



Residual Linear Noise Attenuation

NZ 3D Processing

10 March 2021

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)
6. Debubble
7. Linear noise attenuation (LNA)
8. Tidal statics correction
9. Water column statics correction
10. Shot & channel scaling
11. Receiver motion correction (RMC)
12. Joint Deghost & Designature
13. Residual Bubble Removal
14. Source Sensor Datum Correction
15. Shallow Water Demultiple
16. Surface Related Multiple Elimination (3D SRME)
17. Simultaneous Subtraction of MWD & SRME

18. Residual linear noise attenuation (residual LNA)

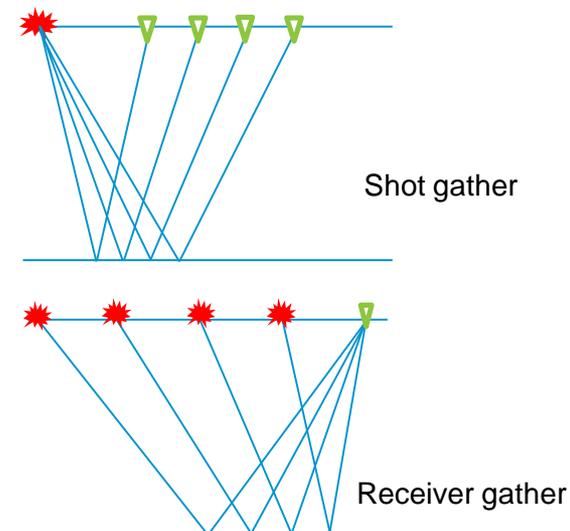
- **Objective:**

To attenuate residual linear noise.

- **Procedure:**

Linear noise attenuation is done on shot and receiver gathers in Tau-P domain.

Start Time	Primary Protection dip (ms/tr)	Corresponding cut-off apparent velocity (m/s)
WBT+700	-8.0 ~ 8.0	1560 m/s
WBT+1300	-6.5 ~ 6.5	1900 m/s
WBT+1750	-4.6 ~ 4.6	2700 m/s
WBT+4300	-3.4 ~ 3.4	3600 m/s
WBT+6700	-3.1 ~ 3.1	4000 m/s



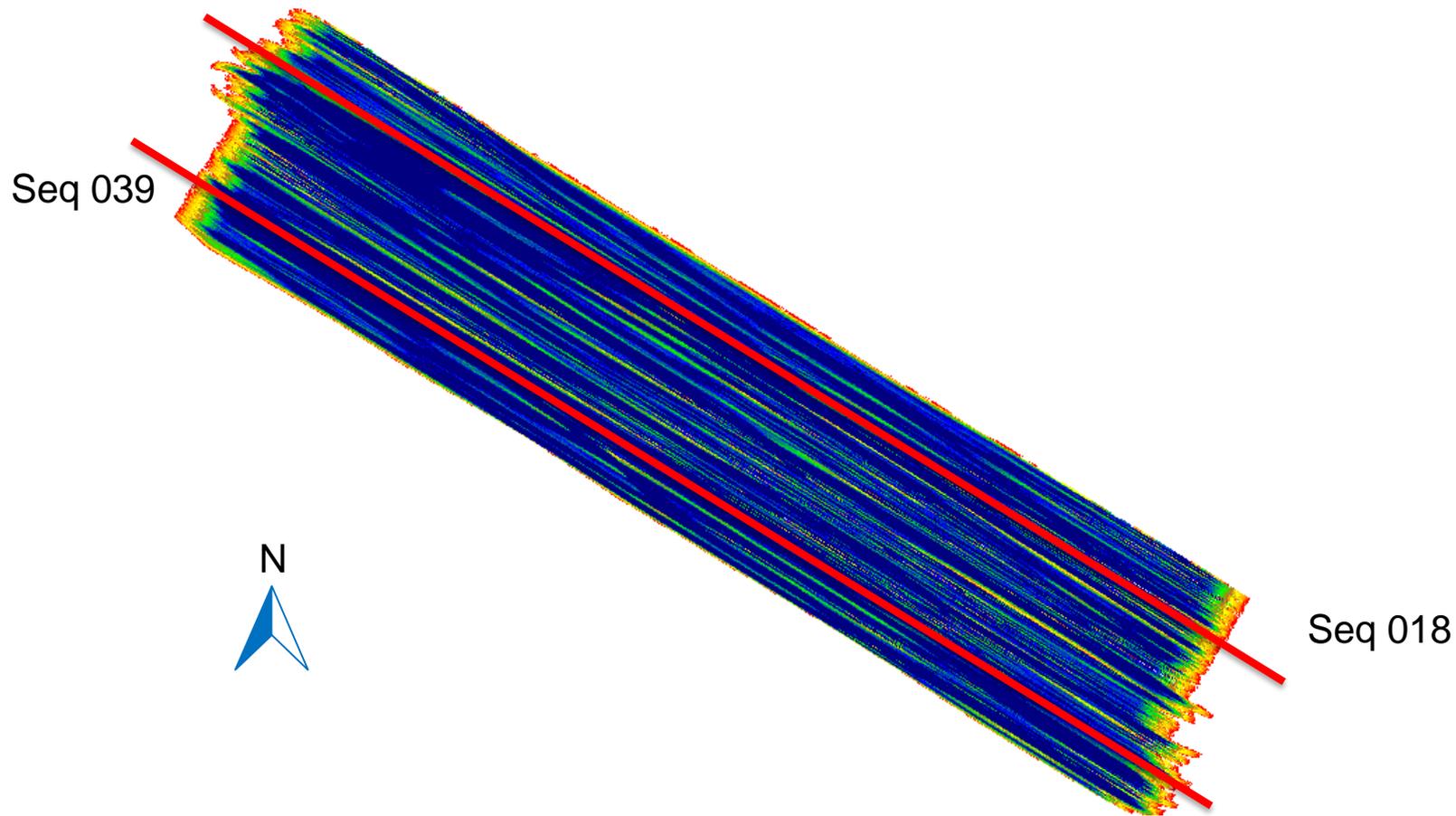
- **Display:**

Test line: Seq 018; Seq 039.

Display: Stack, common channel and Selected Gathers.

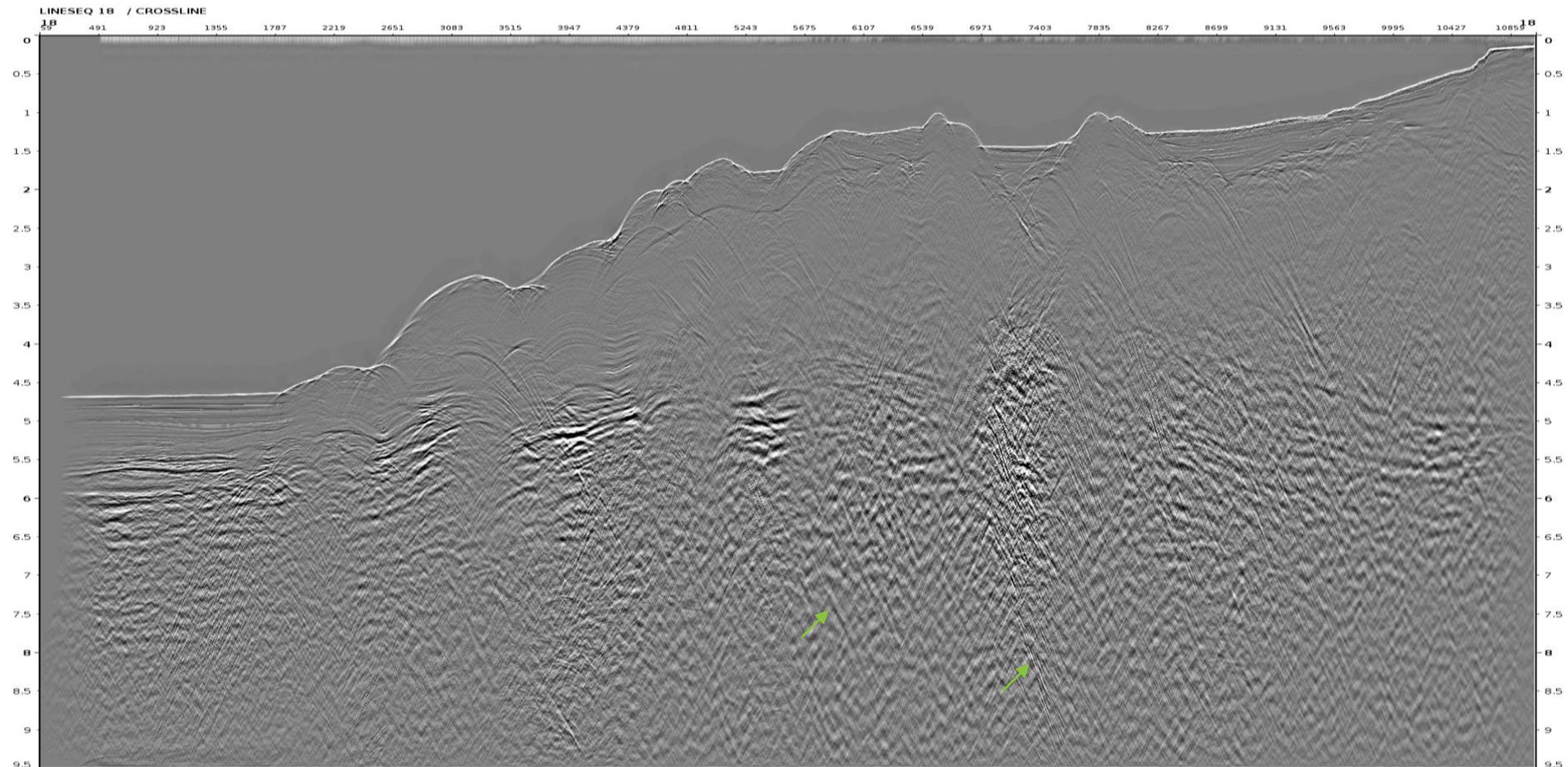
- **Observation and Recommendation:**

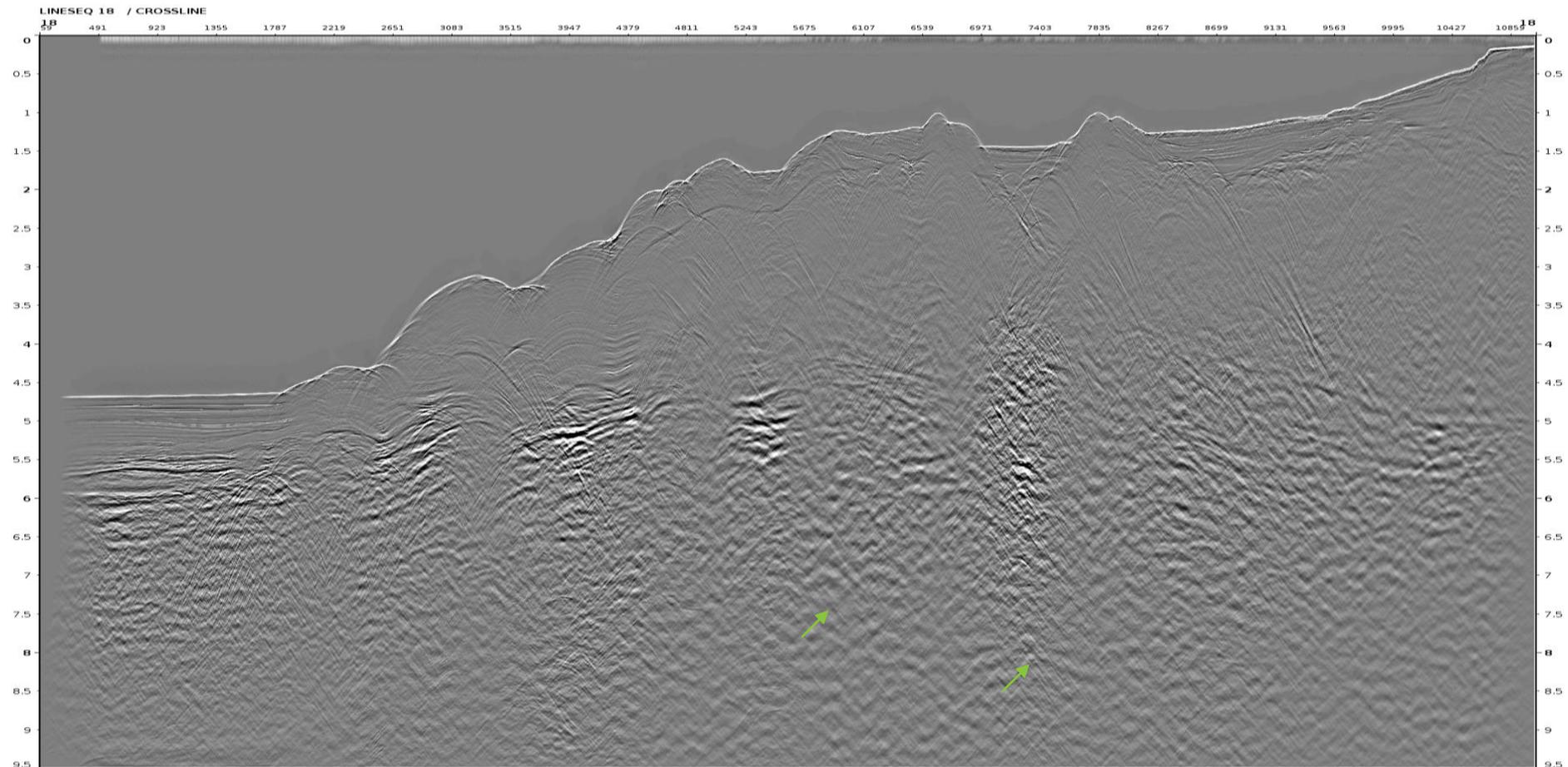
Residual linear noise is attenuated in the data while keeping the primary data intact. It's recommended to apply for production.



