

Comparison of Seismic Inversion Methods on a Single Real Data Set

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Contents

Preface	<i>v</i>
1. A data set for evaluating and comparing seismic inversion methods <i>R. G. Keys and D. J. Foster</i>	1
2. A numerical study of linear viscoacoustic inversion <i>J. O. Blanch, W. W. Symes, and R. J. Versteeg</i>	13
3. AVO inversion of a Mobil data set <i>A. Buland and M. Landrø</i>	45
4. AVO migration/inversion analysis <i>C. Hanitzsch, D. Marion, A. Tura, W. B. Beydoun, D. Jizba, S. Jin, and B. Fredier</i>	57
5. Amplitude-preserved processing and analysis of the Mobil AVO data set <i>D. E. Lumley, D. Nichols, C. Ecker, T. Rekdal, and A. Berlioux</i>	75
6. A comparison of AVO analysis techniques <i>J. E. Malloy, K. L. Woller, and D. D. McAdow</i>	97
7. Trace inversion of North Sea test line with interpretive directions <i>N. S. Neidell, R. P. Mullin, M. Smith, and E. E. Cook</i>	115
8. DELPHI stepwise approach to AVO processing <i>D. J. Verschuur, A.-J. van Wijngaarden, and R. Alá'i</i>	139
9. AVO analysis of Mobil offshore data by linearized inversion in the τ-p domain <i>G. Xia, M. K. Sen, and P. L. Stoffa</i>	165
10. Rock/fluid properties and their effects on seismic responses <i>C.-S. Yin, M. L. Batzle, and C. C. Mosher</i>	185

Preface

When it first was proposed to the Society of Exploration Geophysicists Research Committee, the workshop titled "Comparison of Seismic Inversion Methods on a Single Real Data Set" was intended to be a forum for comparing and discussing seismic inversion methods. A unique aspect of the workshop was its focus on a single field data set that included both seismic and petrophysical measurements. The petrophysical data included measurements of compressional wave velocity, shear wave velocity, and density. These measurements were acquired in two wells that intersected the seismic line. It was our belief that with well-log measurements of the key elastic properties, the accuracy of seismic inversion methods could be confirmed. We did not impose any restrictions on the type of methods that workshop participants could apply to the data set. We wanted to encourage new ideas about the use of seismic inversion or AVO methods for detecting hydrocarbons.

The workshop met in Los Angeles on October 28, 1994, following the 64th SEG International Exposition and Annual Meeting. The papers presented at the workshop covered a broad range of topics related to seismic inversion and the prediction of rock and fluid properties from seismic data. Nine of the papers presented at the workshop are included in this volume.

This workshop was an experiment. As is often the case with experiments, the outcome was different from the expected result. A natural expectation was that, by using a common data set, the workshop would expose the best method for detecting hydrocarbons with seismic data. The flaw in this expectation is the assumption that seismic exploration, or even the seismic inverse problem, is a single, well-defined problem. Some indication of this fact was evident from questions we received prior to the workshop. We observed that some participants were fo-

cused on seismic data processing problems, while others were primarily interested in addressing petrophysical issues. Participants were taking a multidisciplinary approach to the workshop. When the workshop convened in October 1994, it was clear that there is no unique or best approach to the seismic inverse problem.

An indication of the diversity in this workshop can be found in Tables 1 and 2. Table I shows the topics addressed by each workshop paper. The numbers at the top of Table 2 refer to workshop presentations listed in Table II. General areas are highlighted with bold text in Table 1, and subtopics are listed below the major topics. A check mark is assigned to a topic if that topic was a major issue addressed by the paper. As the tables show, "seismic inversion" covers a lot of territory.

The lesson we learned from this workshop is that the exploration problem requires the integration of many different technologies. Techniques are important, but not as important as the proper and appropriate use of those techniques. Exploration success is more likely to follow from the effective integration of these different technologies to obtain a consistent explanation of the observed geologic, petrophysical, and geophysical data. The workshop participants provided a valuable service by demonstrating the diversity of tools that geoscientists can use to solve exploration problems.

The articles in this volume represent a technology baseline against which other methods can be compared. Since the workshop data set is in the public domain, readers can apply their own methods to the data and compare their results with the results of the workshop participants. At the time of this writing, the data set can be obtained from Oil Data Inc., 1888 Stebbins Dr., Houston, Texas 77043-2809.

Keys and Foster

Table 1. Topics covered by papers in this volume resulting from presentations at the 1994 SEG Post-Convention Workshop on "Comparison of Seismic Inversion Methods on a Single Real Data Set." Presentation numbers refer to papers listed in Table 2.

Topics	Presentation No.								
	1	2	3	4	5	6	7	8	9
Geology						√			
Regional Geology						√			
Seismic Interpretation						√			
Inversion	√	√	√	√	√	√	√	√	
Poststack (Trace Inversion)						√			
Prestack Inversion(Linear)	√		√	√	√		√	√	
Prestack Inversion (Nonlinear)		√							
True Amplitude Processing			√	√	√		√	√	√
Multiple Suppression			√	√			√		√
Source/Receiver Corrections				√					√
Migration			√	√	√				
Wave Propagation	√	√					√	√	
Viscoacoustic Media	√								
Attenuation	√	√							
Thin Bed Effects/Tuning									√
τ -p Domain	√	√					√		
Forward Modeling	√	√							
Rock Properties			√		√		√		√
Fluid Substitution									√
Log Calibration			√		√				
AVO	√	√	√		√		√	√	√
AVO Methods/Processing		√	√	√	√		√	√	√
Hydrocarbon Indicators			√	√			√	√	
VSP							√		

Preface

Table 2. A list of presentations at the 1994 SEG Post-Convention Workshop on “Comparison of Seismic Inversion Methods on a Single Real Data Set” for which papers in this volume were written. Presentation numbers in this list can be used with Table 1 to obtain information about the content of each paper. The papers are listed alphabetically by author.

1. Blanch, J. O., Symes, W. W., and Versteeg, R. J., A numerical study of linear viscoacoustic inversion
2. Buland, A., and M. Landrø, AVO inversion of a Mobil data set
3. Hanitzsch, C., Marion, D., Tura, A., Beydoun, W. B., Jizba, D., Jin, S., and Fredier, B., AVO migration/inversion analysis
4. Lumley, D. E., Nichols, D., Ecker, C., Rekdal, T., and Berlioux, A., Amplitude-preserved processing and analysis of the Mobil AVO data set
5. Malloy, J. E., Woller, K. L., and McAdow, D. D., A comparison of AVO techniques
6. Neidell, N. S., Mullin, R. P., Smith, M., and Cook, E. E., Trace inversion of North Sea test line with interpretive directions
7. Verschuur, D. J., van Wijngaarden, A.-J., and Alá'i, R., DELPHI stepwise approach to AVO processing
8. Xia, G., Sen, M. K., and Stoffa, P. L., AVO analysis of Mobil offshore data by linearized inversion in the τ - p domain
9. Yin, C.-S., Batzle, M. L., and Mosher, C. C., Rock/fluid properties and their effects on seismic responses

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