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SIMEDWin

CSIRO ENERGY

SIMEDWin is a coal seam methane reservoir simulator, which can be used to investigate the relationships between reservoir properties, well operating procedures and gas production. SIMEDWin is used to optimise well field design, reservoir management and production forecasting.

Capabilities

SIMEDWin is the windows user interface version of SIMED II, which was originally developed by Val Pinczewski and Mark Stevenson, School of Petroleum Engineering, University of New South Wales.

SIMEDWin is primarily designed for modelling the drainage of gas from coal seams but it can also be used to model conventional dry gas reservoirs. It is ideally suited for modelling coal seam methane production and is capable of single well or full field simulations, which involve multiple wells with multiple completions.

It has seen extensive use since the early 1990s for both coal seam methane and gas management in coal mines. It has been thoroughly tested through comparison with other industry simulators and field data.

SIMEDWin is appropriate for simulating reservoirs which involve:

- two phase (gas and water) flow
- three dimensional geometry
- multi-component (multiple gas species) adsorption and gas migration
- single or dual porosity reservoirs

Features

SIMEDWin incorporates a number of advanced functions, which makes the software ideal for use in the coal seam methane and mining industries. Some significant features of SIMEDWin include:

Model processes

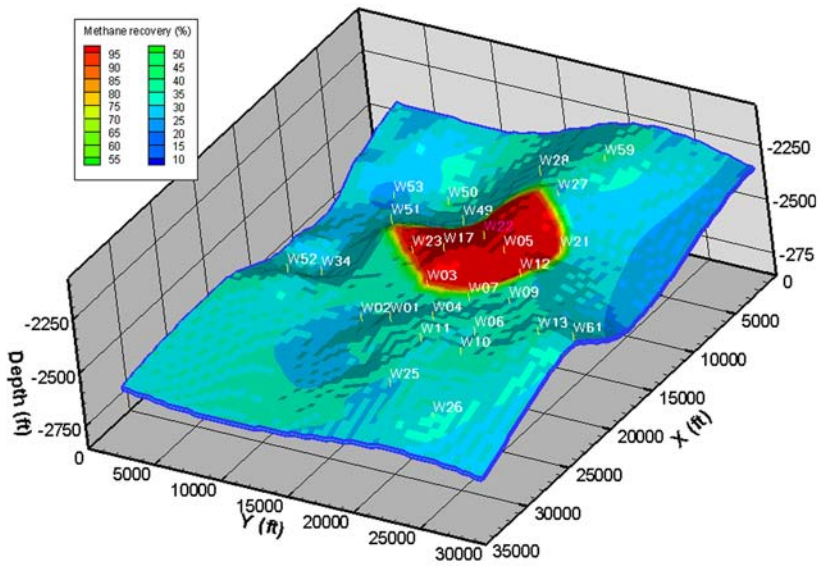
- Dual porosity (Warren-Root)
- Permeability – various options (2 x stress permeability models, multi-component matrix shrinkage effects (modified Sawyer model), klinkenberg correction)
- Multi-component adsorption (extended Langmuir, Ideal Adsorbed Solution)
- Fully coupled implicit well model
- Phase behaviour internally defined for common gas species (methane, carbon dioxide, nitrogen, ethane); ability for the user to define gases (Peng-Robinson EOS)

Input options

- Multiple coal types
- Several initialisation options
- Variable gridding
- Hydraulic fracture model
- Face drainage option (for coal mining)
- Longhole drainage
- Grid block and well numbers limited by memory

Other considerations

- Fully implicit formulation
- Klinkenberg effect correction factor
- Flow dependent skin factor
- Numerical dispersion control
- Jacobian optimisation/inversion
- Comprehensive input data error checking
- Windows user interface and post processing
- Automated history matching using Marquardt's



TECPLOT post-processing of SIMEDWin results. This image was produced for a full field simulation of enhanced coal seam methane production. It shows methane recovery within the reservoir at the end of 17 years primary production and ten years CO_2 injection.

Benefits

- A state of the art reservoir simulator specifically tailored to the unique flow system encountered with coal seam methane
- An integrated windows user interface which provides model parameter input and post-processing within the one environment
- A code that has been validated by a series of model intercomparisons and through a full field intercomparison with ECLIPSE
- A code that can exploit the multi-core processors in PCs through parallel processing
- Uses dynamic memory management so that the size of the model (i.e. numbers of grid blocks, wells) is limited by the available memory

Associated research activities

CSIRO scientists are also exploring the numerous research challenges that exist for exploiting unconventional gas such as coal seam methane. This is a rapidly growing energy source, particularly along the eastern seaboard of Australia.

Coal seam methane reservoirs are generally 'tight', having low permeabilities compared to conventional petroleum reservoirs.

The gas drainage process within coal differs considerably from that encountered in conventional gas reservoirs since the gas within coal is adsorbed. As a result, drainage is determined by the relationship between gas pressure and the quantity adsorbed and the water and gas migration process. CSIRO has a strong research program in these coal gas reservoir processes which is aimed at identifying innovative approaches to gas drainage.

For further information:

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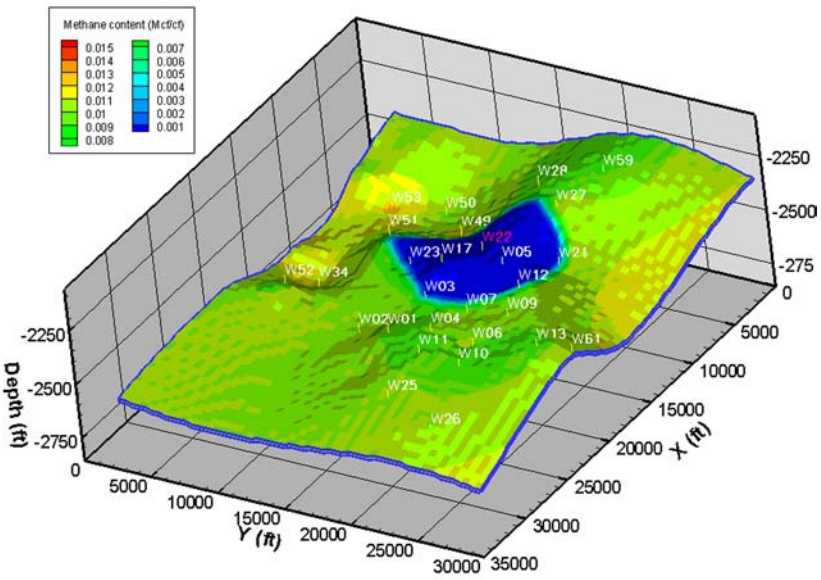

TECPLOT post-processing of SIMEDWin results. This image shows the methane content within the reservoir for the same simulation.

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