Preservation of AVO after Migration

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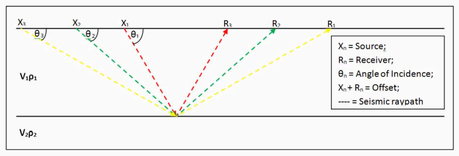
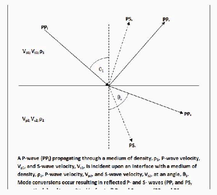
Objective

- **Purpose**: To determine quantitatively how seismic amplitudes are effected by
  - Types of Migration
  - Seismic Acquisition

Background

Amplitude depends on angle (offset) (Zoeppritz, 1919)



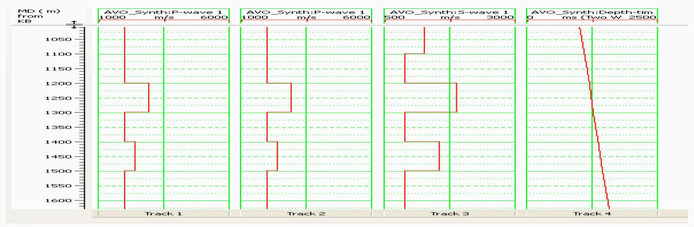


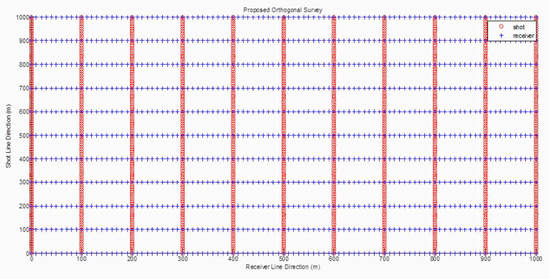
- Calculate reflection and transmission coefficients
- Simplifications (Shuey, 1985)
- **Advantage**:
  - Enhanced ability to determine hydrocarbon reservoirs

Data

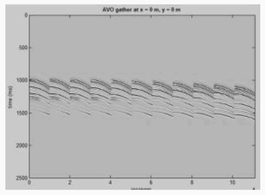
Table 1. Layer Parameters.

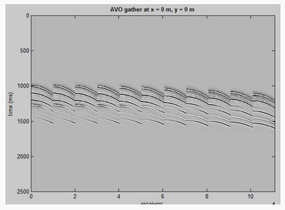
Class	α_1/[m/s]	β_1/[m/s]	ρ_1/[kg/m^3]	α_2/[m/s]	β_2/[m/s]	ρ_2/[kg/m^3]
1	2000	879.88	2400	2933.33	1882.29	2000
2	2000	879.88	2400	2400	1540.05	2000
3	2000	879.88	2400	1963.64	1260.04	2000
4	2000	1000	2400	1598.77	654.32	2456.43



