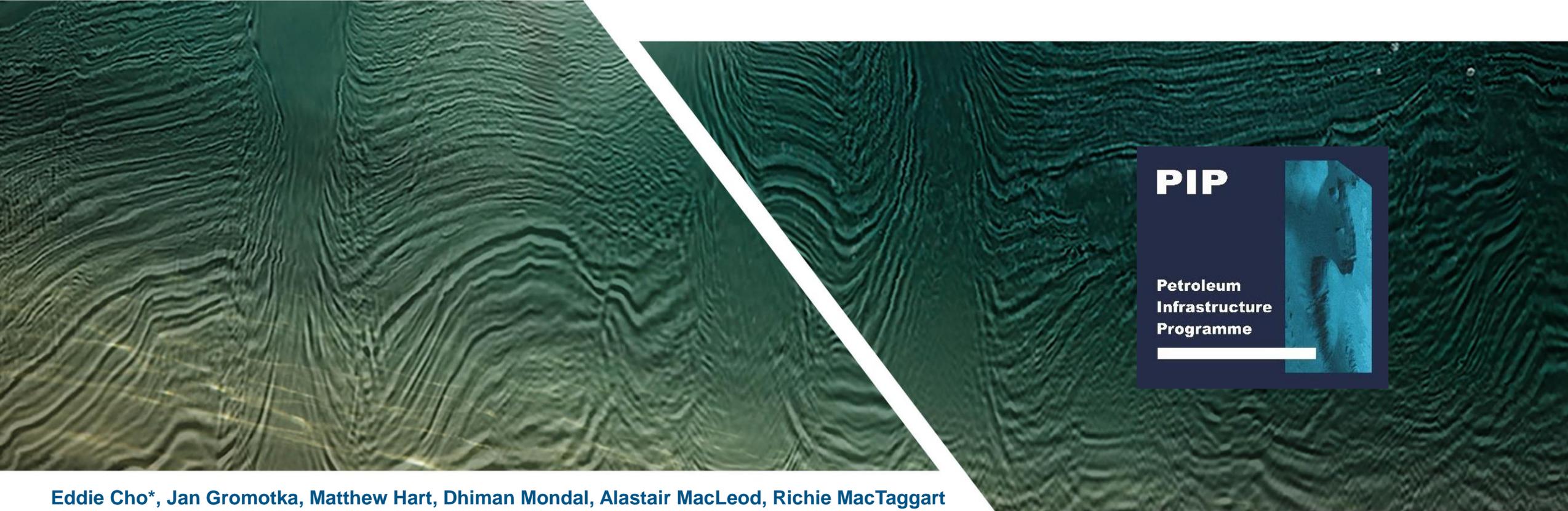




Data You Can Trust, No Matter What The Azimuth – Case History from Irish Atlantic Margin



Eddie Cho*, Jan Gromotka, Matthew Hart, Dhiman Mondal, Alastair MacLeod, Richie MacTaggart

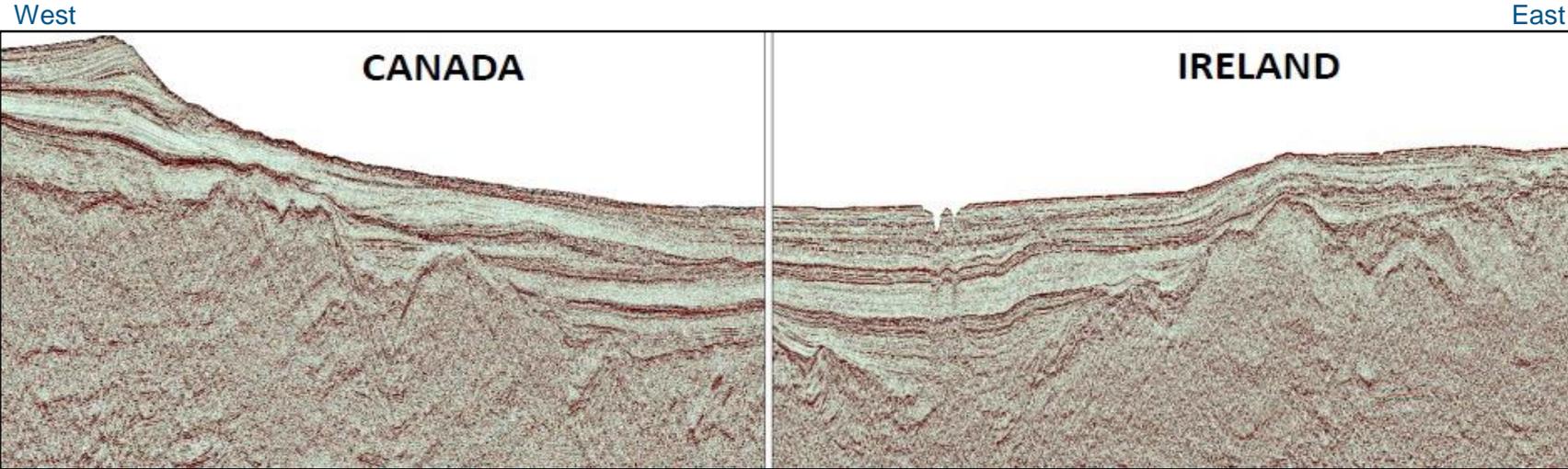
TGS

Overview

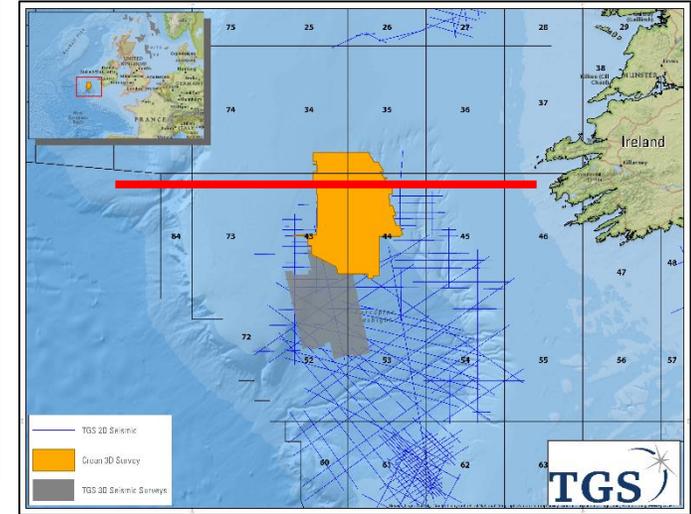
- Introduction
- Processing workflow
- Deblending
- Regularisation
- Leads
- Conclusions

Introduction

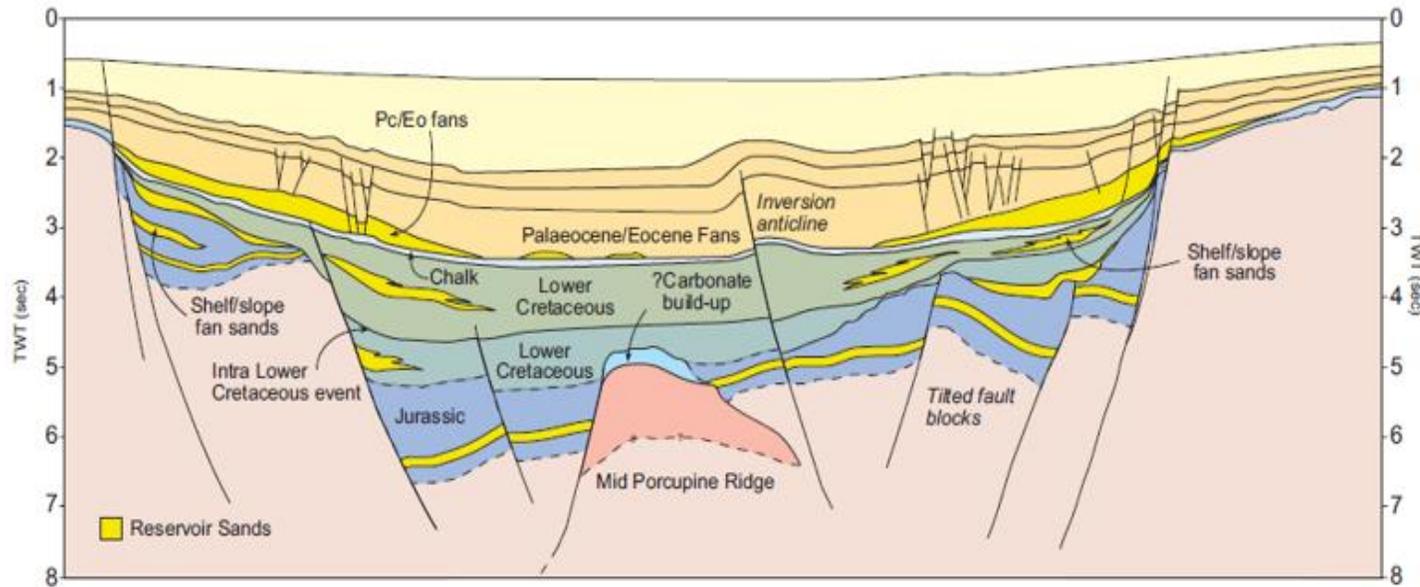
Porcupine basin geological play



Nalcor website, 2016

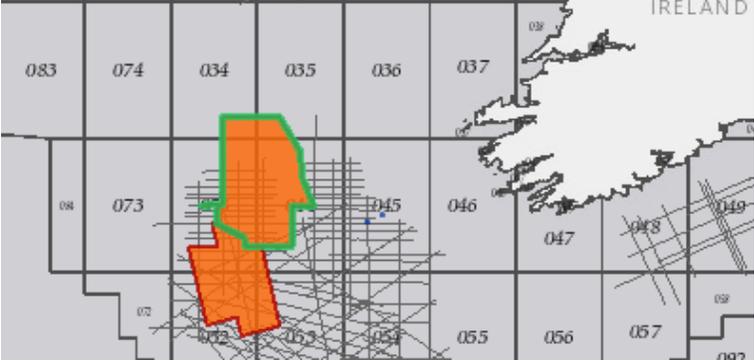
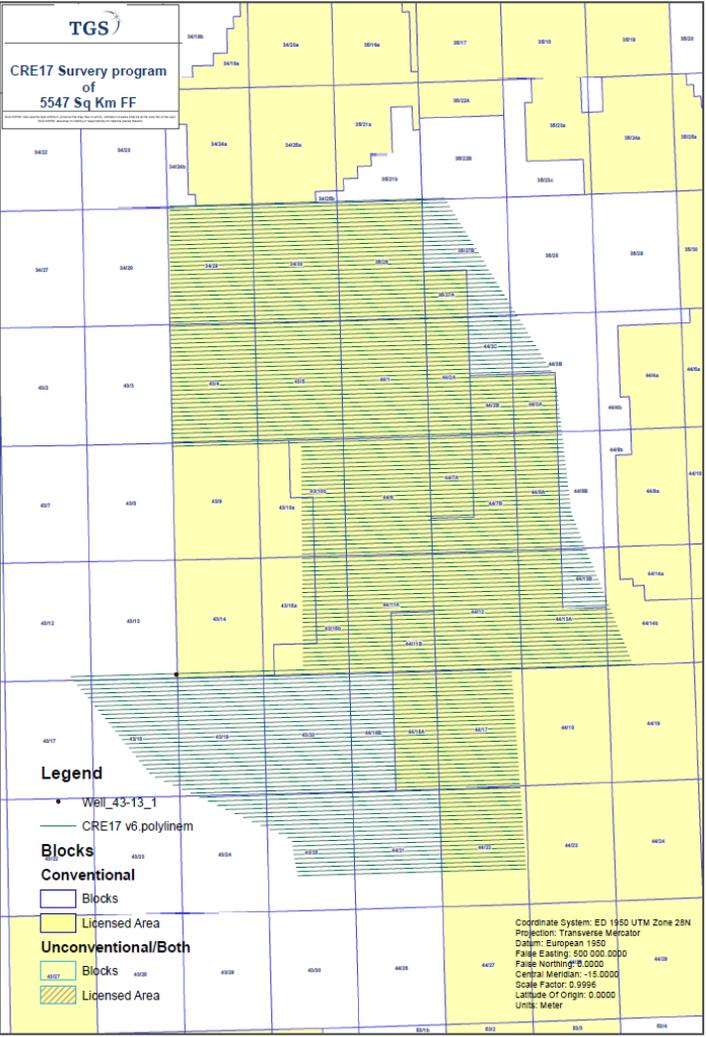


Survey outline for Crean 3D survey.
Red line is an approximate



- Prospective hydrocarbon systems
 - Avalon fan system
 - Drombeg in Lower Cretaceous strata
- Multiple hydrocarbon traps
 - Volcanic sills intrusions
 - Cretaceous carbonate layers

Crean 3D acquisition parameters



| Parameter | Value |
|---------------------|---|
| Streamer Spread | 12 x 112.5 m x 8100 m |
| Streamer Depth | 18 m |
| Number of Channels | 648 |
| Fan Mode | 25% at tail |
| Source Volume | 2965 cu.in. |
| Source Depth | 7 m |
| Shot-Point Interval | 12.5 m triple-source (flip-flop-flap), GDSPL +/- 400 ms |
| Shot Direction | NW-SE |
| Record Length | 11 s cont. rec. (5.3 s "clean record") |
| Fold | 108 |
| Bin-Size | 6.25 m x 18.75 m |



Polar Marquis

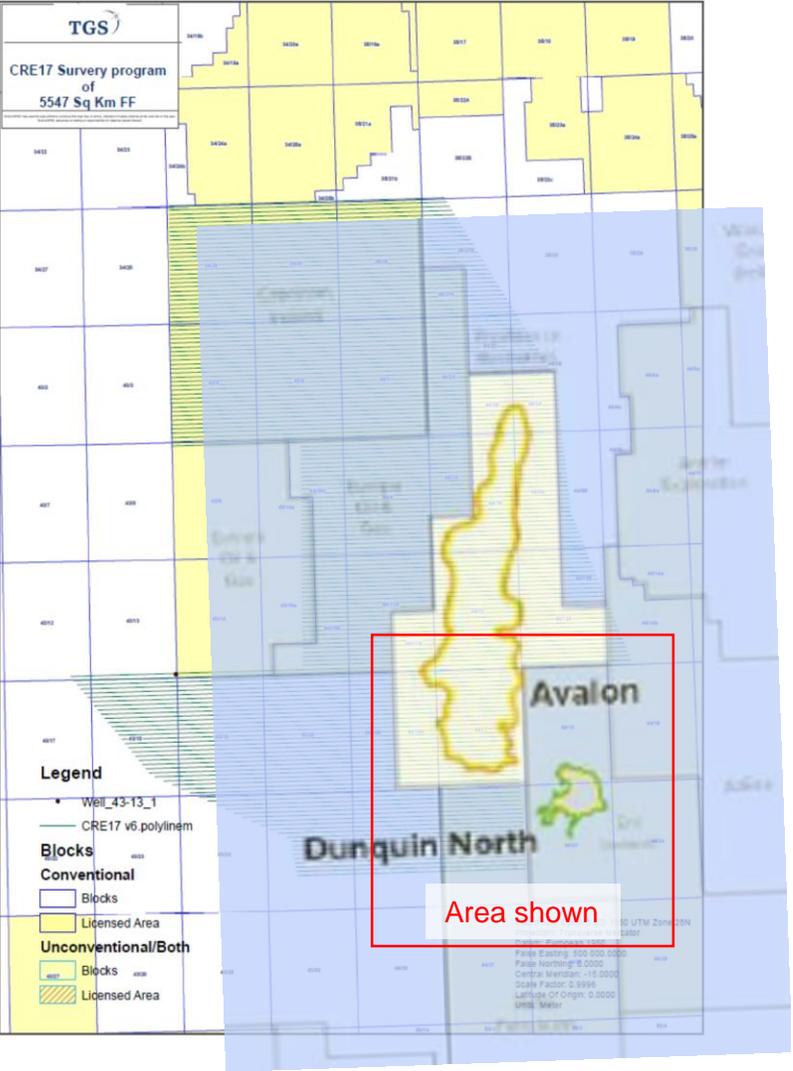


Moonrise GSL

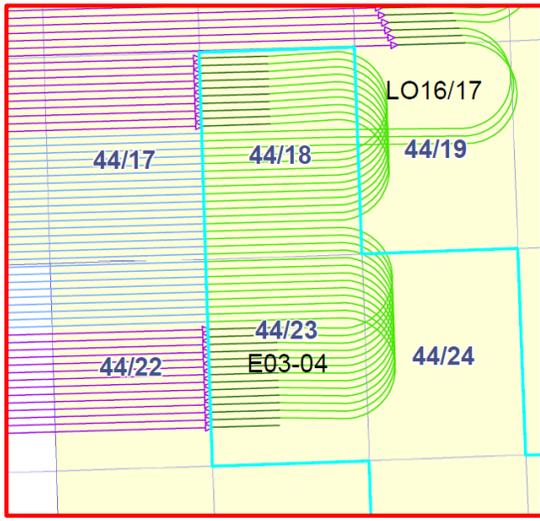


Andrea

Crean 3D sail line preplot



- 8.6% of the sail lines had to be acquired through a north-south shooting direction to conform with the approved license boundary.



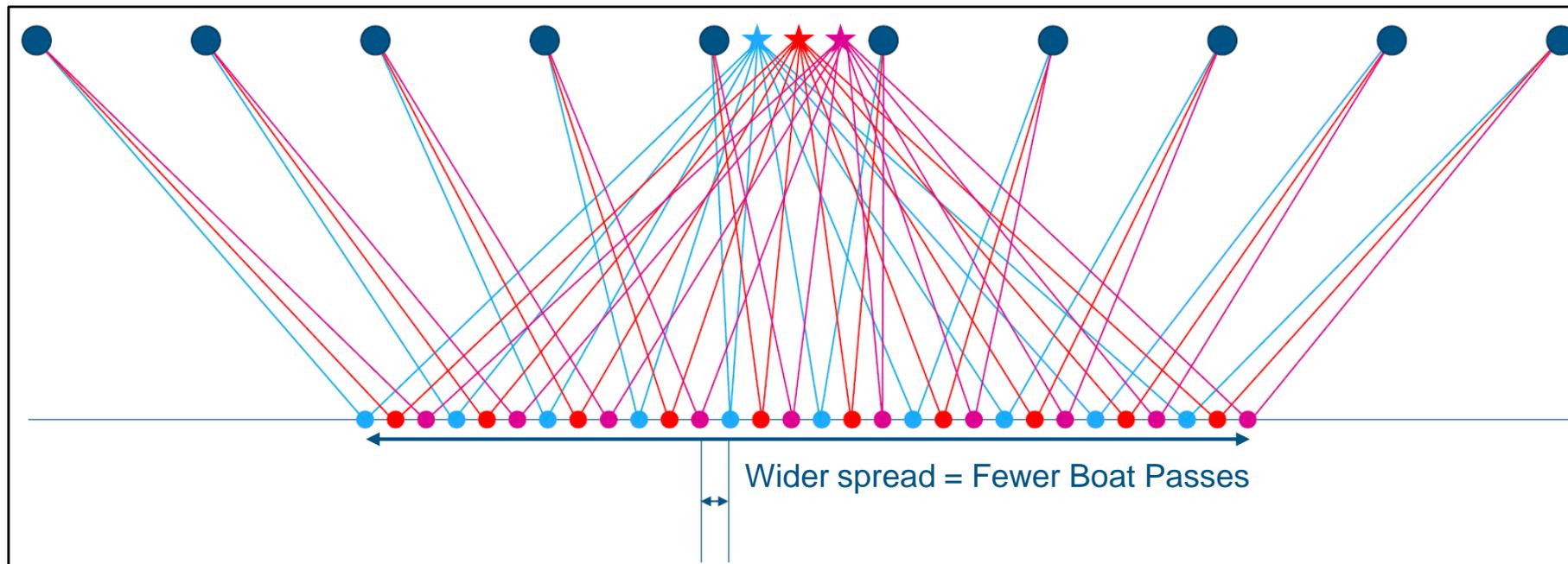
Original preplot



Revised preplot

Survey design – key considerations

- Target imaging grid 12.5 m x 18.75 m
- Acquire survey within a single acquisition season
- Minimise acquisition costs

