Pressure variation

All the simulations so far have been using the reservoir voidage option, i.e. average reservoir pressure remains relatively constant during production. In other words, we haven't tested the STARS data's dependency on pressure. And as all the parameters we have defined induce pressure-dependent viscosity, mixing, gas condensation etc., we cannot have high expectations to the IMEX to STARS conversion once we allow the pressure to vary. First and foremost, I'd be highly surprised if the model I've constructed and matched will have a constant GOR when reservoir pressure is allowed to decrease during production.

So I modified the existing IMEX model, changing the injector to rate control, and adjusting the rate so that the reservoir pressure dropped steadily until the producer's bottom hole constraint was reached. And then implemented the same changes into the STARS model.

And surprise, surprise! The STARS GOR was actually constant, so (unintentionally) this model has ended up as a STARS dead-oil model. The oil rate wasn't matched as good as before, and there are some differences in the pressure development. This difference is actual an issue of concern (feedback highly appreciated!)

The ST injection rates are identical in STARS and IMEX, but RC injection rates are different: 34.1 Rm^3/D in STARS, 35.4 Rm^3/D in IMEX. Also RC oil rate is higher in STARS, hence (with lower injection and higher production) the STARS pressure should drop more quickly than the IMEX pressure, But it's just opposite (!?!).

STARS uses a "standard" model for water, which may be different from the properties I defined in IMEX, but the difference shouldn't be that big, so couldn't resolve this one…

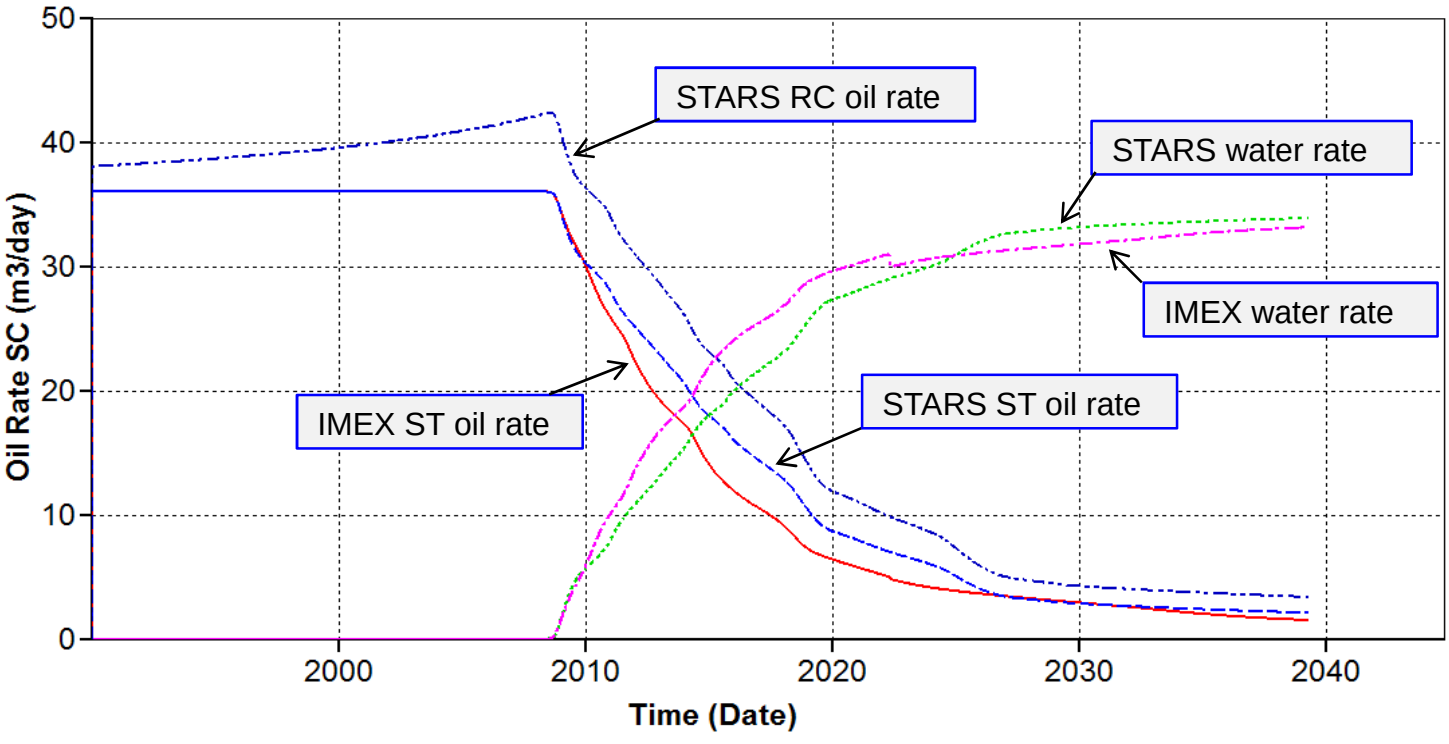
Did some sensitivities:

A. Increased KV3 from 2.0 to 2.4 (better GOR match)
B. Gas CP (compressibility) increased from 1.9E-4 to 3.0E-4 (oil rate *shape* better, but plateau longer)
C. Gas CP = 2.4E-4 (little effect on oil rate, but noticeable effect on pressure)
D. Oil CP increased from 1.0E-7 to 2.0E-7 (almost identical to C)

Although these changes had minor effect on ST oil rate, the influence on RC rate is larger, indicating that "something" is happening to the condensation. Even though ST GOR is constant, RC plateau oil rate is *not*.

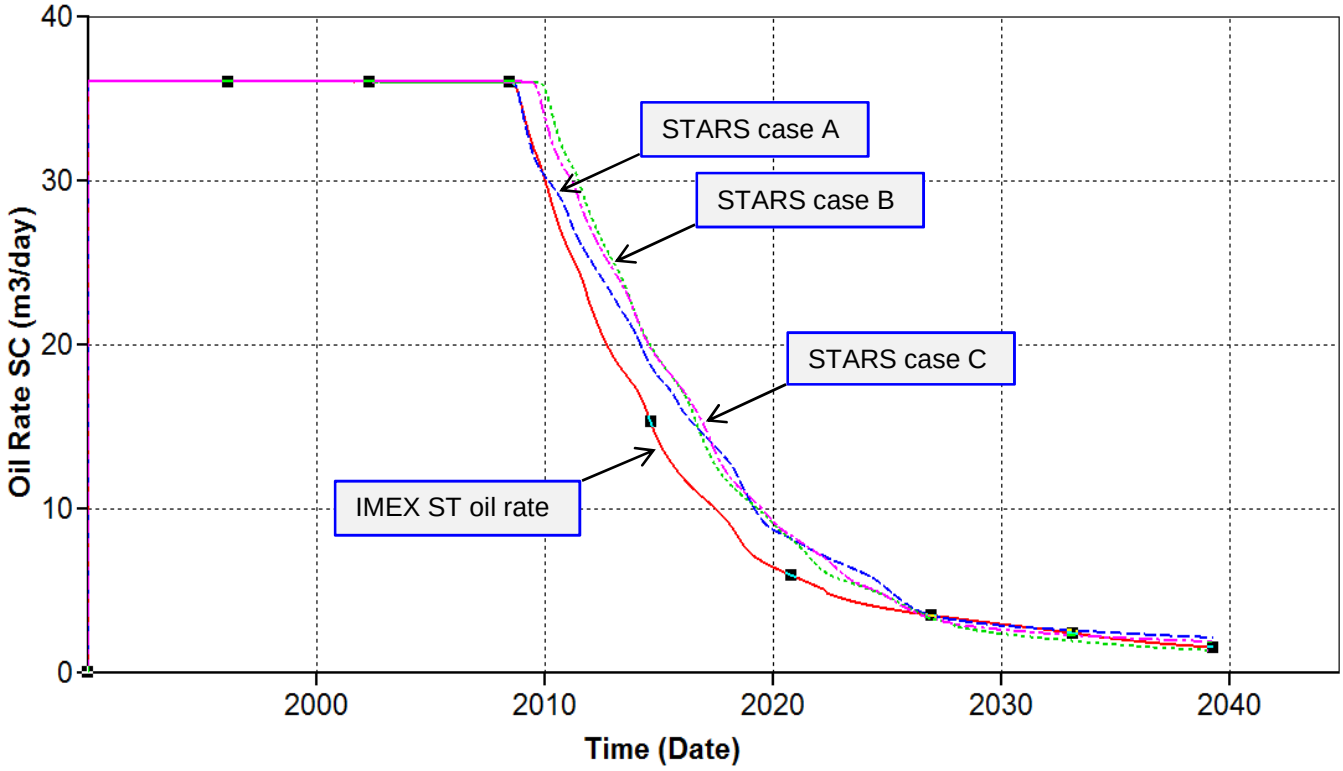
So left it at that, concluding that the differences are not that large, and most importantly, it does behave like a dead oil model should…

