GEOFIZYKA TORUŃ

MULTI - LINE 2D SEISMIC DATA PROCESSING

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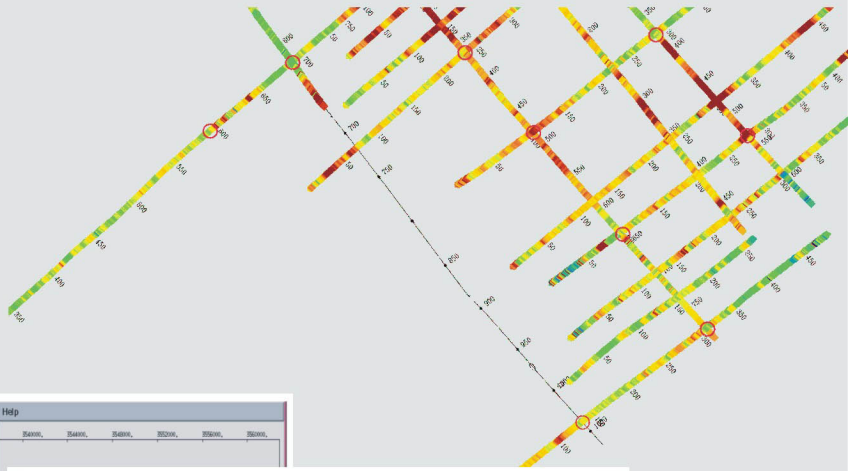