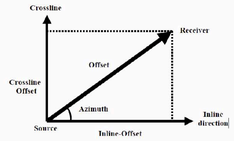


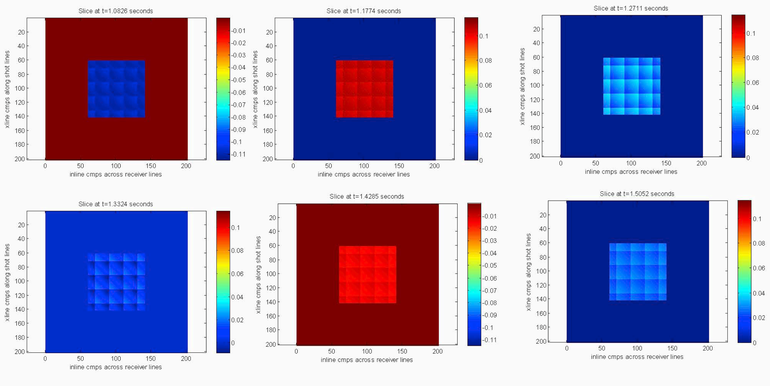
3D Shot gathers





3D COV gathers

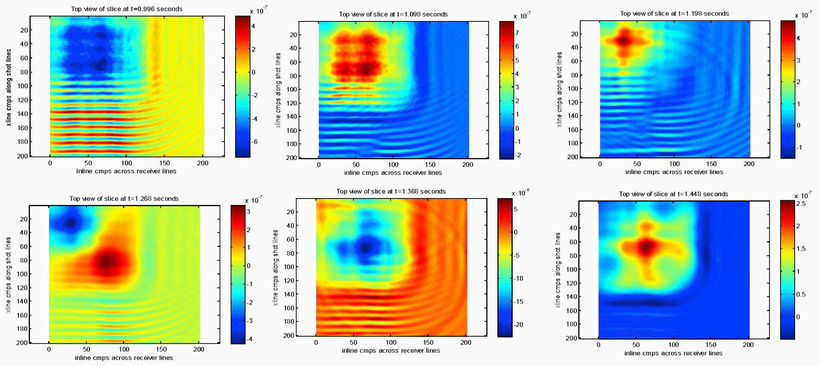




Migrations

3D Shot Migration Kirchhoff

$$\beta_1(\mathbf{y}) = \frac{y_3}{\pi c}\int d^2\xi \left[\frac{(r_s + r_g)\left((r_s)^2 + (r_g)^2\right)}{\left((r_s)^2(r_g)^2\right)}\right]\cdot \int i\omega d\omega e^{-i\omega[r_s + r_g/c]}u_s(\boldsymbol{x}_g, \boldsymbol{x}_x, \omega)$$



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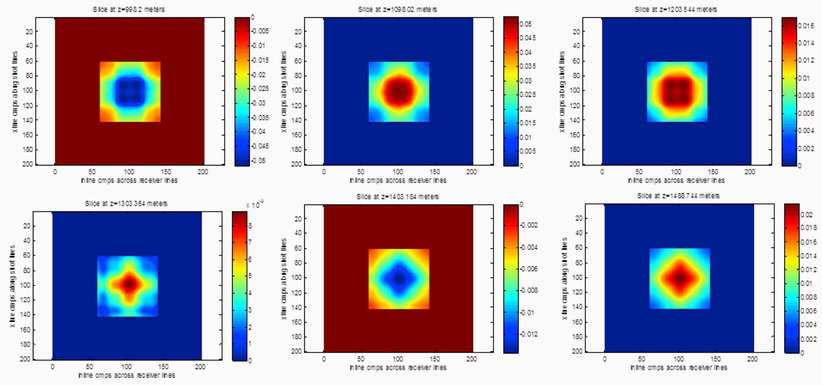
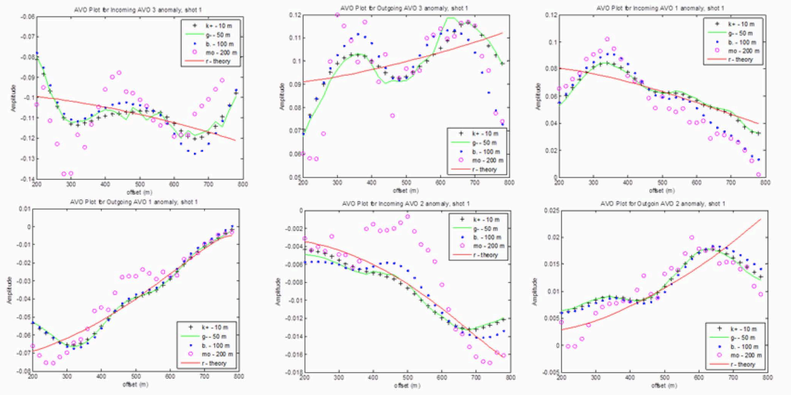


Results

- Zoeppritz plots of expected results and results of shot gather migrations



Conclusions

- Shot gather migrations confirm that amplitude preservation is a function of decimation
  - Need to do more analysis to quantify
- Need to reevaluate motivation and implementation for COV migrations

References

Bleistein. et. al., 2001, Mathematics of Multidimensional Seismic Imaging, Migration, and Inversion: Springer.

Cary, 1999b, 69th Annual International Meeting, SEG, Expanded Abstracts, 1496-1499.

https://commons.wikimedia.org/wiki/Amplitude_versus_Offset

Shuey, 1985., Geophysics, 50, p. 609-614.