Case Study:

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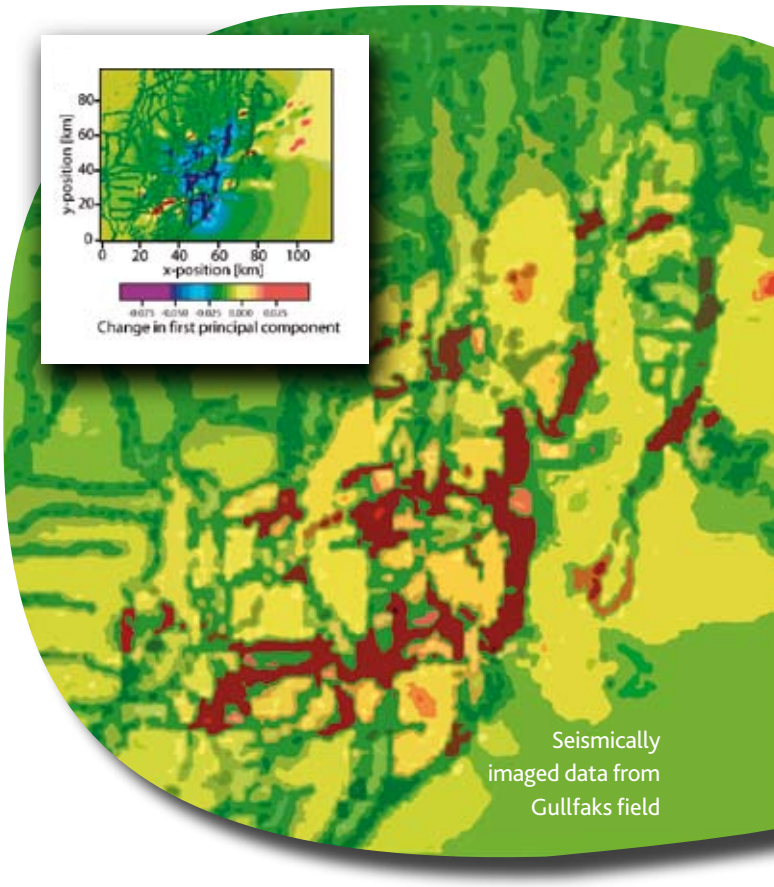
COFFERS

Calibration of Faults and Fractures Extracted from Rate Statistics

The University of Edinburgh, in collaboration with VIPS (now Schlumberger Reservoir GeoMechanics Center of Excellence) and Reservoir Dynamics Ltd., have successfully developed a state-of-the-art forecasting technique to provide independent information about well connectivity to complement existing reservoir models. With support from ITF, COFFERS (Calibration of Faults and Fractures Extracted from Rate Statistics) is now in the initial stages of commercialisation.



Seismically imaged data from Gullfaks field

The Requirement:

Structurally complex reservoirs present many challenges to reservoir engineers, such as establishing well connectivity which can be of hydraulic and/or geo-mechanical origin. There was a need for models to help optimise injection strategies for mature assets, and a growing interest in the influence of near-critical faults and fractures and how these may be affected by pore-pressure or temperature changes over a field's lifetime.

The Solution:

The COFFERS project was funded following submission to an ITF call on Structurally Complex Reservoirs in 2001. The funding allowed the University of Edinburgh, in collaboration with VIPS, and Reservoir Dynamics Ltd., to develop (i) a Statistical Reservoir Model (SRM) to look at flow-rate correlations between injectors and producers in two oilfields and (ii) geo-mechanical models with which to explain the correlations. In addition, a trial user-friendly SRM code was provided as an additional deliverable to sponsors to prove the potential for commercialisation.

Implementation:

Since the SRM requires only existing historical production and injection data, the additional overheads for operators are minimal. In the two test cases, correlations in observed flow-rates were generally consistent with simulations from the geo-mechanical models with near-critical stresses, and displayed associations with faults and fractures via Principal Component Analysis (see figure). Reservoir engineers can utilise this new and independent information, particularly where observations are inconsistent with conventional models.

The Method:

The SRM uses a two-stage filter to identify the most significant flow-rate correlations that together provide a good history-match for any well in a field. Given steady operating conditions, these can then be used to forecast the production rate up to three months ahead. The forecast depends partly on future injection rates, enabling different scenarios to be tested. The method can be used to improve reservoir description, to identify geo-mechanical effects and to inform on infill well placement.

The Outcomes:

Following the success of COFFERS, the partners have now completed a further set of five North Sea field trials in the RESURGE project, part-funded by the UK Technology Strategy Board. The team are now working on wider commercialisation of the software and have completed their first North Sea commercial contract and have been invited to tender for a second. A modification to the technique to identify reservoir compartments is the subject of a current proposal (SPARC) to ITF.

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