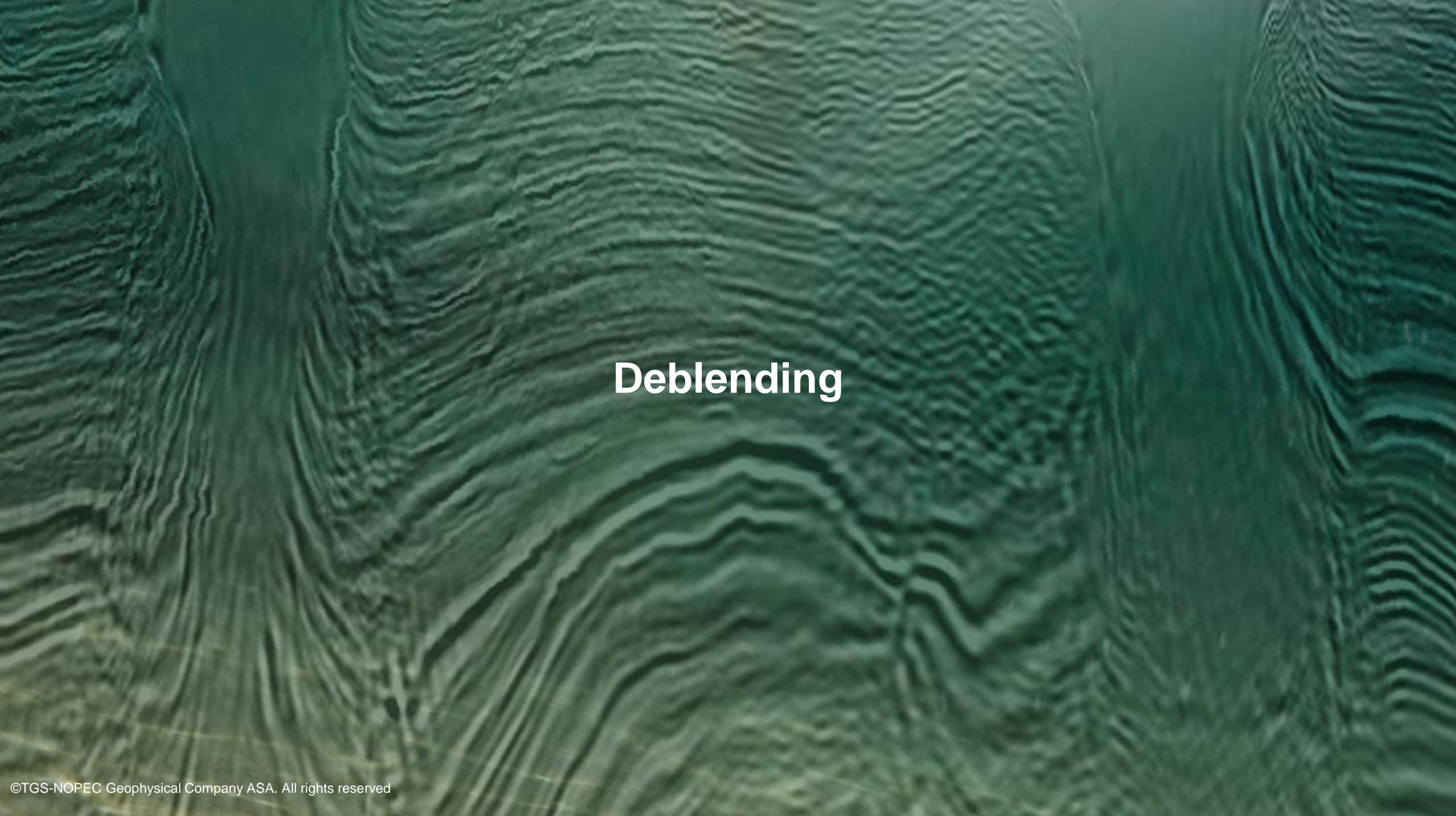


Processing Workflow

Crean 3D processing workflow

- Navigation merge, geometry assignment, trace editing
- Swell noise attenuation
- **Source deblending**
- Deghosting
- Debubble
- Zero phasing
- 3D SRME (TAME™)
- Linear noise attenuation
- Inverse Q filter (phase only)
- Stepwise Multiple Elimination using Linear Transforms (SMELT™)
- **4D Anti-leakage Fourier transform regularisation**
- Pre-migration noise attenuation
- Pre-stack Kirchhoff time migration (PreSTM)
- Time domain radon demultiple
- Post-migration noise attenuation
- Inverse Q filter (amplitude only)
- Stack
- Footprint removal
- Post stack processing

**** Key stages ****

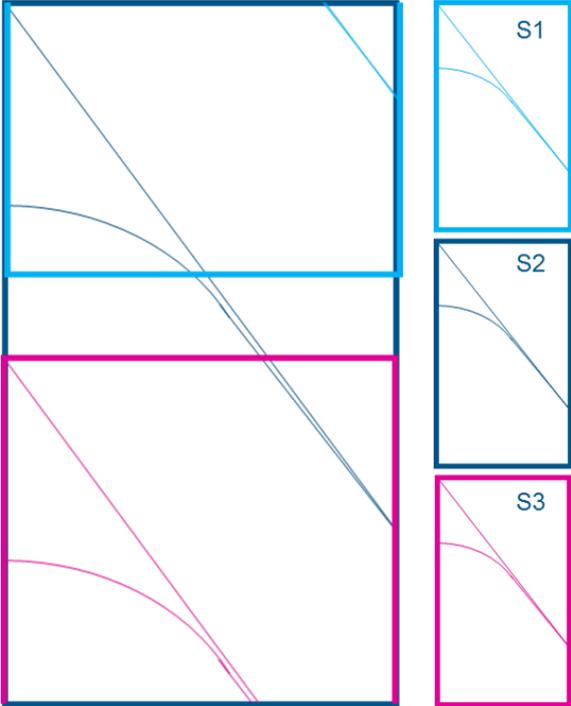


Deblending

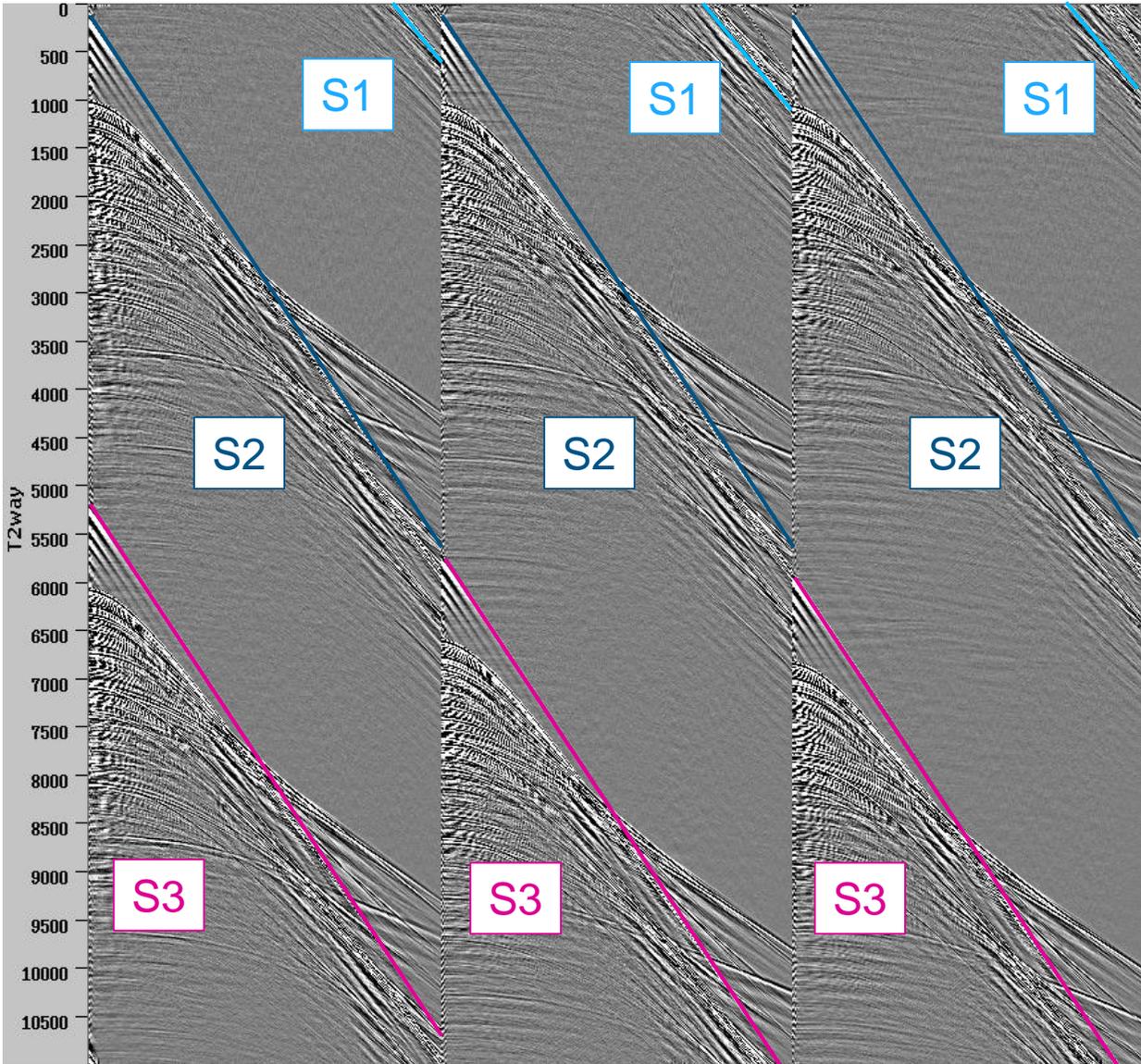
General description of shot gathers with triple source shooting

(After Baldock, et al. 2018)

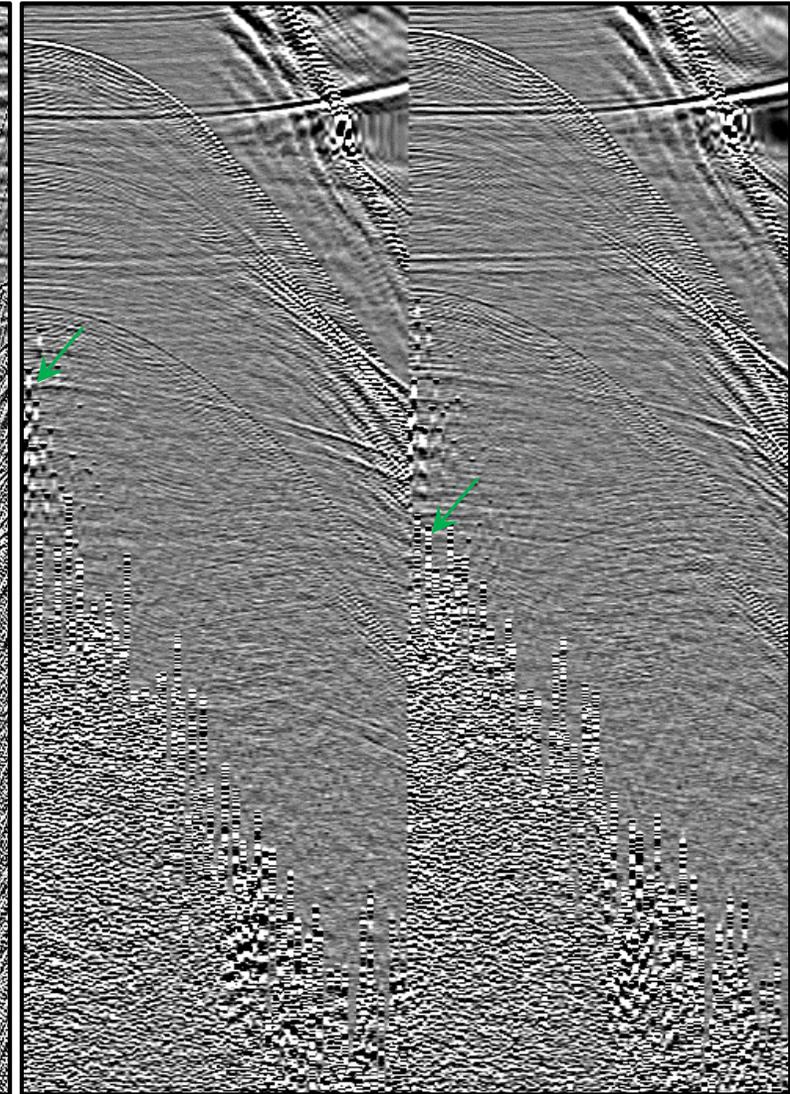
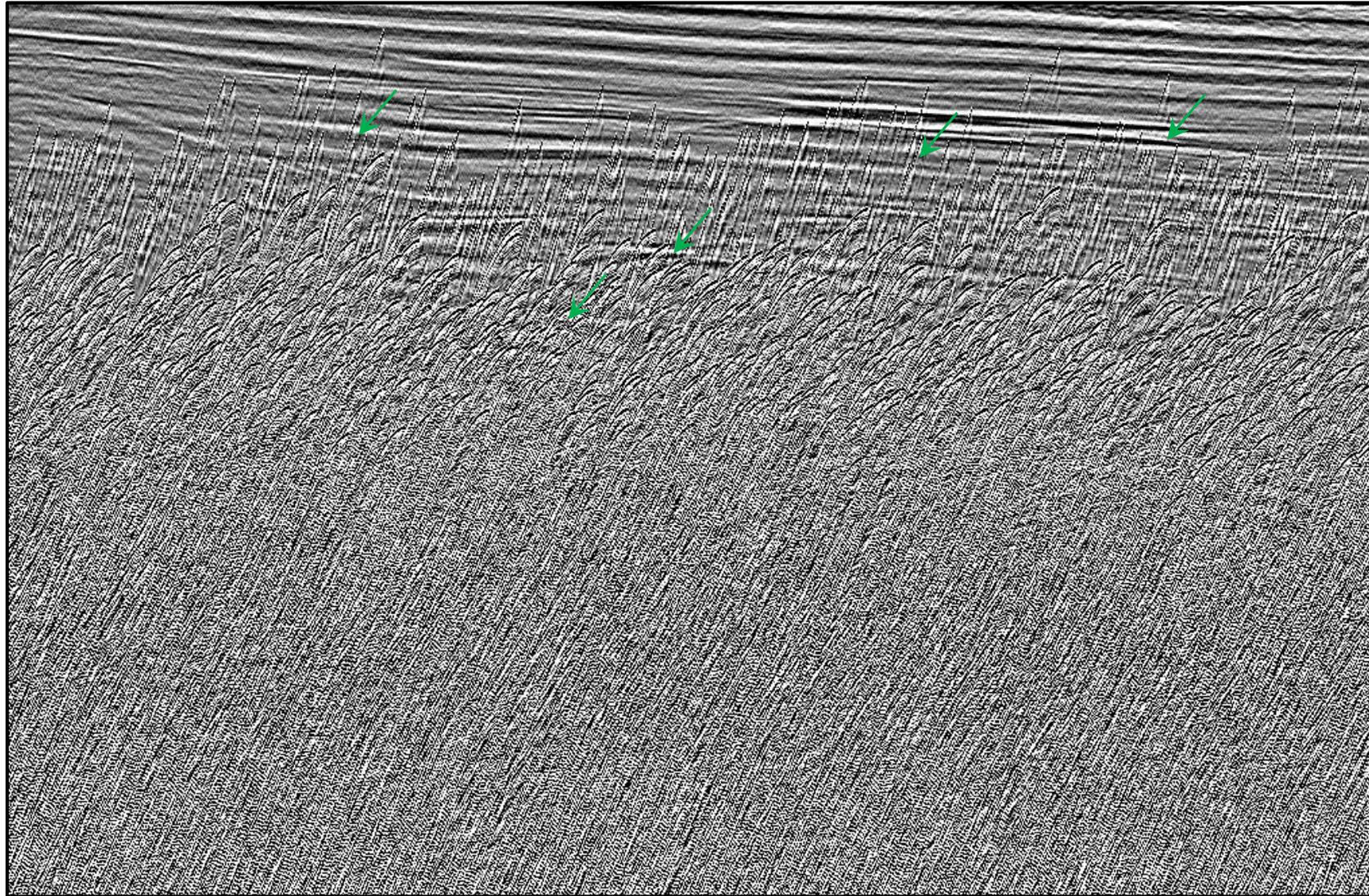
Three overlapping sources:



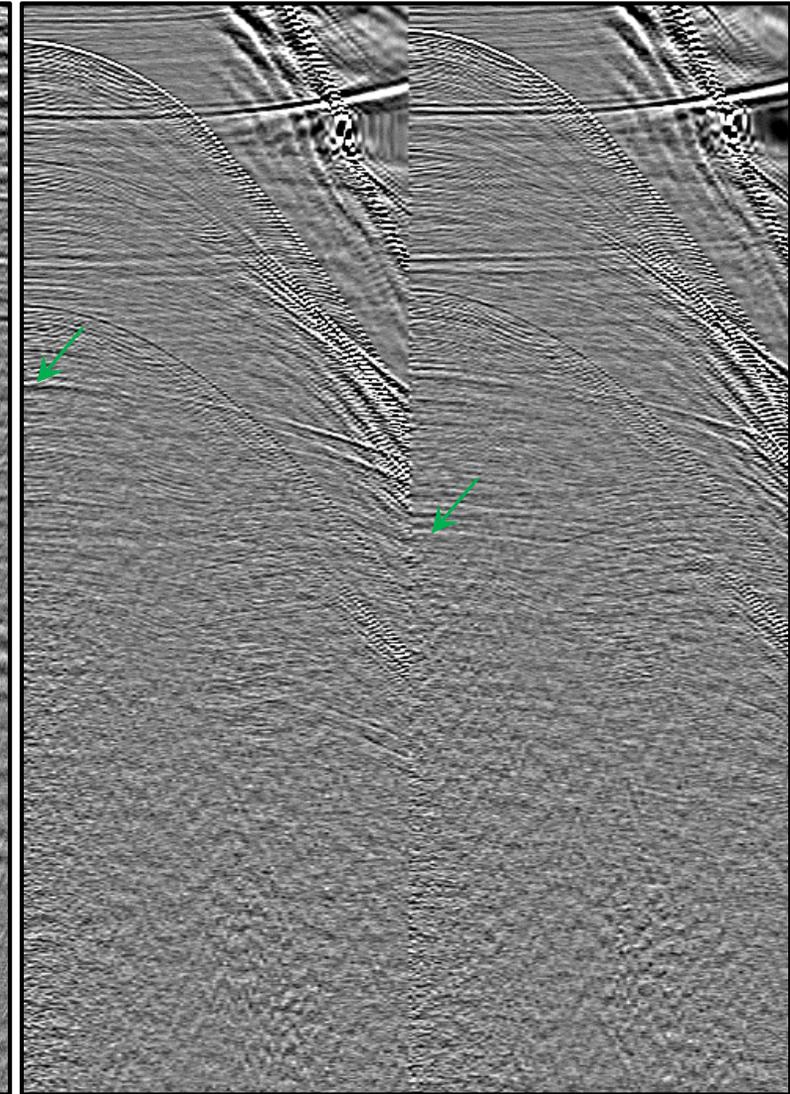
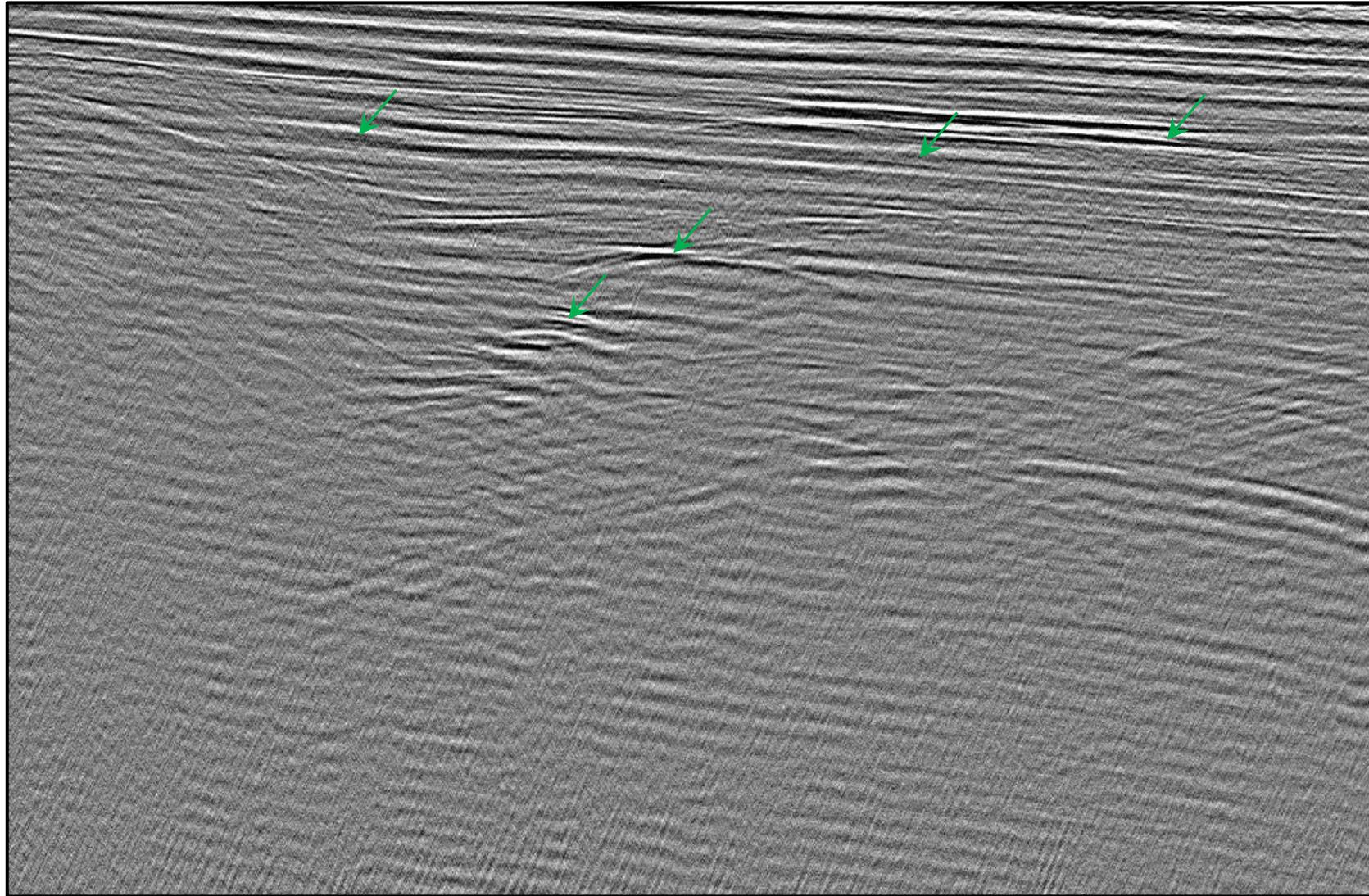
+/- 400 ms random dither + acquisition dither