Seq 018

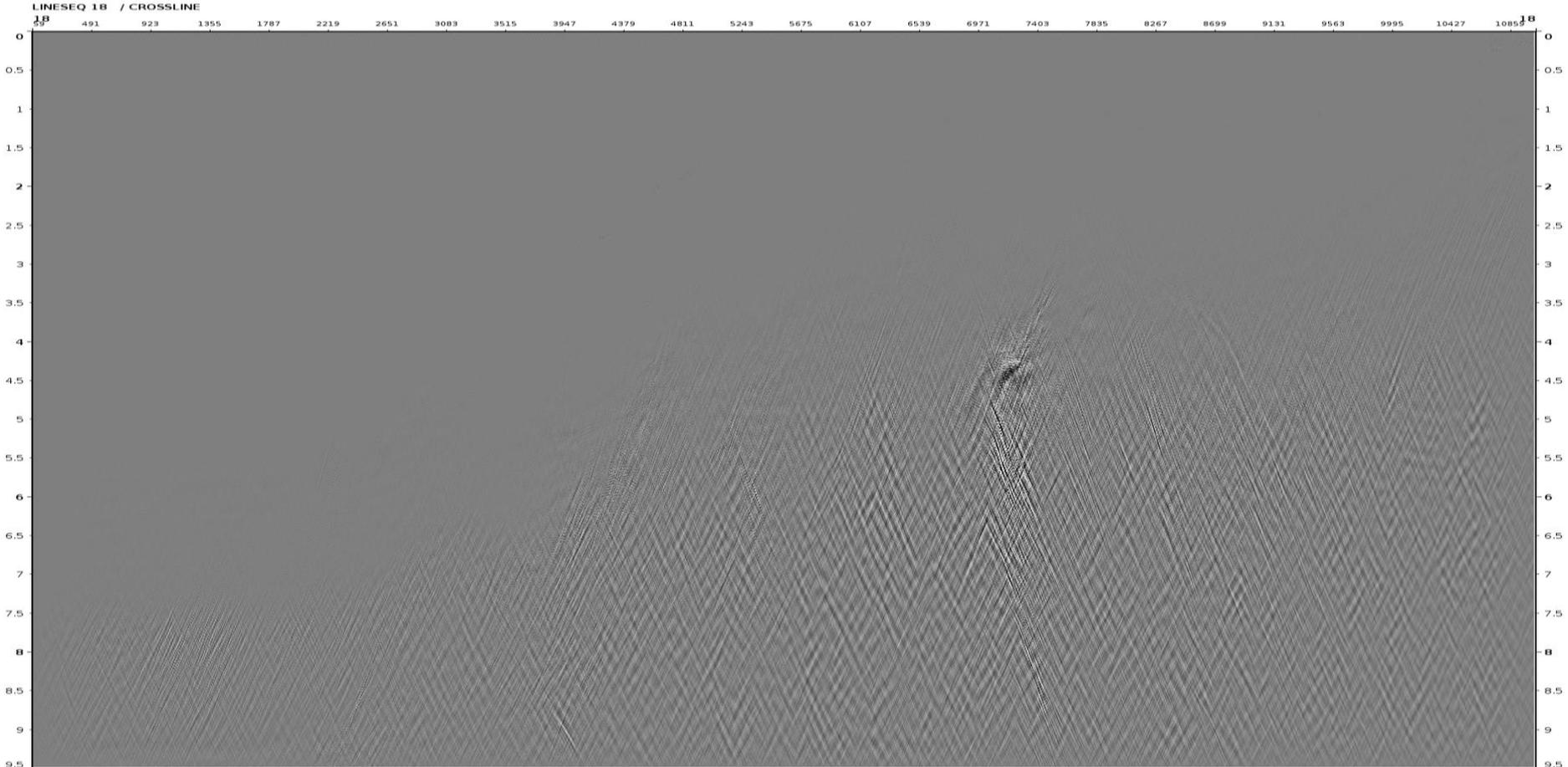
- Stack
- Common Channel
- Gathers







Difference before – after LNA

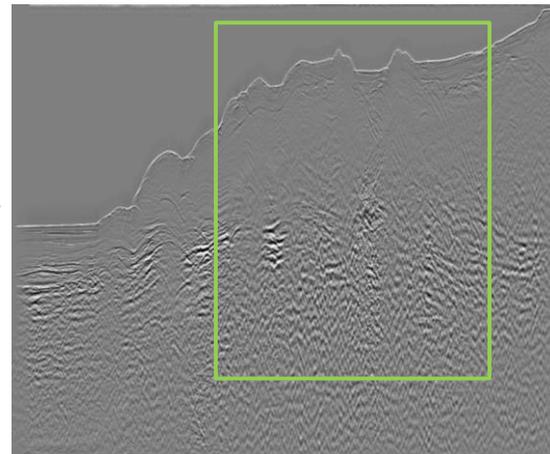
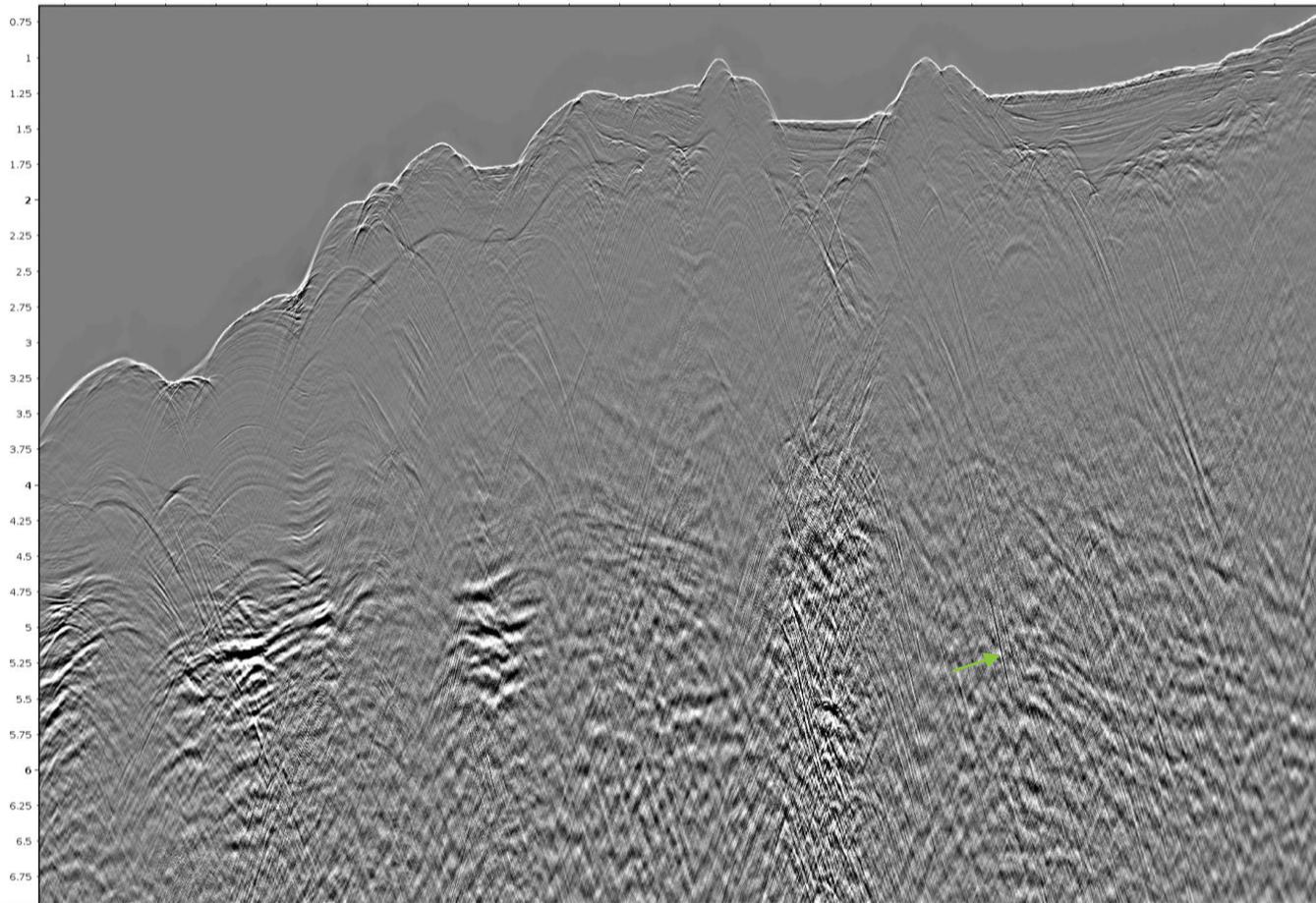




Zoom in Stack before LNA

LINESEQ 18 / CROSSLINE

2929 3216 3503 3790 4077 4364 4651 4938 5225 5512 5799 6086 6373 6660 6947 7234 7521 7808 8095 8382 8669 8956 9243 9530 9817



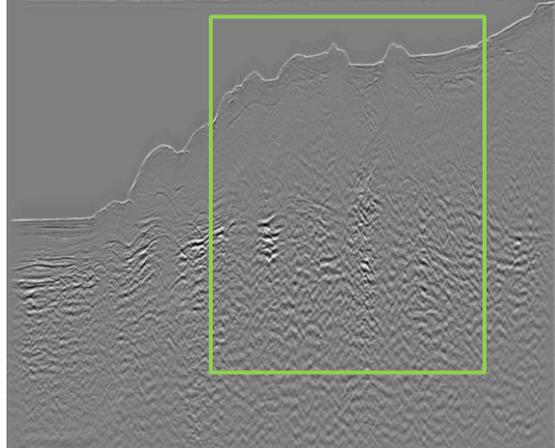
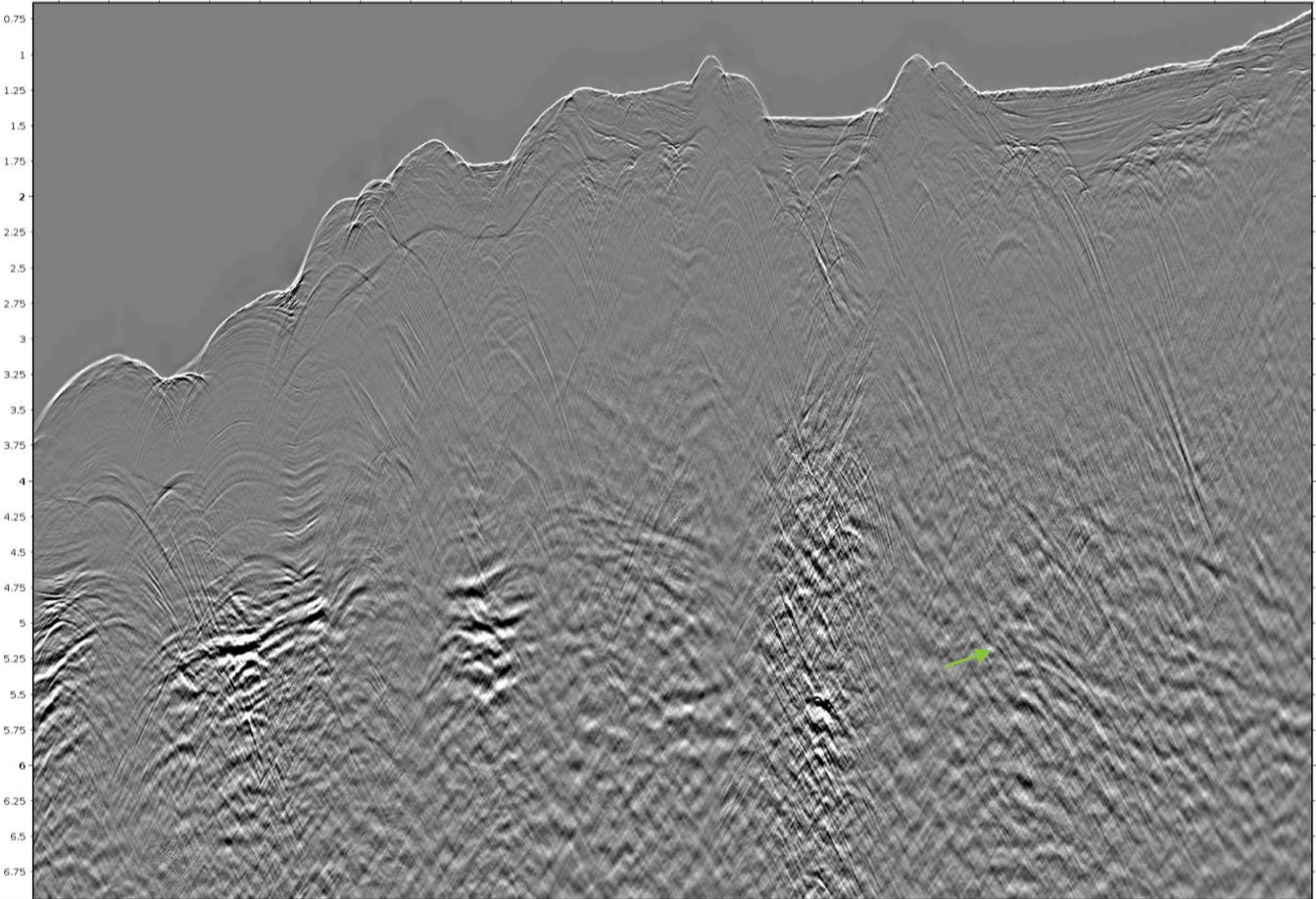
- Dipping noise is observed on stack.



Zoom in Stack after LNA

LINESEQ 18 / CROSSLINE

2929 3216 3503 3790 4077 4364 4651 4938 5225 5512 5799 6086 6373 6660 6947 7234 7521 7808 8095 8382 8669 8956 9243 9530 9817

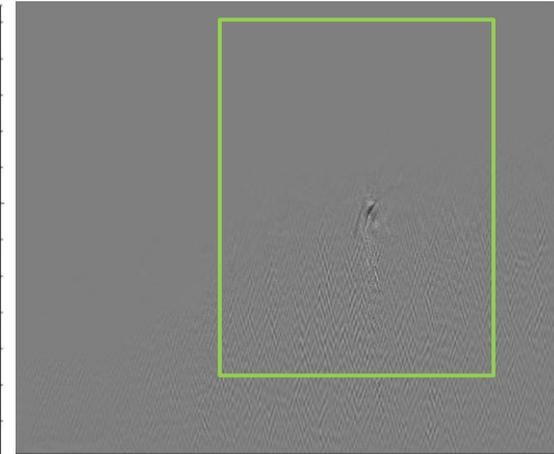
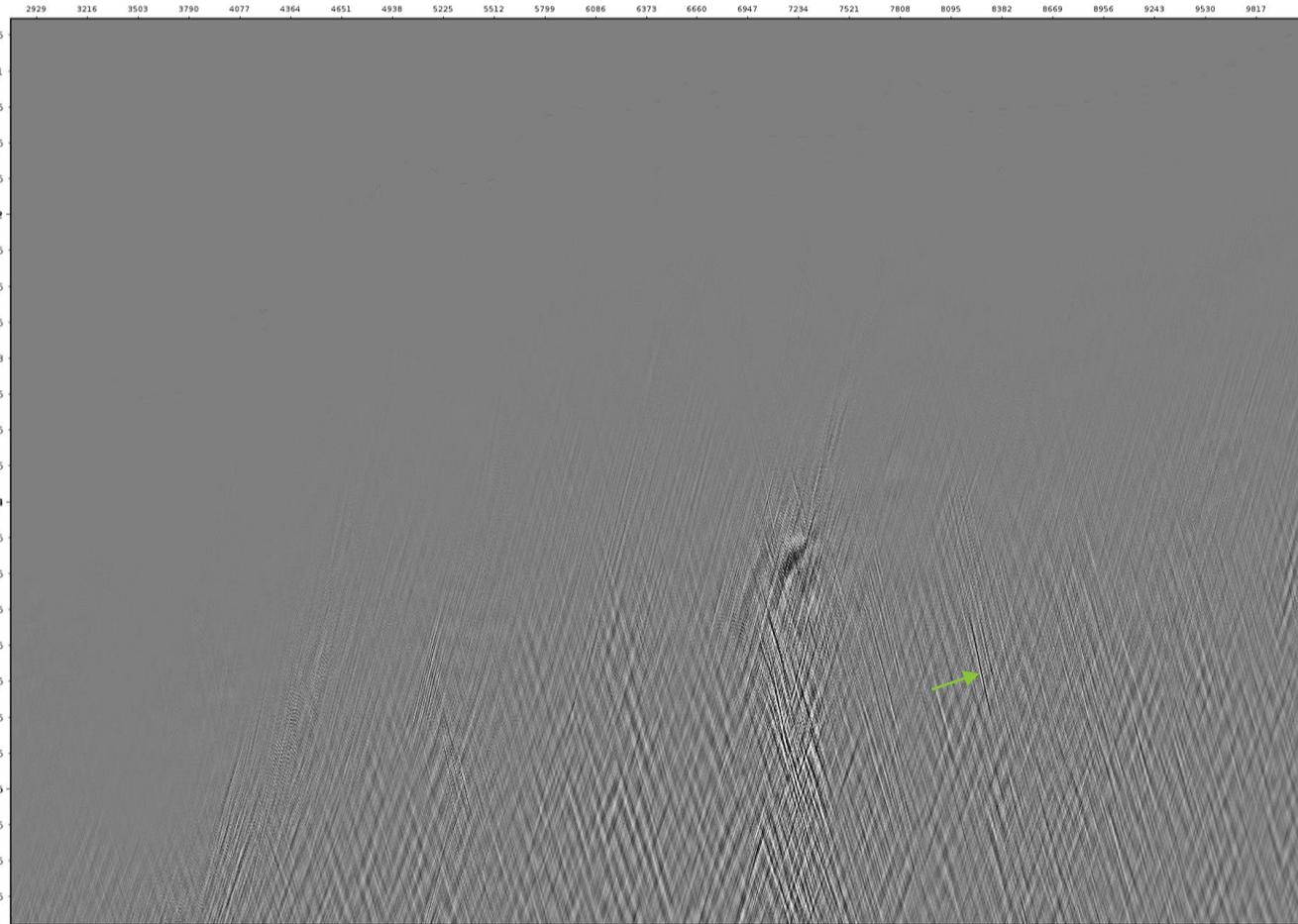


- Noise energy is attenuated.



Difference before - after LNA

LINESEQ 18 / CROSSLINE



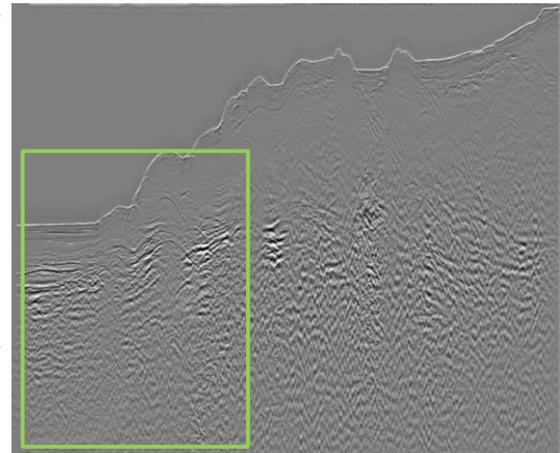
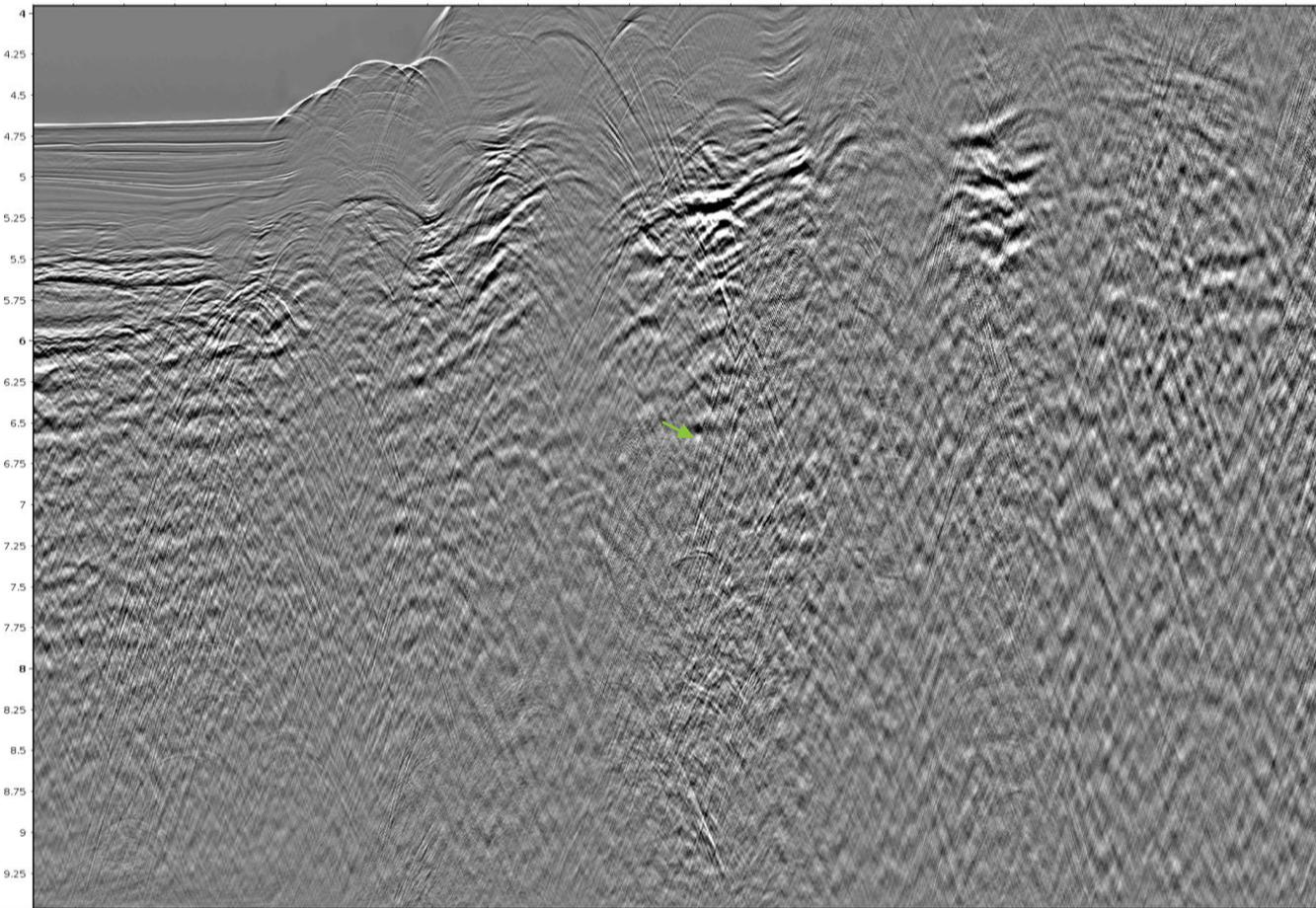
- No primary damage is observed on difference.



