

SPE APPLIED TECHNOLOGY WORKSHOP

**Use of 4D Seismic and Production Data for History Matching
and Optimization – Application to Norne (Norway)**
14-16 June 2011, Trondheim, Norway

Summary REPORT

August 2011

Background

The IO Center through its program 2.1 under the Norne pilot project in conjunction with the Society of Petroleum Engineers (SPE) organized an applied technology workshop on the use of Norne data. The workshop attracted 80 delegates and international speakers from more than ten countries all over the world, namely United States of America, Saudi Arabia, Netherlands, Brazil, Denmark, Angola, Nigeria, United Kingdom, Russia, India, and Norway.

The uniqueness of this workshop was that it addressed for the first time a comparative case study that uses real field data that includes time lapse seismic data. The purpose of reservoir management is to control operations to maximize both short and long term production. This consists of life-cycle optimisation based on reservoir model uncertainties together with model updating by production measurements, time-lapse seismic and other available data. Time-lapse seismic data helps to determine reservoir changes that occur with time and can be used as a new dimension in history matching since it contains information about fluid movement and pressure changes between and beyond the wells. In this course the workshop was designed to address how can we process and use the huge amount of information in an efficient way and ensure that the reservoir models are kept up to date and consistent with the data.

History matching methods are being developed through both field-specific studies and methodological research. The workshop provided an opportunity to address the state of the art technologies within the area of optimisation, focusing both on production history and 4D seismic and the interplay between these two diverse types of data. The workshop was a success with active discussion and contributions from the beginning to the end.



Figure 1: Q & A in one of the sessions (with the microphone is David E. Ciaurri –IBM)

Sessions in the Norne SPE ATW

The structure of the meeting was quite impressive with five different sessions, out of which two are considered the main ones,

- The Norne First Comparative Case Study and
- Similar Case Studies

The Norne First Comparative Case Study – E segment

The exercise was defined six months prior to the workshop on History Matching and EOR optimization using both production and time lapse seismic data. Participants to this case study were from different universities and in collaboration with other research organizations namely Stanford University in collaboration with IBM and Chevron, TU Delft in collaboration with TNO, Texas A&M University and NTNU in collaboration with Sintef. The following is the list of the given presentations

- Amit Suman, Stanford University - Joint Inversion of Production and Time Lapse Seismic Data of Norne Field
- Drosos Kourounis, Stanford University -Adjoint Gradient-Based Optimization of the Norne Benchmark Case Using Eclipse and ADGPRS
- Slawomir Szklarz and Lies Peters, TU Delft/TNO - History matching of the sector of Norne Field using Ensemble Kalman Filter
- Eric Bhark, Texas A&M - Multiscale Parameterization and Streamline-Based Integration of Production and 4D Seismic Data for Production Optimization: Norne Field E-Segment

- Ola T Miljeteig & Anass Ammah, NTNU - Using Production and 4D Seismic Data for History Matching and EOR Optimization on the Norne Field

Similar Case Studies

While the primary focus of the ATW was the Norne Field, we focused in this session on real case applications of Closed-Loop Reservoir Management to other field cases. Specific attention was given to the way 4D seismic data is incorporated. The presentations formed the basis for an open discussion on how different companies apply history matching and optimization techniques to enhance the value of their assets.



Figure 2: Concluding Remarks, Left workshop chairman Prof. Jon Kleppe - NTNU and right standing workshop co-chairman Lars Høier – Statoil.

Future Plans SPE ATW

1. Time Plan Adjustment, for the future comparative case study more time is needed; duration of one year will be considered.
2. A panel of experts will be formed to prepare and monitor a new Norne comparative case study in Feb. 2012.
3. The next case may be developed as a business case. NTNU, Stanford University and TU Delft can collaborate in formulating the coming case study.
4. The use of seismic data in this case was not as expected; we need more use of seismic data qualitatively and quantitatively in future cases.
5. The next workshop will be in June 2013. Thus the required data should be released in May 2012.

6. The next workshop to include sessions on the use of seismic data for closed loop reservoir management.

7. Meetings with SPE and committee members to start in October 2011.

All workshop presentations can be obtained at our website www.ipt.ntnu.no/~norne and then Norne events.