

TITLE: History matching and performance prediction of a polymer flood pilot in heavy oil reservoir on Alaska North Slope

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1. OBJECTIVES/SCOPE: Please list the objectives and scope of the proposed paper. (25-75)
The first-ever polymer flood pilot to enhance heavy oil recovery on Alaska North Slope (ANS) is ongoing. The pilot pattern consists of two horizontal injector-producer well pairs in the Schrader Bluff reservoir. The positive effect of polymer injection was observed from the decrease in water cut from 65% to 15-20%. The primary objective of this study is to develop a robust history-matched reservoir simulation model capable of predicting future polymer flood performance.

2. METHODS PROCEDURES, PROCESS: Briefly explain your overall approach, including your methods, procedures and process. (75-100)

The reservoir simulation model was developed based on the geological model and available reservoir and fluid data. In particular, four high transmissibility strips were introduced to connect the injectors and producers, simulating short-circuiting flow behavior that can be explained by viscous fingering and reproducing the water cut history. The validated simulation model has been employed to investigate the pilot test's oil recovery performance under different development strategies, with consideration to sensitivity to polymer parameter uncertainties. A polymer utilization parameter has been used to evaluate the pilot test's economic efficiency.

3. RESULTS, OBSERVATIONS, CONCLUSIONS: Please describe the results, observations and conclusions of the proposed paper. (100-200)

The history matching results show that, during the waterflooding period, higher strip transmissibilities match the water cut history well. At the early stage of the polymer flooding, the strip transmissibilities need to be higher to match water cut increases after the initial water cut decreases due to polymer injection. After that, the strip transmissibilities need to be reduced with time to match the significant and continuous water cut reduction. By tuning the strip transmissibilities, the viscous fingering effect in the reservoir during waterflooding and the restoration of injection conformance during polymer flooding is effectively represented. Forecasting with the updated reservoir model indicates that the oil recovery factor with polymer flooding can reach about 36% in 30 years, twice as much as forecasted with continued waterflooding. The polymer utilization generally increases with increasing polymer concentration, retention, and injection time. Among the investigated scenarios, the maximum forecasted polymer utilization was 3.5 lb/bbl, which is still economically viable. The field pilot results and our simulation study prove that polymer flooding is a promising technique to

develop the ANS viscous oil resources.

4. Please explain how this paper will present novel (new) or additive information to the existing body of literature that can be of benefit to a practicing engineer. (25-75)

Novel aspects of this work include the introduction of high transmissibility strips into the model to effectively capture the injector – producer flow patterns to obtain a robust history match. The updated reservoir model is successfully employed to forecast polymer utilization, a valuable parameter to evaluate the project’s economic feasibility. Thus, the methods developed in this study are of referential value to other polymer flooding projects.

