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22.Encountered problems

22.1. Propeller Noise

Channels 25 to 40 showed recurring coherent noise. The noise is affecting less than 10% of traces and has a maximum amplitude of 5-10µB. The most likely cause of this noise are waterbottom reverberations of the propeller impulse.

An investigational F-K filter effectively removes this noise with minimal data loss. More thorough testing and a meticulous surgical design of an F-K filter could further optimize noise removal and minimize data loss and introduction of artifacts.

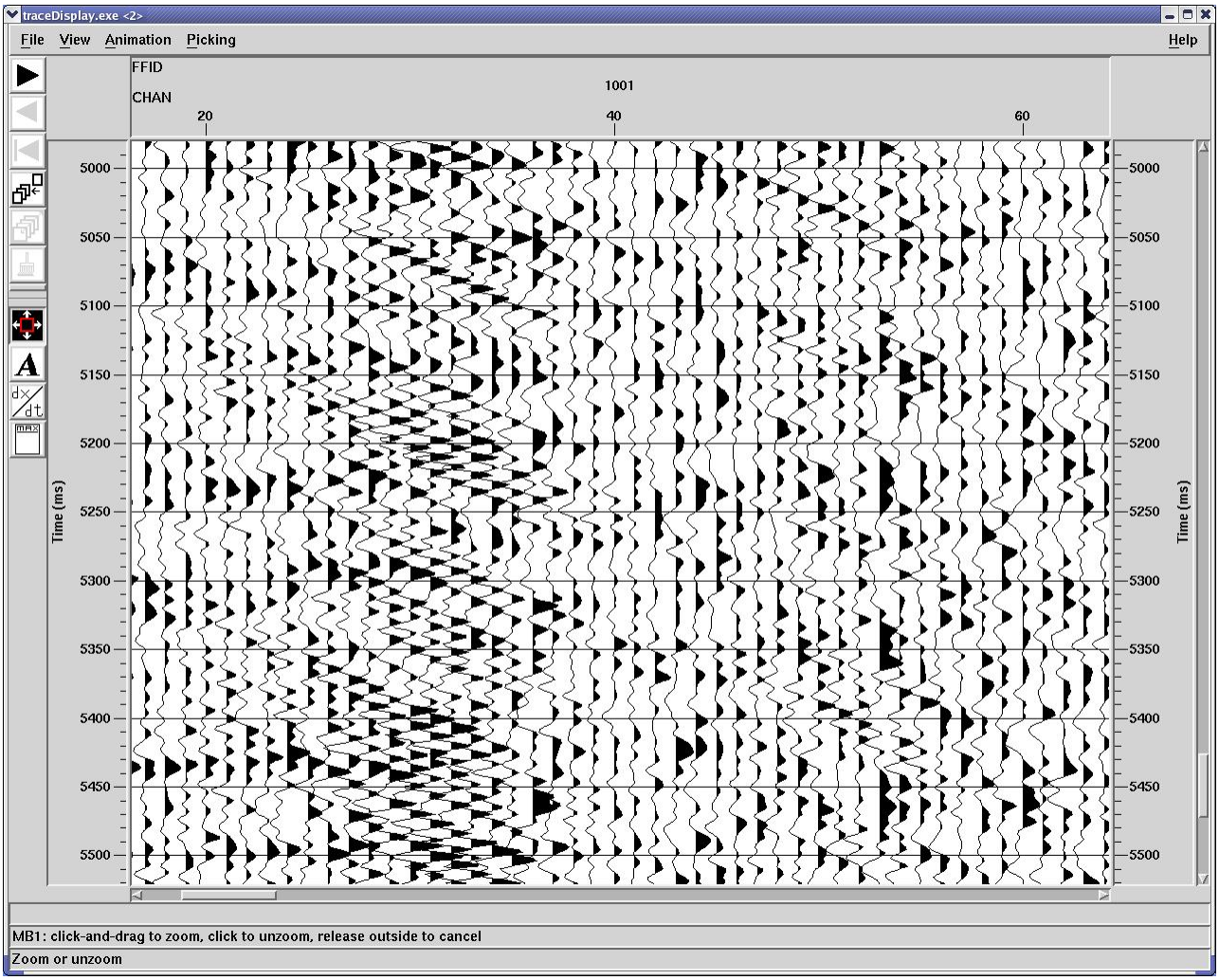

Figure 22-1: Raw shot, zoomed in on the propeller noise. Note the coherent character of the noise.

The following graphs show a noise record with annotated RMS and a Deep RMS window to further highlight the characteristics of the propeller noise.

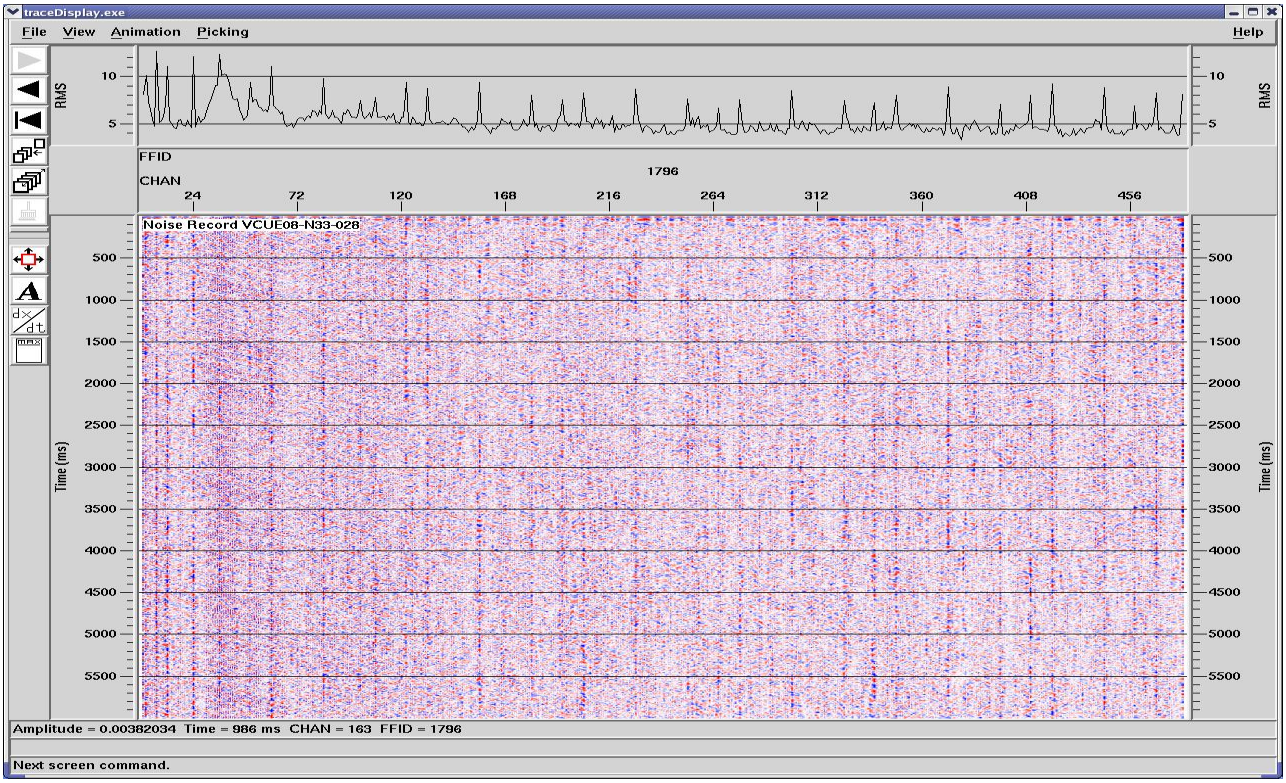

Figure 22-2: SOL noise record for sequence 028 with annotated RMS graph on top of the record. Note propeller noise of 8-10µB on channels 25 to 40.

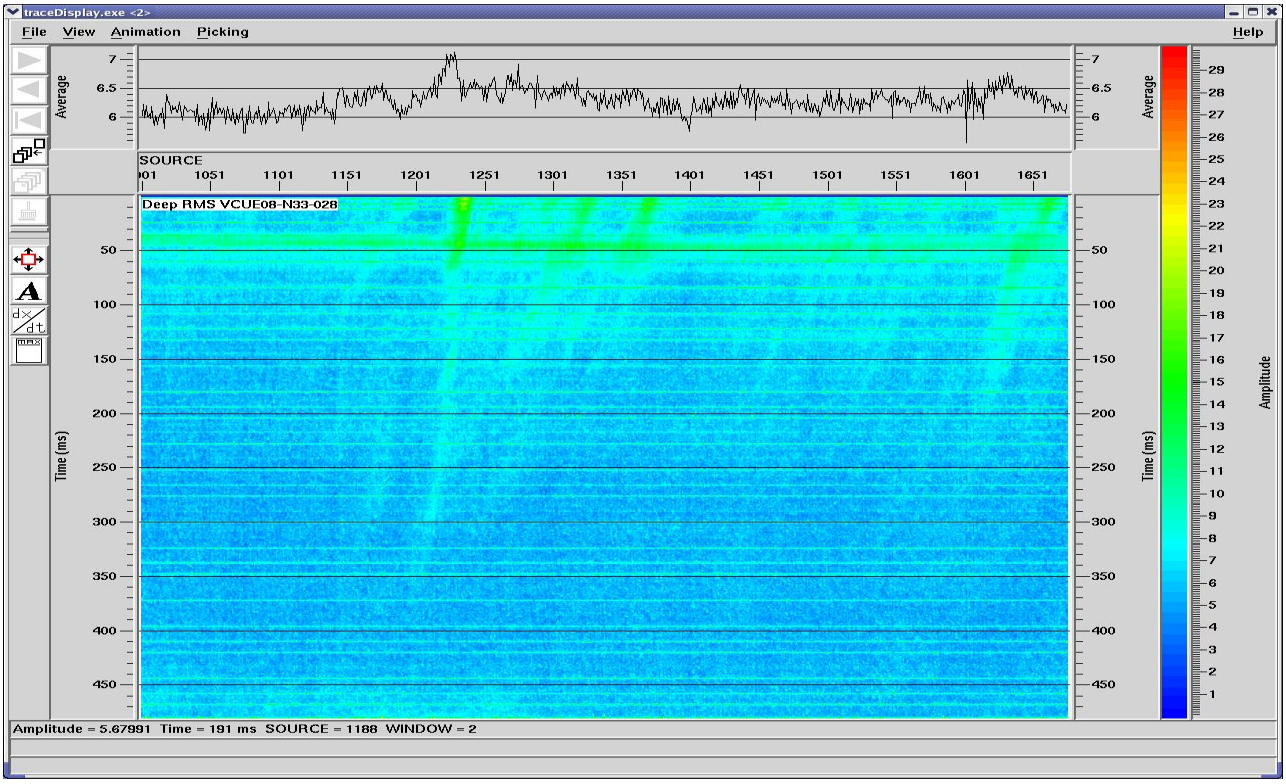

Figure 22-3: Deep RMS window for sequence 028. Note noise on channels 25 to 40.

