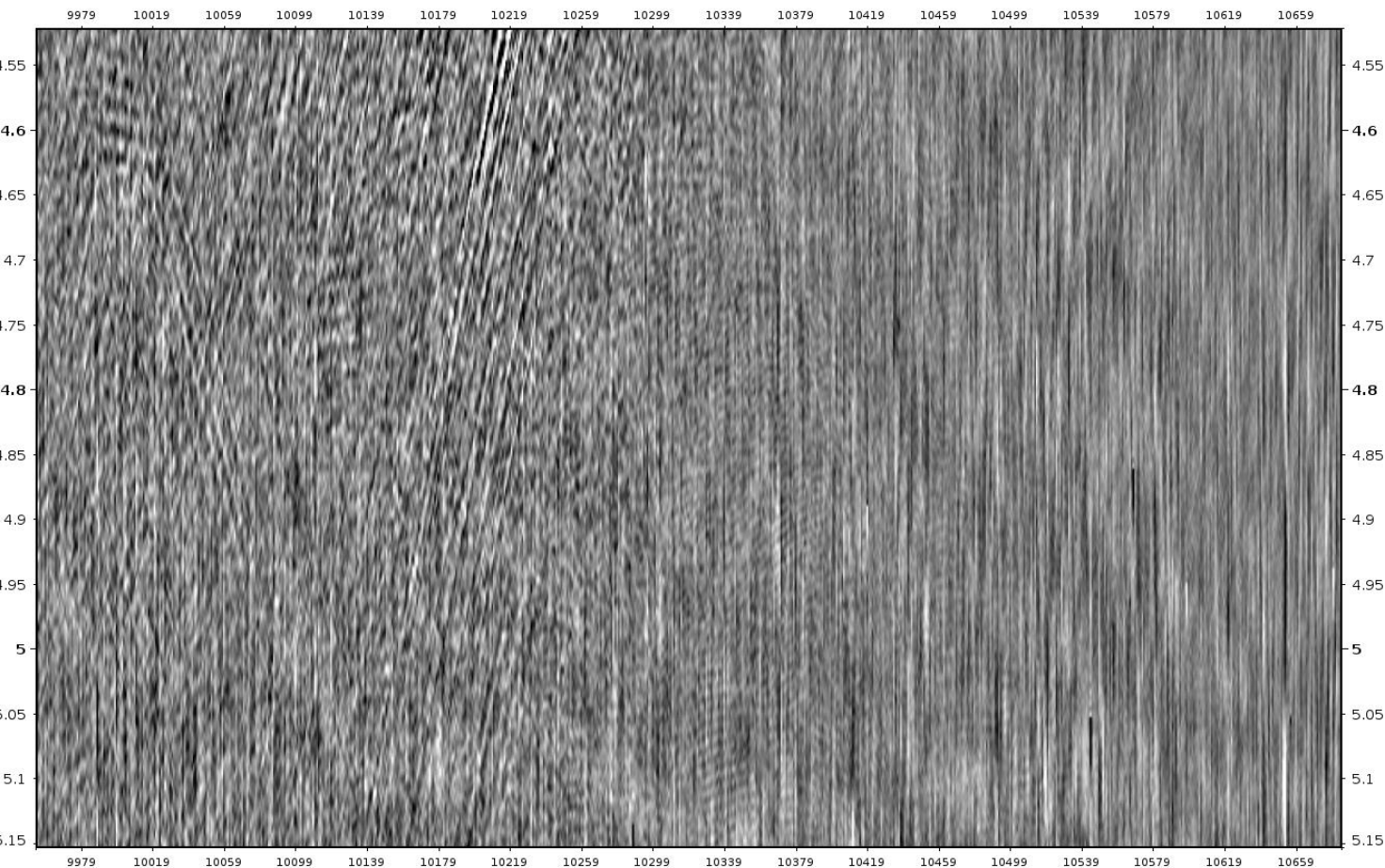
LINESEQ 18 / CROSSLINE



- Deep section shows some high frequency noise.