Zoom in Stack before LNA

LINESEQ 18 / CROSSLINE

809 1059 1309 1559 1809 2059 2309 2559 2809 3059 3309 3559 3809 4059 4309 4559 4809 5059 5309 5559 5809 6059 6309 6559 6809



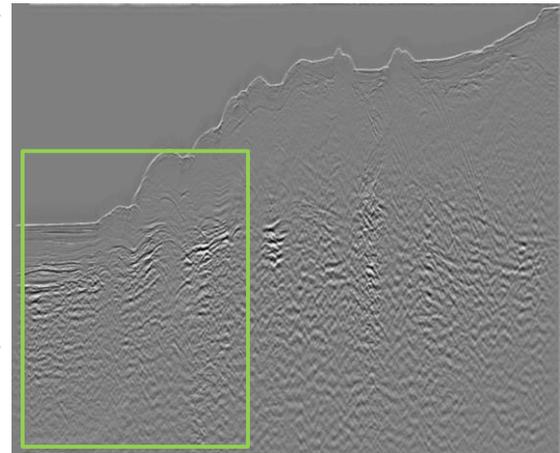
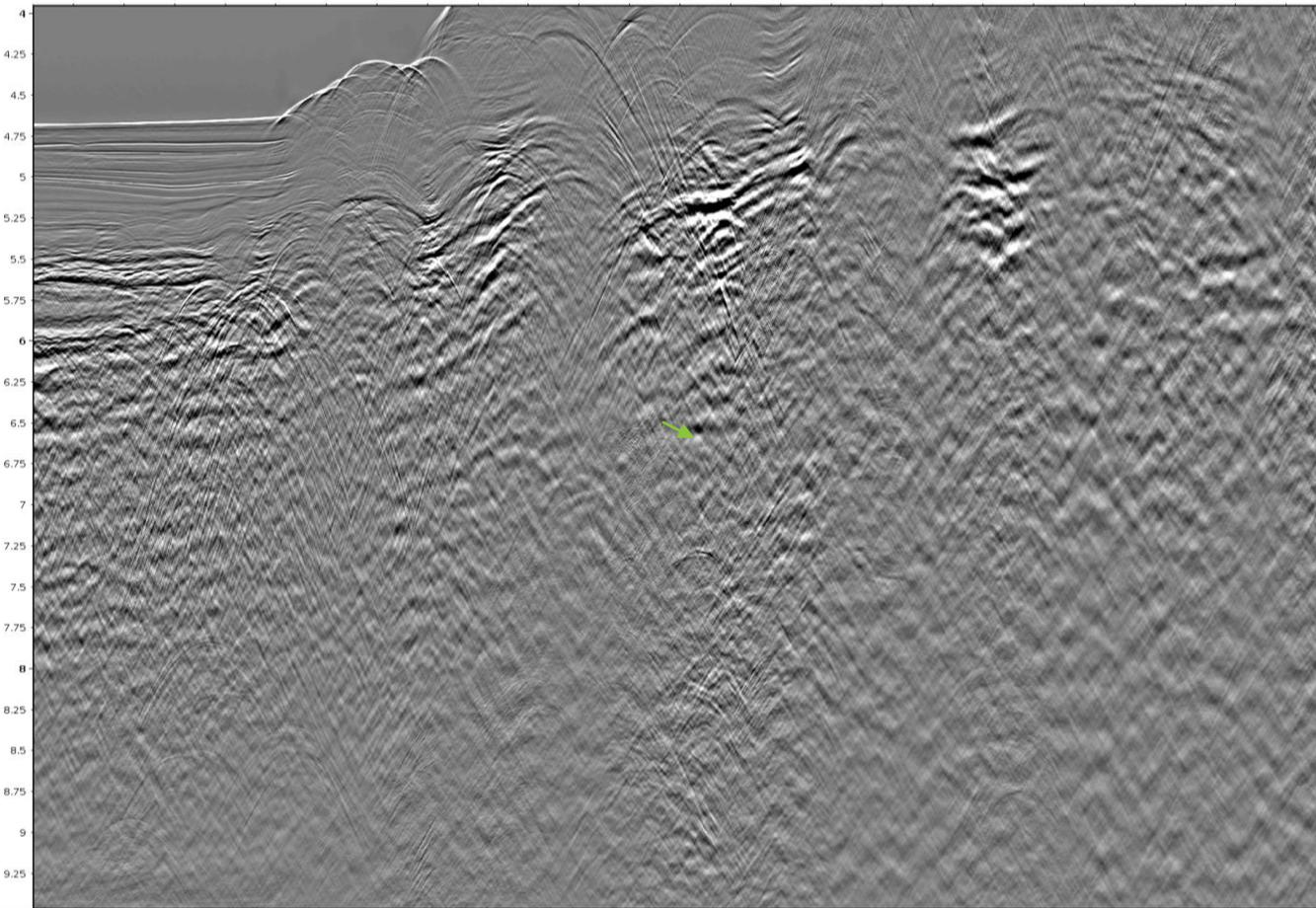
- Dipping noise and residual multiple diffractions are observed on stack.



Zoom in Stack after LNA

LINESEQ 18 / CROSSLINE

809 1059 1309 1559 1809 2059 2309 2559 2809 3059 3309 3559 3809 4059 4309 4559 4809 5059 5309 5559 5809 6059 6309 6559 6809



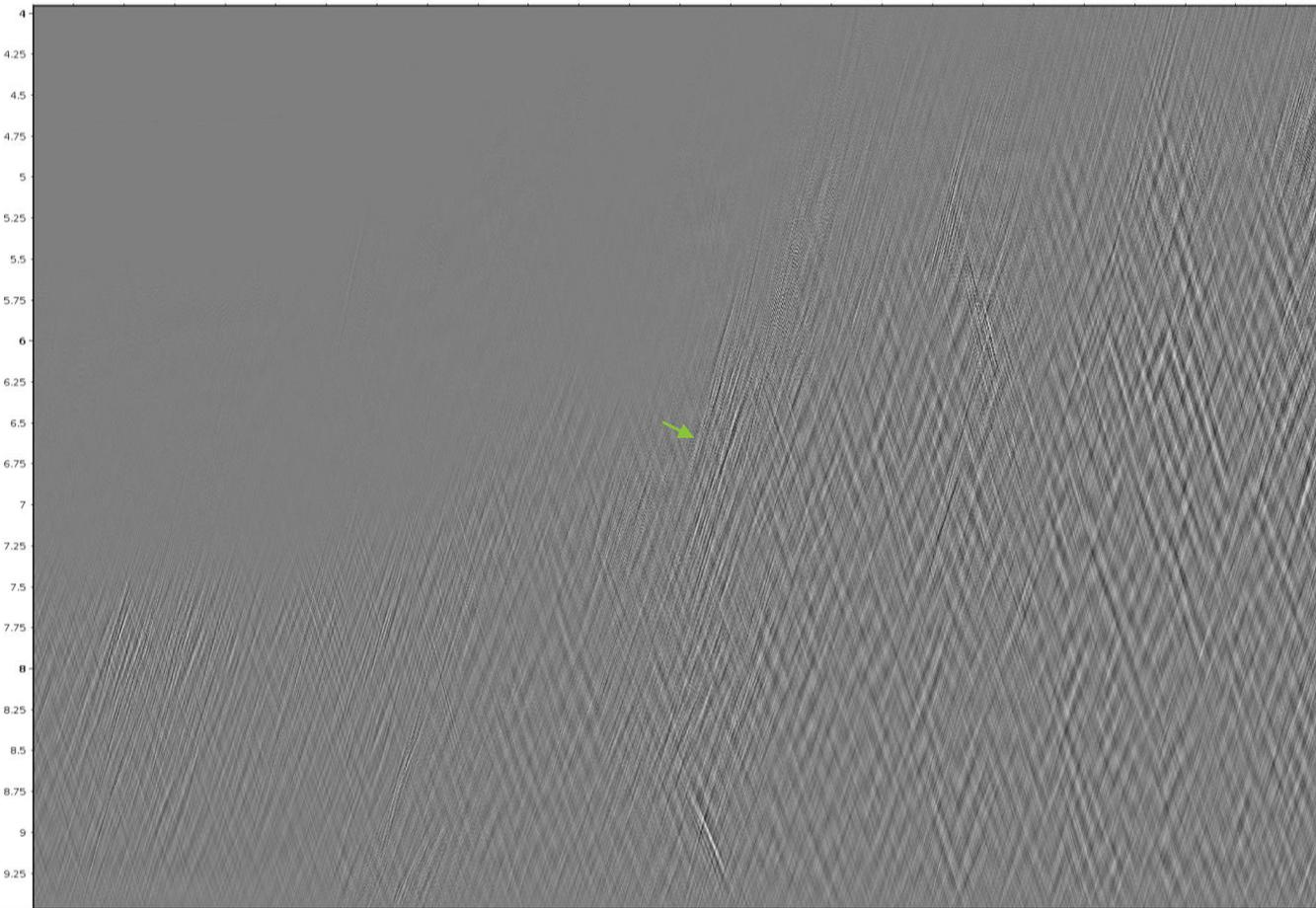
- Noise and residual multiple diffractions are also attenuated.



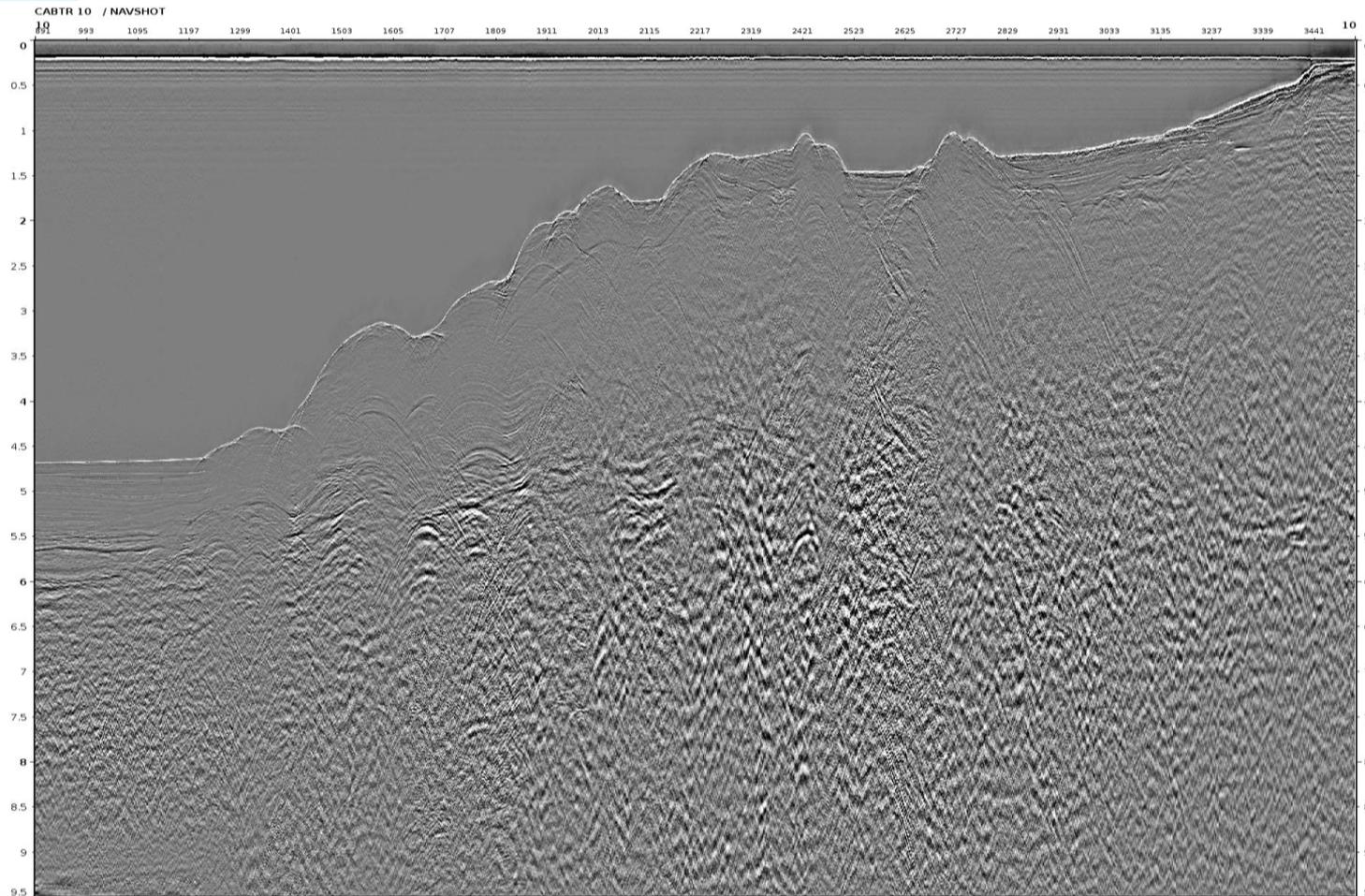
Difference before – after LNA

LINESEQ 18 / CROSSLINE

809 1059 1309 1559 1809 2059 2309 2559 2809 3059 3309 3559 3809 4059 4309 4559 4809 5059 5309 5559 5809 6059 6309 6559 6809

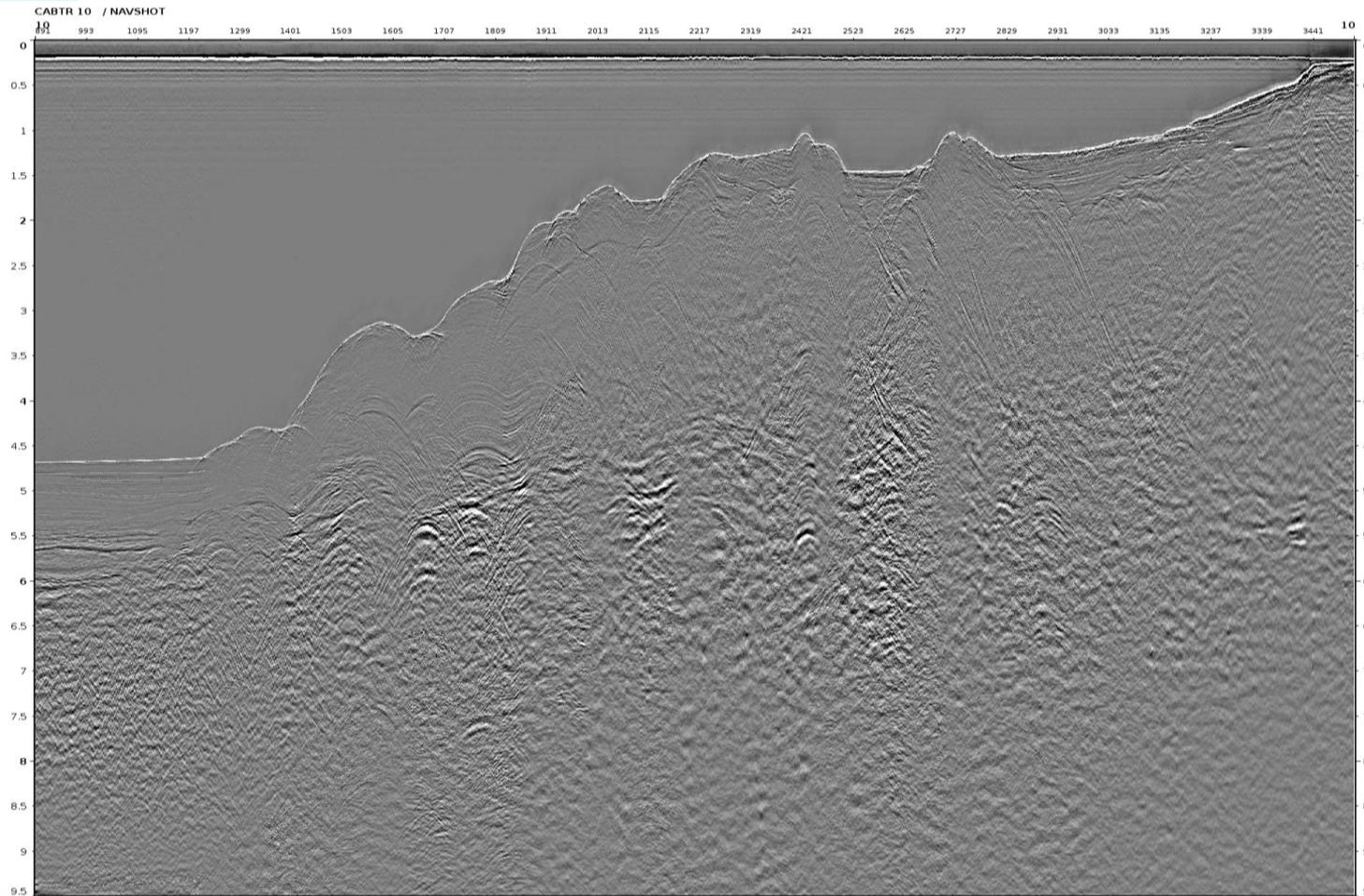


- No primary damage is observed on difference.



- Residual linear noise is visible on common channel.

Common Channel after LNA



- Noise energy is attenuated.