The following graphs show raw and F-K filtered SOL noise records and shot records and their respective sprectral analysis. All screenshots have been taken with exaggerated gain to better illuminate the propeller noise.

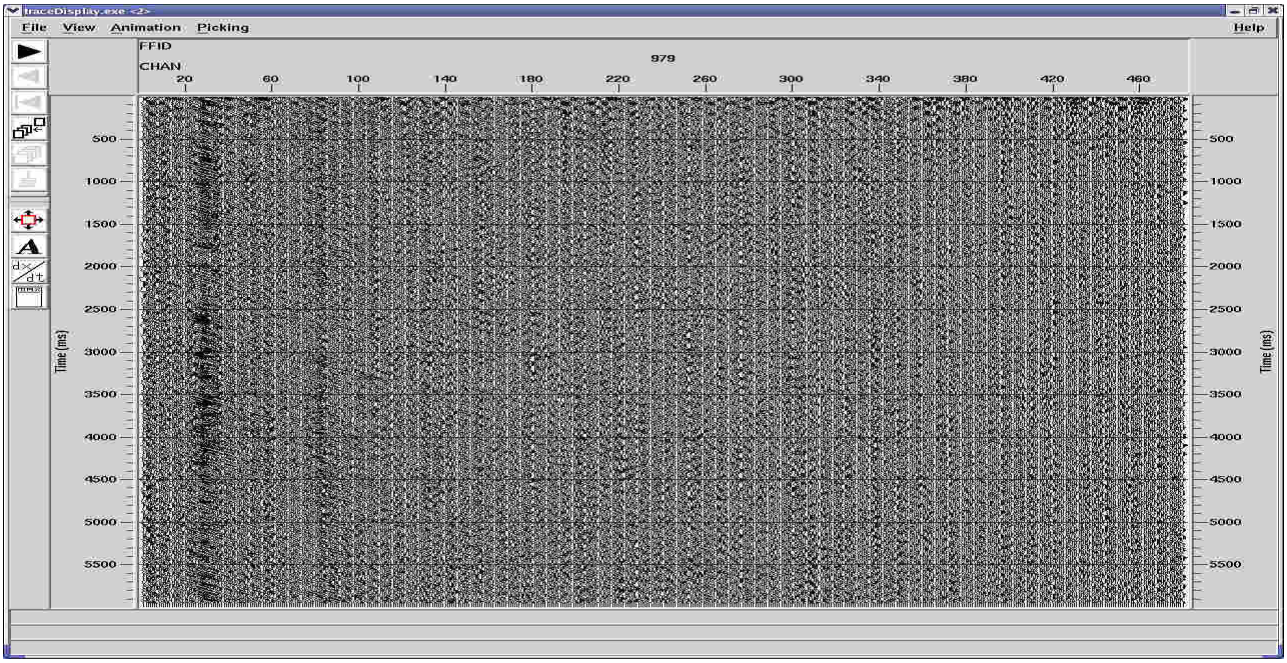

Figure 22-4: Raw SOL noise record.

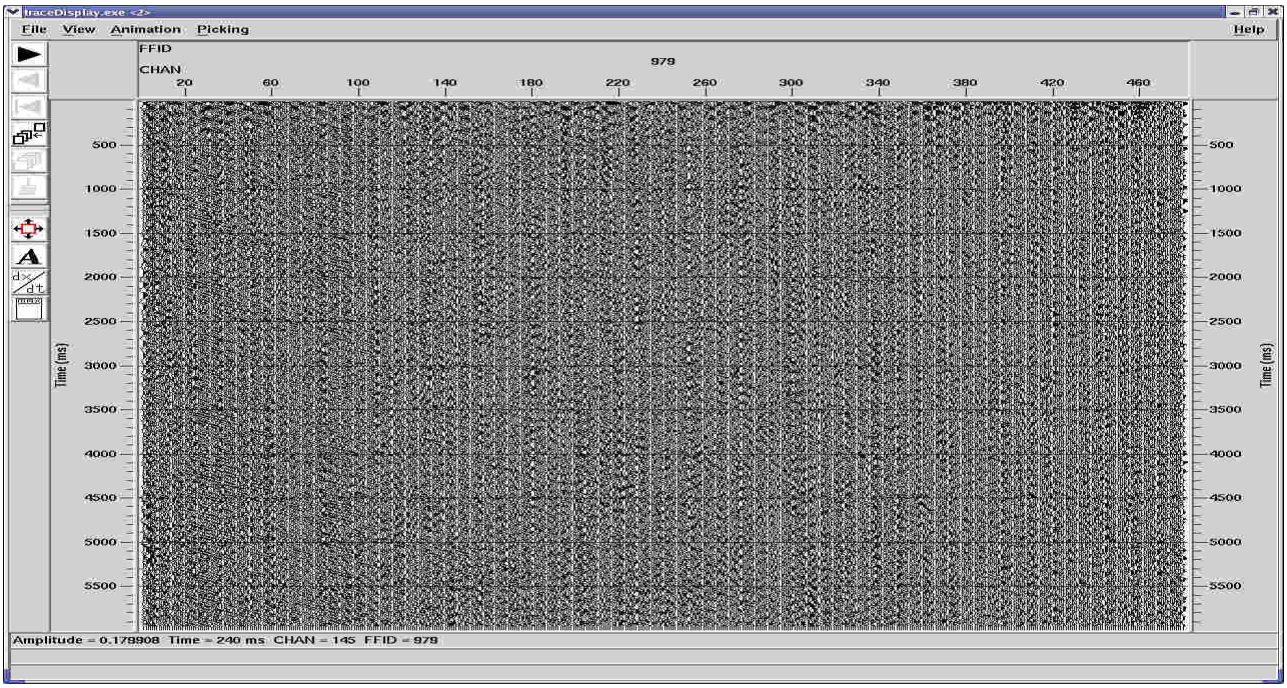

Figure 22-5: F-K filtered SOL noise record.

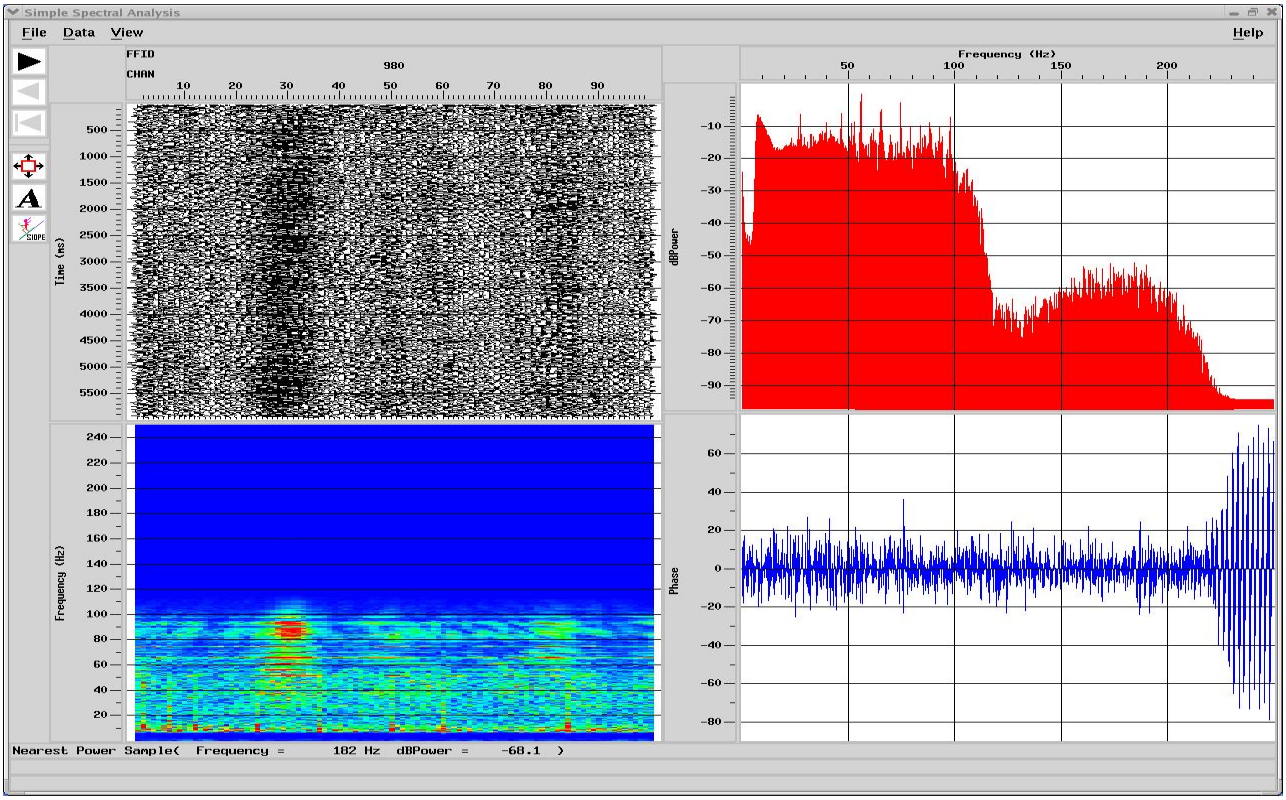

Figure 22-6: Spectral Analysis of raw SOL noise record.

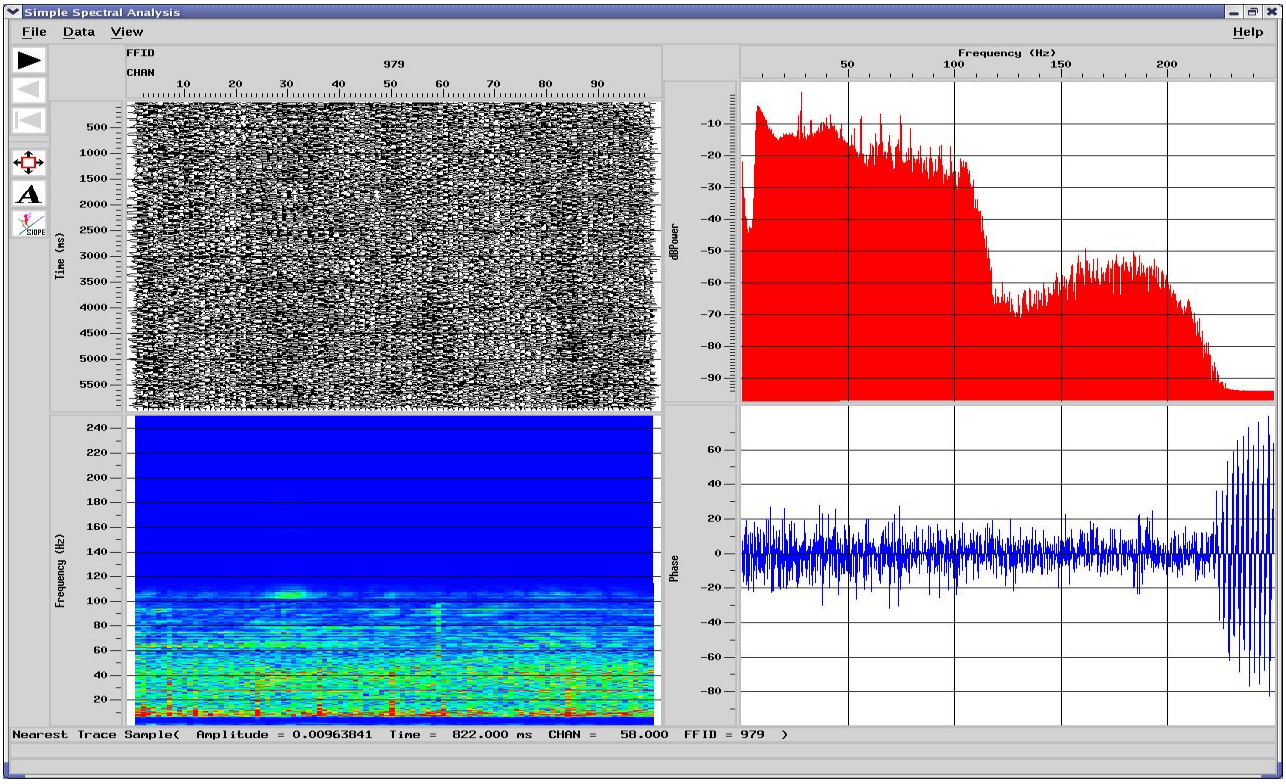

Figure 22-7: Sprectral Analysis of F-K filtered SOL noise record.

