

Numerical Simulation of Reservoir based on Equivalent Characterization of Small Scale Seepage Barriers

—— QHD32-6 Oilfield

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What's Next?

SIS Global Forum 2017

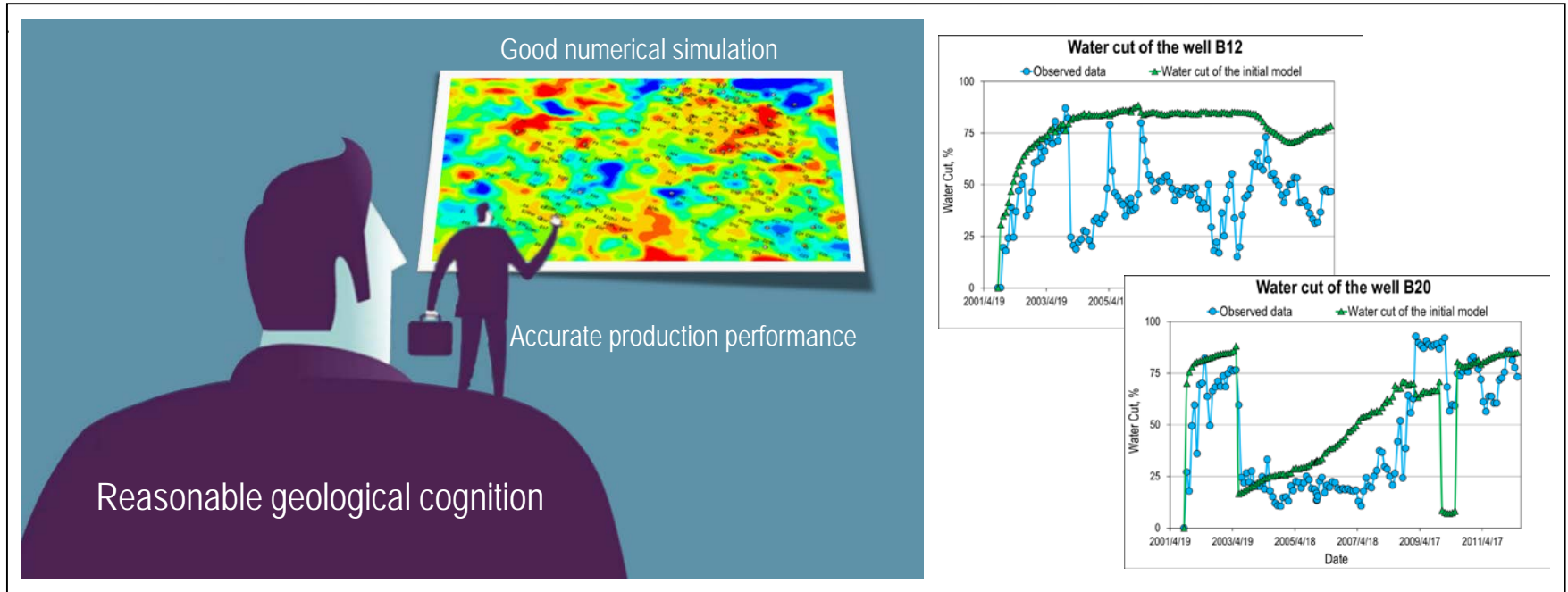
September 13–15

Le Palais des Congrès de Paris

Schlumberger



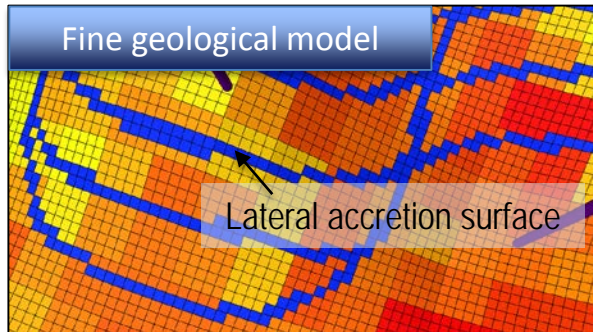
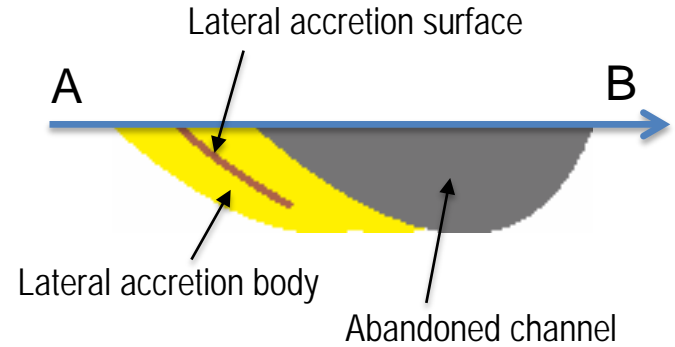
