

IMEX to 2-Component STARS (Water and Dead Oil)

First (naïve?) assumption was that I could do with a 2-component model, as gas is absent in the reservoir. The conversion was relatively straightforward, as I didn't need any mixing parameters. The only parameter that couldn't be copied directly was the oil compressibility C_o . Did some spreadsheet calculations and some sensitivity runs and found that the value wasn't critical.

The conversion is documented by comments in the STARS .dat-file

Findings: oil rates q_o had the "same shape" in IMEX and STARS, but rate decrease (water breakthrough) occurred earlier in IMEX than in STARS (plateau q_o was equal).

Injection rate (determined by reservoir voidage) was 43.8 in IMEX, 35.1 in STARS, but still the average reservoir pressure was equal in the two cases. So how can production rates and pressures be equal when injection rates are different?

You, the reader surely saw the solution immediately, but I needed some time before the *Eureka* hit me. → q_o are equal, but at *Standard Conditions* (SC) – obviously they differ at *Reservoir Conditions* (RC)! (Confirmed by rerunning the cases with the DOWNHOLE flag and comparing RC rates).

Conclusion: Either run IMEX with an $R_s = 0$ (which signifies that only factor when converting from RC to SC is compressibility – equivalently handled in IMEX and STARS), or include gas in the STARS model.

Setting $R_s = 0$ is perfectly acceptable, as the difference between RC and SC is not critical in "our" type of models anyway. But nevertheless chose to try to include the gas – if not for anything else, to improve understanding of STARS.