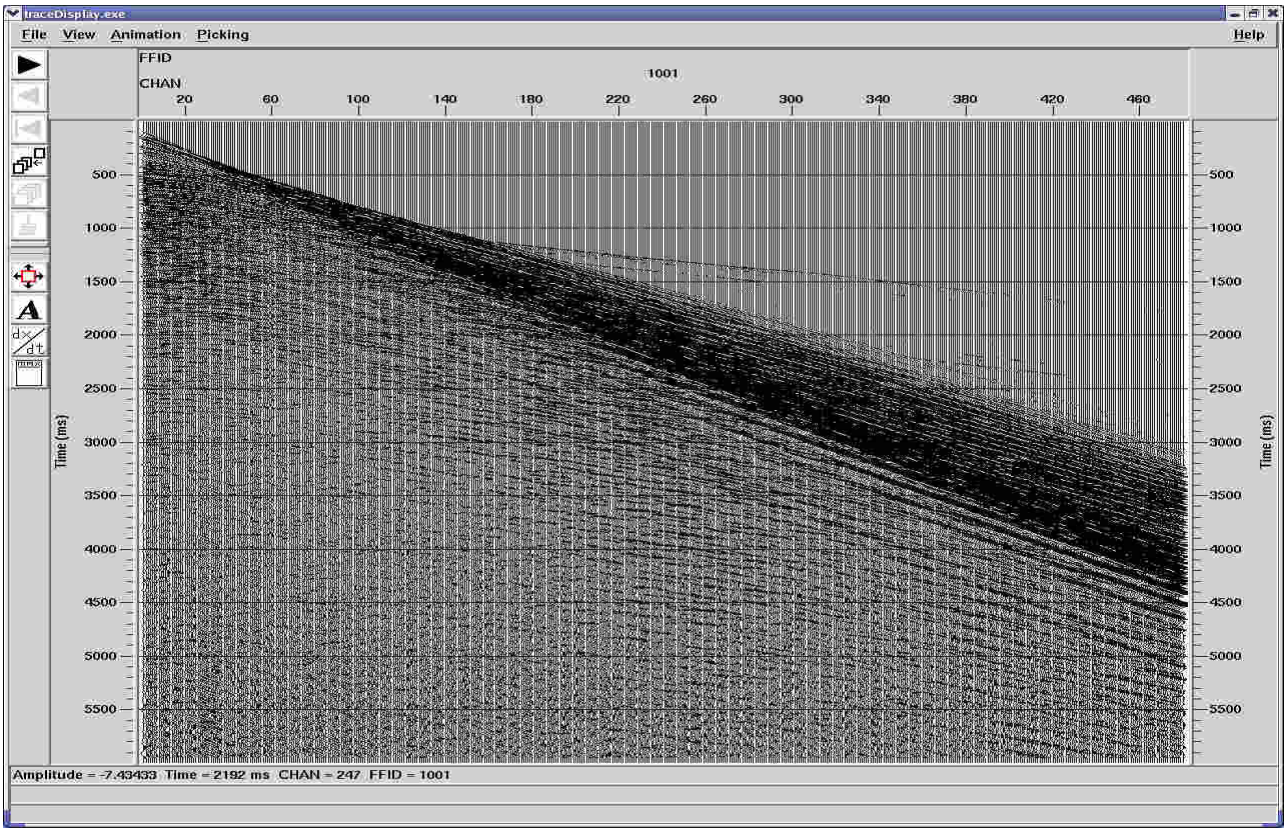

Figure 22-8: Raw Shot. Propeller noise visible, but for the most part drowned out by data.

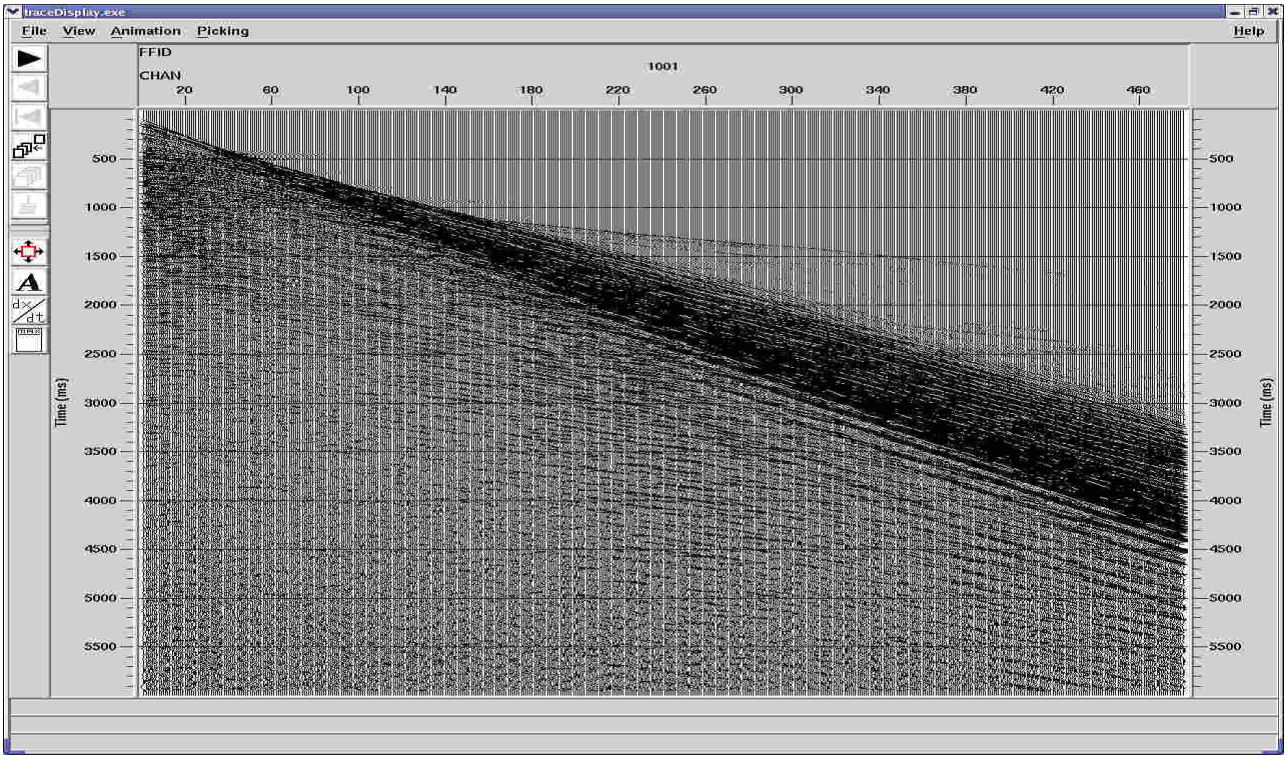

Figure 22-9: F-K filtered shot. Propeller noise mostly removed.

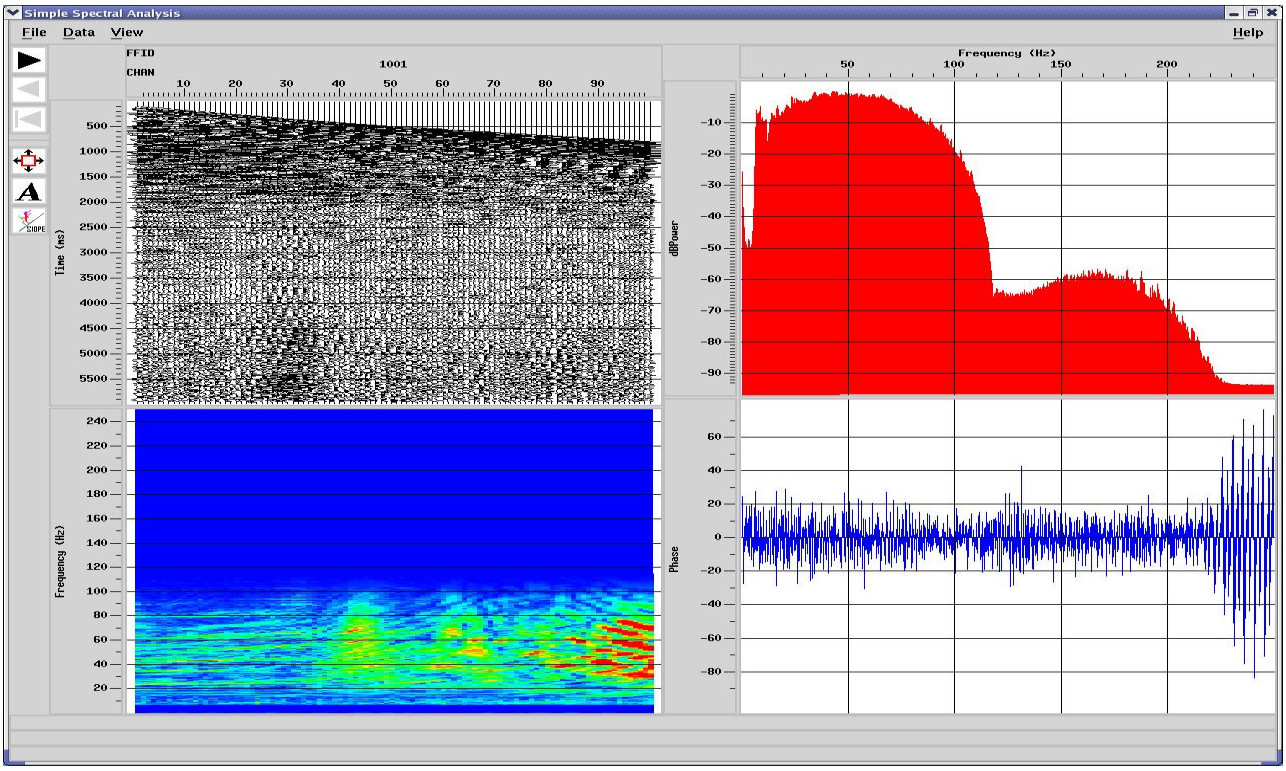

Figure 22-10: Spectral Analysis of raw shot.