LINESEQ 18 / CROSSLINE



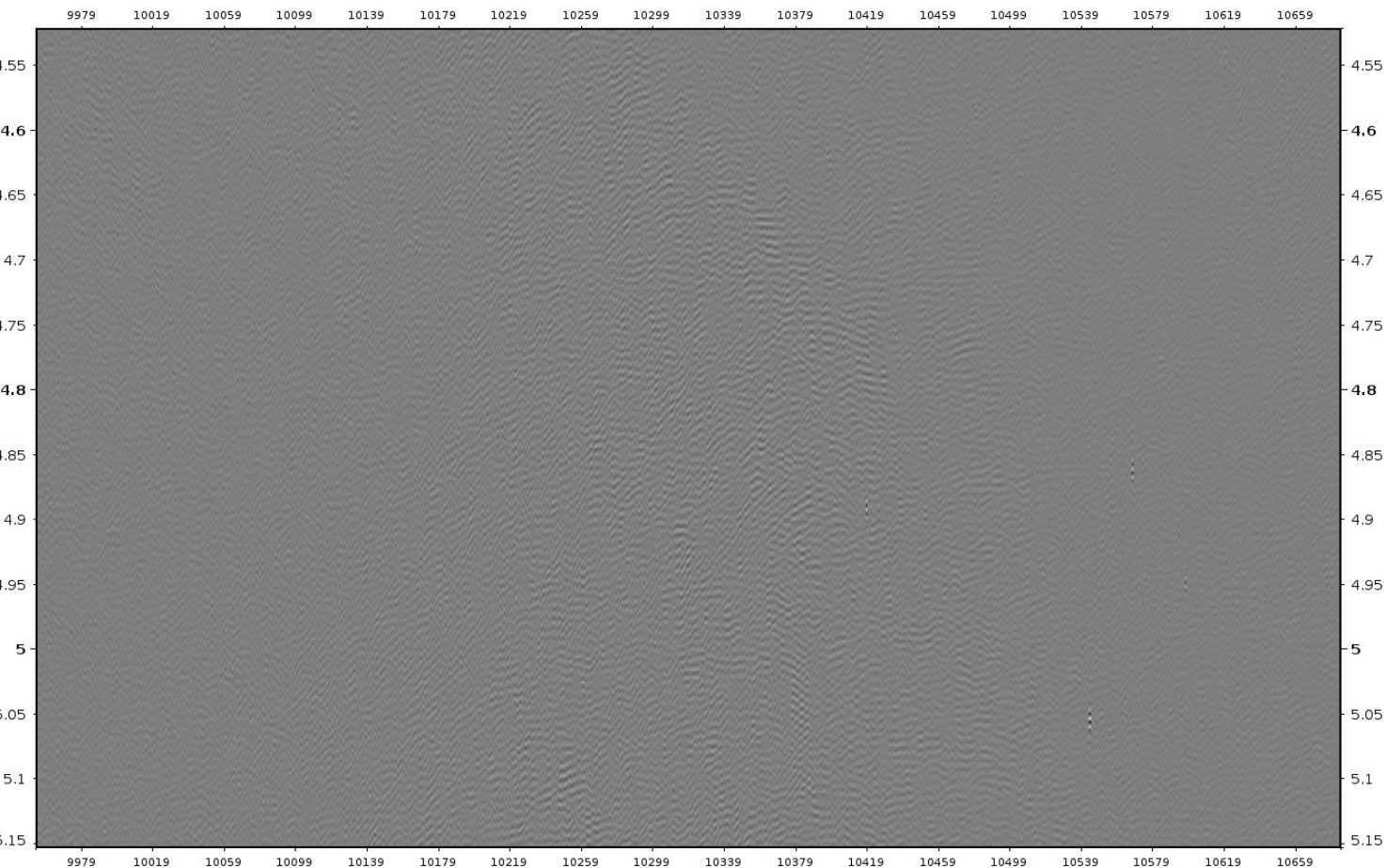
- Resampling help to remove part of the high frequency noise.
- Residual noise will be handled in later stages.