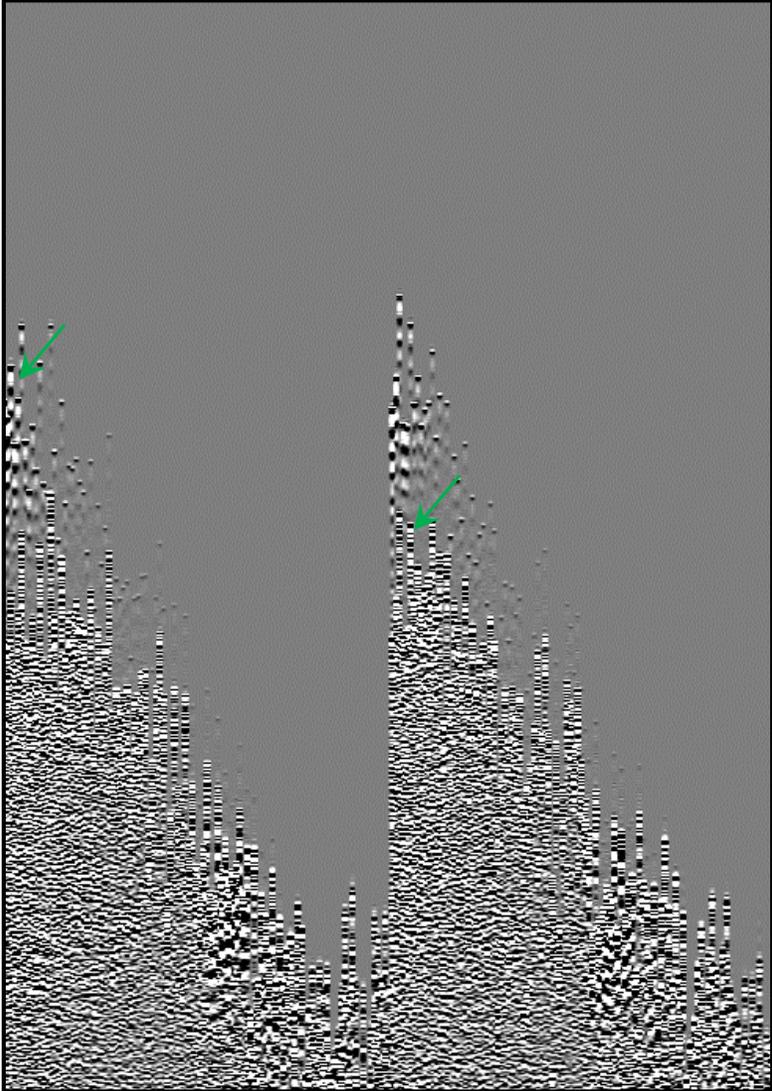
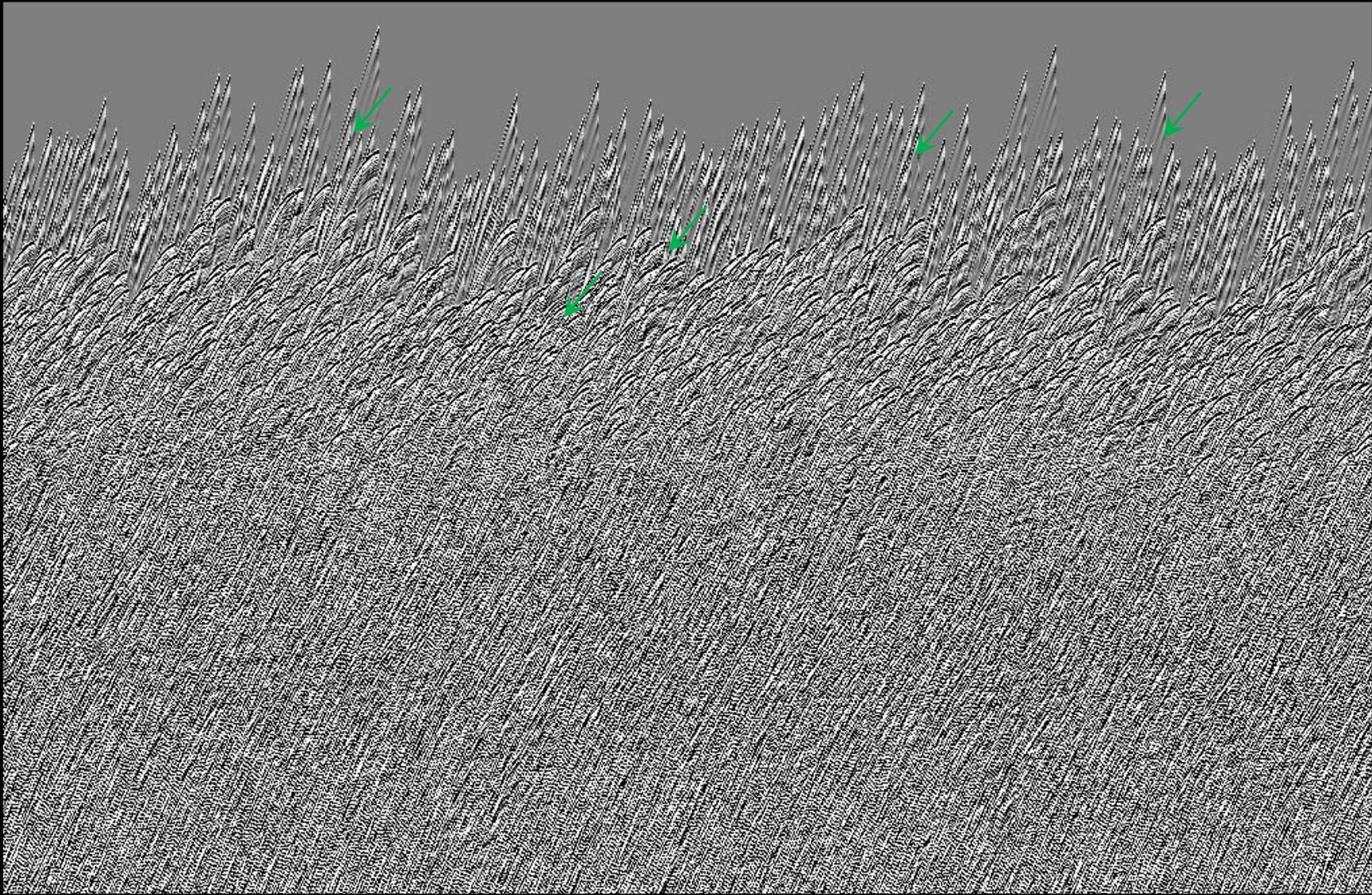
Before deblending



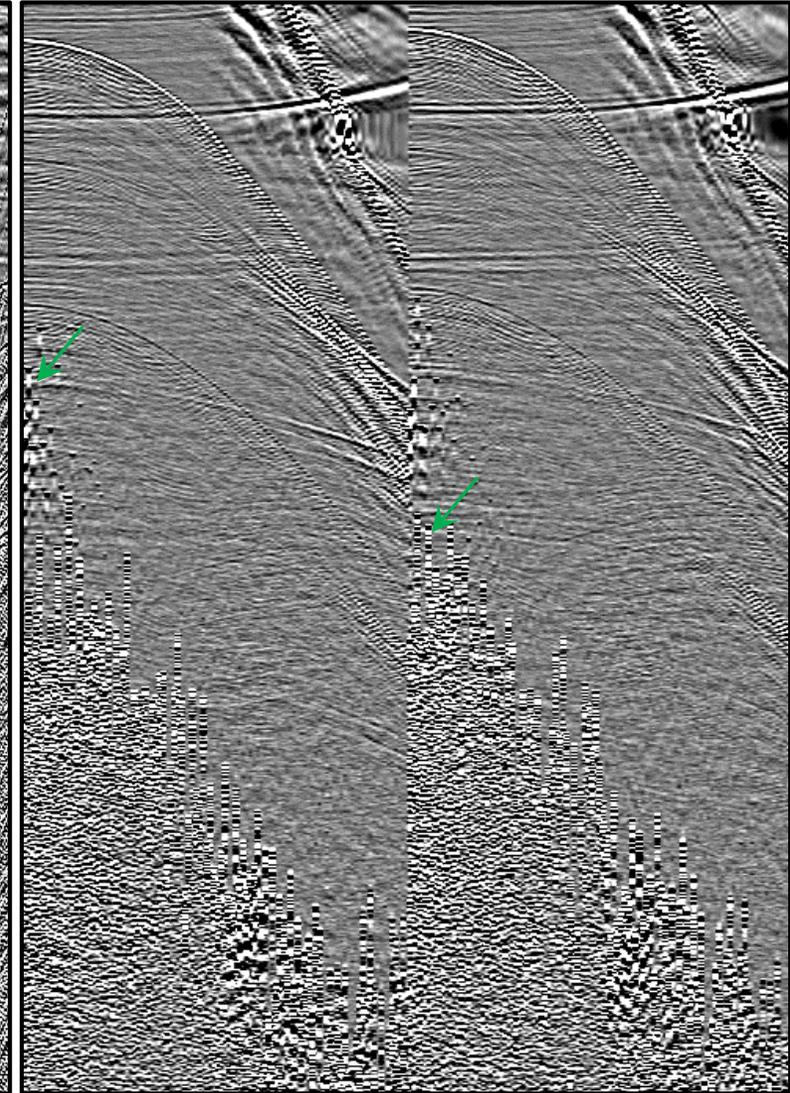
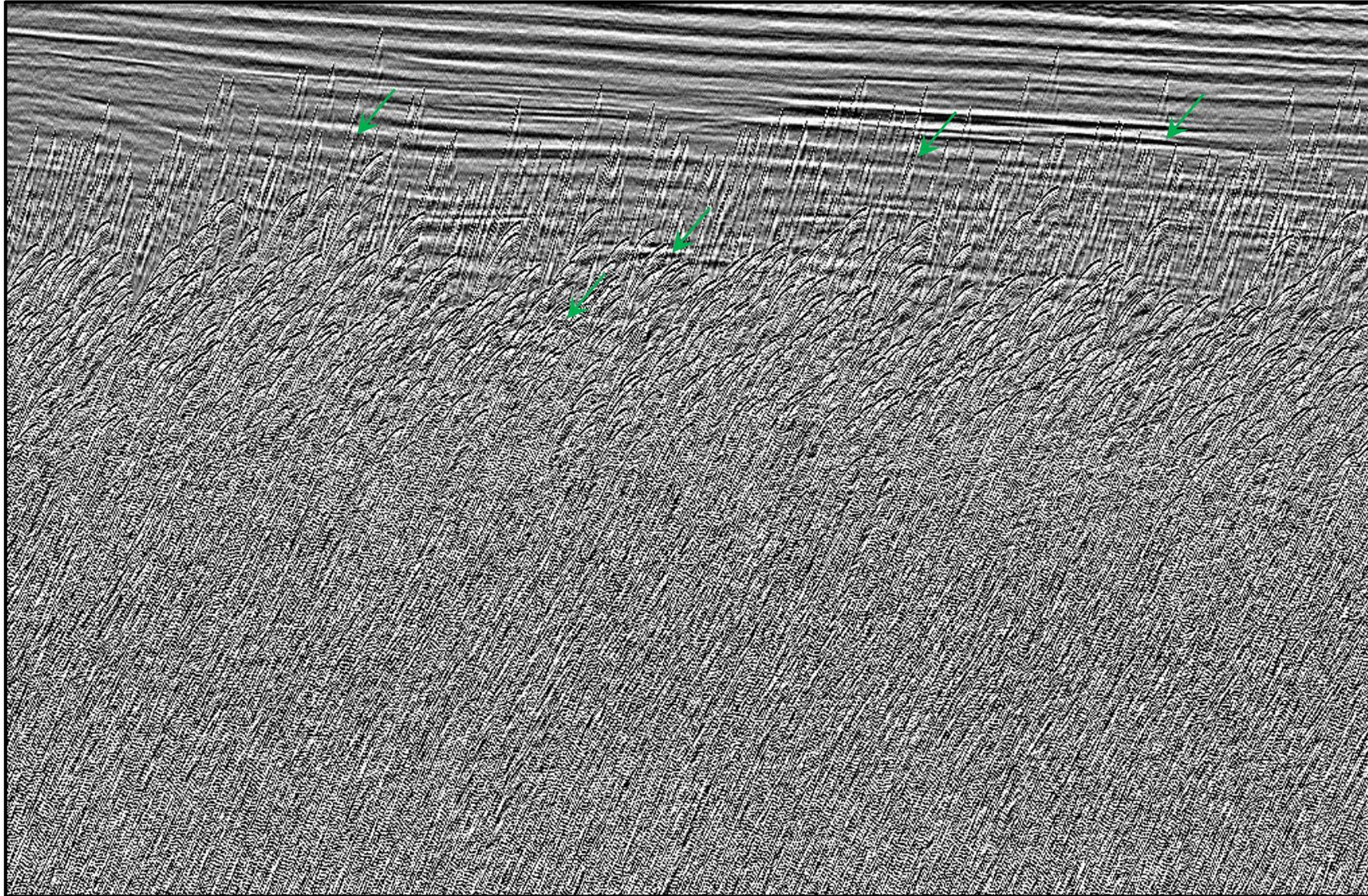
After deblending



Difference



Before deblending (repeat)

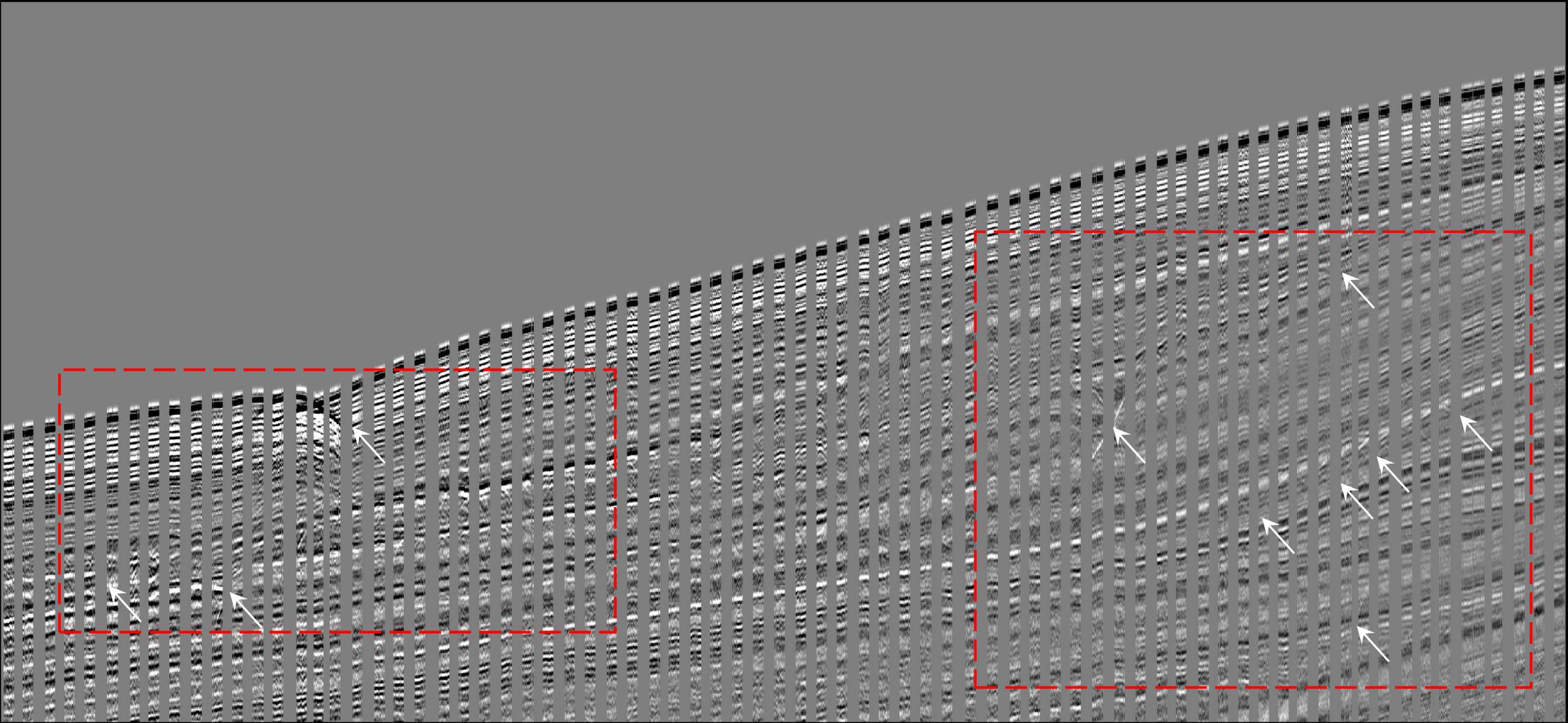


Regularisation

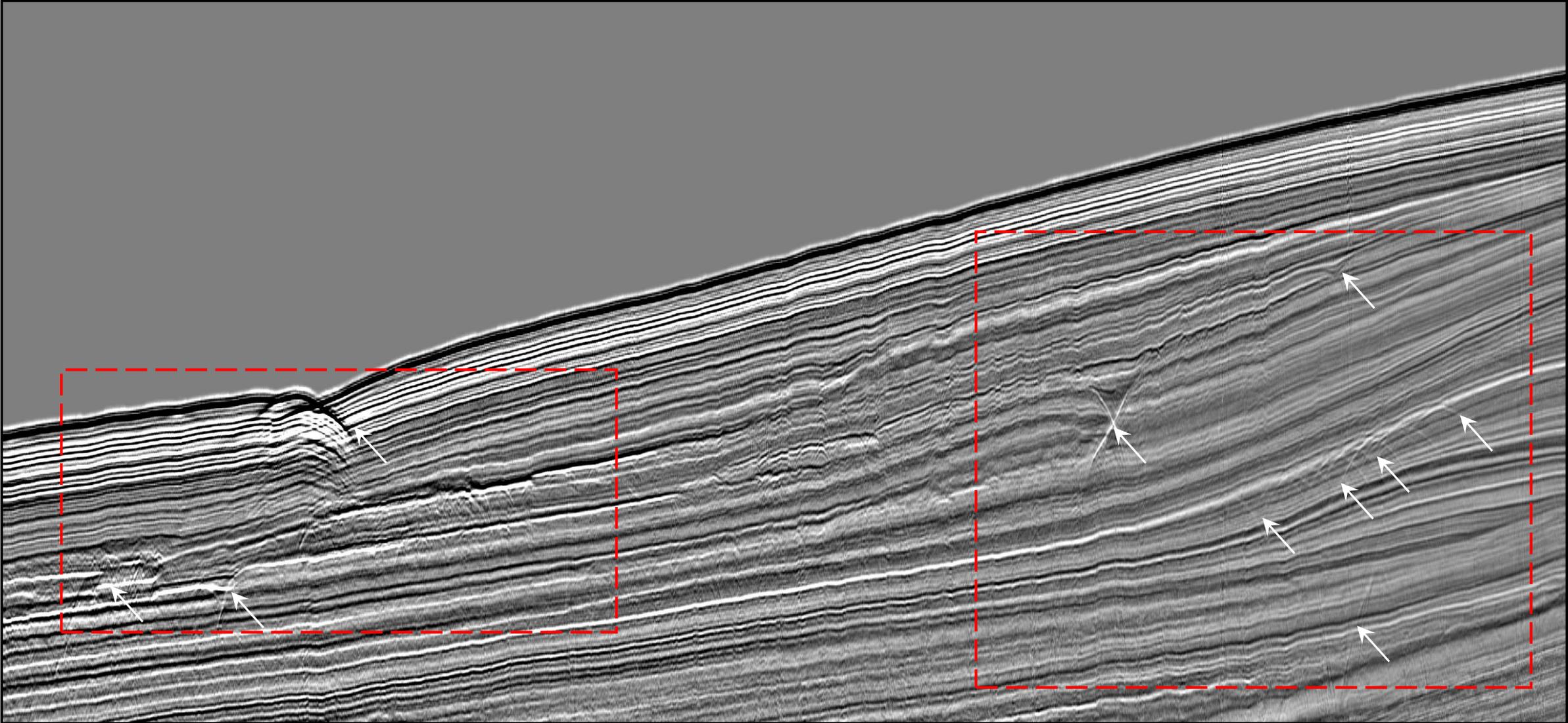
Anti-leakage Fourier transform regularisation

- The ALFT approach regularises the data using a matching-pursuit technique that iteratively claims the strongest plane-wave components in each iteration as described by Whiteside, et al. (2014).

