An example of deconvolution after migration

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ABSTRACT

I presented a paper last year in the CREWES meeting that advocated performing a deconvolution after migration. This year, I provide additional comments and include an example of data processed commercially with a spiking deconvolution after migration.

INTRODUCTION

I presented a number of reasons to deconvolve after migration:

1. The ultimate inversion of seismic data is a least squares prestack migration. This illustrated a significant improvement in the resolution of the data relative to a corresponding prestack Kirchhoff migration. A deconvolution after the migration produced a comparable increase in resolution.

2. The least squares formulation includes a spectral whitening feature that is not included in the migration. Migration is a transpose process.

3. Spectral enhancement should be applied to the data when the signal-to-noise ratio is greater than one. Noise attenuation increases the bandwidth of the data allowing a greater bandwidth to be spectrally enhanced. Migration should attenuate noise and a spectral whitening, or deconvolution, should be applied after the migration.

4. A deconvolution is typically applied after stacking where the SNR has been improved. However, this option is not available to prestack migrations, making deconvolution after a prestack migration even more important.

5. Resolution improvements should be expected from any quality migration that has included noise attenuation components such as antialiasing filters.

I illustrated the improvement in resolution with examples of my own data. It is normally difficult for me to show commercial data as the processing companies wish to keep any significant improvements to be a competitive advantage.

COMMERCIAL DATA

I have fortunately been given permission to show examples from commercial processing. I attended meetings between a processing contractor and representatives from an oil company, regarding a processing problem (of another contractor). After I saw the migration was of a very high quality, I immediately requested a deconvolution after the migration. After nearly three days of negotiating they relented and applied a simple spiking deconvolution. The oil company representatives were very pleased (putting it mildly) with the results, and I am now able to show them publicly. The data is from a 3D project, somewhere in South America. (It was not processed with EOM).

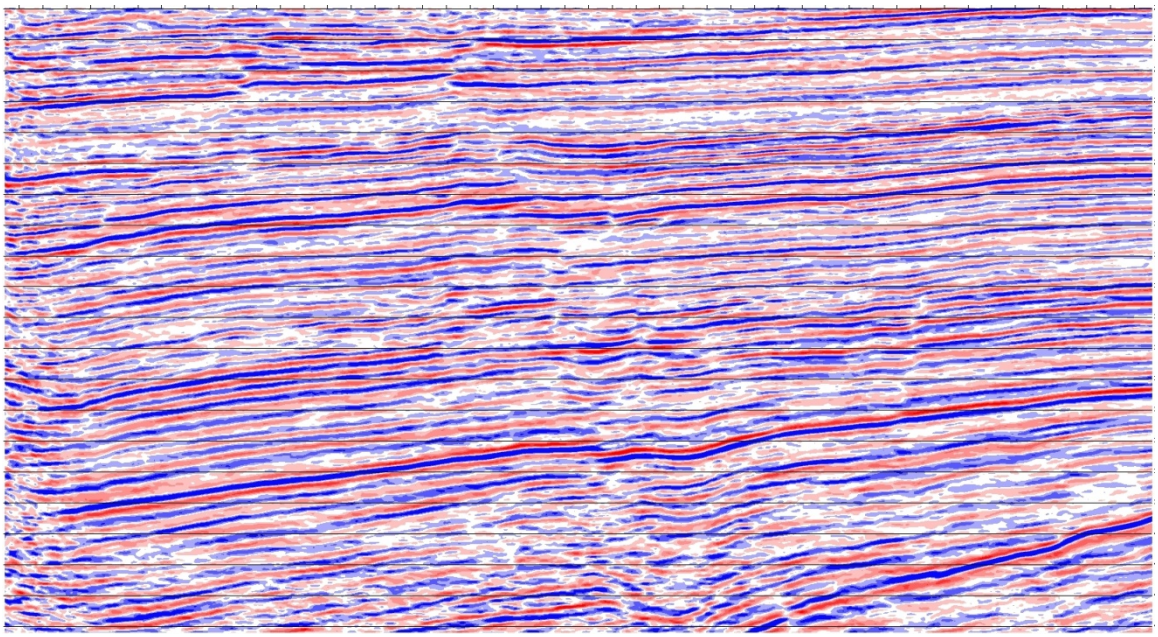

FIG 1 Prestack migrated data.