# Seq 018 Zoomed: 2D Stack Difference Before - After

LINESEQ 18 / CROSSLINE

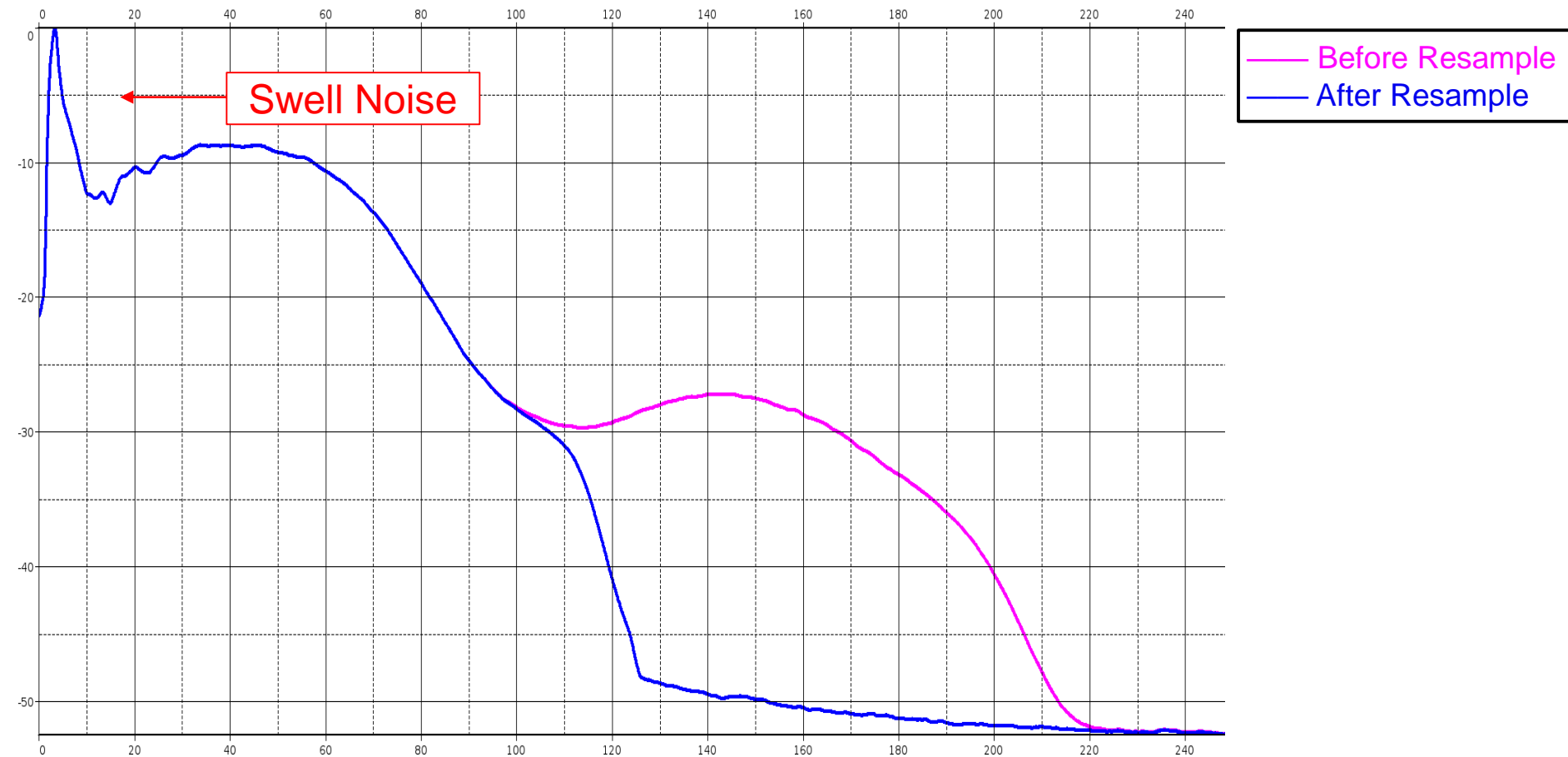


■ Removed high frequency noise.