Offset bin 003 before regularisation

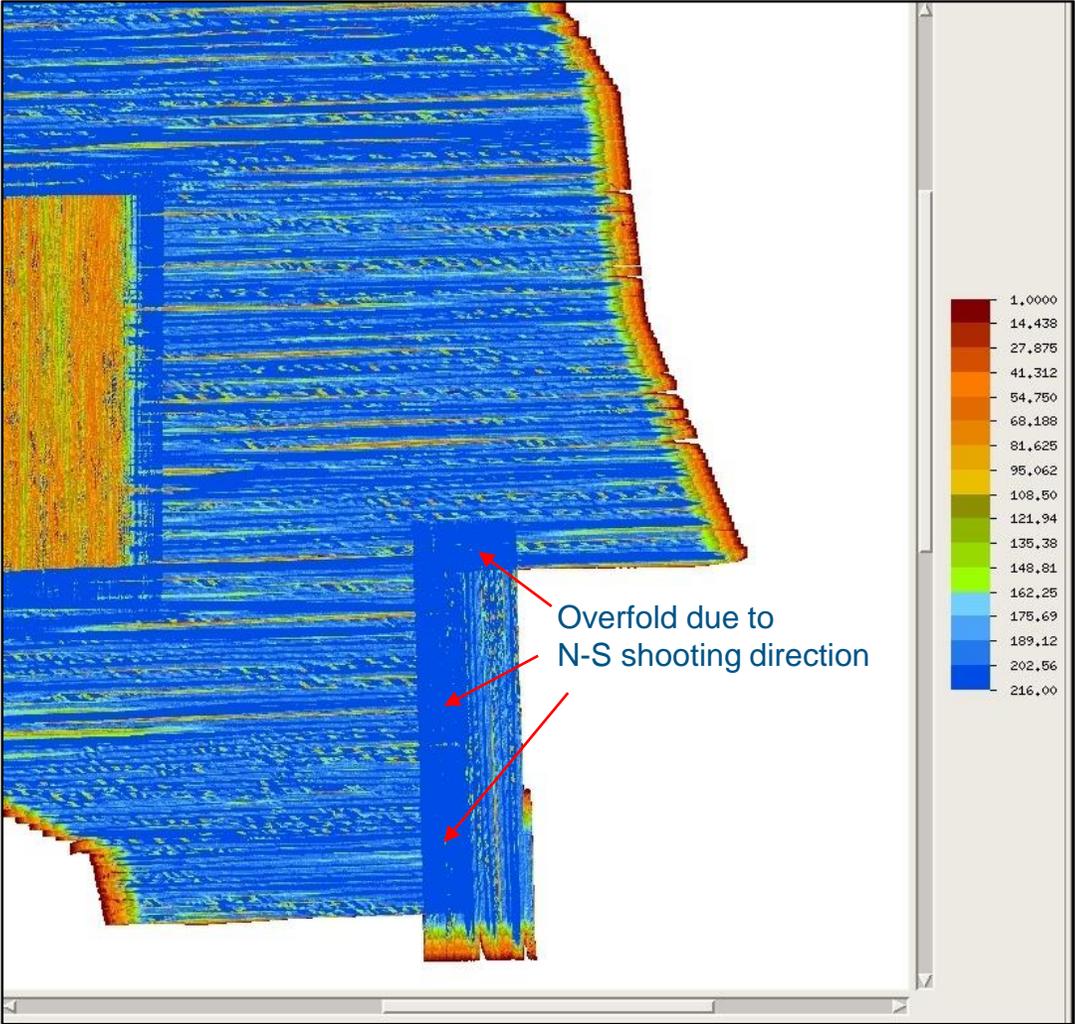
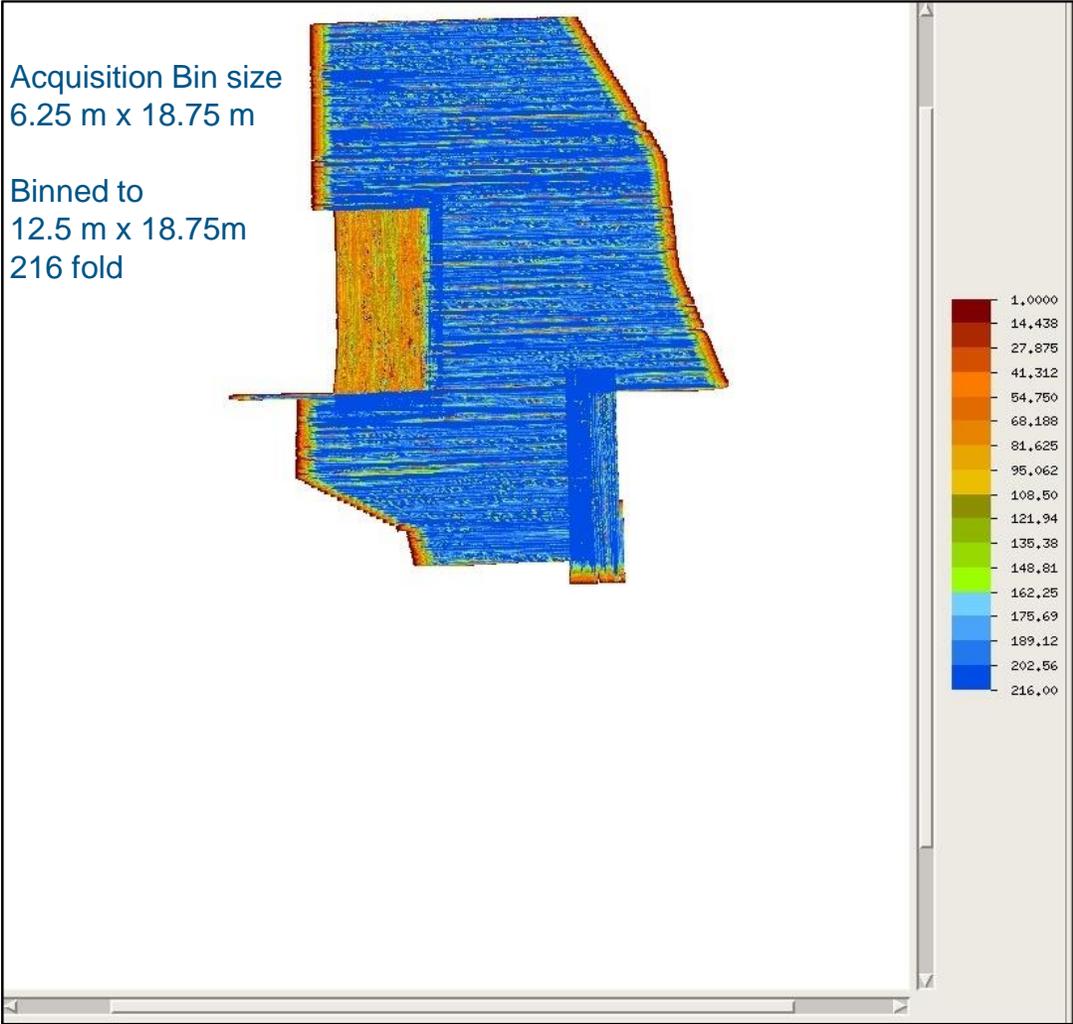


Offset bin 003 after regularisation



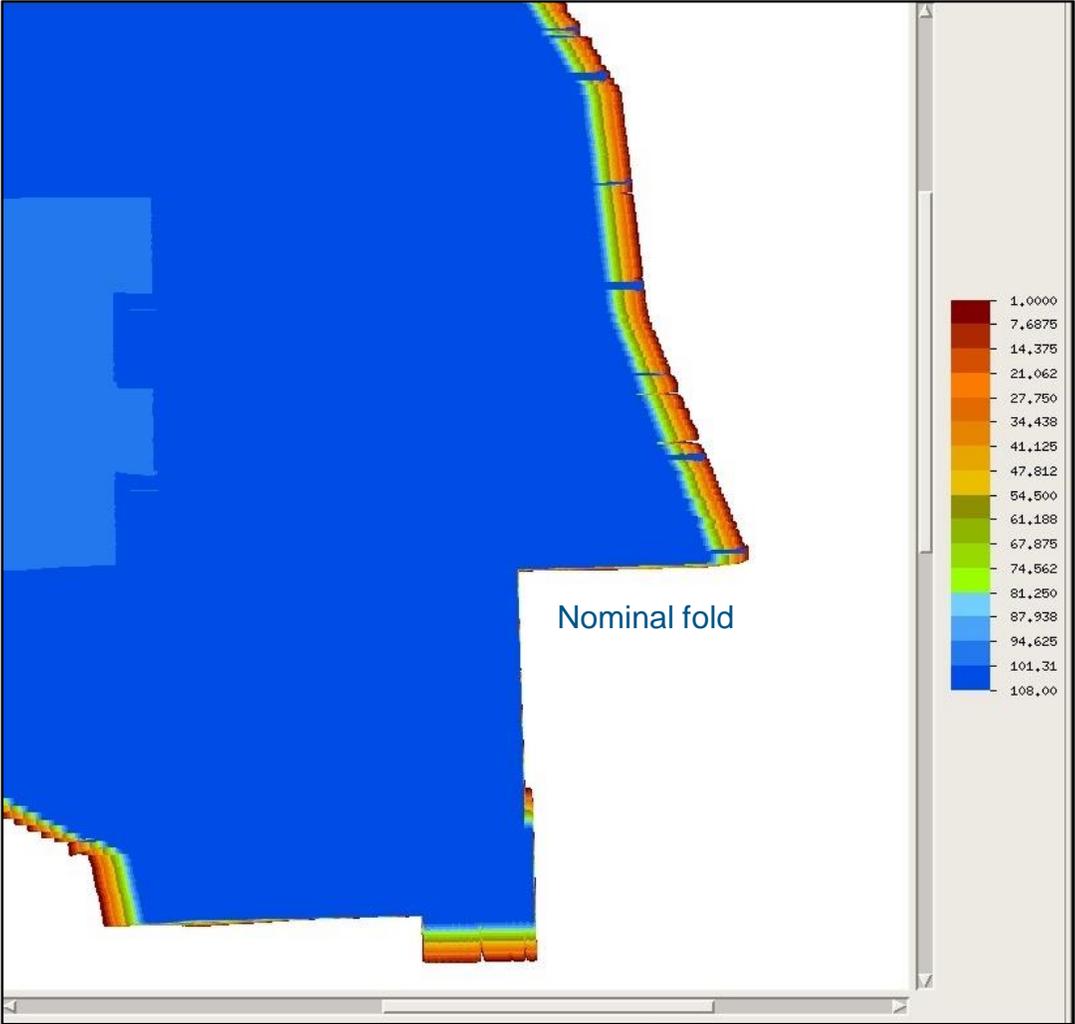
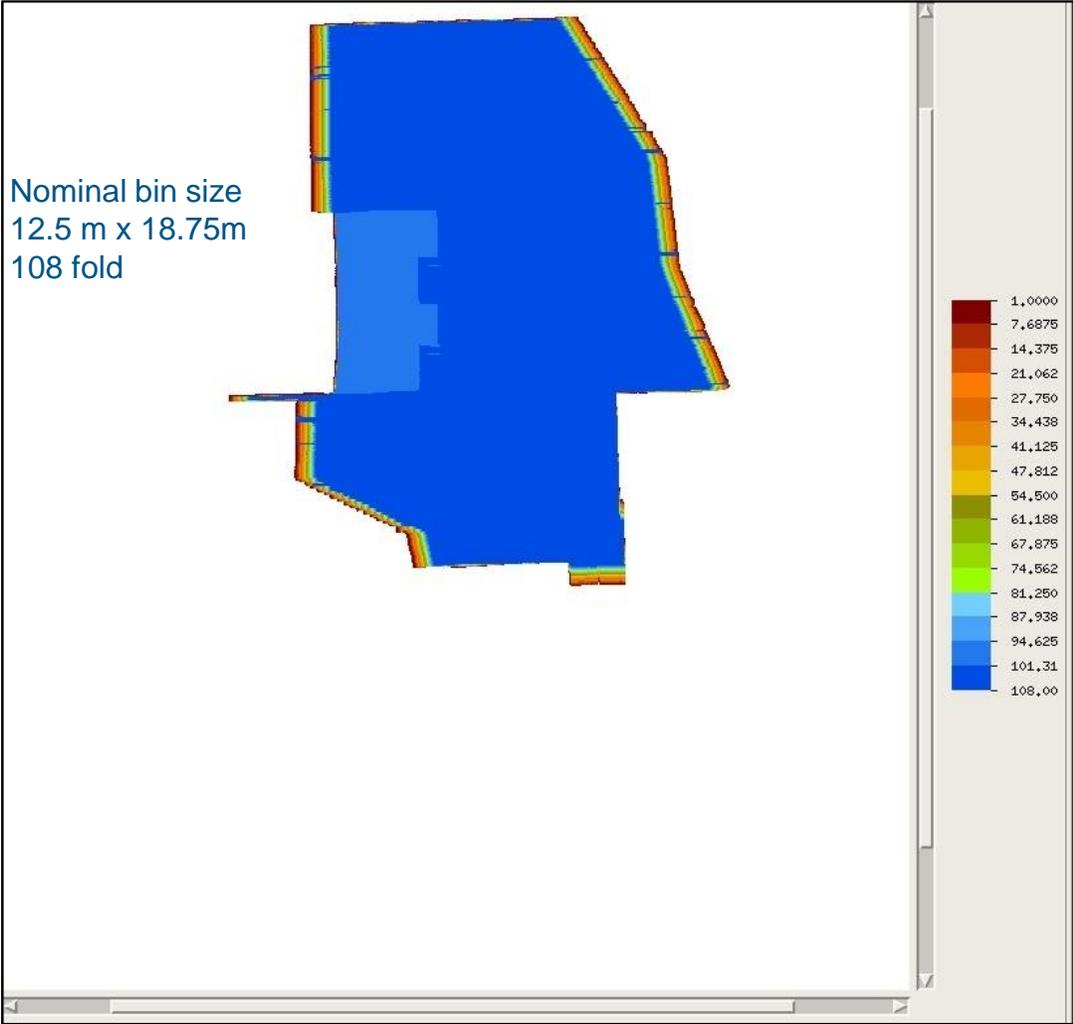
Full fold coverage before regularisation

Offset (148 m – 8300 m)

