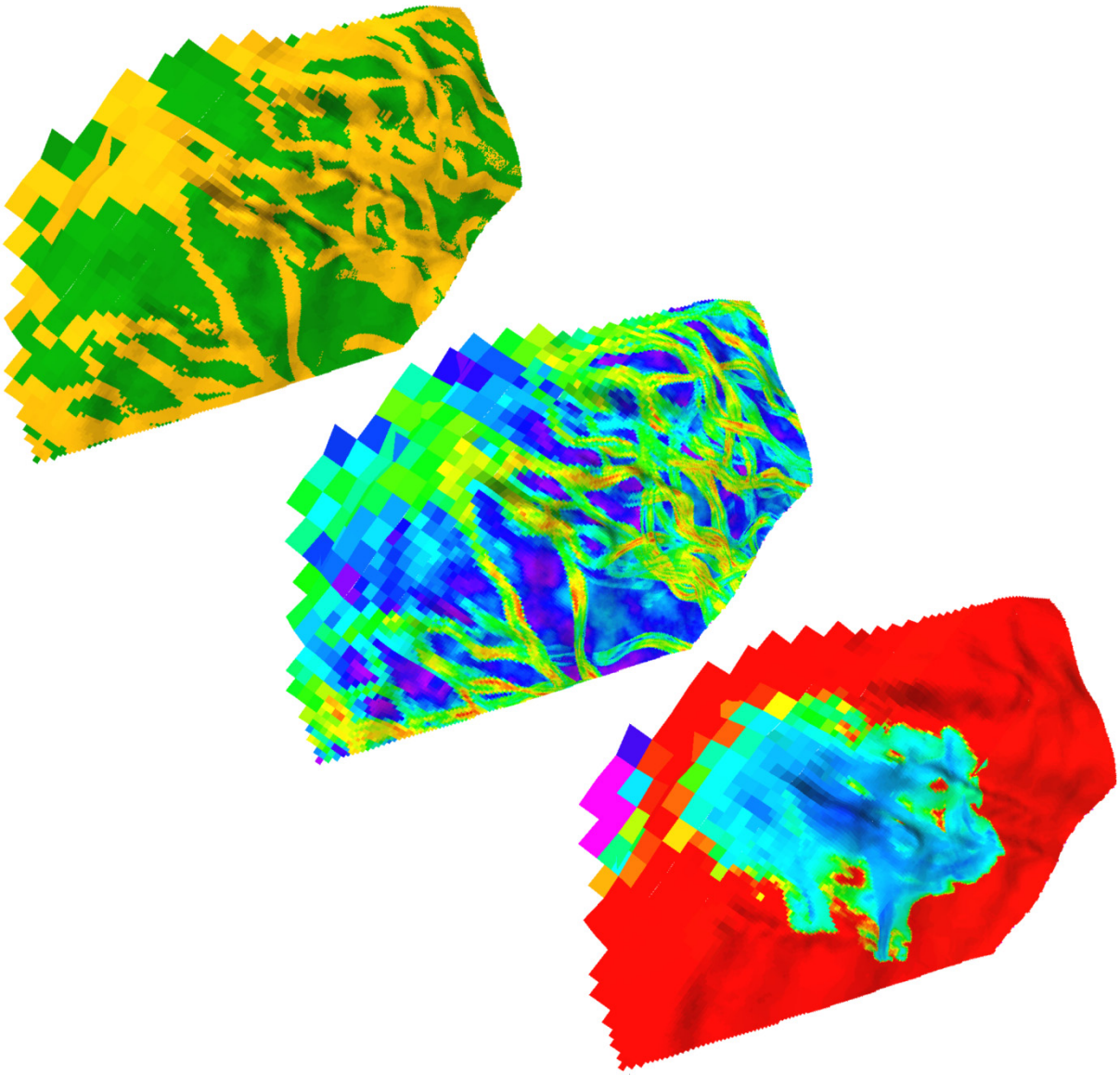
# Managing the Interdisciplinary Requirements of 3D Geological Models

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# Abstract

Despite increasing computer power, the requirement to upscale 3D geological models for dynamic reservoir simulation purposes is likely to remain in many commercial environments. This study established that there is a relationship between sandbody size, cell size and changes to predictions of reservoir production as grids are upscaled. The concept of a cell width to sandbody width ratio (*CSWR*) was developed to allow the comparison of changes in reservoir performance as grids are upscaled.

A case study of the Flounder Field in the Gippsland Basin resulted in the interpretation of three depositional environments in the intra-Latrobe reservoir interval. The sandbody dimensions associated with these depositional environments were used to build a series of 3D geological models. These were upscaled vertically and horizontally to numerous grid cell sizes. Results from over 1400 dynamic models indicate that if the *CSWR* is kept below 0.3 there will be a strong correlation between the average production from the upscaled grids compared to those of a much finer grid, and there will be less than 10% variation in average total field production. If the *CSWR* is between 0.3 and 1, there could be up to 30% difference, and once the *CSWR* exceeds 1.0 there is only a weak relationship between the results from upscaled grids and those of finer grids.

As grids are upscaled the morphology of bodies in facies models changes, the distribution of petrophysical properties is attenuated and the structure is smoothed. All these factors result in a simplification of the fluid flow pathways through a model. Significant loss of morphology occurs when cells are upscaled to more than a half the width of the reservoir body being modelled. A simple rule of thumb is established — if the geological features of a model cannot be recognised when looking at a layer in the upscaled grid, the properties of the upscaled grid are unlikely to be similar to those of the original grid and the predictions of dynamic models may vary significantly from those of a finer grid.

This understanding of the influence of sandbody size on the behaviour of upscaled dynamic models can be used in the planning stages of a reservoir modelling project. Two simple charts have been created. The first chart is for calculating the approximate number of cells in a model before it is built. The second chart is for comparing the proposed cell size against the *CWSR*, so that the predicted discrepancy between the ultimate production from the upscaled grid and one with much smaller cells can be assessed. These two charts enhance discussion between all interested disciplines regarding the potential dimensions of both static and upscaled dynamic models during the planning stage of a modelling project, and how that may influence the results of dynamic modelling.

# Thesis Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

# Acknowledgements

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***For Mum – another milestone in my life you would have loved to see***

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