NMO Correction and Full Common Depth Point Velocity and Anisotropy Estimation In Anisotropic and Lateral Heterogeneous Media Using Possibilities Matrix

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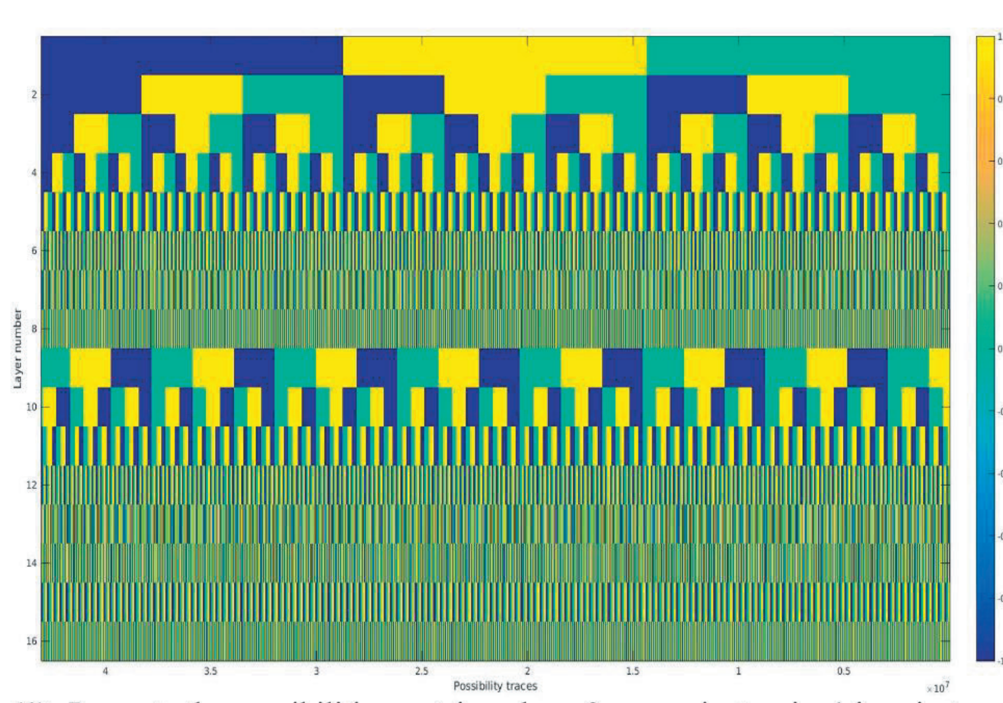
Methodology

Our new method assumes that each subsurface layer could have three different possibilities:

1. **Isotropic.**
2. **Anisotropic where NMO velocity is increasing (+).**
3. **Anisotropic where NMO velocity is decreasing (-).**



Figure(1): Presents the possibilities matrix, where 0 means isotropic, 1 is anisotropic(+) and -1 is anisotropic (-).

- Due to the computational cost of the possibilities matrix we came up with a very simple strategy to reduce the computational time and achieve the same expected results. We suggest to divide each CDP into two main intervals. Doing so will help in decreasing the size of the possibilities matrix and speed up the computational process.

Results: Synthetic data examples (Isotropic, Anisotropic and Lateral Heterogeneous media)