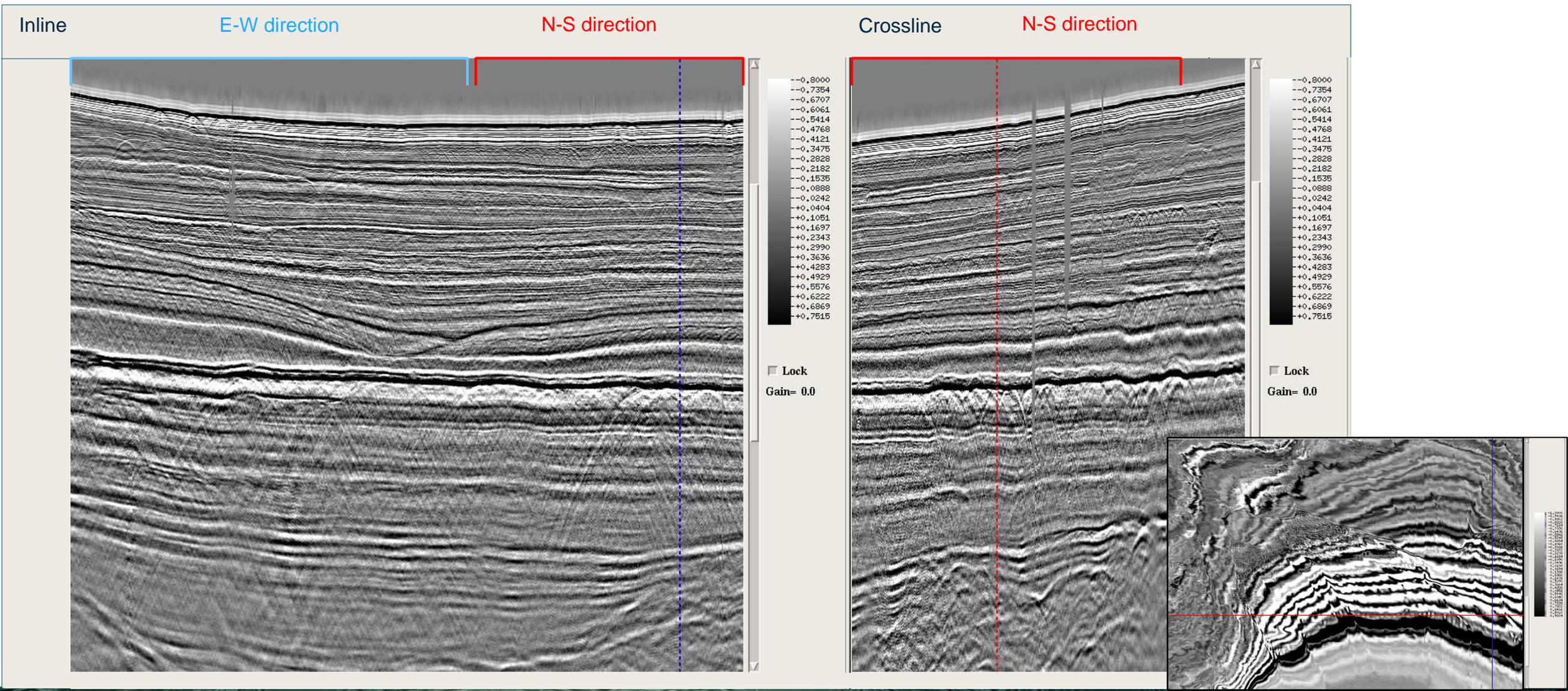


Full fold coverage after regularisation

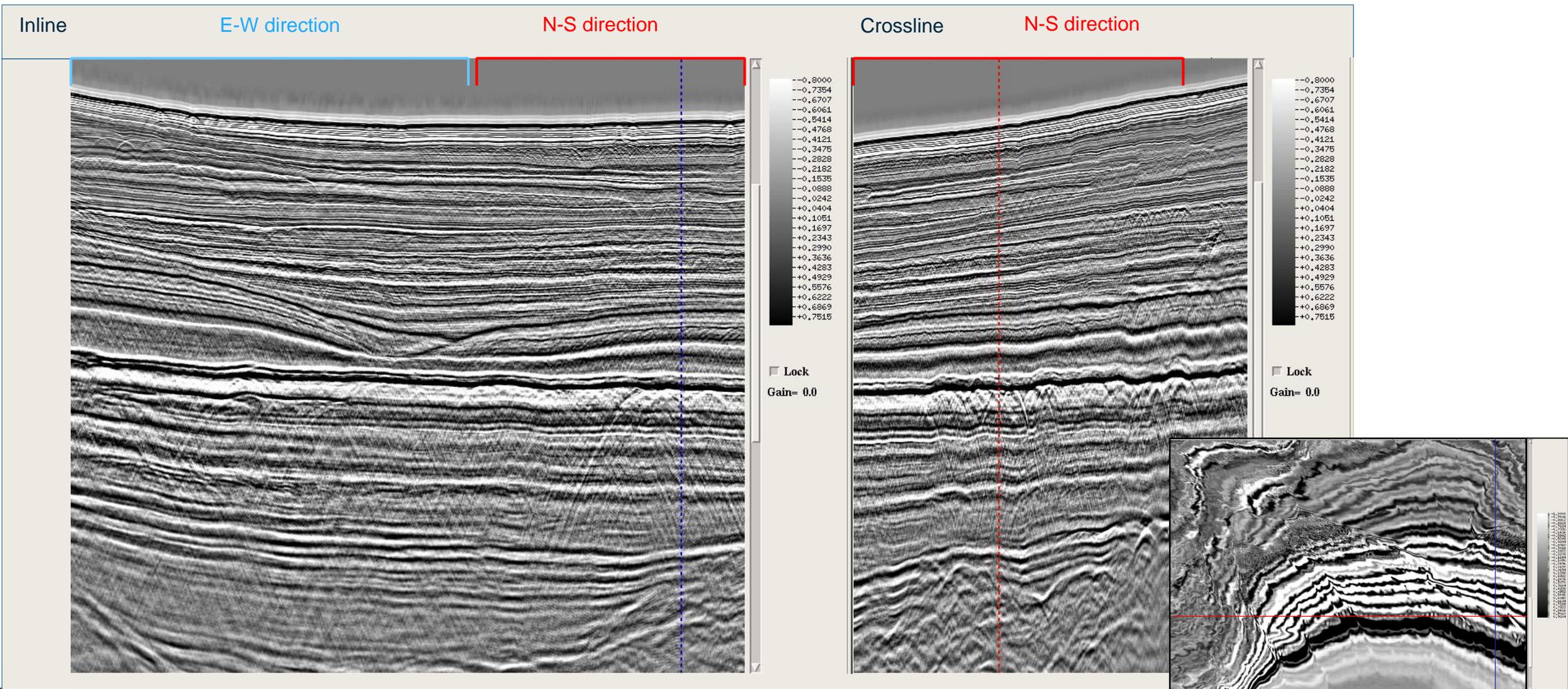
Offset (181 m – 8206 m increment 75 m)



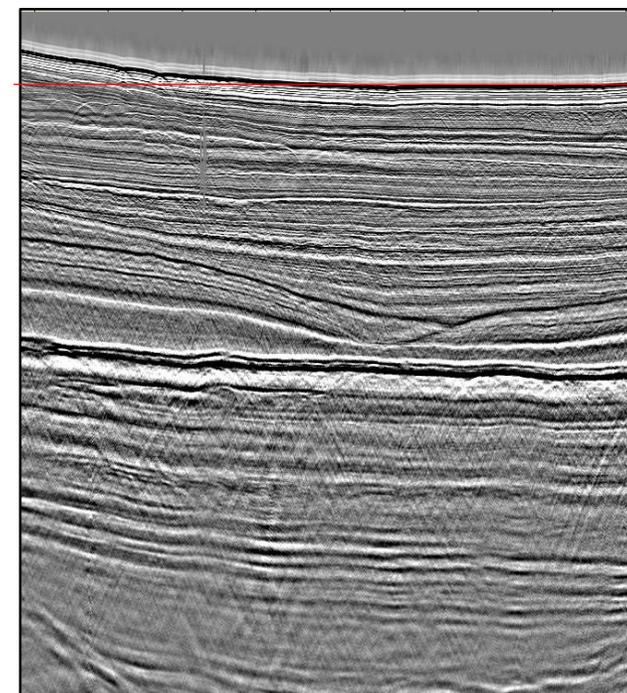
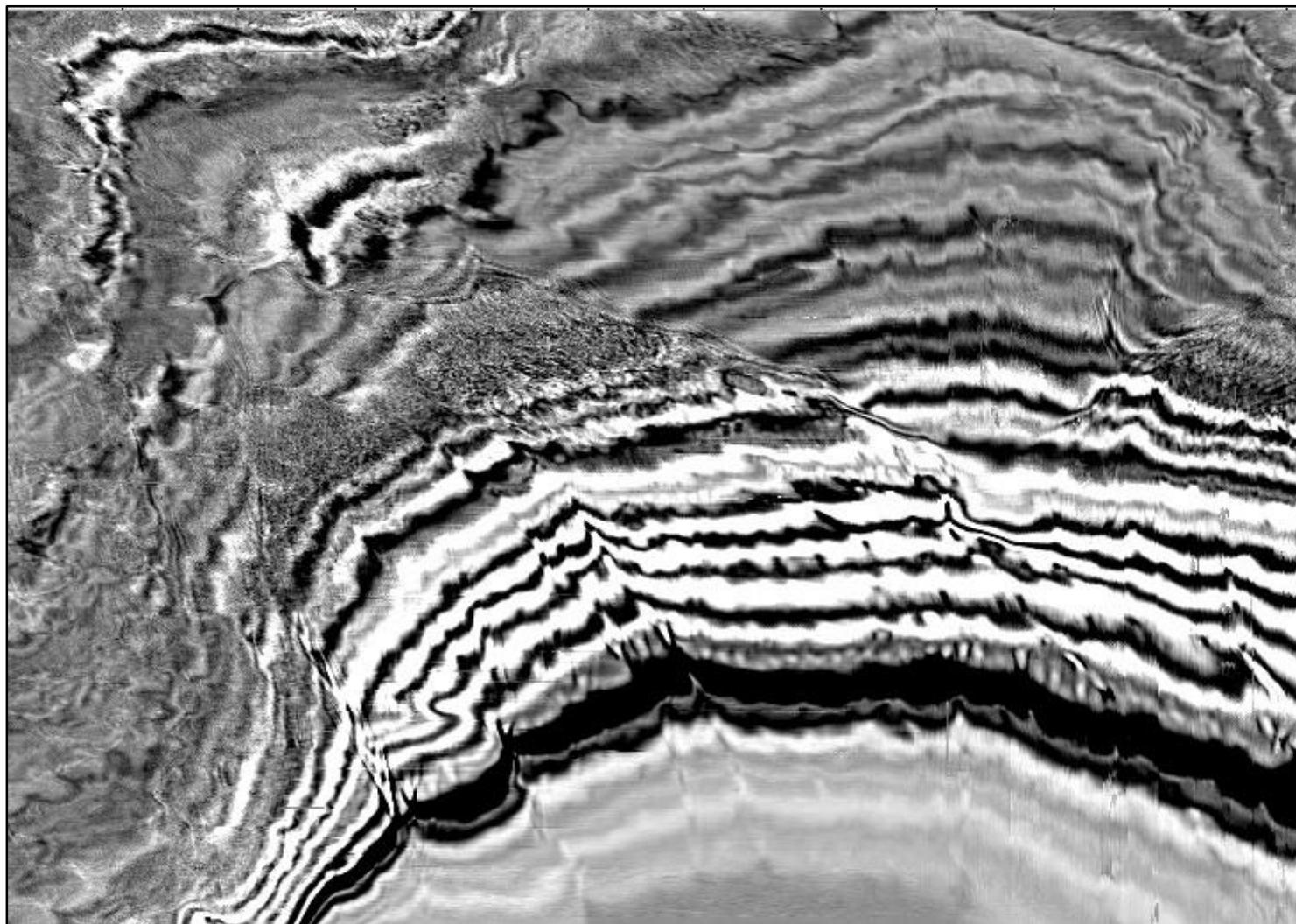
3D Stack 00-30 degree before regularisation



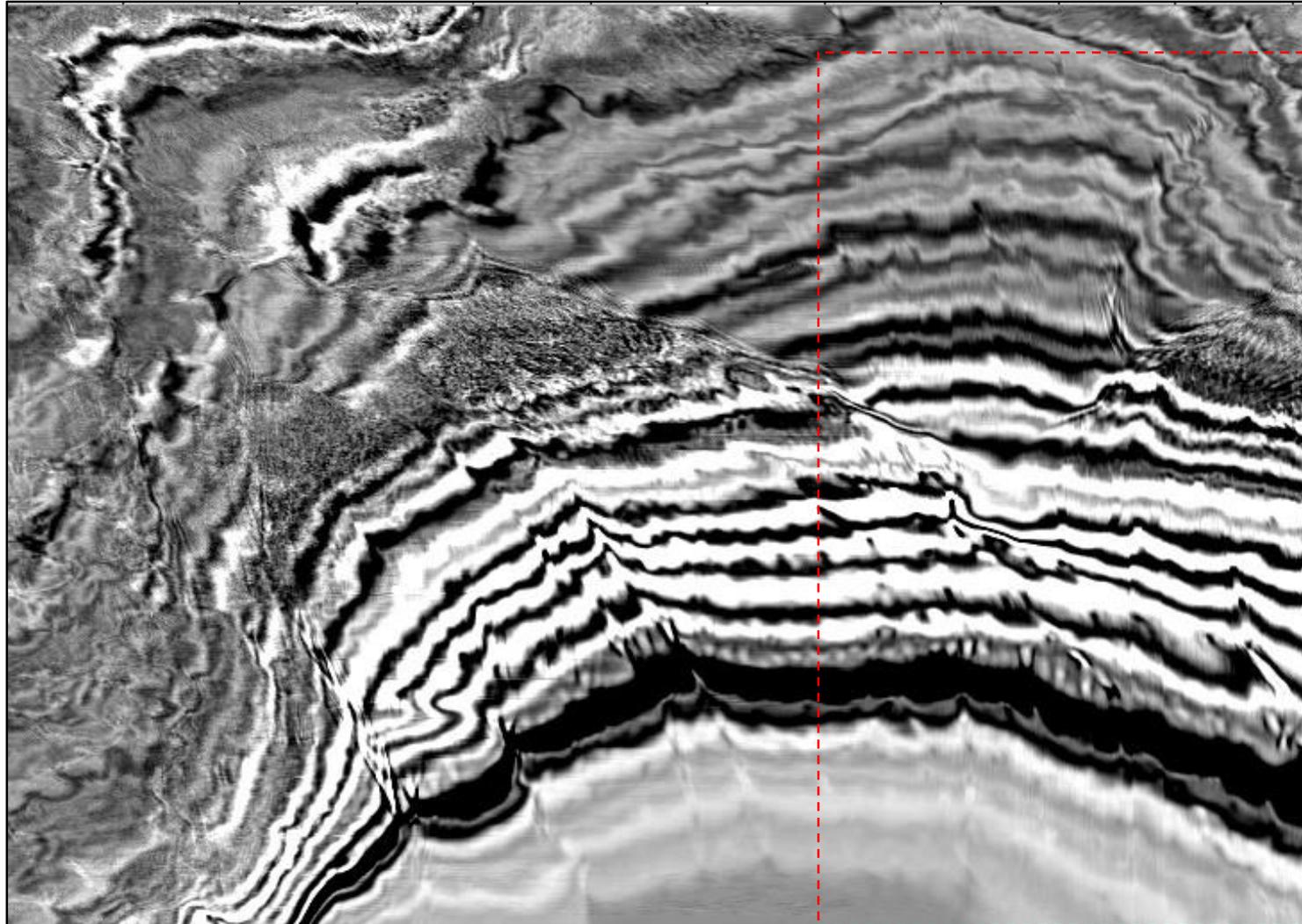
3D Stack 00-30 degree after regularisation



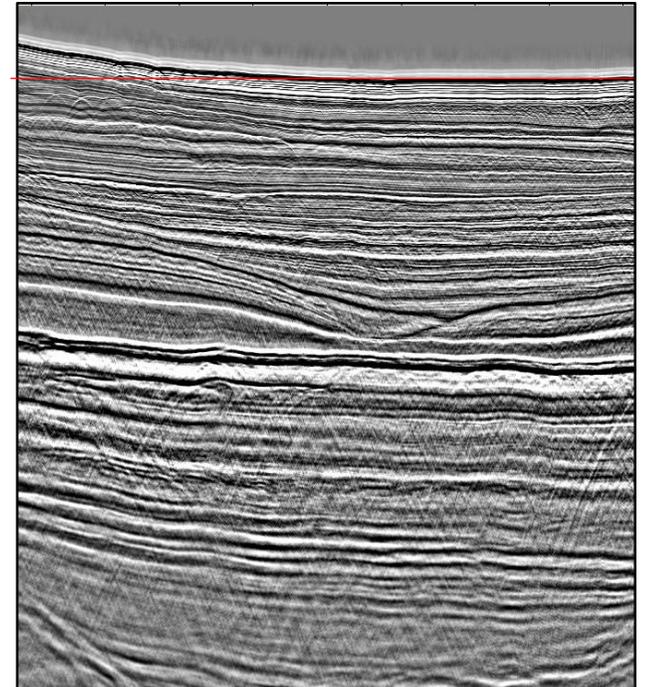
Time slice A before regularisation



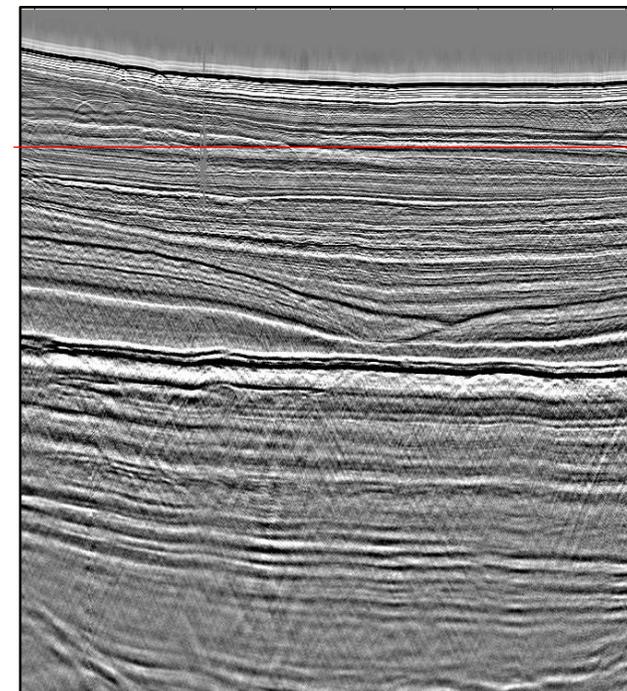
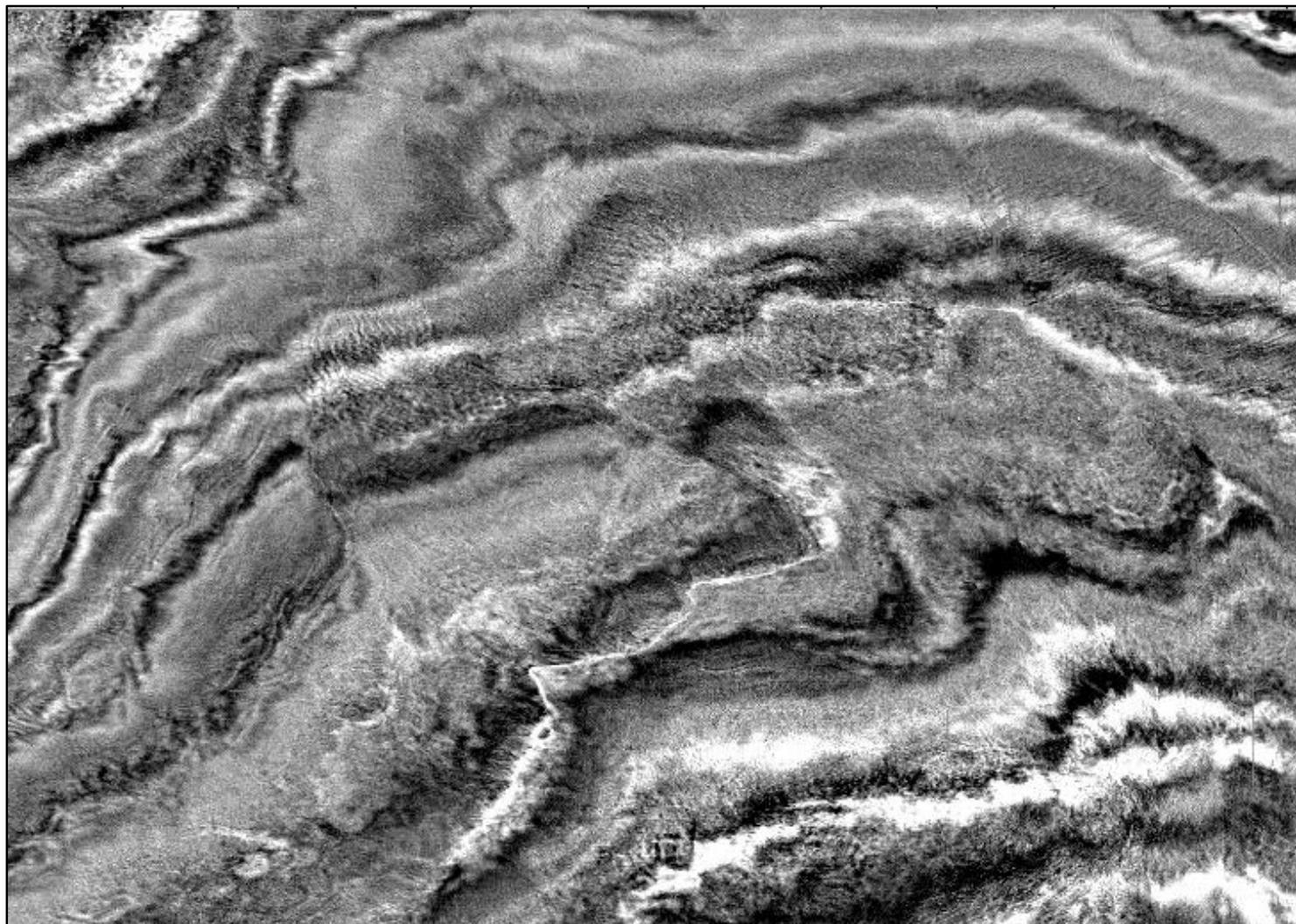
Time slice A after regularisation



