

## Global History Matching

Ghis™ (Global History Matching) plug-in for Petrel\*, is a powerful and flexible tool to optimize many reservoir engineer problems. The optimizer is a global optimization method: CMA-ES (Covariance Matrix Adaptation – Evolution Strategy). The algorithm used is known as one of the most efficient for strongly nonlinear problems and as one of the best metaheuristics for continuous problems.

Ghis™ can be used for many workflows: Well Placement Optimization, Field Development Scheduling, History Matching with Multiple Models, Global Optimization of Oil Production Systems, Screening and Designing Improved Oil Recovery Methods.

Since the above Reservoir Engineering procedures require a large number of reservoir simulation runs which can result in a large computational effort, Ghis™ can be used with different proxies (cf. Sirenn™) to accelerate the optimization.

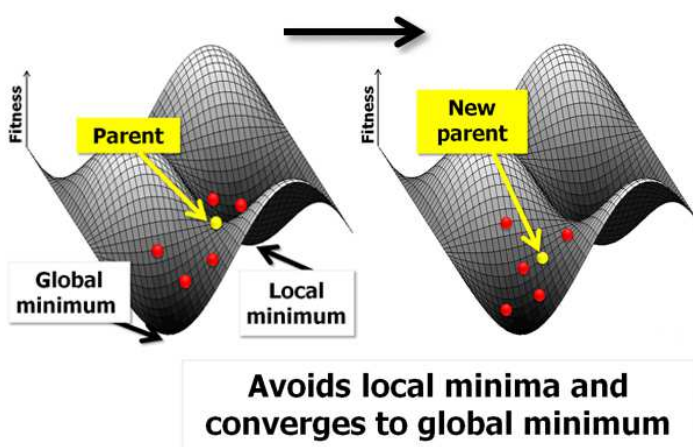
Global optimization methods are the best suited approach as they are very well adapted to resolve nonlinear phenomena. Ghis™ shows its superiority knowing that the cost in terms of number of evaluations of the objective function is similar or less than local optimization methods (gradient base methods).

The strengths of this plug-in are many, Ghis™:

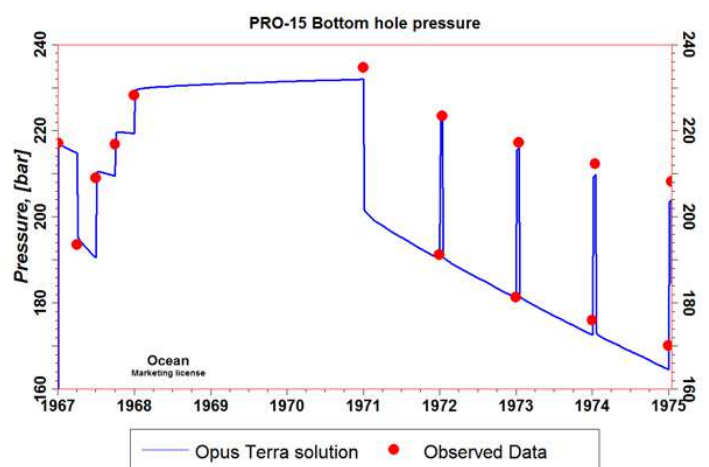
- provides more accurate solutions than local optimizer;
- is fully integrated in Petrel (just adding a task in the "Uncertainties & Optimization" process);
- is fully parameterizable (population size, parent size, termination criteria, etc.).

As with any other optimizer in Petrel's Uncertainty & Optimization workflow, Ghis™ can be used with different simulators or with proxies (cf. Sirenn™) to accelerate the optimization.

Ghis™ allows bypassing time consuming reservoir simulations, only one optimization performed by Ghis™ is necessary when a local optimization method requires several optimizations to obtain an acceptable solution.



**An illustration of the CMA-ES.** Skips local minima and converges to global minimum



**Data Match.** Production data generated from model realizations based on an optimizer solution.

\* mark of Schlumberger