



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 |

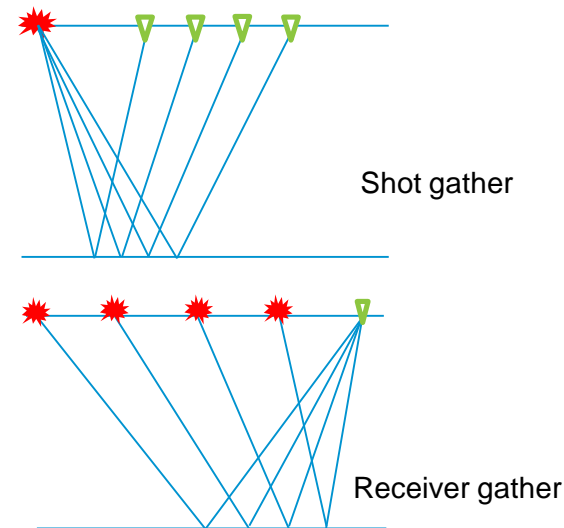
- Display:**

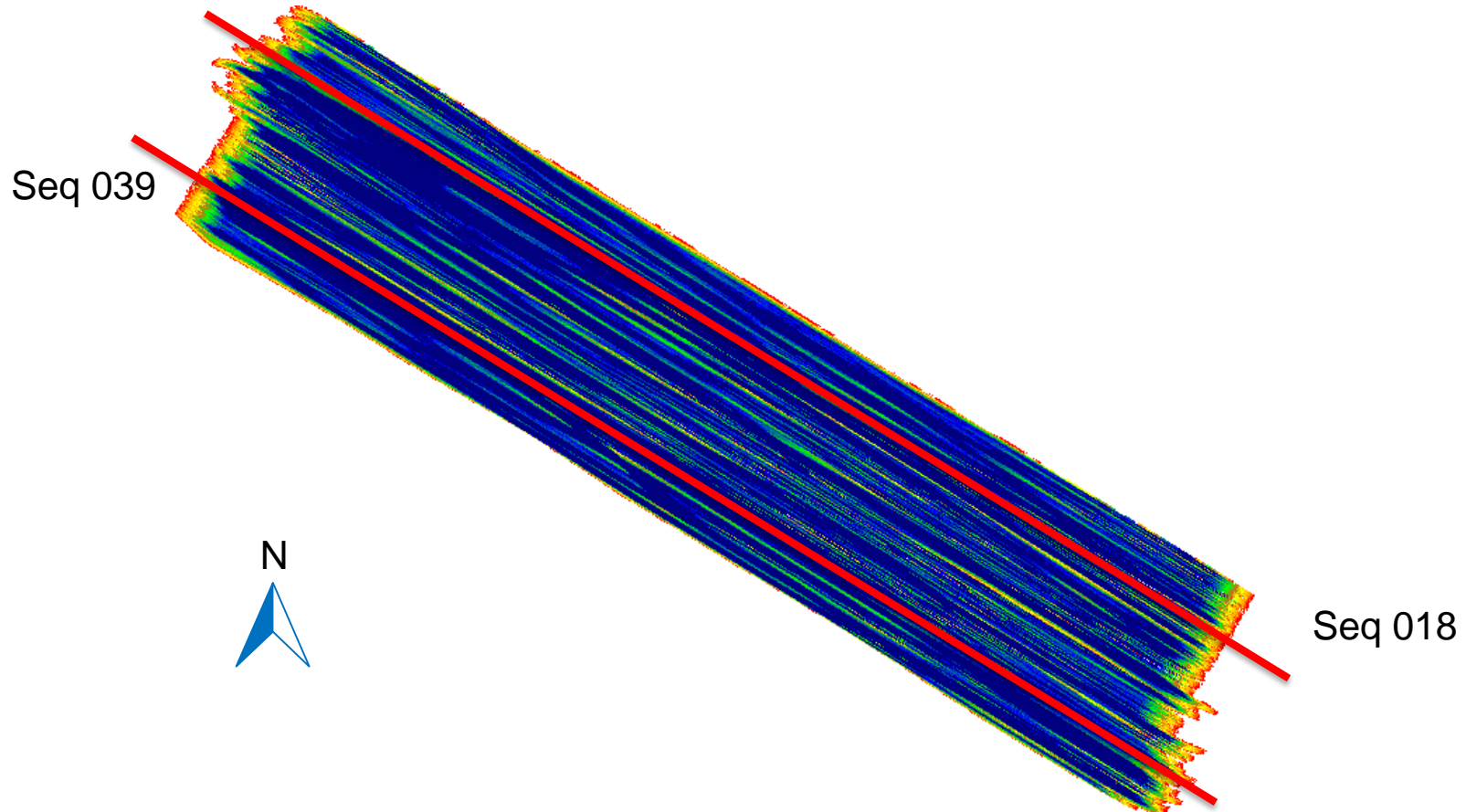
Test line: Seq 018; Seq 039.

Display: Stack, common channel and Selected Gathers.

- Observation and Recommendation:**

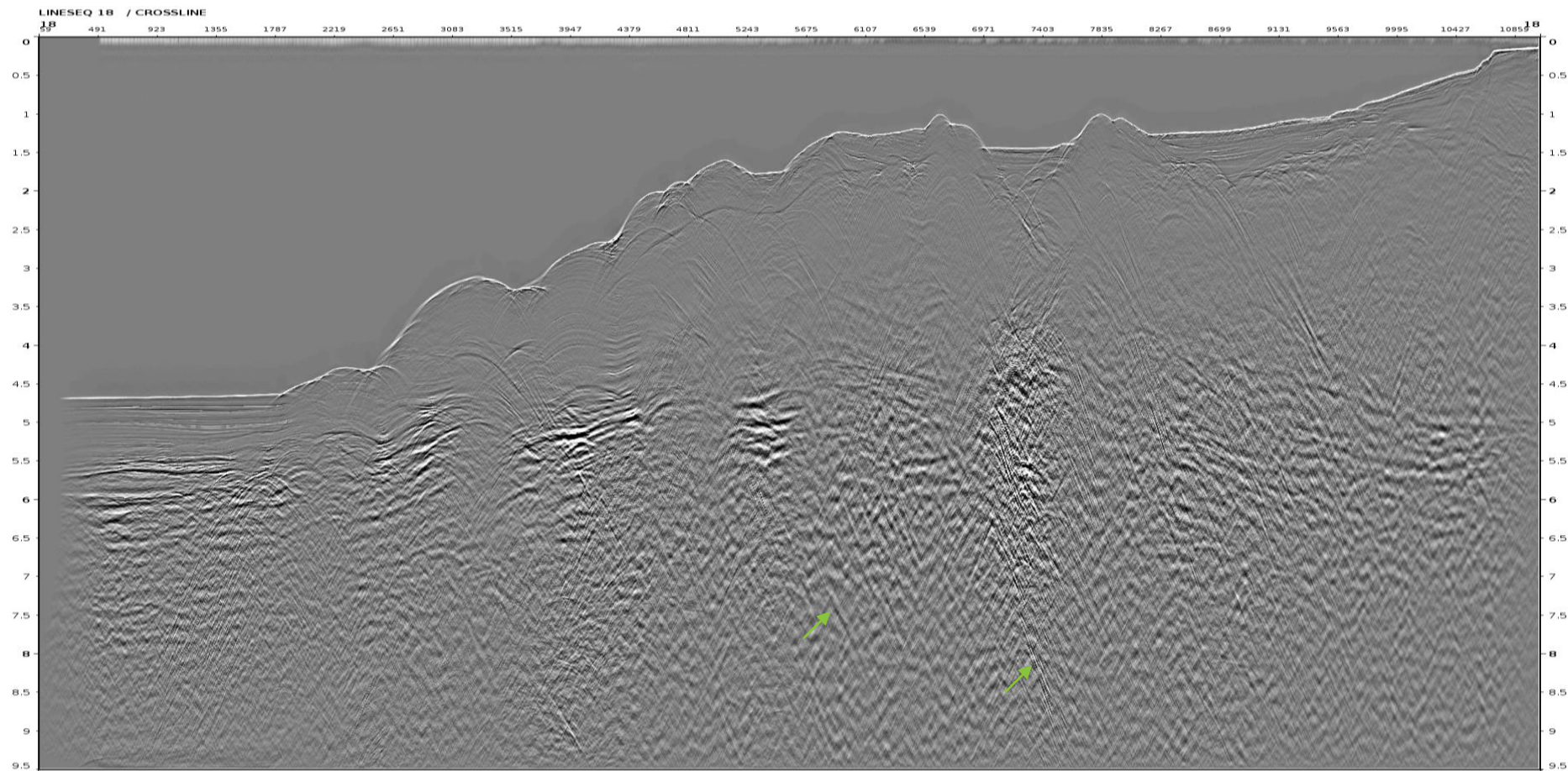
Residual linear noise is attenuated in the data while keeping the primary data intact. It's recommended to apply for production.