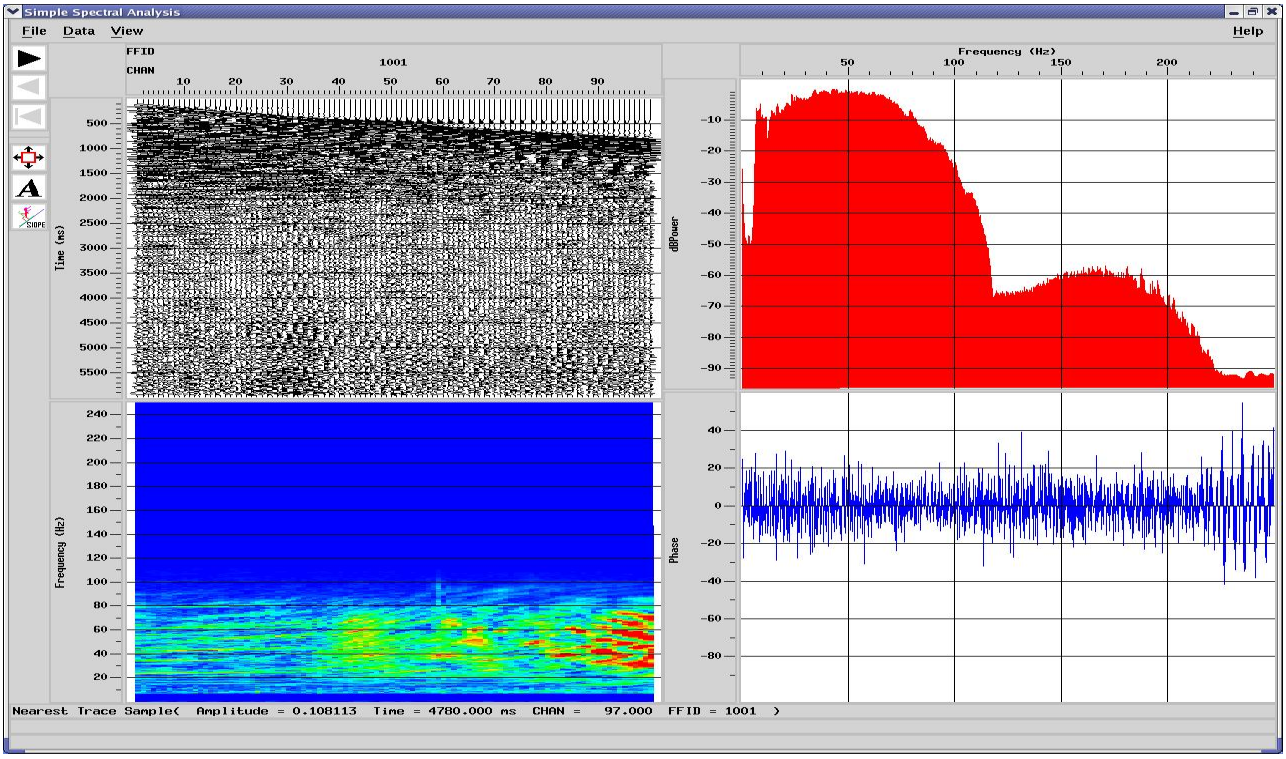

Figure 22-11: Spectral Analysis of F-K filtered shot.

22.2. Loss of Tailbuoy Positioning

From sequence 20 onwards there was no Tailbuoy data available, and navigation processing was performed based solely on compass data. To quantify the impact of the loss of the Tailbuoy data, the following test was run for sequence 015, where Tailbuoy data was still available.

The far trace arrival times were calculated from navigation-derived offsets and displayed as an overlay over the seismic data. This process was performed first on positioning data that included both Tailbuoy positions and compass bearings (red graph in figure below). The process was then repeated on positioning data that included no Tailbuoy positions but compass bearings only (blue graph in figure below). Subsequently the absolute difference of the two values was calculated (graph on top of figure below). The error was found to be less than 2ms, i.e. less than the seismic sampling interval.

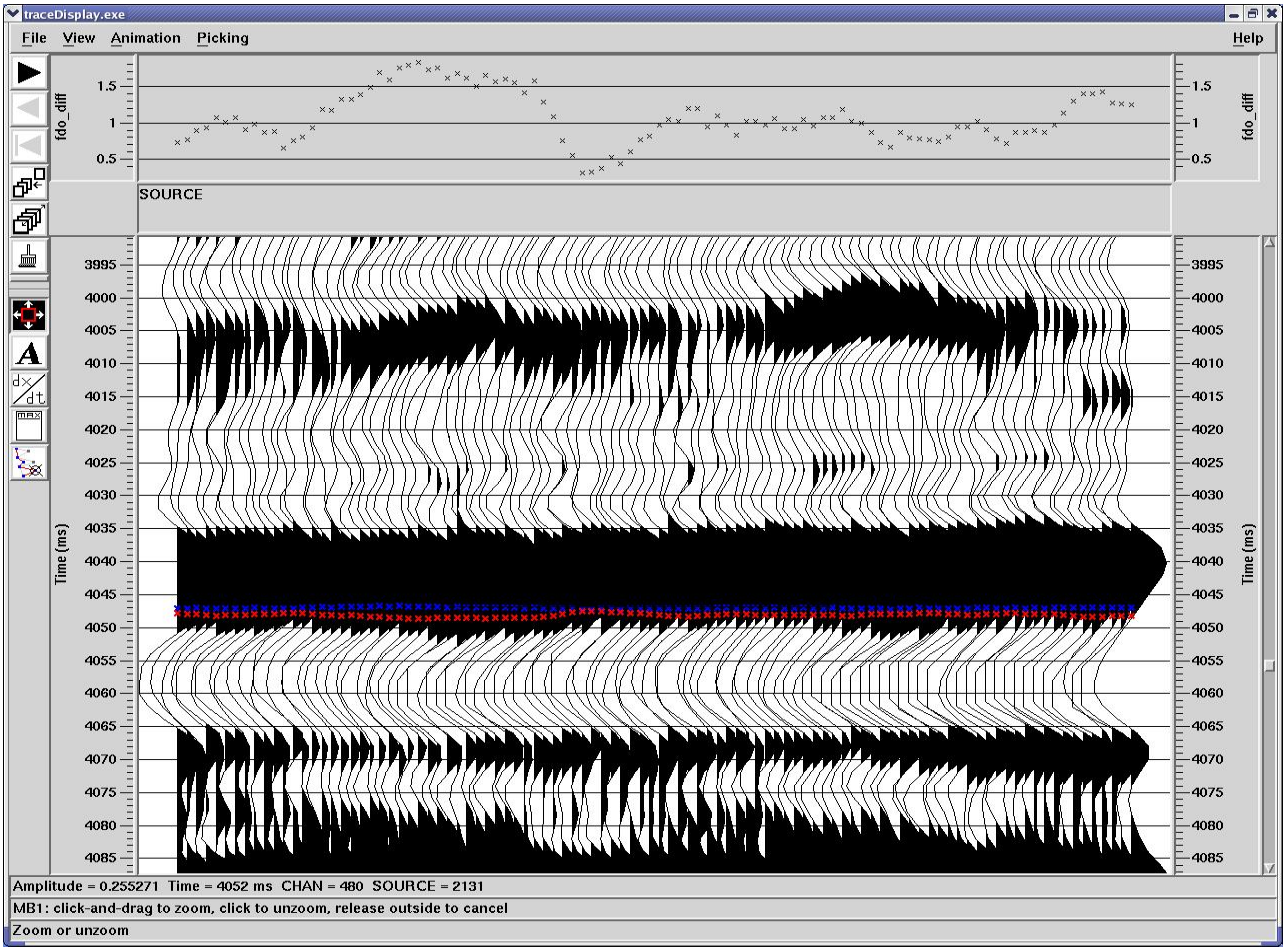

Figure 22-12: Far trace arrival time (FTAR) overlayed on seismic data for sequence 015.
Red Graph: FTAR derived from positioning data that included tailbuoy positions and compass bearings.
Blue Graph: FTAR derived from positioning data that included compass bearings only.
Graph on top of the section: Absolute difference of the two FTAR values. Note, the difference is consistently less than the seismic sampling interval.

22.3. Swell noise

Weather conditions over the survey period were varied. In general, the weather was good, with swell heights less than 2m. Swell bursts were seen on the raw shot records, typically affecting less than 10% of the traces, usually at a level below 25ub. Because of the high fold of coverage, this noise invariably stacked out, even with no noise attenuation processes applied to the data.

Sequence 38 was NTBP due to heavy swell. Sequences 013 and 014 were shot during swell heigths of 3m and contained strong swell noise. At its peak, the swell bursts affected about 30% of the traces and stacked occasionally within the prospect's target area of 2seconds.