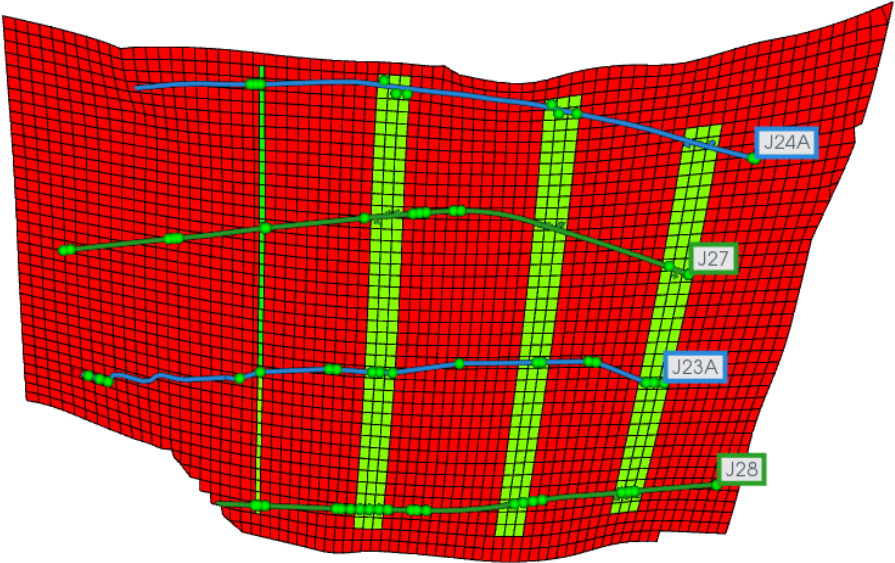
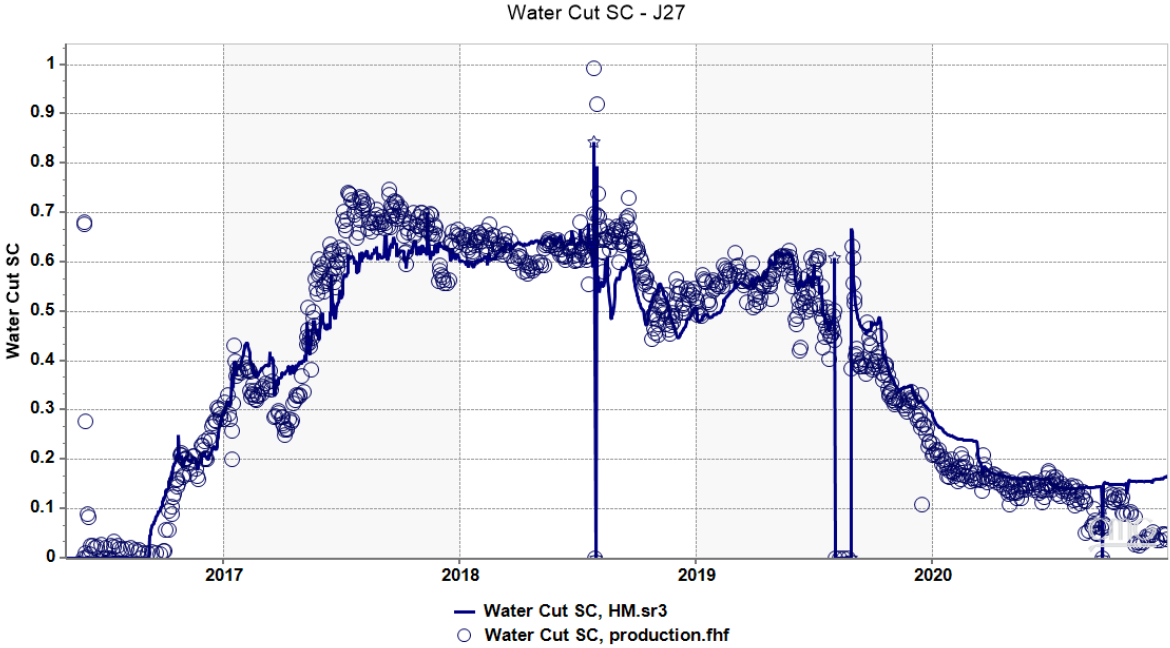
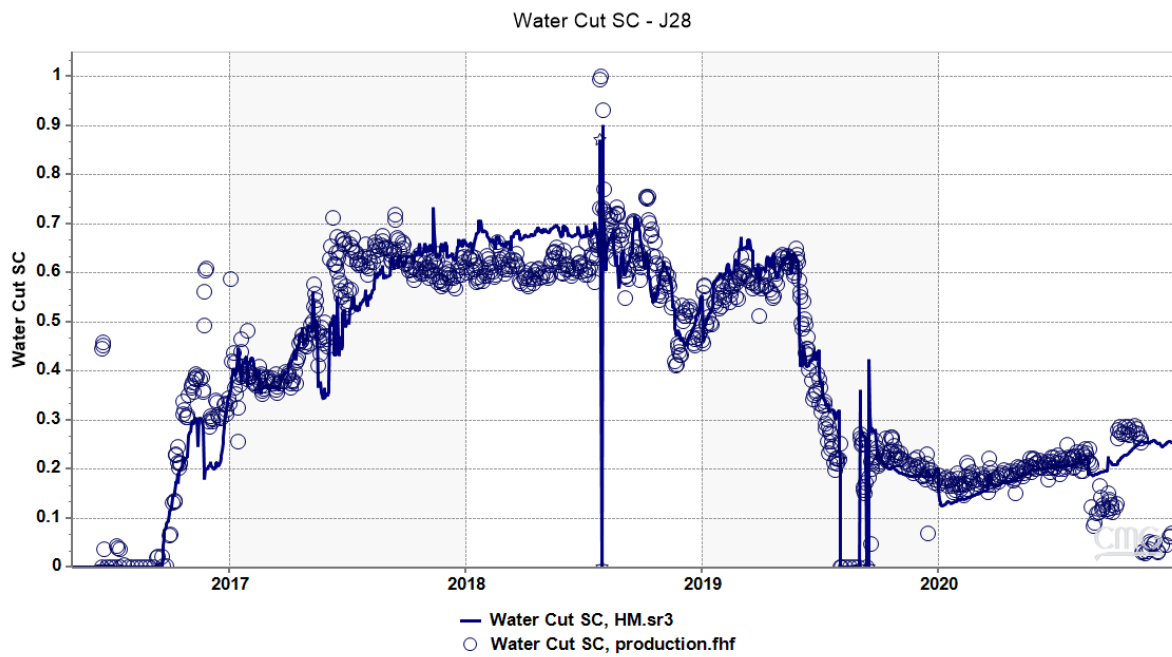