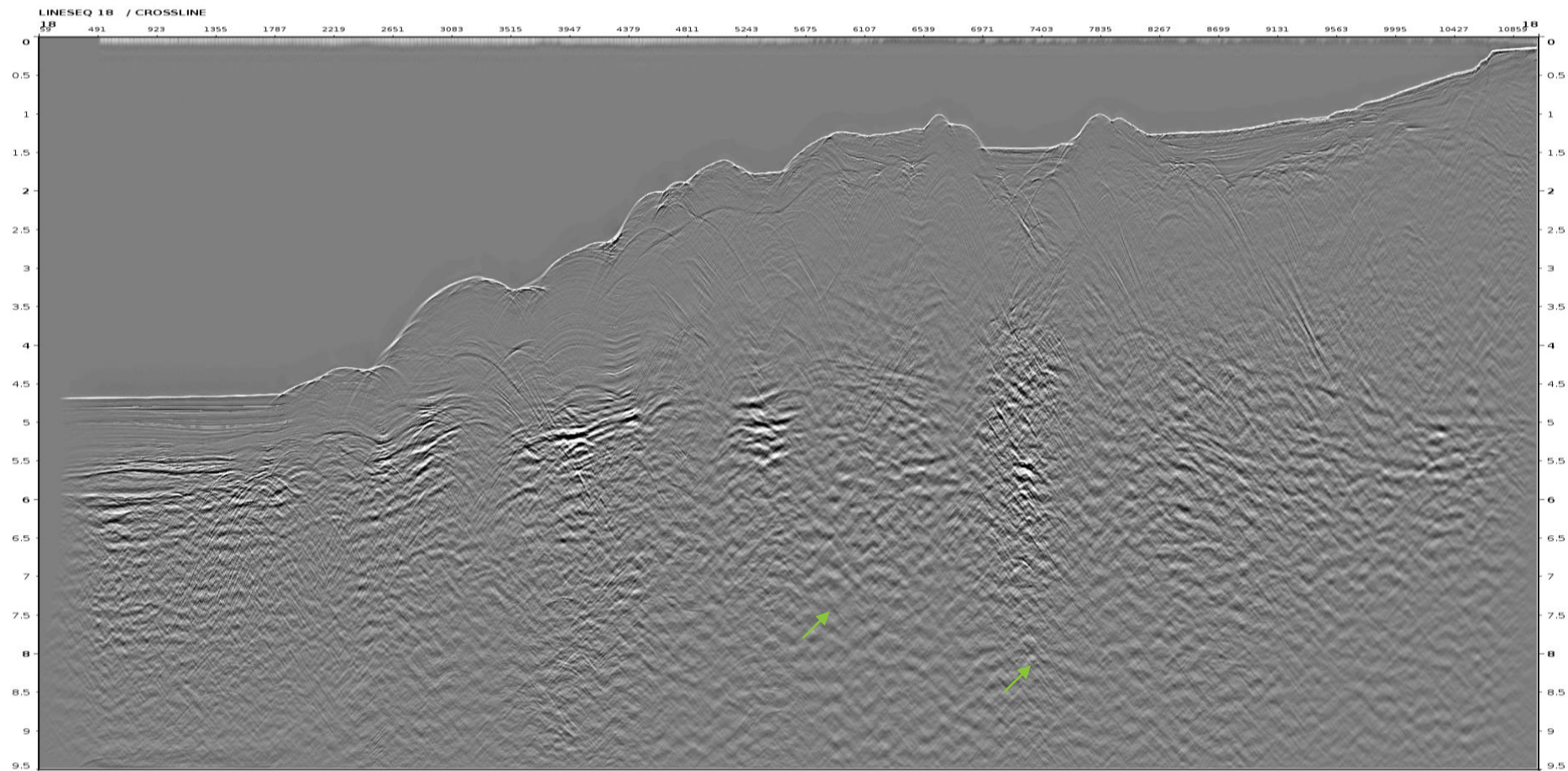




Seq 018

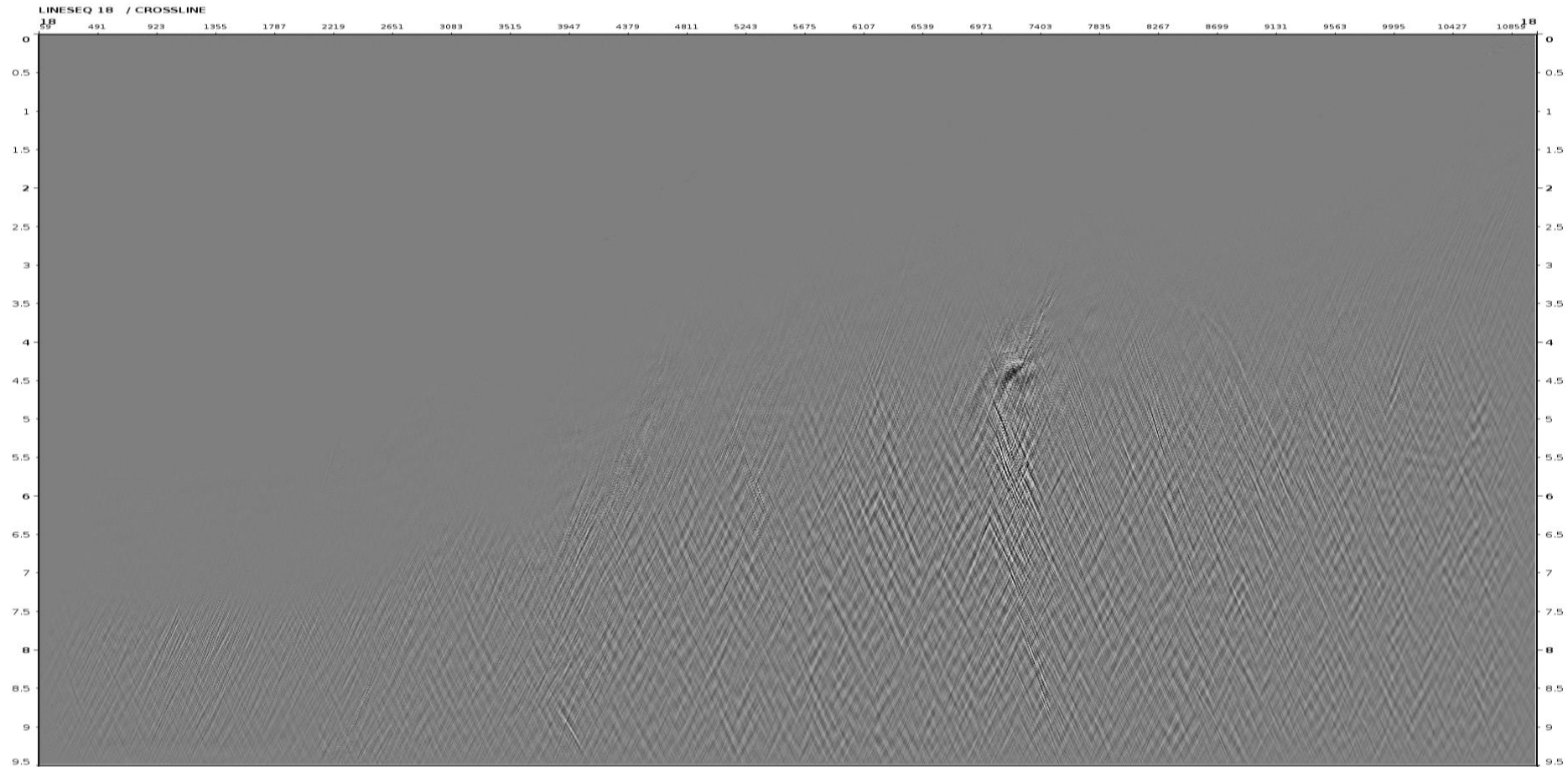
- Stack
- Common Channel
- Gathers







Difference before – after LNA



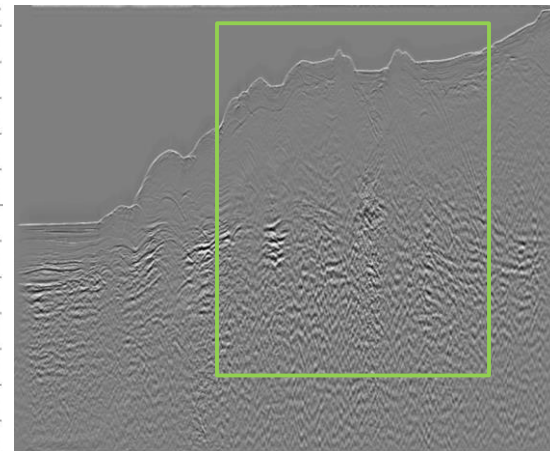
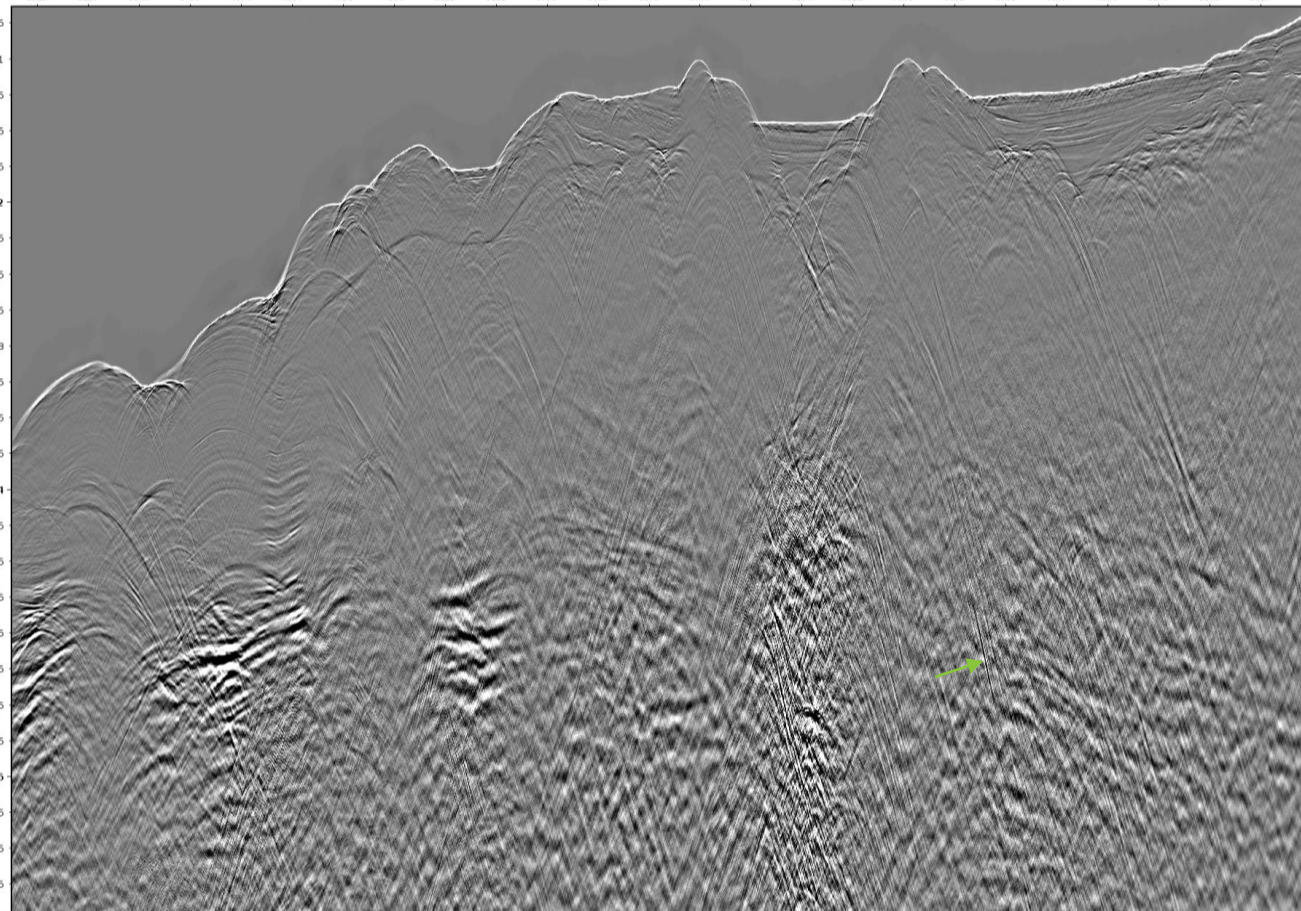


Zoom in Stack before LNA

9

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.

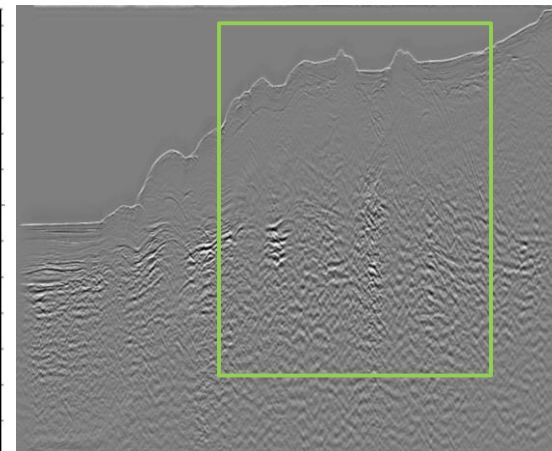
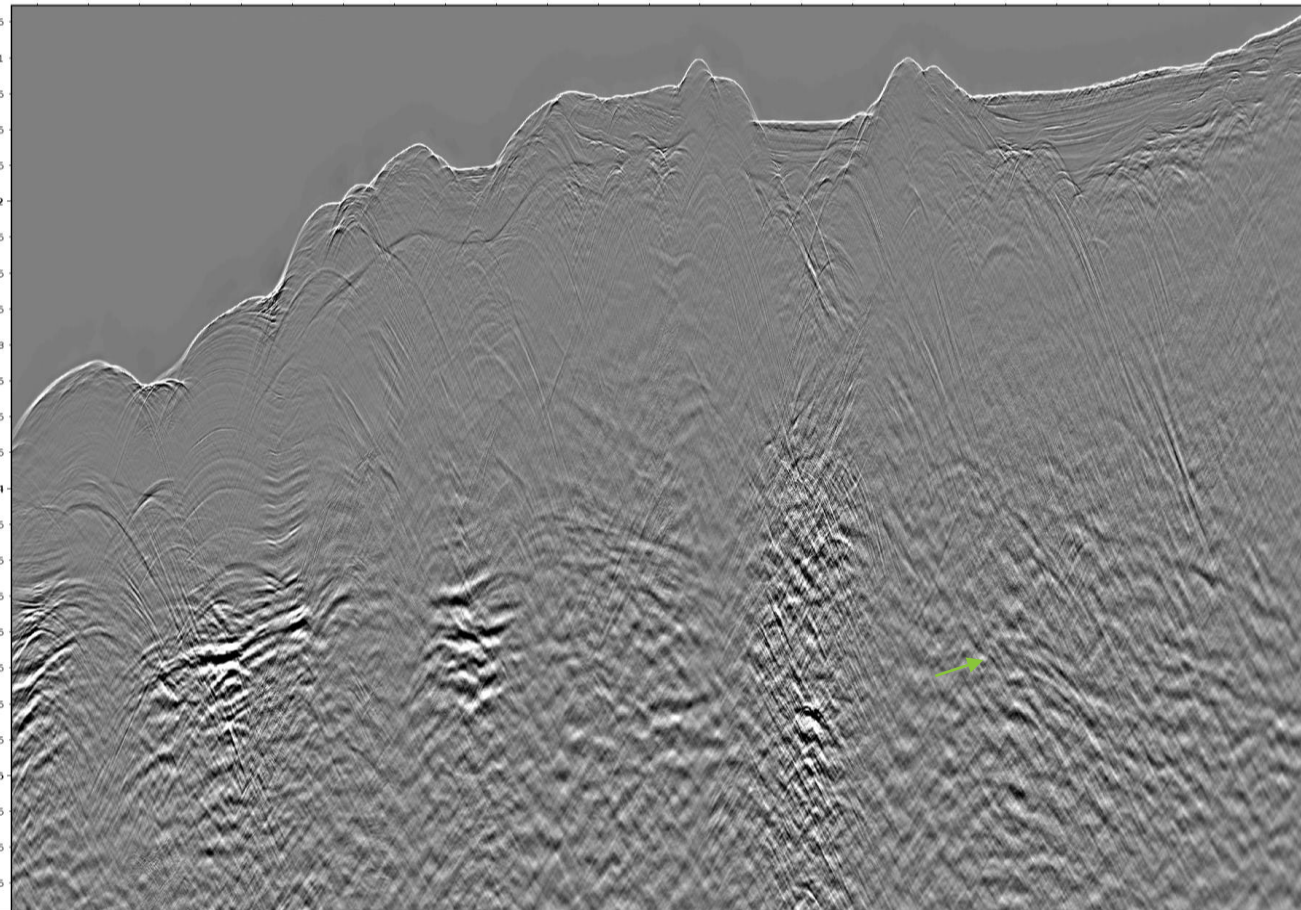


Zoom in Stack after LNA

10

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



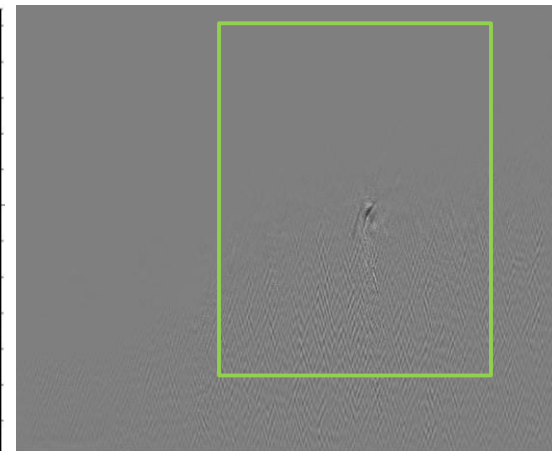
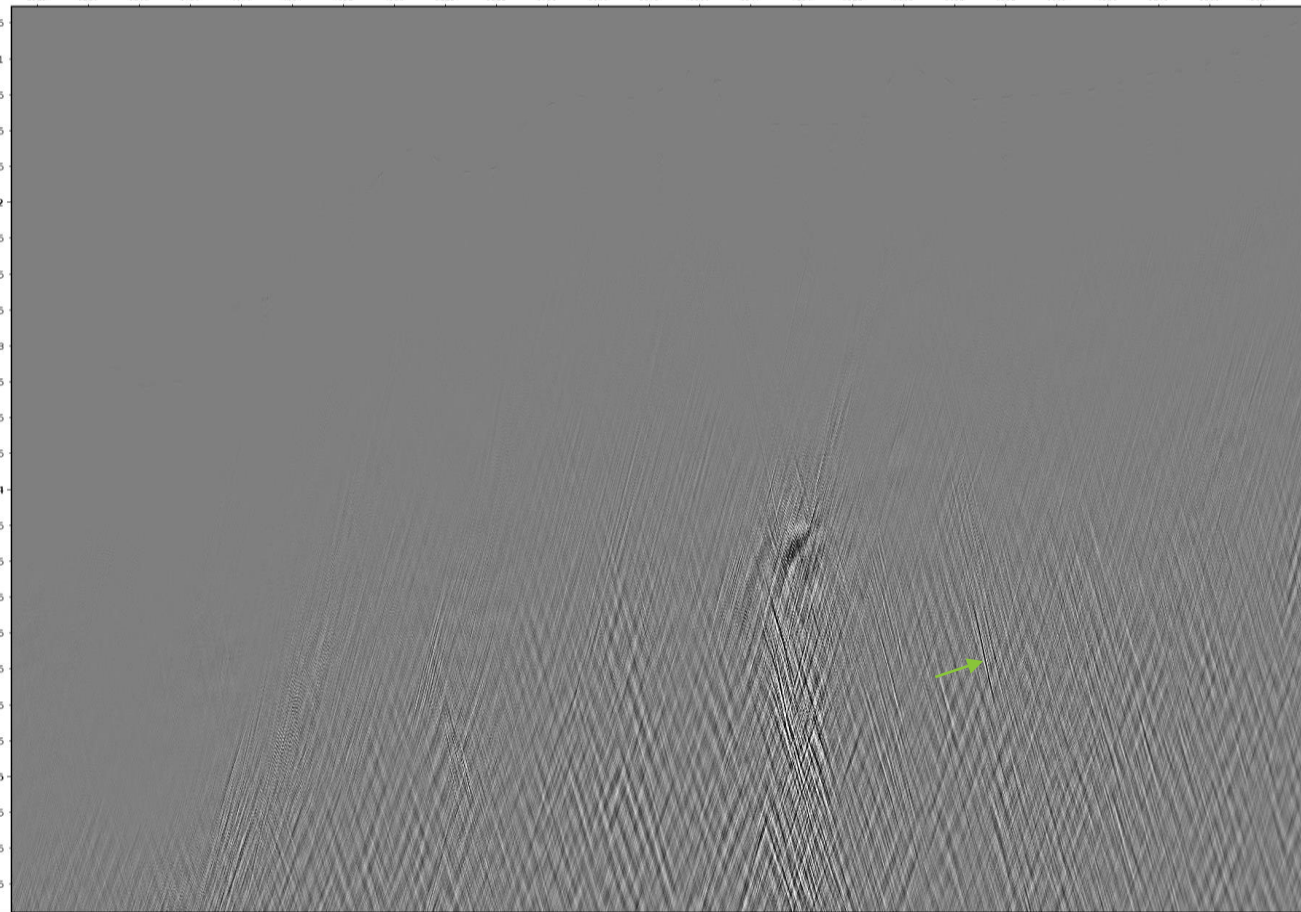
- Noise energy is attenuated.

Difference before - after LNA

11

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



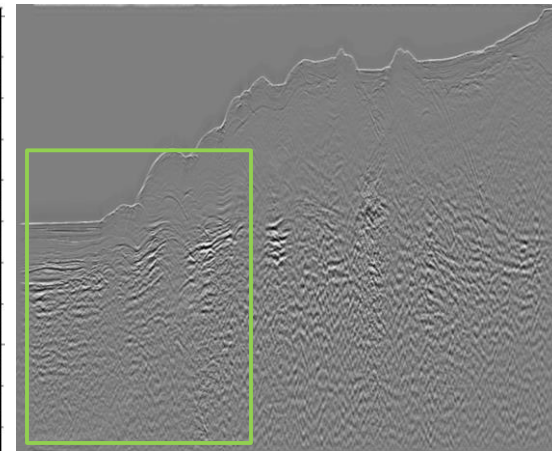
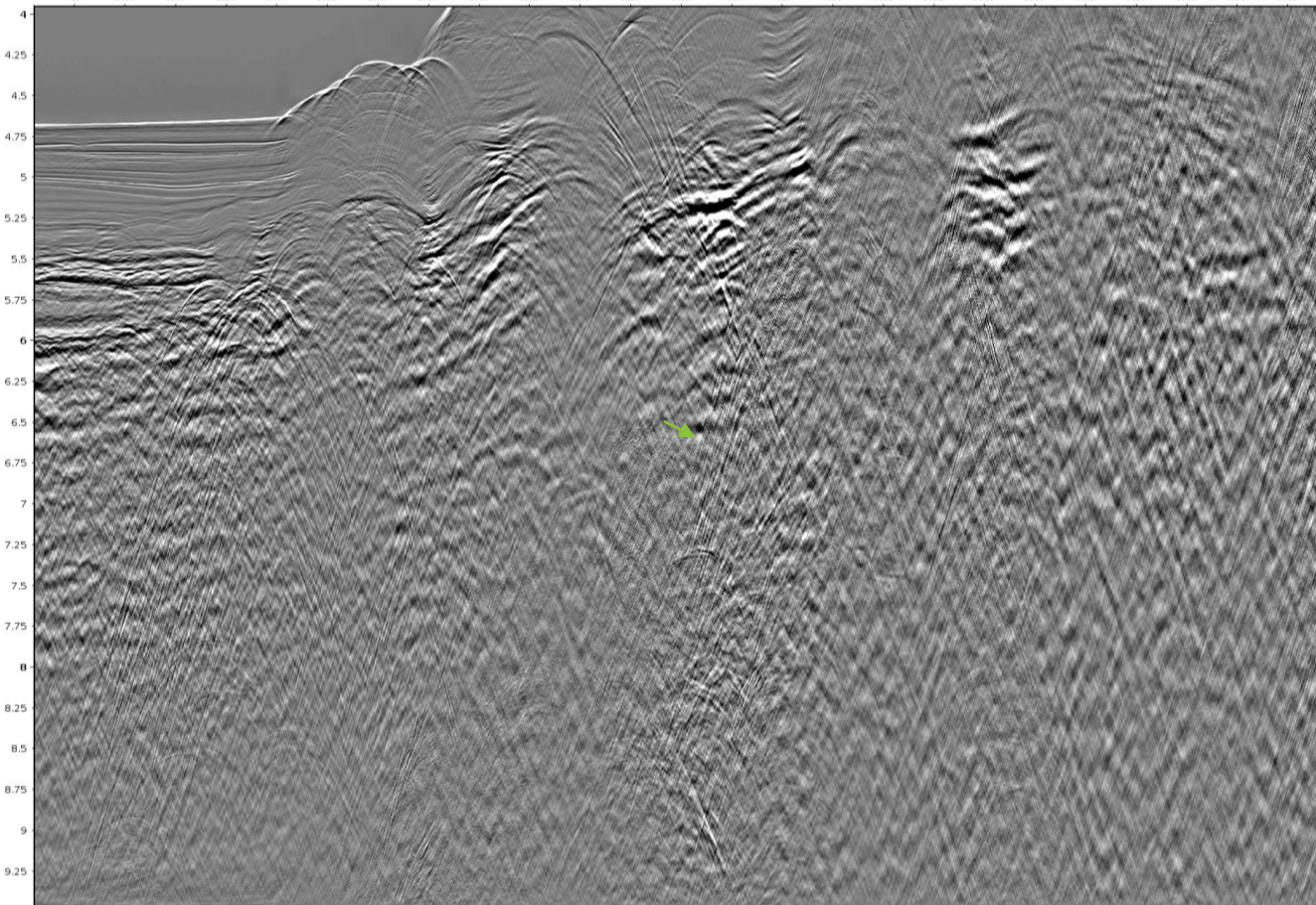
- No primary damage is observed on difference.