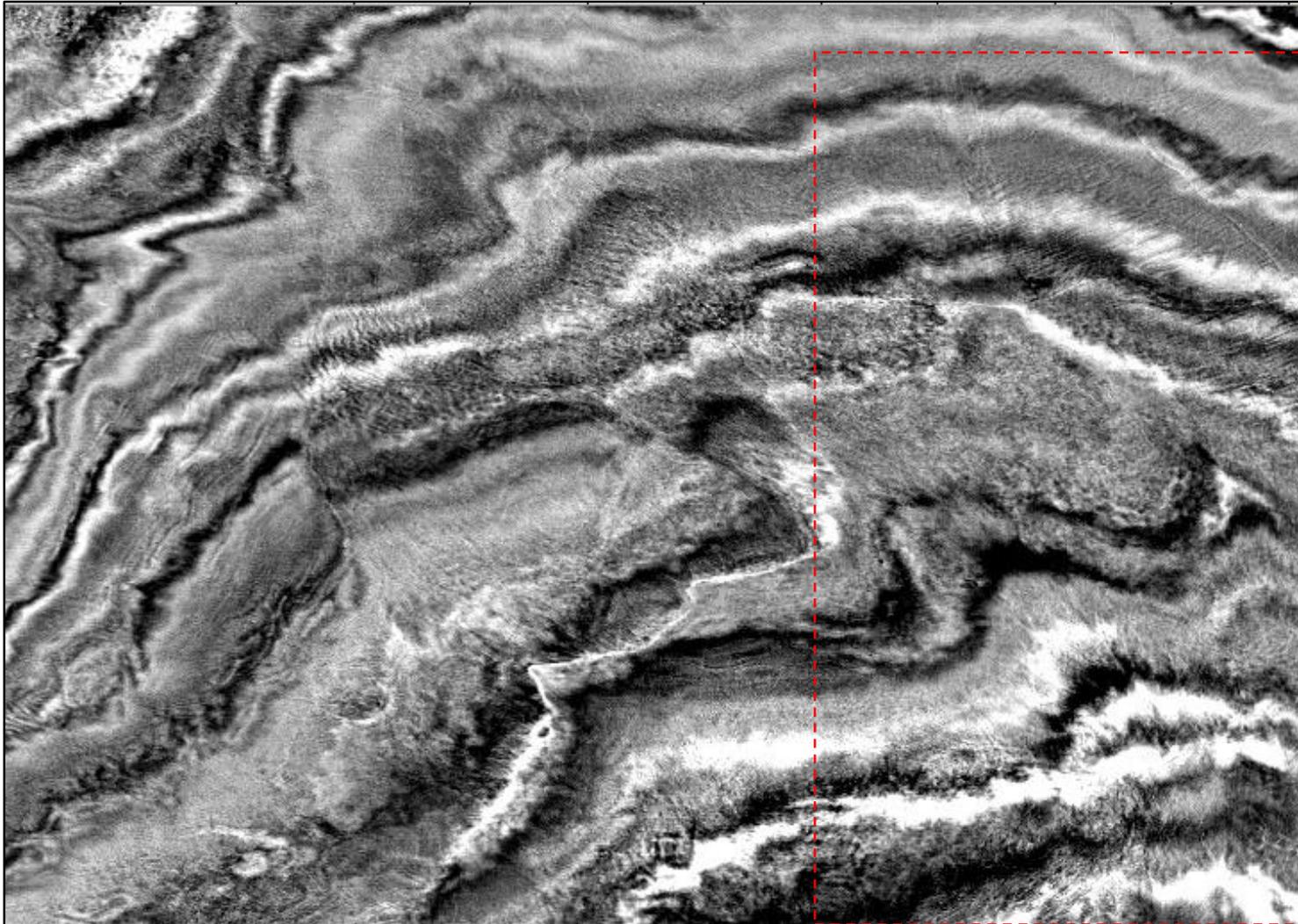
N-S direction



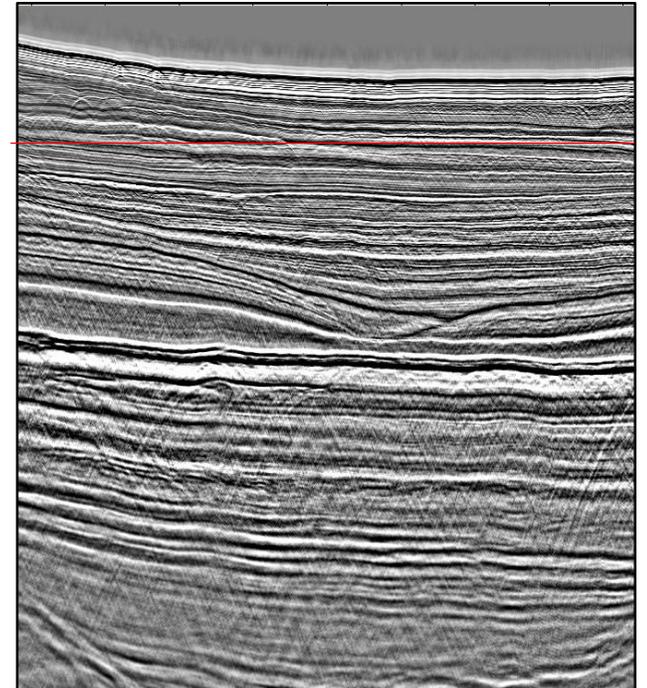
Time slice B before regularisation



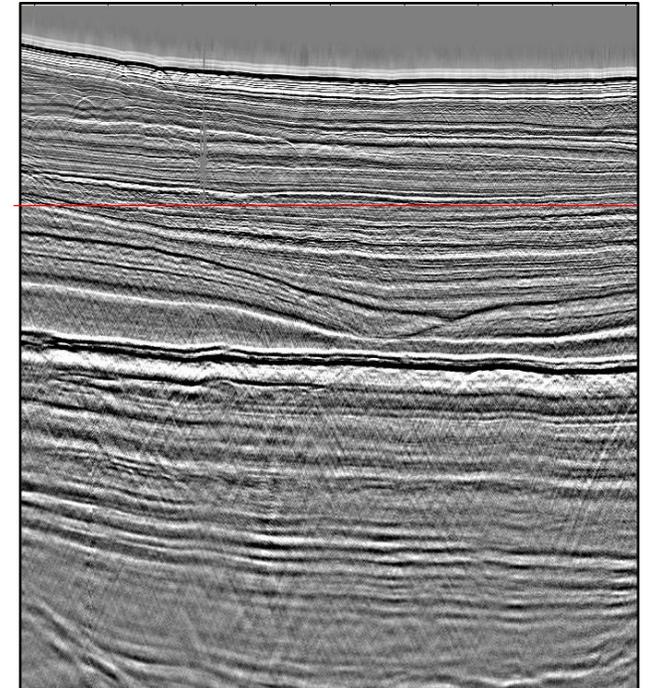
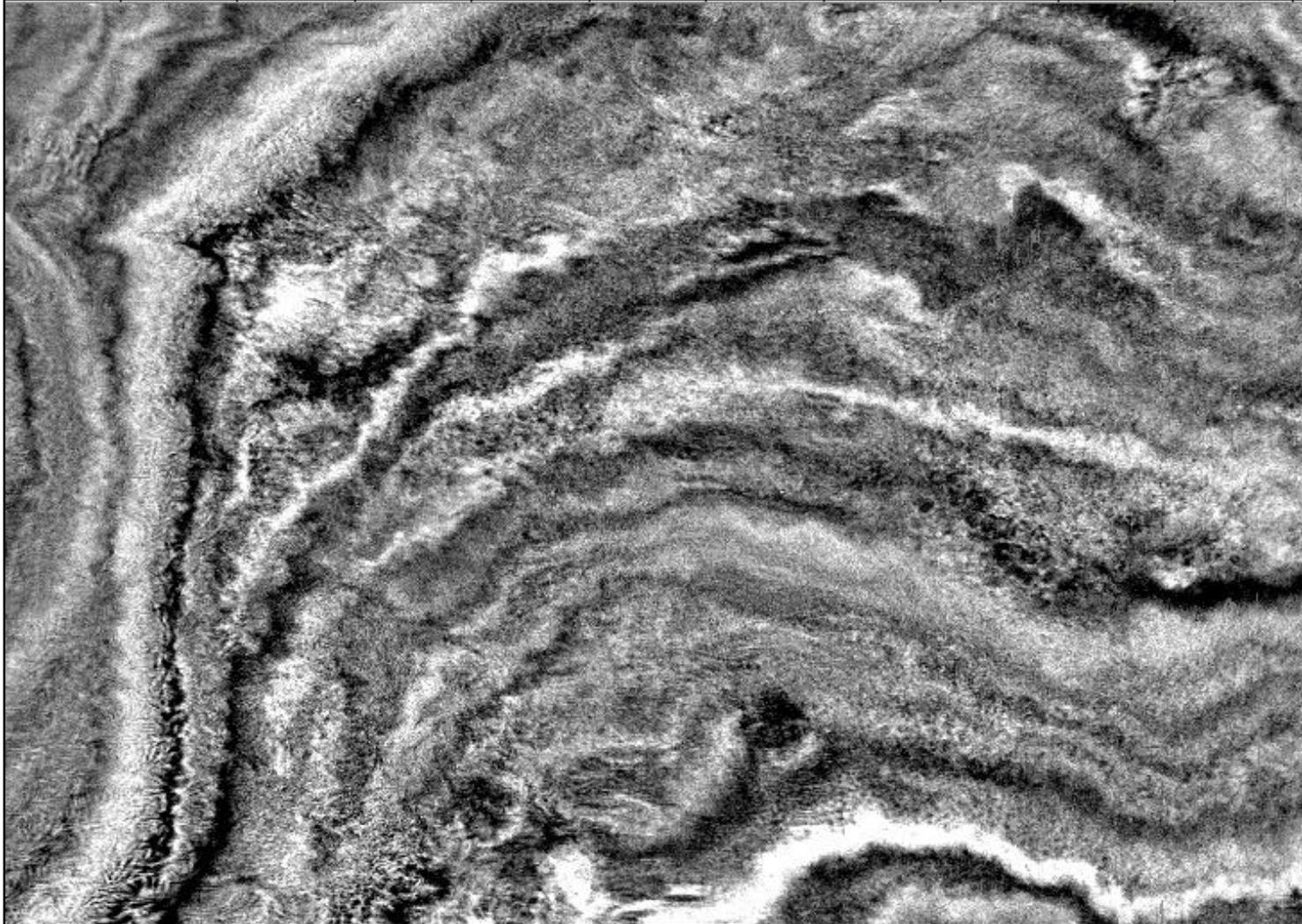
Time slice B after regularisation



