APPLICATION OF GEOLOGICALLY CONDITIONED PETROPHYICAL CONSTRAINTS IN JOINT INVERSION: A CASE STUDY

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Quantitative integration of geology, petrophysics and geophysics in a single inversion scheme is a complex, yet theoretically powerful method to solve challenges faced in exploration scenarios. In this work, we present a case study illustrating the improvements in subsurface imaging and uncertainty reduction brought by the integration of probabilistic geological modelling and petrophysical constraints in three-dimensional geophysical joint inversion. The area investigated is located in the Yerrida Basin (Yilgarn Craton, Western Australia). The main difficulty encountered by previous studies was to characterize the thickness of the overburden, thought to be in contact with a potentially mineral-rich basement. Using gravity and magnetic data, results show that the use of constraints derived from the statistics of petrophysical measurements in inversion permits to retrieve sharp contrasts and to delineate geological units directly. The use of probabilistic geological modelling to condition the petrophysical constraints allows to 1) refine the inverted model by enforcing geological consistency, and 2) reduces the impact of inversion's inherent non-uniqueness. Finally, statistical and structural analysis of the results suggest that areas previously considered too uncertain may show good prospectivity, highlighting areas for future exploration targeting.