Synthetic: Isotropic media

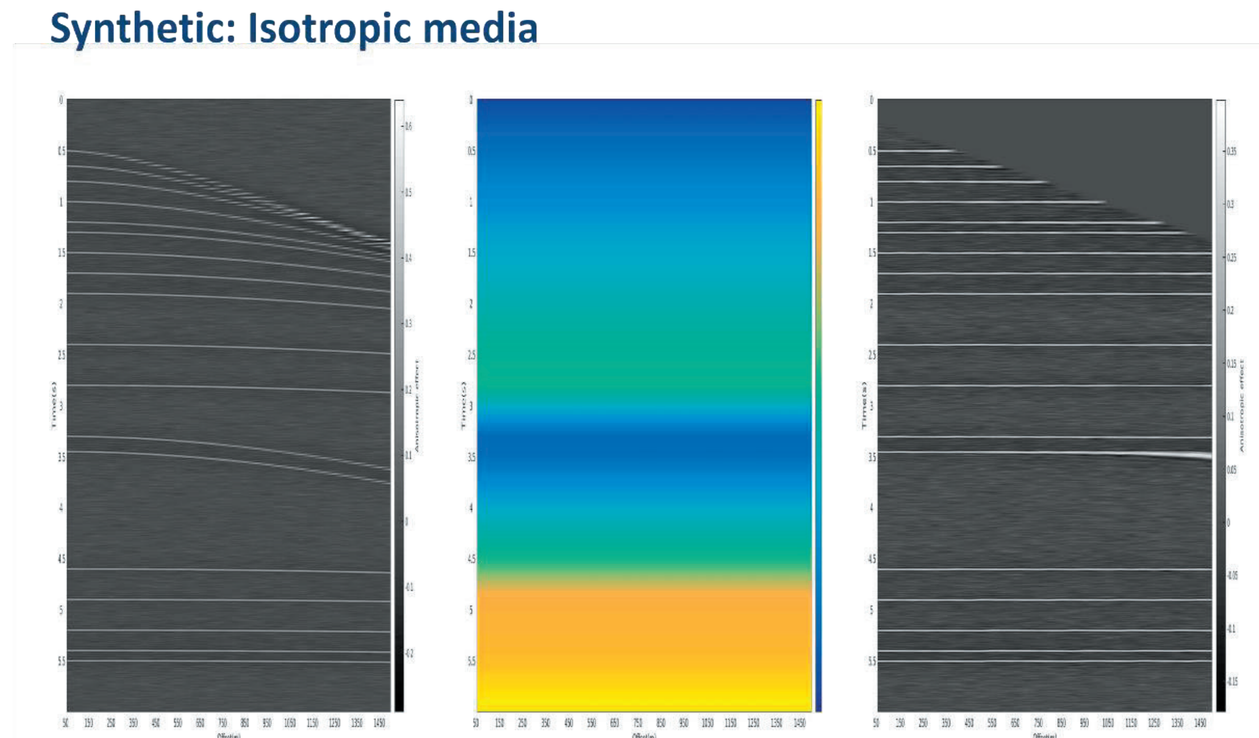
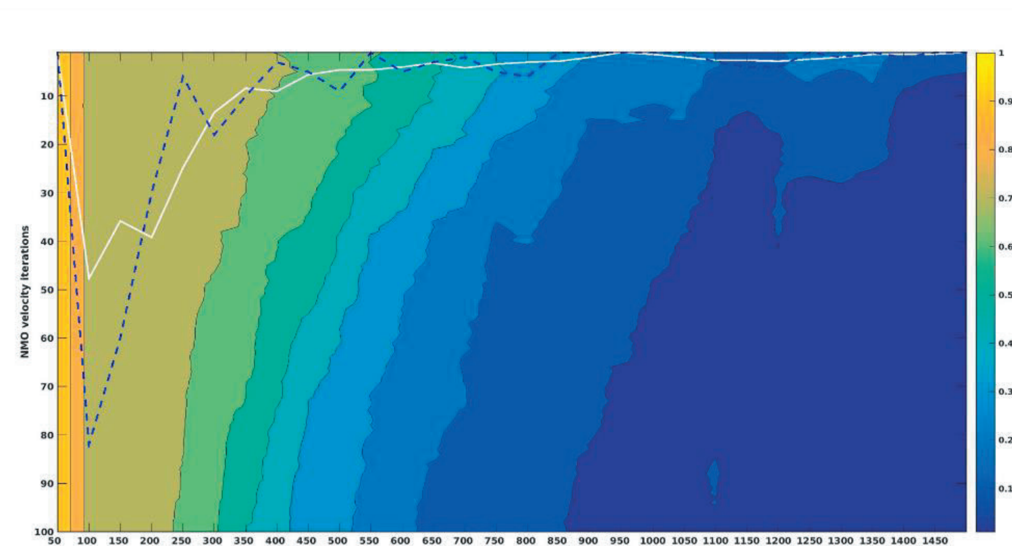


Figure (2): Synthetic isotropic example: The model consists of 18 layers. At the middle is the created NMO velocity field and the right side is the corrected CDP.

New Semblance plot: Isotropic case:



Figure(3): The new semblance plot shows the tracks (white and blue) of the optimum NMO velocity traces.