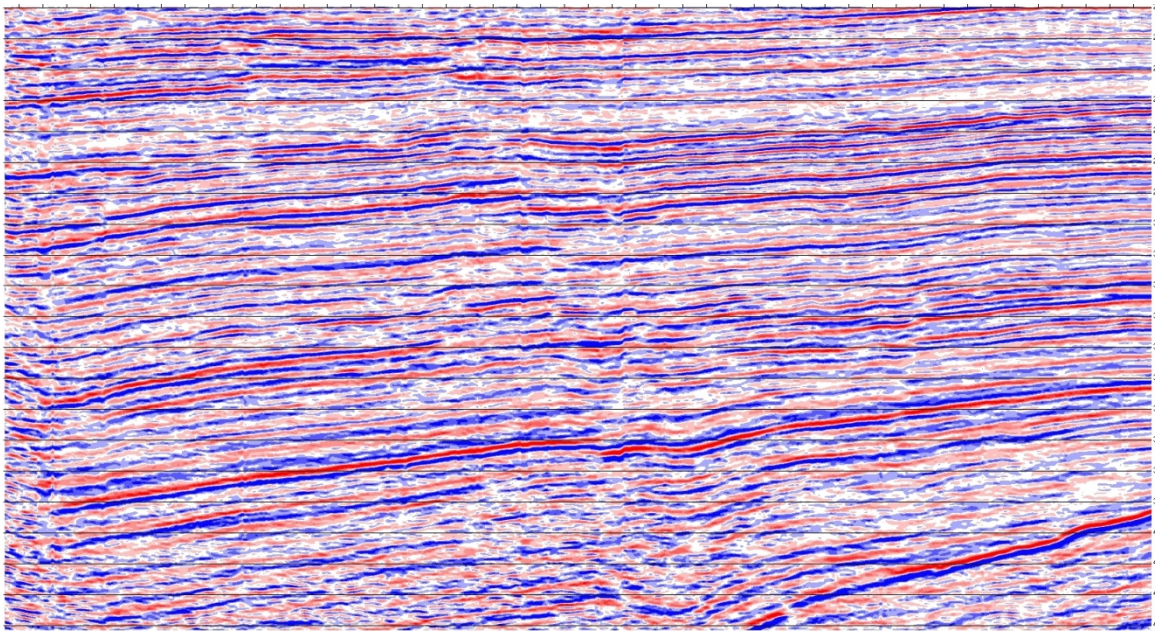

FIG 2 Prestack migration followed with a spiking deconvolution.

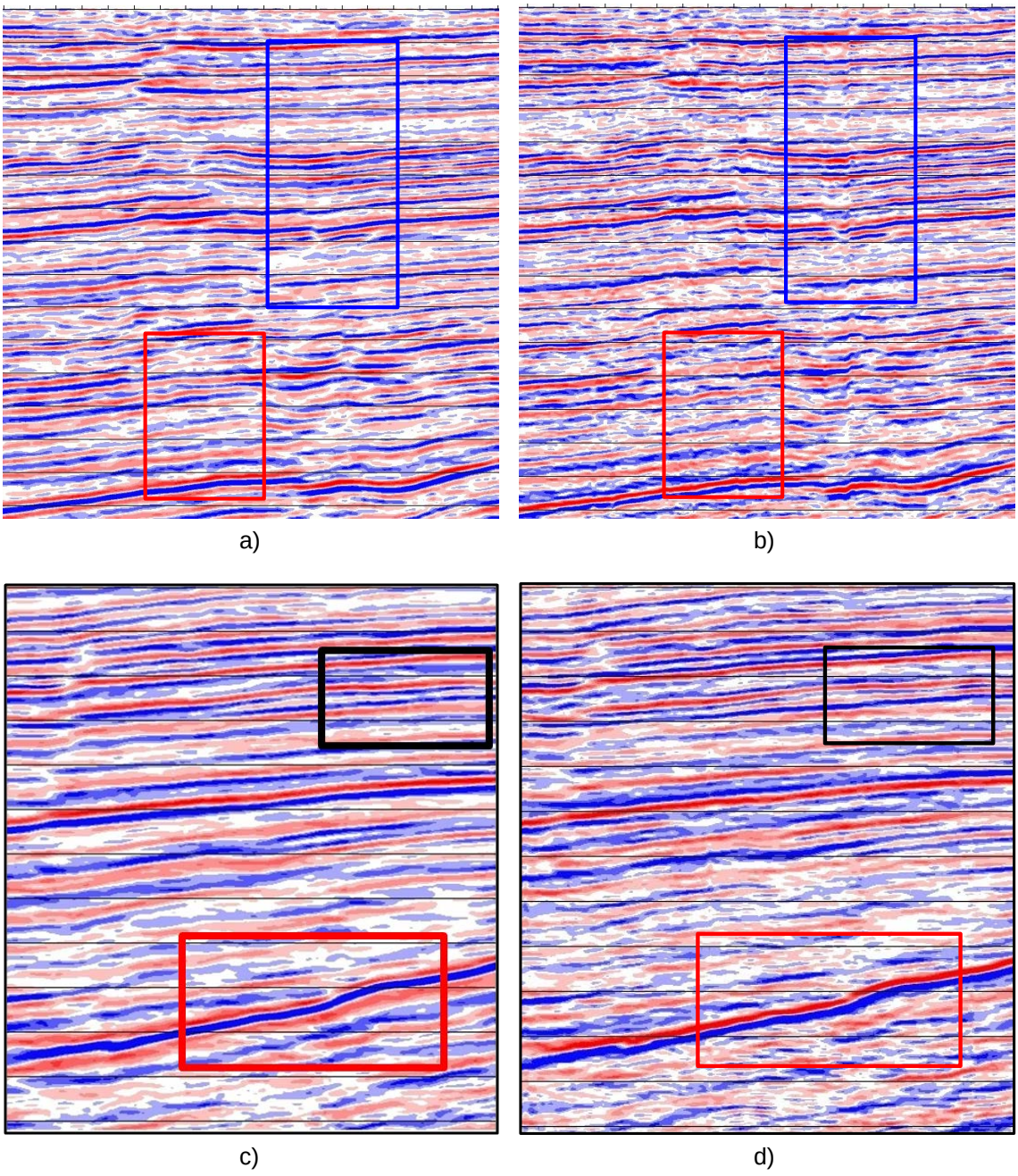

FIG 3 Zoom of the data with a) showing one portion and b) its equivalent deconvolution. Part c) and d) show a similar comparison for another part of the data.

COMMENTS AND CONCLUSIONS

Deconvolution should be applied after a quality migration.

Deconvolution after migration is even more important after a prestack migration.

A spiking deconvolution was applied in the previous example. A non-stationary or time varying deconvolution should produce greater improvements over a larger portion of the data.

A clean, noise reduced migration may appear wormy to an interpreter, and noise may be deliberately added. A deconvolution after the migration will make the section appear less wormy, with the added benefit of increased resolution.

ACKNOWLEDGEMENTS

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