# Hurst IARF Aquifer Drive @model

## Motivation

The most accurate way to simulate Aquifer Expansion (or shrinkage) is full-field 3D Dynamic Flow Model where Aquifer Expansion is treated as one of the fluid phases and accounts of geological heterogeneities, gas fluid properties, relperm properties and heat exchange with surrounding rocks.

Unfortunately, in many practical cases the detailed information on the aquifer is not available which does not allow a proper modelling of aquifer expansion using a geological framework.

Besides many practical applications require only knowledge of cumulative water influx from aquifer under pressure depletion.

This allows building an Aquifer Drive Models using analytical methods.

## Inputs & Outputs

| Inputs | | Outputs | |
|---|---|---|---|
| $p(t)$ | field-average formation pressure at time moment $t$ | $Q^{\downarrow}_{AQ}(t)$ | Cumulative subsurface water influx from aquifer |
| $p_i$ | initial formation pressure | $q^{\downarrow}_{AQ}(t) = \frac{dQ^{\downarrow}_{AQ}}{dt}$ | Subsurface water flowrate from aquifer |
| $\sigma$ | aquifer transmissibility | | |
| $\chi$ | aquifer diffusivity | | |
| $A_e$ | pay area | | |

## Physical Model

| | |
|---|---|
| Radial Composite Reservoir | |
| Infinite Acting Radial Flow Aquifer | (1) $$J_{AQ}(t) = \frac{4 \pi \sigma}{\ln \frac{1.781 \cdot A_e}{4 \pi \chi t}}$$ |

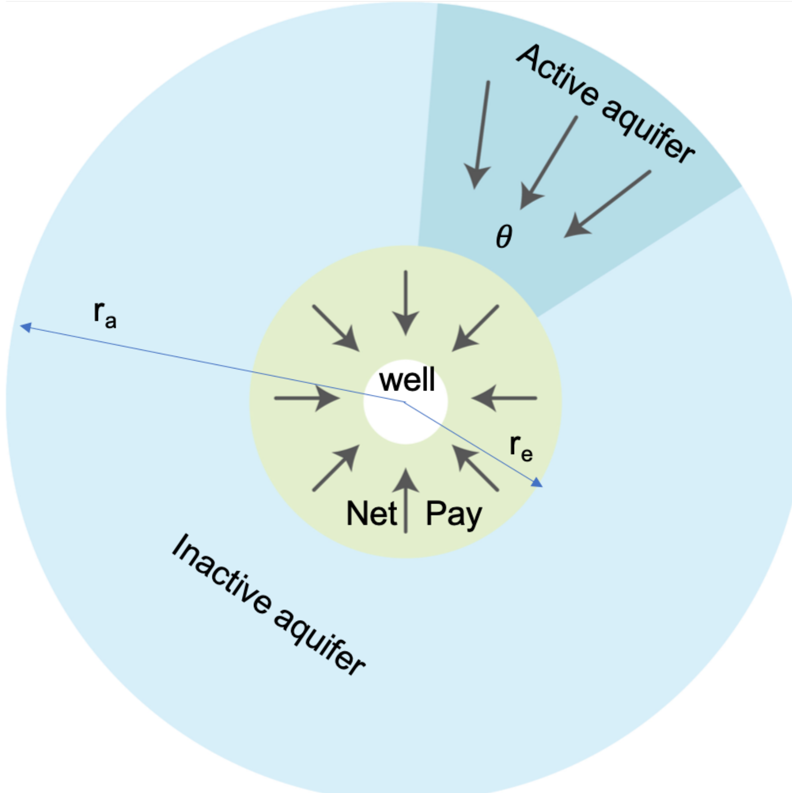


**Fig. 1.** Carter-Tracy aquifer drive schematic

## Mathematical Model

| | | | |
|---|---|---|---|
| (2) | $\frac{dQ_{AQ}}{dt} = J_{AQ}(t) \cdot (p_i - p(t))$ | (3) | $J_{AQ}(t) = \frac{4\pi\sigma}{\ln \frac{1.781 \cdot A_e^2}{4\pi\chi t}}$ |

## See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Field Study & Modelling / Aquifer Drive / Aquifer Drive Models

## Reference

1. Fetkovich, M.J. 1971. A Simplified Approach to Water Influx Calculations—Finite Aquifer Systems. J Pet Technol 23 (7): 814–28. SPE-2603-PA. http://dx.doi.org/10.2118/2603-PA