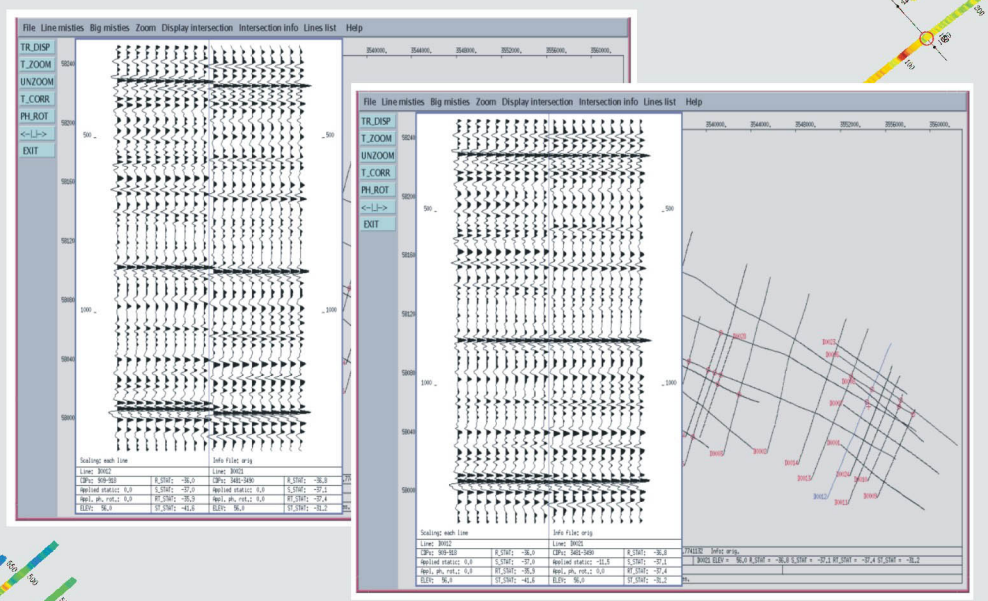

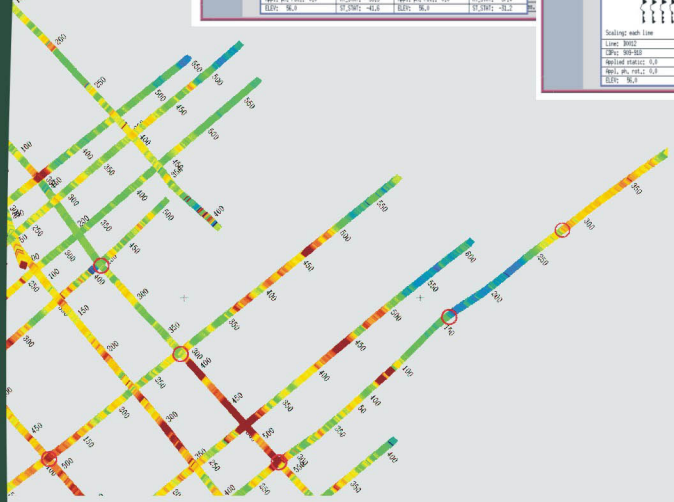

looking for challenges

SEISMIC DATA PROCESSING DIVISION

MULTI-LINE 2D SEISMIC DATA PROCESSING

by

Leon Głogowski, Waldemar Ogonowski & Krystyna Ornoch

Geofizyka Toruń Sp. z o.o.

INTRODUCTION

Coherent statics solution is especially important, where the near surface zone is complicated and varying across the project. The problem was faced in areas of various environments:

- Mountains – Andes in Colombia,
- Sand dunes covering smooth or rough surface of hard rocks- deserts of Libya, Algeria,
- Post glacial rough topography – Poland,
- Transition zone – India, Poland,
- Permafrost – Siberia.

Processing and re-processing of seismic data from these areas forced use of multi-line-consistent static solution for 2D seismic surveys.

In order to have satisfactory procedure for land seismic data processing, a package of interactive software tools for multi-line consistent statics estimation and correction was designed and next turned out to be a success.

PROCESSING STAGE

At the earliest stage of statics calculation, field statics are computed from shallow refraction, uphole as well as production uphole measurements in dynamite wells. For that purpose, GT proprietary software, SEISDAT is used. The system enables to calculate multi-line consistent statics for the project using the field measurements and makes possible very easy QC with displays of various maps including plots of in-field parameters, displays of near surface model, statics vs. elevation, comparison of statics on the intersections etc.