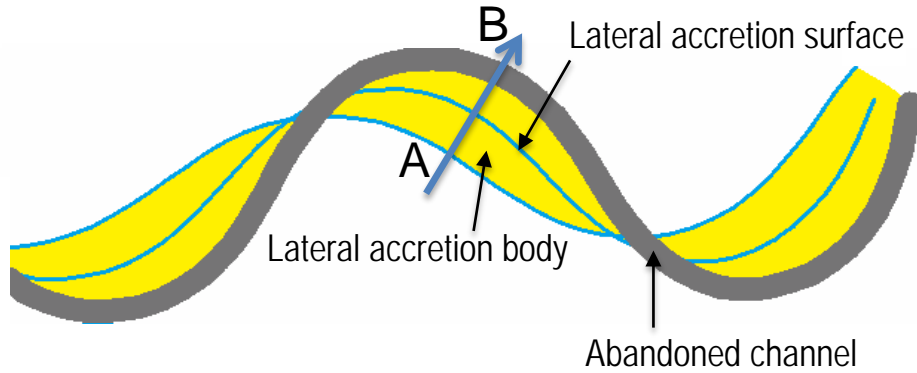
Reservoir profile map of QHD32-6 oilfield



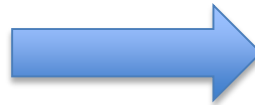
- ▣ Presently, the north area has come into high water-cut stage (80%) with low recovery factor (12.7%).
- ▣ By this situation, the remaining oil distribution becomes particularly important.
- ▣ Several wells have poor history matching which will bring an error distribution of remaining oil.