# Seq 018: Full Window Amplitude Spectrum of 2D Stack

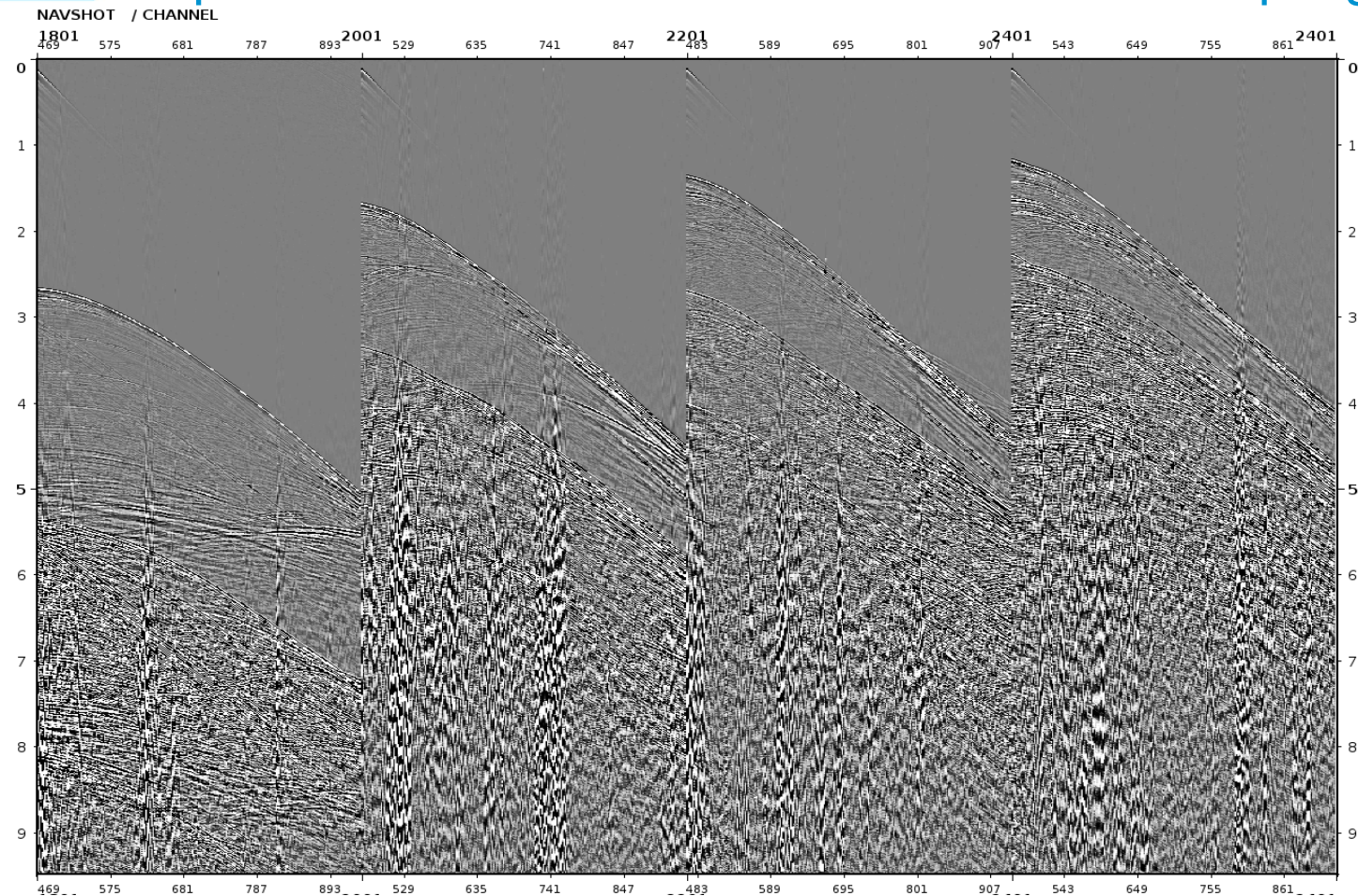
40





# Seq 018: Selected Shot Gathers before Resampling

41