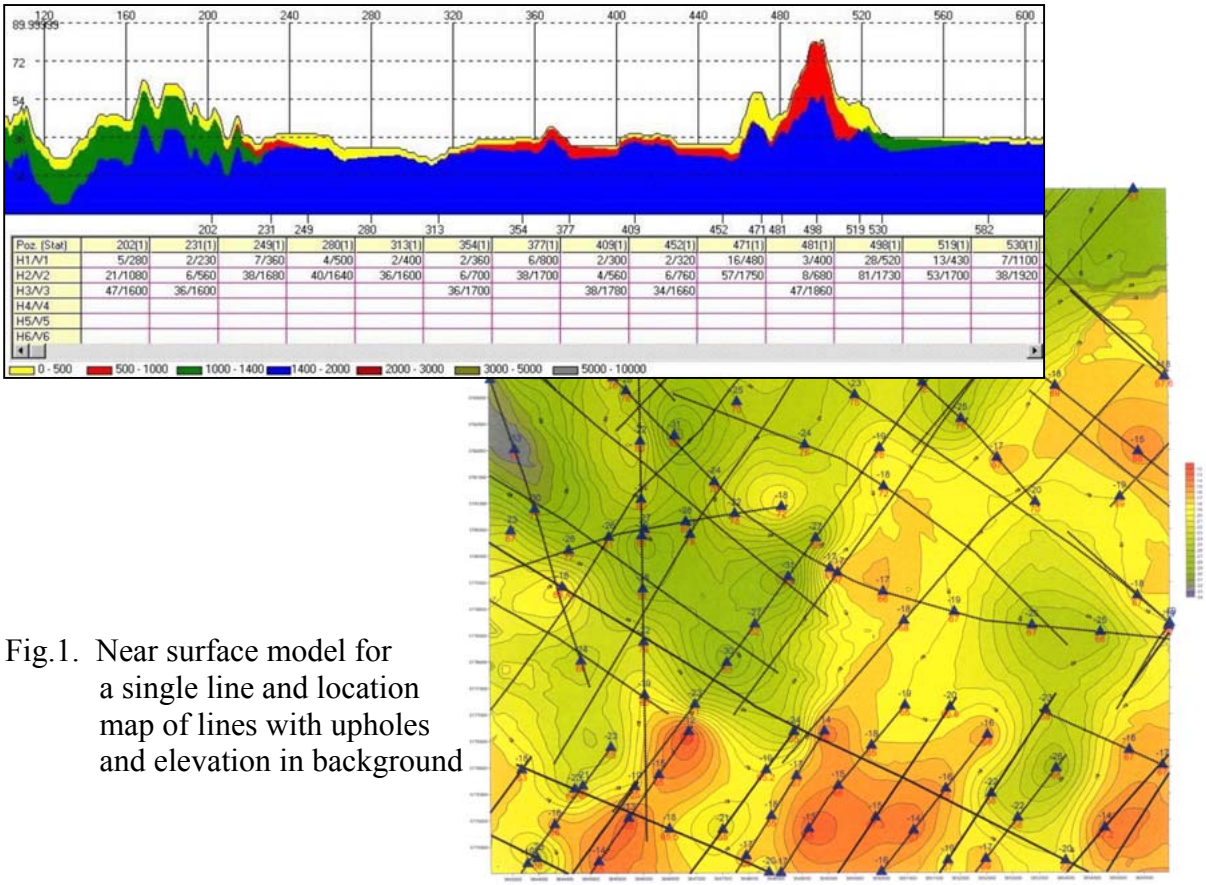

Fig.1. Near surface model for a single line and location map of lines with upholes and elevation in background

All the programs are applied before starting the processing, so homogenous statics for the whole project can be used from the beginning of processing. Some intermediate results are used for refraction statics calculation.