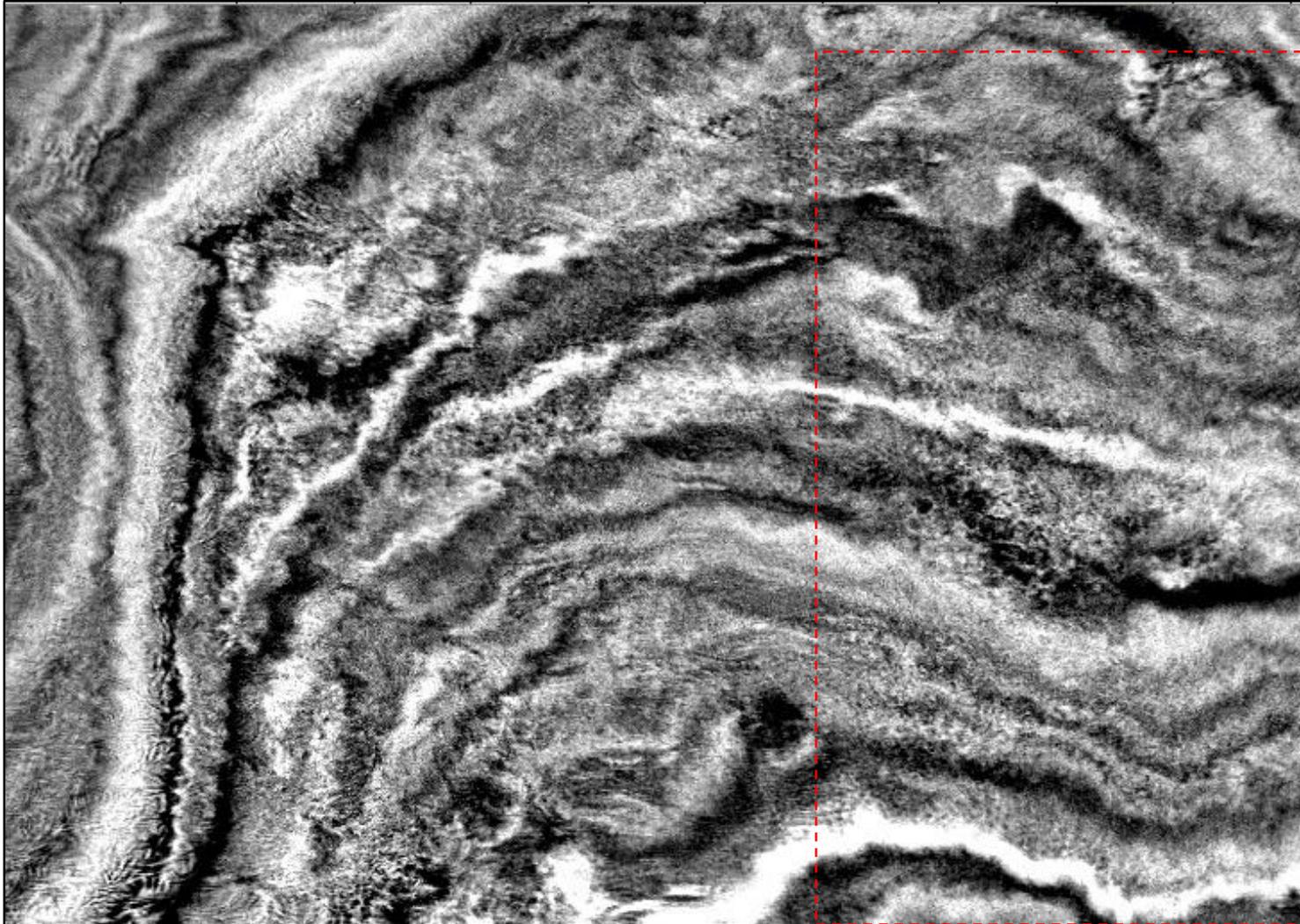
N-S direction



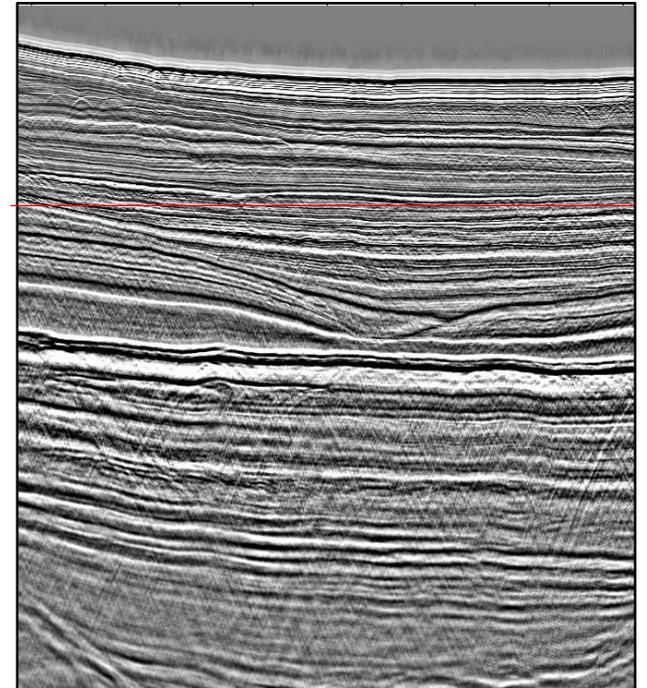
Time slice C before regularisation



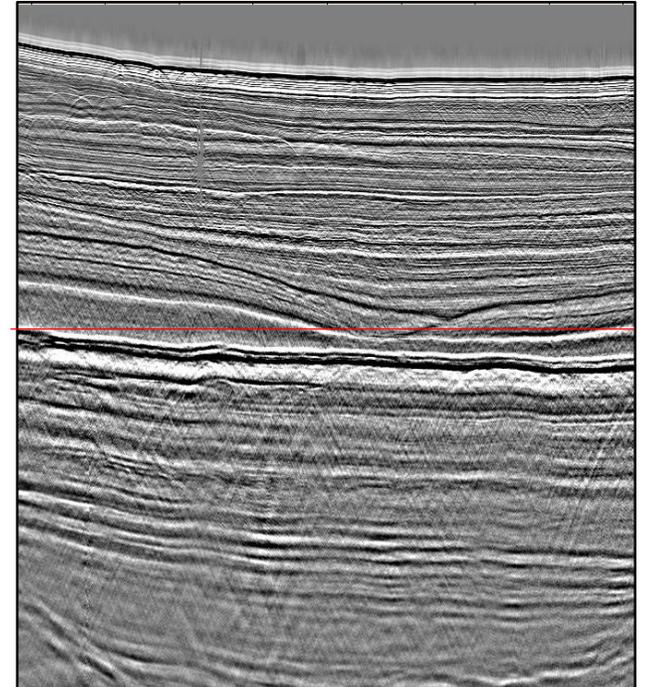
Time slice C after regularisation



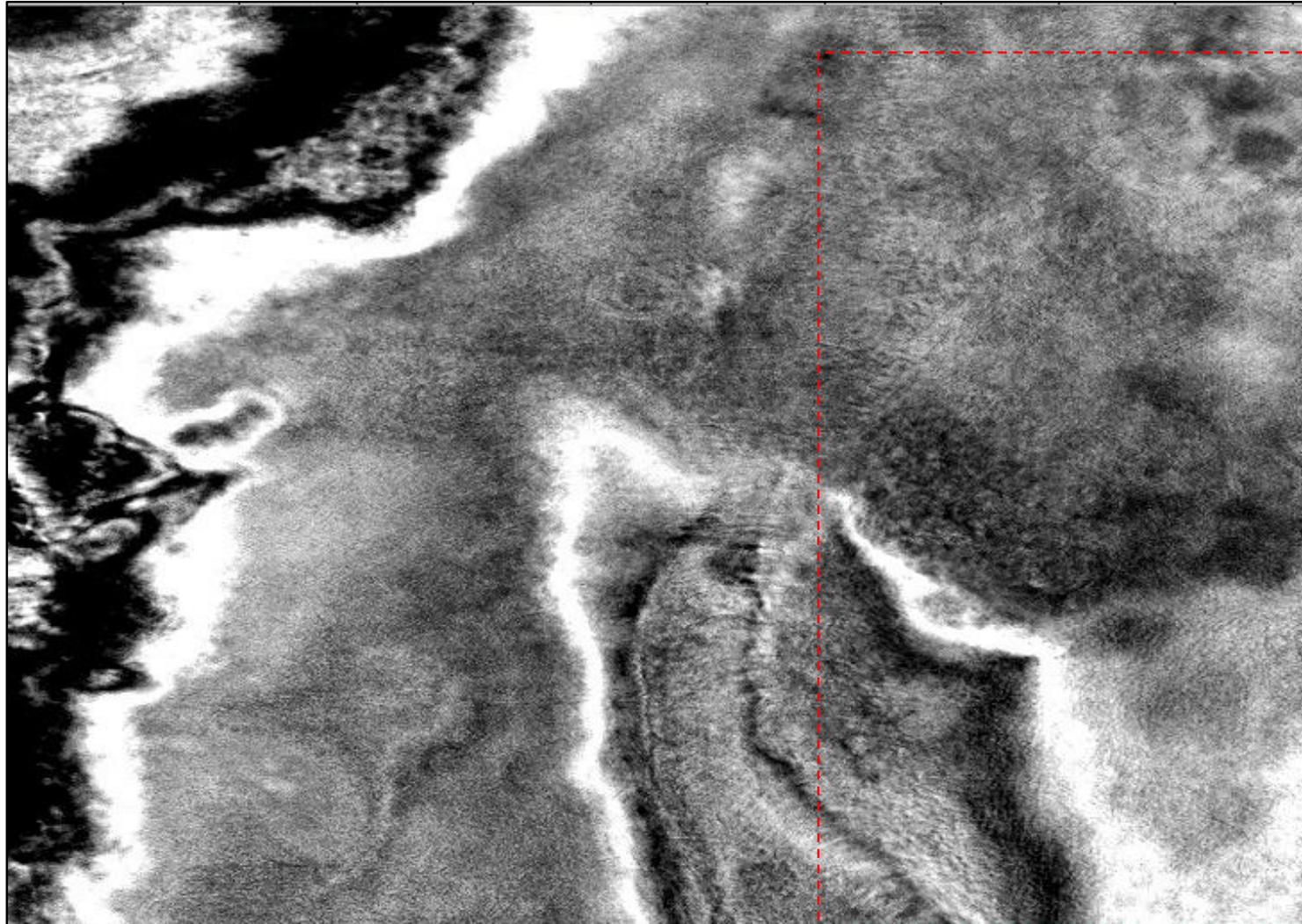
N-S direction



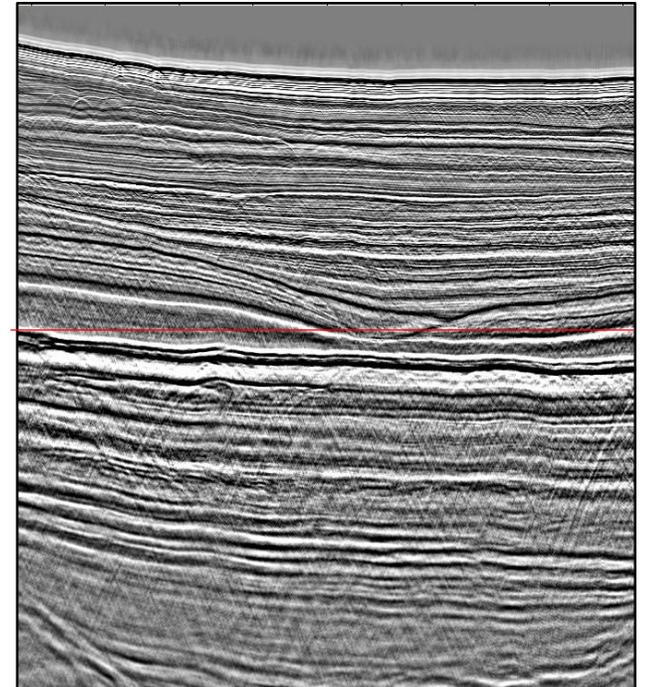
Time slice D before regularisation



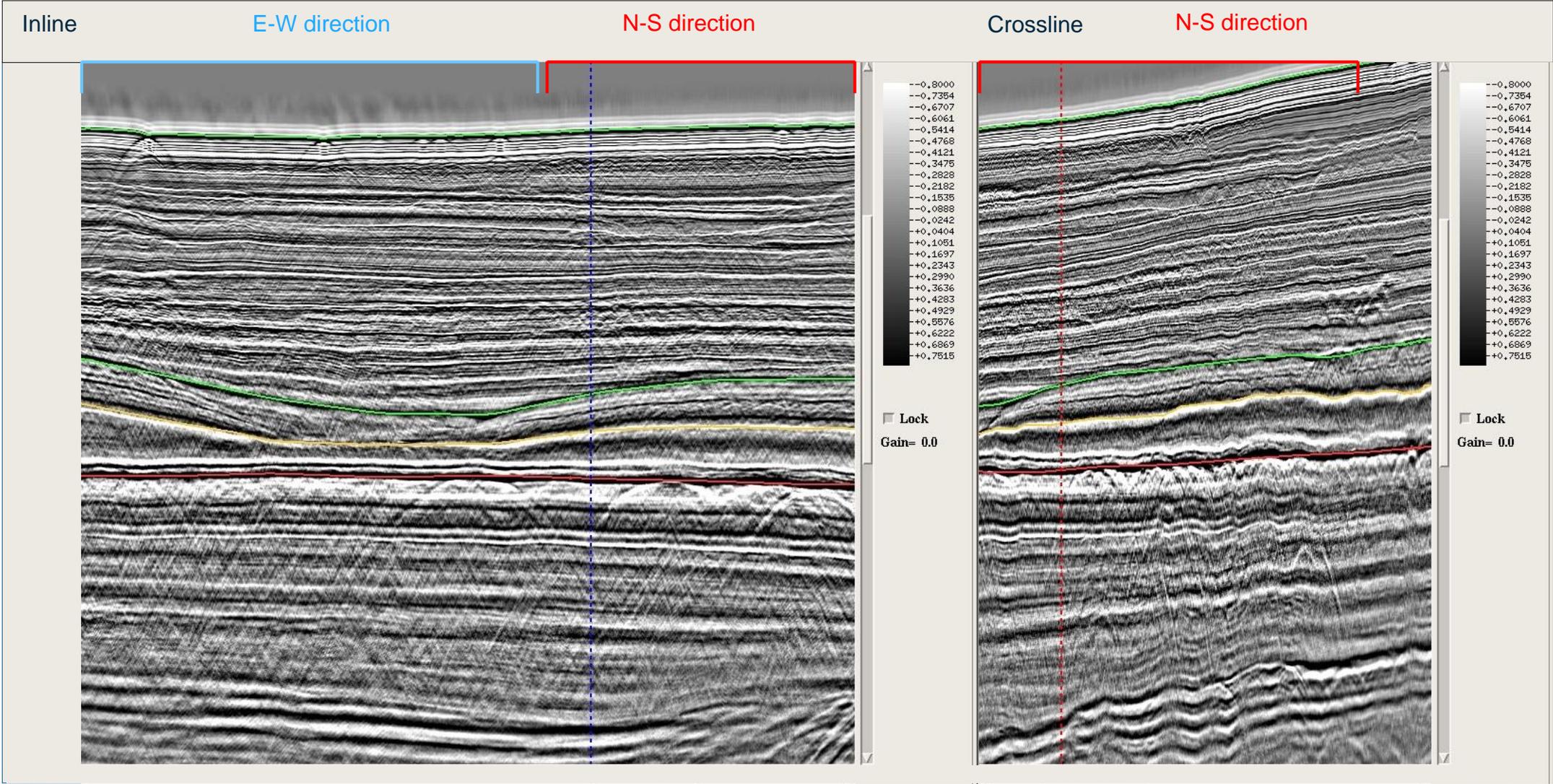
Time slice D after regularisation



N-S direction



Horizons used for RMS amplitude extraction



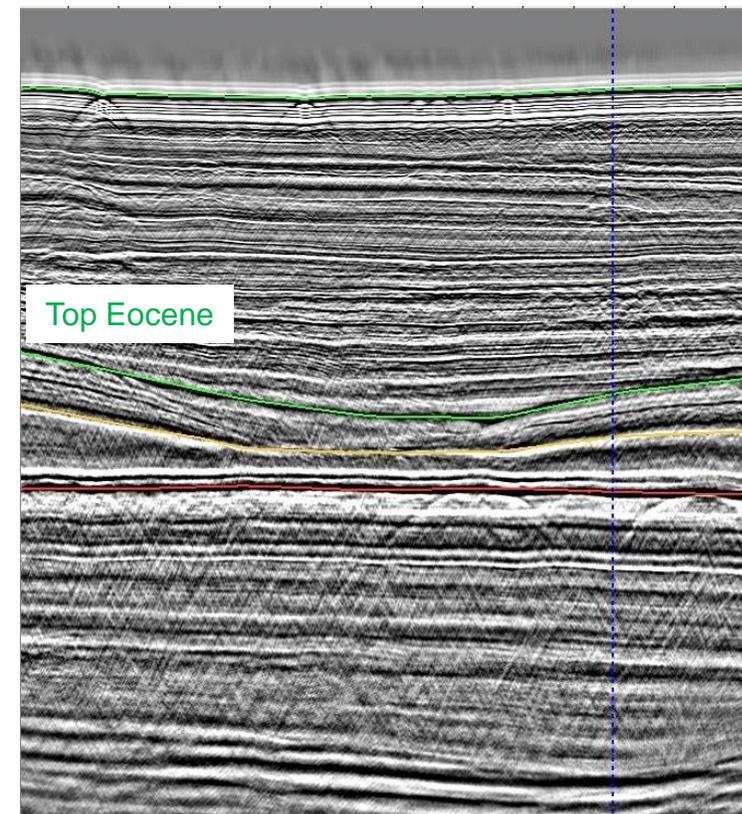
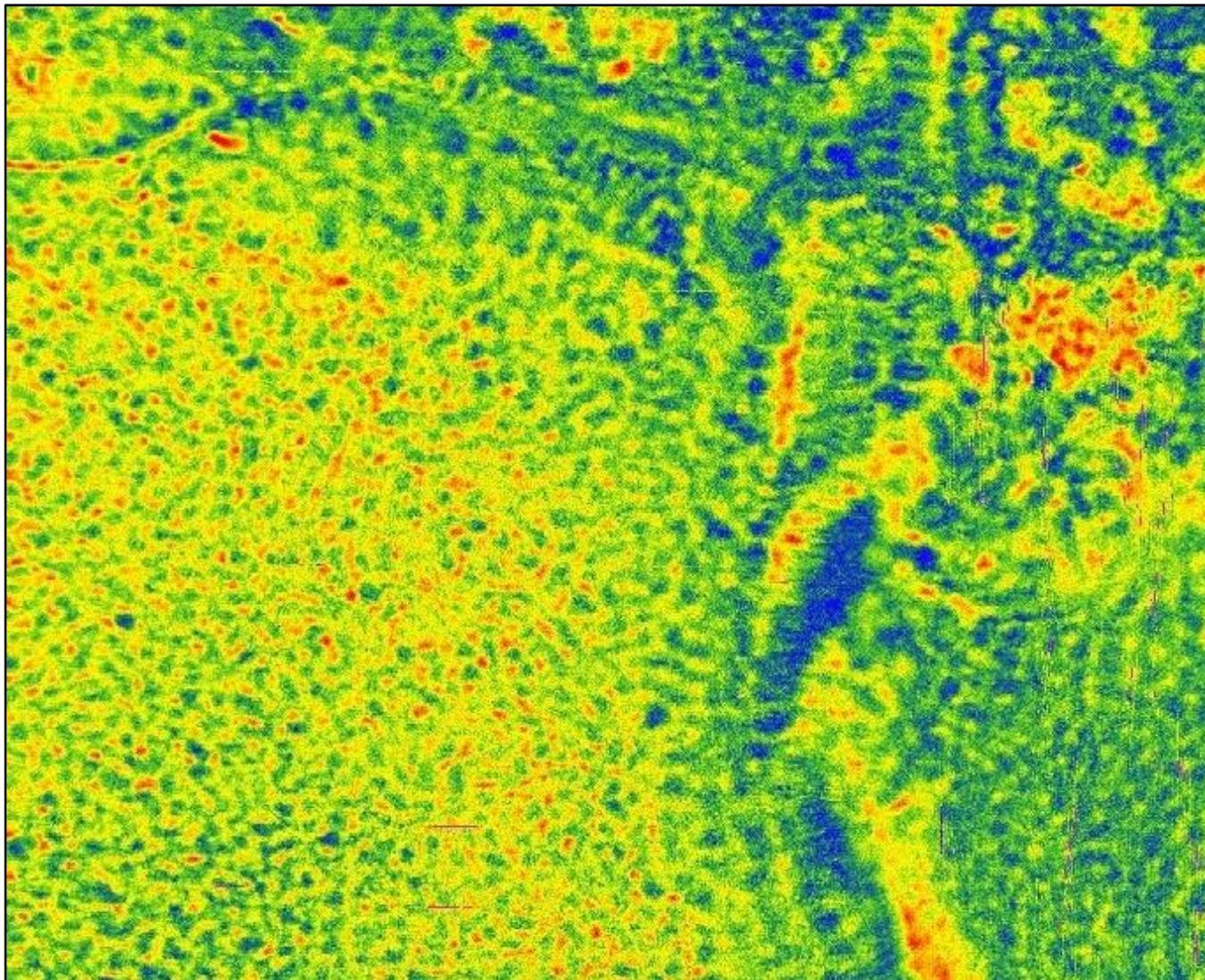
Water bottom

Top Eocene

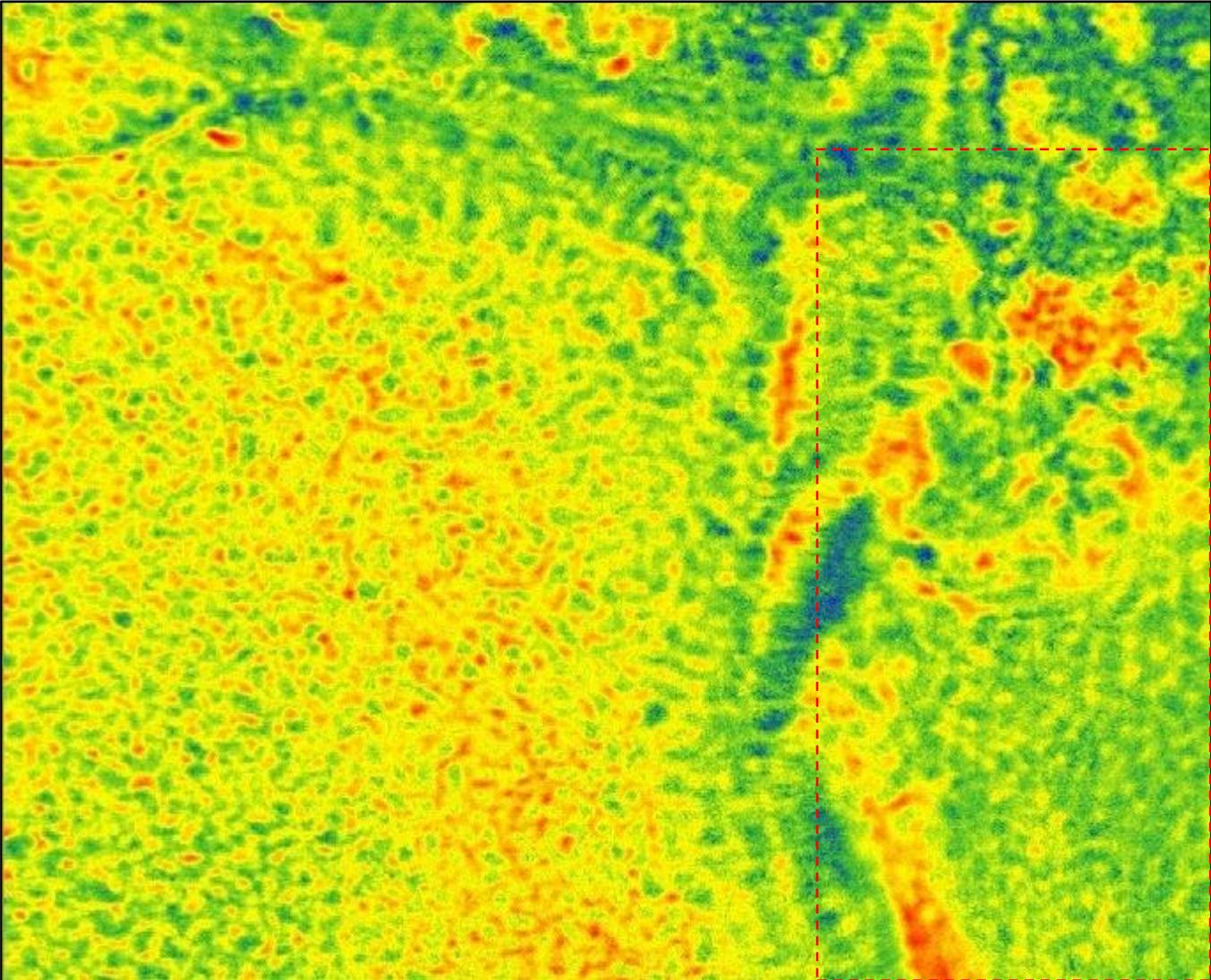
Lower Eocene

Top Chalk

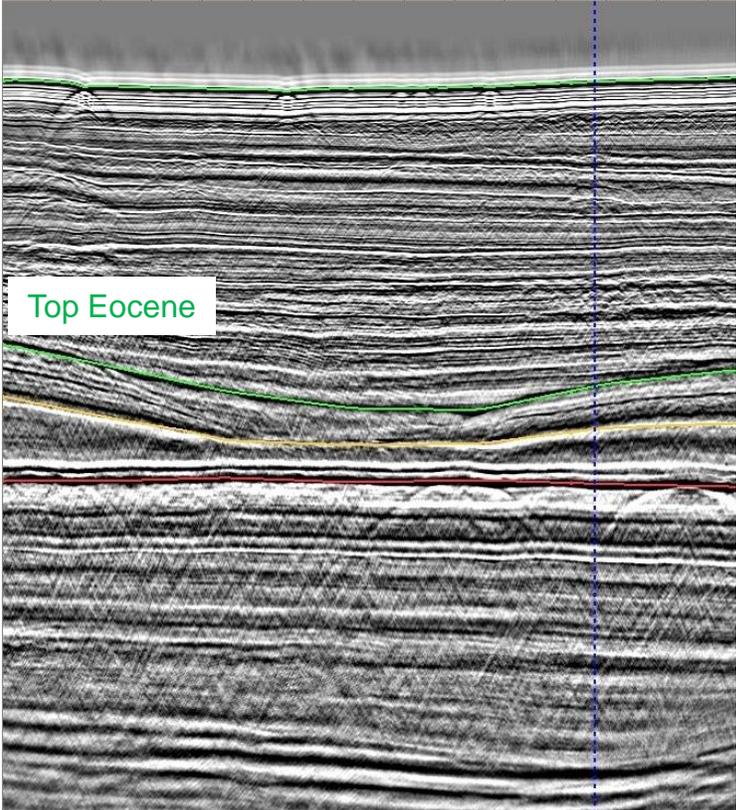
RMS Amplitude maps Top Eocene before regularisation



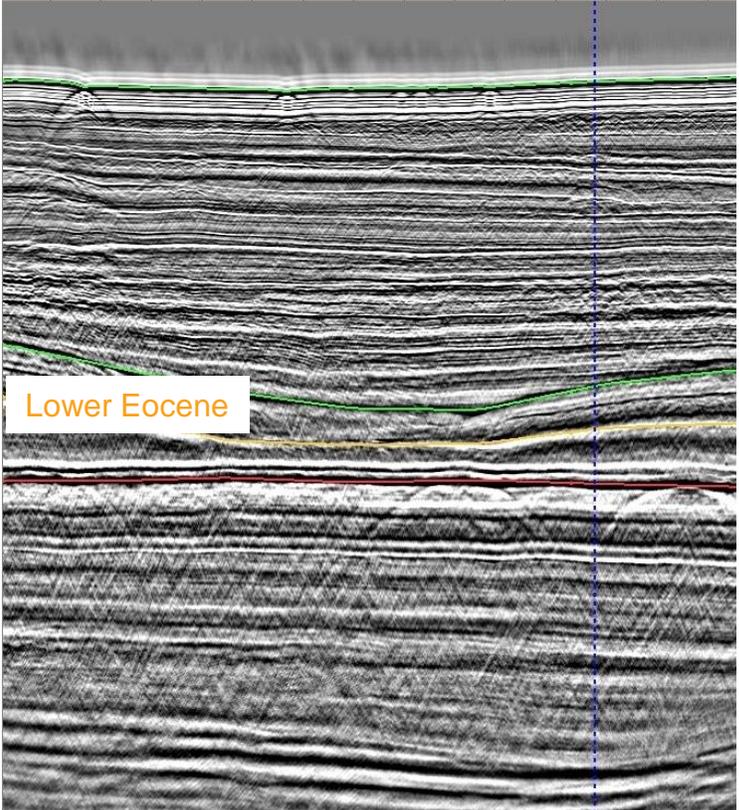
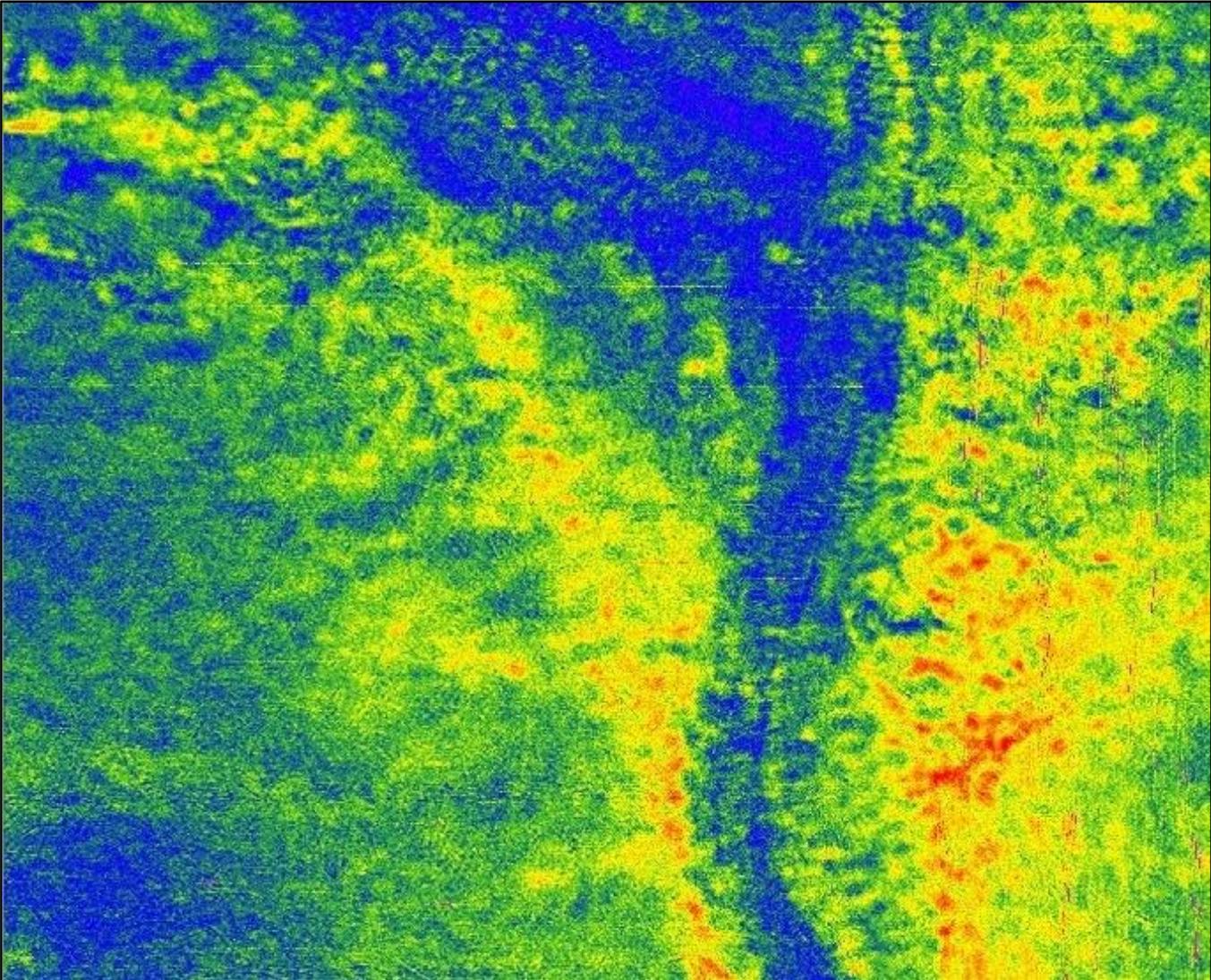
RMS Amplitude maps Top Eocene after regularisation