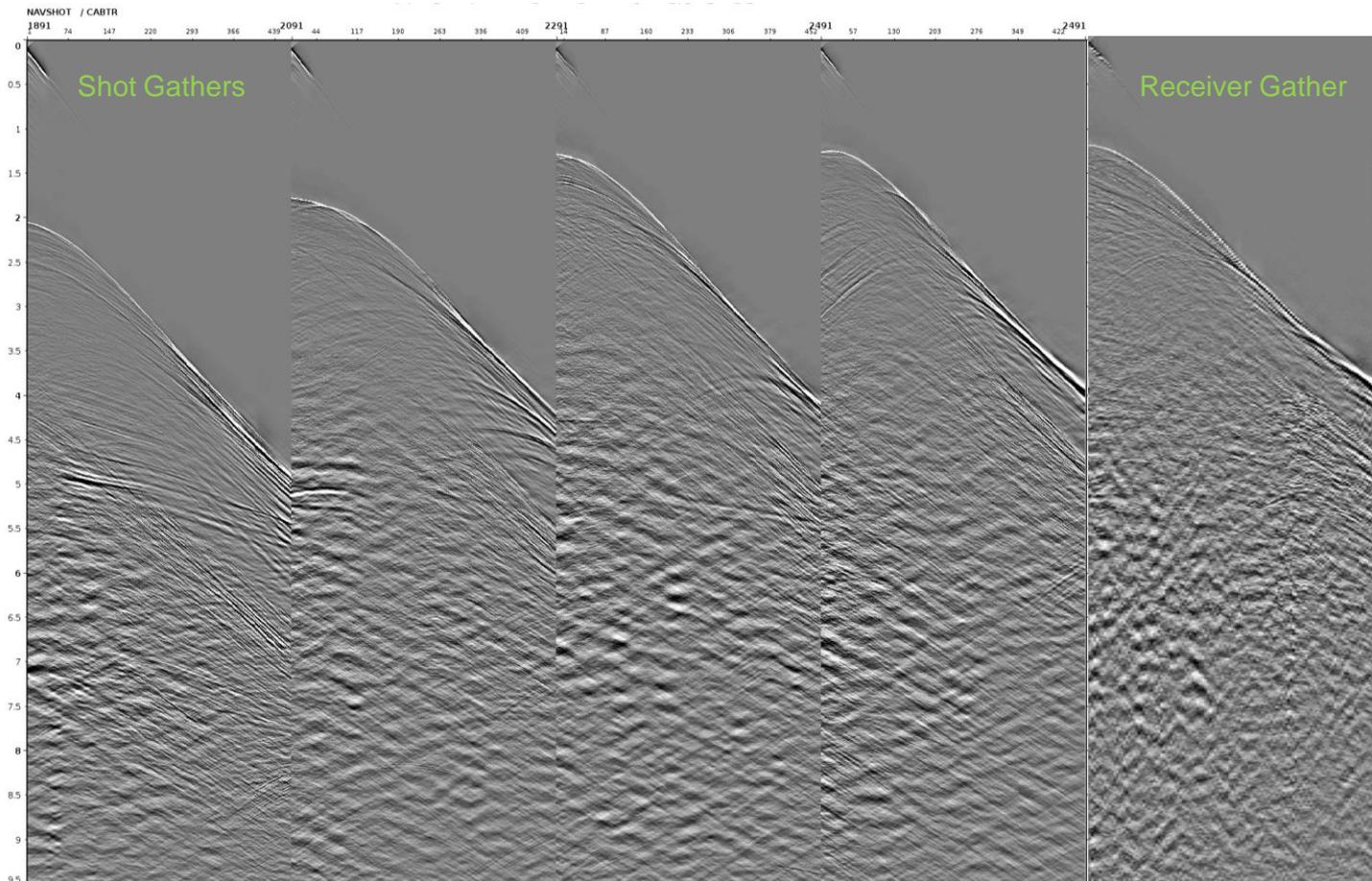


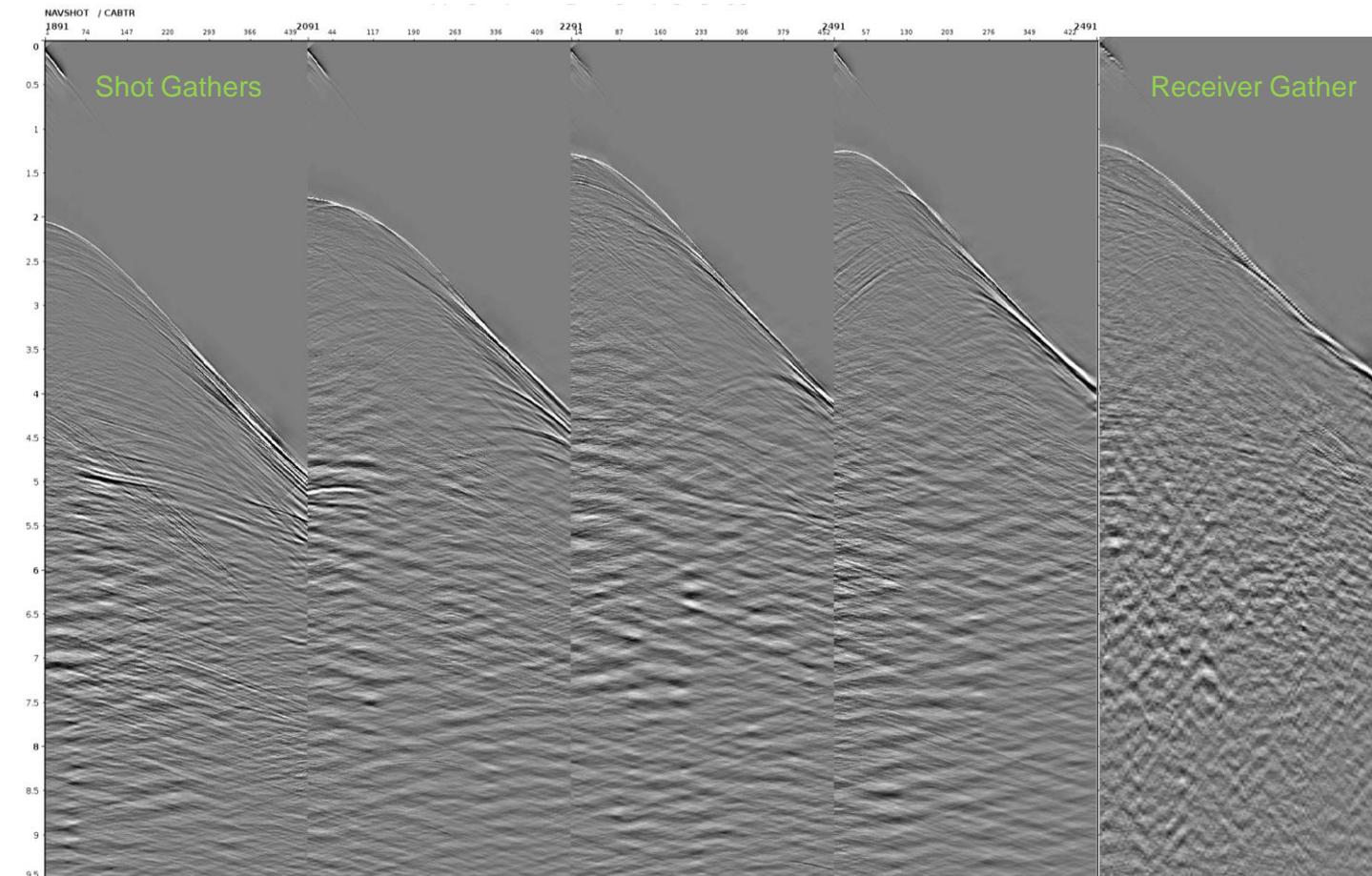
Difference before – after LNA



- No primary damage is observed on difference.

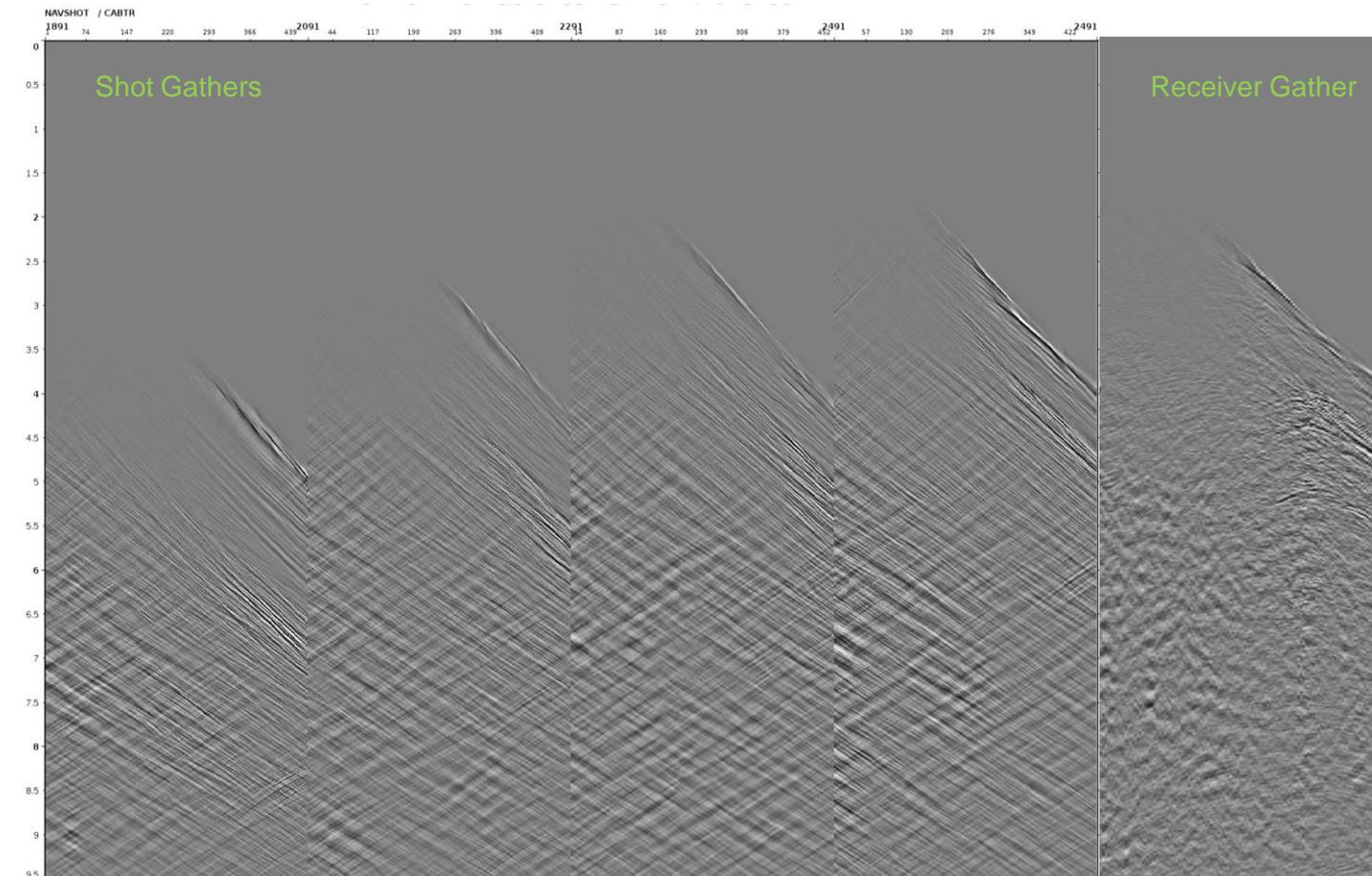
Selected Gathers before Shot LNA





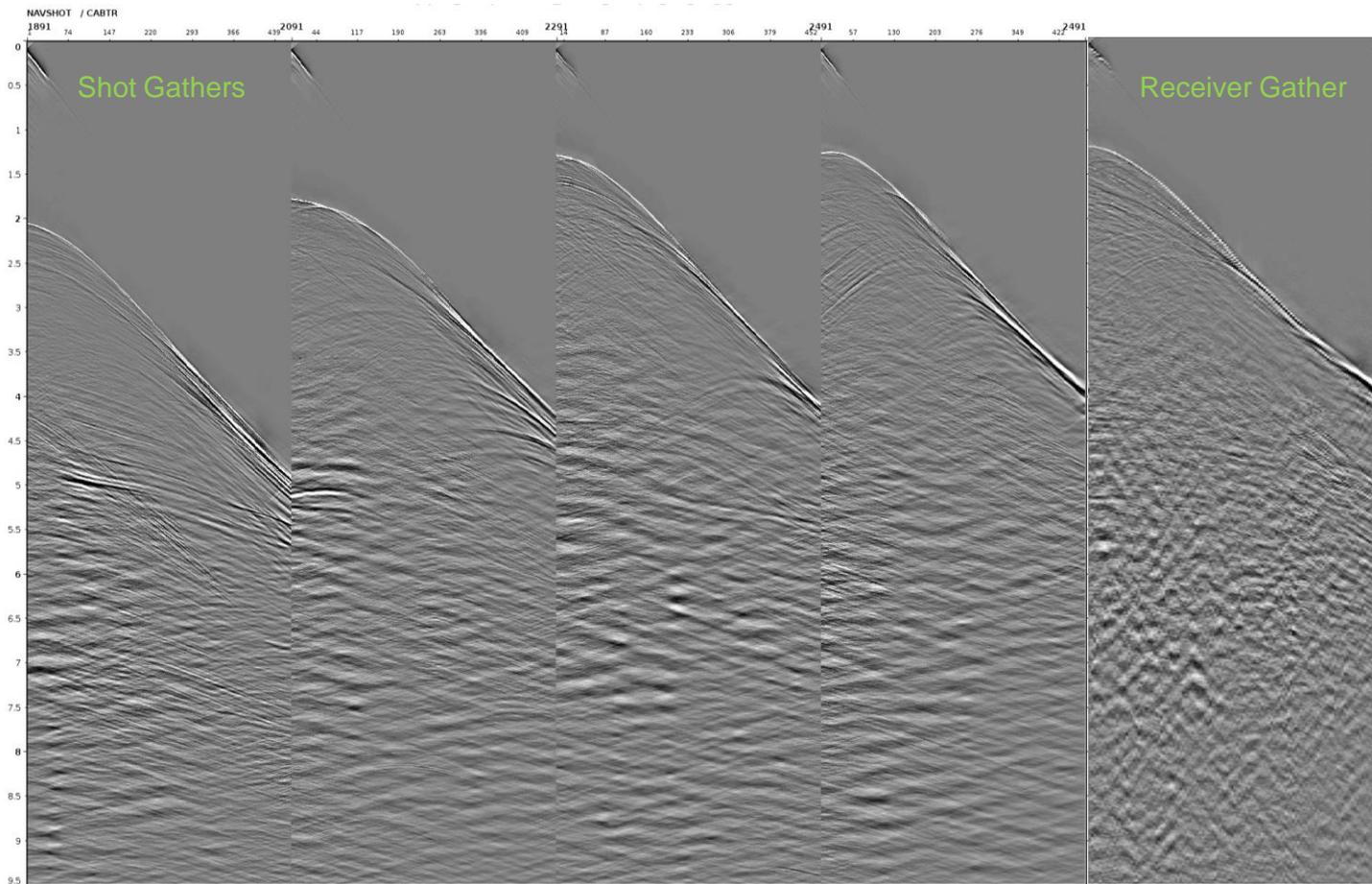
- Linear noises on shot gathers are attenuated

Difference before – after Shot LNA

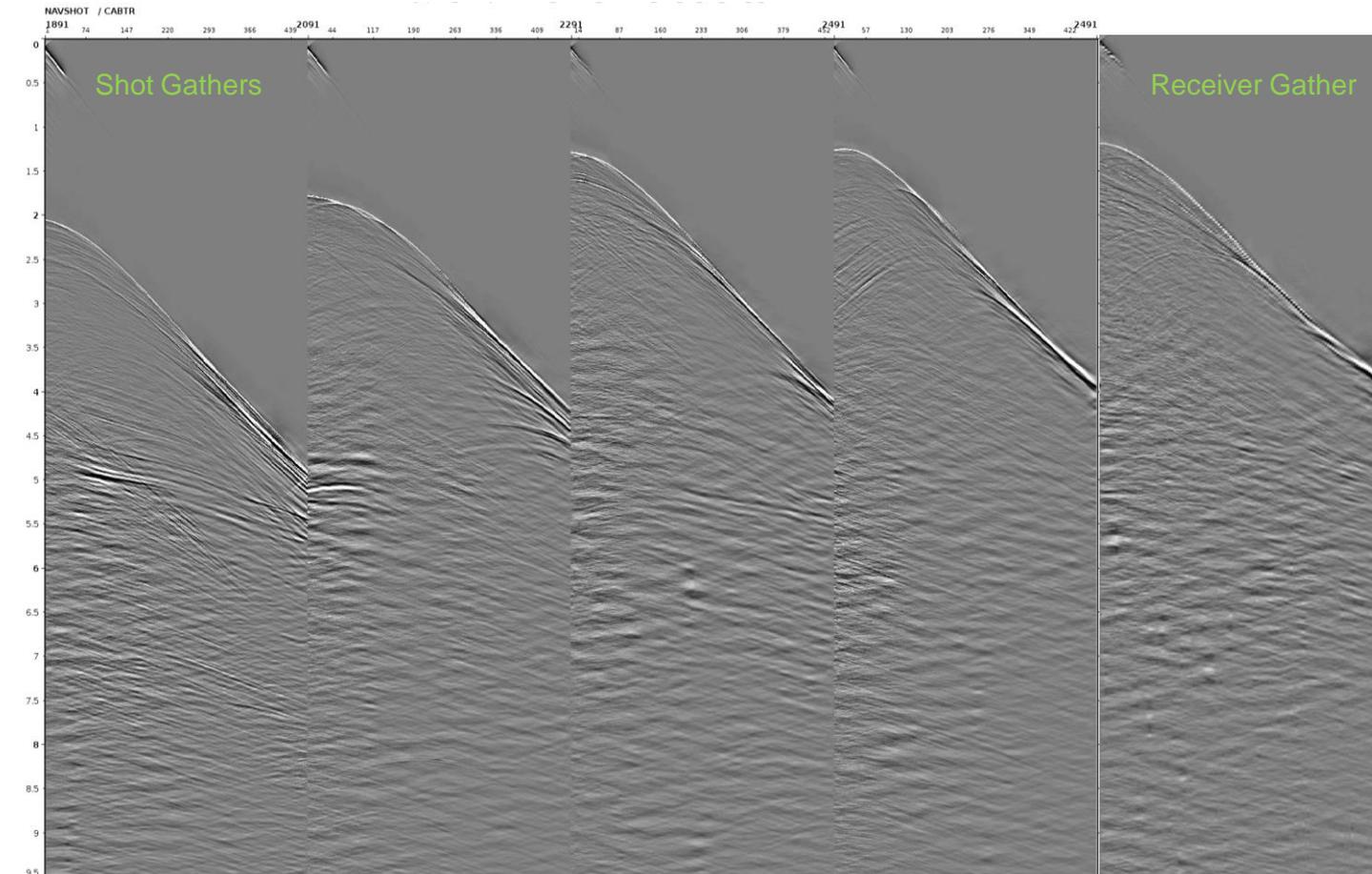


- No primary damage is observed on shot gathers.

