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David Fuentes

Bill Menke

Charlotte Rhoads
Does Supplementing Travel Time Data with Amplitude Data improve Geo-tomographic Determinations of Earth Structure?

Charlotte Rhoads¹, Dr. William Menke²
¹Vassar College, ²Lamont-Doherty Earth Observatory of Columbia University

Yes, the addition of amplitude data can substantially improve Earth images in a broad range of studies.
Can Earthquakes be Induced by Thermal Expansion or Chemical Expansion Affecting Stress in the Earth?

David Fuentes¹, Dr. William Menke²
¹City College, ²LDEO

Earth Model

Coulomb Fracture Criteria

Yes, it is possible.
Does Supplementing Travel Time Data with Amplitude Data Improve Geo-tomographic Determinations of Earth Structure?

Charlotte Rhoads¹, Dr. William Menke²
¹Sasun College, ²Columbia University

1. Abstract

1.1. Introduction

In this study, novel geophysics imaging methods are employed to demonstrate the potential of using amplitude data in conjunction with travel time data to improve the resolution of tomographic images.

1.2. Methodology

The method involves a hybrid approach that combines travel time data with amplitude data. This approach allows for a more accurate determination of the Earth's internal structure.

1.3. Results

1.3.1. Image Quality Improvement

The results show a significant improvement in image quality when amplitude data is incorporated into the data assimilation process. The images produced with the new method are sharper and more detailed than those produced with traditional travel time data alone.

1.3.2. Earth Model Reconstruction

The improved image quality allows for a more accurate reconstruction of the Earth's internal structure, providing valuable insights into the dynamics of the Earth.

1.4. Conclusion

The integration of amplitude data with travel time data significantly enhances the resolution of geo-tomographic images, offering a more comprehensive understanding of the Earth's internal structure.

2. Methods

2.1. Data Collection

The study utilizes a combination of seismic and geophysical data to create a comprehensive dataset for analysis.

2.2. Image Processing

Advanced imaging techniques, including seismic tomography, are employed to process the collected data and enhance the resolution of the resulting images.

2.3. Data Analysis

Statistical methods are applied to evaluate the effectiveness of the new imaging approach, comparing it with traditional methods.

3. Results

3.1. Image Quality Analysis

The new method produces images with higher resolution, allowing for a more detailed depiction of the Earth's internal structure.

3.2. Earth Model Validation

The improved images are validated against known geological data, demonstrating the method's accuracy.

4. More Results

Further experiments and simulations support the findings, highlighting the potential of the new method in various applications.

5. Analysis

5.1. Comparison with Traditional Methods

The new method shows a significant improvement over traditional approaches, particularly in resolving fine-scale structures.

5.2. Future Directions

Future research will focus on refining the method and expanding its applications to other geological features.

References

Can earthquakes be induced by thermal expansion or chemical expansion affecting stress in the earth?

David Fuentes¹, Dr. William Mentie²
NJIT College of Science
Columbia University

Abstract

The CPG is used to assess whether or not earthquakes occurring in the shallows of the eastern United States have a relationship to the thermal activity of the mantle. The hypothesis is that the lower crustal volume changes are produced by chemical alteration.

A suite of different shapes are simulated using a 3D finite difference method finding that the strongest effects are produced by a chimney-shaped hydrous fault.

The overall effect of the chemical alteration is to lead to patterns of seismicity that are spatially very heterogeneous which shows some similarity with the actual pattern of seismicity observed in New England.

References


Methodology

- Simulated mechanics in the Earth's mantle and faulted earthquakes were performed.
- The model uses a 3D finite element method.
- The source of stress was a sequence of frictional, creep, and thermal effects.
- The chemical reactions were determined to determine whether stress changes occurred in the mantle.

Results

- Different combinations of stress and strain were inputted as thermal effects.
- The chimney shape and surrounding environment were found to be the strongest stress changes.
- The results are consistent with the actual pattern of seismicity observed in New England.

Effects of Other Shapes

- In other cases, shapes were simulated. It was found that the chimney shape was the most effective in producing the stress changes.
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Summary of Results

- The chimney shape is the most effective in producing the stress changes.
- The results are consistent with the actual pattern of seismicity observed in New England.

Acknowledgments

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