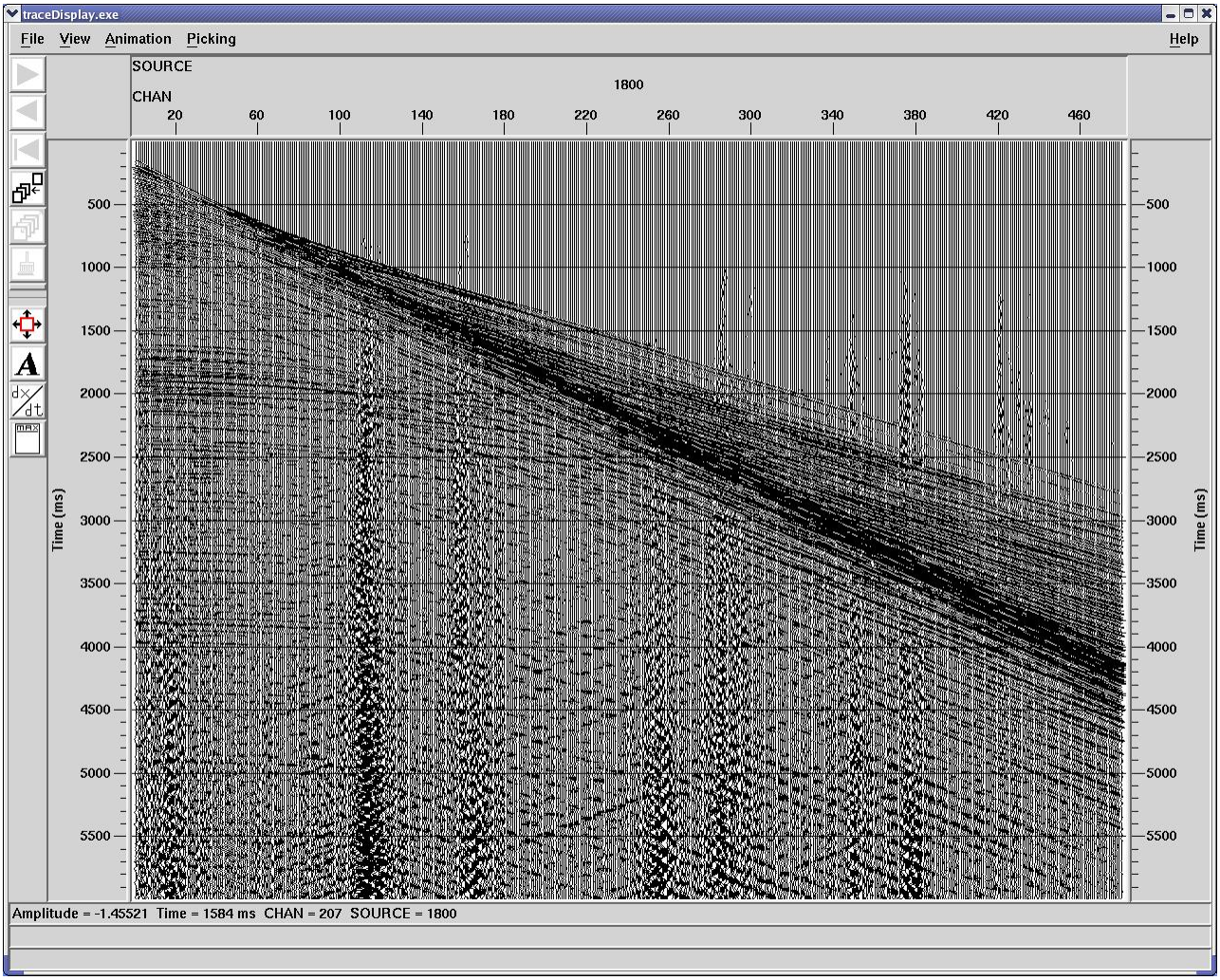

Figure 22-13: Shot gather of SP 1800 for sequence 013. Swell noise affecting approximately 25% of traces is evident.

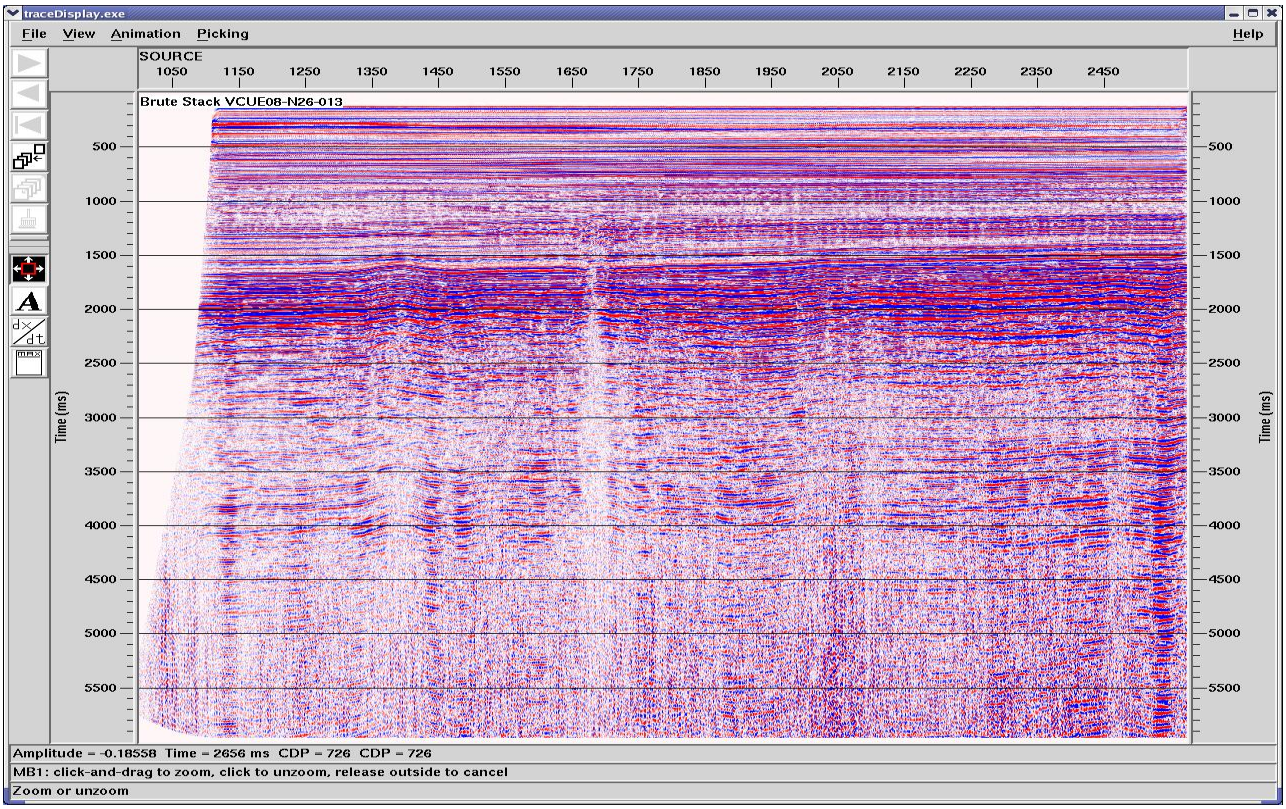

Figure 22-14: Brute stack for sequence 013. Bottom third of stack affected by swell noise, some bursts reaching into target area.

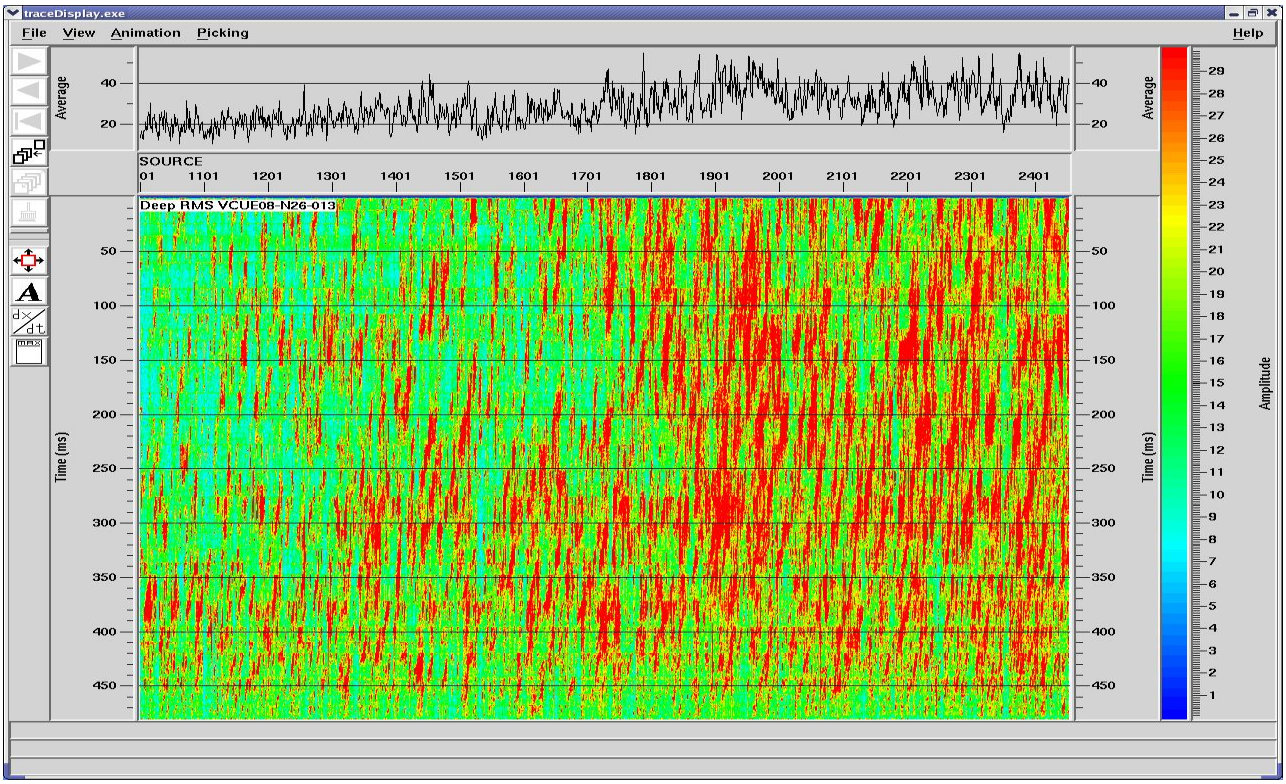

Figure 22-15: Deep window shot vs. channel RMS for sequence 013.

22.4. Autofires/Misfires

Overall, the guns performed well during the period of acquisition. Processing QC confirmed the guns' performance. Autofires misfires and air pressures were closely monitored. Occasionally gunlink flagged shots with incomplete or missing headers as autofires, which was closely investigated to ensure correctness. Gun delta errors, missing headers etc were marked both in the Observer Logs and in the QC logs.

The QC procedures in place to check for autofires and other gun problems are described in section **Error! Reference source not found.**.