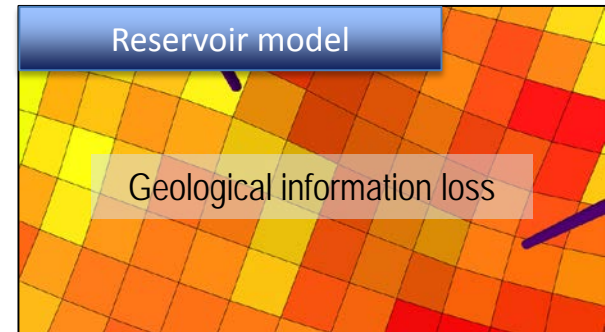
Formation of Meandering stream deposit

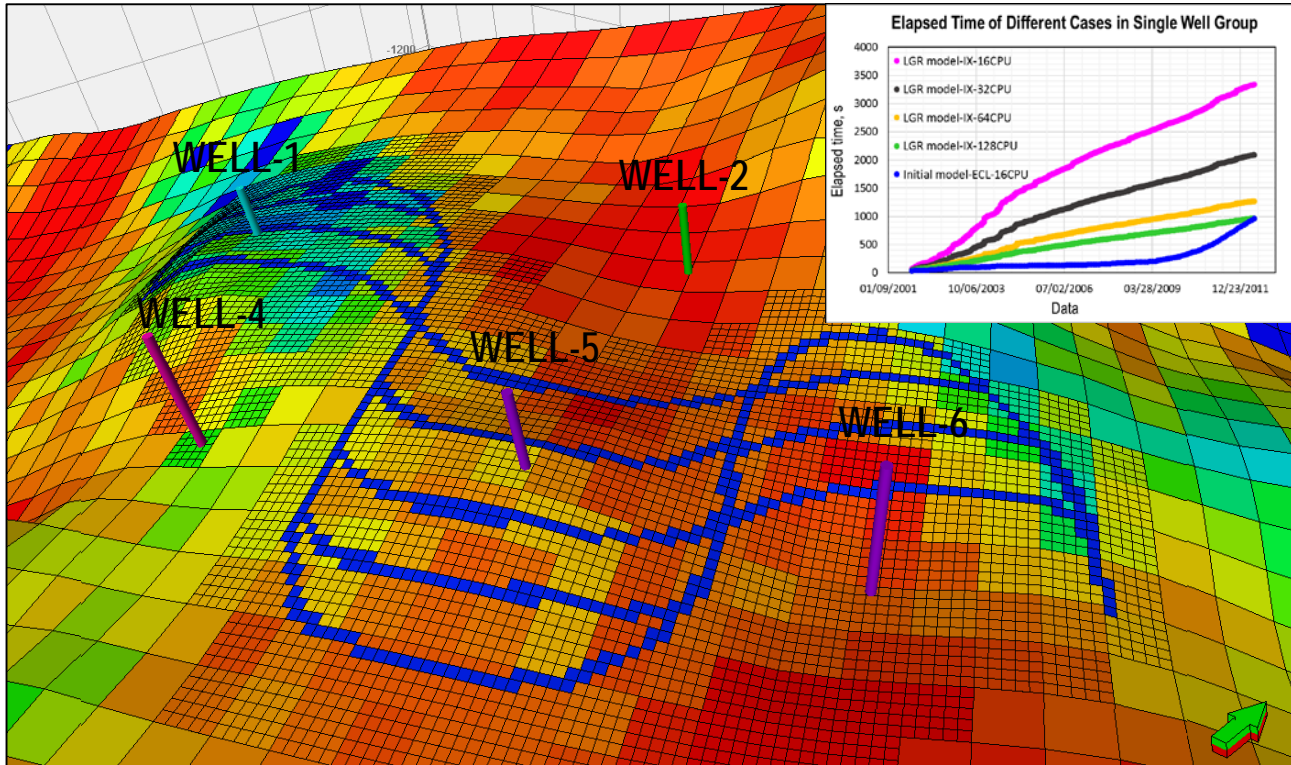


Grid upscaling process



Grid averaging





Process

Estimate the location

Refine the grids

