Modeling foam for enhanced oil recovery in 6X

Using 6X to model foam creation and its effect on gas mobility

In EOR foam can be particularly useful in highly fractured reservoirs such as in unconventional and tight oil fields. Here the primary challenge is to maintain gas within the target formation and prevent it from escaping into adjacent wells.

Without conformance improvement techniques, the gas might simply rush through the high conductivity fractures, channels, or weakness planes in the reservoir.

Foam generation

Foam is created by injecting a mix of water and surfactant into the reservoir. Surfactants decrease surface tension, enabling gas to be encapsulated in water-based films, thus generating foam. The foam then decreases the mobility of the gas by increasing its viscosity.

Foam modelling within 6X

Traditional simulator foam models use empirical methods to represent surfactant-induced foam generation, selecting certain variables while leaving others out.

6X enables dynamic scripting, which allows for the creation of custom foam models that incorporate user-derived data and insights.

6X employs tracers to simulate the transport of surfactants, carried by the aqueous or liquid phases.

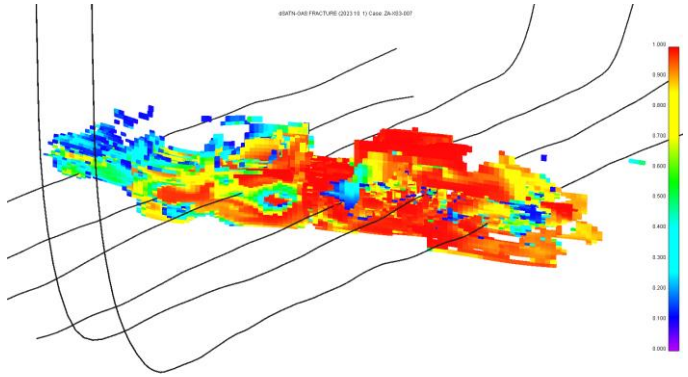
Custom foam models in 6X can be used in simulating the entire life-span of foam in a reservoir, including its generation, stability, and collapse.

Variables such as surfactant concentration, foam quality, velocities, pressure, saturation of phases, and temperature effects are all taken into account.

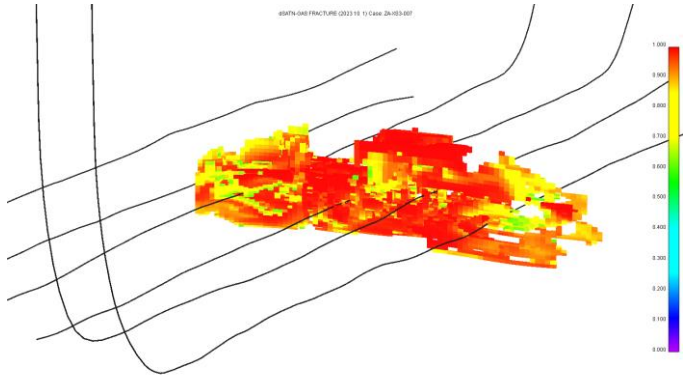
The models also simulate the time decay of foam effectiveness and collapse, and the adsorption of surfactant into the rock as a function of surface area.

For this type of foam modeling it is essential to utilize multi-well models to account for connectivity among the wells. 6X is fully equipped to integrate these models into its simulations.

The following figures display gas saturation within the fractures, filtered to highlight only the middle part of the reservoir. Gas is injected from the right side of the wells and subsequently migrates to the left side. In the second figure, the introduction of a surfactant has effectively limited the spread of gas.



Gas saturation without foam



Gas saturation with foam

Use 6X with a custom foam script model to study the effect of foam on enhanced oil recovery