Zoom in Stack before LNA

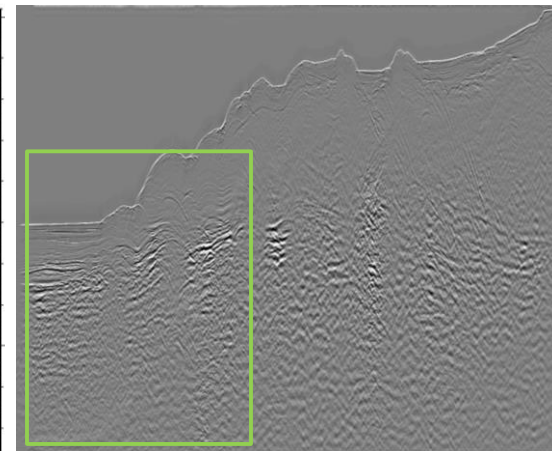
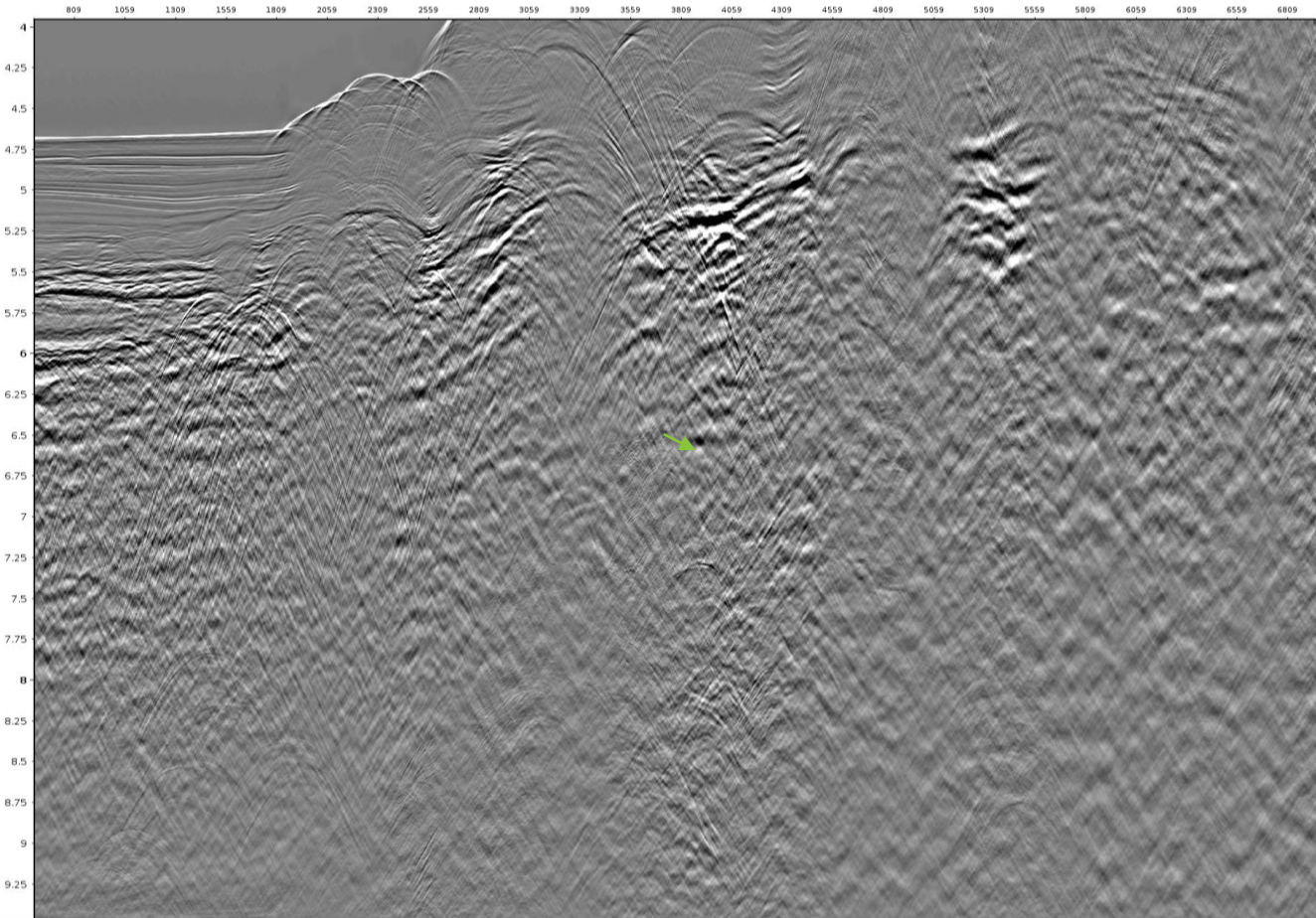
12

LINESEQ 18 / CROSSLINE



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

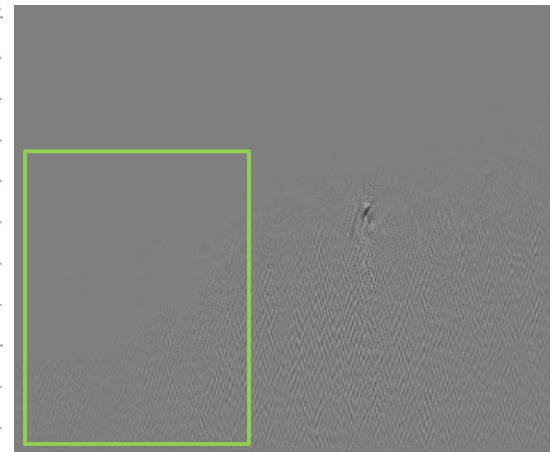
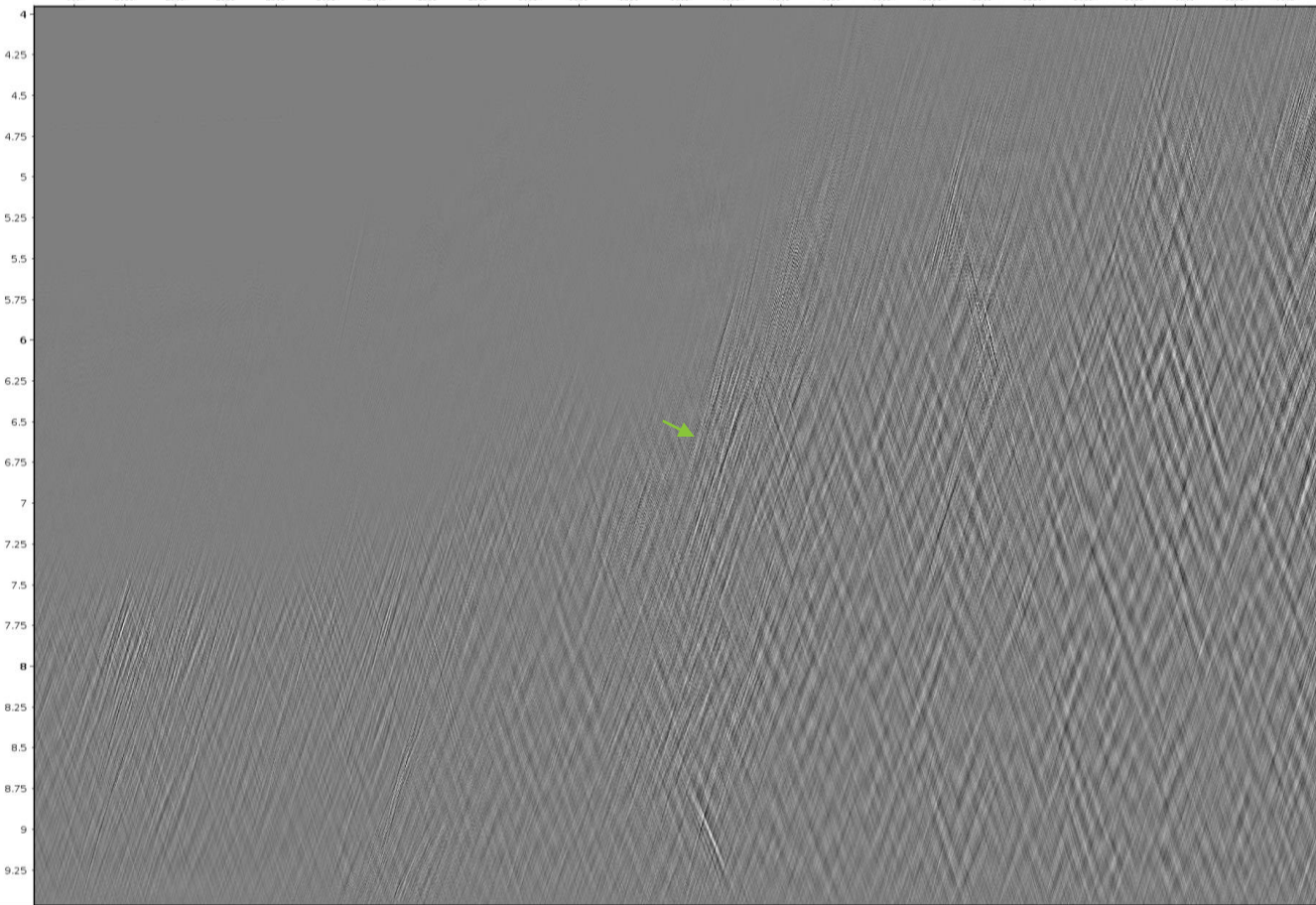
LINESEQ 18 / CROSSLINE



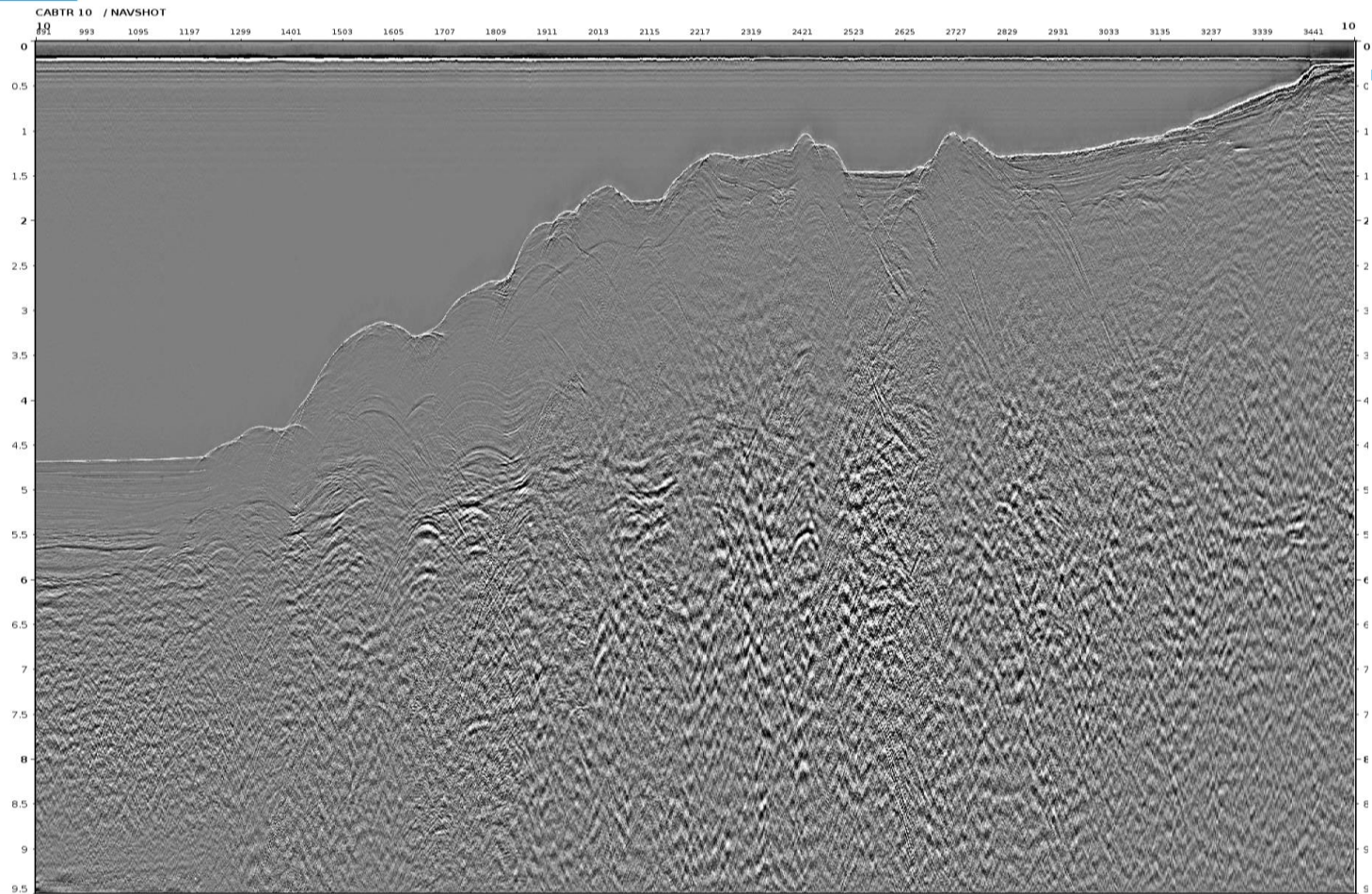
- Noise and residual multiple diffractions are also attenuated.

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.

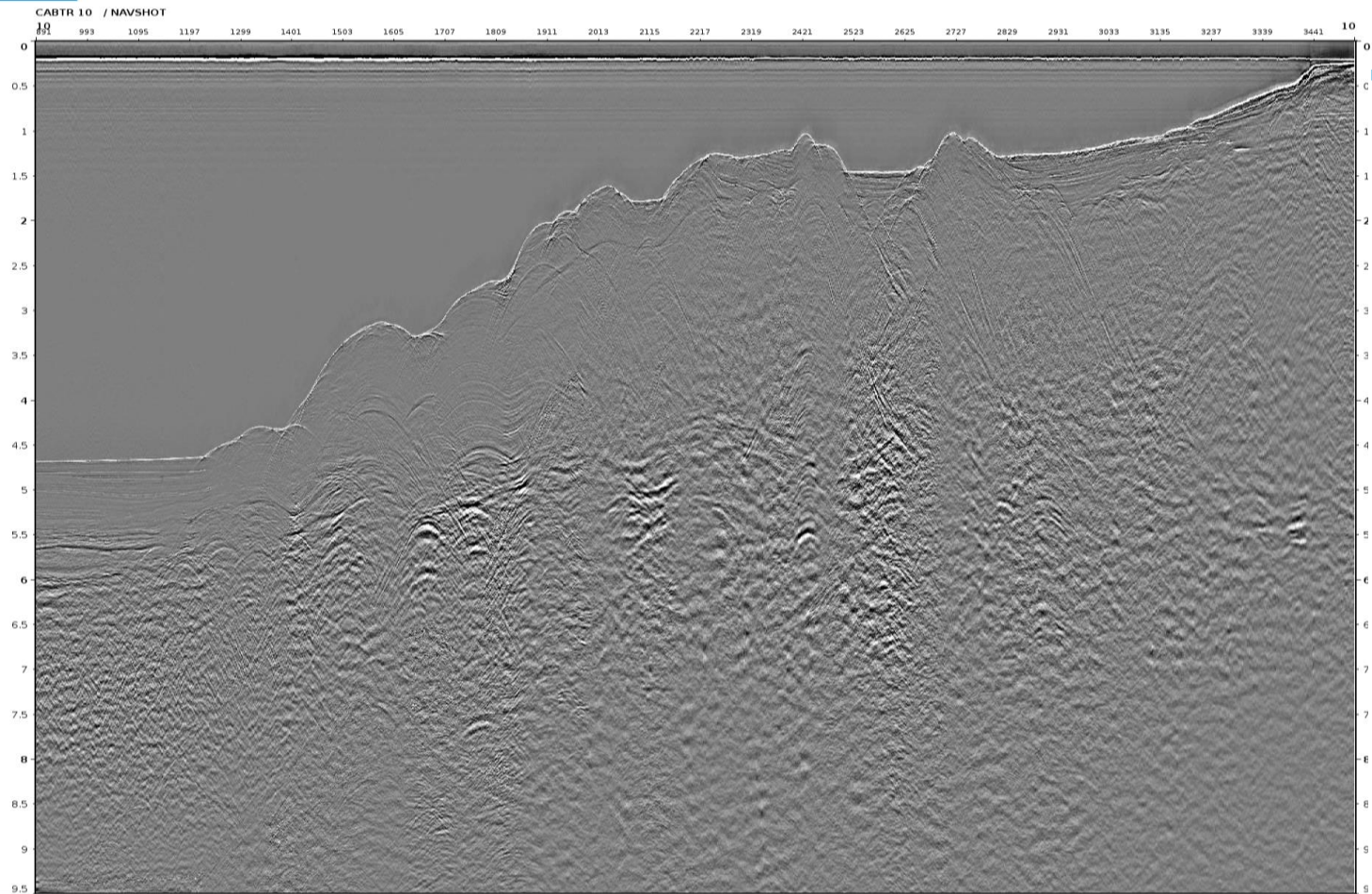


- Residual linear noise is visible on common channel.



Common Channel after LNA

16



- Noise energy is attenuated.