Selected Gathers after Shot LNA (copy)

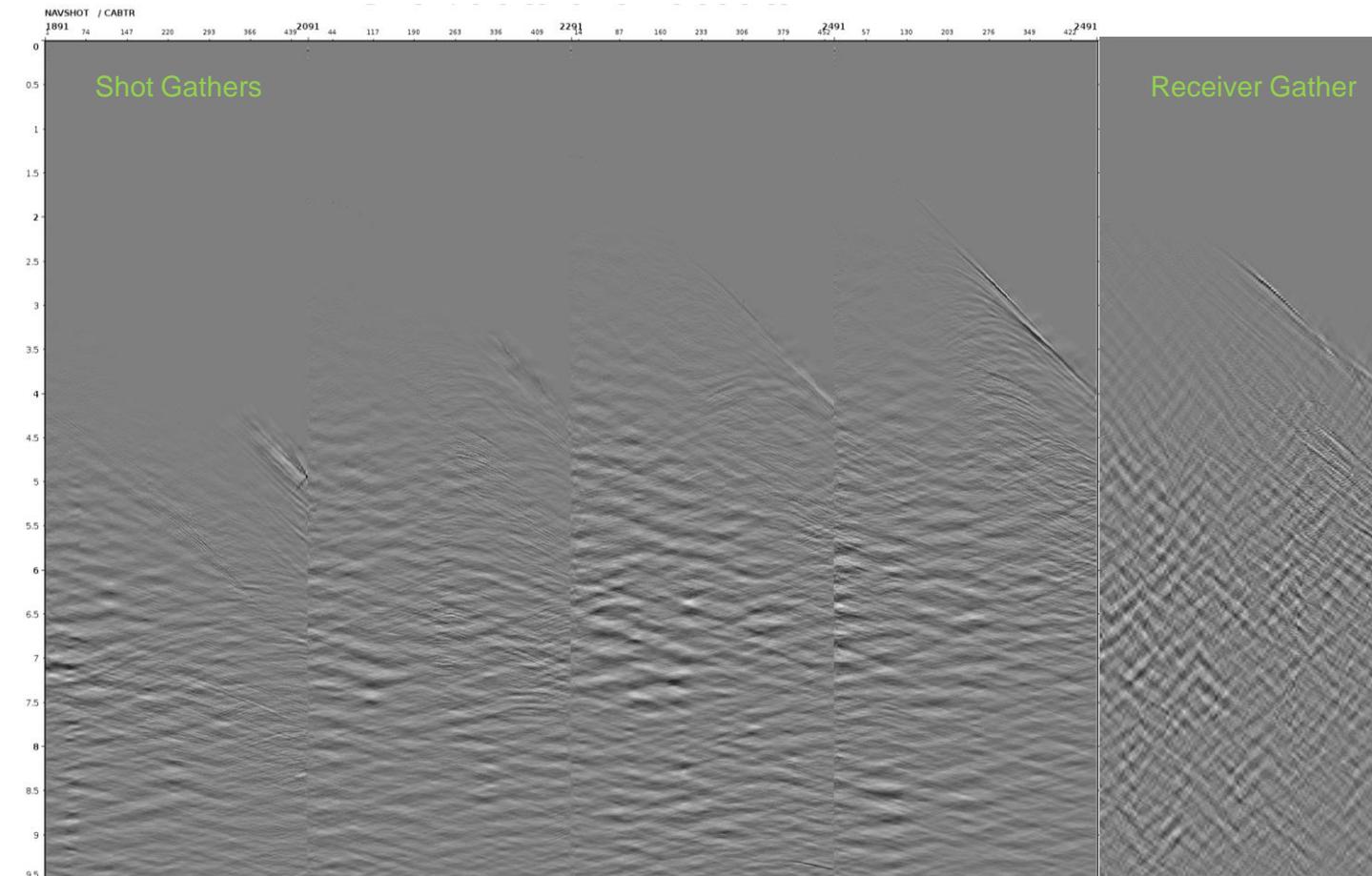


Selected Gathers after Receiver LNA



- Linear noises on receiver gather are attenuated

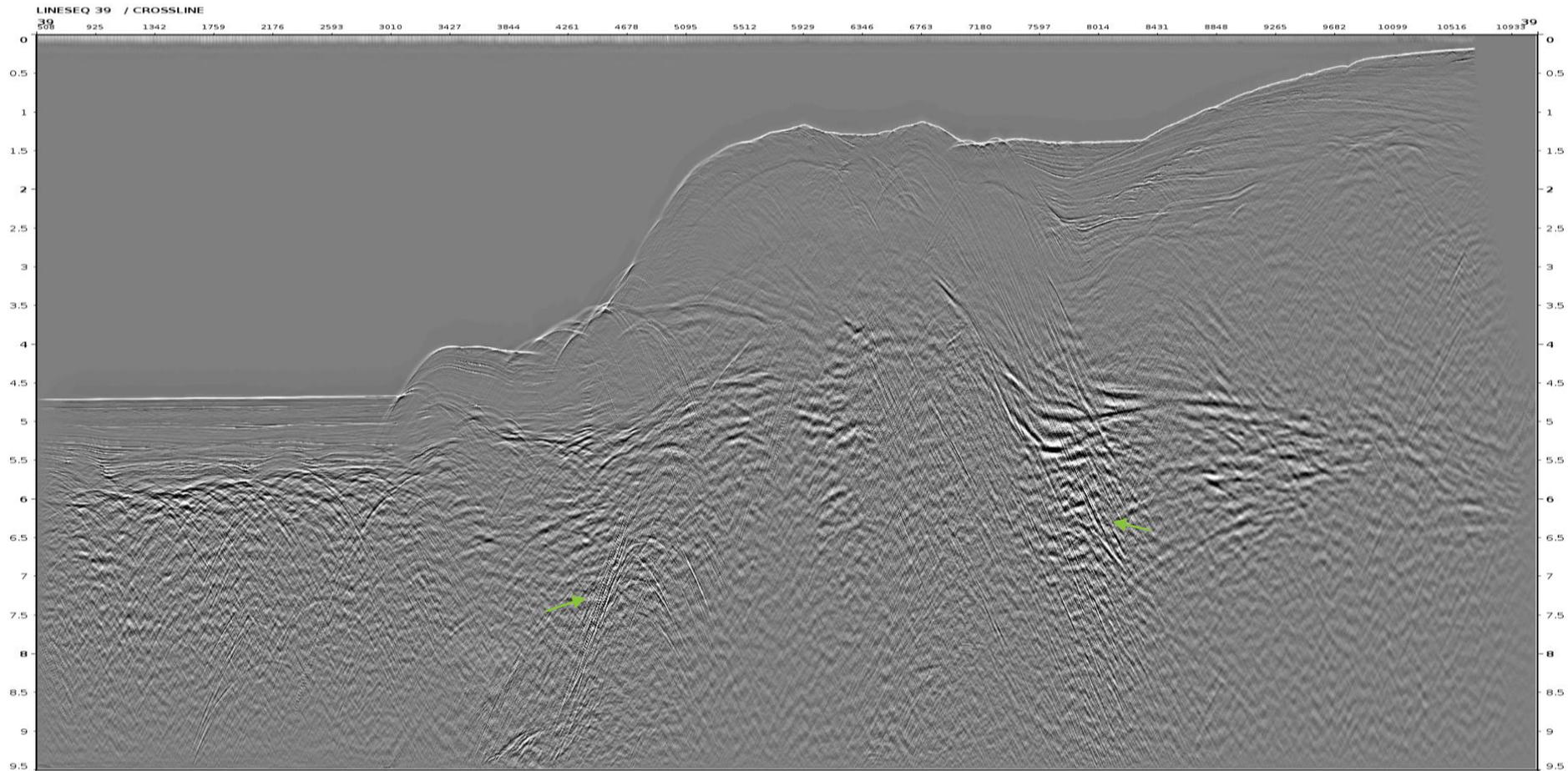
Difference before – after Receiver LNA

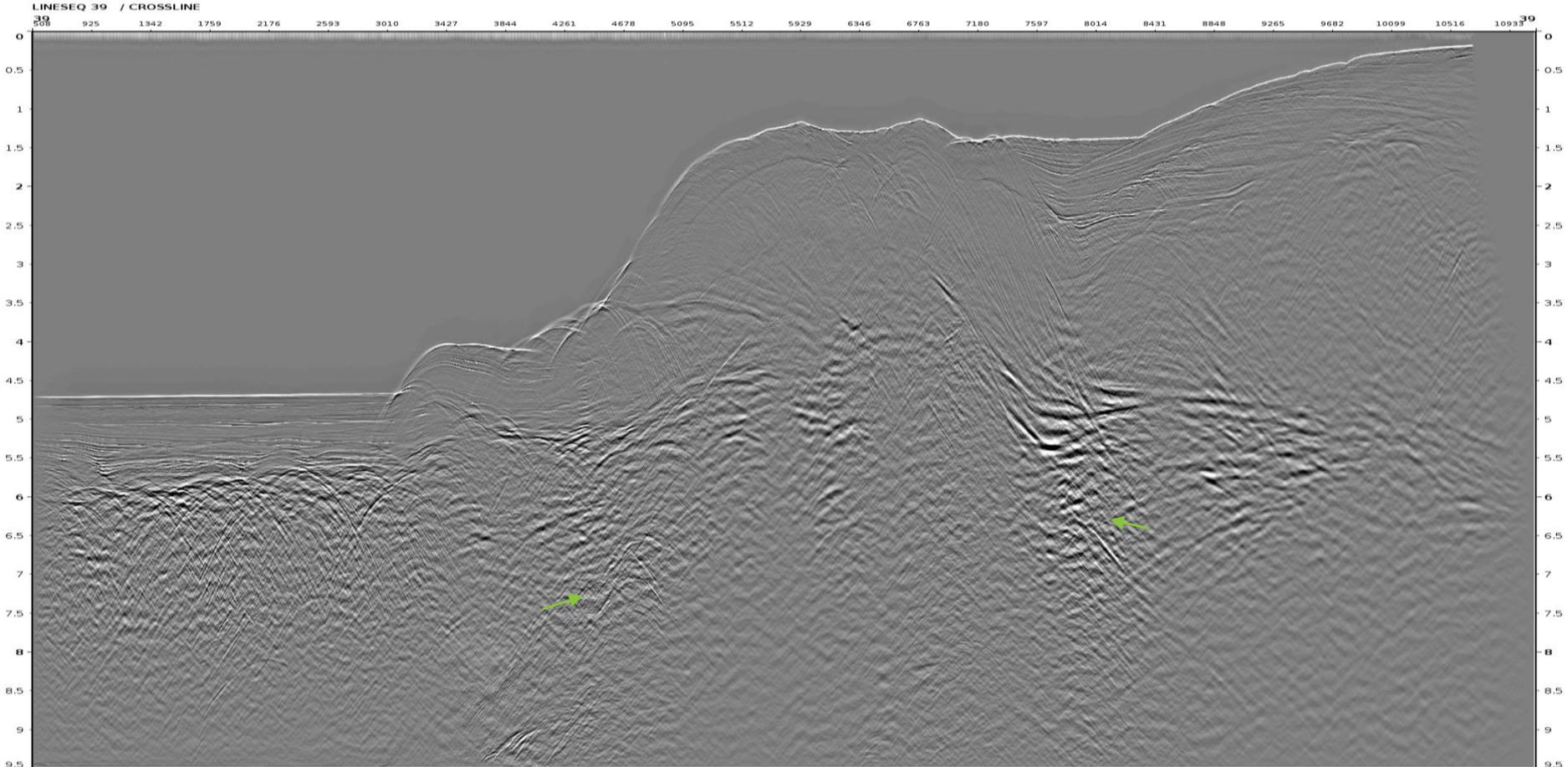


- No primary damage is observed on receiver gather.

Seq 039

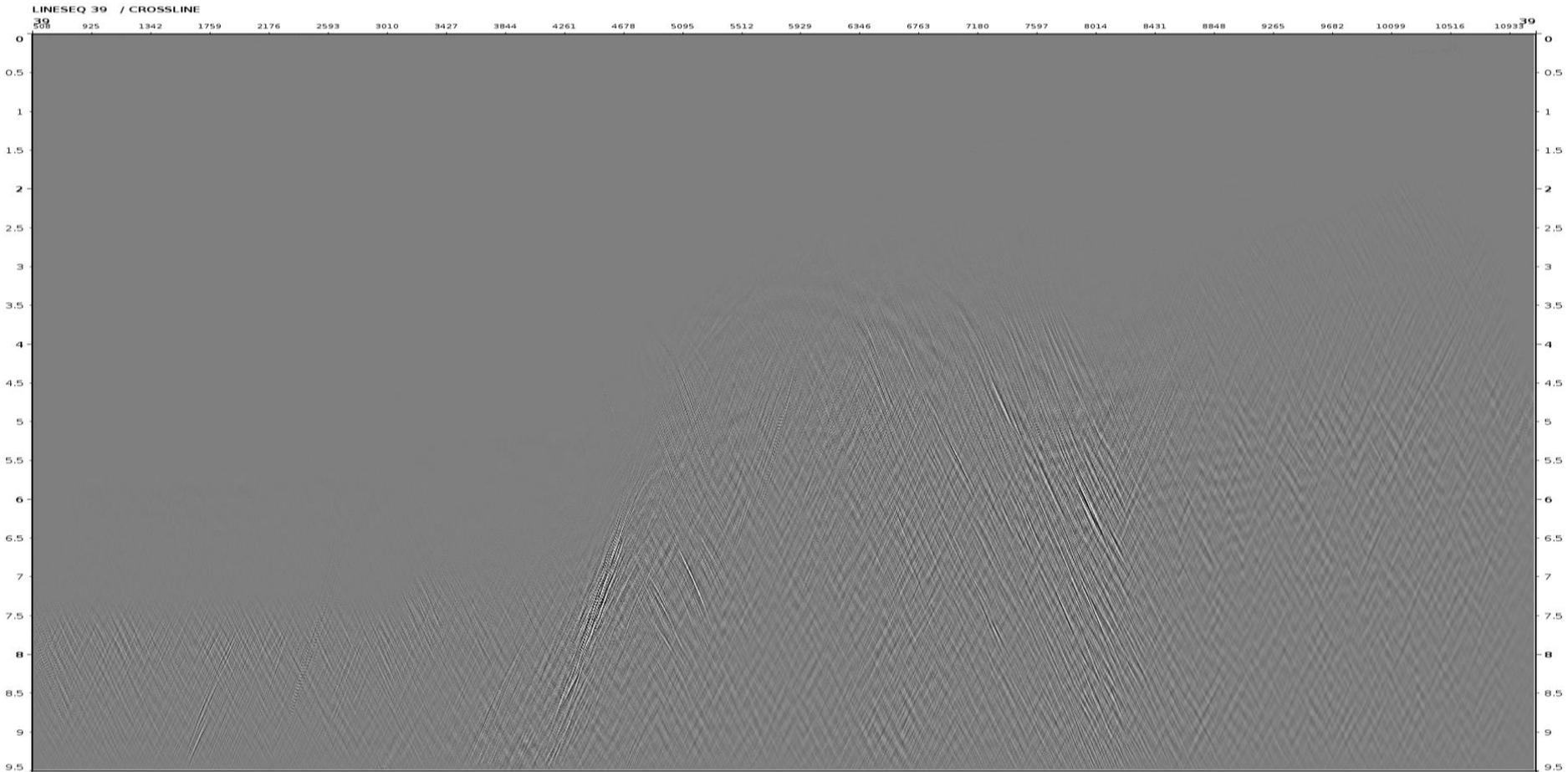
- Stack
- Common Channel
- Gathers







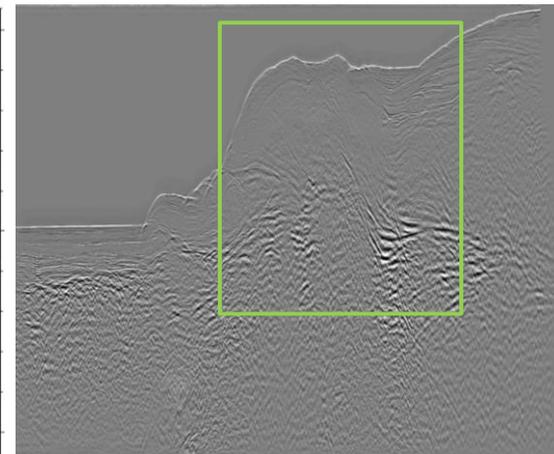
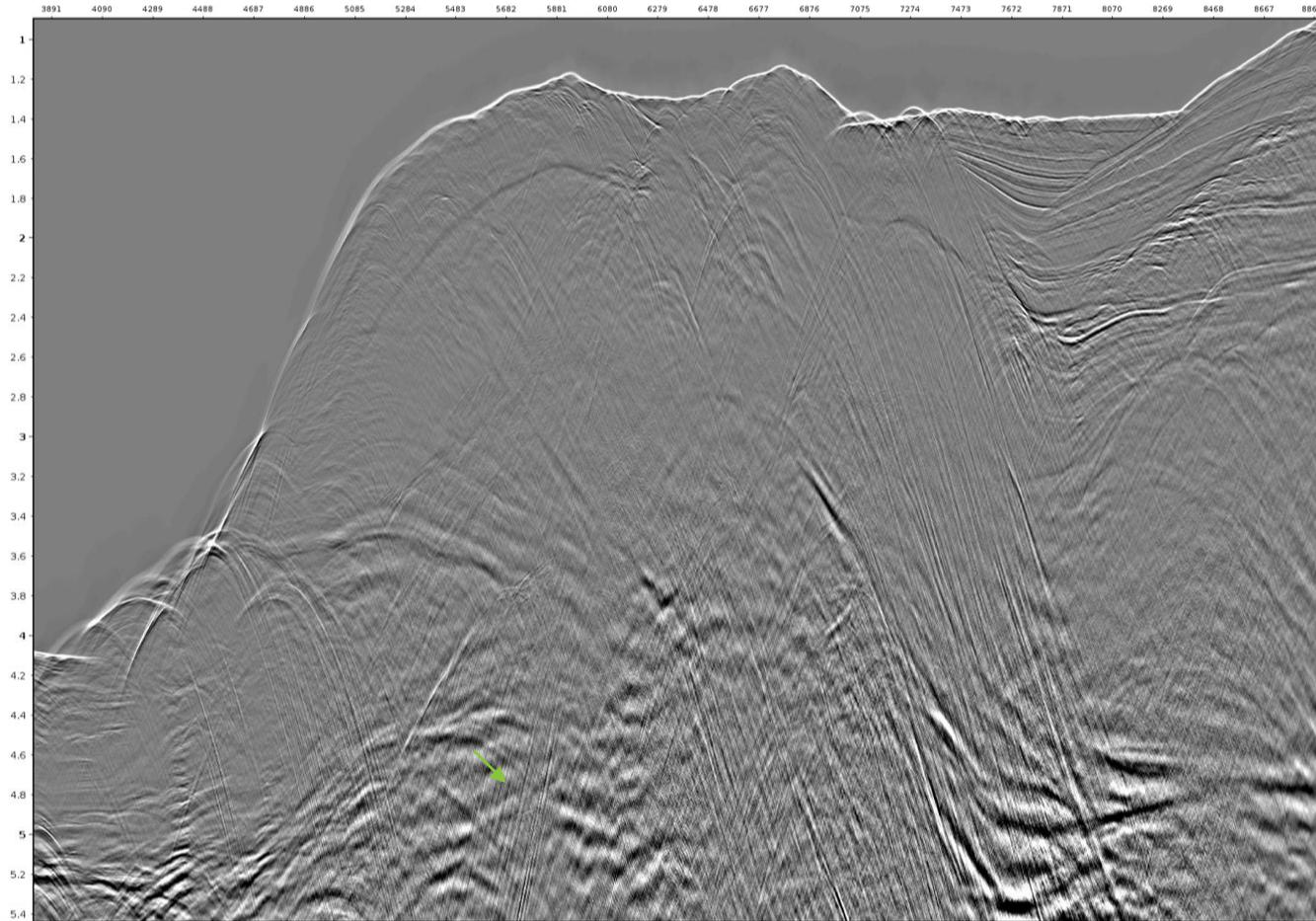
Difference before – after LNA





