

Reservoir model improvement from IWTT

Water tracers to improve model and identify un-swept oil

Challenge

In a North Sea reservoir (Fig. 1) it was difficult to map channel flow and assess correct communication.

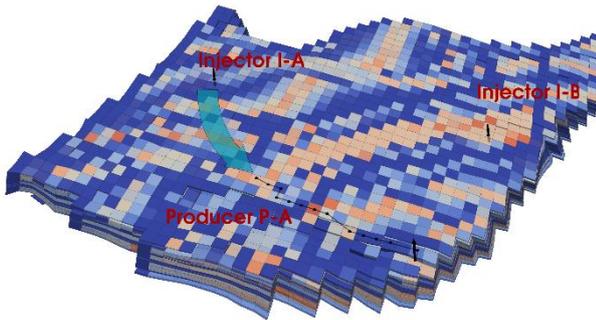


Fig. 1 – Channel structure in the base case reservoir model. In the base model water can only move from I-B along the channel towards P-A. Based on RESMAN interwell tracer technology, information on water movement from I-A towards P-A (blue arrow) was obtained and the model improved.

Solution

A significant tracer campaign was carried out to map flow and reveal communications between injectors and producers. The tracer data were compared to a reservoir simulation model to further understand the flow in the reservoir.

Application

Tracer was added to the water injectors and yielded tracer curves in the offset producers. The tracer production curves were also included in the reservoir simulation workflow and used as an additional constraint to the model.

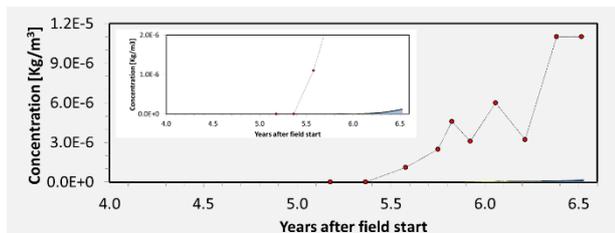


Fig. 2 – Tracer response from the base case reservoir model. Despite an excellent water cut match, the simulated tracer response (black curve with blue shade) from the base model did not compare well with tracer concentration measurements (red circles).

Before the tracer campaign, available production data were used to verify the model assumptions. This resulted in a model able to predict the correct amount of produced water. However, the original model failed to predict the data from the tracer campaign. Fig. 2 shows that the true tracer production curve, with a significant tracer production, disagrees with the base model tracer response. The channel structures assumed in the original model thus predict correct production of water, but from the wrong source.

The channel widths were therefore increased to enable water to flow across the channels. The result of this model modification on the simulated response can be seen in Fig. 3. The updated model is aligned both with the water and the tracer production.

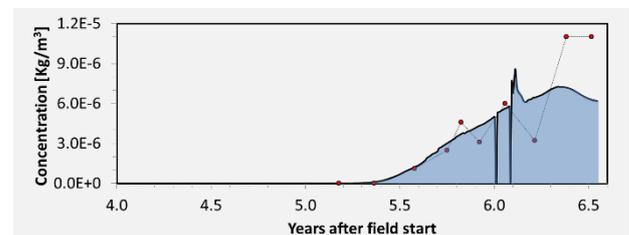


Fig. 3 – Tracer response from the updated reservoir model. By assimilating tracer data into the modelling workflow, a correct understanding of cross-channel flows is achieved.

Results

The main result from the tracer study is insight into actual water movement from injector I-A to producer P-A in the field. This reveals that the channel sands from Injector I-B towards the producer are poorly swept.

By re-routing the water injected in I-A towards I-B it was possible to produce this otherwise un-swept oil.