Difference before – after LNA

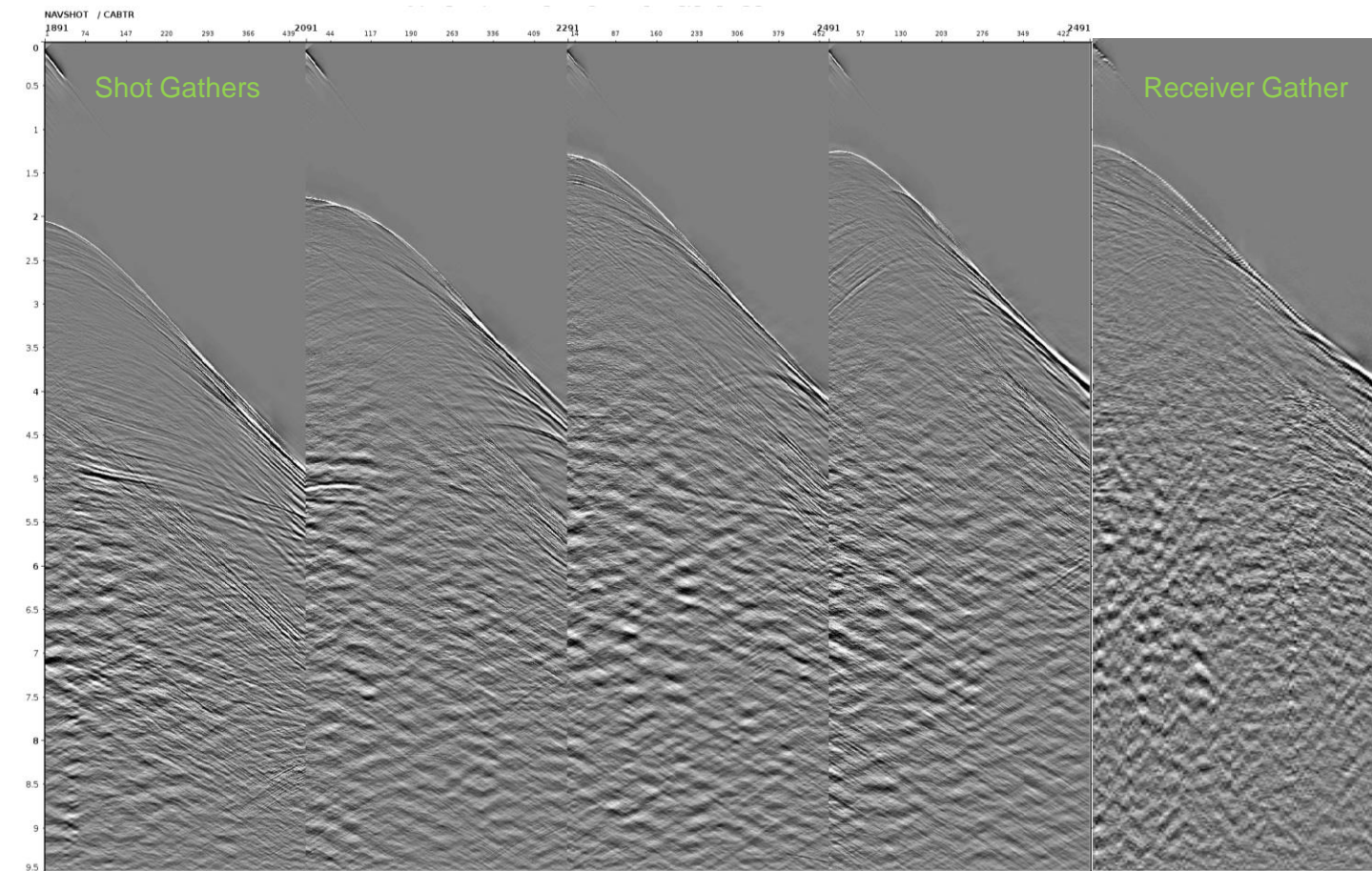
17

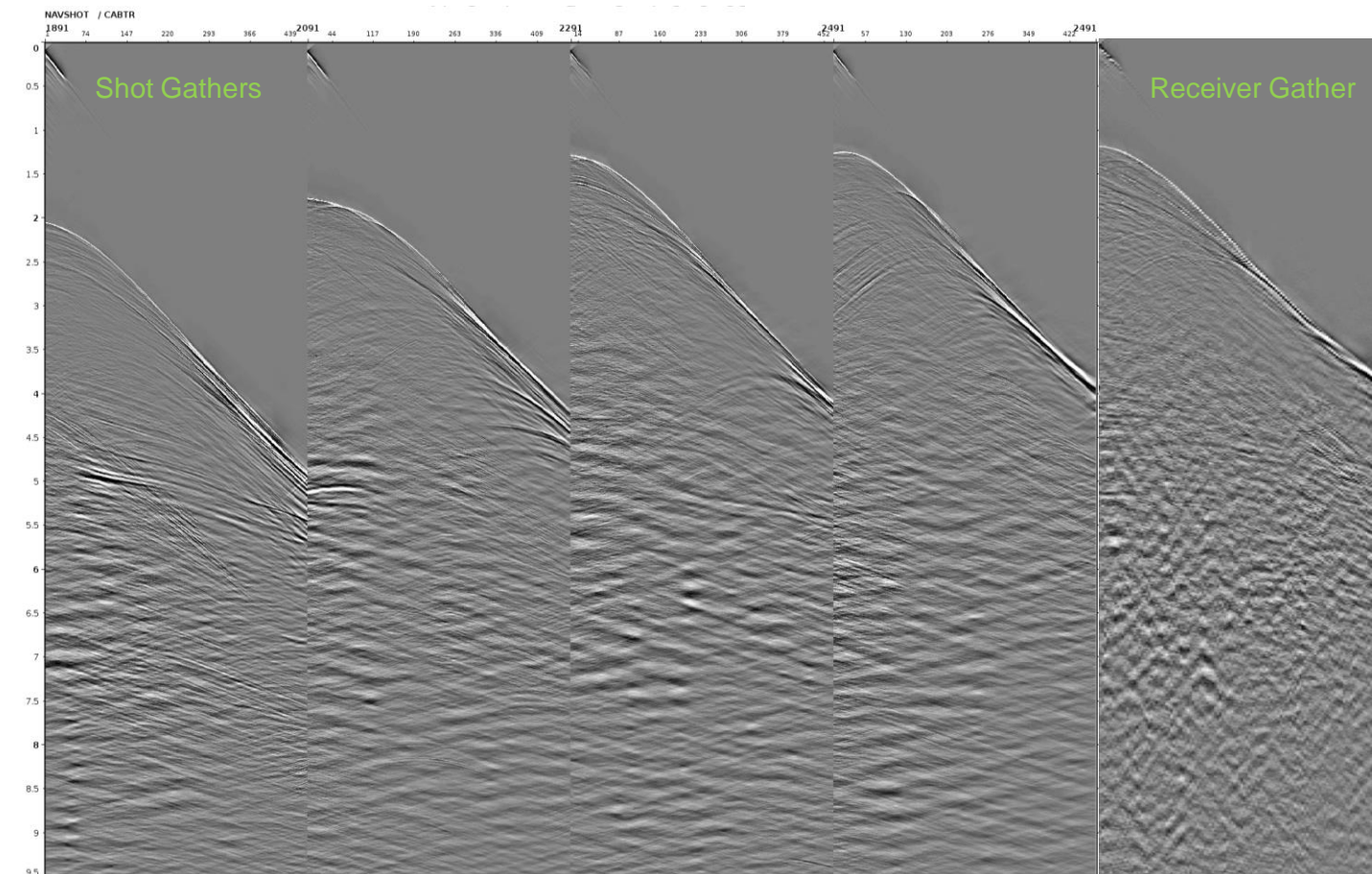


- No primary damage is observed on difference.

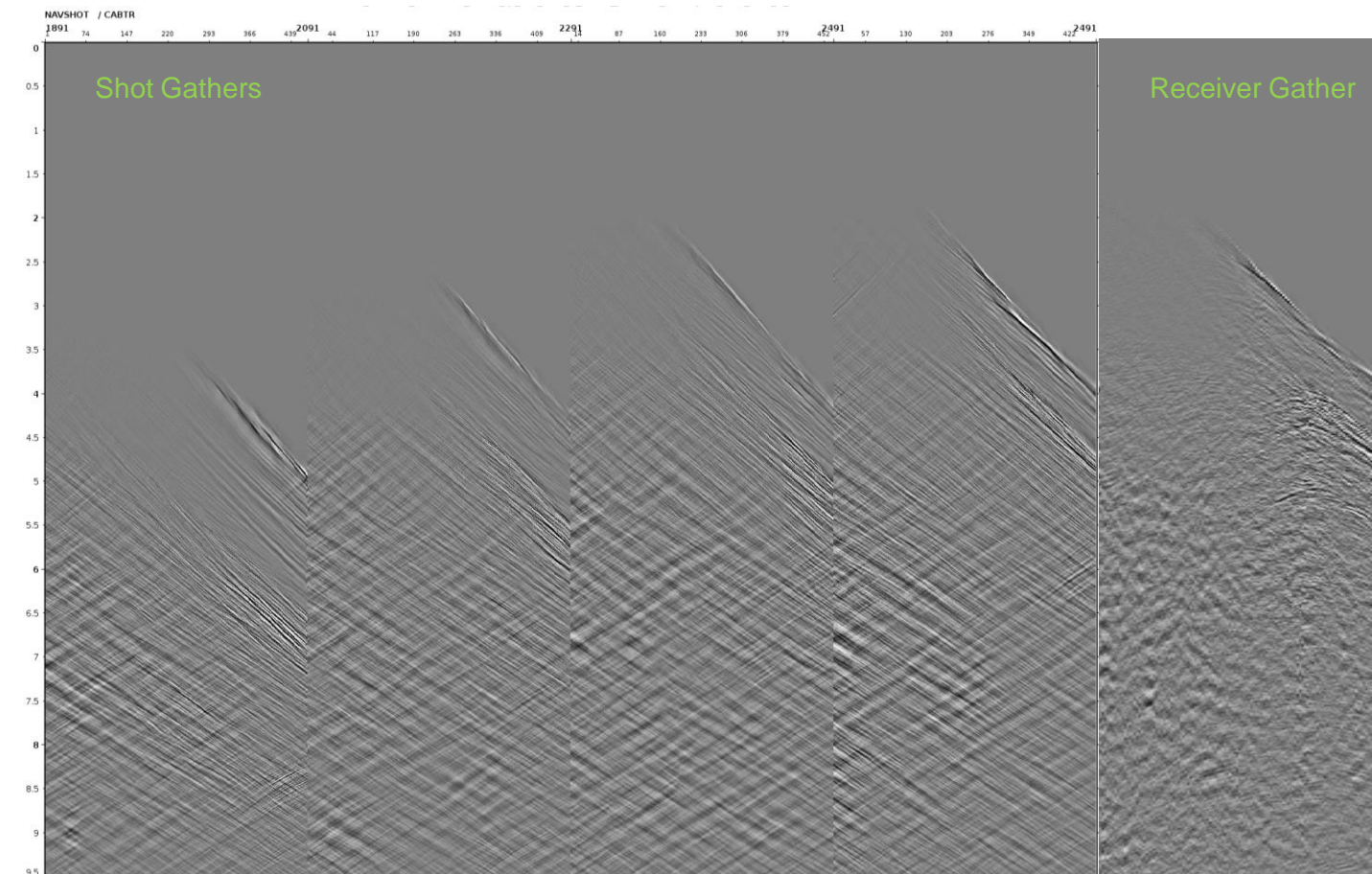
Selected Gathers before Shot LNA

18





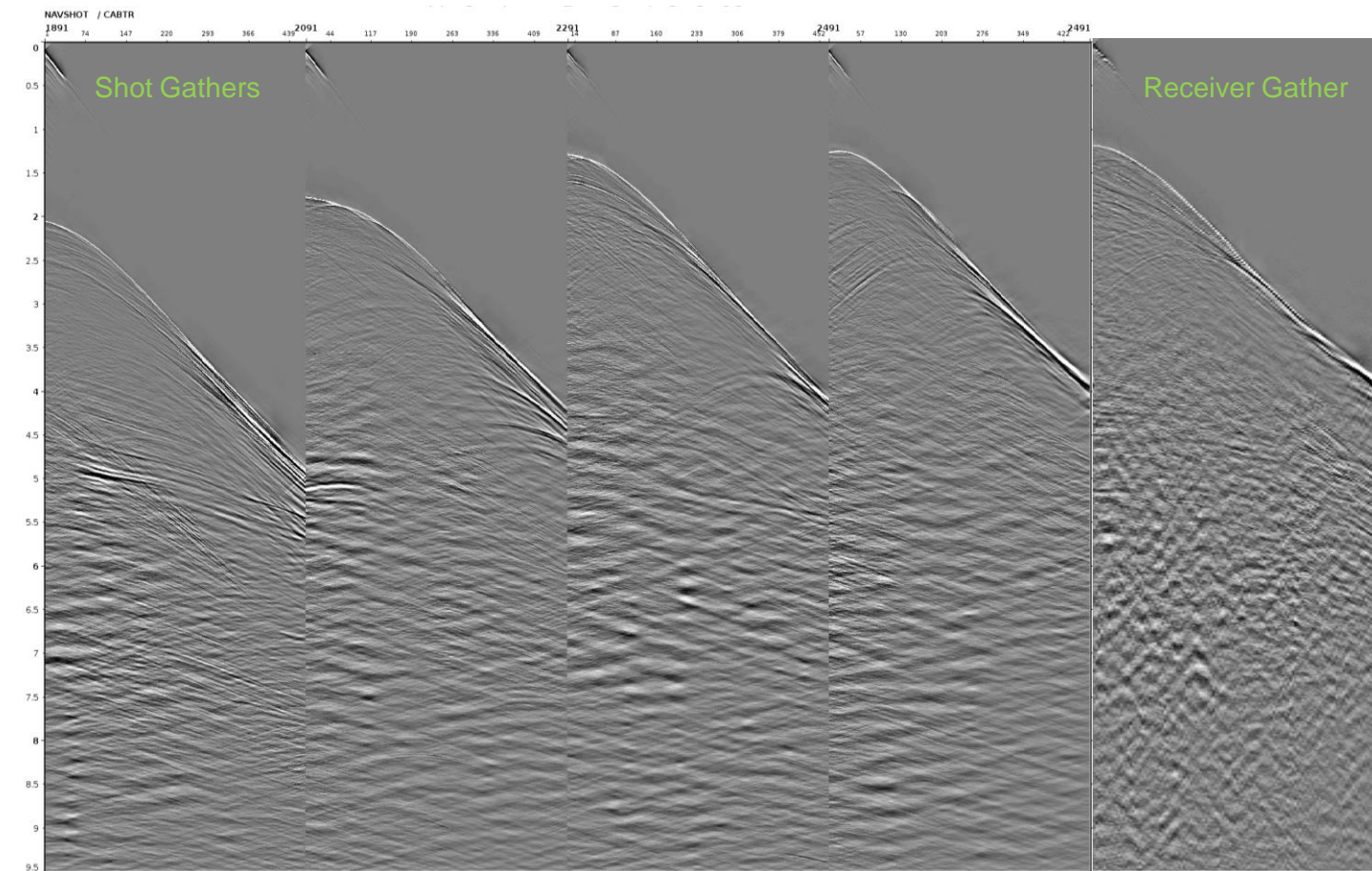
- Linear noises on shot gathers are attenuated

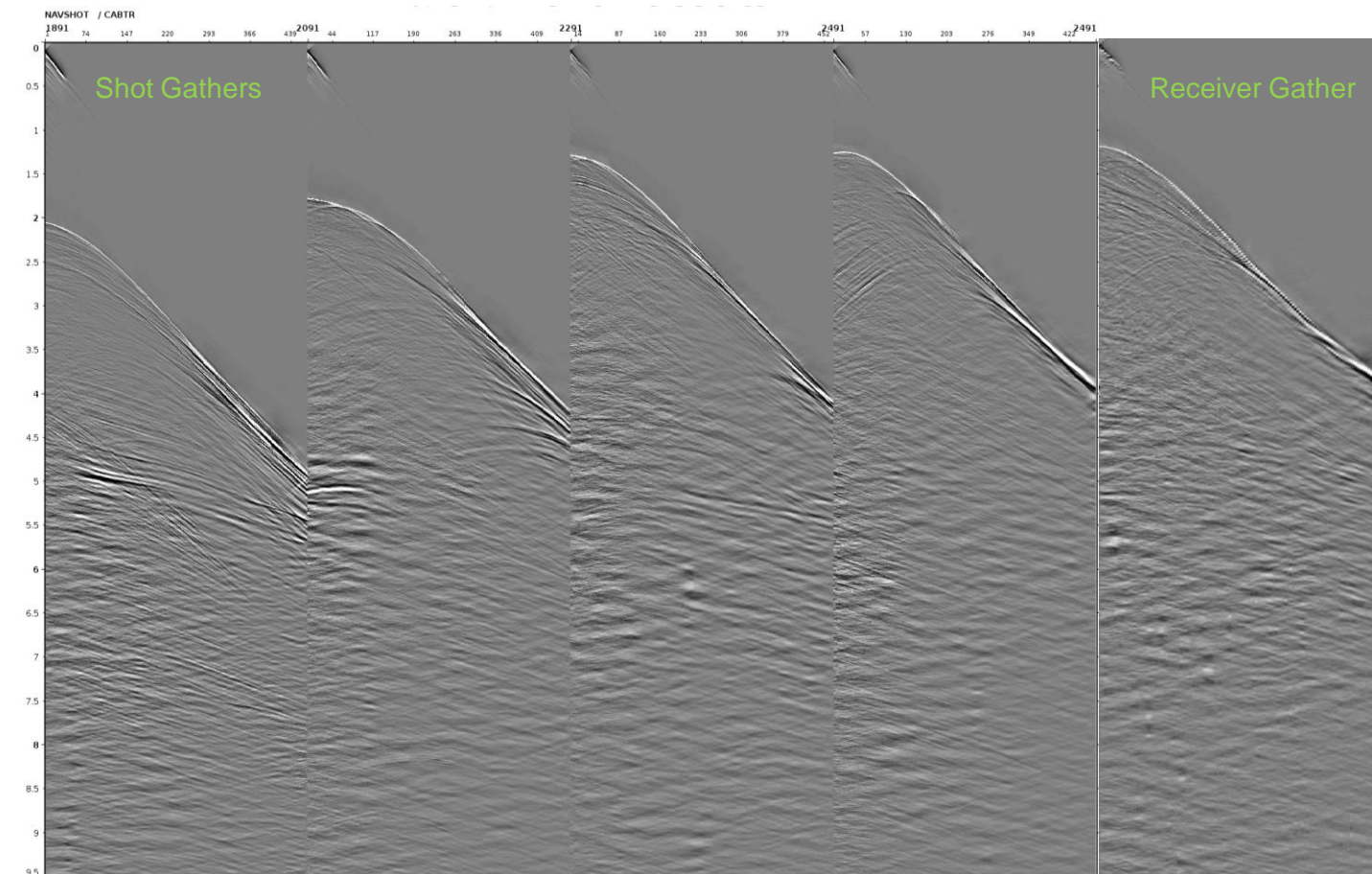


- No primary damage is observed on shot gathers.