Figure 1: Reservoir model with high permeability strips



(a) Water cut of producer J27



(b) Water cut of producer J28

Figure 2: History matching results of water cut for two producers

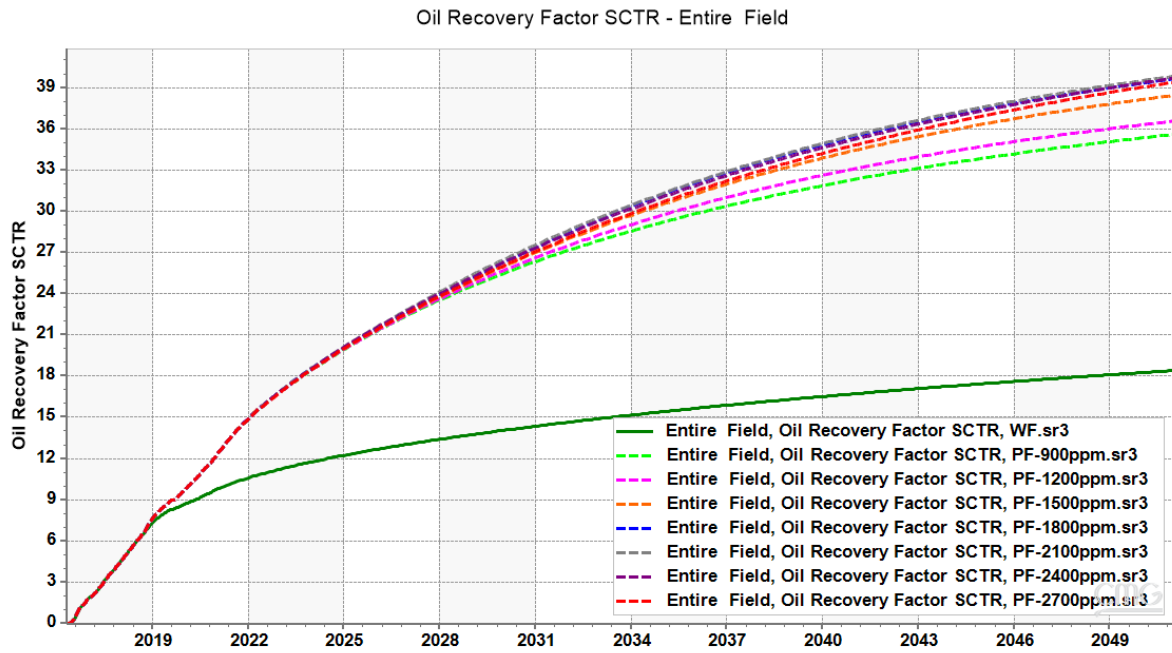


Figure 3: Oil recovery factors of waterflooding and polymer flooding