AQUIFER IMPLEMENTATION

Carter Tracy and Fetkovich models in OPM | Ir. W. de Zeeuw, Ir. R. Nair, Ir. K. Loh
INTRODUCTION

- Introduce different types of Aquifers available in OPM
- Flow Chart
- Input Deck
- Results
- What remains to be done
## AQUIFER TYPES IN OPM

- Carter-Tracy aquifers
- Fetkovich aquifers
  - Not available, but available in ECLIPSE: Numerical-, Constant Flux-, Constant head-, Multi-component aquifers.

### Carter-Tracy
- Simplifies the tedious calculations fully transient model by removing the superposition.
- Approximation of the diffusivity equation
- Assumes constant water influx rates over each finite time interval
- Uses dimensionless time and dimensionless pressure influence as by EH.
- Accuracy depends on time step
- Excellent match with EH-method

### Fetkovich
- Simplifies the tedious calculations fully transient model by removing the superposition.
- Approximation of the diffusivity equation
- Water influx rates are proportional to pressure drop of average aquifer pressure and pressure at aquifer front.
- Neglects effect of any transient period. Based on pseudo-steady state
FLOWCHART

Flow of Aquifer Data in OPM

INPUT

OPM-COMMON

EWOMS

OPM-SIMULATORS

Inputdeck

./opm-common/git
GenerateKeywords, cmake

src/opm/parer/eclipse/
EclipseData
AquiferCT.cpp
AquiferCT.hpp

opm/parer/eclipse/
EclipseData
AquiferModel.hpp

opm/autodiff/
BlackOil
AquiferModel.hpp

opm/autodiff/
AquiferInterface.hpp

opm/autodiff/
AquiferCT.hpp

opm/autodiff/
AquiferFetkovich.hpp

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Required Keywords:
AQUDIMS defines the number of aquifers and max. number of grid block connections
AQUANCON defines the aquifer connections to one or more faces of the reservoir
AQUTAB defines the influence function table as by van Everdingen and Hurst
• User can also supply custom influence functions
AQUCT defines all aquifer properties
• Aquifer ID number, Datum Depth, Initial aquifer pressure, permeability, porosity, compressibility, external radius, angle of influence, table number for water properties, table number for influence function, initial salt concentration, temperature

Keywords that yet are not available
AAQR, AAQT, AAQP, AQANTRC
FETKOVICH AQUIFERS IN INPUT DECK

Required Keywords:
AQuDIMS defines the number of aquifers and max. number of grid block connections
AQuANCON defines the aquifer connections to one or more faces of the reservoir
• Datum depth, Initial aquifer pressure, initial water volume, compressibility, aquifer productivity index, table number for water pressure properties, Initial salt concentration, temperature in aquifer

Keywords that yet are not available
AQuFET, A AQ R, A AQ T, A AQ P, A QANTRC
RESULTS AND CONCLUSION

- Carter Tracy results are accurate according to pressure difference
  - However, inflow rates are quite different
  - Implementation of summary keywords is beneficial
- Fetkovich Results are accurate but must be tested on more complex models
- Models work on all flows (solvent, polymer, normal, geothermal)
- Final implementation for the AquiferInterface class
- Easily extendible framework for aquifers in OPM
THANK YOU FOR YOUR ATTENTION

Take a look: TNO.NL/TNO-INSIGHTS