Selected Gathers after Shot LNA (copy)

21

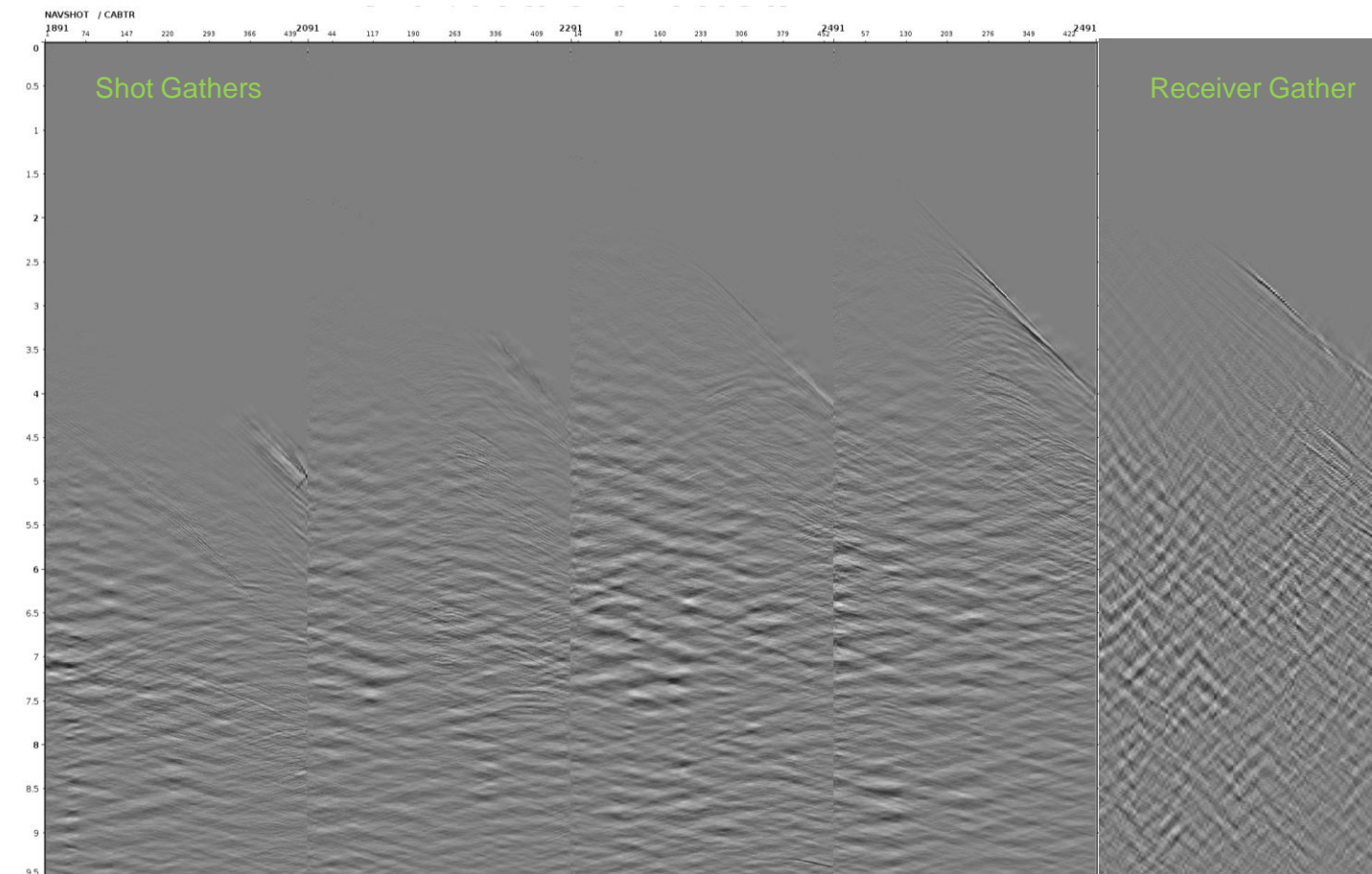




- Linear noises on receiver gather are attenuated

Difference before – after Receiver LNA

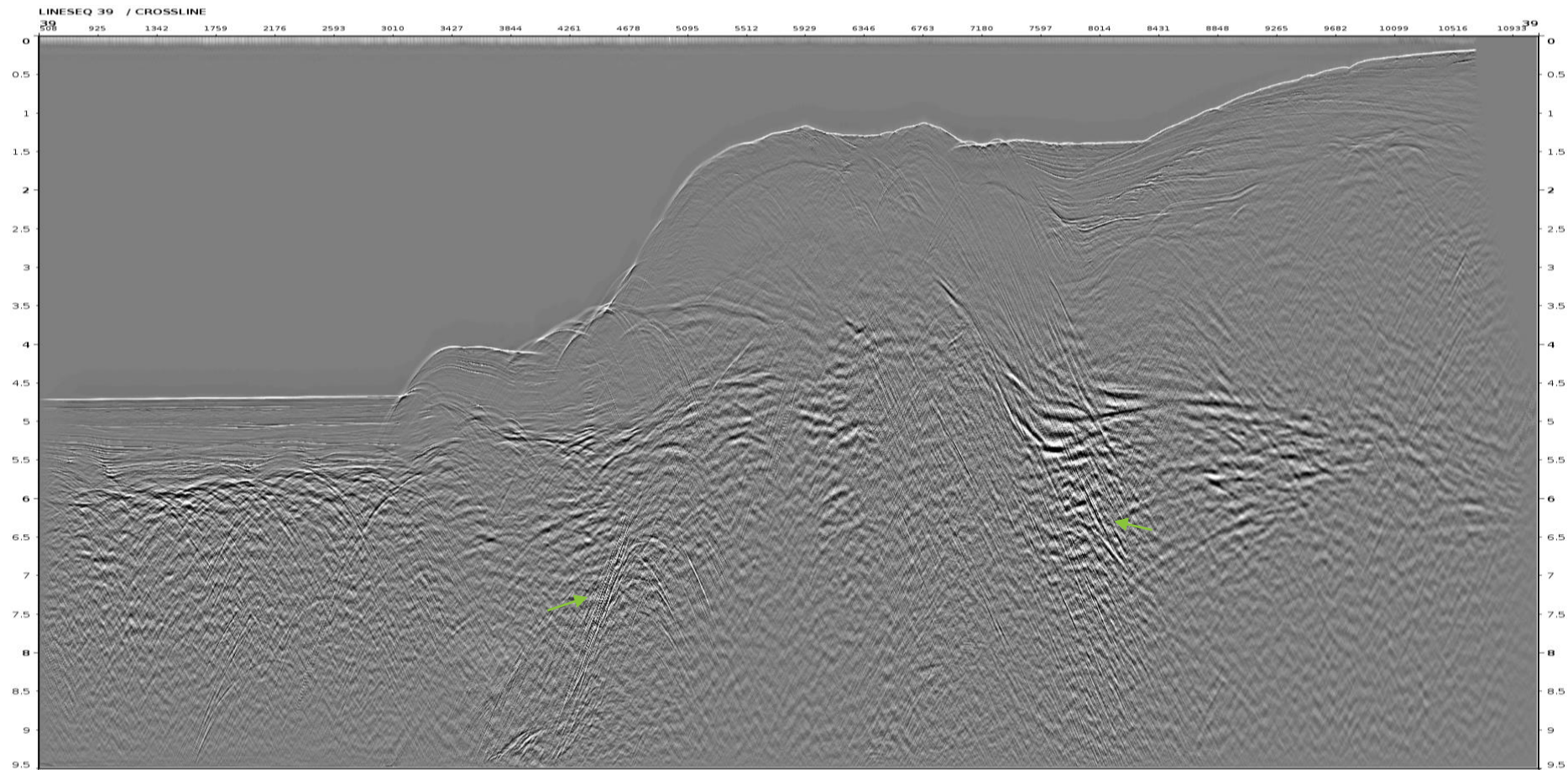
23

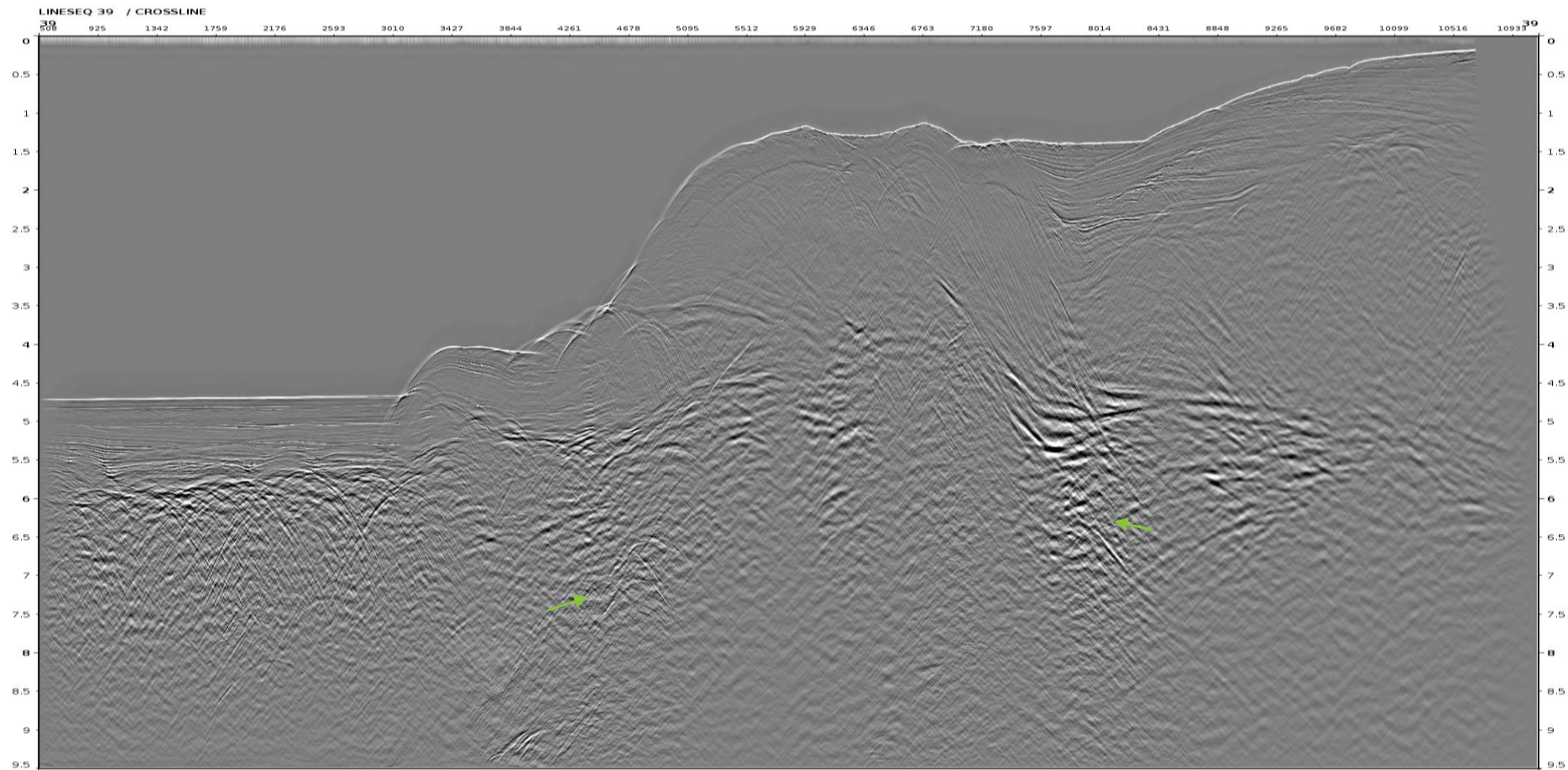


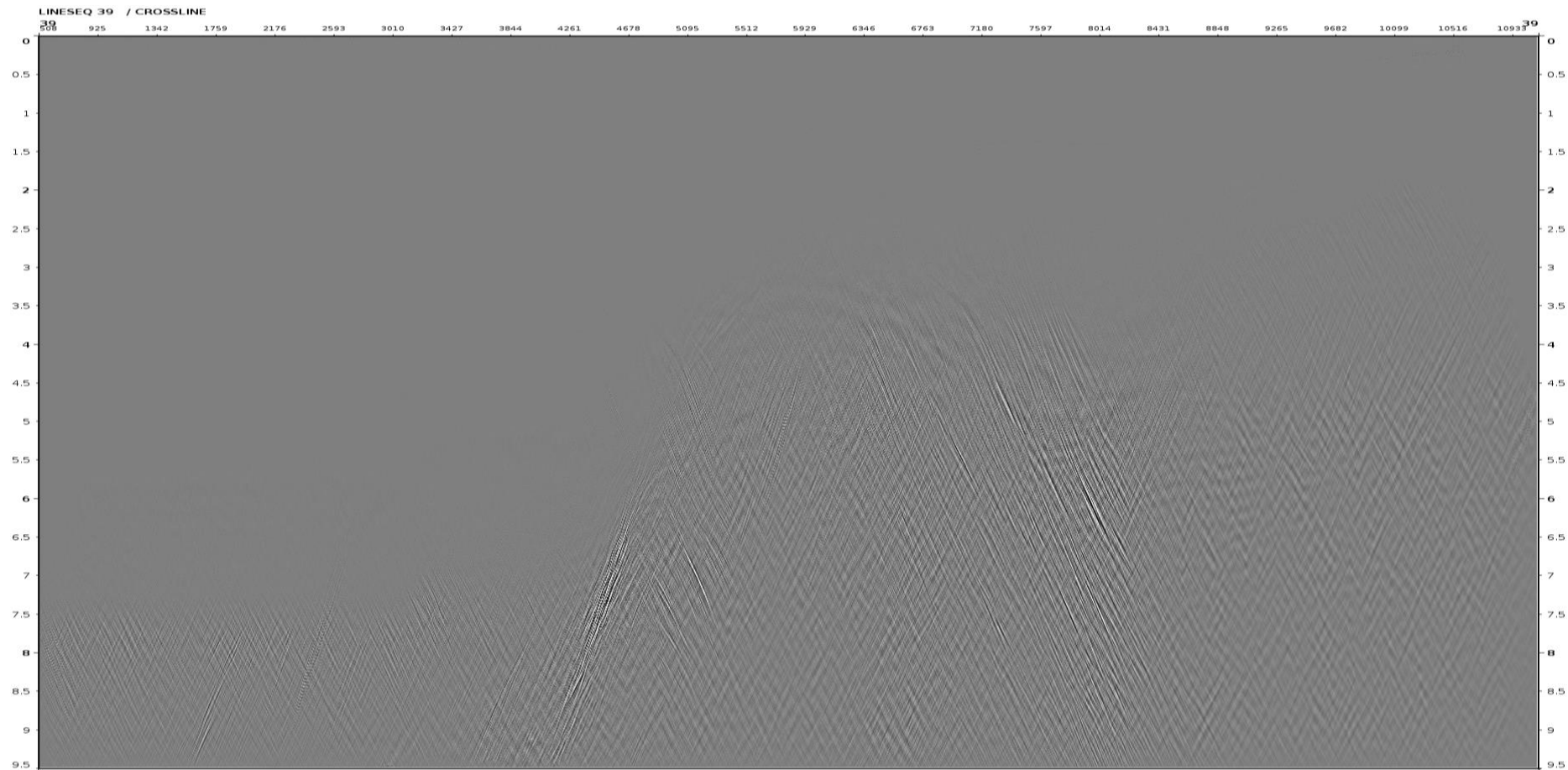
- No primary damage is observed on receiver gather.

Seq 039

- Stack
- Common Channel
- Gathers





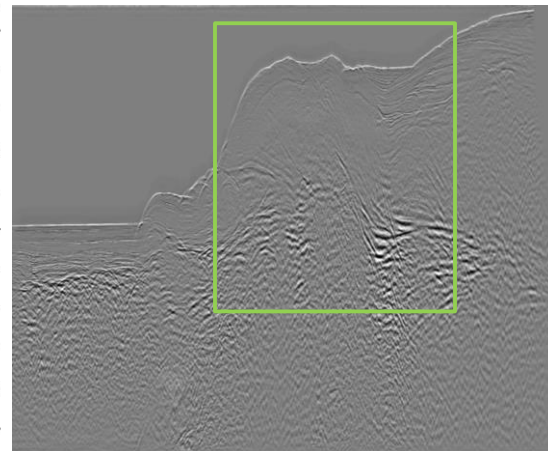
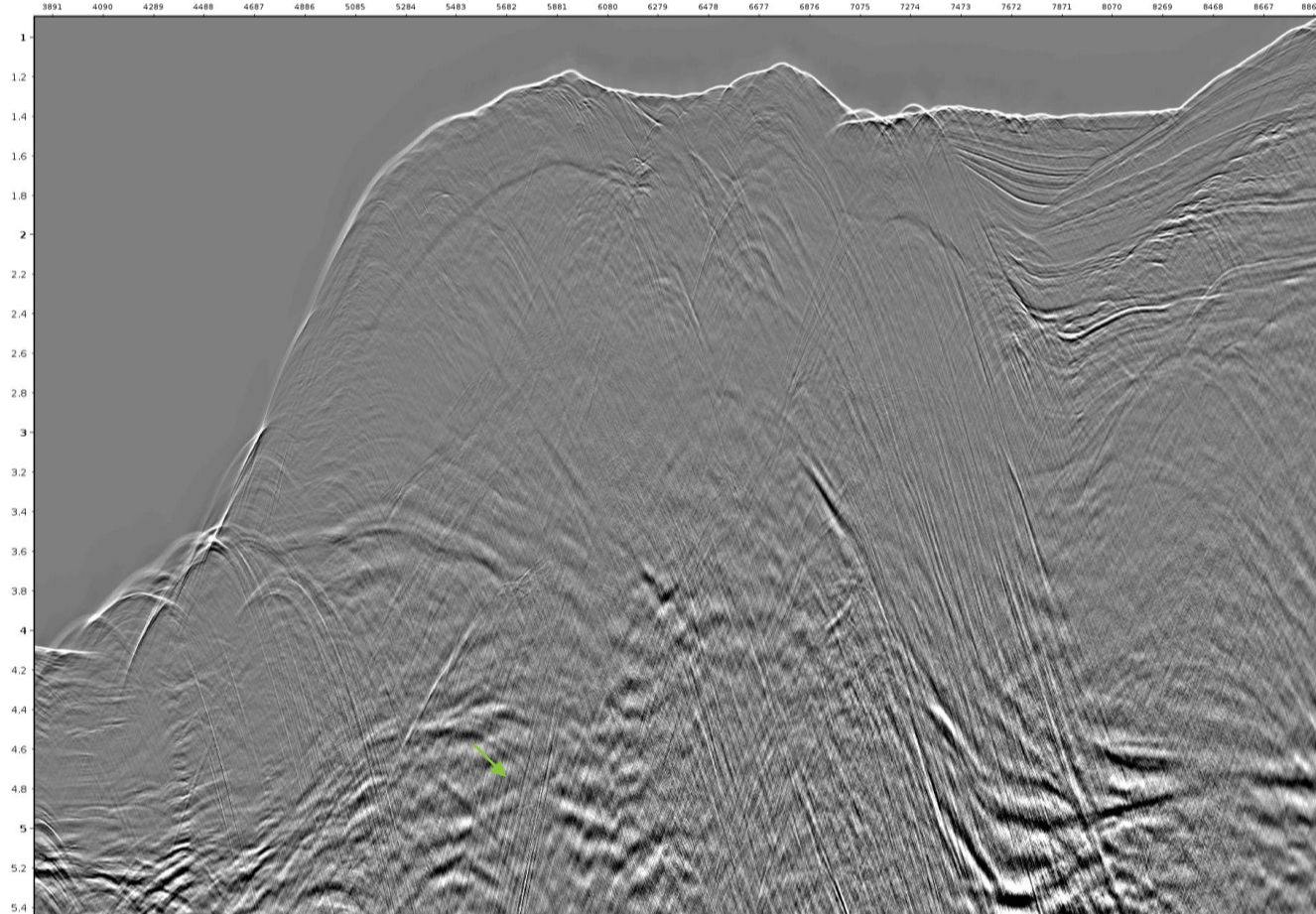




