

PS Comparative Analysis between Prestack and Poststack Seismic Attributes in the Heidrun Oil Field*

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Abstract

Seismic attributes are important tools in the study of seismic interpretation in both exploration and reservoir characterization. With them it is possible to determine facies, structures (folds, faults, fractures), and investigate anomalies that can be generated by fluids (water, oil or gas). Historically, the extraction of seismic attributes is commonly performed in the stacked data, this is due to the computational limitations of both hardware and software. But nowadays, technological advances allow us to work with prestack data that is normally underutilized for seismic interpreters. The objective of this article is to compare the response of the seismic attributes of the prestack data with the stacked data, for better characterization of the reservoir. This methodology was applied in reservoir the Bat and the Fangst groups in the Heidrun Oil Field.

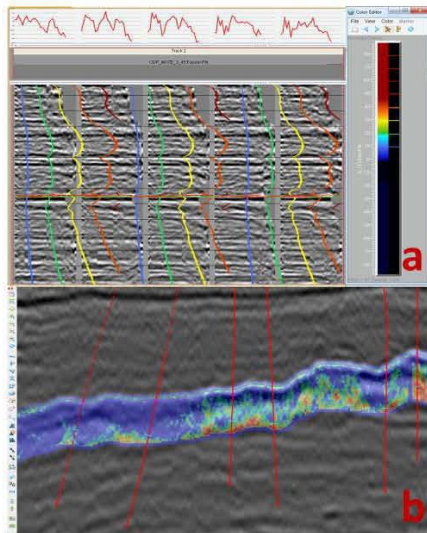
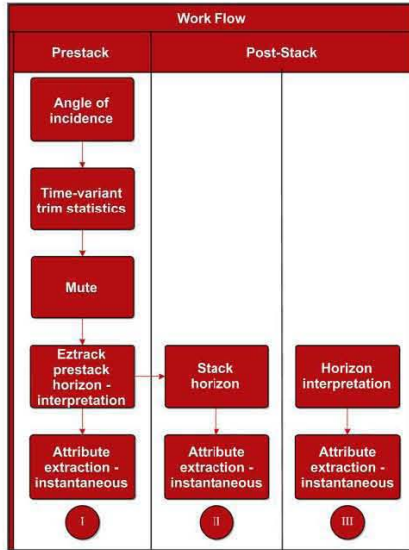


Figure 1: a) Prestack data with angle of incidence, stack horizon (green), prestack horizon (red), and amplitude and offset plot; b) post-stack data with horizon in top of Fangst reservoir and reflector amplitude from gather.

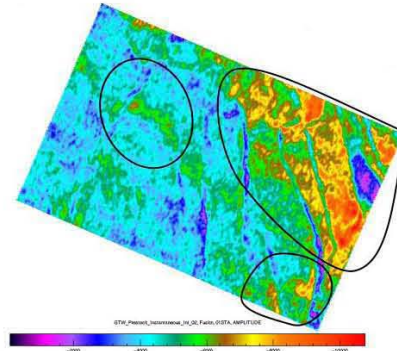


Figure 2: Instantaneous amplitude from prestack data (I); circles show the details of amplitude anomalies from prestack data.

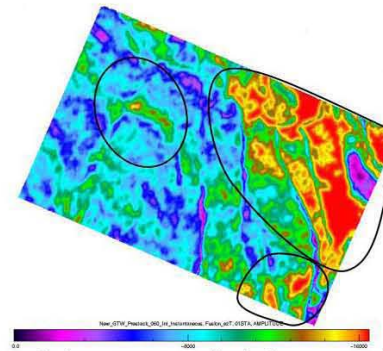


Figure 3: Instantaneous amplitude from post-stack data (II); circles show the amplitude anomalies from post-stack data.

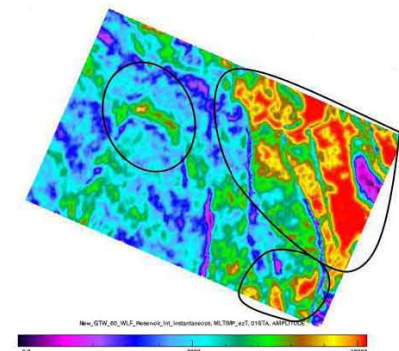


Figure 4: Instantaneous amplitude from post-stack data (III); circles show the amplitude anomalies from post-stack data.

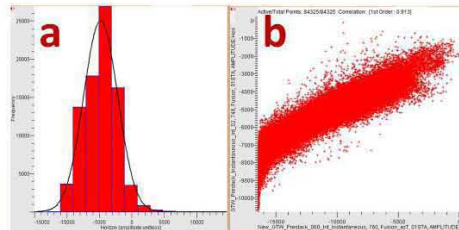


Figure 5: a) Histogram III - I; b) 91% correlation between III and I.

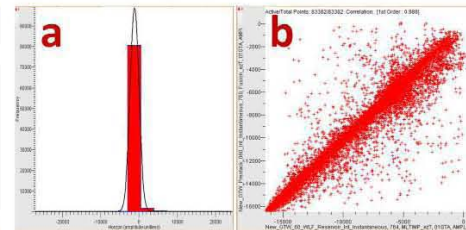


Figure 6: a) Histogram III - II; b) 98% correlation between III and II.

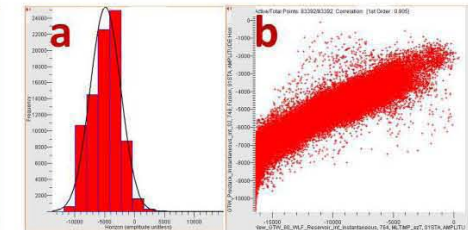


Figure 7: a) Histogram II - I; b) 90% correlation between II and I.

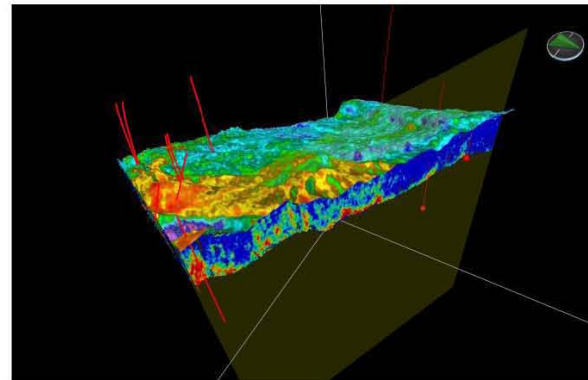


Figure 8: Prestack data with angle of incidence and stack horizon prestack data with prestack horizon, stack horizon, and Graphy amplitude and offset.

Conclusion and Discussion

- Amplitude analysis on prestack gathers can reveal more anomaly details than post-stack data; therefore, interpreters can determine reservoir boundaries and target wells.
- Figure 6 shows a histogram revealing the small difference between Horizons I and III (a) and a high correlation of 98% (b), confirming that the structural horizons interpreted on pre- and post-stack data were similar.
- Figures 5 and 7 show a lower correlation compared to Figure 6, with values of 91 and 90%, respectively. This shows how different amplitudes can be if extracted from prestack or extracted from post-stack data.
- Figure 2 (prestack) shows three circles, spotting the amplitude details that cannot be identified on Figures 3 and 4. This is a result of the richness of amplitude information provided by the prestack data.
- Figure 8 shows that the wells with oil and gas columns identified in Heidrun field are exactly the points revealed by analysis of the prestack data. This case study shows that the prestack data should be widely used by seismic interpreters instead of remaining exclusively in the realm of seismic processing.