

# Enhancing Interpretation Efficiency: Transforming Sparse 2D Data into a 3D Volume

Peter Lee<sup>1</sup>, Adam Betteridge<sup>1</sup>, Tom Travis<sup>1</sup>, Moussa Abugouda<sup>2</sup>, Ahmed Abdul Aziz<sup>2</sup>, Ahmed Sami<sup>2</sup>, Mohamed Morsi<sup>2</sup>, Subodh Notiyal<sup>1</sup>, Tanya Johnstone<sup>1</sup>, Andrew King<sup>1</sup>

<sup>1</sup>TGS

<sup>2</sup>TGS-Geopex

## Abstract

Cooper Basin is located onshore South Australia and contains a vast amount of multi-vintage 2D and 3D seismic data. Modern pre-stack time and depth processing flows were applied to the field data on 3, 855 2D lines (totaling 44, 215 km) from 96 vintages (1985-2012). The 2D<sup>cubed</sup> process uses structurally conformable interpolation to derive a 3D volume using the demigrated 2D lines. This dataset was subsequently post-stack depth migrated, using a derived 3D regional depth velocity model, and the 3D legacy data incorporated before post migration processing was applied, producing a 3D seismic volume covering an area of 32, 880 km<sup>2</sup>.

To derive the 3D regional depth velocity model, an initial velocity model was constructed from the combined 2D pre-stack time velocities and converted into a 3D field where all 2D lines tied. Several iterations of reflection tomography were performed along with reflection Full Waveform Inversion, FWI, to build the final 3D regional velocity field.

The 2D time stack data was demigrated, using the 3D regional velocity model, and input to the 2D<sup>cubed</sup> process building a 3D data volume using structurally conformable interpolation. The 2D<sup>cubed</sup> flow can be split into three phases: data preparation where the 2D surveys are matched; creation of a 3D geological model from the 2D dip field; and 3D interpolation using the 3D geological model.

A post stack Kirchhoff migration was run on the 3D dataset using the derived regional 3D field and some post migration processing performed.

From this final seamless 3D migrated stack cube interpretation can be performed to gain a regional understanding of the data. Identified areas of interest can be referenced back to the 2D processed lines.