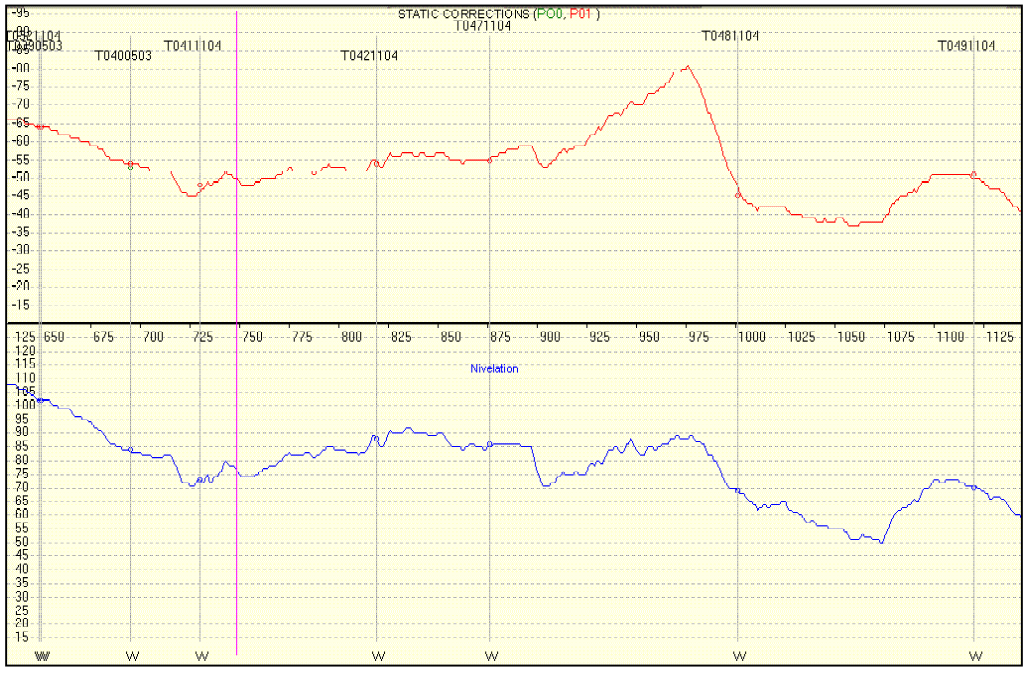

Fig.2. Display of receiver statics vs. elevation along with intersections marked

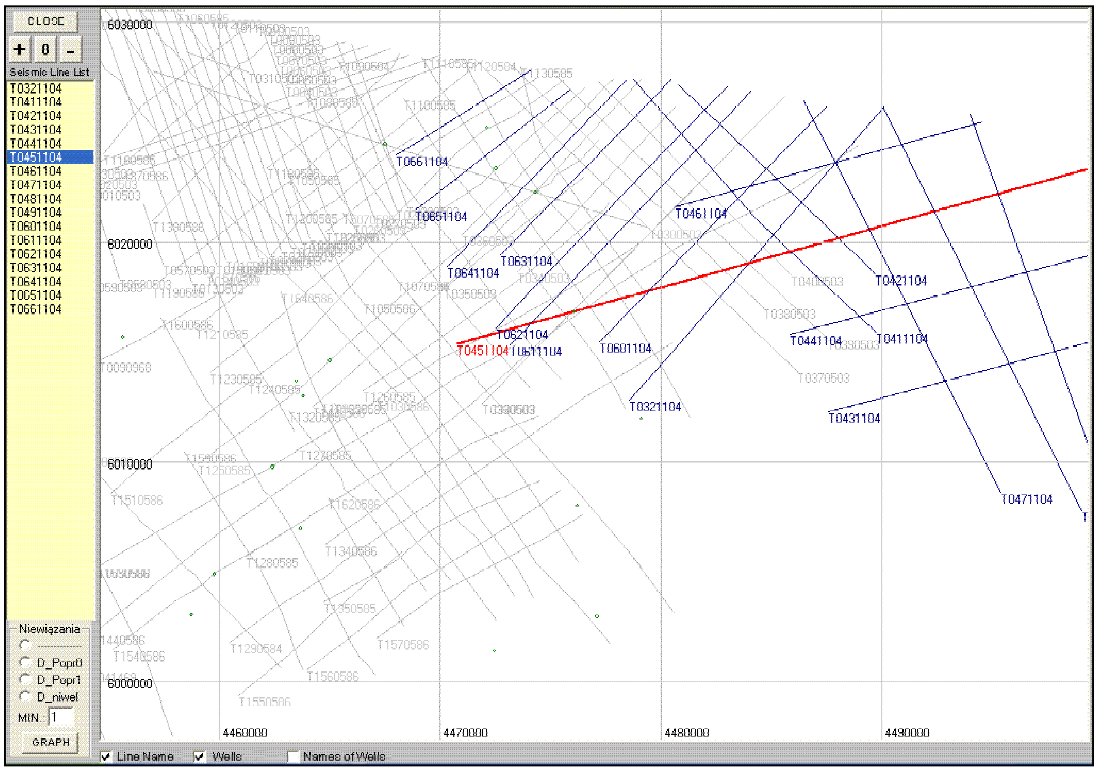

Fig.3. Map of lines of interested project with analysed line highlighted

As the next step, refraction statics calculation is performed. In this case multi-line commercial packages are applied. Statics are calculated with coherent parameters to get uniform solution for the whole project. Results are QC-ed using displays of near surface models, maps of statics, comparison of the statics to uphole times, etc. and the best solution is selected.