Seq	Line	Bad Shots: MSP - missed SP (not fired); REC - not recorded SP or bad due to recording system; GAF - gun autofire; GTE - gun timing error >1.5ms; NOR - noise on record out of specs; NAV - nav error or missing nav header; SE - spread error
1	VCUE08-E08-001	NO HEADER: 3121,2220 MSP: 2895
2	VCUE08-E11-002	NO HEADER: 1106,1171,2306,2509,2714,3277, MSP: 1597,1709,3243,3319 NOR 1431 (cable strike)
3	VCUE08-E15-003	NO HEADER: 3137,2104,1845 MSP: 2257,1850
4	VCUE08-E12-004	NO HEADER: 1165,1205,2800,2937 MSP: 2134
5	VCUE08-E09-005	NO HEADER: 1931,1242,1161
6	VCUE08-E14-006	NO HEADER: 1282,1659,3163 MSP: 2773
7	VCUE08-E10-007	NO HEADER: 2710,2494,2496,1945,1601,1345
8	VCUE08-E06-008	NO HEADER: 1055,1096,1828,1925,1966,1969,2024,2191,2241
9	VCUE08-E04-009	NO HEADER: 1055,1096,1828,1925,1966,1969,2024,2191,2242
10	VCUE08-E07-010	NO HEADER: 1160,1843
11	VCUE08-N34-011	NONE
12	VCUE08-N32-012	NONE
13	VCUE08-N26-013	NO HEADER: 1911 MSP: 1524,2269
14	VCUE08-N21-014	NO HEADER: 2333,2285,2167,2112,1224 MSP: 2576,1903
15	VCUE08-N24-015	NO HEADER: 1541,1620 MSP: 2017,2093
16	VCUE08-N20-016	NO HEADER: 2669
17	VCUE08-N27-017	MSP: 2298
18	VCUE08-N22-018	NO HEADER: 1466,1194
19	VCUE08-N28-019	NO HEADER: 1060,1315,1821,1929
20	VCUE08-N23-020	NO HEADER: 1602
21	VCUE08-N30-021	NO HEADER: 1923, 1968, MSP: 1067, 2325
22	VCUE08-N25-022	NO HEADER: 2034,2031,1927,1873,1154 MSP: 1906
23	VCUE08-N29-023	NO HEADER: 1513,2036 MSP: 2030
24	VCUE08-N31-024	NO HEADER:1915
25	VCUE08-E03-025	MSP: 1906,1702
26	VCUE08-E01-026	NO HEADER: 1012, MSP: 1995
27	VCUE08-N35-027	NO HEADER: 1330
28	VCUE08-N33-028	MSP: 1602, NO HEADER: 1377,1132
29	VCUE08-E02-029	MSP: 2125,1334, NO HEADER: 1398,1142
30	VCUE08-E05-030	NONE
31	VCUE08-N40-031	NO HEADER: 1164,1199 NO FIRE (GUN 1-7): 1420,1421,1432,1434
32	VCUE08-N36-032	NO HEADER: 1493
33	VCUE08-N39-033	NO HEADER: 1158 MSP: 1209
34	VCUE08-N43-034	MSP: 1210, 1175
35	VCUE08-N38-035	NONE
36	VCUE08-N41-036	NONE

Figure 22-16: Shot edits section of the QC log listing bad shots.

22.5. Turn noise

On occasion the streamer was still in turn when the SOL noise files were recorded, due to the line run-in being constrained by safe navigation areas, with associated noise up to 150ub. This did not affect the chargeable SPs, only the noise records. Notes regarding the sequences affected can be found in the QC logs.

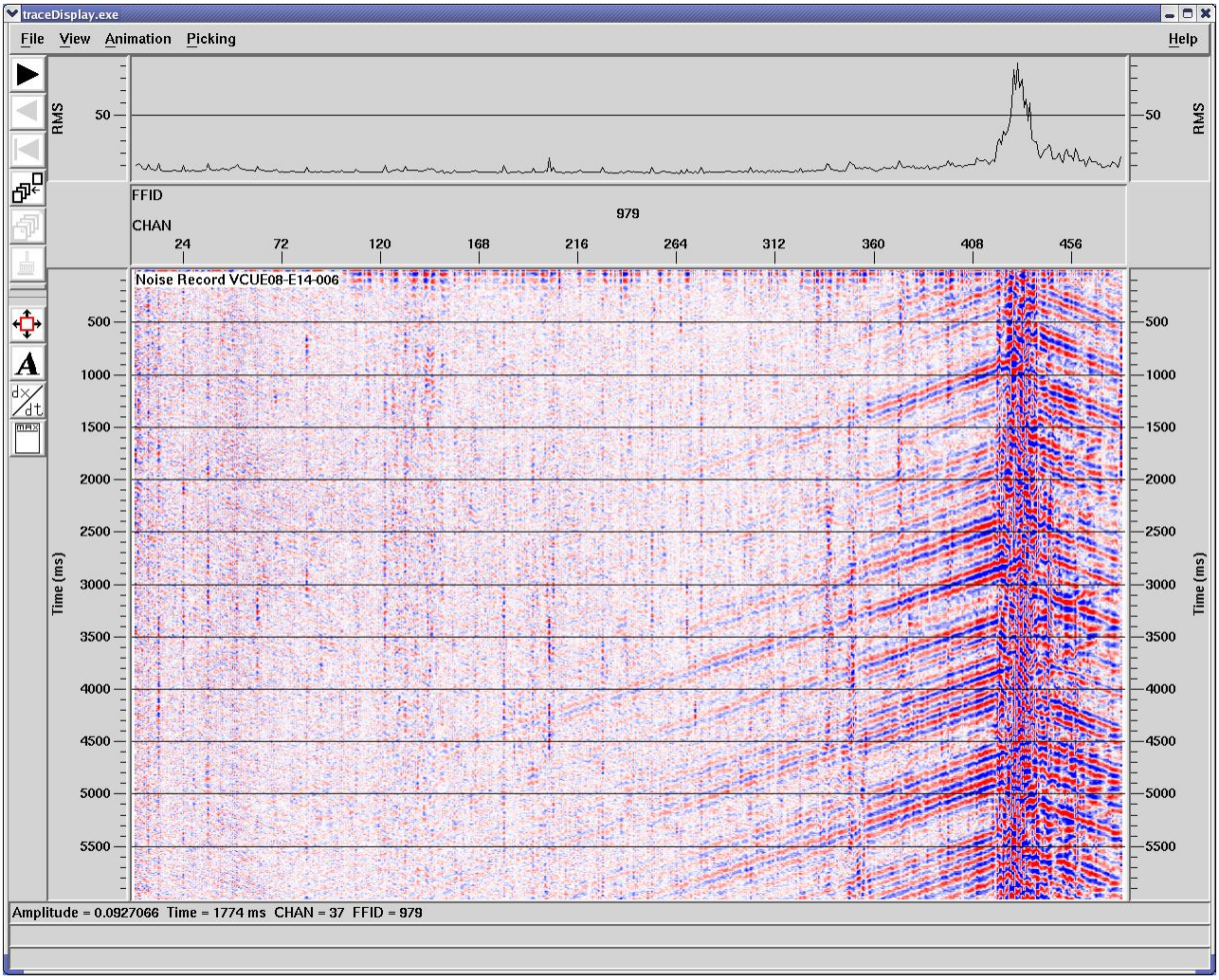

Figure 22-17: SOL noise display of sequence 006. Streamer still in turn while SOL noise records were taken.

22.6. Spiky Channels

The number of bad channels did not exceed 1.7% for the entire survey. No channel was particularly spiky.

reversed polarity
fails instrumentation tests
noisy
spiking

for more detailed info, see OBSERVER LINE LOGS

seq	channel																Q	%
001		59	91					242			337						4	0.8
002		59	91					242			337						4	0.8
003		59	91					242			337						4	0.8
004		59	91					242			337						4	0.8
005		59	91					242			337						4	0.8
006		59	91				202	242			337						5	1.0
007		59	91				202	242			337						5	1.0
008		59	91				202	242			337						5	1.0
009		59	91				202	242			337						5	1.0
010		59	91				202	242			337						5	1.0
011		59	91					242			337						4	0.8
012		59	91					242			337						4	0.8
013		59	91					242			337						4	0.8
014		59	91					242			337						4	0.8
015		59	91					242			337						4	0.8
016		59	91					242			337						4	0.8
017		59	91					242			337						4	0.8
018		59	91					242			337						4	0.8
019		59	91					242			337						4	0.8
020		59	91					242			337						4	0.8
021		59	91					242			337						4	0.8
022		59	91					242			337						4	0.8
023		59	91					242			337						4	0.8
024		59	91					242			337						4	0.8
025		59	91					242			337						4	0.8
026		59	91					242			337						4	0.8
027		59	91					242			337						4	0.8
028		59	91					242			337						4	0.8
029		59	91					242			337						4	0.8
030		59	91					242			337						4	0.8
031		59	91					242			337						4	0.8
032		59	91					242			337						4	0.8
033		59	91					242			337						4	0.8
034		59	91					242			337						4	0.8
035		59	91					242			337						4	0.8
036		59	91					242			337						4	0.8

Figure 22-18: Channel edits section of QC log listing of bad channels (noted from observer logs).

22.7. Noise history display

The following display shows the noise record history for all sequences, calculated from the SOL and EOL noise files.

All channels for each noise record have been stacked together to a single trace, and these average channel values are annotated above the display.

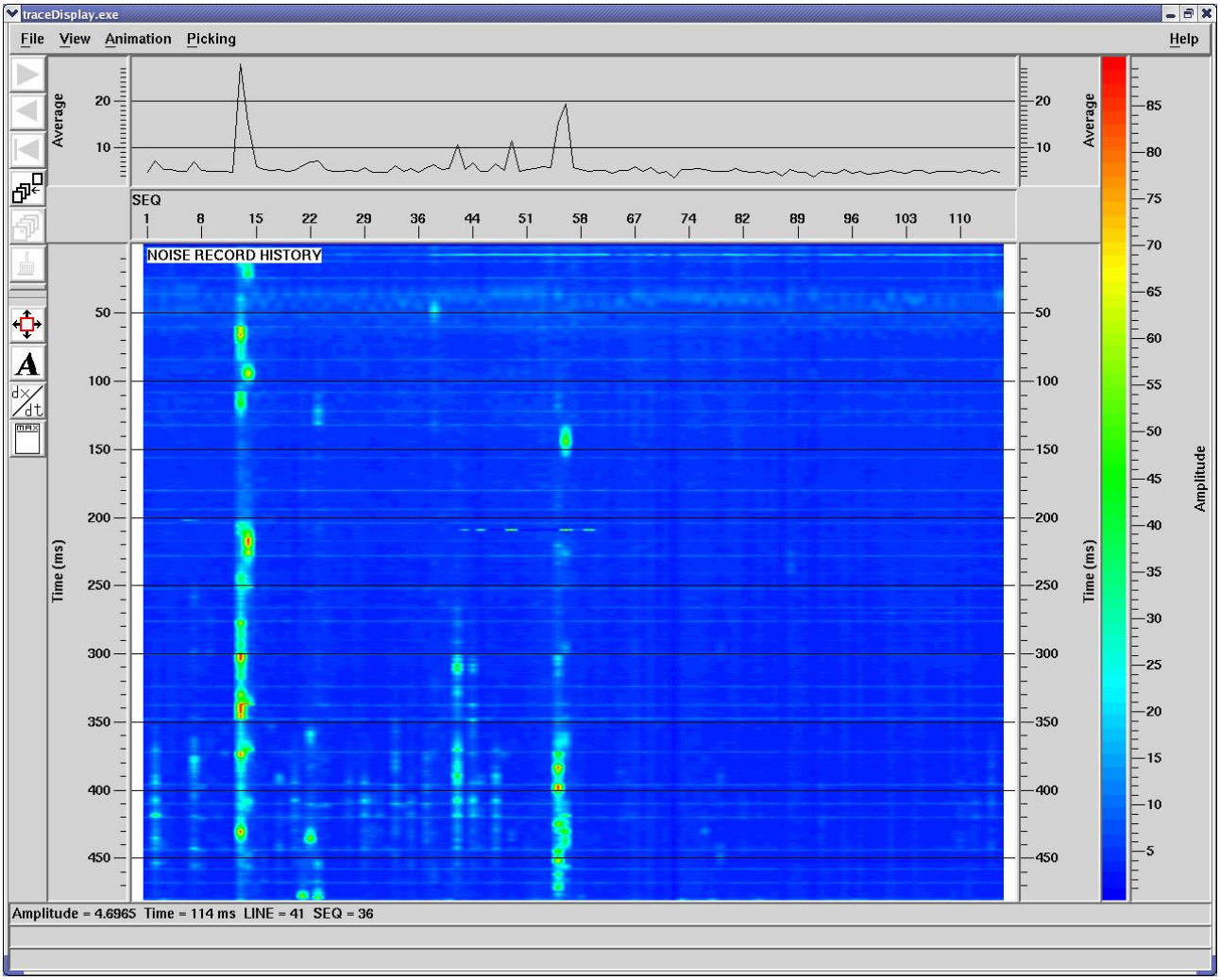

Figure 22-19 : Noise history display for sequences 001 to 115.