Synthetic: Lateral Heterogeneous Model

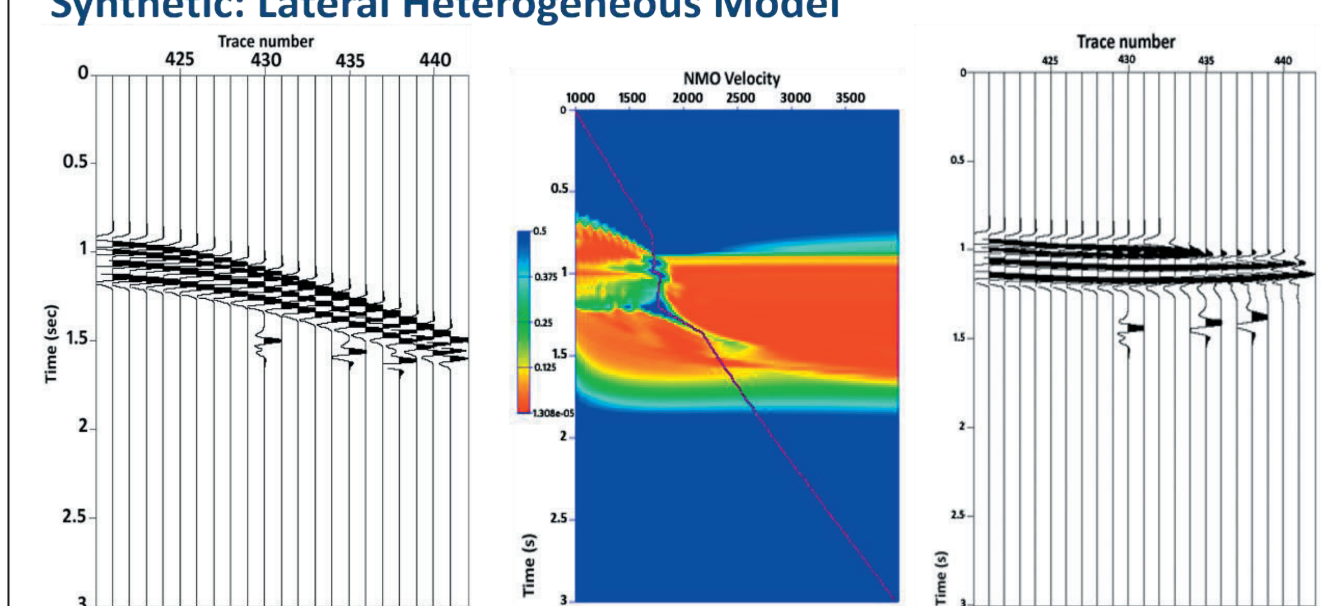


Figure (4): Lateral heterogeneous media example: At the left is the uncorrected CDP of four layers one of them is very thin, the middle plot is the conventional semblance plot and the black line represents the track of the picked NMO velocities, the right plot is the same CDP after the conventional NMO correction. The first plot from the right side shows the stacked trace, only 3 reflections can be seen.

Synthetic: Lateral heterogeneous media (NMO using Our Method)