Zoom in Stack before LNA

28

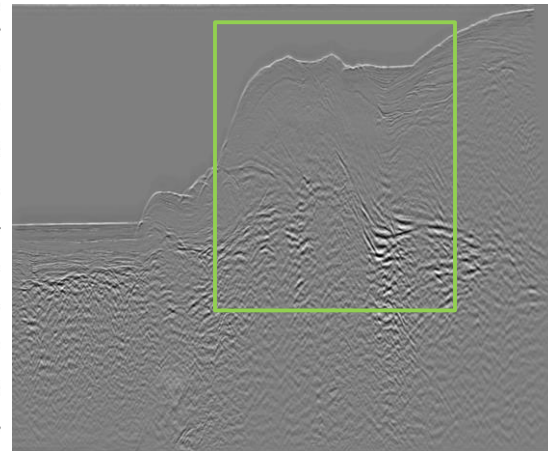
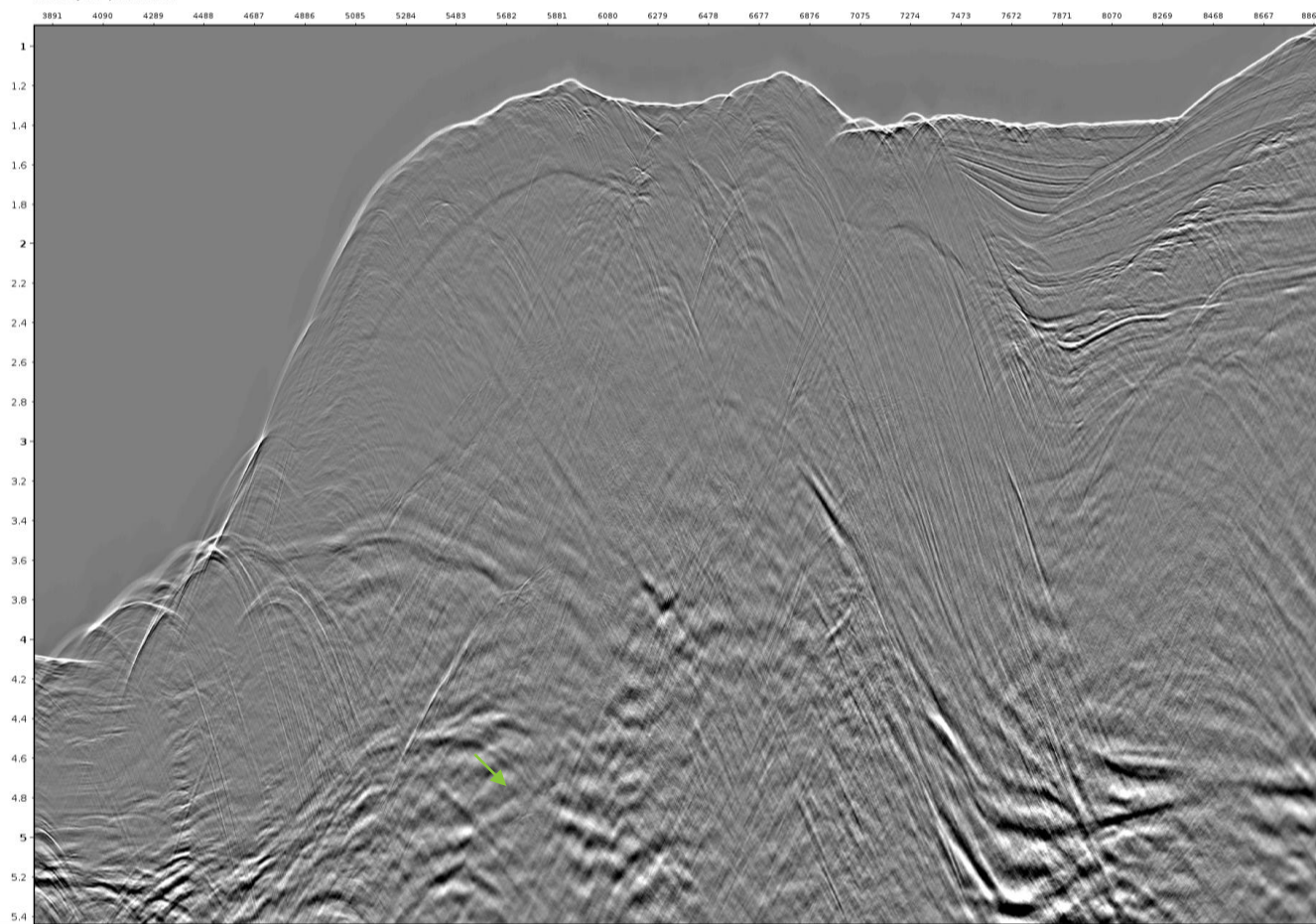
LINESEQ 39 / CROSSLINE



- Dipping noise is observed on stack.

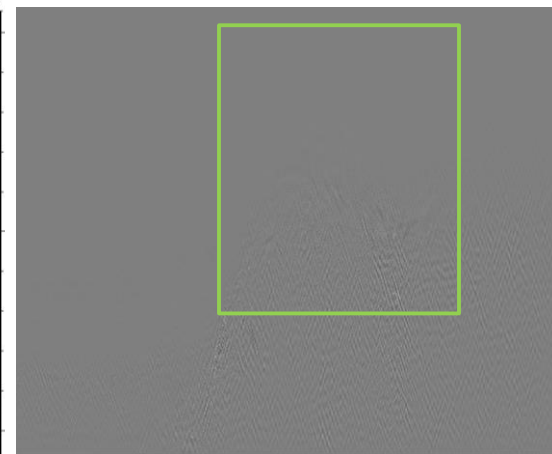
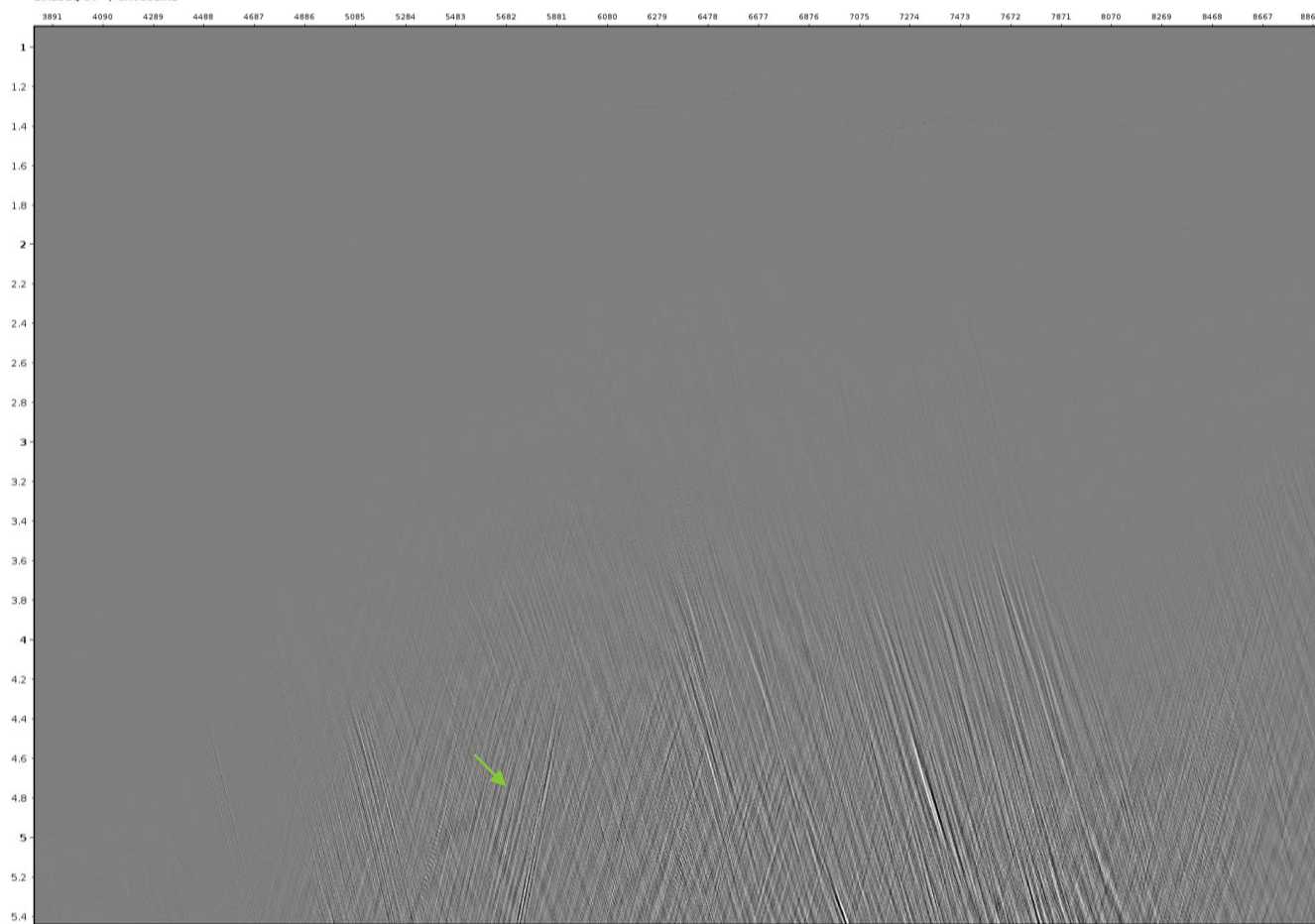


LINESEQ 39 / CROSSLINE



- Noise energy is attenuated.

LINESEQ 39 / CROSSLINE



- No primary damage is observed on difference.

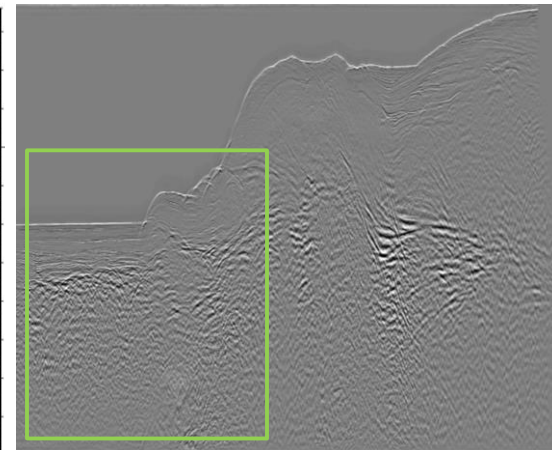
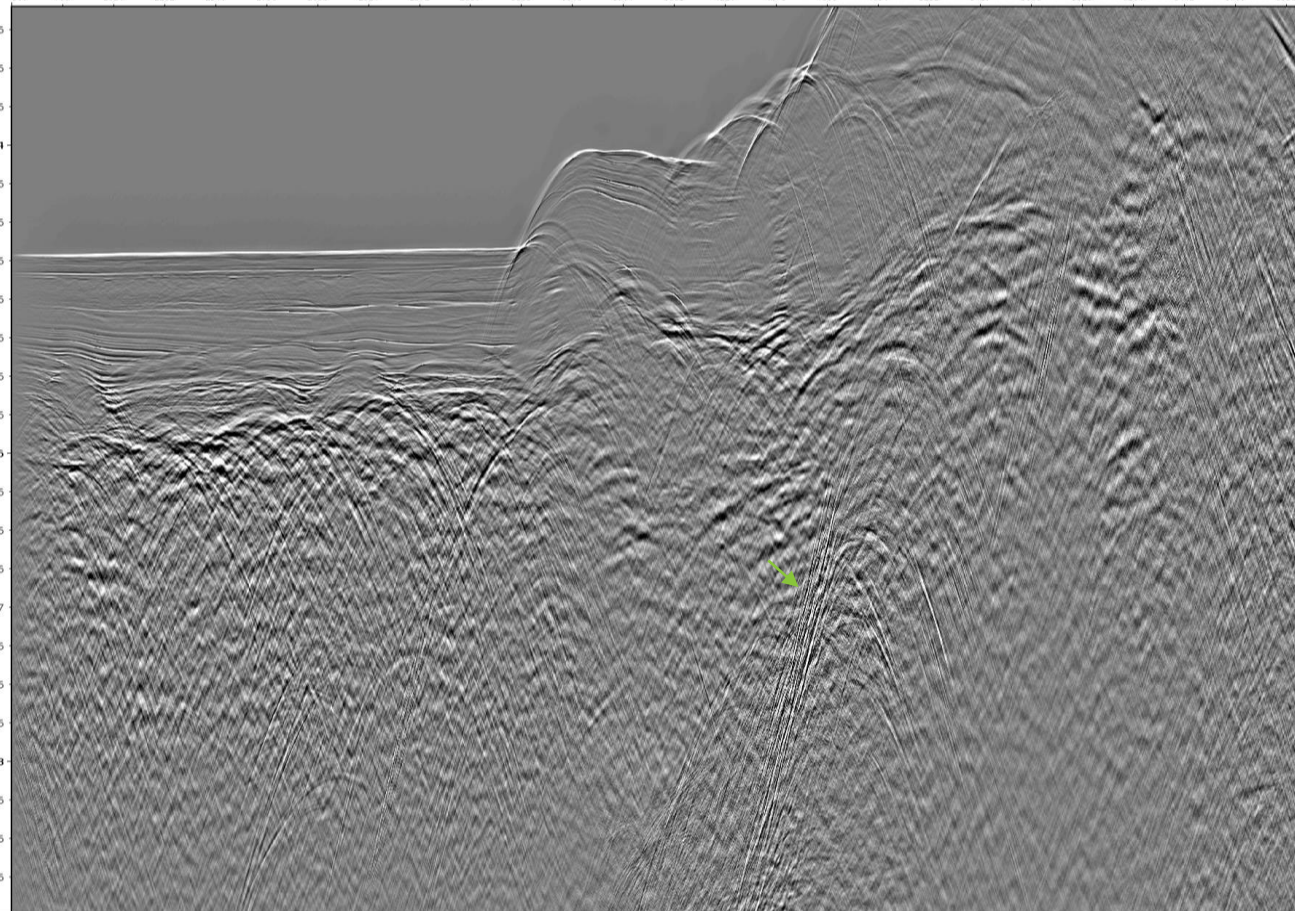


Zoom in Stack before LNA

31

LINESEQ 39 / CROSSLINE

308 766 1024 1282 1540 1798 2056 2314 2572 2830 3088 3346 3604 3862 4120 4378 4636 4894 5152 5410 5668 5926 6184 6442 6700 6958

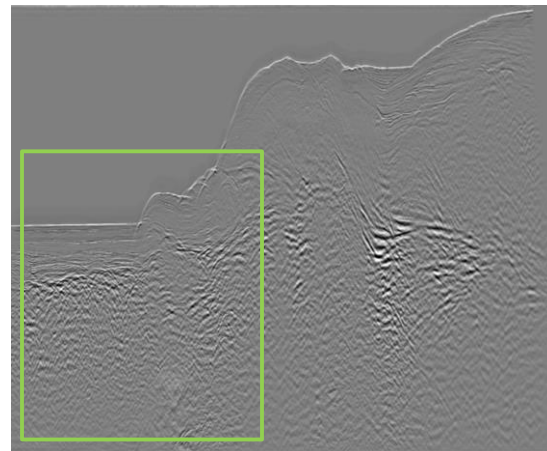
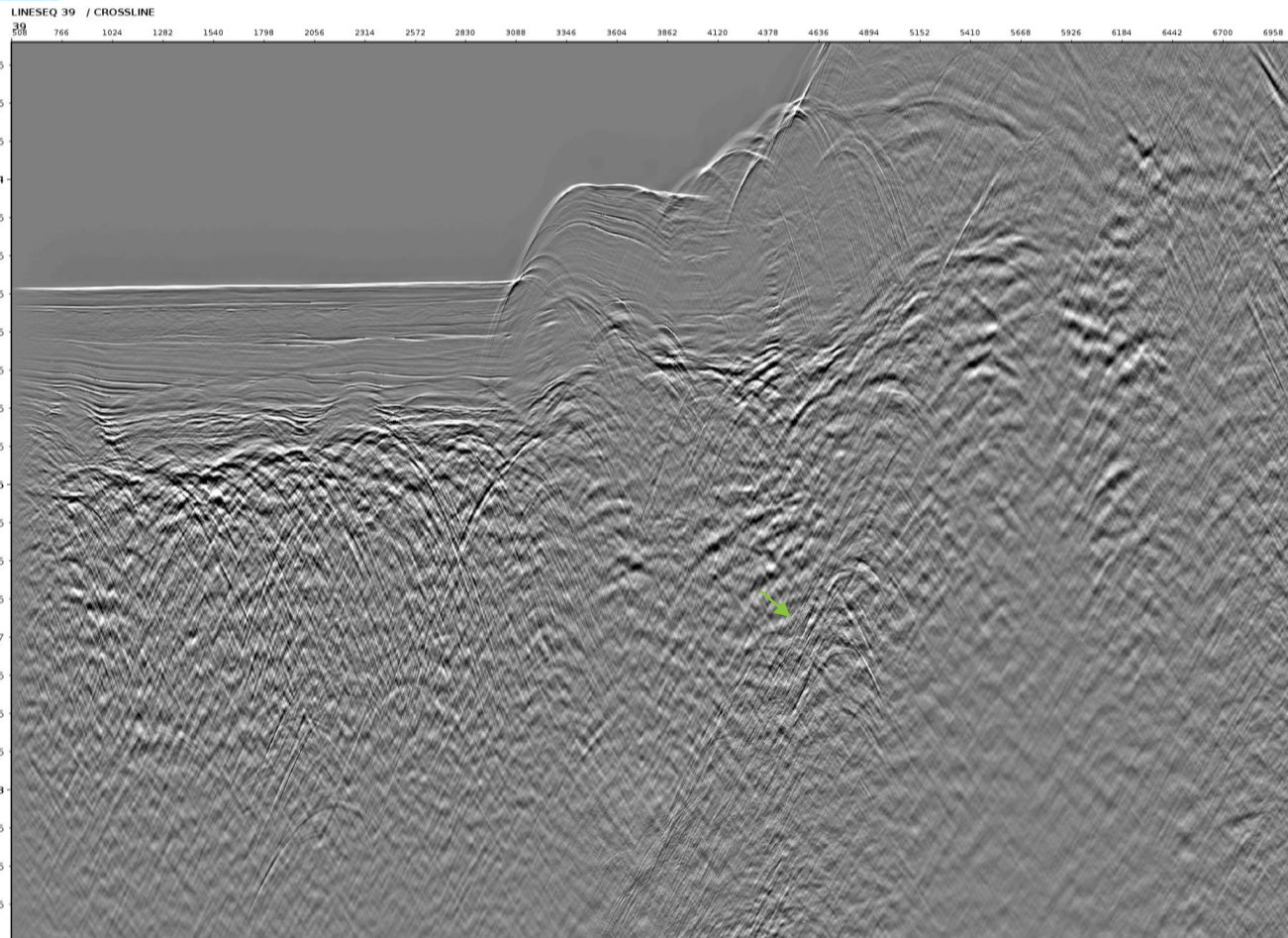


- Dipping noise and residual multiple diffractions are observed on stack.