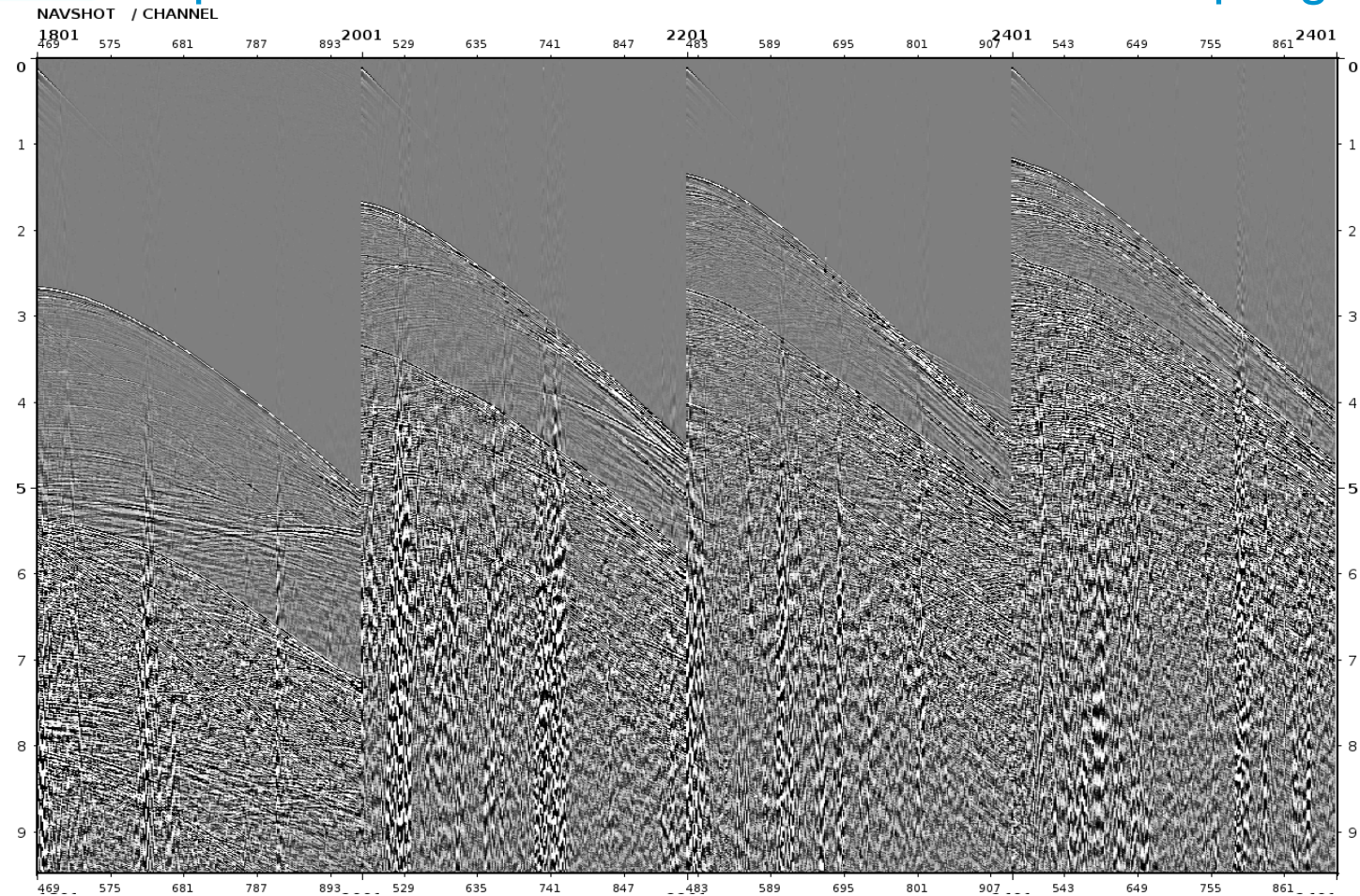
- TVS applied for display





# Seq 018: Selected Shot Gathers after Resampling

42