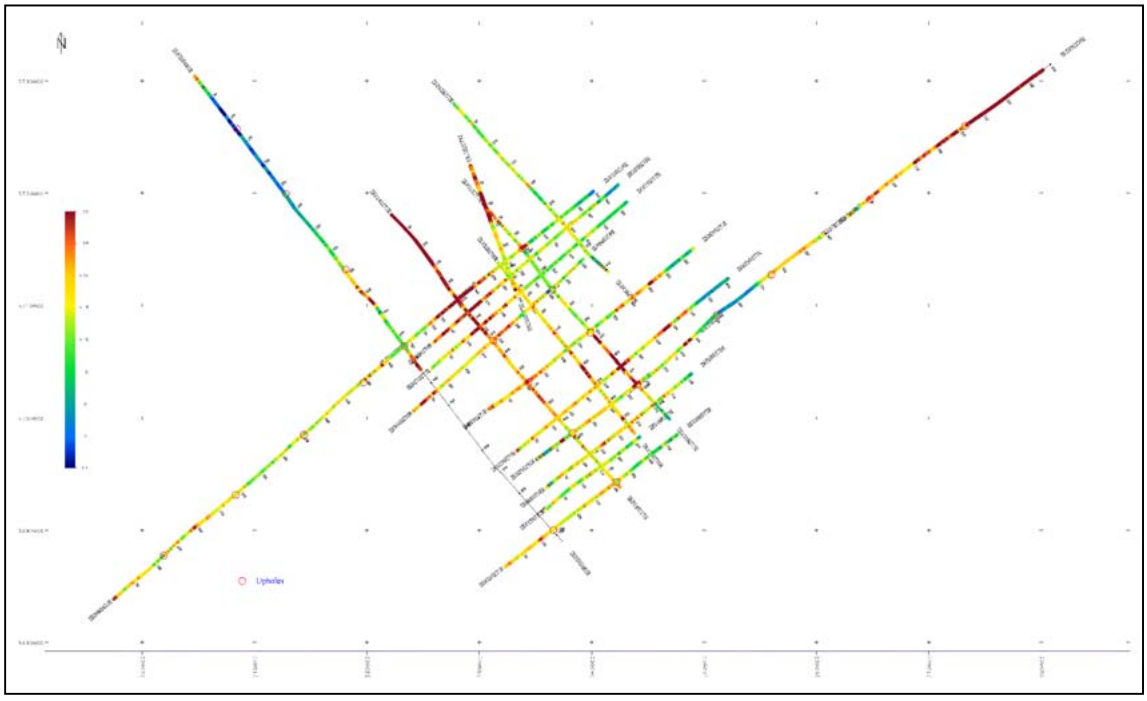

Fig.4. Location map with receiver refraction statics

PROCESSING STAGE

Processing is being carried out as multi-line project and consistency of statics is QC-ed at minimum three levels:

- at the early stage of processing,
- after residual statics,
- at the final stack stage.

Statics, phase and amplitude misties are calculated on each intersection of the project/vintage in batch mode and then can be interactively checked.

SPECIAL PROPRIETARY PROGRAMS SERVE TO EXAMINE LINES' INTERSECTIONS

MISTIE ANALYSIS

Mistie Analysis computes amplitude, time and phase misties for a set of 2D lines and calculates constant corrections for each line to minimize misties.

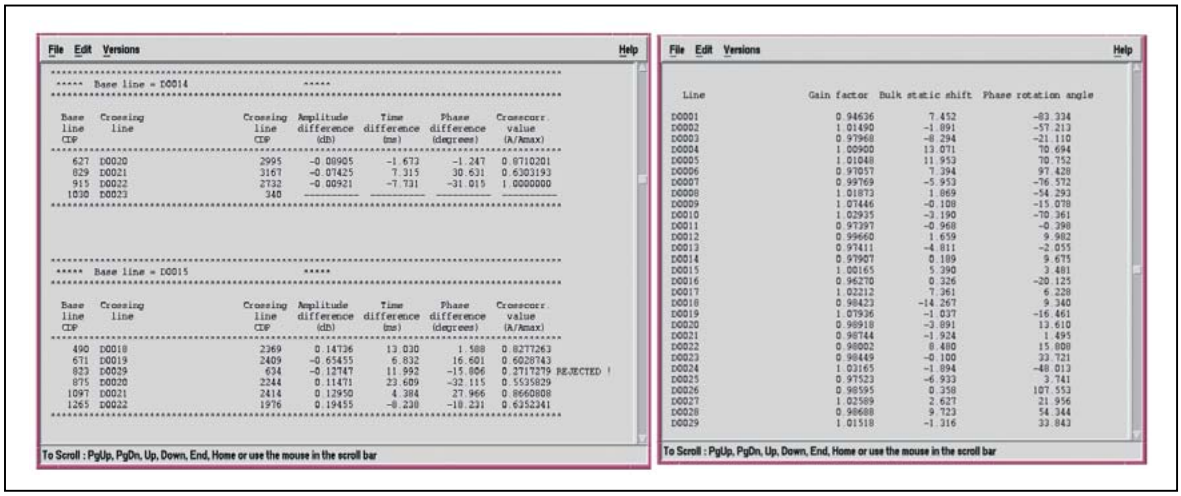

Fig.5. Screed displays of Mistie Analysis results

LINE MAP

Line Map uses data generated by the Mistie Analysis process and displays location map of the 2D lines and respective intersection information. A user can interactively modify time and phase shifts and compare pieces of stacked sections closest to a particular intersection.

