Geological realization screening using Python script for reservoir simulation: first results of application on Mittelplate simulation model

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The Mittelplate oilfield is Germany's largest and most productive oil field, on-stream since 1987, located in the national park and UNESCO World Heritage Wadden Sea – the tidal flats of the Elbe Estuary. The oilfield is producing from four reservoirs – the Jurassic Dogger Beta, Gamma, Delta and Epsilon sandstone – with currently 27 production wells (offshore & onshore) and 10 injection wells (offshore). Reservoir simulation models have been conducted to ensure applicable production forecast and determine optimal development concepts. Although after more than 35 years of production, different parts of the reservoir zones still exhibit uncertainties that have strong influences on the dynamic behaviors.

In order to represent the uncertainties, more than hundred geological realizations were initially created based on geostatistical algorithm. However, it is usually very time-consuming to run all the realizations and thus very challenging to finalize the dynamic modeling process within tight time schedule. Therefore, as a reservoir engineer, how to select representative geological realizations before implementing reservoir simulation, becomes one important question to be answered.

This presentation will provide you an insight of first python application results on screening 50 geological realizations for Mittelplate reservoir simulation. Python scripts have been applied to generate distance matrix, which describes how similar two realizations are in terms of critical geological properties. The distance matrix is then used to map all geological realizations into a Euclidean space, using a so-called multidimensional scaling technique. A small sub-set of representative realizations are selected using python script of kernel k-means clustering algorithm. Finally, only the selected representative realizations will be conducted for reservoir simulation instead of the full set of geological realizations. This will reduce the computation time significantly. This python application on geological realization screening supports reservoir engineers to find good starting realizations to proceed with the comprehensive history matching process.