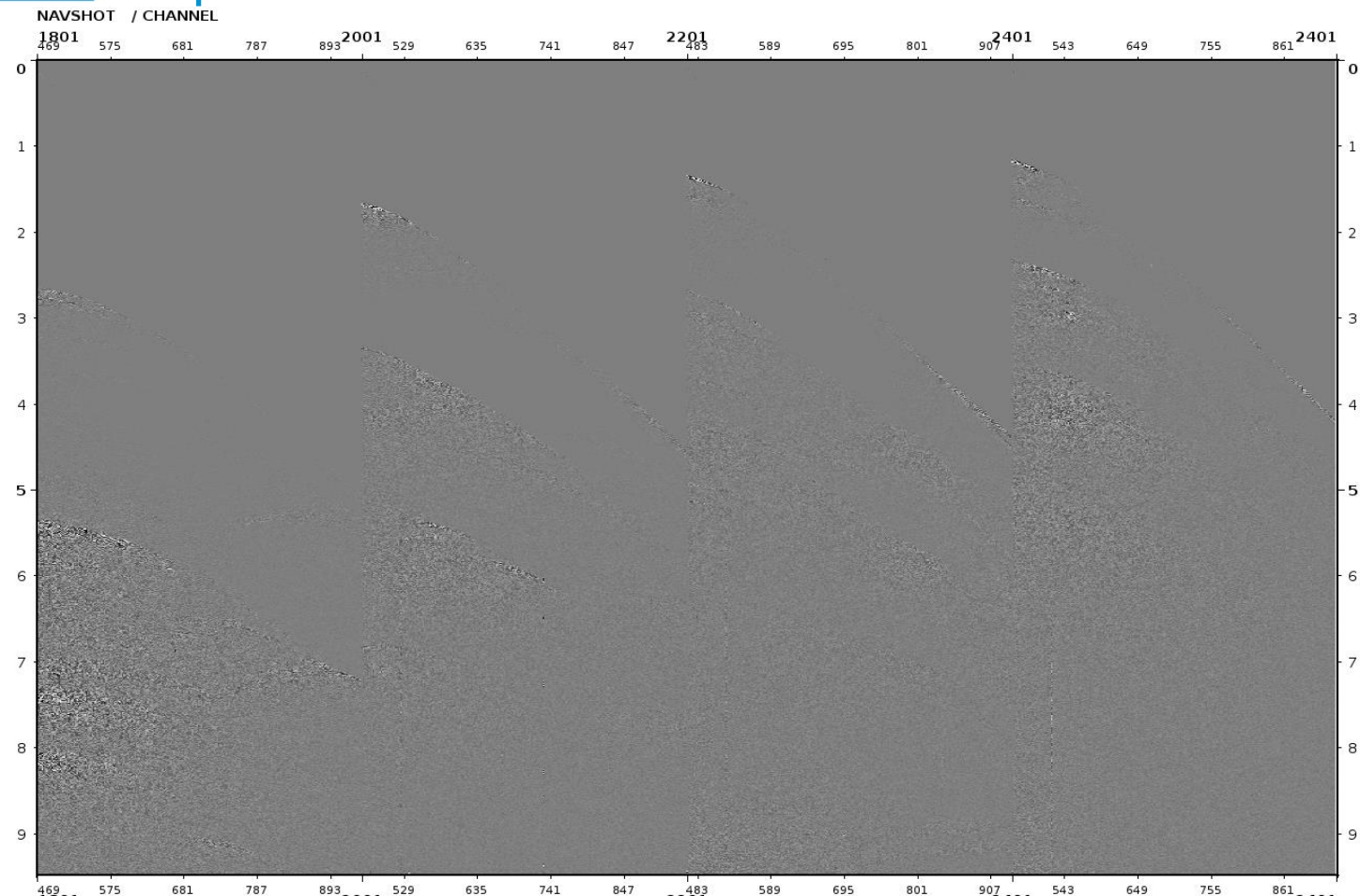


- TVS applied for display



# Seq 018: Selected Shot Gathers Difference Before - After

43



- TVS applied for display