Make a filter and adjust parameters

Run the simulation case

Limitations

Huge number of grids

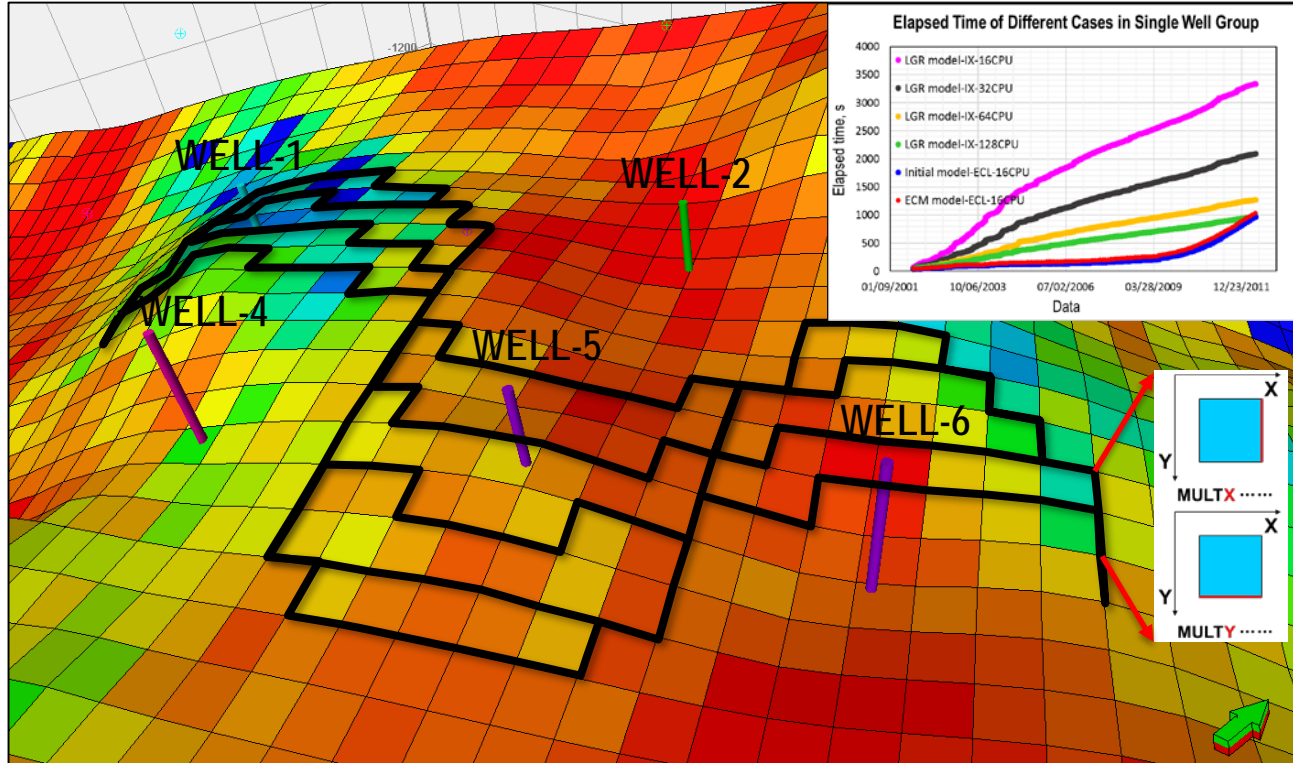
Convergence problem

Long calculation time

Low efficiency



Equivalent Characterization Method (For short: ECM)