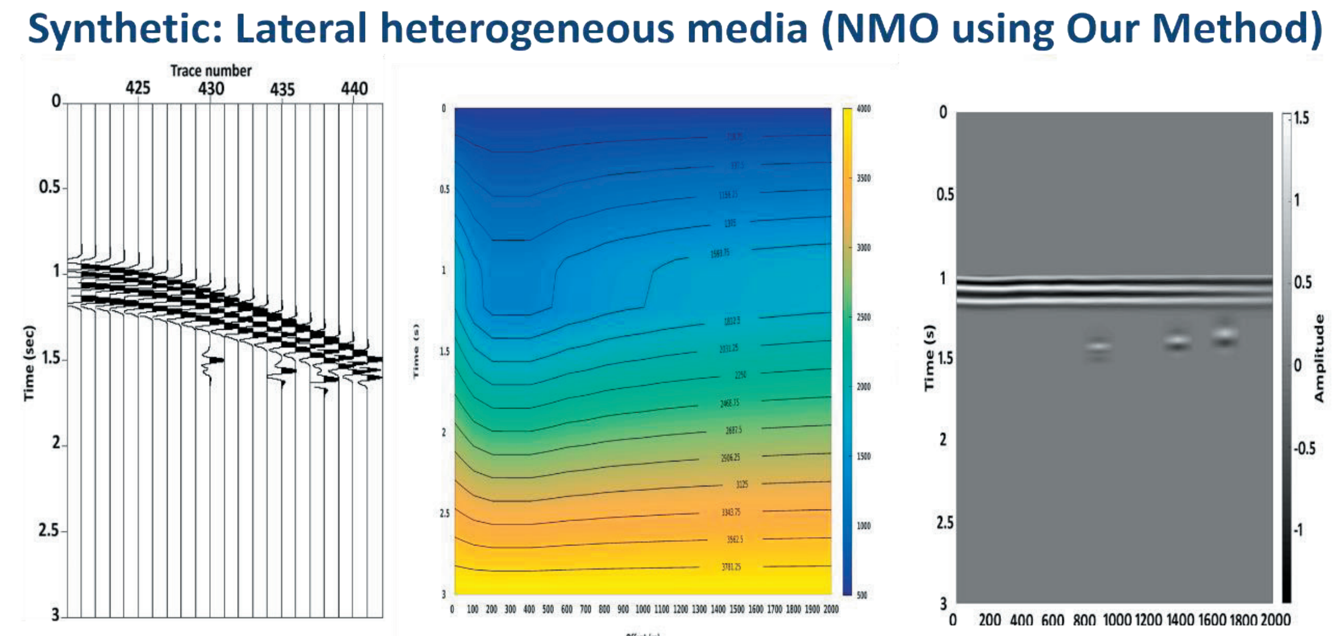


Figure (5): Lateral heterogeneous media example: At the left is the uncorrected CDP of four layers – one of them is very thin. The middle plot is the created NMO velocity field, which is clearly different from the isotropic or weak anisotropy case. The right plot is the same CDP after the NMO correction using our method.

New semblance plot: Lateral Heterogeneous case:

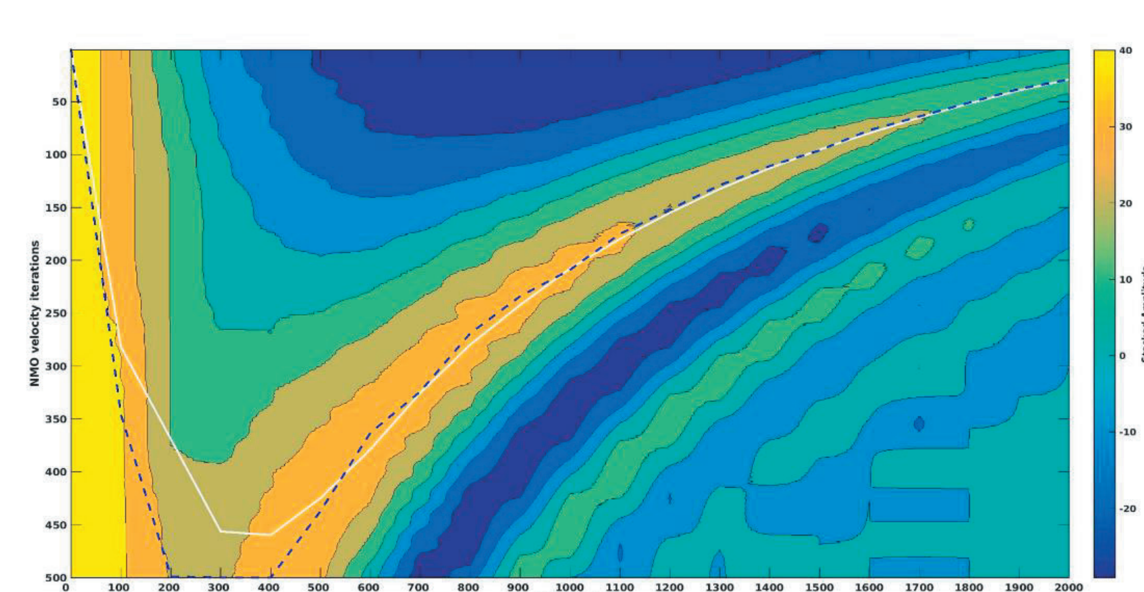


Figure (6): The semblance plot shows the tracks to obtain the optimum NMO velocity traces in Lateral Heterogeneous media.

Conclusions:

• Using our method we achieved an excellent stretch free NMO correction even in far offsets .
• High resolution NMO velocities that cover every single offset/ Azimuth.
• Provides a solution for the anisotropy and lateral heterogeneity in Pre-stack seismic data.

Acknowledgements:
This work is funded by the Centre for Coal Seam Gas at the University of Queensland, which is currently funded by the University, Santos, Arrow Energy, APLNG and QGC.

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