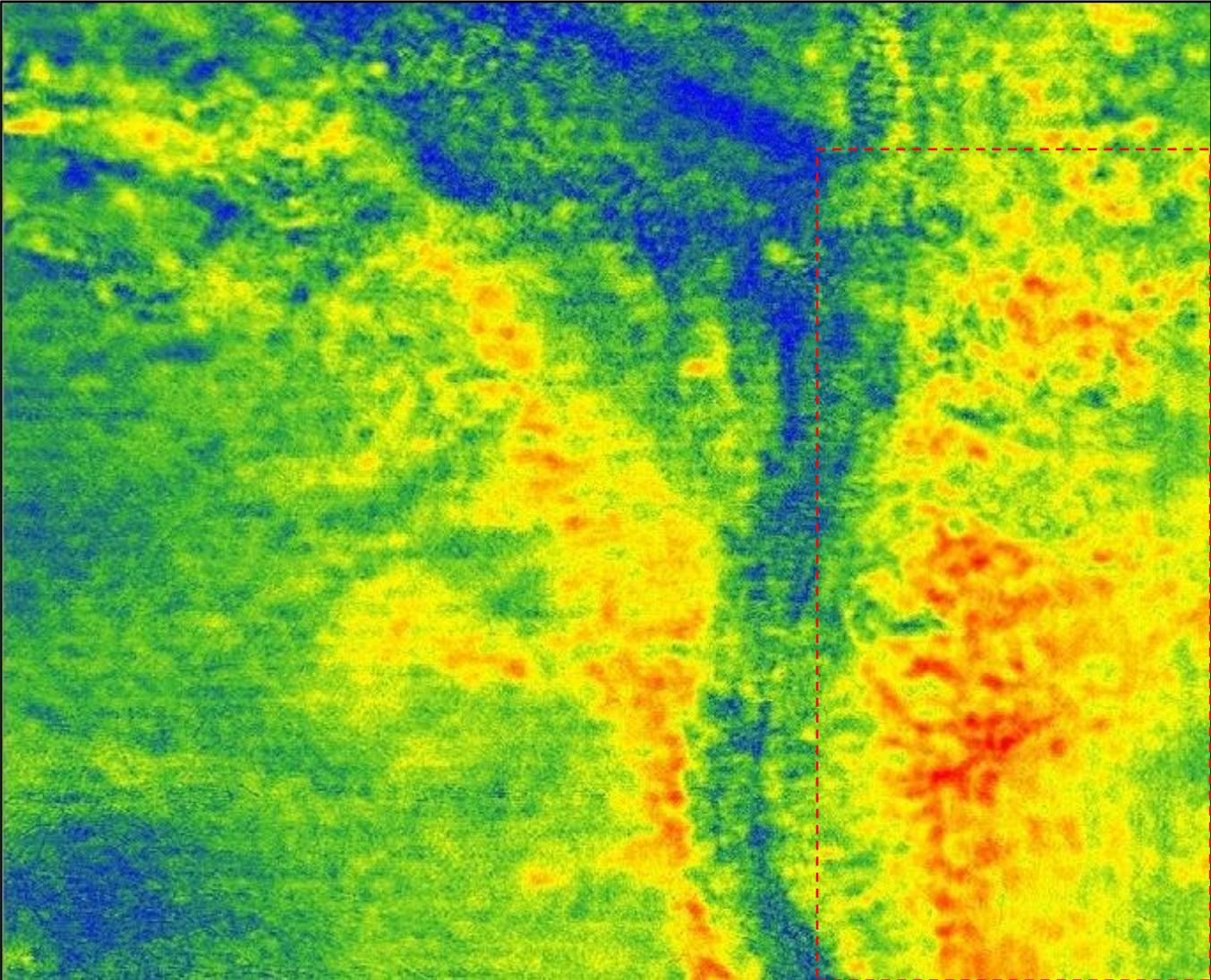
N-S
direction



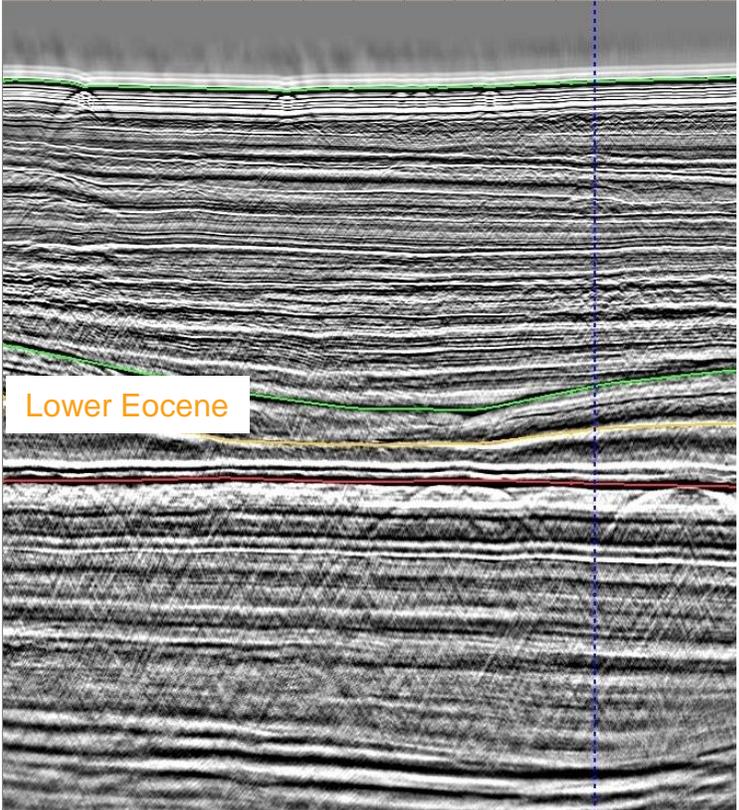
RMS Amplitude maps Lower Eocene before regularisation



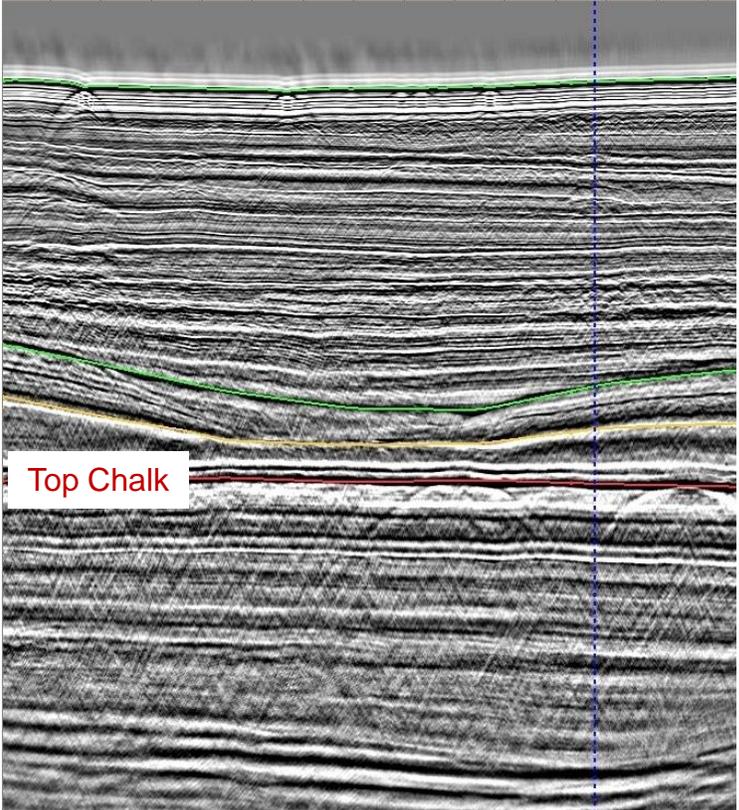
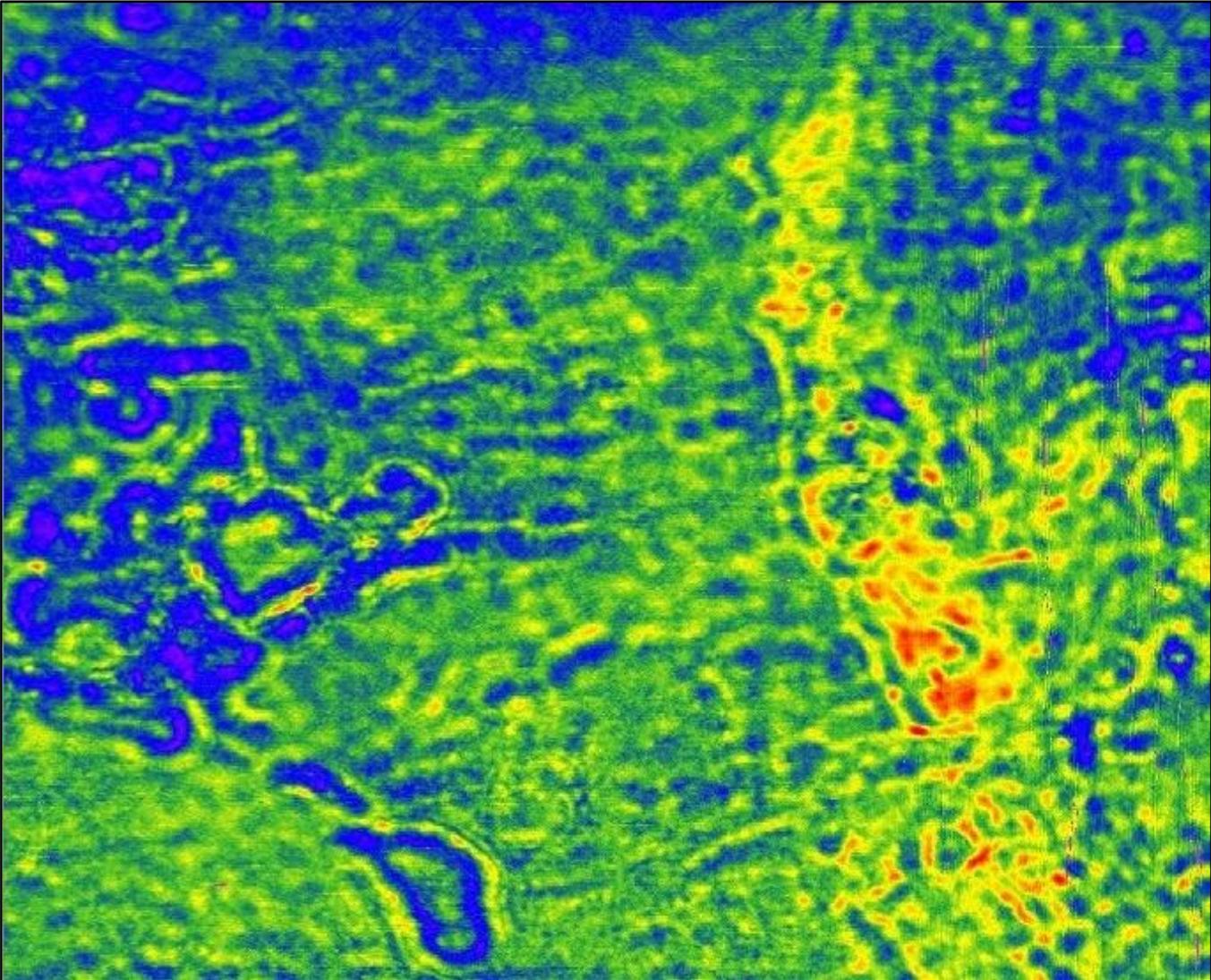
RMS Amplitude maps Lower Eocene after regularisation



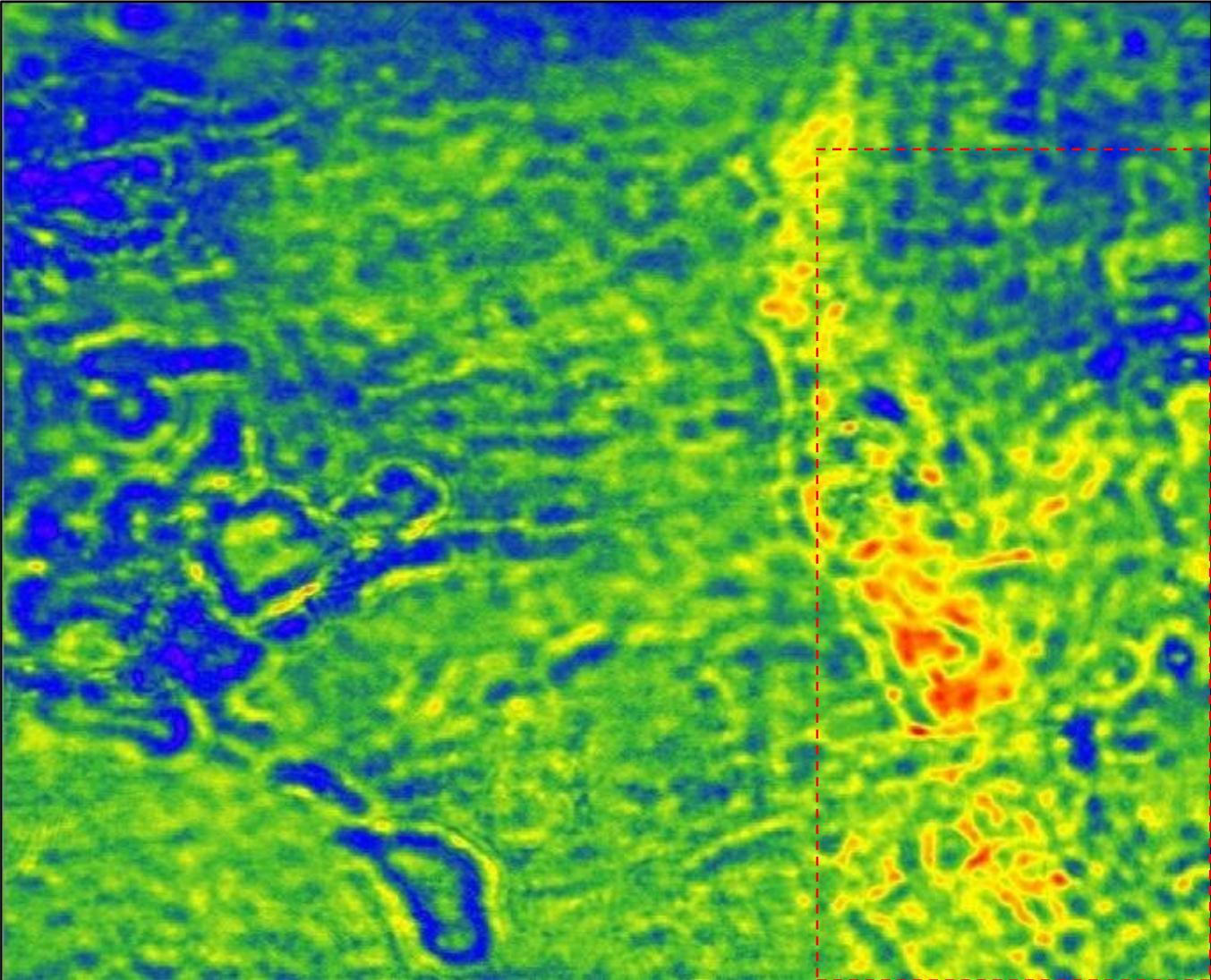
N-S
direction



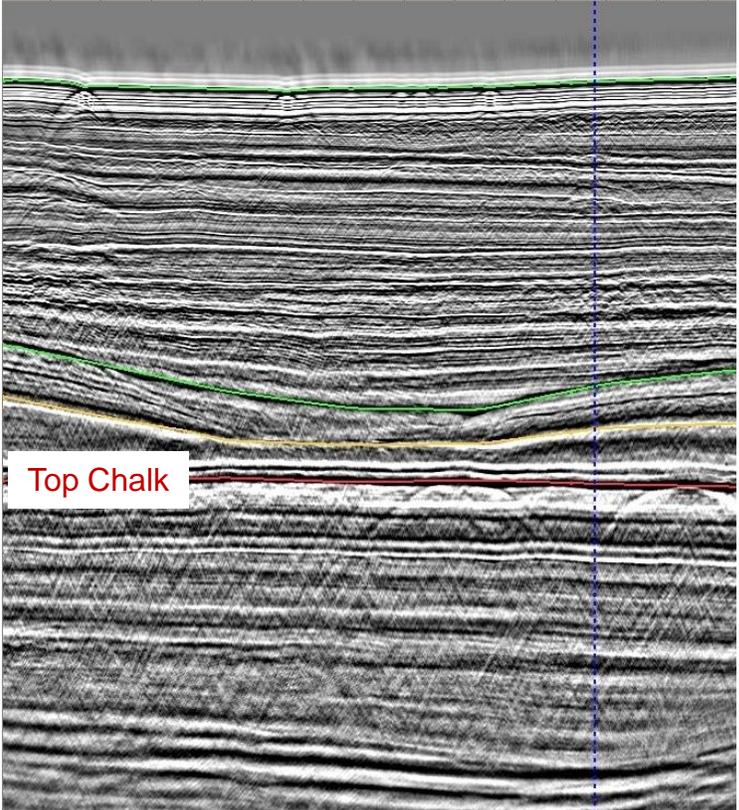
RMS Amplitude maps Top Chalk before regularisation



RMS Amplitude maps Top Chalk after regularisation



N-S
direction



Conclusions

Conclusions

- Although the datasets were acquired with two distinct shooting directions, they can be processed successfully to produce a single uniform seismic volume.
- This was achieved through:
 - Good parameterisations of regularisation stage
 - Triple source, continuous recording acquisition combined with deblending technology.
 - Advanced seismic processing workflow to deliver high quality seismic.

Acknowledgements

- We would like to thank the processing team for the hard work on the project.
- Big thank you to Simon Baldock and Antonia Hardwick for their valuable advice.
- Special thanks to Adriana Citlali Ramirez, Bent Erlend Kjølhamar and Nick Woodburn for proofreading the presentation.
- Thank you TGS management for permission to publish this work.

Thank you



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