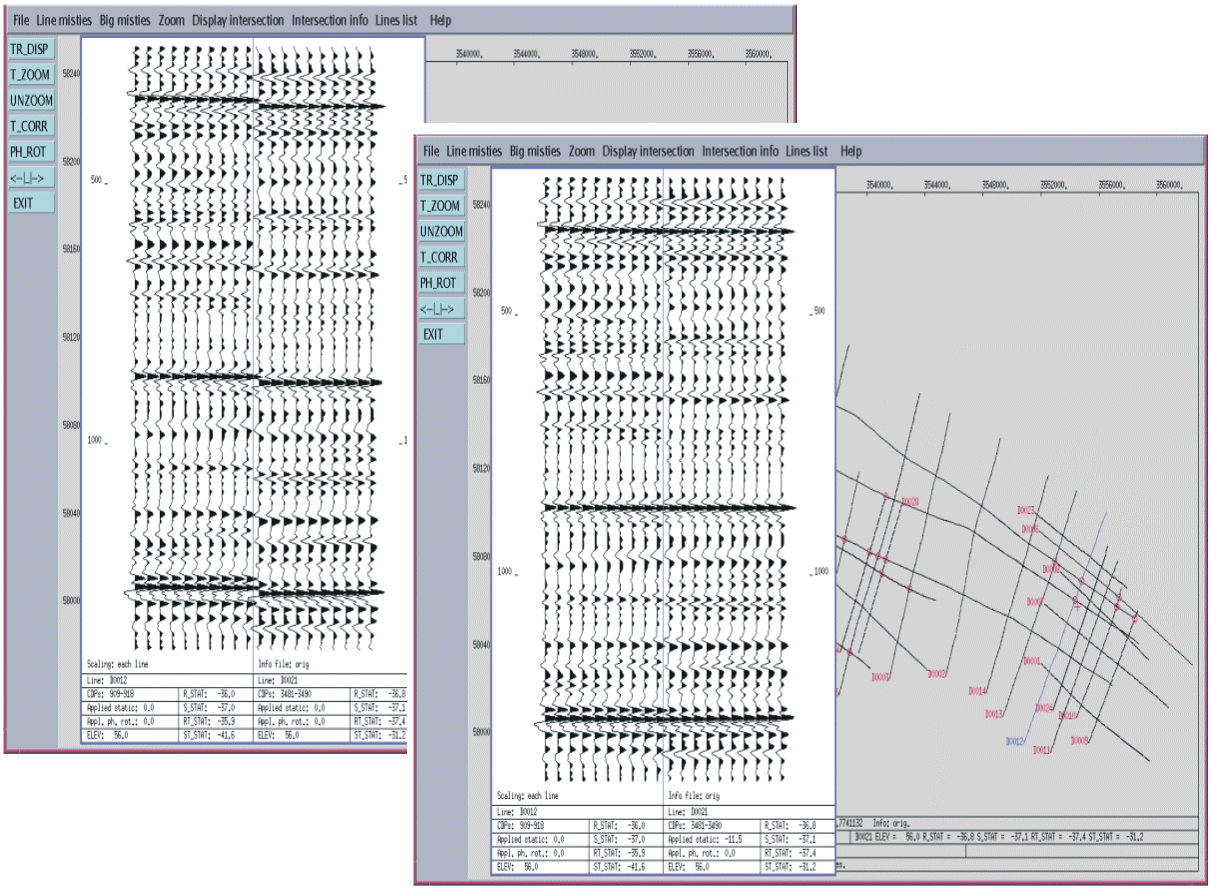

Fig.5. Screen displays of Line Map with intersection traces displayed before and after interactive correction

