

Integration of Surface Seismic with Geo-electric Data (Seismic Refraction)



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Senior Project

OUTLINE

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- ▶ FIELD GEOMETRY
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INTRODUCTION

- ▶ With the help of Schlumberger we were going to make our senior project an “Integration of Surface Seismic with Geo-electric data”
- ▶ From this we would like to accomplish:
 1. Acquiring as much knowledge about the subsurface.
 2. See the relation between Refraction and Geo-electric method.

LOCATION

- ▶ The area that we agreed on doing the experiment in, is Dhahran Techno Valley.
- ▶ It lies over the proven Dammam reservoir.
- ▶ By knowing the weathering layers properties over this region it could help in reflection seismic “static correction”.



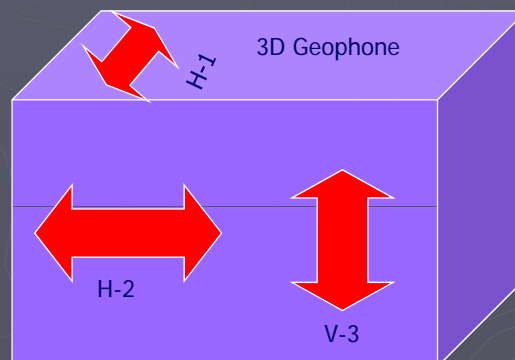
Seismic Equipment

- ▶ The Seismic acquisition machine is “Geometrics”
- ▶ Connecting Cables
- ▶ Geodes.
- ▶ 32 3D Geophones.

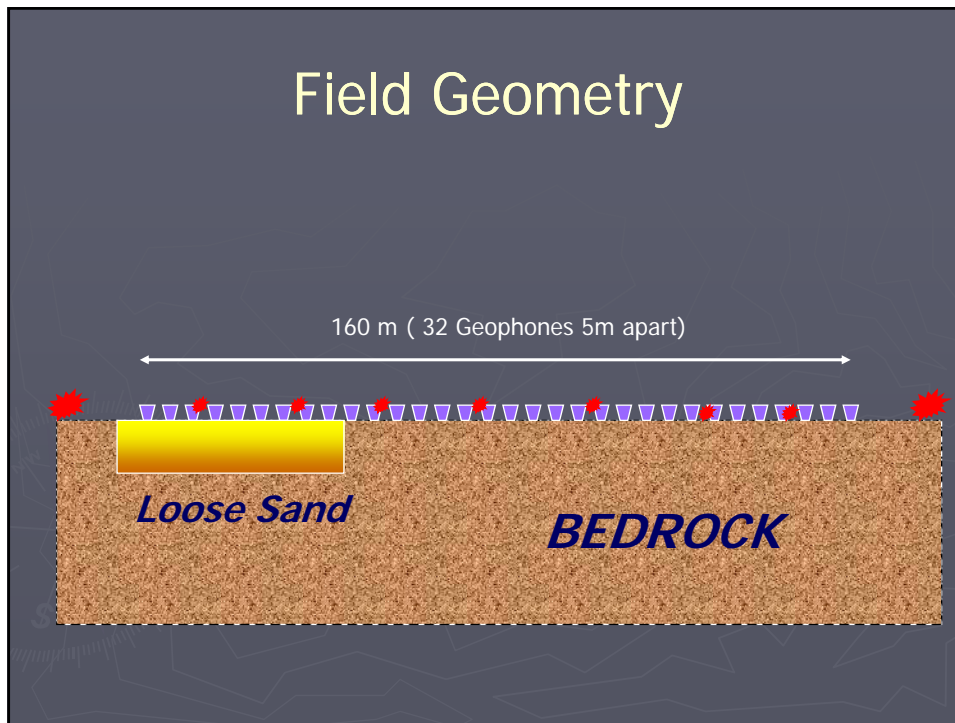


3D Geophones

- ▶ Records particle velocity in 3 directions.

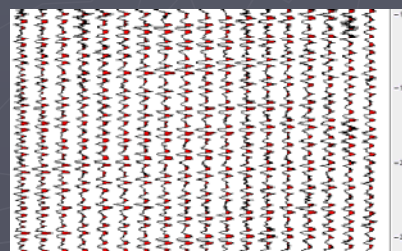
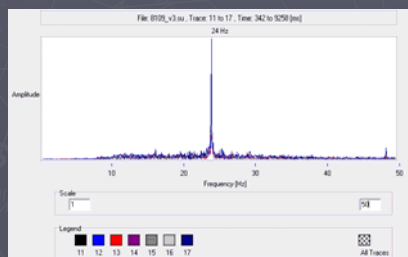


Field Geometry



Noise Analysis

- ▶ Before any shots are recorded noise analysis has to be done for QC.
- ▶ We noticed a very noisy source that distorted the data.

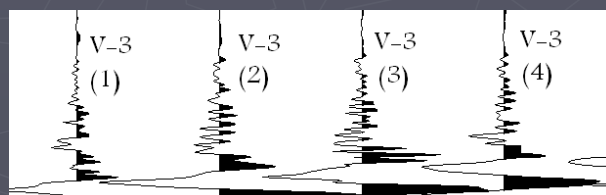
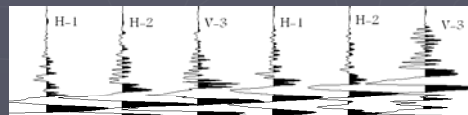


Noise Analysis



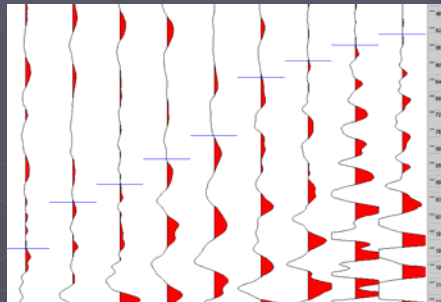
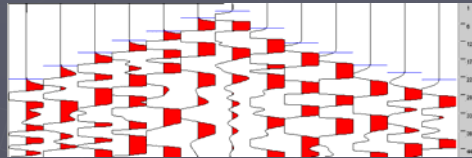
Pre-Processing

- ▶ The 3 component data was recorded using 1 profile, hence we got 96 traces in each record.
- ▶ Before any processing could take place we had to separate the H-1, H-2 components.
- ▶ Using VISUAL SUNT we successfully separated the components and got only the V-3 component.



