Integration of uncertain well data for seismic reservoir characterization

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Summary

- Motivation
- Methodology
- Real Case Application
- Conclusions
Motivation
**Methodology**

**Stochastic sequential simulation with point distributions**

1. **Stochastic Simulation of AI from well-log data (DSS)**
2. **Convolution**
3. **Synthetic seismic**
4. **Real seismic**
5. **compare seismic**
6. **select best local correlation**
7. **Local correlation**
8. **Best AI mode**
9. **Iterate until a given global correlation coefficient is reached.**
10. Use local correlation and Best AI for co-simulation.

Diagram: Graphical representation of the simulation process.
Real Case Application

Case Study Dataset

- Simulation grid size: 840x567x49;
- 6 available wells with Ip logs;
- Post-stack seismic reflection data (fullstack).
Real Case Application

(Global Stochastic Inversion Tests)

Tests with hard-data
- TEST 1: GSI without point distributions
- TEST 2: Bayesian inversion (low variability)
- TEST 3: Uniform distributions
- TEST 4: Bayesian inversion (high variability)

Tests without hard-data
- TEST 1: GSI without point distributions
- TEST 2: Bayesian inversion (low variability)
- TEST 3: Uniform distributions
- TEST 4: Bayesian inversion (high variability)

Multidimensional scaling

GSI with point distributions
Real Case Application

(GSI Tests with HD)

Results display scale: (6000-18000 kPa.s/m)

Well 4

<table>
<thead>
<tr>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 3</th>
<th>Test 4</th>
<th>Caliper</th>
<th>Ip HD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>[SSTVD]</td>
<td></td>
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</tbody>
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Test 1
Test 2
Test 3
Test 4
Caliper
Ip HD

[Graph and chart data]

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Real Case Application
(GSI Tests with HD)

Well 4

MDS Space

- Test 1 - Without point distributions
- Test 2 - Bayesian low variability
- Test 3 - Uniform distributions
- Test 4 - Bayesian high variability
- P50 - Test 1
- P50 - Test 2
- P50 - Test 3
- P50 - Test 4
- Real
Real Case Application

(GSI Tests without HD)

Results display scale: (6000-18000 kPa.s/m)

Well 4

<table>
<thead>
<tr>
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</table>
Real Case Application

(GSI Tests without HD)

Well 4

MDS Space

- Test 1 - Without point distributions
- Test 2 - Bayesian low variability
- Test 3 - Uniform distributions
- Test 4 - Bayesian high variability
- P50 - Test 1
- P50 - Test 2
- P50 - Test 3
- P50 - Test 4
- Real
Real Case Application

(GSI Tests with HD)

Results display scale: (6000-18000 kPa.s/m)

Well 5

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</table>

Test results and analysis for Well 5, showing data across various tests with different scales and measurements.
Real Case Application
(GSI Tests with HD)

Well 5

MDS Space

Test 1 - Without point distributions
Test 2 - Bayesian low variability
Test 3 - Uniform distributions
Test 4 - Bayesian high variability
P50 - Test 1
P50 - Test 2
P50 - Test 3
P50 - Test 4
Real
Real Case Application

(GSI Tests without HD)

Results display scale: (6000-18000 kPa.s/m)

Well 5

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</tbody>
</table>
Real Case Application

(GSI Tests without HD)

Well 5

MDS Space
Real Case Application

(GSI Tests with HD)

All Wells (6)

MDS Space
Real Case Application

(GSI Tests without HD)

All Wells (6)

MDS Space
Conclusions

- The stochastic sequential simulation with point distributions:
  - allows the integration of uncertain experimental data and the estimation of the petro-elastic properties measured along the well path;
  - offers a better alternative for accounting for the collapsed sections uncertainty compared to removing those sections;
  - provides a framework to add information at the problematic zones and a better guide of the inversion procedure near the wells.

- The inclusion of uncertainty on the experimental data increases considerably the exploration of the model parameters space, reducing the uncertainty of the properties at the well-logs.
Thanks for your attention

QUESTIONS?