Process

Estimate the location

Make a filter

Adjust the grids' transmissibility

Run the simulation case

Advantage

Size and number of grids unchanged

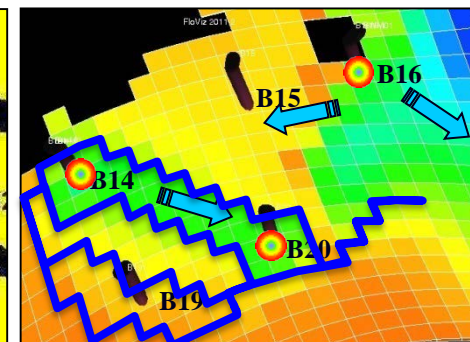
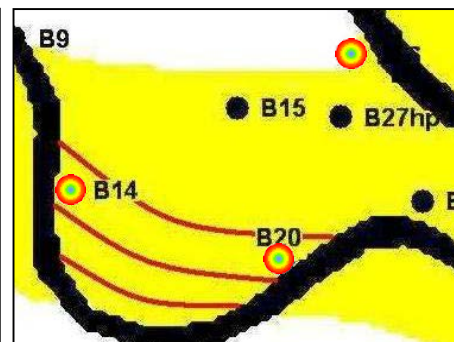
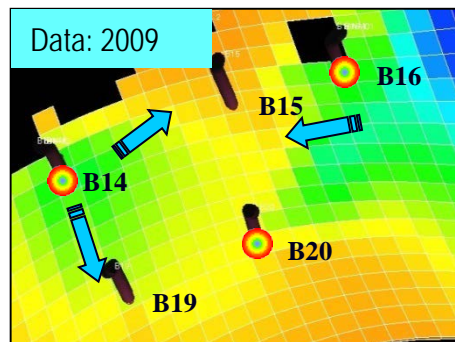
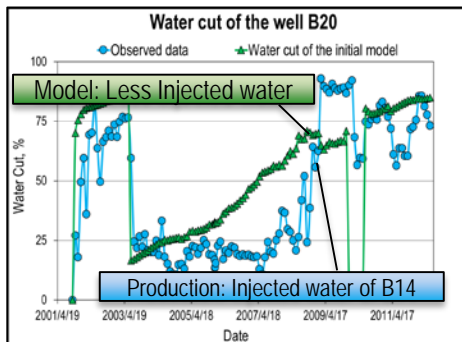
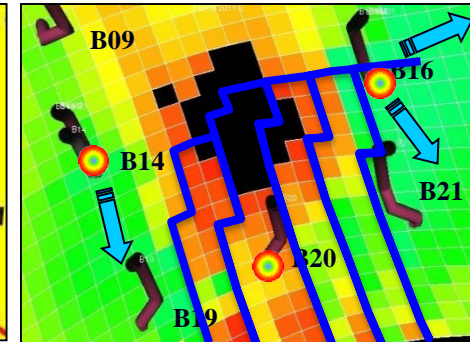
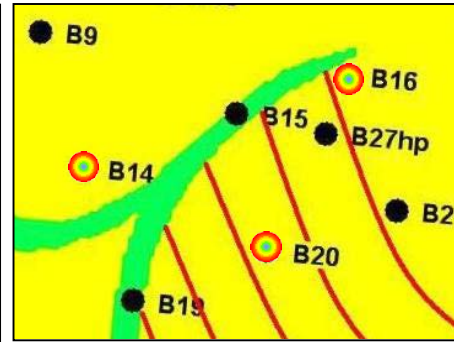
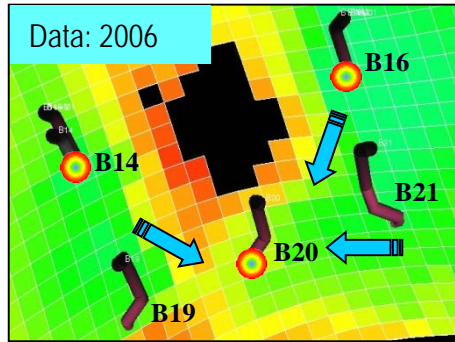
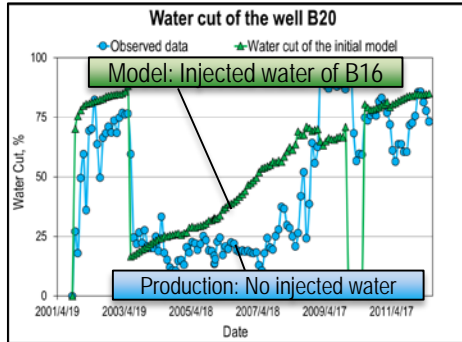
No convergence problem