Zoom in Stack before LNA

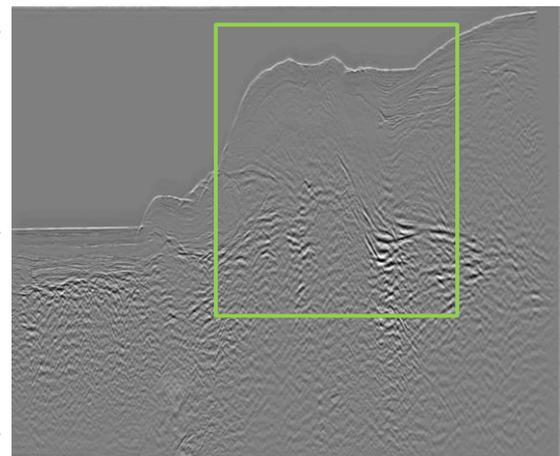
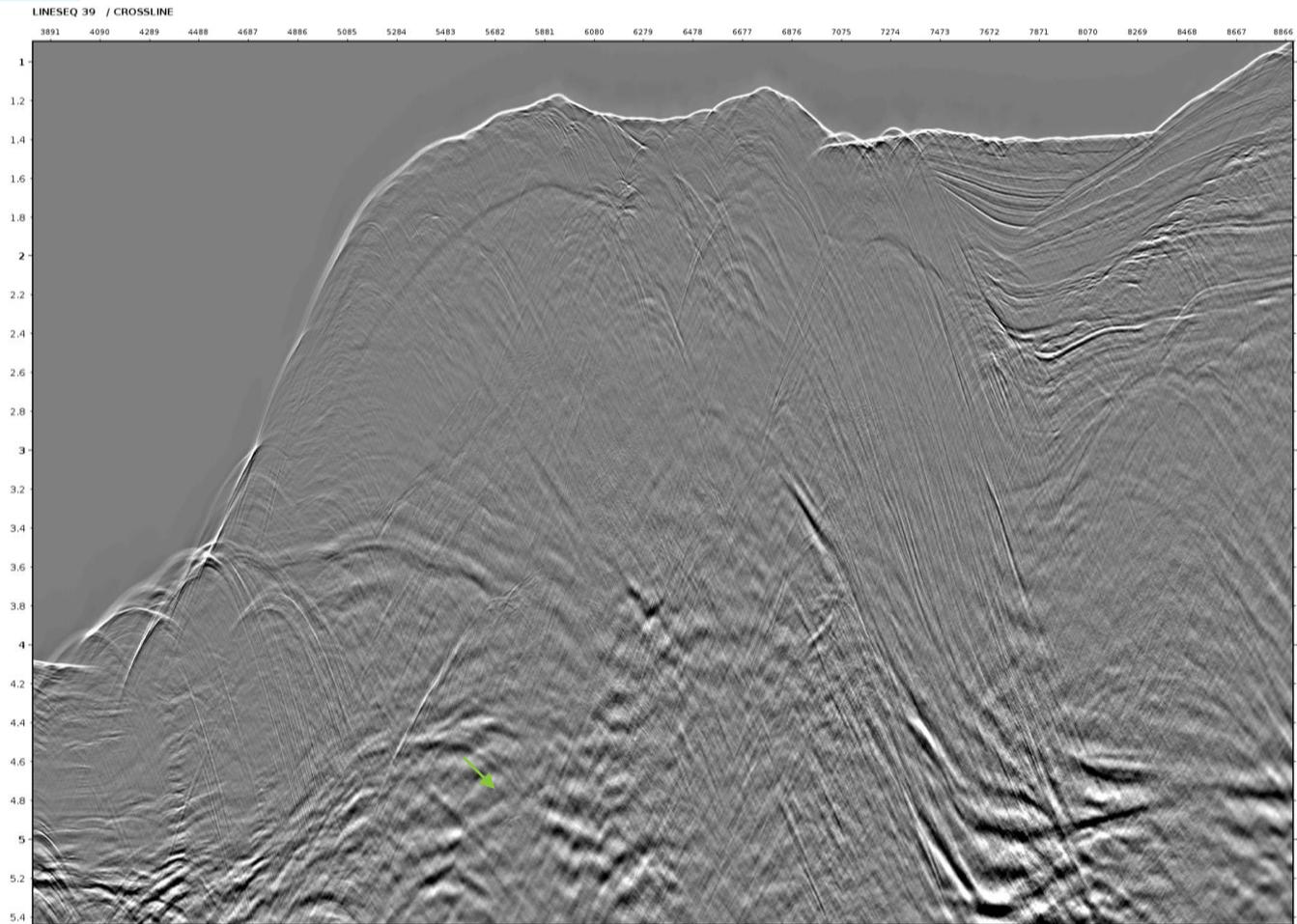
LINESEQ 39 / CROSSLINE



- Dipping noise is observed on stack.



Zoom in Stack after LNA

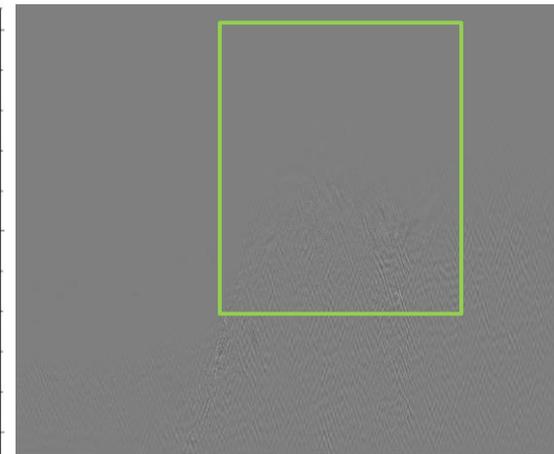
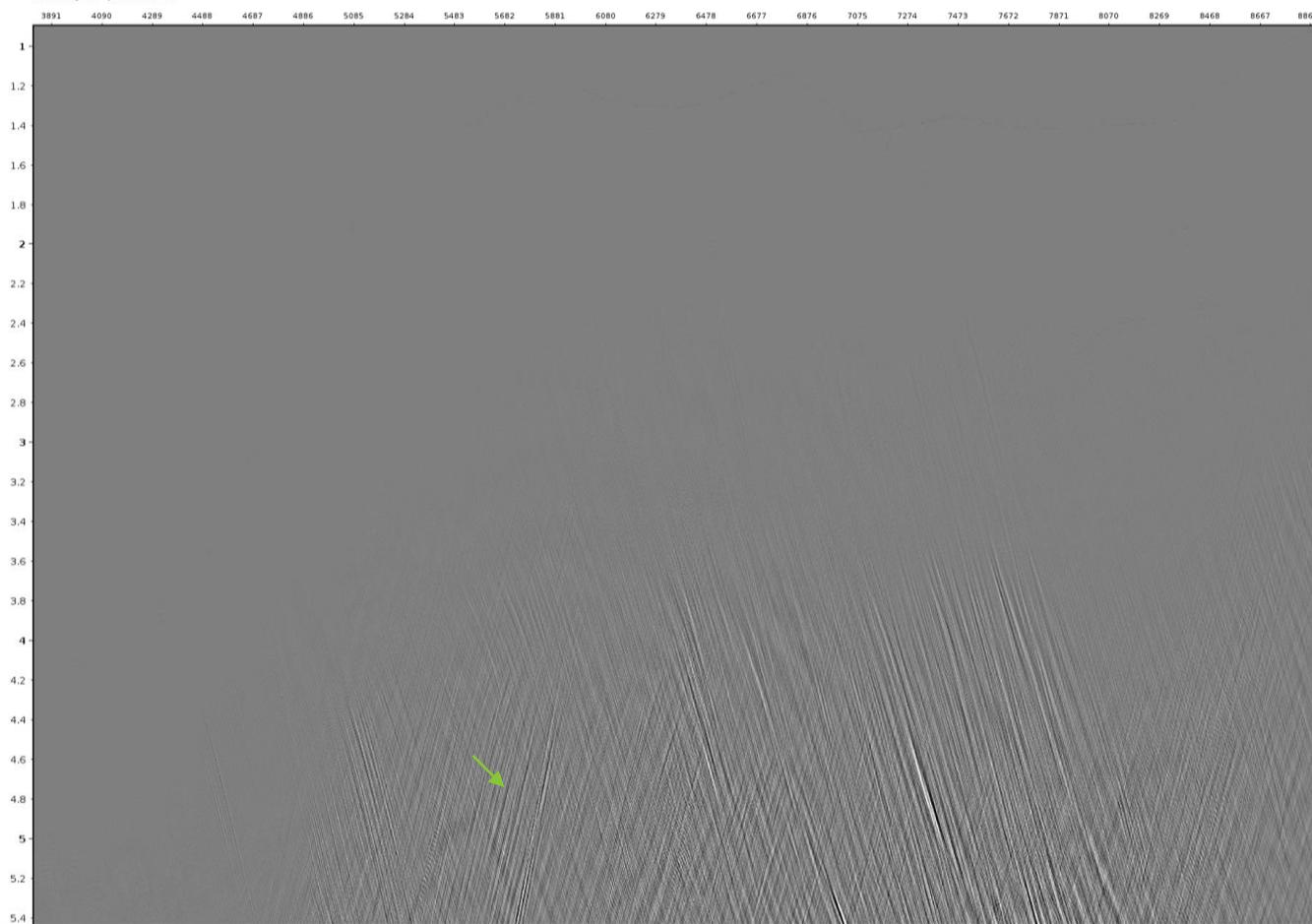


- Noise energy is attenuated.

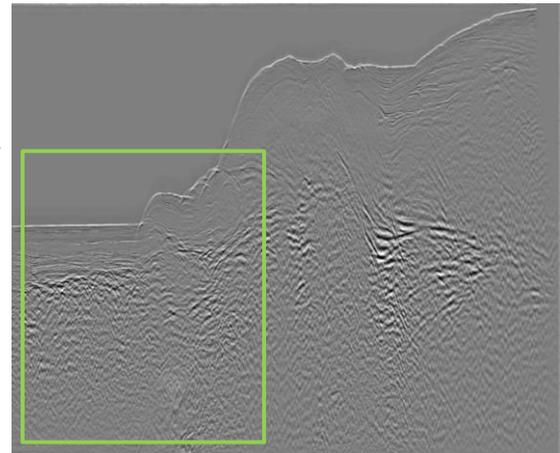
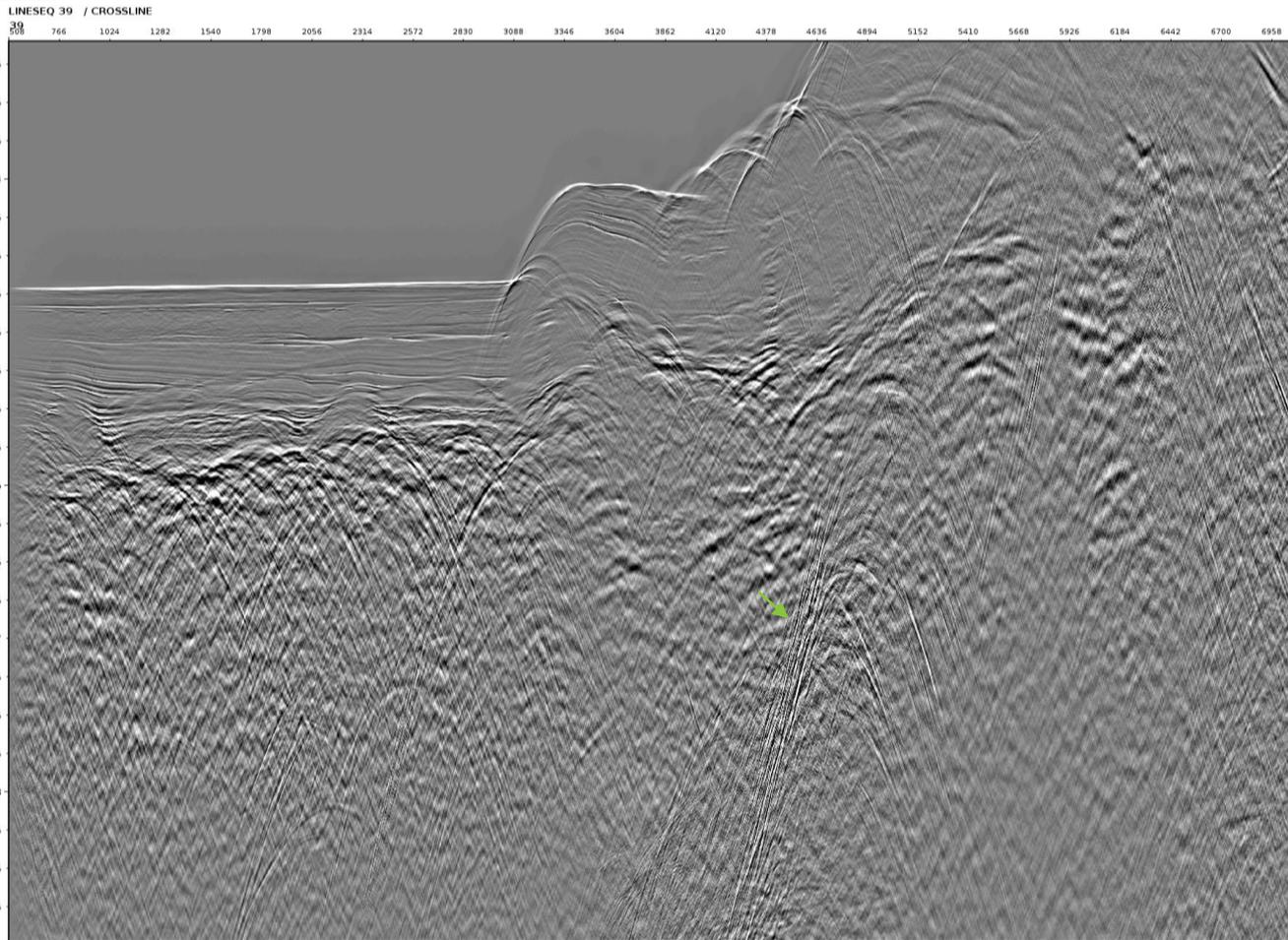


Difference before – after LNA

LINESEQ 39 / CROSSLINE



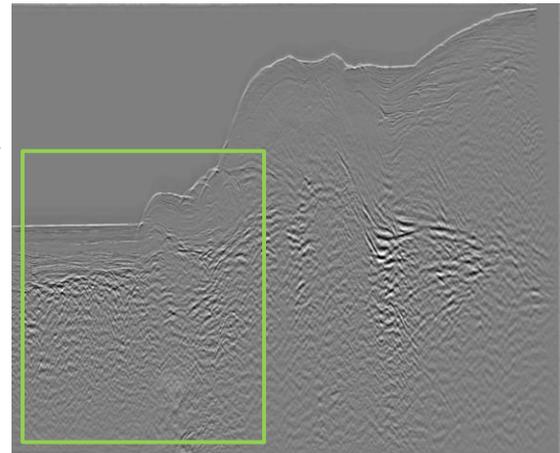
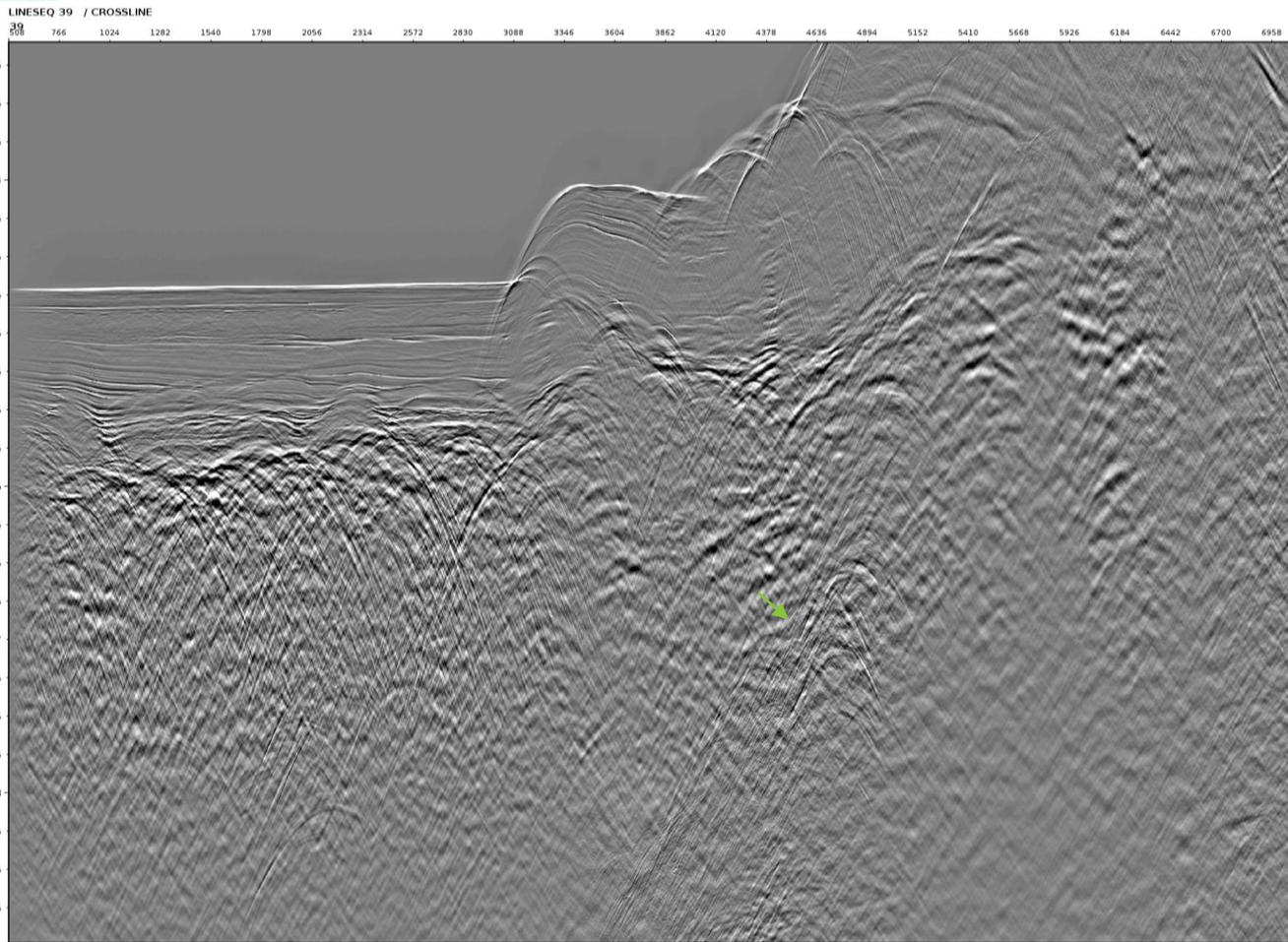
- No primary damage is observed on difference.



- Dipping noise and residual multiple diffractions are observed on stack.



