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Abstract

The Gippsland Basin, situated in southeastern Australia, is where several giant oil and gas fields were discovered in the 1960s. To date, the Gippsland Basin may be considered as being mature given that production rates have been declining since the late 1990s. The unique challenge associated with the geological complexities of Gippsland Basins has historically impacted the quality of seismic imaging which has proven to be a significant barrier to reducing exploration risk. Therefore, high resolution velocity modeling and imaging is essential to provide high fidelity depth structure and AVO inversion thus improve the understanding of subsurface geology for clearer prospect mapping.

We demonstrate the value of new advanced workflow by intergrating 3D joint deghosting/de-signature, full waveform inversion (FWI), and least-square Q pre-stack migration (LSQPSDM) to target the mentioned velocity model building and seismic imaging challenges. The newly processed data shows substantial improvements as compared with the existing legacy data, specifically: 1) a more geologically plausible velocity model resulting in better mis-tie; 2) better suppression of multiples and coherent noise, events are more continuous and focused; 3) higher resolution imaging, particularly at reservoir level; 4) sharper fault delineation; and 5) reliable AVO inversion. The inverted Vp/Vs result at the well location is then correlated to well data at the reservoir level, the correlation coefficient is also greatly improved from 48% to 74% indicating the higher confidence in mapping the remaining prospects.

Furermore, the success of the high-end reprocessing proves that even in basins that are considered mature, new ideas and new processing technology can change long-held perceptions, opening up areas for renewed exploration activities.