Short calculation time

Hold the information of seepage barriers



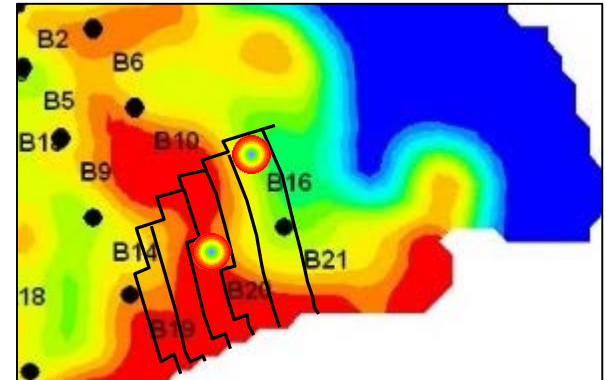
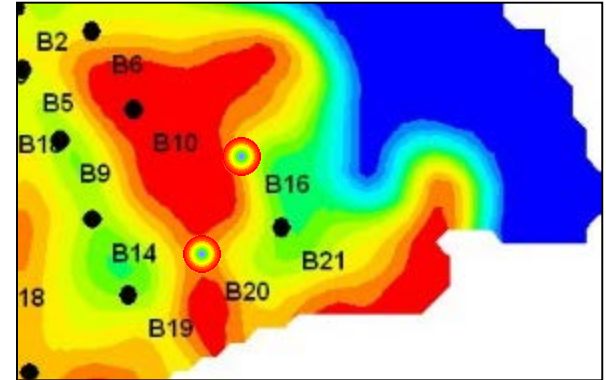
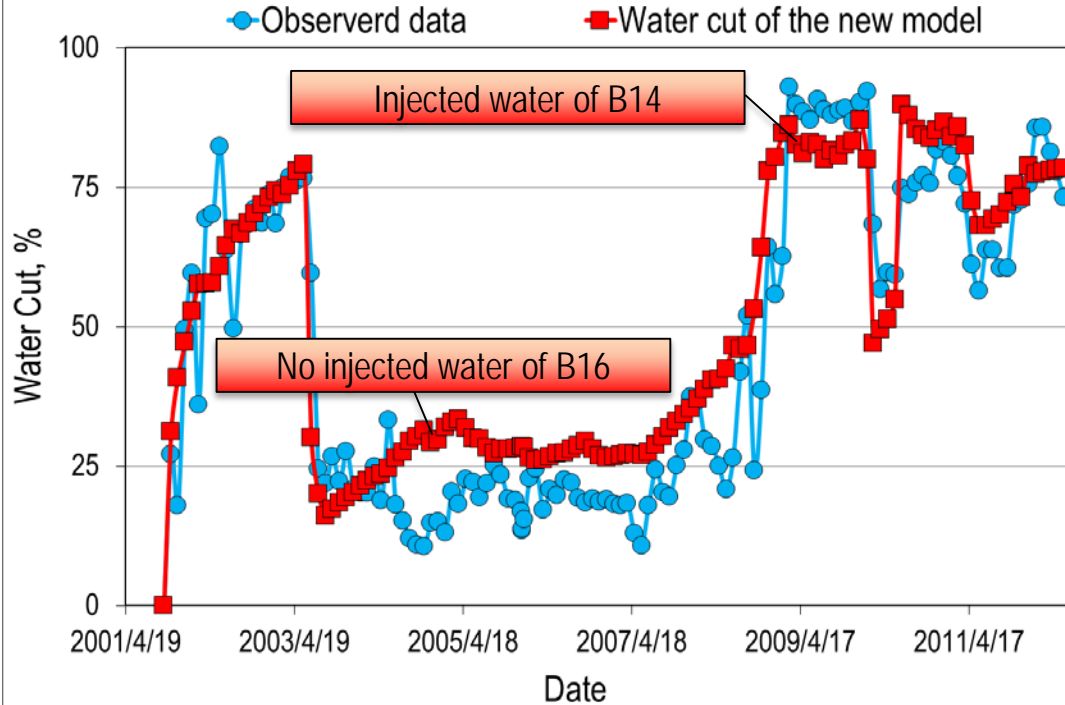
Application of the New Method in Well Group B20