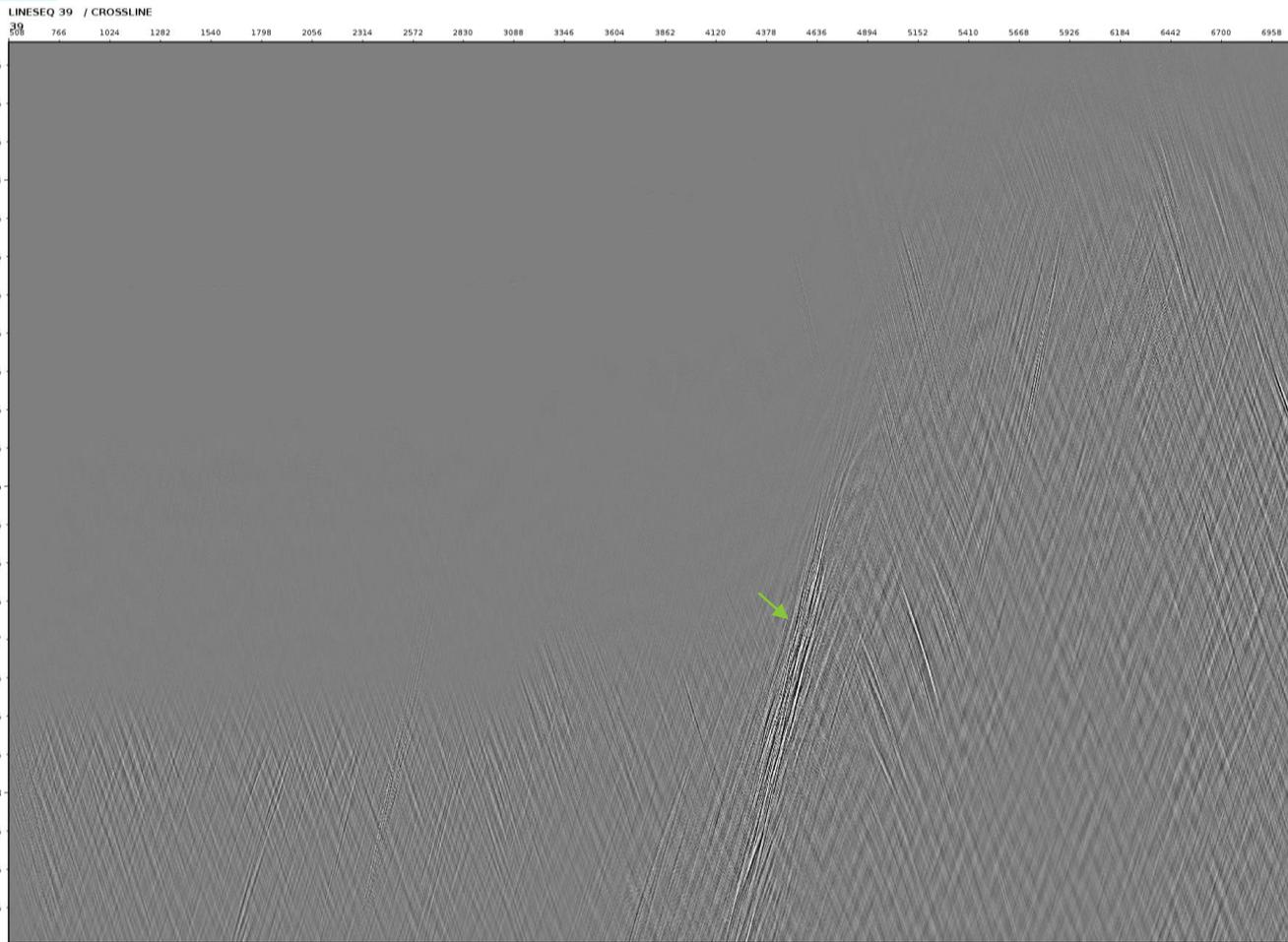
Zoom in Stack after LNA



- Noise and residual multiple diffractions are also attenuated.

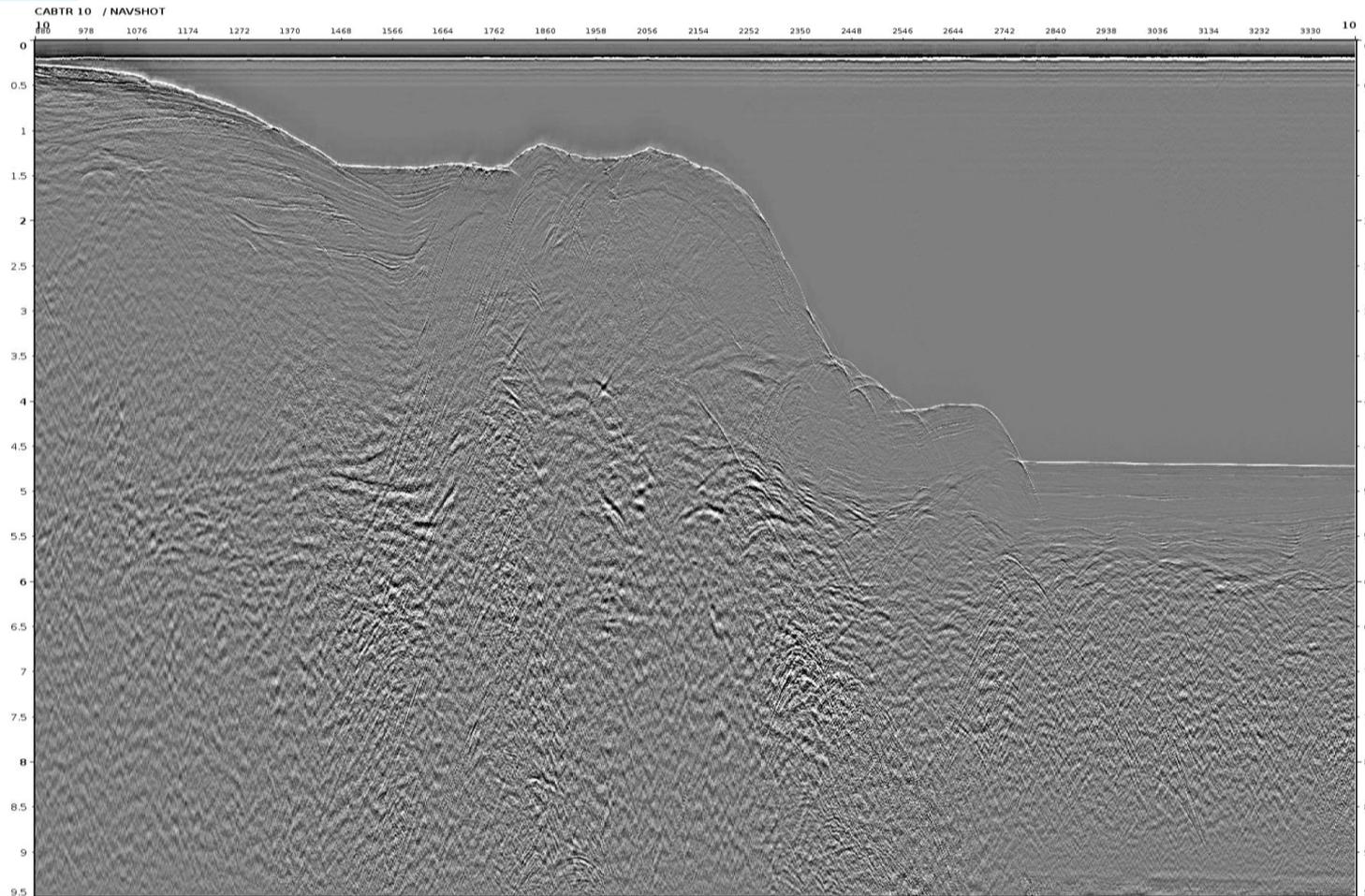


Difference before – after LNA



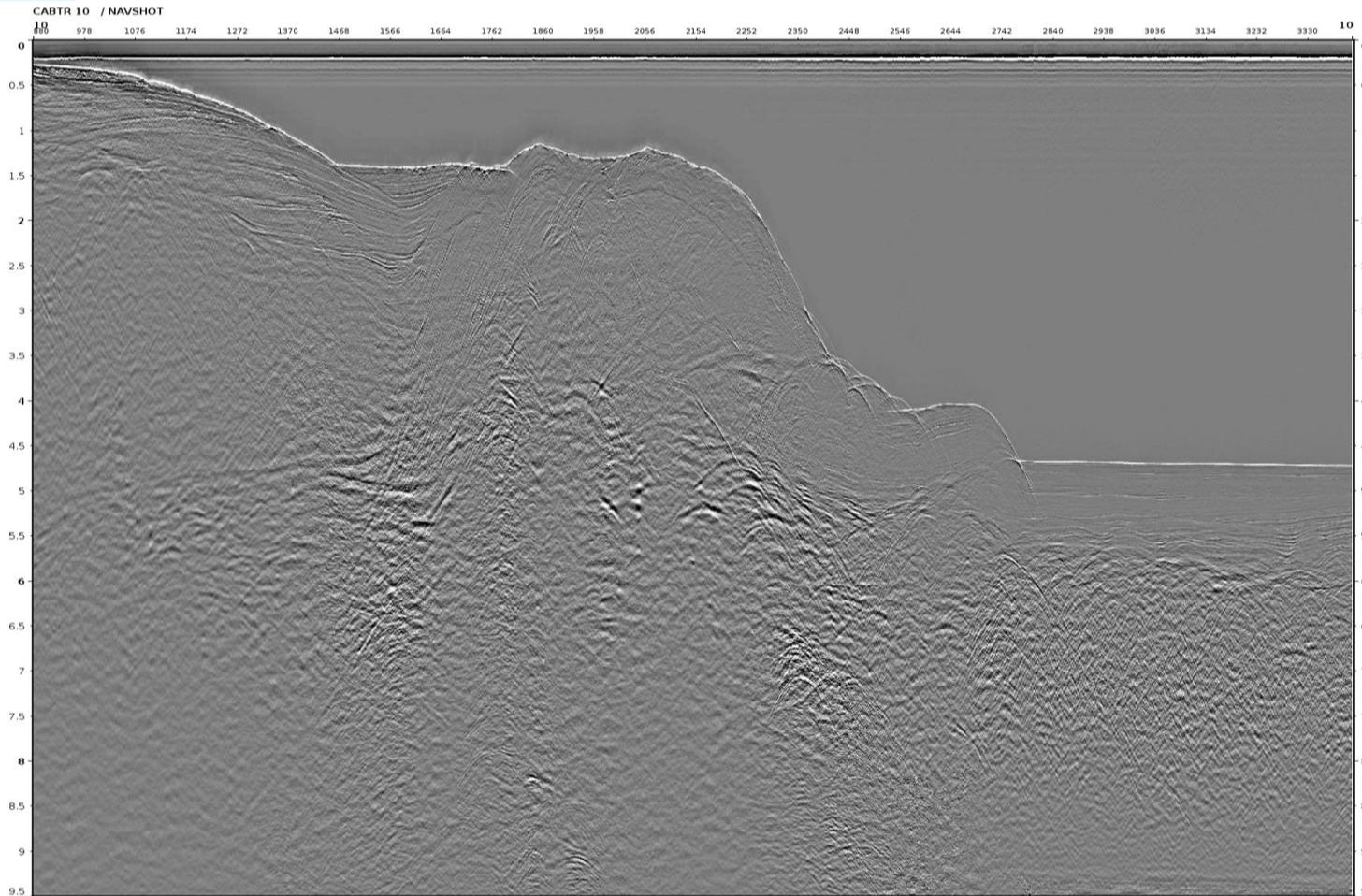
- No primary damage is observed on difference.

Common Channel before LNA



- Residual linear noise is visible on common channel.

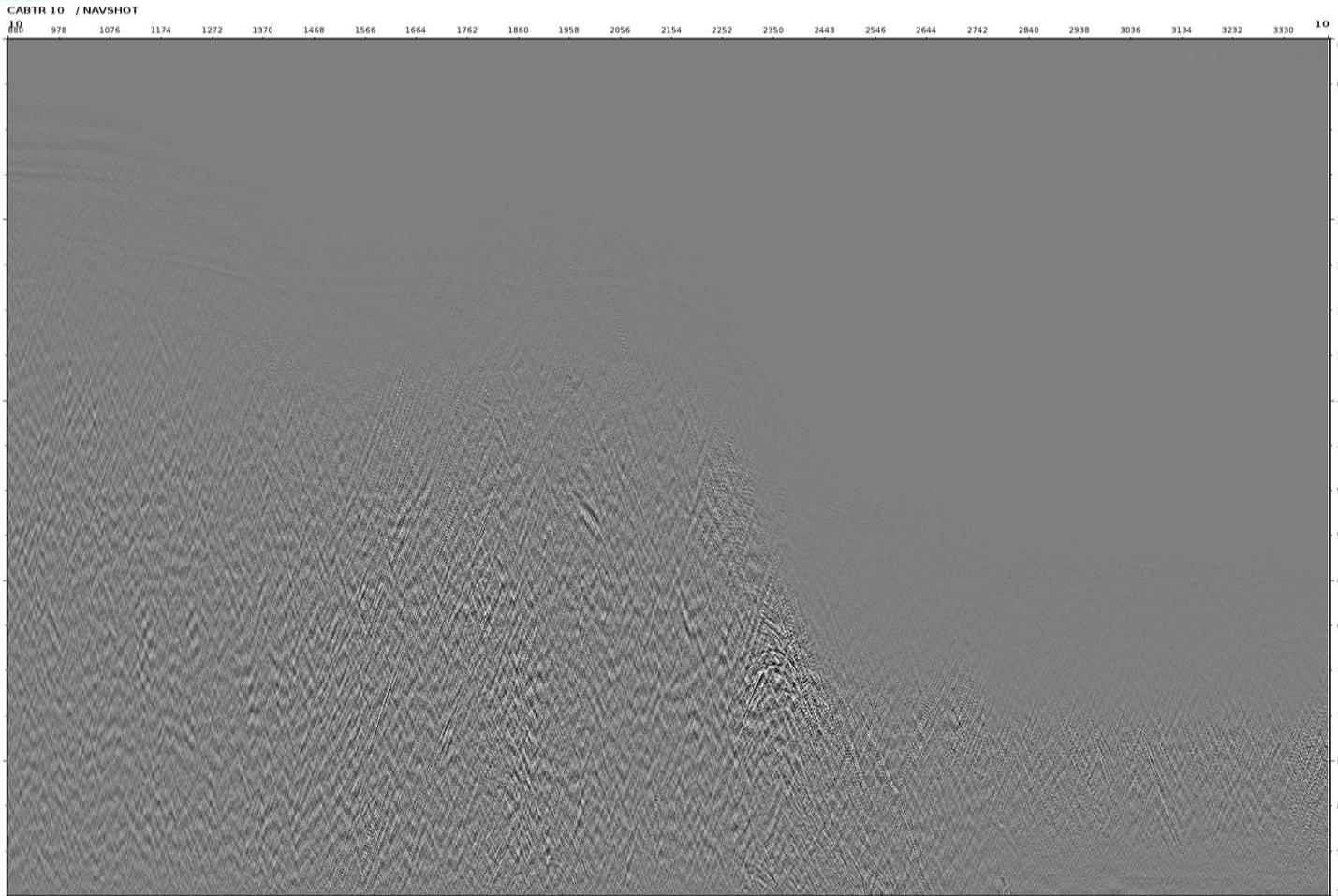
Common Channel after LNA



- Noise energy is attenuated.