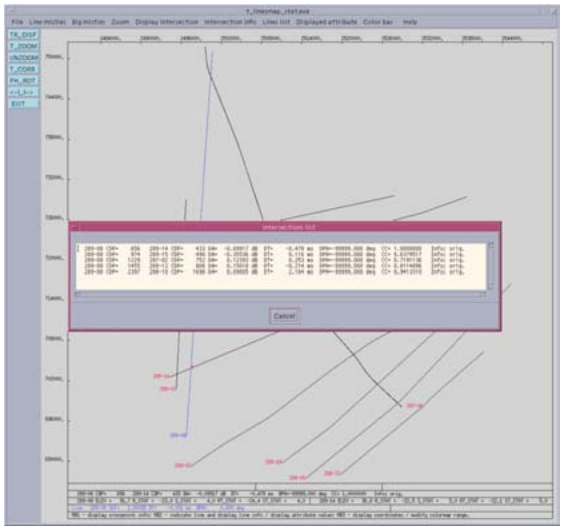

Fig. 6 List of intersection details for the chosen line

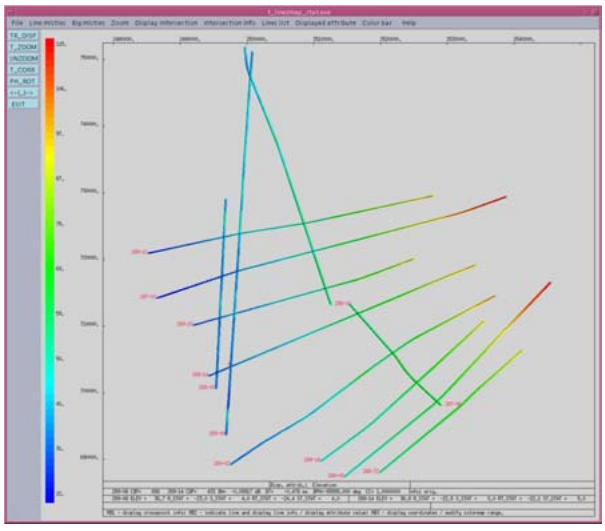

Fig. 7 Screen display of Line Map with elevation plot

SC VELOCITY EDITOR

SC Velocity Editor displays lines map, velocity (with or without traces), velocity gradient for a set of 2D-lines. It allows to define polygons in which velocities will be adjusted to other side on an intersection.