Result of the New Method in Well Group B20

Water cut of the well B20

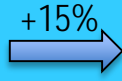




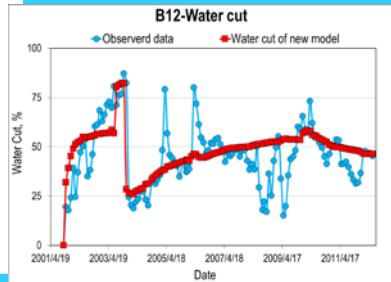
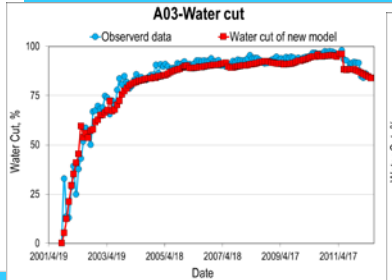
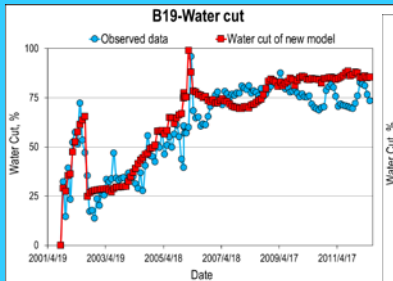
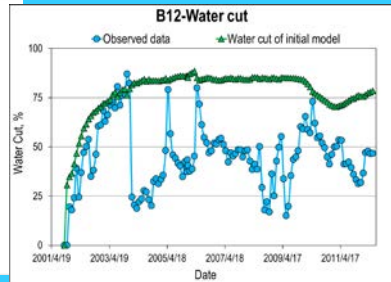
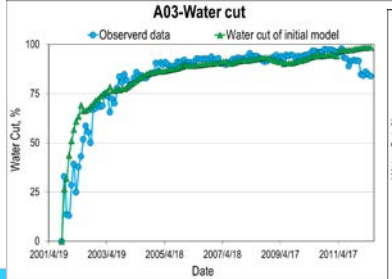
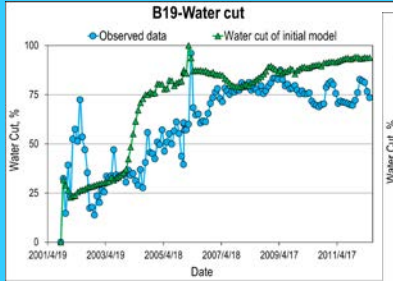
Application of the New Method in North Area of QHD32-6 Oilfield

History Matching of Water Cut

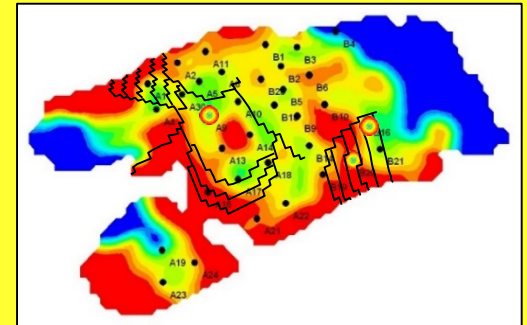
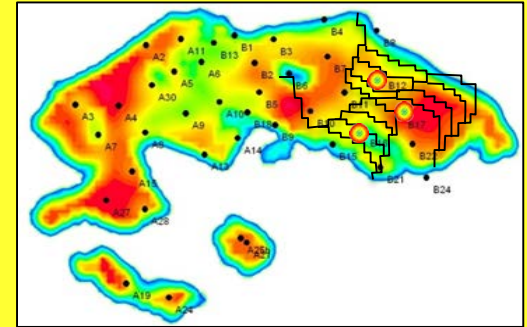
76%



