

# Water Saturation Estimation

## Preliminary Field Application in Louisiana Shelf, GOM

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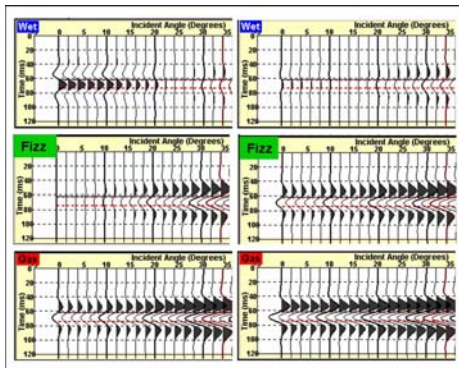
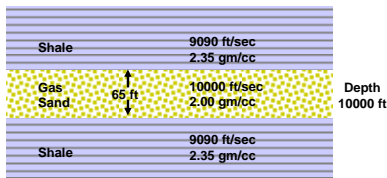
### Objective

The objective of this research is to differentiate **FIZZ** saturation from **GAS** saturation in the Louisiana shelf based on the pore-fluid and slope transforms derived from borehole data.

"Fizz" ⇒ Low gas saturation  
"Gas" ⇒ Economic gas saturation

### Introduction

The AVO responses for gas and fizz saturation based on the thin-bed model can be very similar with only a slight change in the rock properties. However, the down-dip water-saturated AVO response can assist in differentiating fizz from gas.

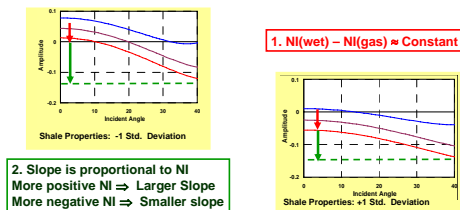


AVO synthetics. Left column are based on the original model. The right column are based on a model with shale velocity and density increased by one standard deviation.

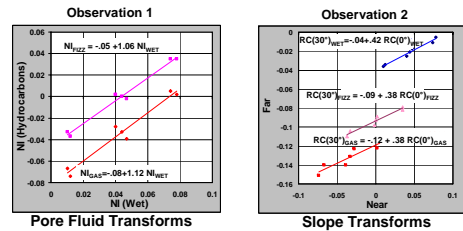
### Rock Property Transforms

The Zoeppritz curves illustrate that the magnitude of the reflection coefficient curves vary significantly when rock-property deviations are introduced. Note: (1) the differences NI(wet)-NI(gas) within a plot are relatively constant as depicted by the red arrows; (2) the slope is proportional to NI as depicted by the green arrows.

#### Two Observations



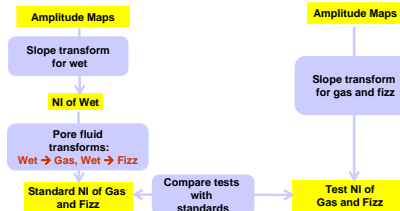
### Quantifying Local Reflectivity



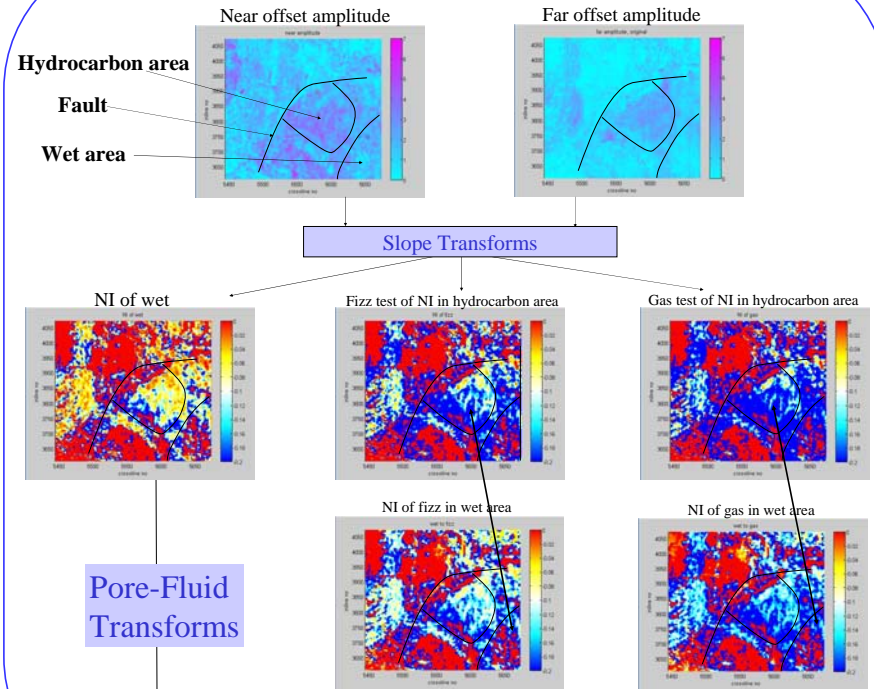
### Conversion of Amplitude into NI

$$NI = \frac{A(0^\circ) \cdot b0}{A(30^\circ)/\cos(30^\circ) - b1A(0^\circ)}$$

### Estimation steps



### Application of Transforms in Louisiana Shelf, GOM



Robust normalization procedures being investigated for borehole calibration to reflection coefficient maps.

### Conclusions and Future Work

- Fizz and gas reservoirs can have the same AVO responses, but down-dip water-saturated AVO responses assist in the discrimination of fizz from gas reservoirs.
- In theory, pore-fluid transforms and slope transforms can be used to predict fizz from gas saturation.
- For real field data, procedures to improve horizon picking and amplitude measurements are being investigated.

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