Results from first comparison run:

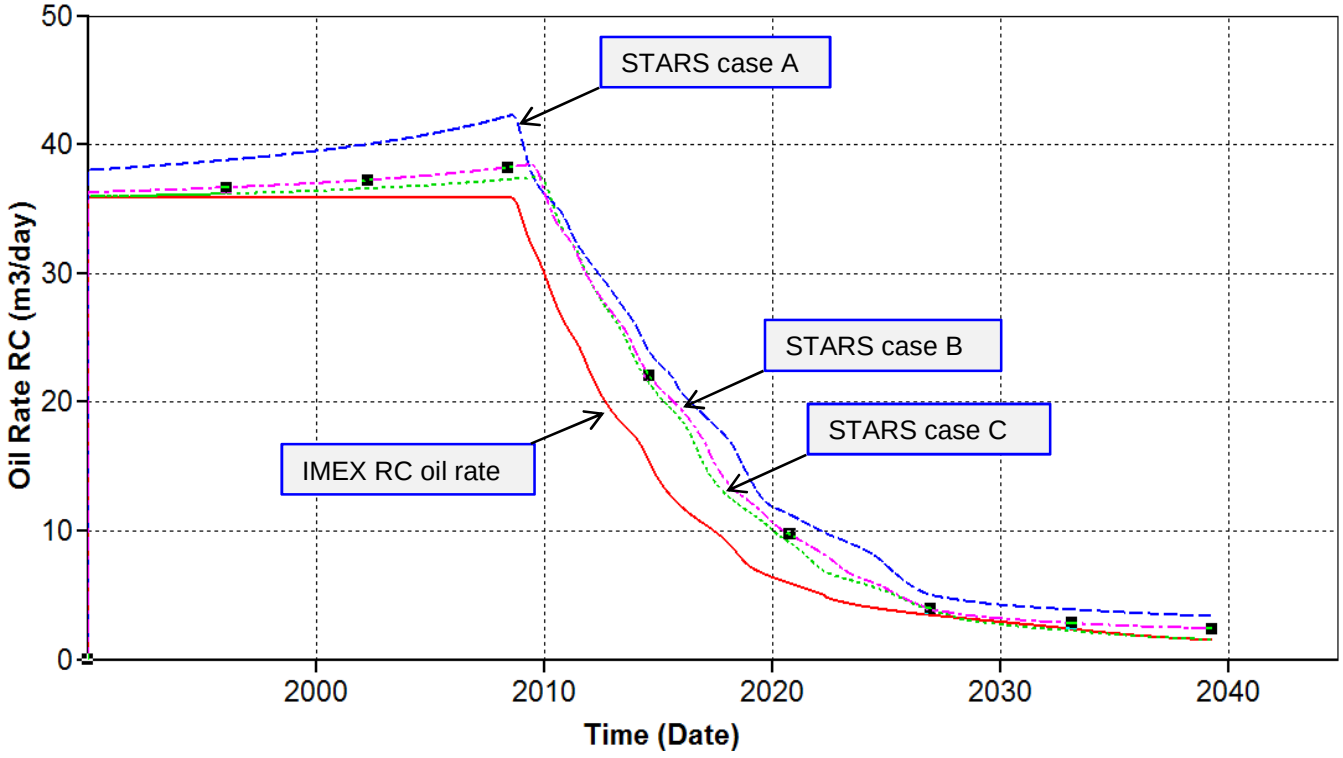


Results from the sensitivity runs,

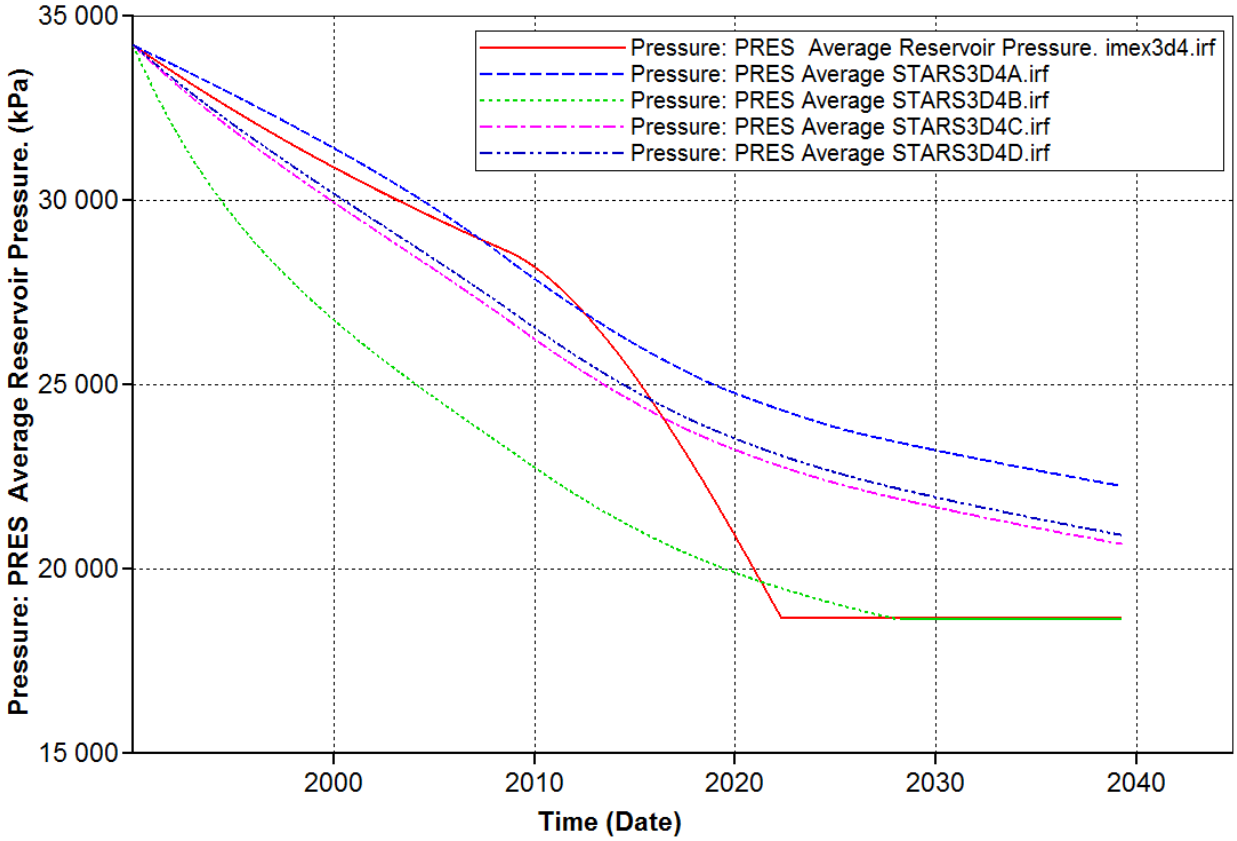
1. ST oil rates for the four cases:



2. RC oil rates:



3. Reservoir pressure (average)



Most noticeably; we can't reproduce the slope change from the IMEX run in any of the STARS cases. I don't say it can't be done, but I didn't succeed with the model I've used. Probably requires more advanced understanding of the STARS mixing mechanism.

So for now we leave it at that.