Dynamic modelling of coal seam gas production: understanding how individual coal seams contribute to production profiles

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Introduction

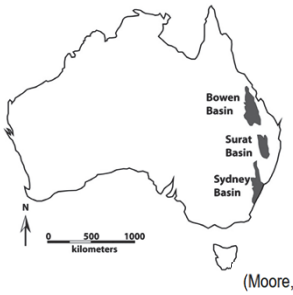
Even though thousands of wells are producing coal seam gas (CSG) from the Surat Basin, predictive models struggle to match actual well behavior.

Depending on the degree of heterogeneity of coalbeds, average properties do not necessarily represent the inherent characteristics of each coal seam.

Additionally, the interaction between individual seams (and possibly the interburden, i.e. rock layers between the seams) can influence the total response during multi-seam gas drainage (Jiang et al., 2016; Zheng et al., 2018).

Objectives

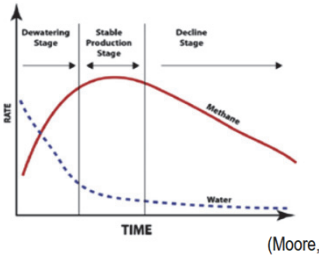
- Understand the contribution of individual coal seams to total gas and water production in multi-zone wells and how it changes over time.
- Investigate the effects of individual seam properties (porosity and permeability, amongst others) on total production.



(Moore, 2012)

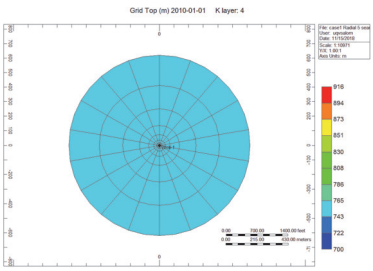
Methodology

- Dynamic simulation of multi-phase flow.
- Sensitivity analysis using reservoir simulation tools to investigate the effects of coal porosity, permeability, gas content, coal body size, and including interburden properties on gas flow in multi-zone coal seam gas (CSG) wells.



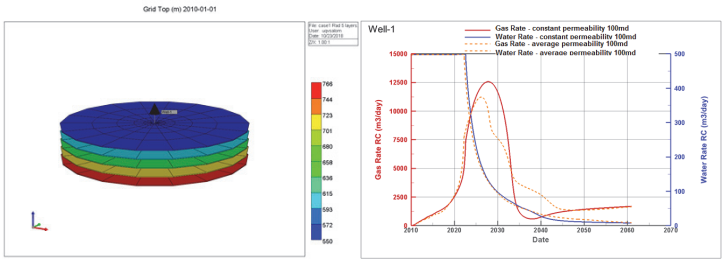
(Moore, 2012)

Initial Synthetic Models

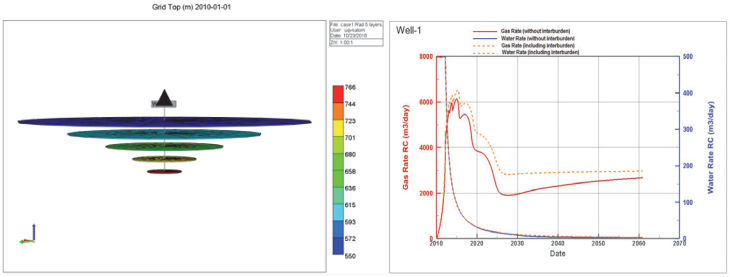


Top depth: 700m
Radius = 620.1m
Coal seam parameters:
Porosity = 5%
Initial Permeability = 100 md
Density = 1,500kg/m^3
Sorption time = 10 days
Langmuir Volume = 250scf/ton
Langmuir Pressure = 4178kPa
Initial Pressure = 10,400kPa
Seam Thickness = 4m

Multiple seams with same radius



Multiple seams with different radius



Preliminary conclusions

- Initial modelling results suggest that gas production profiles may exhibit complex shapes due to different properties of individual seams.
- Including the interburden in the model influences gas production profiles. This has a significant impact on the degree of permeability enhancement due to matrix shrinkage and, as a consequence, on gas recovery.
- Next steps will adress specific cases for the Surat Basin.

Acknowledgements

This research has been conducted with the support of Energi Simulation and software from CMG Limited.

References

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