22.8. RMS history displays

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 115, calculated from the shallow RMS window at 50 to 500 ms.

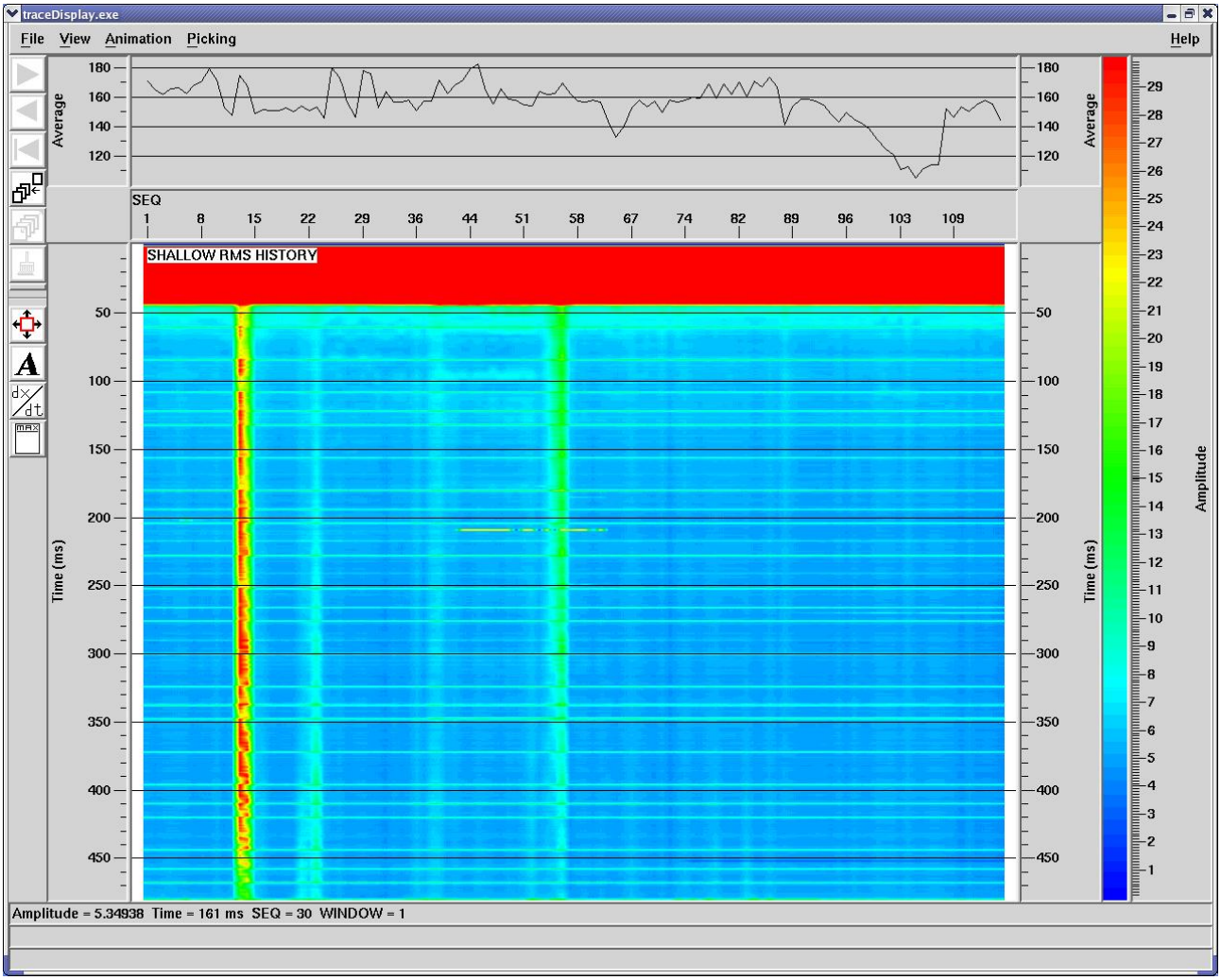

Figure 22-20: Shallow RMS history display for sequences 001 to 115. Notice that the first 50 channels are dominated by direct arrival energy.

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 115, calculated from the deep RMS window at 5450 to 5950 ms

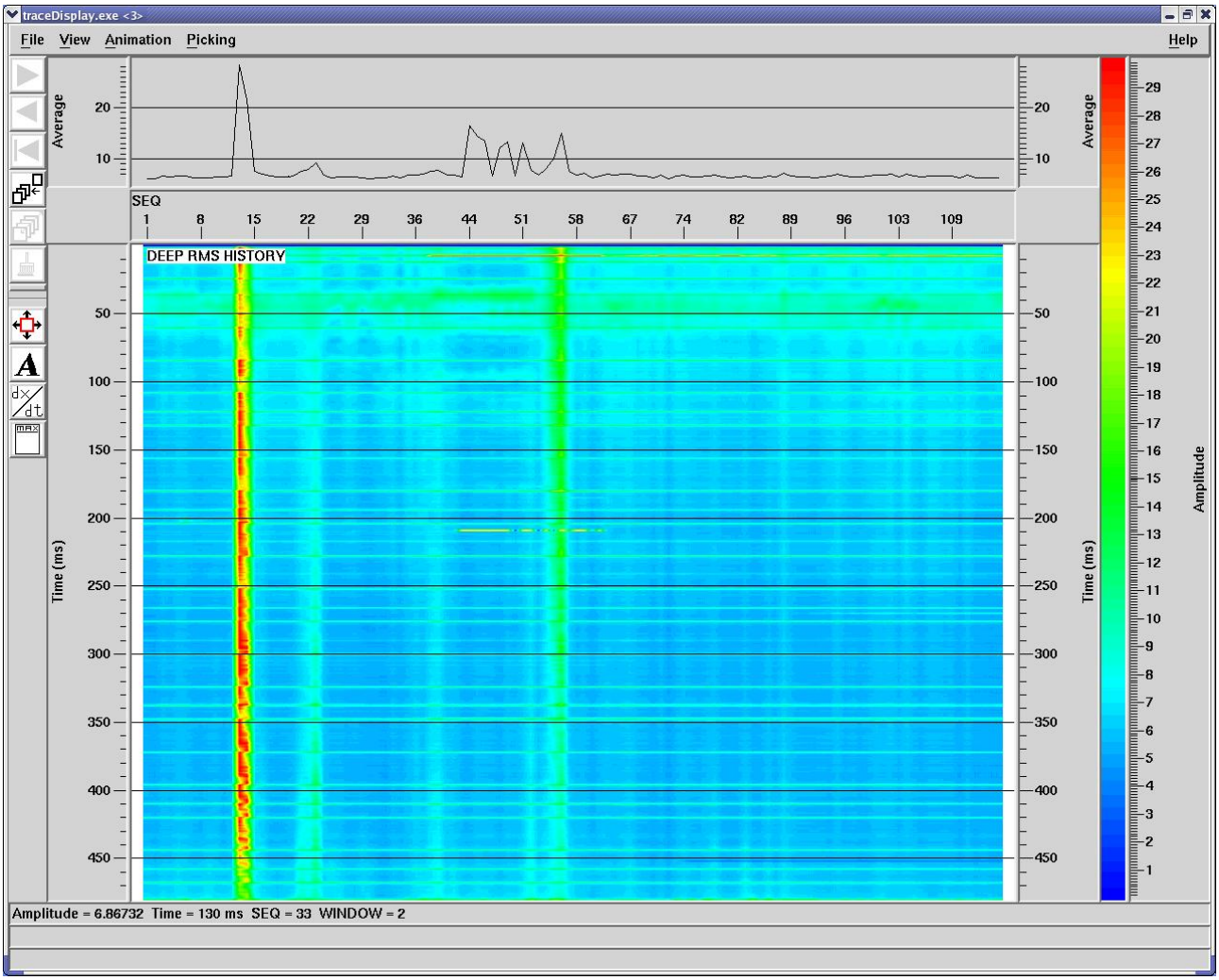

Figure 22-21 Deep RMS history display for sequences 001 to 115. Note strong swell noise on sequences 13 and 14, and slightly increased ambient noise for sequence 24, and noise on channels 25-40.

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23.Conclusion

Overall the data recorded on this survey was of good quality, helped by good acquisition conditions with low extraneous noise levels, except for some periods of heavy swell noise.

A total of 115 sequences were shot, mostly of good quality. The number of bad channels did not exceed 1.7% for the entire survey.

Some swell noise was evident, although mostly of low amplitude and affecting few traces. It was efficiently dealt with by swell noise attenuation processing. Only in three instances were the brute stacks significantly affected.

The brute stacks showed good data quality and contained dipping surfaces, diffractions and multiples and good evidence of the captured geology including anticline structures and faulting planes.

Signal penetration was good for the top half of the record, but poor beyond this, probably as a result of the high reflectivity of the intermediate layers. Strong multiples were observed.