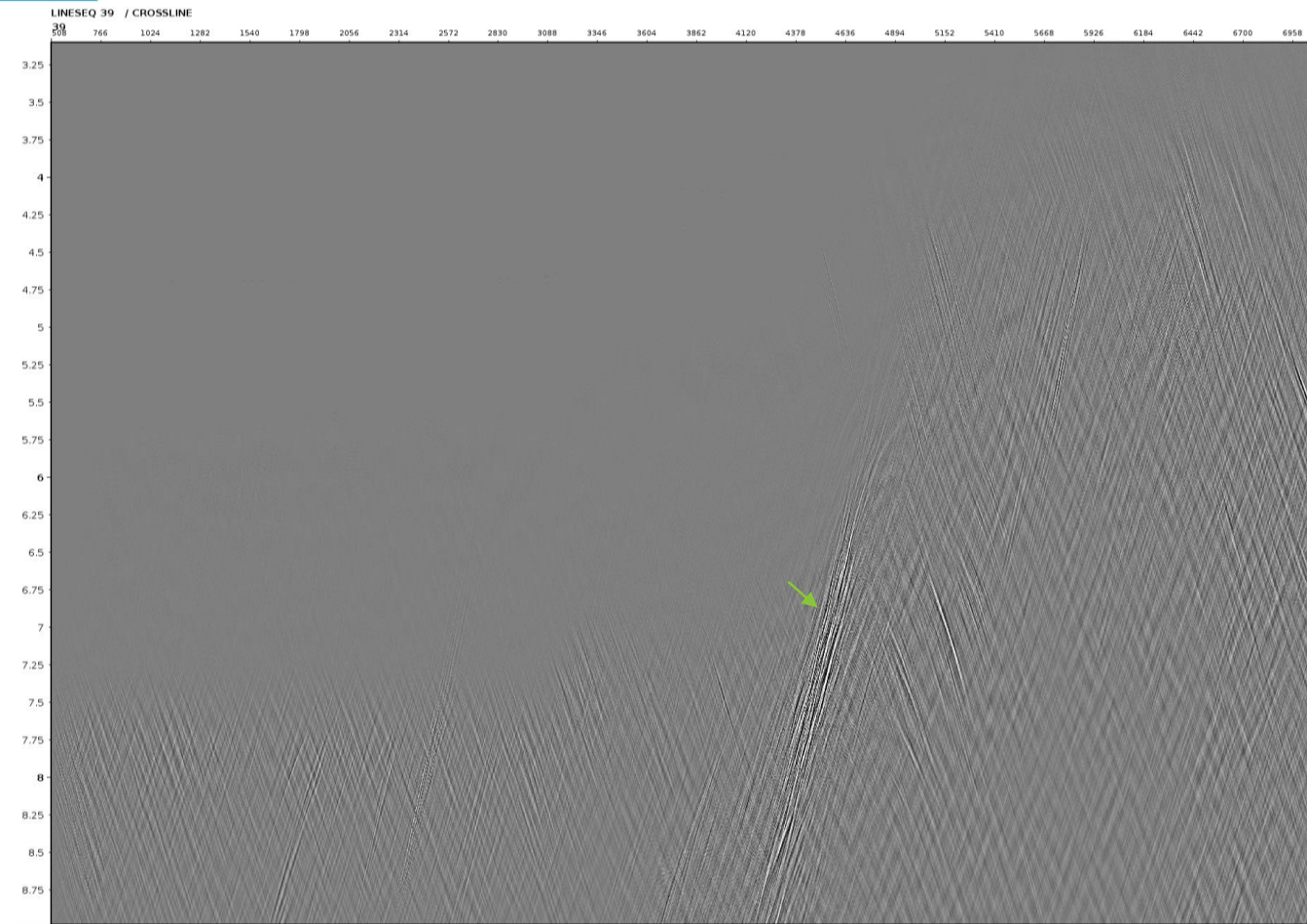


Zoom in Stack after LNA

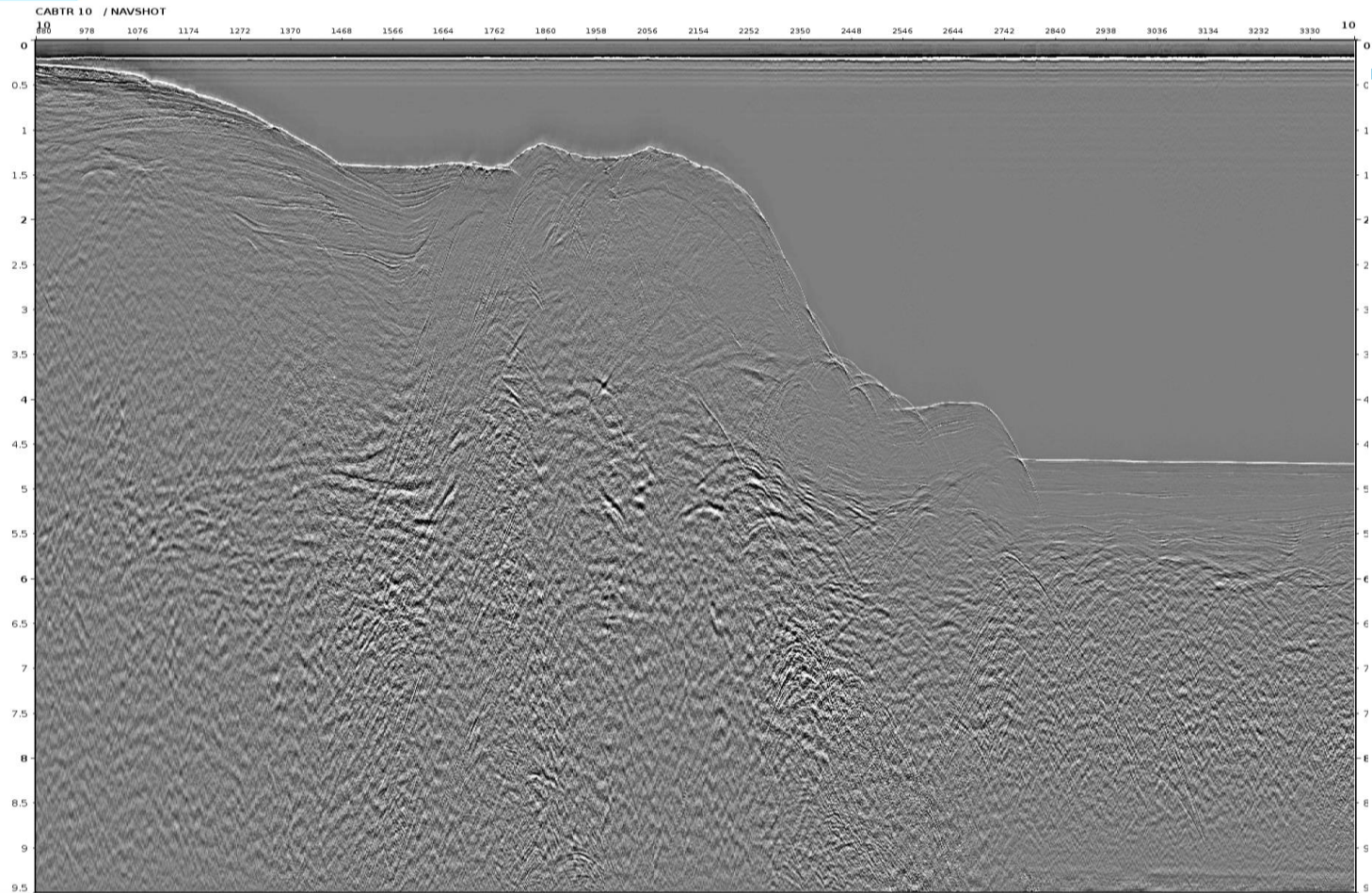
32



- Noise and residual multiple diffractions are also attenuated.



- No primary damage is observed on difference.

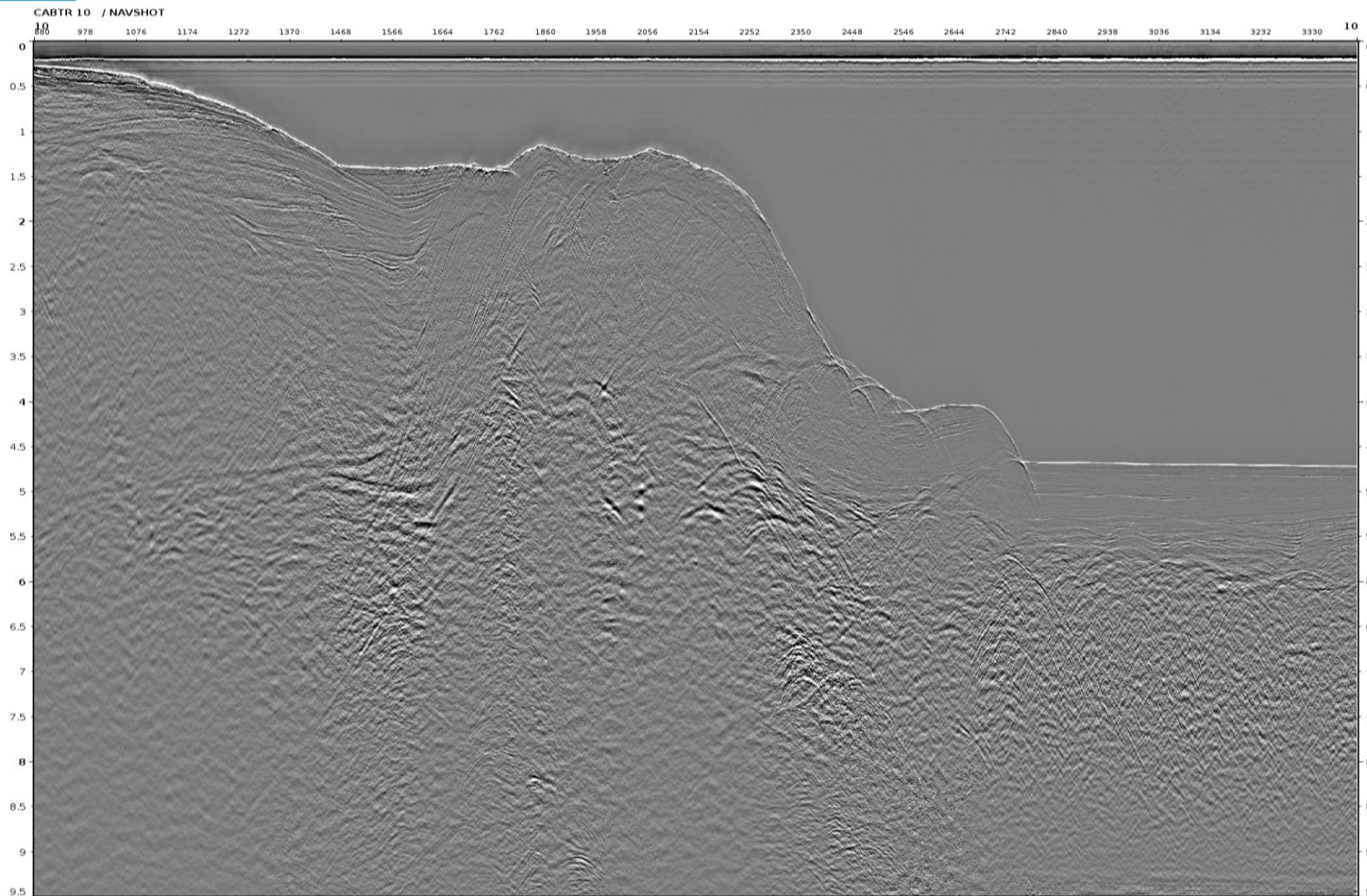


- Residual linear noise is visible on common channel.



Common Channel after LNA

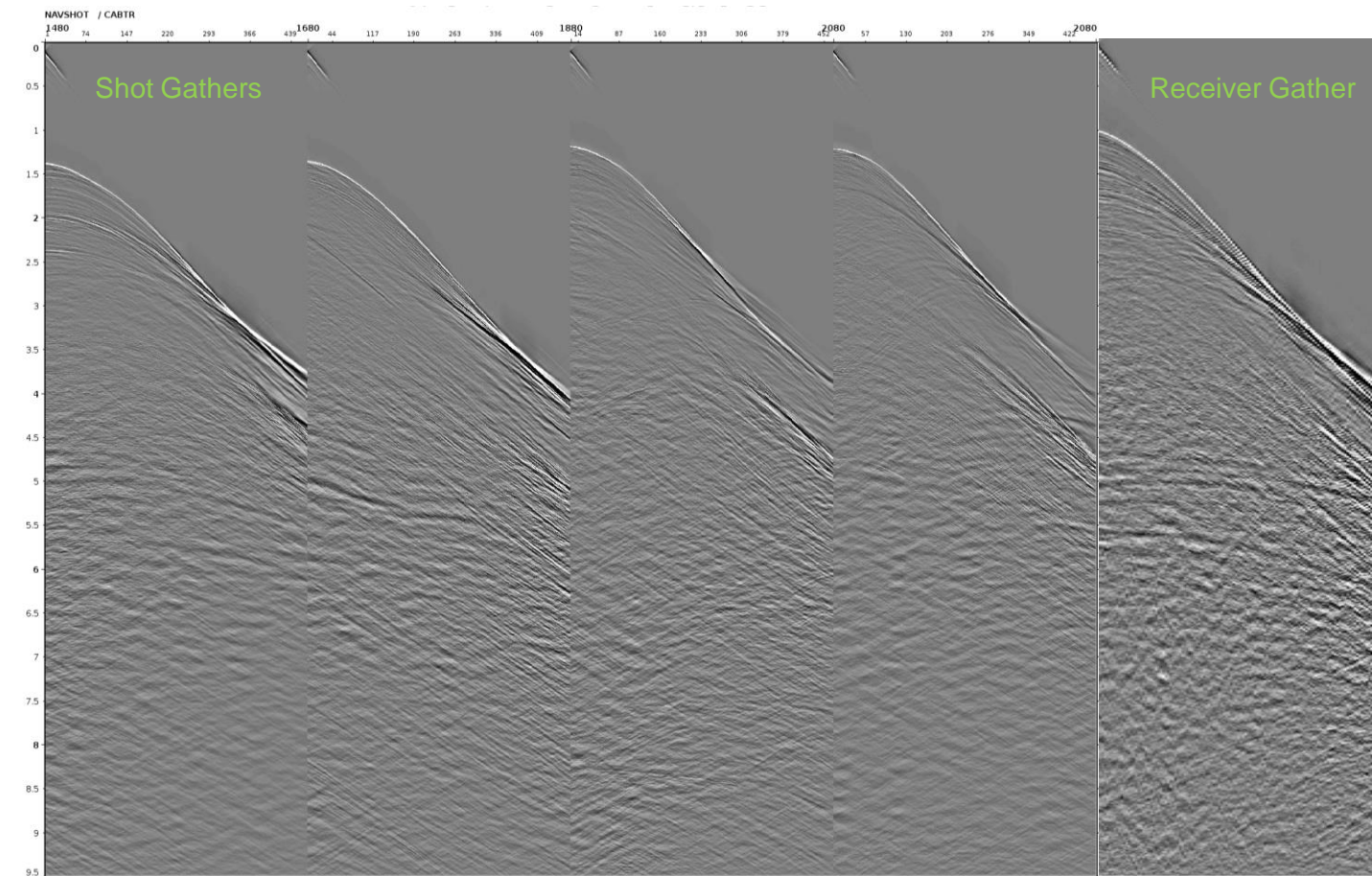
35

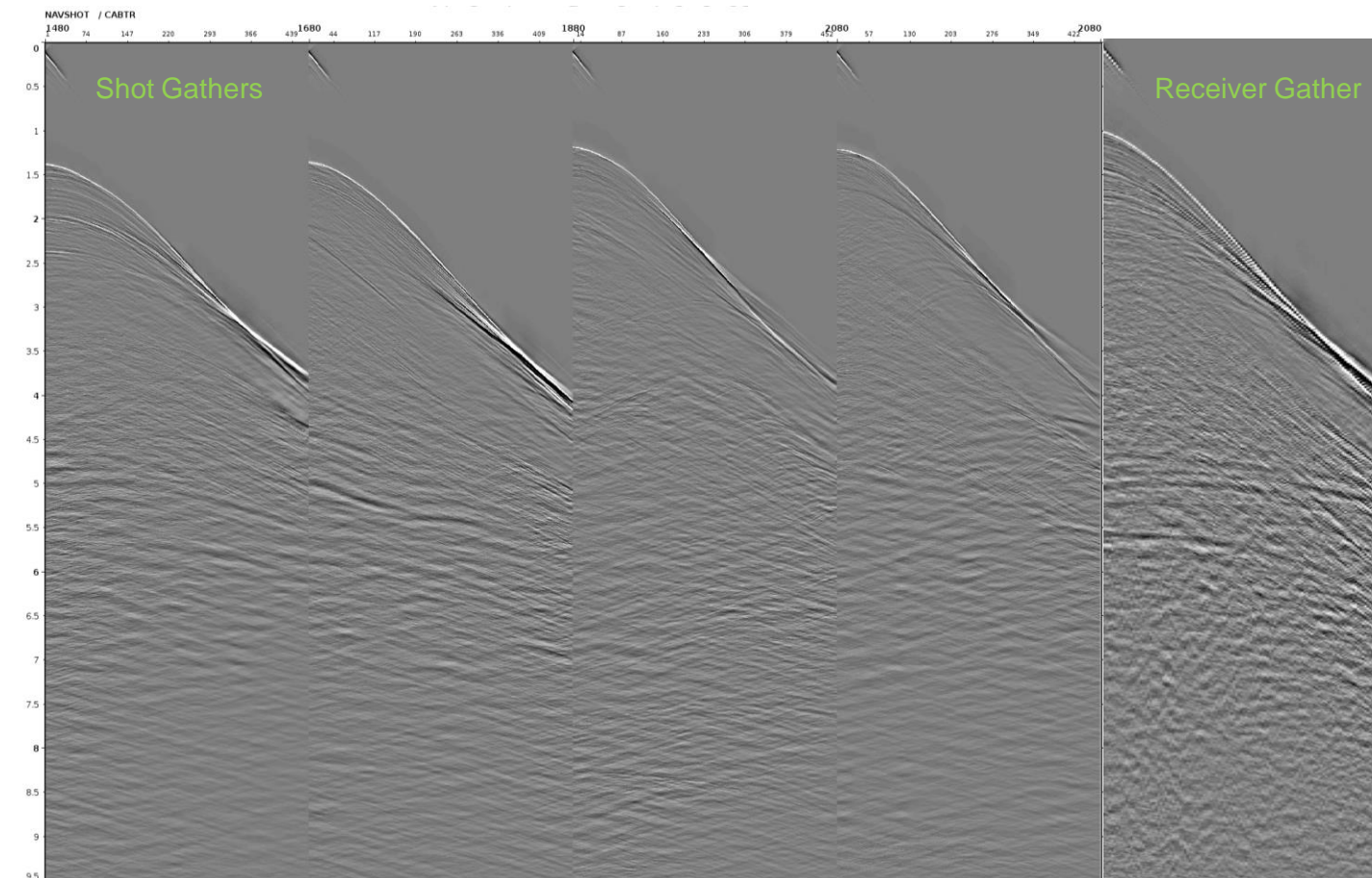


- Noise energy is attenuated.