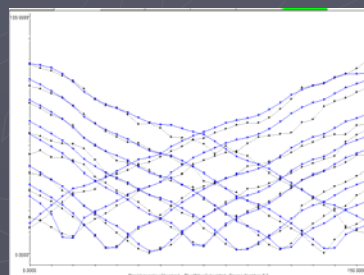
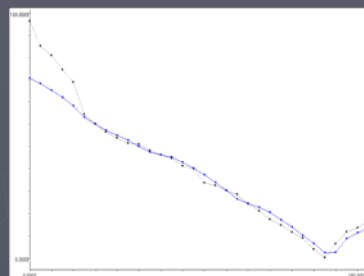
Processing

- ▶ Then next was to pick the first breaks.
- ▶ Using SeisOPT Picker we were able to get the first arrivals.
- ▶ It was difficult to find the first break when the shot was furthest from the sand.



Processing

- ▶ For modeling we used SeisOPT@2D
- ▶ Before modeling the data we had to check the first arrivals with respect to the other shots.



Interpretation

- ▶ First model that we obtain has its parameters automatically calculated.
- ▶ Then we run it 10 more times while changing 1 of the parameters.
- ▶ Finally we take the 3 least error models.

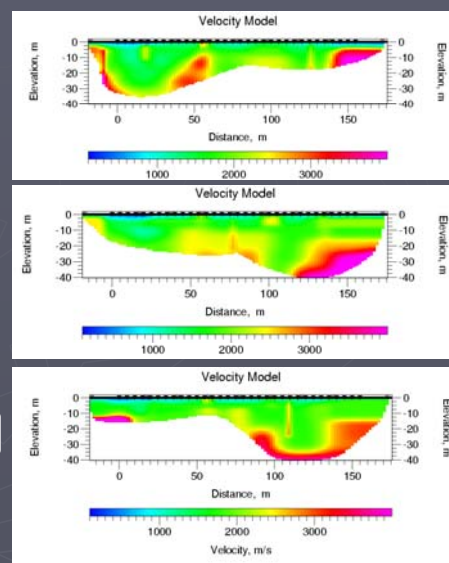
Interpretation

Best Models

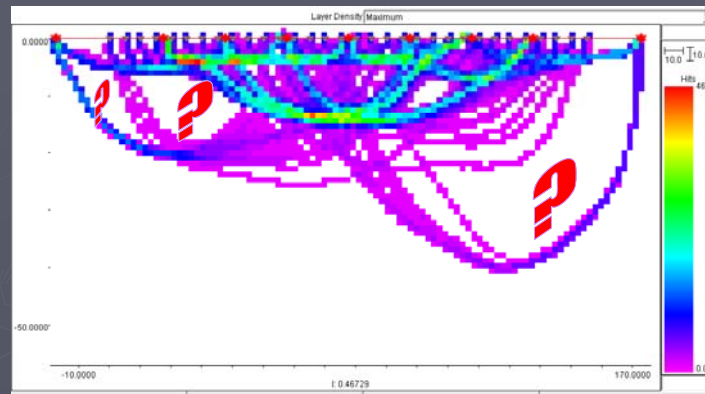
(a) Error: $4.872072e-006$

(b) Error: $5.523698e-006$

(c) Error: $4.934083e-006$

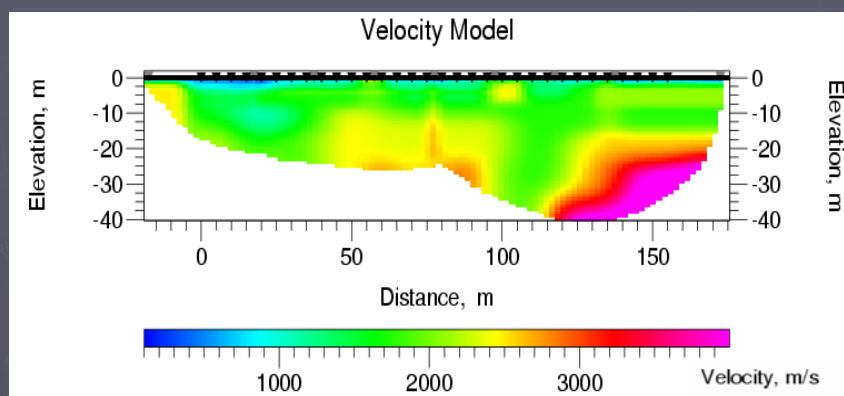


Interpretation



- ▶ Each model defines a certain area bounded by the ray paths.

Interpretation



Conclusion

- ▶ Using two geophysical methods proves to be very useful in interpreting the subsurface.
- ▶ The quality of the interpretation was affected by the field setup and geometry.
- ▶ There were many models but we chose the one that agreed with the surface geology seen during the acquisition phase.



Acknowledgments