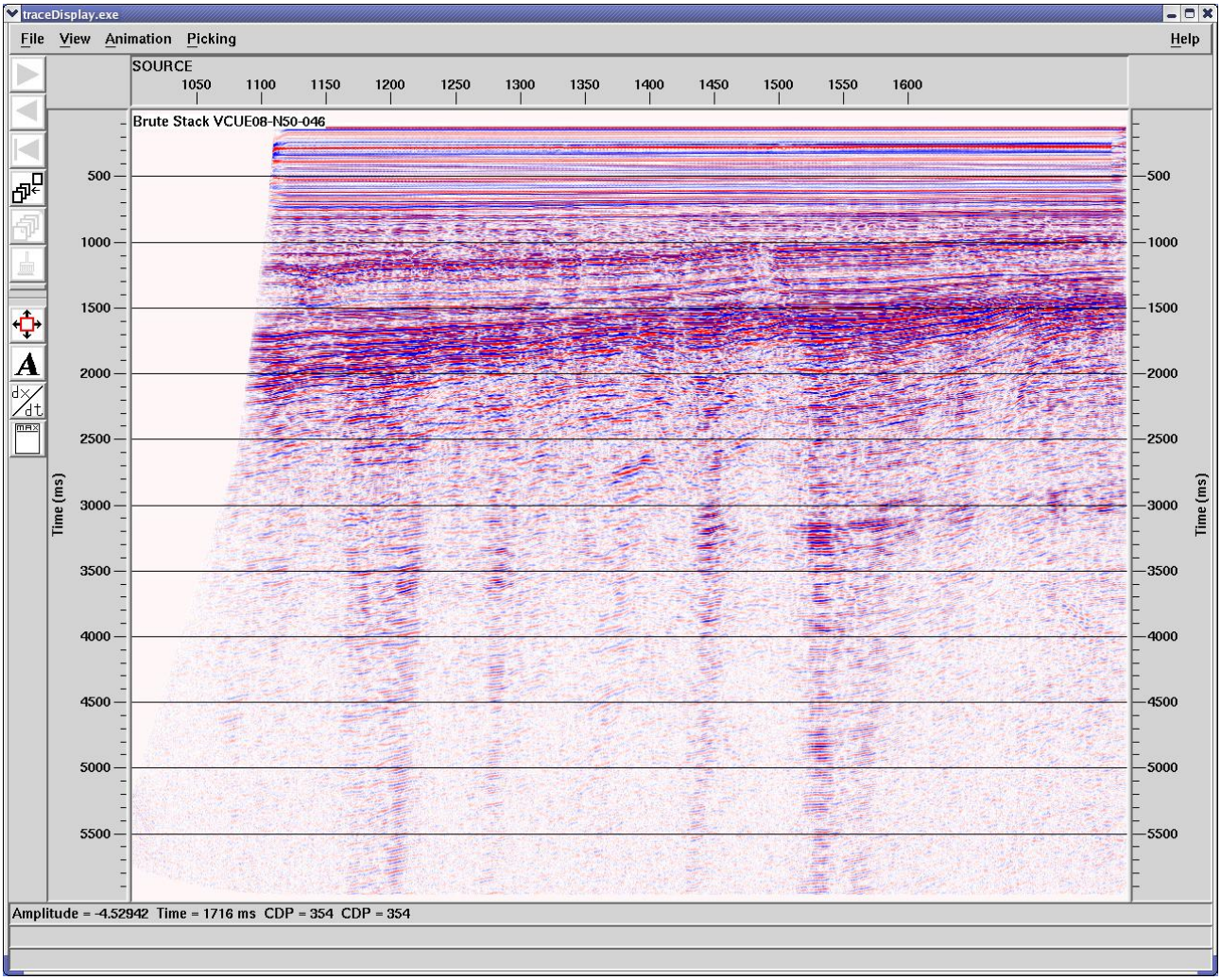

Figure 23-1: Brute stack of sequence 046.

A QC log in Excel format detailing quality control analysis of each line was delivered to the client at the completion of the survey.

Seq	Line	SHOTS	STACK
1	VCUE08-E08-001	Av. Ambient RMS: 5.1µb, strong ringing at EOL	Good clean stack
2	VCUE08-E11-002	Av. Ambient RMS: 6.2µb, strong ringing at SOL, cable strike on channel 266 SP 1431	Good clean stack
3	VCUE08-E15-003	Av. Ambient RMS: 5.4µb, strong ringing at EOL	Good clean stack
4	VCUE08-E12-004	Av. Ambient RMS: 5.2µb, strong ringing at SOL	Good clean stack
5	VCUE08-E09-005	Av. Ambient RMS: 5.3µb, strong ringing at EOL	Good clean stack
6	VCUE08-E14-006	Av. Ambient RMS: 5.2µb, strong ringing at SOL. Tail end of cable still in turn during SOL.	Good clean stack
7	VCUE08-E10-007	Av. Ambient RMS: 6.5µb, strong ringing at EOL. Tail end of cable still in turn during SOL.	Good clean stack
8	VCUE08-E06-008	Av. Ambient RMS: 5.4µb	Good clean stack
9	VCUE08-E04-009	Av. Ambient RMS: 5.2µb	Good clean stack
10	VCUE08-E07-010	Av. Ambient RMS: 5.3µb. Ringing at SOL.	Good clean stack
11	VCUE08-N34-011	Av. Ambient RMS: 5.0µb. Some swell at front of streamer.	Stack mostly unaffected by swell
12	VCUE08-N32-012	Av. Ambient RMS: 5.0µb. Some swell at front of streamer.	Some swell bursts affecting stack.
13	VCUE08-N26-013	Av. Ambient RMS: 25.6 µb. Strong swell bursts on SOL and EOL noise records and throughout whole line.	Bottom third of stack affected by swell noise, some bursts reaching into target area.
14	VCUE08-N21-014	Av. Ambient RMS: 12.2 µb. Strong swell bursts on SOL, but decreases in intensity towards EOL.	Bottom third of stack affected by swell noise, reaching up to 2.0sec near SOL.
15	VCUE08-N24-015	Av. Ambient RMS: 6.2µb	Stack mostly unaffected by swell
16	VCUE08-N20-016	Av. Ambient RMS: 5.6µb	Good clean stack
17	VCUE08-N27-017	Av. Ambient RMS: 5.3µb	Good clean stack
18	VCUE08-N22-018	Av. Ambient RMS: 5.4µb	Good clean stack
19	VCUE08-N28-019	Av. Ambient RMS: 5.1µb	Stack mostly unaffected by swell
20	VCUE08-N23-020	Av. Ambient RMS: 5.1µb. Tail end of cable still in turn during SOL.	Stack mostly unaffected by swell
21	VCUE08-N30-021	Av. Ambient RMS: 5.9µb. Only the very tail end of cable still in turn during SOL.	Stack mostly unaffected by swell
22	VCUE08-N25-022	Av. Ambient RMS: 6.6µb. Tail end of cable still in turn during SOL.	Stack mostly unaffected by swell
23	VCUE08-N29-023	Av. Ambient RMS: 7.0µb. Tail end of cable still in turn during SOL.	Stack mostly unaffected by swell
24	VCUE08-N31-024	Av. Ambient RMS: 5.4µb. Swell increasing towards EOL.	Some swell bursts affecting stack.
25	VCUE08-E03-025	Av. Ambient RMS: 5.2µb.	Good clean stack
26	VCUE08-E01-026	Av. Ambient RMS: 5.2µb.	Good clean stack
27	VCUE08-N35-027	Av. Ambient RMS: 5.3µb. Tail end of cable still in turn during SOL.	Good clean stack
28	VCUE08-N33-028	Av. Ambient RMS: 5.2µb.	Good clean stack
29	VCUE08-E02-029	Av. Ambient RMS: 5.6µb.Tail end of cable still in turn during SOL.	Fairly clean stack.
30	VCUE08-E05-030	Av. Ambient RMS: 4.7µb.Tail end of cable still in turn during SOL.	Good clean stack
31	VCUE08-N40-031	Av. Ambient RMS: 5.1µb	Good clean stack
32	VCUE08-N36-032	Av. Ambient RMS: 4.4µb	Good clean stack
33	VCUE08-N39-033	Av. Ambient RMS: 6.0µb. Tail end of cable still in turn during SOL.	Good clean stack
34	VCUE08-N43-034	Av. Ambient RMS: 5.1µb.	Good clean stack
35	VCUE08-N38-035	Av. Ambient RMS: 5.4µb. Tail end of cable still in turn during SOL.	Good clean stack
36	VCUE08-N41-036	Av. Ambient RMS: 4.6µb	Good clean stack

Figure 23-2: Quality section of QC log.

24.Appendices

24.1. SEGY Brute Stack Headers

The following SEGY Stacks EBDIC header template was used. Items marked in bold differ from line to line.

C 1 CLIENT: SEBOA CONSORTIUM COMPANY: CGG VERITAS
C 2 SURVEY: GROUP SHOOT 2D AREA: EAST BASIN, OFFSHORE AUSTRALIA
C 3 VCUE08-N04-080 SP: 3166-881 CDP: 1-4810
C 4 DATA TRACES/STREAMER: 480 AUXILIARY TRACES/RECORD: 30
C 5 SAMPLE RATE: 2MS RECORD LENGTH: 6000ms
C 6 RECORDING FORMAT: SEG-D 8058 REV 100 FILTERS: DIGITAL LOW CUT: ON
C 7 ANALOG LOW CUT: 3 HZ 6 DB/OCTAVE HIGH CUT: 200 HZ 370 DB/OCTAVE
C 8 STREAMER: SERCEL SEAL SOLID ACTIVE LENGTH: 6000 M
C 9 GROUP INTERVAL: 12.5 M DEPTH: 8 M
C10 SOURCE TYPE: BOLT AIRGUN VOLUME: 2130 CU IN
C11 NO OF SUB ARRAY/SOURCE: 3 SUB ARRAY SEPARATION: 10 M
C12 ARRAY PRESSURE: 2000 PSI ARRAY DEPTH: 6 M
C13
C14 SEGY HEADER BYTES
C15 Water Depth 185-188
C16 Line Number 189-192
C17 Cable 193-194
C18 Gun Sequence 195-196
C19
C20 SP ANNOTATED AT NEAR TRACE CDP
C21
C22 PROCESSING:
C23
C24 REFORMAT - SEGD TO PROMAX FORMAT
C25 INSTRUMENT DELAY -50ms
C26 SHOT AND CHANNEL EDITS BASED ON OBSERVER LOGS
C27 BANDPASS FILTER, ORMSBY 6-8-90-120 HZ
C28 RESAMPLE 2ms TO 4ms. HIGH FIDELITY ANTIALIAS FILTER
C29 TRACE DECIMATION, 2:1, USING SINGLE NMO FUNCTION
C30 TAR - T**2 CORRECTION
C31 NMO, VELOCITIES PICKED AT 4 KM INTERVALS
C32 CDP STACK, STRAIGHT MEAN SQUARE ROOT NORMALIZATION
C33 GUN & CABLE STATIC 9ms
C34
C35 CDP INTERVAL 12.5 METRES
C36
C37
C38 APRIL 2008

24.2. Shipment

QC deliverables were included in the Primary and Copy Tape Shipments. The following QC products were shipped to the client at the end of the survey:

Shipment No: PT-2008-025

Date: 2nd. April 2008

Contents cover Sequences: 1 to 58

1 x DVD containing QC Log File (MS Excel), Stack files (SEGY format), various QC screen displays (JPG format), velocities (ASCII format) and ambient noise (ASCII format) files.

Shipped to:

Nigel Seymour
DP Manager
WesternGeco
Level 5 St. Georges Terrace
Perth 6000
WA, Australia

Shipment No: PT-2008-029

Date: 07th May 2008

Contents cover Sequences: 59 to 115

1 x DVD containing QC Log File (MS Excel), Stack files (SEGY format), various QC screen displays (JPG format), velocities (ASCII format) and ambient noise (ASCII format) files.

Shipped to:

Nigel Seymour
DP Manager
WesternGeco
Level 5 St. Georges Terrace
Perth 6000
WA, Australia

24.3. QC Line log

A QC log was maintained for the duration of the project to keep track of the workflows being run, shot edits, problems encountered and any processing comments. This log file has been written to DVD, and was included in the final data shipment to the client.