- No primary damage is observed on difference.

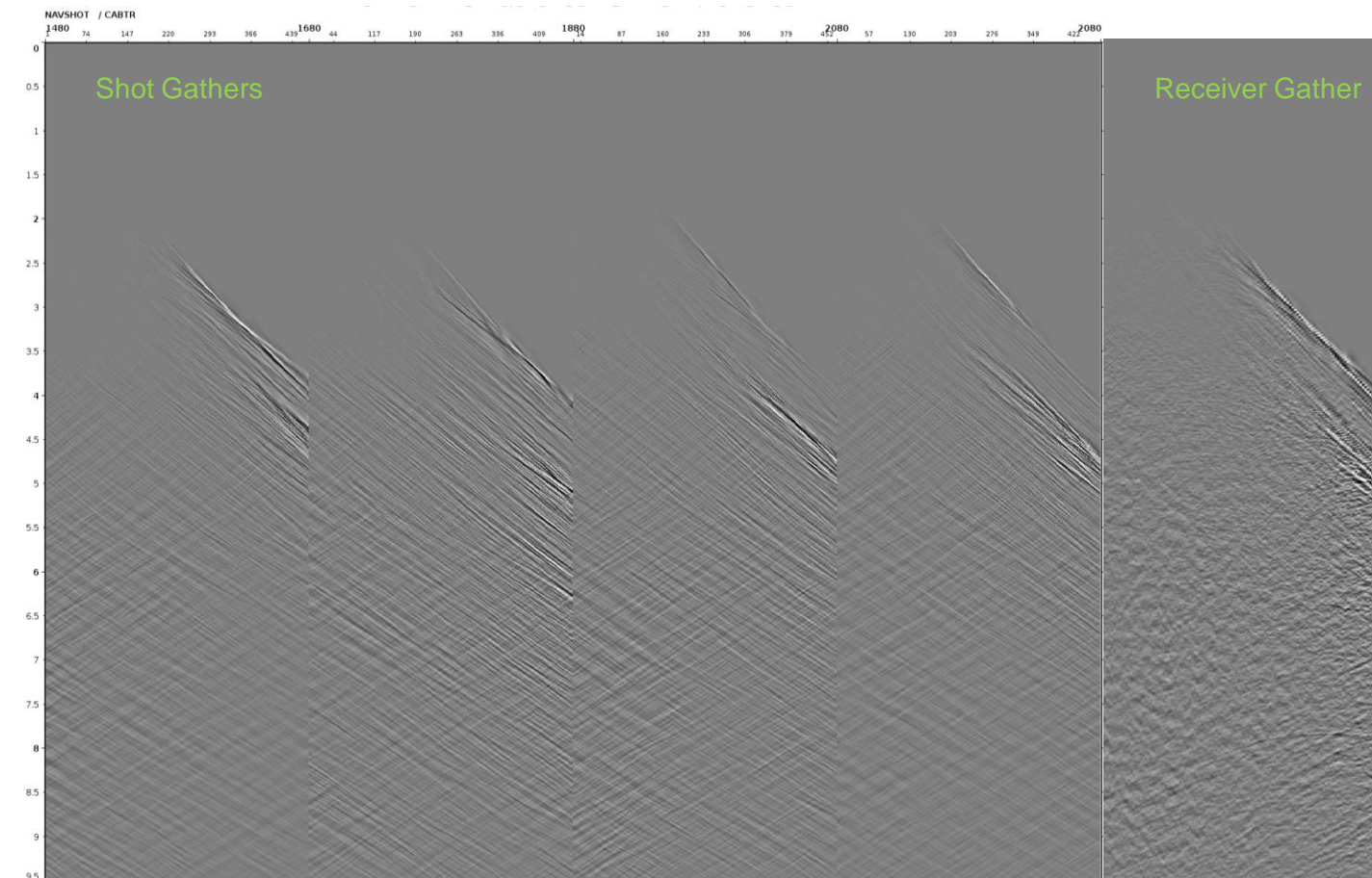




- Linear noises on shot gathers are attenuated

Difference before – after Shot LNA

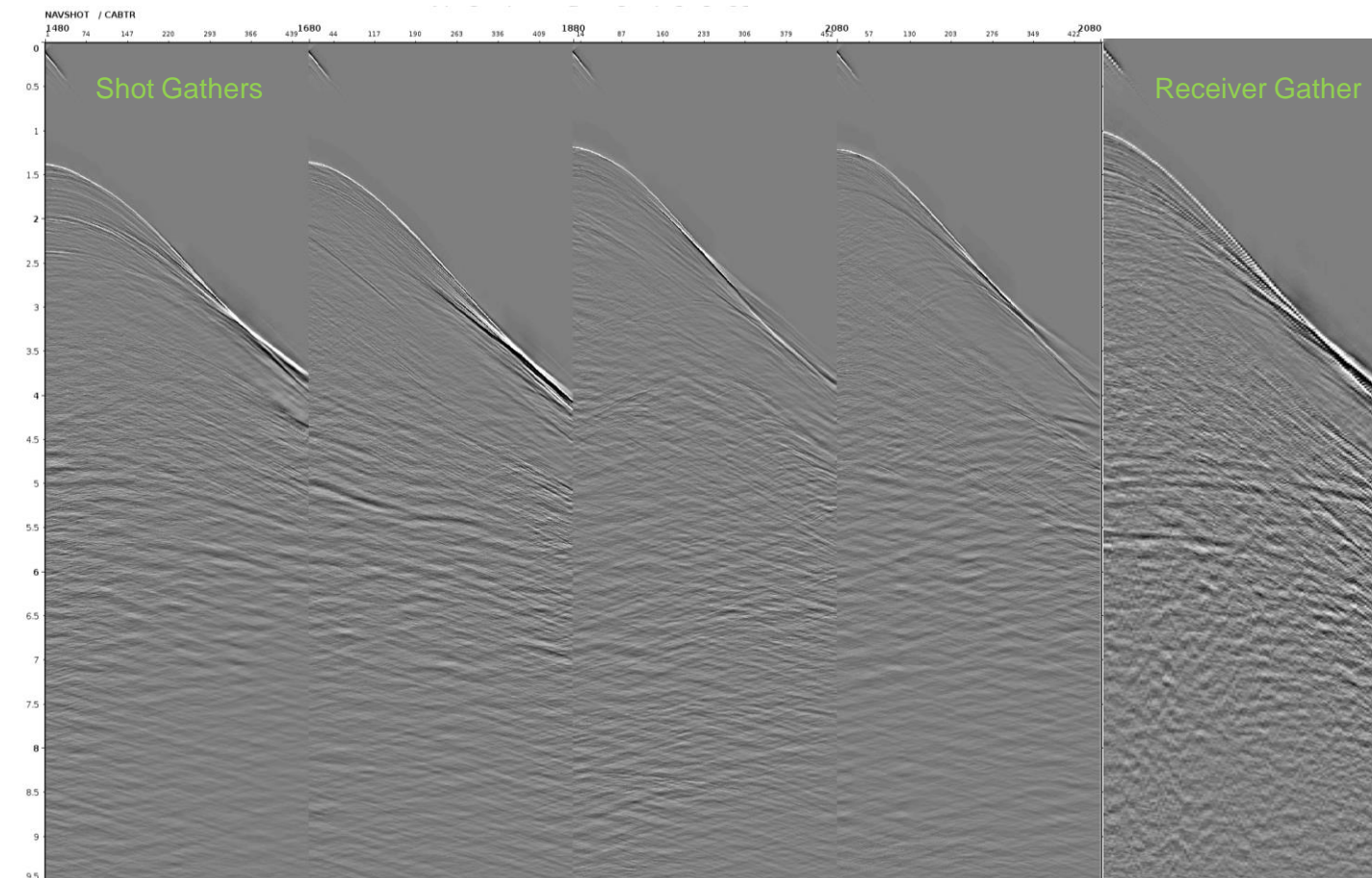
39



- No primary damage is observed on shot gathers.

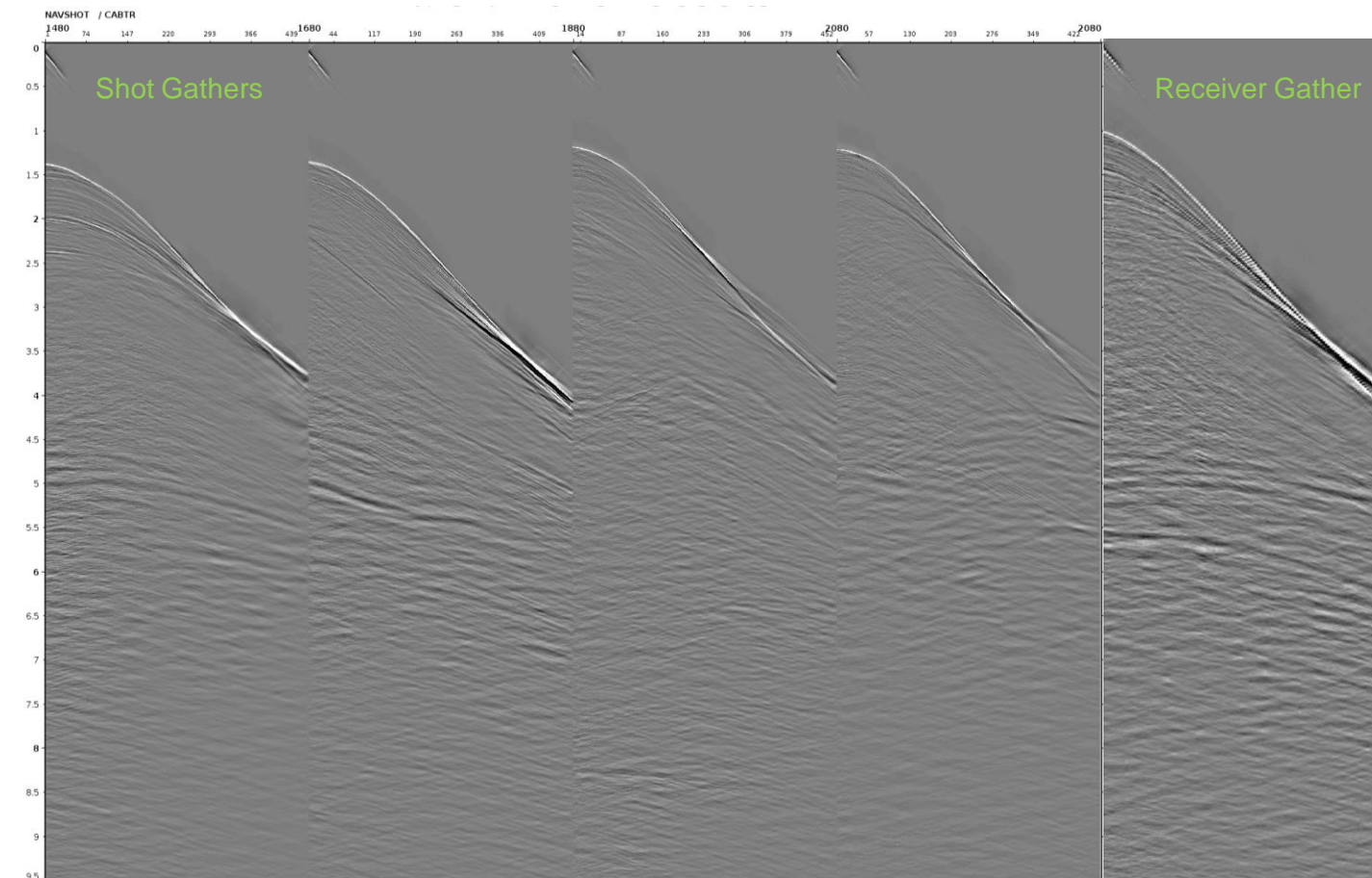
Selected Gathers after Shot LNA (copy)

40



Selected Gathers after Receiver LNA

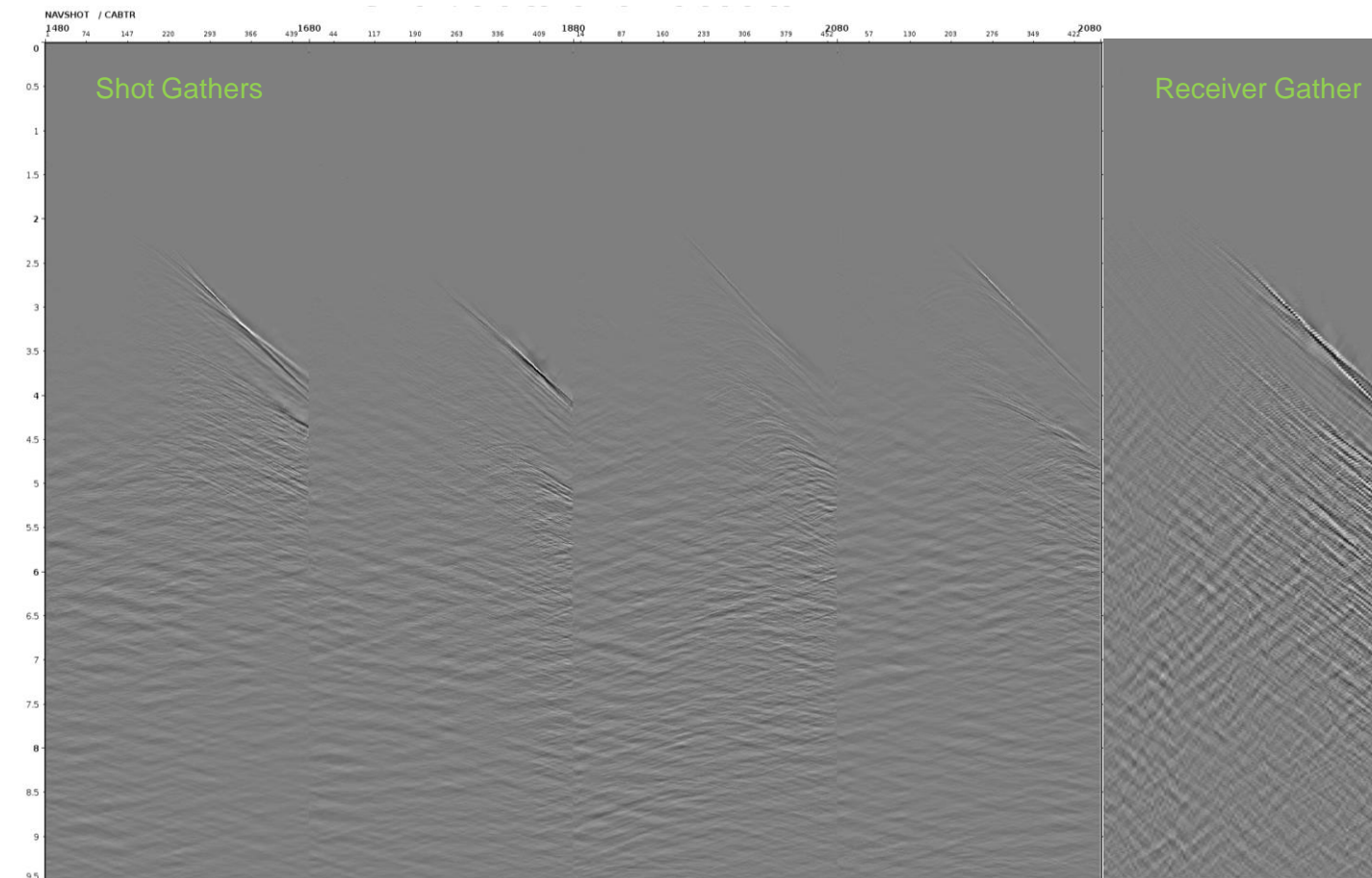
41



- Linear noises on receiver gather are attenuated

Difference before – after Receiver LNA

42



- 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.