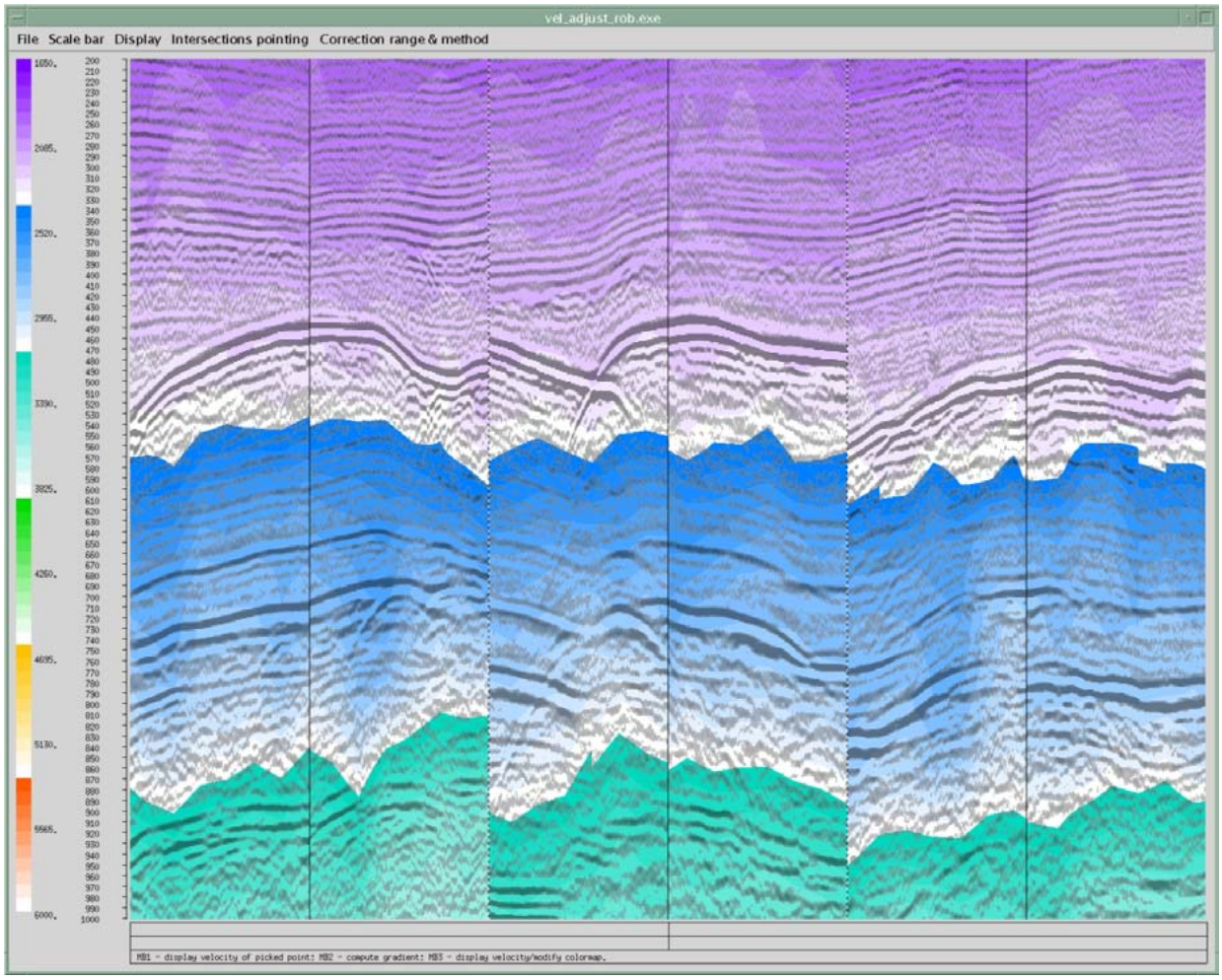

Fig.8. SC Velocity Editor - Comparison of velocities at three intersections

VINTAGE PHASE COMPARISON

Vintage Phase Comparison computes amplitude, time and phase differences between lines which belong to two vintages.

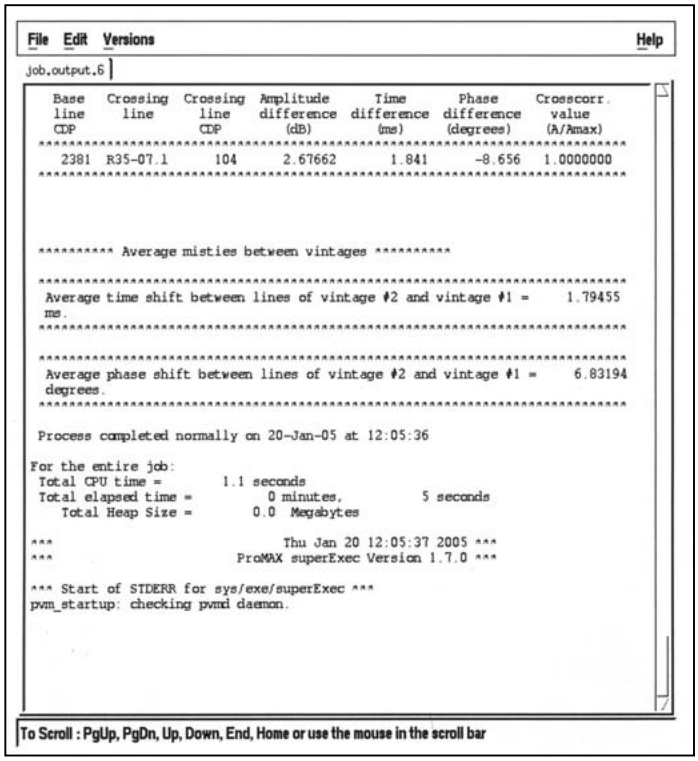

Fig. 9 Results of vintage phase comparison tool

CONCLUSIONS

Multi-line consistent 2D statics are invaluable factor within the entire process of the whole volume consistent 2D seismic data processing.

Due to the multi-line consistent approach to processing of 2D seismic datasets reliable, sparse 3D volume of data is delivered to interpreter.

Reliable, consistent over a whole project, 2D static solution turned out to be a useful calibration information to many 3D seismic projects which usually suffer of insufficient near-surface fold.

References:

1. Mike Cox, 1999, Statics corrections for seismic reflection surveys, SEG
2. Thomas N. Bishop and Alan G. Nunns, 1994, Correcting amplitude, time, and phase mis-ties in seismic data: Geophysics, Vol. 59
3. Michael D. Harper, 1991, Seismic mis-tie resolution technique: Geophysics, Vol. 56
4. W. L. Bandy, A. F. Gangi, and F. D. Morgant, 1990, Direct method for determining constant corrections to geophysical survey lines for reducing mis-ties: Geophysics, Vol. 55