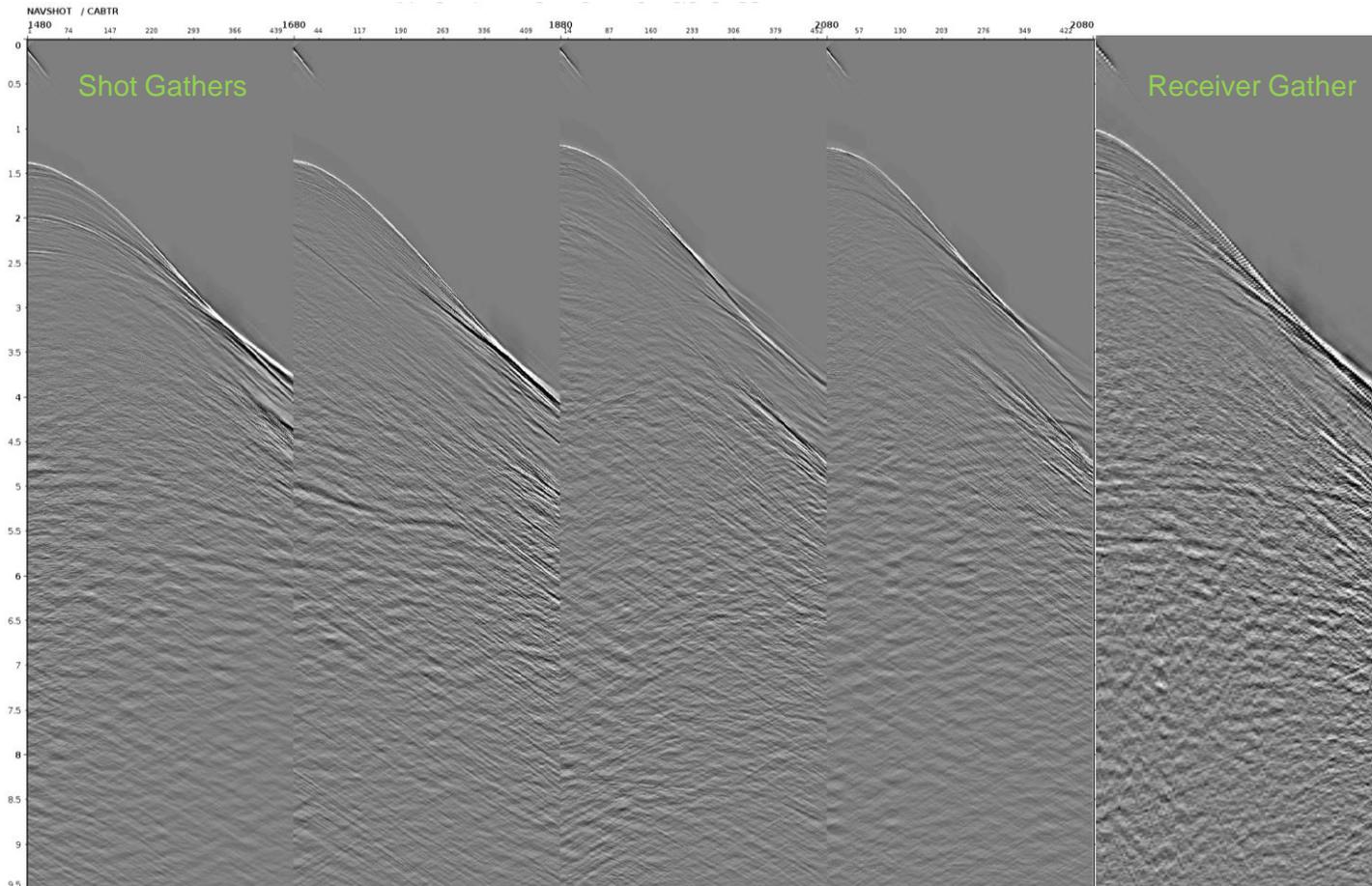


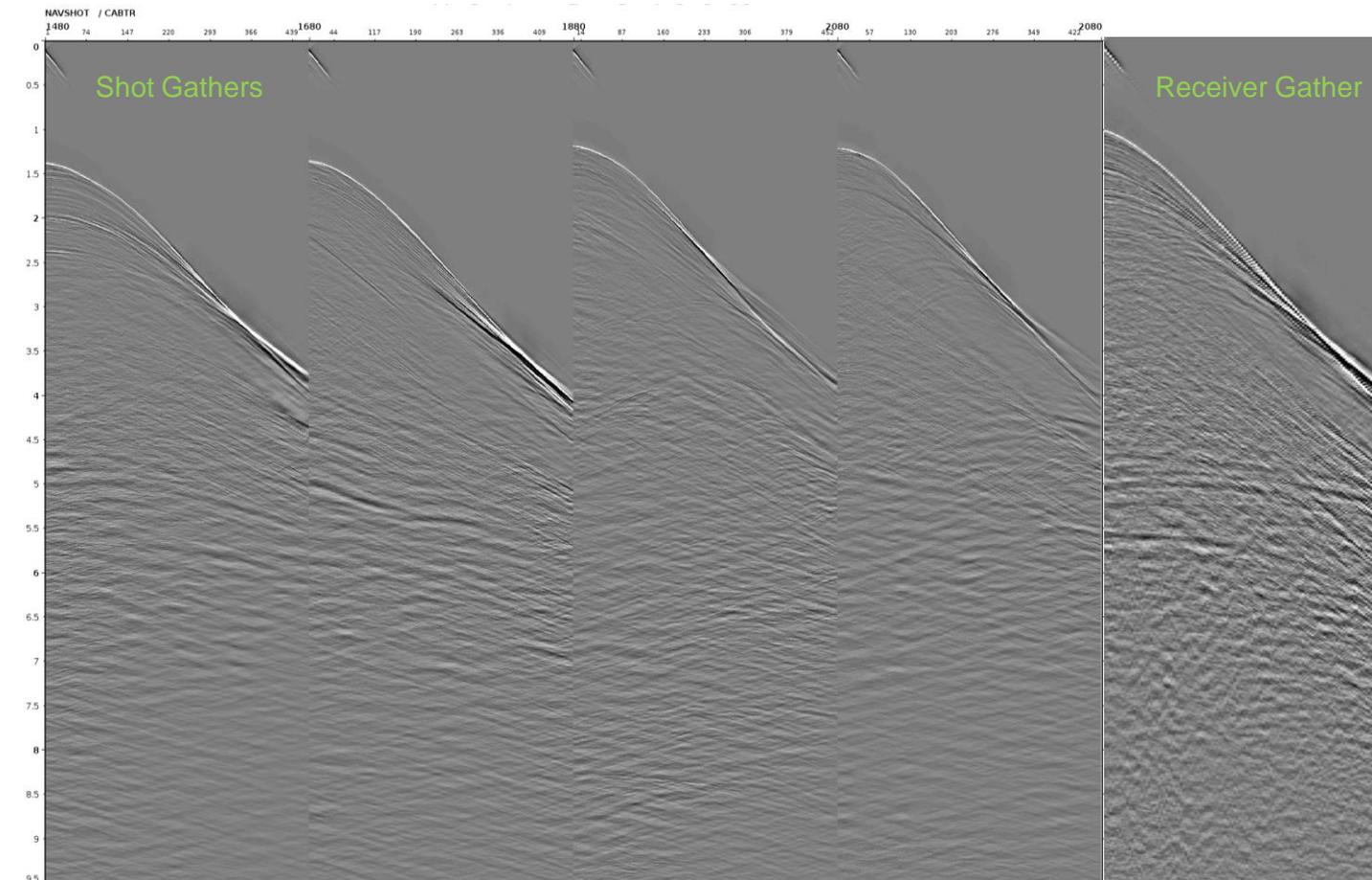
Difference before – after LNA



- No primary damage is observed on difference.

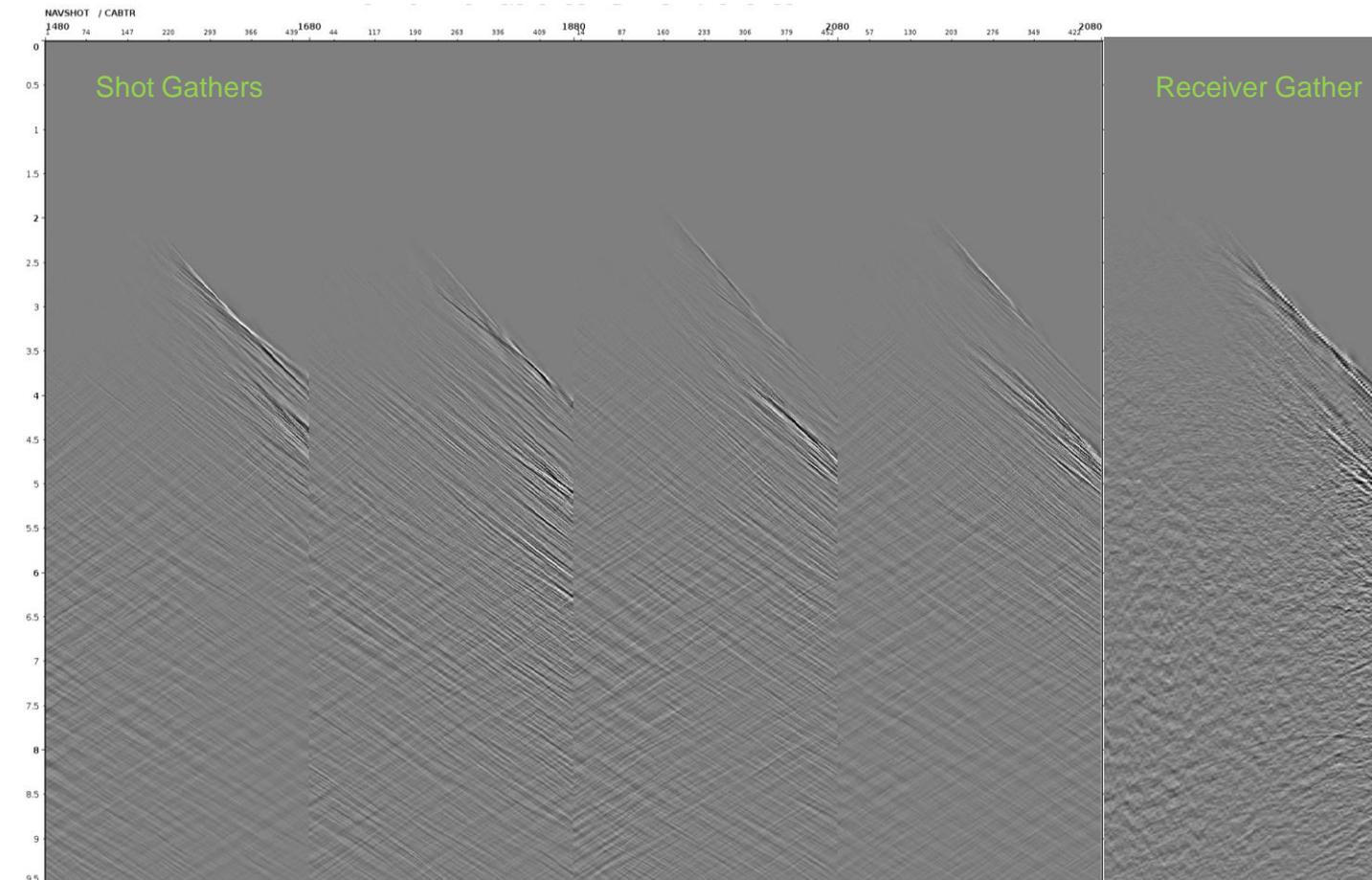
Selected Gathers before Shot LNA





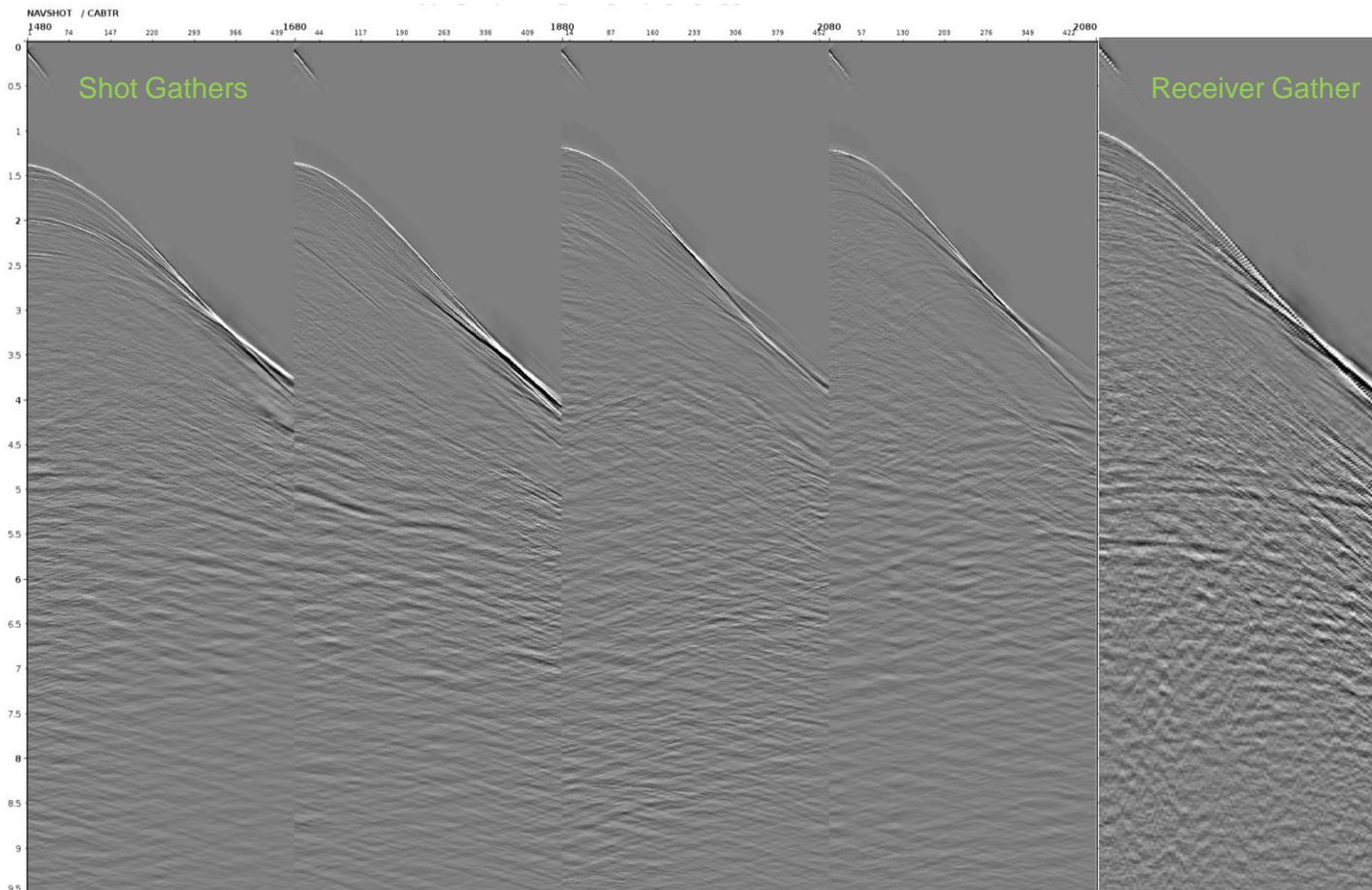
- Linear noises on shot gathers are attenuated

Difference before – after Shot LNA

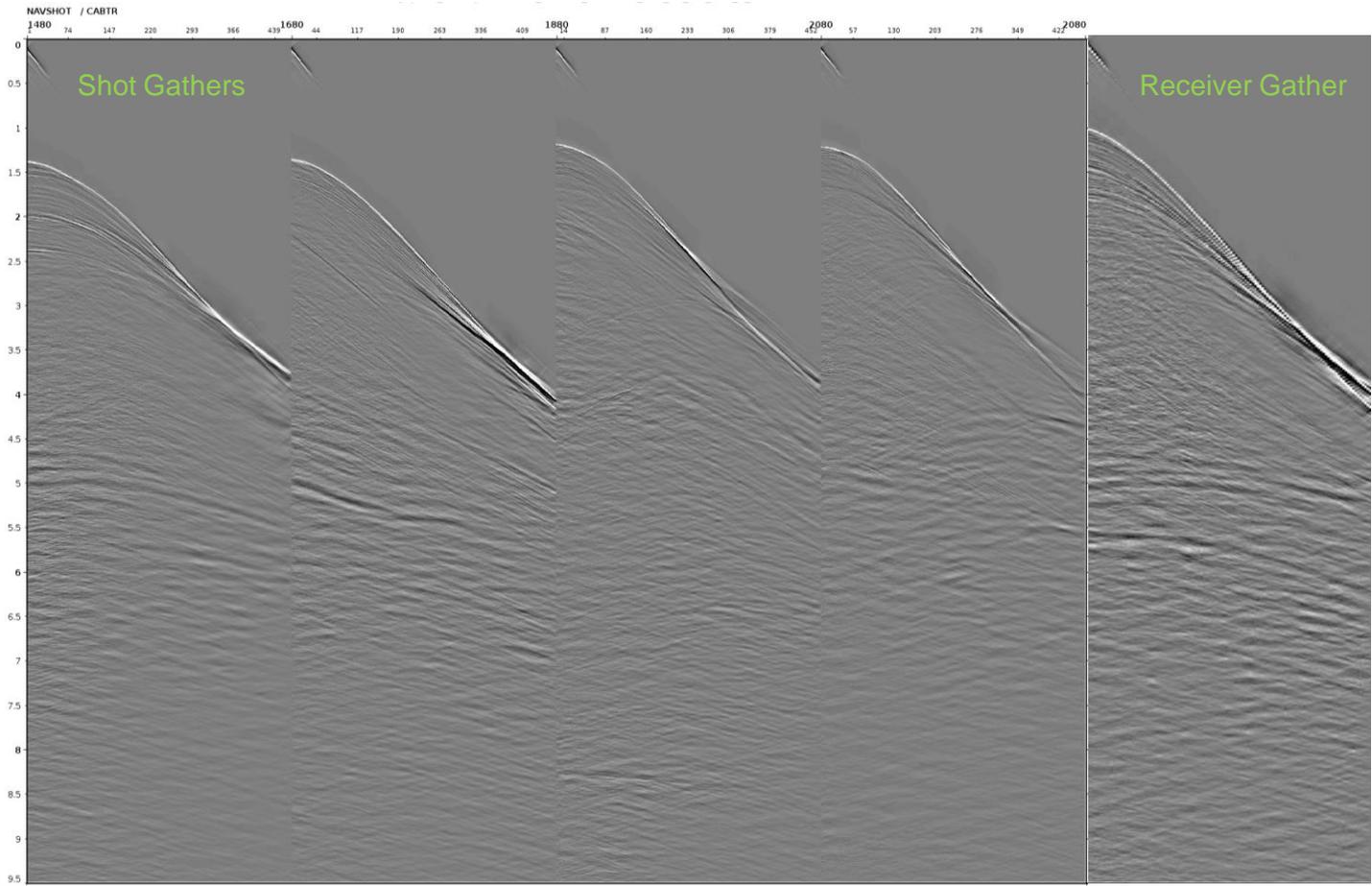


- No primary damage is observed on shot gathers.

Selected Gathers after Shot LNA (copy)

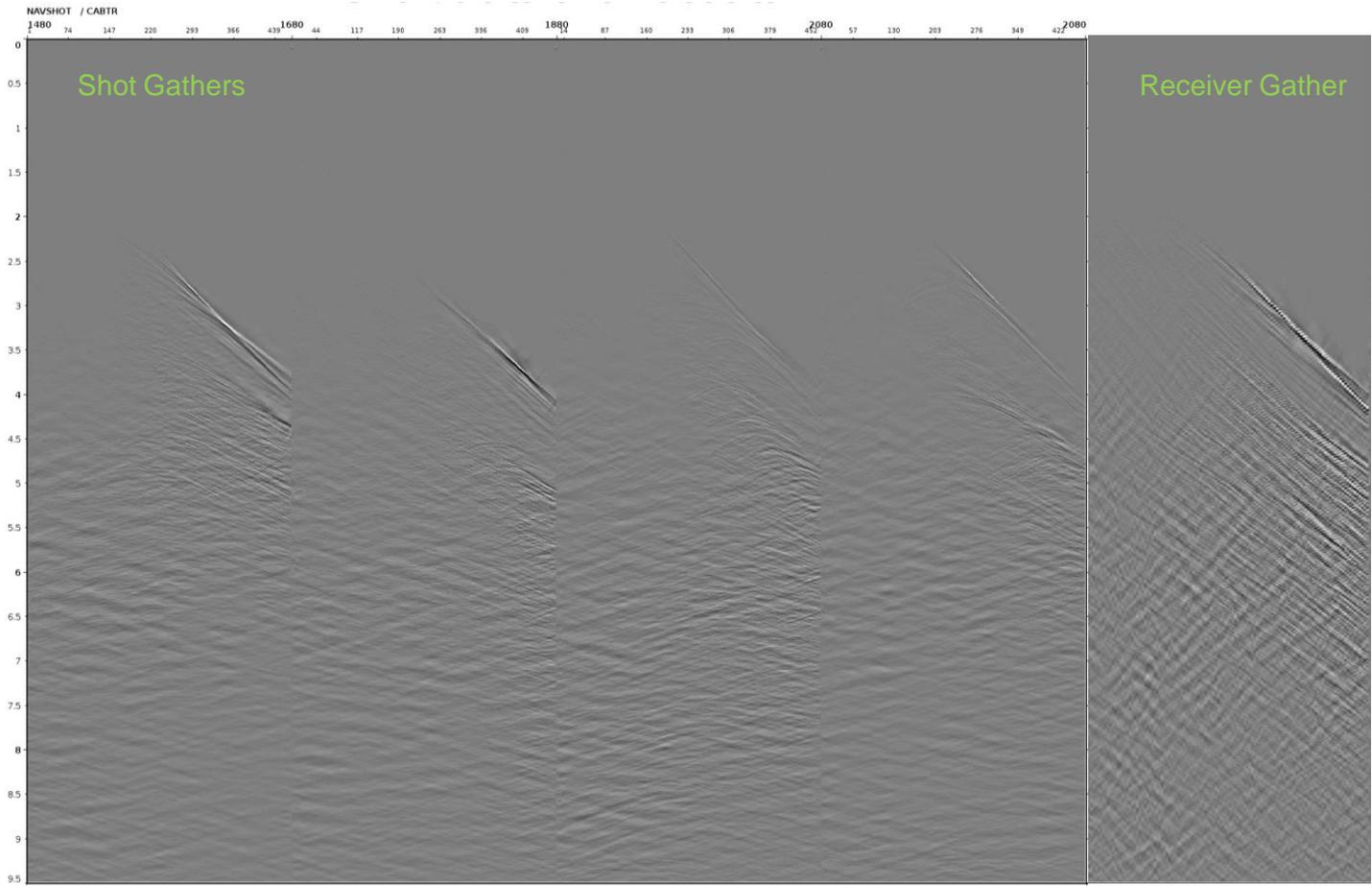


Selected Gathers after Receiver LNA



- Linear noises on receiver gather are attenuated

Difference before – after Receiver LNA



- No primary damage is observed on receiver gather.

- Shot & receiver side LNA can attenuate residual linear noise while keep primary untouched. We recommend to apply for production.