91%



New Remaining Oil Distribution

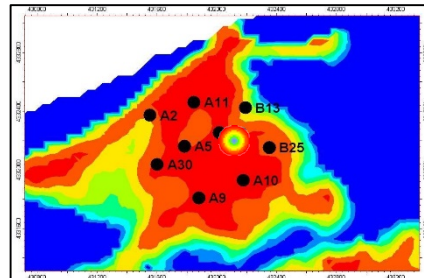
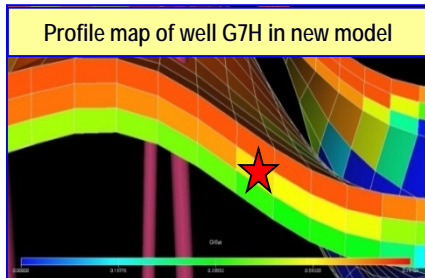
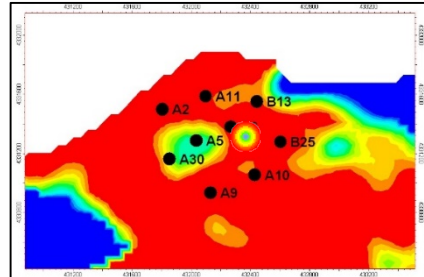
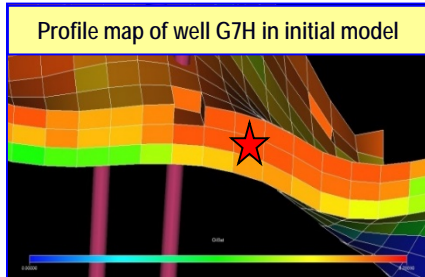




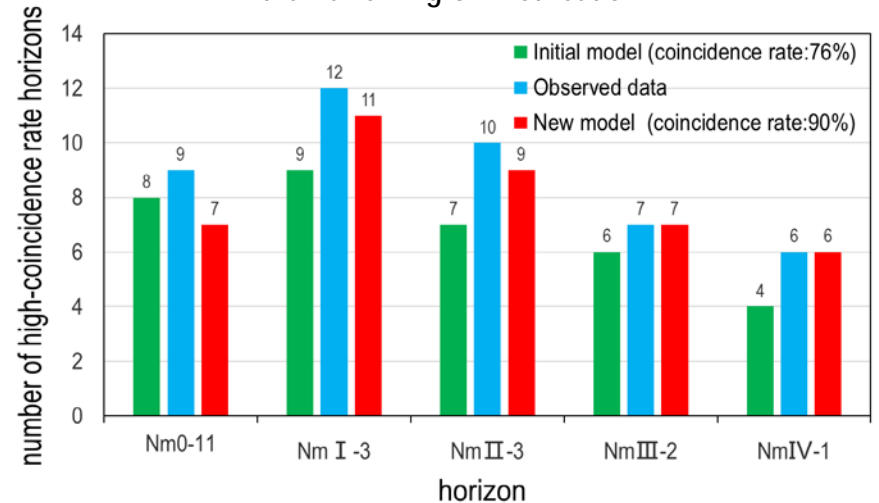
Verification by New Adjusting Well

The Log Interpretation of Water Flooded of New Adjusting Well G7H

Vertical depth(m)	1145.92-1146.92	1146.92-1148.42	1148.42-1150.82
log interpretation of water flooded	weak	middle	serious
Initial model	weak	weak	middle
New model	weak	middle	serious



The Coincidence Rate between the Log Interpretation and the Remaining Oil Distribution





Summary

1

In meandering stream deposit, the lateral accretion surface which has poor permeability takes an important influence on fluid flow, and it plays an important role in distribution of remaining oil.

2

There are several limitations by using conventional method (LGR), which were broke through by using **Equivalent Characterization Method**.

3

It is verified that the new model increased coincidence rate of history matching and accuracy of remaining-oil distribution by actual application.

4

The Equivalent Characterization Method can not only describe the lateral accretion surfaces, but also be widely used to describe the interface of various genetic sand bodies.



Acknowledgements

To Schlumberger & CNOOC:

Thank you for this precious opportunity!

To Schlumberger:

Thank you for your rapid, comprehensive and detailed technical guidance over years!

To myself:

Thank my own courage!

To you:

Thank you for your listening!

Thank you !

